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Key Points

Chapter 1: Nursing Practice Today

- **Nursing** involves the (1) protection, promotion, and optimization of health and abilities; (2) prevention of illness and injury; (3) alleviation of suffering through the diagnosis and treatment of human response; and (4) advocacy in the care of individuals, families, communities, and populations.

- Nurses offer skilled care to those recuperating from illness or injury, advocate for patients' rights, teach patients so that they can make informed decisions, support patients at critical times, and help them navigate the increasingly complex health care system.

- **Certification** in nursing specialties (e.g., ambulatory care, critical care, gerontologic, pediatric, psychiatric and mental health, and community health nursing) is offered through a variety of nursing organizations.

- Entry-level nurses with an associate or baccalaureate degree in nursing are prepared to function as generalists. With additional preparation, nurses can assume roles such as clinical nurse specialist and nurse practitioner.

- The exact roles (i.e., independent, dependent, collaborative) of the nurse are often determined by state and agency policies. In most cases, the nurse's role is one of "interdependence and co-participation" with the patient and other health team members.

- **Delegation** of nursing interventions to licensed practical nurses/licensed vocational nurses (LPNs/LVNs) and unlicensed assistive personnel (UAP) is an important function of the professional nurse.

- ***Healthy People 2010*** is a broad-based program that involves government, private, public, and nonprofit organizations in preventing disease and promoting health.

- **Evidence-based practice** (EBP) is the conscientious use of the best evidence (e.g., findings from research) in combination with clinician expertise and patient preferences and values in clinical decision-making.

- **Nursing informatics** is a specialty that integrates nursing science, computer science, and

information science in identifying, collecting, processing, and managing data and information to support nursing practice, administration, education, and research.

- The five elements of the **nursing process** are assessment, diagnosis, planning, implementation, and evaluation. Once begun, the nursing process is not only continuous but it is also cyclic in nature.

- **Standardized nursing terminologies** can promote continuity of patient care and provide data that can support the credibility of the profession.

- **Nursing diagnoses** describe health states that nurses can legally diagnose and treat. A three-part nursing diagnosis statement includes the problem, etiology, and signs and symptoms.

- **Collaborative problems** are potential or actual complications of disease or treatment that nurses treat with other health care providers, most frequently physicians.

- The **Nursing Outcomes Classification (NOC)** is a research-based, standardized language for nursing outcomes. It is used to evaluate the effects of nursing interventions. NOC is a list of measures that describes patient outcomes influenced by nursing interventions.

- The **Nursing Interventions Classification (NIC)** includes independent and collaborative interventions that nurses carry out, or direct others to carry out, on behalf of patients.

- A **nursing intervention** is any treatment based on clinical judgment and knowledge that a nurse performs to enhance **patient outcomes.**

- The setting of specific outcomes with outcome indicators is necessary for systematic measurement of the patient's progress.

- Outcomes may be developed by writing specific outcome statements or choosing outcomes from the Nursing Outcomes Classification (NOC).

- The Nursing Interventions Classification (NIC) includes treatments (both physiologic and psychosocial) that nurses perform in all settings and specialties.

- NIC and NOC provide a common language for communication among nurses and facilitate computer collection of standardized nursing data.

- During the **evaluation** phase, the nurse determines whether the patient outcomes and nursing interventions were realistic, measurable, and achievable.

- Assessment, diagnosis, outcomes, interventions, and evaluation of the patient's response to care are a critical part of the patient's record.

- When nursing terminologies are used in information systems for documentation of nursing practice, nurses can track and report on the benefits of nursing care.

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Key Points

Chapter 2: Health Disparities

- **Determinants of health** are those factors that influence the health of individuals.

- **Health disparities** refer to differences in measures in the **health status** among groups of people in a community, a state, or the entire nation.

- Racial, ethnic, and cultural differences exist in the health screening behaviors, treatments provided, and access to health care providers.

- Factors such as stereotyping and prejudice can affect health care seeking behavior in minority populations.

- Discrimination and bias occur when negative treatment occurs based on race, ethnicity, gender, aging, and sexual orientation.

- Use of standardized evidence-based guidelines can reduce health disparities in diagnosis and treatment.

- Interpersonal skills such as active listening, relationship building, and effective communication are basic to the delivery of high quality and equitable health care.

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Key Points

Chapter 4: Health History and Physical Examination

- The nurse and physician both obtain a patient history and perform a physical examination, but they use different formats and analyze the data differently.

- The nursing assessment includes both subjective and objective data**.**
  - **Subjective data** are what the patient tells the nurse about himself or herself.
  - **Objective data** are obtained using inspection, palpation, percussion, and auscultation during the physical examination.

- A comprehensive **database** includes information about the patient's health status, health maintenance behaviors, individual coping patterns, support systems, current development tasks, and any risk factors or lifestyle changes.

- When a patient is unable to provide data (e.g., the person is aphasic or unconscious), the person assuming responsibility for the patient's welfare can be asked about the patient.

- Patients should be informed that federal legislation affects the exchange, privacy, and security of an individual's health information.

- Assessment data should be obtained and organized systematically so that they can be analyzed to make judgments about the patient's health status and health problems.

- One framework for obtaining data uses the **functional health patterns** developed by Gordon.

- Subjective data include past health history, medications, surgery, or other treatments.

- The two types of physical examinations are as follows:
  - **Screening**
  - **Focused** (problem-centered)

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Key Points

Chapter 5: Patient and Family Teaching

- Specific goals for patient education include health promotion, prevention of disease, management of illness, and appropriate selection and use of treatment options.
- A **teaching plan** includes assessment of the patient's ability, need, and readiness to learn as well as identification of problems that can be resolved with teaching.
- **Learning** occurs when there is an internal mental change characterized by rearrangement of neural pathways.
- **Teaching** is a process of deliberately arranging external conditions to promote the internal transformation that results in a change in behavior.
- When teaching adults, it is important to identify what is valued by the person to enhance motivation.
- **Reinforcement** is a strong motivational factor for maintaining behavior. Positive reinforcement involves rewarding a desired behavior with a positive stimulus to increase its occurrence.
- Required skills for the nurse as a teacher include knowledge of the subject matter, communication skills, and empathy.
- Because of shortened hospital stays and clinic visits, the nurse and the patient need to set priorities of the patient's **learning needs** so that teaching can occur during any contact with the patient or family.
- Education of family members is important because family members can promote the patient's self-care and prevent complications.
- The **teaching process** involves development of a plan that includes assessment, diagnosis, setting patient outcomes or objectives, intervention, and evaluation.
- The patient's experiences, rate of learning, and ability to retain information are affected by age.
- Pain, fatigue, and certain medications influence the patient's ability to learn.
- Anxiety and depression can negatively affect the patient's motivation and readiness to learn.
- An individual's belief in his or her capability to produce and regulate events in life affects motivation, thought patterns, behavior, and emotions.
- **Health literacy** is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.

- Each person has a distinct style of learning. The three learning styles are as follows:
  (1) Visual (reading)
  (2) Auditory (listening)
  (3) Physical (doing things)

- **Learning objectives** are written statements that define exactly how patients demonstrate their mastery of the content.

- Learning objectives contain the following four elements:
  (1) Who will perform the activity or acquire the desired behavior
  (2) The actual behavior that the learner will exhibit to demonstrate mastery of the objective
  (3) The conditions under which the behavior is to be demonstrated
  (4) The specific criteria that will be used to measure the patient's success

- Selecting a particular strategy is determined by at least three factors:
  (1) Patient characteristics (e.g., age, educational background, nature of illness, culture)
  (2) Subject matter
  (3) Available resources

- Because of extent of health illiteracy, it is now recommended that all patient education materials be written at the 5th- to 6th-grade reading level.

- Evaluation strategies for teaching include observing the patient directly, observation of verbal and nonverbal cues, discussion with the patient or family member, using a standardized measurement tool, and the patient's self-evaluation of progress.

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Key Points

Chapter 6: Older Adults

- **Ageism** (negative attitude based on another's age) can lead to discrimination and disparities in health care provided to older adults.

- Aging affects every body system. **Biologic aging** is a balance of positive (e.g., healthy diet, exercise, coping, resources) and negative factors (e.g., smoking, obesity).

- Biologic theories can be divided into **stochastic** and **non-stochastic** theories.

- Older women are especially at risk for chronic health problems, including arthritis, hypertension, strokes, and diabetes.

- The **frail elderly** are individuals who are more vulnerable because of declining physical health and limited resources.

- **Activities of daily living** (ADL), including bathing, dressing, eating, toileting, and transferring, are important for the nurse to assess in the older patient living with chronic illness.

- For the hospitalized older adult, there are special concerns related to high surgical risk, acute confusional state, nosocomial infection, and premature discharge with an unstable condition.

- The intensity and complexity of caregiving place the **caregiver** at risk for high levels of stress. This may lead to emotional problems, including depression, anger, and resentment.

- Family members are perpetrators in approximately 9 out of 10 cases of domestic **elder abuse and neglect.**

- Continuing care retirement communities, congregate housing, and assisted living facilities are housing options for the older adult.

- Home health care services require physician recommendation and skilled nursing care for Medicare reimbursement.

- Ethical issues surrounding care of the older adult include using restraints, evaluating the patient's ability to make decisions, initiating resuscitation, treating infections, providing nutrition and hydration, and advocating for an institutional ethics committee.

- Reducing disability through **geriatric rehabilitation** is important to the quality of life of the older adult.

- Age-related changes in pharmacodynamics and pharmacokinetics of drugs, as well as **polypharmacy,** put the older adult at risk for adverse drug reactions.

- Depression is the most common mood disorder in older adults.

- The comprehensive nursing geriatric assessment includes a thorough history using a functional health pattern format, physical assessment, mood assessment, mental status evaluation, ADL and instrumental ADL (IADL) evaluation, and social-environmental assessment.

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Key Points

Chapter 7: Community-Based Nursing and Home Care

- The focus of **community-based nursing** is the illness-oriented care of individuals and families throughout the lifespan.
- Many factors are changing the health care system, including socioeconomic status, demographics, prevalence and type of illness, technology, and increased consumerism.
- The goals of **case management** are to provide quality care along a continuum, decrease fragmentation of care across many settings, enhance the patient's qualify of life, and contain cost.
- The use of Diagnosis Related Groups (DRGs) has had a dramatic impact on health care.
- Health care is constrained by third-party payer cost containment.
- Community-based settings where nursing care is delivered include **ambulatory care, transitional care,** and **long-term care** (skilled nursing, intermediate care, and residential care facilities).
- **Community-oriented nursing** involves the engagement of nursing in promoting and protecting the health of populations.
- **Home health care** may include health maintenance, education, illness prevention, diagnosis and treatment of disease, palliative care, and rehabilitation.
- **Skilled nursing care** may include observation, assessment, management evaluation, teaching, training, administration of medications, wound care, tube feeding, catheter care, and behavioral health interventions.
- In home care situations, it is common for caregivers to become physically, emotionally, and economically overwhelmed with responsibilities and demands of caregiving.
- The home health care team may include the patient, family, nurses, physician, social worker, physical therapist, occupational therapist, speech therapist, home health aide, pharmacist, respiratory therapist, and dietitian.

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Key Points

Chapter 8: Complementary and Alternative Therapies

- **Complementary and alternative therapies** include a broad domain of resources, including health systems, modalities, and practices other than those intrinsic to the dominant health system of a particular society or culture.

- This definition highlights that what might be considered "complementary and alternative" in one country or at one period of history might be considered "conventional" in another place or time.

- Individuals often "self-select" these therapies, using them without professional supervision.

- Nearly half of the users of these therapies do not consult an alternative and complementary practitioner or disclose such use to their traditional health care provider.

- Patients should be advised that complementary therapies do not replace conventional therapies, but can often be used in combination with conventional therapies.

- **Traditional Chinese Medicine** (TCM) is a complete system of medicine with an individualized form of diagnosis and treatment, as well as having its focus on prevention.

- TCM includes acupuncture, Chinese herbal medicine, and other modalities.

- **Mind-body interventions** are a variety of techniques designed to facilitate the mind's capacity to affect body function, including behavioral, psychologic, social, and spiritual approaches to health such as imagery, biofeedback, prayer, and meditation.

- Over the past 30 years, a resurgence of interest in **herbal therapy** has occurred in countries whose health care is dominated by the biomedical model.

- Medicinal plants work in much the same way as drugs; both are absorbed and trigger biologic effects that can be therapeutic. Many have more than one physiologic effect and thus have more than one condition for which they can be used.

- Patients should be advised that if they take herbal therapies, they should adhere to the suggested dosage. Herbal preparations taken in large doses can be toxic.

- **Manipulative and body-based methods** include interventions and approaches to health care based on manipulation or movement of the body. Examples include chiropractic therapy, yoga, massage, and acupressure.

- **Massage** is a form of touch and also a form of caring, communication, and comfort. Nurses can use specific massage techniques as part of nursing care, when indicated by the nursing diagnosis or patient assessment.

- **Energy therapies** are those that involve the manipulation of energy fields such as Therapeutic Touch, Healing Touch, and Reiki.

- **Therapeutic Touch** (TT) is a method of detecting and balancing human energy that was developed jointly by a nurse and a traditional healer.

- It is important for the nurse to collect data on the patient's use of complementary and alternative therapies.

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Key Points

Chapter 9: Stress and Stress Management

- **Stress** occurs when individuals perceive that they cannot adequately cope with the demands being made on them or with the threats to their well-being.

- Key personal characteristics—such as hardiness, sense of coherence, resilience, and attitude—buffer the impact of stress.

- The physiologic response of the person to stress is reflected in the interrelationship of the nervous, endocrine, and immune systems. Stress activation of these systems affects other systems, such as the cardiovascular, respiratory, gastrointestinal, renal, and reproductive systems.

- Stress can have effects on cognitive function, including poor concentration, memory problems, distressing dreams, sleep disturbances, and impaired decision-making.

- Long-term stress may increase the risk of cardiovascular diseases such as atherosclerosis and hypertension. Other conditions either precipitated or aggravated by stress include migraine headaches, irritable bowel syndrome, and peptic ulcers.

- **Coping** is defined as a person's cognitive and behavioral efforts to manage specific external or internal stressors that seem to exceed available resources.

- Coping can be either positive or negative. Positive coping includes activities such as exercise and use of social support. Negative coping may include substance abuse and denial.

- Coping strategies can also be divided into two broad categories: emotion-focused coping and problem-focused coping.

- **Emotion-focused coping** involves managing the emotions that an individual feels when a stressful event occurs. **Problem-focused coping** attempts to find solutions to resolve the problems causing the stress.

- **Relaxation strategies** can be used to cope with stressful circumstances and elicit the relaxation response.

- The **relaxation response** is the state of physiologic and psychologic deep rest. It is the opposite of the stress response and is characterized by decreased sympathetic nervous system activity, which leads to decreased heart rate and respiratory rate, decreased blood pressure, decreased muscle tension, decreased brain activity, and increased skin temperature.

- Regular elicitation of the relaxation response can be achieved through relaxation breathing, meditation, imagery, music, muscle relaxation, and massage.

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Key Points

Chapter 10: Pain

- **Pain** is defined as whatever the person experiencing the pain says it is, existing whenever the person says it does.

- Untreated pain can result in unnecessary suffering, physical and psychosocial dysfunction, impaired recovery from acute illness and surgery, immunosuppression, and sleep disturbances.

- Inadequate pain management may be due to (1) insufficient knowledge and skills to assess and treat pain; (2) unwillingness of providers to believe patients' report of pain; (3) lack of time, expertise, and perceived importance of conducting regular pain assessments; (4) inaccurate and inadequate information regarding addiction, tolerance, respiratory depression, and other side effects of opioids; and (5) fear that aggressive pain management may hasten or cause death.

- Components of the nursing role include (1) assessing pain and communicating this information to other health care providers, (2) ensuring the initiation and coordination of adequate pain relief measures, (3) evaluating the effectiveness of these interventions, and (4) advocating for people with pain.

- Pain has many dimensions and components, including the following:
    - The *physiologic* dimension of pain includes the genetic, anatomic, and physical determinants of pain.
    - The *affective* component of pain is the emotional response to the pain experience.
    - The *behavioral* component of pain refers to the observable actions used to express or control the pain.
    - The *cognitive* component of pain refers to beliefs, attitudes, memories, and meaning attributed to the pain.
    - The *sociocultural* dimension of pain encompasses factors such as demographics, support systems, social roles, and culture.

- The emotional distress of pain can cause **suffering,** which is defined as the state of severe distress associated with events that threaten the intactness of the person.

- Culture also affects the experience of pain, specifically the pain expression, medication use, and pain-related beliefs and coping.

- Pain is most commonly categorized as nociceptive or neuropathic based on underlying pathology or as acute or chronic.

- **Nociception** is the physiologic process by which information about tissue damage is communicated to the central nervous system. Nociception involves transduction, transmission, perception, and modulation.
    - **Transduction** is the conversion of a mechanical, thermal, or chemical stimulus into a neuronal action potential.
        - Noxious (tissue-damaging) stimuli cause the release of numerous chemicals into the area surrounding the peripheral nociceptors. Inflammation and the subsequent release of chemical mediators increase the likelihood of transduction.
        - The pain produced from activation of peripheral nociceptors is called nociceptive pain.
        - Pain arising from abnormal processing of stimuli by the nervous system is called neuropathic pain.

        - Decreasing the effects of chemicals released at the periphery is the basis of several drugs (e.g., nonsteroidal antiinflammatory drugs [NSAIDs]).
    - **Transmission** is the movement of pain impulses from the site of transduction to the brain.
        - **Dermatomes** are areas on the skin that are innervated primarily by a single spinal cord segment.
        - **Referred pain** must be considered when interpreting the location of pain reported by the person with injury to or disease involving visceral organs.
    - **Perception** occurs when pain is recognized, defined, and responded to by the individual experiencing the pain. The brain is necessary for pain perception.
    - **Modulation** involves the activation of descending pathways that exert inhibitory or facilitatory effects on the transmission of pain.

- Neuropathic pain is further classified as somatic and visceral.
    - **Somatic pain** is characterized by deep aching or throbbing that is well localized and arises from bone, joint, muscle, skin, or connective tissue.
    - **Visceral pain,** which may result from stimuli such as tumor involvement or obstruction, arises from internal organs.

- **Neuropathic pain** is caused by damage to peripheral nerves or CNS. Common causes of neuropathic pain include trauma, inflammation, metabolic disease, infections of the nervous system, tumors, toxins, and neurologic disease.

- Acute pain and chronic pain are different as reflected in their cause, course, manifestations, and treatment.
    - **Acute pain** typically diminishes over time as healing occurs.
    - **Chronic pain,** or persistent pain, lasts for longer periods, often defined as longer than 3 months or past the time when an expected acute pain or acute injury should subside.

- The goals of a nursing pain assessment are (1) to describe the patient's multidimensional pain experience for the purpose of identifying and implementing appropriate pain management techniques and (2) to identify the patient's goal for therapy and resources for self-management.

- A comprehensive assessment of pain includes describing the onset, duration, characteristics, pattern, location, intensity, quality, and associated symptoms such as anxiety and depression.

- **Breakthrough pain** is a transient, moderate to severe pain that occurs beyond the pain treated by current analgesics.

- Pain scales are useful tools to help the patient communicate pain intensity. Scales must be adjusted for age and cognitive development.

- Patients typically describe neuropathic pain as a burning, numbing, shooting, stabbing, or itchy sensation.

- Nociceptive pain may be described as sharp, aching, throbbing, and cramping. Associated symptoms such as anxiety, fatigue, and depression may exacerbate or be exacerbated by pain.

- Strategies for pain management include prescription and nonprescription drugs and nondrug therapies such as hot and cold applications, complementary and alternative therapies (e.g., herbal products, acupuncture), and relaxation strategies (e.g., imagery).
    - All strategies must be documented, both those that work and those that are ineffective.
    - Patient and family beliefs, attitudes, and expectations influence responses to pain and pain treatment.

- Pain medications generally are divided into three categories: nonopioids, opioids, and co-analgesic or adjuvant drugs.
    - Mild pain often can be relieved using nonopioids alone.
    - Moderate to severe pain usually requires an opioid.
    - Neuropathic pain often requires a co-analgesic and adjuvant drug.
    - Nonopioid pain medications include acetaminophen, aspirin, and nonsteroidal antiinflammatory agents (NSAIDs).

- NSAIDs are associated with a number of side effects, including bleeding tendencies, gastrointestinal ulcers and bleeding, and renal and CNS dysfunction.

- **Opioids** are the strongest analgesics available.
    - Opioids produce their effects by binding to receptors in the CNS.
    - Common side effects of opioids include constipation, nausea, vomiting, sedation, respiratory depression, and pruritus.
    - A bowel regimen should be instituted at the beginning of opioid therapy and should continue for as long as the person takes opioids.
    - Concerns about sedation and respiratory depression are two of the most common fears associated with opioids.
    - If severe respiratory depression occurs and stimulation of the patient (calling and shaking patient) does not reverse the somnolence or increase the respiratory rate and depth, naloxone (Narcan), an opioid antagonist, can be administered intravenously or subcutaneously.

- **Adjuvant analgesic therapies** include antidepressants, antiseizure drugs, α_2-adrenergic agonists, and corticosteroids.
    - Tricyclic antidepressants enhance the descending inhibitory system and are effective for a variety of pain syndromes, particularly neuropathic pain syndromes.

  - Antiseizure or antiepileptic drugs (AEDs) affect both peripheral nerves and the CNS and are effective for neuropathic pain and prophylactic treatment of migraine headaches.
  - Clonidine (Catapres) and tizanidine (Zanaflex) are the most widely used α_2-adrenergic agonists and may be used for chronic headache and neuropathic pain.
  - Corticosteroids—including dexamethasone [Decadron], prednisone, and methylprednisolone [Medrol]—are used for management of acute and chronic cancer pain, pain secondary to spinal cord compression, and inflammatory joint pain syndromes.

- Appropriate analgesic scheduling focuses on *prevention* or *control* of pain rather than the provision of analgesics only after the patient's pain has become severe.

- **Equianalgesic dose** refers to a dose of one analgesic that is equivalent in pain-relieving effects compared with another analgesic.

- Opioids and other analgesic agents can be delivered via many routes.
  - Most pain medications are available in oral preparations, such as liquid and tablet formulations. Opioids can be administered under the tongue or held in the mouth and absorbed into systemic circulation, which would exempt them from the first-pass effect.
  - Fentanyl citrate (Actiq) is administered transmucosally.
  - Intranasal administration allows delivery of a medication (e.g., butorphanol [Stadol]) to highly vascular mucosa and avoids the first-pass effect.
  - Analgesics available as rectal suppositories include hydromorphone, oxymorphone, morphine, and acetaminophen.
  - Intravenous administration is the best route when immediate analgesia and rapid titration are necessary.
  - Intraspinal (epidural or intrathecal) opioid therapy involves inserting a catheter into the subarachnoid space (intrathecal delivery) or the epidural space (epidural delivery).
  - Intraspinally administered analgesics are highly potent because they are delivered close to the receptors in the spinal cord dorsal horn.
    - Long-term epidural catheters may be placed for patients with terminal cancer or those with certain pain syndromes that are unresponsive to other treatments.
    - Intraspinal catheters can be surgically implanted for long-term pain relief.
    - A specific type of IV delivery system is **patient-controlled analgesia** (PCA) or demand analgesia. It can also be connected to an epidural catheter (patient-controlled epidural analgesia [PCEA]). With PCA, a dose of opioid is delivered when the patient decides that a dose is needed.

- **Neuroablative interventions** are performed for severe pain that is unresponsive to all other therapies.

- **Neuroaugmentation** involves electrical stimulation of the brain and the spinal cord.

- Massage (superficial or deep) is a common therapy for pain. A **trigger point** is a circumscribed hypersensitive area within a tight band of muscle and is caused by acute or chronic muscle strain.

- Exercise is a critical part of the treatment plan for patients with chronic pain, particularly those experiencing musculoskeletal pain.

- **Transcutaneous electrical nerve stimulation** (TENS) involves the delivery of an electric current through electrodes applied to the skin surface over the painful region, at trigger points, or over a peripheral nerve.

- **Percutaneous electrical nerve stimulation** (PENS) stimulates deeper peripheral tissues through a needle with an attached stimulator. The needle is inserted near a large peripheral or spinal nerve.

- Acupuncture is a technique of Traditional Chinese Medicine in which very thin needles are inserted into the body at designated points to reduce musculoskeletal pain, repetitive strain disorders, myofascial pain syndrome, postsurgical pain, postherpetic neuralgia, peripheral neuropathic pain, and headaches.

- Heat therapy can be either superficial or deep.

- Cold therapy involves the application of either moist or dry cold to the skin.

- Techniques to alter the affective, cognitive, and behavioral components of pain include distraction, hypnosis, and relaxation strategies.

- The nurse acts as planner, educator, patient advocate, interpreter, and supporter of the patient in pain and the patient's family. It is important to realize that a nurse's beliefs and attitudes may hinder appropriate pain management.

- Gerontologic considerations:
    - Treatment of pain in the elderly patient is complicated.
    - Older adults metabolize drugs more slowly than younger persons and thus are at greater risk for higher blood levels and adverse effects.
    - The use of NSAIDs in elderly patients is associated with a high frequency of serious GI bleeding.
    - Older people often take many drugs for one or more chronic conditions.
    - Cognitive impairment and ataxia can be exacerbated when analgesics such as opioids, antidepressants, and antiseizure drugs are used.
    - Health care providers for older patients should titrate drugs slowly and monitor carefully for side effects.

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Key Points

Chapter 11: End-of-Life and Palliative Care

- **End-of-life care** (EOL care) is the term currently used to describe issues related to dying and death care.
- EOL care focuses on the physical and psychosocial needs of the patients and their families at the end of life.
- **Death** is the irreversible cessation of circulatory and respiratory function or the irreversible cessation of all functions of the entire brain, including the brainstem.
- **Bereavement** is an individual's emotional response to the loss of a significant person.
- **Grief** develops from bereavement and is a dynamic psychologic and physiologic response following the loss.
- Assessment of spiritual needs in EOL care is a key consideration.
- Family involvement is integral to providing culturally competent EOL care.
- Persons who are legally competent may choose organ donation.
- **Advance care planning** is focused on anticipated challenges that the patient and family will face because of illness, medical treatment, and other concerns.
- The nurse needs to be aware of legal issues and the wishes of the patient.
- **Advance directives** and organ donor information should be located in the medical record and identified on the patient's record and/or the nursing care plan.
- **Palliative care** is the active total care of patients whose disease is not responsive to curative treatment. Palliative care focuses on controlling pain and other symptoms, as well as reducing psychologic, social, and spiritual distress for the patient and the family.

- Palliative care is the framework for **hospice** care. Palliative care can start much earlier in a disease process, whereas hospice traditionally is limited to the projected last 6 months of life.

- Admission to a hospice program has two criteria: (1) the patient must desire the services; and (2) a physician must certify that the patient has 6 months or less to live.

- The objective of a bereavement program is to provide support and to assist survivors in the transition to a life without the deceased person.

- The physical assessment is abbreviated in EOL care and focuses on changes that accompany terminal illness and the specific disease process.

- Families need ongoing information on the disease, the dying process, and any care that will be provided.

- Respiratory distress and shortness of breath (dyspnea) are common near the end of life. The sensation of air hunger results in anxiety for the patient and family members.

- Most terminally ill and dying people do not want to be alone and fear loneliness.

- Priority interventions for grief must focus on providing an environment that allows the patient to express feelings.

- People who are dying deserve and require the same physical care as people who are expected to recover.

- To meet the holistic needs of the patient, the nurse collaborates with the social worker, chaplain, physical therapist, occupational therapists, certified nursing assistants, and physician.

- The patient near death may seem to be withdrawn from the physical environment, maintaining the ability to hear while not being able to respond.

- It is important not to delay or deny pain relief measures to a terminally ill patient.

- Skin integrity is difficult to maintain at the end of life due to immobility, urinary and bowel incontinence, dry skin, nutritional deficits, anemia, friction, and shearing forces.

- After the patient is pronounced dead, the nurse prepares or delegates preparation of the body for immediate viewing by the family with consideration for cultural customs and in accordance with state law and agency policies and procedures.

- The role of caregiver includes working and communicating with the patient, supporting the patient's concerns, helping the patient resolve any unfinished business, working with other family members and friends, and dealing with the caregiver's own needs and feelings.

- An understanding of the grieving process as it affects both the patient and the family caregivers is of great importance.

- Recognizing signs and behaviors among family members who may be at risk for abnormal grief reactions is an important nursing intervention.

- Caring for dying patients is intense and emotionally charged. It is important to consider interventions that help ease physical and emotional stress for the nurse.

- Terminal illness and dying are extremely personal events that affect the patient, the family, and health care providers.

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Key Points

Chapter 12: Addictive Behaviors

- The illicit substances most commonly used in the United States include marijuana/hashish, cocaine, hallucinogens, and heroin.

- Compulsive behaviors, including eating disorders, gambling, computer gaming and interacting, and excessive exercise, are considered **addictive behaviors.**

- **Addiction** is a complex disorder that is a treatable, chronic, relapsing disease. It is considered a biobehavioral disorder.

- Addiction results from the prolonged effects of addictive drugs or behaviors on the brain.

- The **brain reward system** is a system that creates the sensation of pleasure. The neurotransmitter dopamine plays a role in addiction.

- Genetics, environment, and sociocultural factors contribute to addiction.

- Tobacco:

  - The most common addictive behavior is tobacco use. The complications associated with the use of tobacco (nicotine) are related to dose and method of ingestion.
  - Tobacco use is the leading cause of preventable illness and death in the United States.

- Cocaine:
  - Is the most potent of the abused stimulants. Besides its effects on the brain reward system, cocaine produces adrenalin-like effects.
  - Persons who abuse cocaine have problems related to sleep, appetite, depression, respiratory infections, chest pain, and/or headaches.

- Amphetamines stimulate the central and peripheral nervous systems. They cause increased alertness, improved performance, relief of fatigue, and anorexia.

- Caffeine promotes alertness and alleviates fatigue. It is a weak CNS stimulant.

- Alcohol:
  - Is consumed by almost 50% of Americans over the age of 12. Alcohol abuse affects 10% of the population.
  - Alcoholism is a chronic and potentially fatal disease if not treated.
  - In alcoholics, abrupt withdrawal may have life-threatening effects. Persons who abuse alcohol often have a number of health problems.
  - Acute alcohol toxicity can occur with binge drinking or the use of alcohol with other CNS depressants.

- Sedative-hypnotic agents:
  - Commonly used ones include barbiturates, benzodiazepines, and barbiturate-like drugs.
  - Sedative-hypnotics act on the CNS to cause sedation at low doses and sleep at high doses. Tolerance develops rapidly.

- Signs and symptoms of opioid overdose include pinpoint pupils, clammy skin, depressed respiration, coma, and death (if not treated).

- Opioid overdose can precipitate a medical emergency.

- Cannabis (or marijuana) is the most widely used illicit drug in North America. Marijuana produces euphoria, sedation, and hallucinations.

- The nurse must be alert to signs and symptoms of the many health problems associated with addictive behaviors.

- It is important for the nurse to promote an open and nonjudgmental communication style with the patient.

- A drug **overdose** is an emergency situation, and management is based on the type of substance involved.

- In general, **withdrawal** signs and symptoms are opposite in nature from the direct effects of the drug.

- The patient who is dependent on substances is at risk for postoperative complications.

- Severe pain should be treated with opioids and at a much higher dosage than that used with drug-naïve persons.

- It is the nurse's responsibility—in collaboration with a multidisciplinary team composed of physicians, social workers, and addiction specialists—to address the patient's substance abuse problem and motivate the patient to change behaviors and seek treatment for the addiction.

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Key Points

Chapter 13: Inflammation and Wound Healing

- The **inflammatory response** is a sequential reaction to cell injury. It neutralizes and dilutes the inflammatory agent, removes necrotic materials, and establishes an environment suitable for healing and repair.

- The basic types of inflammation are acute, subacute, and chronic.
    - In **acute inflammation,** the healing occurs in 2 to 3 weeks and usually leaves no residual damage.
    - **Subacute inflammation** has the features of the acute process but lasts longer.
    - **Chronic inflammation** lasts for weeks, months, or even years.

- The inflammatory response can be divided into a vascular response, a cellular response, formation of exudate, and healing.

- The **vascular response** results in vasodilation causing hyperemia (increased blood flow in the area), which raises filtration pressure.

- During the **cellular response,** neutrophils and monocytes move to the inner surface of the capillaries (margination) and then through the capillary wall (diapedesis) to the site of injury.

- **Exudate** consists of fluid and leukocytes that move from the circulation to the site of injury. The nature and quantity of exudate depend on the type and severity of the injury and the tissues involved.

- **Healing** includes the two major components of regeneration and repair. **Regeneration** is the replacement of lost cells and tissues with cells of the same type. **Repair** is the more common type of healing and usually results in scar formation.

- The best management of inflammation is the prevention of infection, trauma, surgery, and contact with potentially harmful agents.

- The purposes of **wound management** include (1) cleaning a wound to remove any dirt and debris from the wound bed, (2) treating infection to prepare the wound for healing, and (3) protecting a clean wound from trauma so that it can heal normally.

- A **pressure ulcer** is a localized area (usually over a bony prominence) of tissue necrosis caused by unrelieved pressure that occludes blood flow to the tissues. Pressure ulcers generally fall under the category of healing by secondary intention.

- Care of a patient with a pressure ulcer requires local care of the wound and support measures of the *whole person*, including adequate nutrition, pain management, control of other medical conditions, and pressure relief.

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Key Points

Chapter 14: Genetics, Altered Immune Responses, and Transplantation

GENETICS

- Genetic disorders can be categorized into autosomal dominant, autosomal recessive, or sex-linked (X-linked) recessive disorders.
    - **Autosomal dominant disorders** are caused by a mutation of a single gene pair (heterozygous) on a chromosome.
    - **Autosomal recessive disorders** are caused by a mutation in two gene pairs (homozygous) on a chromosome.

  - X-linked recessive disorders are caused by a mutation on the X chromosome.

- The different types of genetic testing include direct testing, linkage testing, biochemical testing, and karyotyping.

- **Gene therapy** is an experimental technique used to replace or repair defective or missing genes with normal genes.

- **Stem cells** are cells in the body that have the ability to differentiate into other cells. Stem cells can be divided into two types: embryonic and adult.

ALTERED IMMUNE RESPONSES

- **Immunity** is a state of responsiveness to foreign substances such as microorganisms and tumor proteins. Immune responses serve three functions: defense, homeostasis, and surveillance.

- Immunity is classified as innate (natural) or acquired. Acquired immunity is the development of immunity, either active or passive.

- The immune response involves complex interactions of T cells, B cells, monocytes, and neutrophils. These interactions depend on **cytokines** (soluble factors secreted by WBCs and a variety of other cells in the body) that act as messengers between the cell types.

- **Humoral immunity** consists of antibody-mediated immunity. In contrast, immune responses initiated through specific antigen recognition by T cells are termed **cell-mediated immunity.** Both humoral and cell-mediated immunity are needed to remain healthy.

- **Immunocompetence** exists when the body's immune system can identify and inactivate or destroy foreign substances.

- A **hypersensitivity reaction** occurs when the immune response is overreactive against foreign antigens or fails to maintain self-tolerance. This results in tissue damage.

- Although an alteration of the immune system may be manifested in many ways, allergies or type I hypersensitivity reactions are seen most frequently.
  - Common allergic reactions include anaphylaxis and atopic reactions.
  - Allergic rhinitis, atopic dermatitis, urticaria, and angioedema are common type I hypersensitivity reactions.

- After an allergic disorder is diagnosed, the therapeutic treatment is aimed at reducing exposure to the offending allergen, treating the symptoms, and if necessary, desensitizing the person through immunotherapy.

- **Anaphylactic reactions** occur suddenly in hypersensitive patients after exposure to the offending allergen. They may occur following parenteral injection of drugs (especially antibiotics), blood products, and insect stings.

- Most allergic reactions are chronic and are characterized by remissions and exacerbations of symptoms.

- The major categories of drugs used for symptomatic relief of chronic allergic disorders include antihistamines, sympathomimetic/decongestant drugs, corticosteroids, antipruritic drugs, and mast cell–stabilizing drugs.

- Immunotherapy is the recommended treatment for control of allergic symptoms when the allergen cannot be avoided and drug therapy is not effective.

- Two types of latex allergies can occur: type IV allergic contact dermatitis and type I allergic reactions.

- **Multiple chemical sensitivities** (MCS) is an acquired disorder in which certain people exposed to various foods and chemicals in the environment have many symptoms related to multiple body systems.

- The **human leukocyte antigen** (HLA) system consists of a series of linked genes that occur together on the sixth chromosome in humans. Because of its importance in the study of tissue matching, the chromosomal region incorporating the HLA genes is termed the major histocompatibility complex.

- **Autoimmunity** is an immune response against self. The immune system no longer differentiates self from nonself.

- Immunodeficiency disorders involve an impairment of one or more immune mechanisms, which include the following:
  (1) Phagocytosis
  (2) Humoral response
  (3) Cell-mediated response
  (4) Complement
  (5) A combined humoral and cell-mediated deficiency

- Immunodeficiency disorders are *primary* if the immune cells are improperly developed or absent and *secondary* if the deficiency is caused by illnesses or treatment.

TRANSPLANTATION

- Commonly transplanted organs and tissues include corneas, kidneys, skin, bone marrow, heart valves, bone, and connective tissues.

- The degree of HLA matching required or deemed suitable for successful solid organ transplantation depends on the type of organ and the transplant center at which the transplant is being performed.

- Rejection of organs occurs if the donor organ does not perfectly match the recipient's HLAs. The rejection can be prevented by closely matching ABO, Rh, and HLAs between donor and recipient.

- The three types of organ rejection can be classified as hyperacute, acute, and chronic.

- The goal of **immunosuppressive therapy** is to adequately suppress the immune response to prevent rejection of the transplanted organ while maintaining sufficient immunity to prevent overwhelming infection.

- Commonly used immunosuppressive drugs include corticosteroids, cyclosporine, tacrolimus (Prograf), and mycophenolate mofetil (CellCept).

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Key Points

Chapter 15: Infection and Human Immunodeficiency Virus Infection

INFECTION

- An **infection** is an invasion of the body by a *pathogen* (any microorganism that causes disease) and the resulting signs and symptoms that develop in response to the invasion.

- The most common causes of infection are bacteria, viruses, fungi, and protozoa.

- An **emerging infection** is an infectious disease whose incidence has increased in the past 20 years or threatens to increase in the immediate future.

- Emerging infectious diseases can originate from unknown sources, contact with animals, changes in known diseases, or biologic warfare.

- **Resistance** occurs when pathologic organisms change in ways that decrease the ability of a drug (or a family of drugs) to treat disease.

- Methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), and penicillin-resistant *Streptococcus pneumoniae* are three of the most troublesome antibiotic-resistant bacteria currently causing problems in North America.

- **Nosocomial infections** are infections that are acquired as a result of exposure to a microorganism in a hospital setting and typically occur within 72 hours of hospitalization.

- For older adult patients, the rate of nosocomial infection is two to three times higher than for younger patients.

HUMAN IMMUNODEFICIENCY VIRUS INFECTION

- The **human immunodeficiency virus** (HIV) is a ribonucleic acid (RNA) virus, which means it replicates going from RNA to deoxyribonucleic acid (DNA).

- HIV can only be transmitted under specific conditions that allow contact with infected body fluids, including blood, semen, vaginal secretions, and breast milk.

- Sexual contact with an HIV-infected partner is the most common mode of transmission.

- Immune dysfunction in HIV disease is caused predominantly by damage to and destruction of $CD4^+$ T cells (also known as T helper cells or $CD4^+$ T lymphocytes).

- The major concern related to immune suppression is the development of **opportunistic diseases** (infections and cancers that occur in immunosuppressed patients that can lead to disability, disease, and death).

- HIV infections are divided into acute, early chronic, intermediate chronic, and late chronic infection.

- Late chronic infection is also known as **acquired immunodeficiency syndrome** (AIDS).

- The most useful screening tests for HIV are those that detect HIV-specific antibodies. The major problem with these tests is that there is a median delay of 2 months after infection before antibodies can be detected. This creates a **window period** during which an infected individual may not test positive for HIV-antibody.

- The goals of drug therapy in HIV infection are to (1) decrease the **viral load,** (2) maintain or raise $CD4^+$ T cell counts, and (3) delay the development of HIV-related symptoms and opportunistic diseases.

- The major drug classifications for HIV include nonnucleoside reverse transcriptase inhibitors (NNRTIs), nucleoside reverse transcriptase inhibitors (NRTIs), nucleotide reverse transcriptase inhibitors (NtRTIs), protease inhibitors (PIs), and entry inhibitors.

- Management of HIV is complicated by the many opportunistic diseases that can develop as the immune system deteriorates.

- Examples of opportunistic infections include *Pneumocystis jiroveci* pneumonia (PCP), *Mycobacterium avium* complex (MAC), and Kaposi sarcoma.

- Nursing care for individuals not known to be infected with HIV should focus on behaviors that could put the person at risk for HIV infection and other sexually transmitted and blood-borne diseases.

- The overriding goals of therapy for infected individuals are to keep the viral load as low as possible for as long as possible, maintain or restore a functioning immune system, improve the patient's quality of life, prevent opportunistic disease, reduce HIV-related disability and death, and prevent new infections.

- HIV-infected patients share problems experienced by all individuals with chronic diseases, but these problems are exacerbated by negative social constructs surrounding HIV.

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Key Points

Chapter 16: Cancer

- **Cancer** encompasses a broad range of diseases of multiple causes that can arise in any cell of the body capable of evading regulatory controls over proliferation and differentiation.

- Two major dysfunctions present in the process of cancer are (1) defective cellular proliferation (growth) and (2) defective cellular differentiation.

- Cancer cells usually proliferate at the same rate of the normal cells of the tissue from which they arise. However, cancer cells divide indiscriminately and haphazardly and sometimes produce more than two cells at the time of mitosis.

- **Protooncogenes** are normal cellular genes that are important regulators of normal cellular processes. When these genes become mutated, they can begin to function as **oncogenes** (tumor-inducing genes).

- Tumors can be classified as benign or malignant.
    - **Benign neoplasms** are well-differentiated.
    - **Malignant neoplasms** range from well-differentiated to undifferentiated.

- The stages of cancer include initiation, promotion, and progression.
    - The first stage, initiation, is the occurrence of a mutation in the cell's genetic structure, resulting from an inherited mutation, an error that occurs during DNA replication, or following exposure to a chemical, radiation, or viral agent.
    - Promotion, the second stage in the development of cancer, is characterized by the reversible proliferation of the altered cells.
    - Progression, the final stage, is characterized by increased growth rate of the tumor, increased invasiveness, and spread of the cancer to a distant site (**metastasis**).

- Since cancer cells arise from normal human cells, the immune response mounted against cancer cells may be inadequate to effectively eradicate them.

- The process by which cancer cells evade the immune system is termed immunologic escape.

- Tumors can be classified according to anatomic site, **histologic (grading),** and extent of disease (**staging**).
    - In the anatomic classification of tumors, the tumor is identified by the tissue of origin, the anatomic site, and the behavior of the tumor (i.e., benign or malignant).
    - In histologic grading of tumors, the appearance of cells and the degree of differentiation are evaluated pathologically. For many tumor types, four grades are used to evaluate abnormal cells based on the degree to which the cells resemble the tissue of origin.
    - The staging classification system is based on a description of the extent of the disease rather than on cell appearance.

- The biopsy procedure is the only definitive means of diagnosing cancer.

- The goal of cancer treatment is cure, control, or palliation.
    - When cure is the goal, the treatment offered is expected to have the greatest chance of disease eradication and may involve local therapy (i.e., surgery or radiation) alone or in combination with or without periods of adjunctive systemic therapy (i.e., chemotherapy).
    - Control is the goal of the treatment plan for many cancers that cannot be completely eradicated but are responsive to anticancer therapies and, as with other chronic illnesses such as diabetes mellitus and heart failure, can be managed for long periods of time with therapy.
    - With palliation, relief or control of symptoms and the maintenance of a satisfactory quality of life are the primary goals rather than cure or control of the disease process.

- Modalities for cancer treatment with all three goals include surgery, chemotherapy, radiation therapy, and biologic and targeted therapy.

- The goal of **chemotherapy** is to eliminate or reduce the number of malignant cells present in the primary tumor and metastatic tumor site(s).
- Chemotherapeutic drugs are classified in general groups according to their molecular structure and mechanisms of action.
- Chemotherapy can be administered by multiple routes, such as central vascular access devices, peripherally inserted central venous catheters, or implanted infusion ports.
- Regional treatment with chemotherapy involves the delivery of the drug directly to the tumor site.
- Chemotherapy-induced side effects are the result of the destruction of normal cells, especially those that are rapidly proliferating such as those in the bone marrow, lining of the gastrointestinal system, and the integumentary system (skin, hair, and nails).
- **Radiation** is the emission and distribution of energy through space or a material medium.
- Radiation is used to treat a carefully defined area of the body to achieve local control of disease.
- Simulation is a part of radiation treatment planning used to determine the optimal treatment method by focusing on the geometric aspects of treatment.
- Nurses play a key role in assisting patients to cope with the psychoemotional issues associated with receiving cancer treatment.
- Educating patients about their treatment regimen, supportive care options (e.g., antiemetics, antidiarrheals), and what to expect during the course of treatment is important to help decrease fear and anxiety, encourage adherence, and guide at-home self-management.
- Myelosuppression is one of the most common effects of chemotherapy, and, to a lesser extent, it can also occur with radiation.
- Fatigue is a nearly universal symptom affecting 70% to 100% of patients with cancer.
- The intestinal mucosa is one of the most sensitive tissues to radiation and chemotherapy.
- Nausea and vomiting are common sequelae of chemotherapy and, in some instances, radiation therapy.
- Biologic and targeted therapy can be effective alone or in combination with surgery, radiation therapy, and chemotherapy.

- **Biologic therapy** consists of agents that modify the relationship between the host and the tumor by altering the biologic response of the host to the tumor cells.

- **Targeted therapy** interferes with cancer growth by targeting specific cellular receptors and pathways that are important in tumor growth.

- Capillary leak syndrome, pulmonary edema, bone marrow depression, and fatigue are associated with biologic therapy.

- **Hematopoietic stem cell transplantation** is an effective, lifesaving procedure for a number of malignant and nonmalignant diseases.
    - Hematopoietic stem cell transplants are categorized as allogeneic, syngeneic, or autologous.
    - In allogeneic transplantation, stem cells are acquired from a donor who has been determined to be human leukocyte antigen (HLA)–matched to the recipient.
    - Syngeneic transplantation is a type of allogeneic transplant that involves obtaining stem cells from one identical twin and infusing them into the other.
    - In autologous transplantation patients receive their own stem cells back following myeloablative (destroying bone marrow) chemotherapy.

- **Gene therapy** is an experimental therapy that involves introducing genetic material into a person's cell to fight a disease, such as cancer.

- Cancer patients may develop complications related to the continual growth of the malignancy into normal tissue or to the side effects of treatment.

- Moderate to severe pain occurs in approximately 50% of patients who are receiving active treatment for their cancer and in 80% to 90% of patients with advanced cancer.

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Key Points

Chapter 17: Fluid, Electrolyte, and Acid-Base Imbalances

- Body fluids and electrolytes play an important role in **homeostasis.**

- Many diseases and their treatments have the ability to affect fluid and electrolyte balance.

- Water is the primary component of the body, accounting for approximately 60% of the body weight in the adult.
- The two major fluid compartments in the body are intracellular and extracellular.
- The measurement of **electrolytes** is important to the nurse in evaluating electrolyte balance, as well as in determining the composition of electrolyte preparations.
- **Osmolality** is important because it indicates the water balance of the body.
- In the metabolically active cell, there is a constant exchange of substances between the cell and the interstitium, but no net gain or loss of water occurs.
- The major colloid in the vascular system contributing to the total **osmotic pressure** is protein.
- The amount and direction of movement between the interstitium and the capillary are determined by the interaction of (1) capillary **hydrostatic pressure**, (2) plasma oncotic pressure, (3) interstitial hydrostatic pressure, and (4) interstitial oncotic pressure.
- If capillary or interstitial pressures are altered, fluid may abnormally shift from one compartment to another, resulting in edema or **dehydration**.
- Fluid is drawn into the plasma space whenever there is an increase in the plasma osmotic or oncotic pressure. This could happen with administration of colloids, dextran, mannitol, or hypertonic solutions.
- **First spacing** describes the normal distribution of fluid in the intracellular fluid (ICF) and extracellular fluid (ECF) compartments. **Second spacing** refers to an abnormal accumulation of interstitial fluid (i.e., edema). **Third spacing** occurs when fluid accumulates in a portion of the body from which it is not easily exchanged with the rest of the ECF.
- Water balance is maintained via the finely tuned balance of water intake and excretion.
- An intact thirst mechanism is important for fluid balance. The patient who cannot recognize or act on the sensation of thirst is at risk for fluid deficit and hyperosmolality.
- An increase in plasma osmolality or a decrease in circulating blood volume will stimulate antidiuretic hormone (ADH) secretion. Reduction in the release or action of ADH produces diabetes insipidus.
- Aldosterone is a mineralocorticoid with potent sodium-retaining and potassium-excreting capability.

- The primary organs for regulating fluid and electrolyte balance are the kidneys, lungs, and gastrointestinal tract.
- **Insensible water loss,** which is invisible vaporization from the lungs and skin, assists in regulating body temperature.
- With severely impaired renal function, the kidneys cannot maintain fluid and electrolyte balance. This condition results in edema, potassium, and phosphorus retention, acidosis, and other electrolyte imbalances.
- Structural changes to the kidney and a decrease in the renal blood flow lead to a decrease in the glomerular filtration rate, decreased creatinine clearance, the loss of the ability to concentrate urine and conserve water, and narrowed limits for the excretion of water, sodium, potassium, and hydrogen ions.
- Fluid and electrolyte imbalances are commonly classified as deficits or excesses.
- Fluid volume deficit can occur with abnormal loss of body fluids (e.g., diarrhea, fistula drainage, hemorrhage, polyuria), inadequate intake, or a plasma-to-interstitial fluid shift.
- The use of 24–hour intake and output records gives valuable information regarding fluid and electrolyte problems.
- Monitoring the patient for cardiovascular and neurologic changes is necessary to prevent or detect complications from fluid and electrolyte imbalances.
- Accurate daily weights provide the easiest measurement of volume status. Weight changes must be obtained under standardized conditions.
- Edema is assessed by pressing with a thumb or forefinger over the edematous area.
- The rates of infusion of IV fluid solutions should be carefully monitored.
- The goal of treatment in fluid and electrolyte imbalances is to treat the underlying cause.

SODIUM

- Is the major ECF cation.
- An elevated serum sodium may occur with water loss or sodium gain.
- ***Hyponatremia:***
    - Common causes include water excess from inappropriate use of sodium-free or hypotonic IV fluids.
    - Symptoms of hyponatremia are related to cellular swelling and are first

manifested in the central nervous system (CNS).

POTASSIUM

- Is the major ICF cation.

- Factors that cause potassium to move from the ICF to the ECF include acidosis, trauma to cells (as in massive soft tissue damage or in tumor lysis), and exercise.

- ***Hyperkalemia***
  - The most common cause is renal failure. Hyperkalemia is also common with massive cell destruction (e.g., burn or crush injury, tumor lysis); rapid transfusion of stored, hemolyzed blood; and catabolic states (e.g., severe infections).
  - Manifestations of hyperkalemia include cramping leg pain, followed by weakness or paralysis of skeletal muscles.
  - All patients with clinically significant hyperkalemia should be monitored electrocardiographically to detect dysrhythmias and to monitor the effects of therapy. Cardiac depolarization is decreased, leading to flattening of the P wave and widening of the QRS wave. Repolarization occurs more rapidly, resulting in shortening of the QT interval and causing the T wave to be narrower and more peaked. Ventricular fibrillation or cardiac standstill may occur.
  - The patient experiencing dangerous cardiac dysrhythmias should receive IV calcium gluconate immediately while the potassium is being eliminated and forced into cells.

- ***Hypokalemia***
  - The most common causes are from abnormal losses via either the kidneys or the gastrointestinal tract. Abnormal losses occur when the patient is diuresing, particularly in the patient with an elevated aldosterone level.
  - In the patient with hypokalemia, cardiac changes include impaired repolarization, resulting in a flattening of the T wave and eventually in emergence of a U wave. The incidence of potentially lethal ventricular dysrhythmias is increased in hypokalemia.
  - Patients taking digoxin experience increased digoxin toxicity if their serum potassium level is low. Skeletal muscle weakness and paralysis may occur with hypokalemia. Severe hypokalemia can cause weakness or paralysis of respiratory muscles, leading to shallow respirations and respiratory arrest.
  - Hypokalemia is treated by giving potassium chloride supplements and increasing dietary intake of potassium.

CALCIUM

- ***Hypercalcemia***
  - About two thirds of cases are caused by hyperparathyroidism and one third are caused by malignancy, especially from breast cancer, lung cancer, and multiple myeloma.
  - Manifestations of hypercalcemia include decreased memory, confusion,

disorientation, fatigue, muscle weakness, constipation, cardiac dysrhythmias, and renal calculi.
  - Treatment of hypercalcemia is promotion of excretion of calcium in urine by administration of a loop diuretic and hydration of the patient with isotonic saline infusions.

- ***Hypocalcemia***
  - Is caused by a decrease in the production of parathyroid hormone.
  - Hypocalcemia is characterized by increased muscle excitability resulting in tetany.
  - A patient who has had neck surgery including thyroidectomy is observed carefully for signs of hypocalcemia.

Phosphate

- The major condition that can lead to hyperphosphatemia is acute or chronic renal failure.

- Hypophosphatemia (low serum phosphate) is seen in the patient who is malnourished or has a malabsorption syndrome.

MAGNESIUM

- Hypomagnesemia (low serum magnesium level) produces neuromuscular and CNS hyperirritability.

- Hypermagnesemia usually occurs only with an increase in magnesium intake accompanied by renal insufficiency or failure.

ACID-BASE IMBALANCES

- Patients with diabetes mellitus, chronic obstructive pulmonary disease, and kidney disease frequently develop acid-base imbalances. Vomiting and diarrhea may cause loss of acids and bases.

- The nurse must always consider the possibility of acid-base imbalance in patients with serious illnesses.

- The **buffer system** is the fastest acting system and the primary regulator of acid-base balance.

- The lungs help maintain a normal pH by excreting CO_2 and water, which are by-products of cellular metabolism.

- The three renal mechanisms of acid elimination are secretion of small amounts of free hydrogen into the renal tubule, combination of H^+ with ammonia (NH_3) to form ammonium (NH_4^+), and excretion of weak acids.

- Acid-base imbalances are classified as respiratory or metabolic.
    - **Respiratory acidosis** (carbonic acid excess) occurs whenever there is hypoventilation.
    - **Respiratory alkalosis** (carbonic acid deficit) occurs whenever there is hyperventilation.
    - **Metabolic acidosis** (base bicarbonate deficit) occurs when an acid other than carbonic acid accumulates in the body or when bicarbonate is lost from body fluids.
    - **Metabolic alkalosis** (base bicarbonate excess) occurs when a loss of acid (prolonged vomiting or gastric suction) or a gain in bicarbonate occurs.

- Arterial blood gas (ABG) values provide valuable information about a patient's acid-base status, the underlying cause of the imbalance, the body's ability to regulate pH, and the patient's overall oxygen status.

- In cases of acid-base imbalances, the treatment is directed toward correction of the underlying cause.

- Fluid replacement therapy is used to correct fluid and electrolyte imbalances.
    - A **hypotonic** solution provides more water than electrolytes, diluting the ECF.
    - Plasma expanders stay in the vascular space and increase the osmotic pressure.
    - A **hypertonic** solution initially raises the osmolality by the ECF and expands it.

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Key Points

Chapter 18: Nursing Management: Preoperative Care

- **Surgery** is performed to diagnose, cure, palliate, prevent, explore, and/or provide cosmetic improvement.

- **Ambulatory surgery** is generally preferred by patients, physicians, and third-party payers.

- The preoperative nursing assessment is performed to:
    - Determine the patient's psychologic and physiologic factors that may contribute to operative risk factors
    - Establish baseline data
    - Identify and document the surgical site
    - Identify prescription and over-the-counter (OTC) drugs and herbal products

  - Confirm laboratory results
  - Note cultural and ethnic factors that may affect the surgical experience
  - Validate that the consent form has been signed and witnessed

- Common fears associated with surgery include the potential for death, permanent disability resulting from surgery, pain, change in body image, or results of a diagnostic procedure.

- In the nursing assessment, information should also be obtained about the patient's family concerning any history of adverse reactions to or problems with anesthesia.

- All findings on the medication history should be documented and communicated to the intraoperative and postoperative personnel.

- Patients should also be screened for possible latex allergies.

- The preoperative assessment of the older person's baseline cognitive function is especially crucial for intraoperative and postoperative evaluation.

- The patient with diabetes mellitus is especially at risk for adverse effects of anesthesia and surgery.

- Obesity stresses both the cardiac and pulmonary system and makes access to the surgical site and anesthesia administration more difficult.

- Preoperative teaching involves the following:
  - Three types of information: sensory, process, and procedural.
  - Different patients, with varying cultures, backgrounds, and experiences, may want different types of information.
  - All teaching should be documented in the patient's medical record.
  - All patients should receive instruction about deep breathing, coughing, and moving postoperatively.

- **Informed consent:**
  - Is an active, shared decision-making process between the provider and the recipient of care.
  - A true medical emergency may override the need to obtain consent.

- On the day of surgery, the nurse is responsible for the following:
  - Final preoperative teaching
  - Assessment and communication of pertinent findings
  - Ensuring that all preoperative preparation orders have been completed
  - Ensuring that records and reports are present and complete to accompany the patient to the OR

  - Verifying the presence of a signed operative consent
  - Laboratory data
  - A history and physical examination report
  - A record of any consultations
  - Baseline vital signs
  - Nurses' notes complete to that point.

- Preoperative medications may include the following:
  - Benzodiazepines and barbiturates for sedation and amnesia
  - Anticholinergics to reduce secretions
  - Opioids to decrease intraoperative anesthetic requirements and pain
  - Additional drugs include antiemetics, antibiotics, eye drops, and regular prescription drugs

- Frequently performed procedures in the older adult are cataract extraction, coronary and vascular procedures, prostate surgery, herniorrhaphy, cholecystectomy, and hip repair.

- Older adults may have sensory, motor, and cognitive deficits necessitating that more time may be needed to complete preoperative testing and understand preoperative instructions. These changes also require attention to promote patient safety and prevent injury.

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Key Points

Chapter 19: Nursing Management: Intraoperative Care

- The **surgical suite** is divided into three distinct areas: unrestricted, semirestricted, and restricted.
  - The *unrestricted area* is where personnel in street clothes can interact with those in scrub clothing.
  - In the *semirestricted area,* personnel must wear surgical attire and cover all head and facial hair.
  - In the *restricted area*—which includes the **operating room** (OR), the sink area, and clean core—masks are required to supplement surgical attire.

- In the **holding area,** the perioperative nurse makes the final identification and assessment before the patient is transferred into the OR for surgery. Procedures such as inserting intravenous (IV) catheters and arterial lines, removing casts, and drug administration may occur here.

- The OR is a unique acute care setting removed from other hospital clinical units. It is controlled geographically, environmentally, and bacteriologically, and it is restricted in terms of the inflow and outflow of personnel.

- The **perioperative nurse** is a registered nurse who implements patient care during the perioperative period. This includes the following:
    - Preparing the OR for the patient
    - Serving as the patient's advocate during surgery
    - Assessing the patient for additional needs or tasks before surgery
    - Educating the patient and family members

- The **function of circulating** is implemented by the perioperative nurse who is not scrubbed, gowned, and gloved and remains in the unsterile field.

- The **function of scrubbing** is implemented by the nurse who follows the designated scrub procedure, is gowned and gloved in sterile attire, and remains in the sterile field.

- The **registered nurse first assistant (RNFA)** works in collaboration with the surgeon to produce an optimal surgical outcome for the patient.

- Assessment data important to intraoperative nursing care include the patient's vital signs, height, weight, and age; allergic reactions to food, drugs, and latex; condition and cleanliness of skin; skeletal and muscle impairments; perceptual difficulties; level of consciousness; nothing-by-mouth (NPO) status; and any sources of pain or discomfort.

- Surgical hand antisepsis is required of all sterile members of the surgical team (scrub assistant, surgeon, and assistant).

- The center of the sterile field is the site of the surgical incision.

- The nurse must understand the mechanism of anesthetic administration and the pharmacologic effects of the agents as well as the location of all emergency drugs and equipment in the OR area.

- It is a nursing responsibility to secure the patient's extremities, provide adequate padding and support, and obtain sufficient physical or mechanical help to avoid unnecessary straining of self or patient.

- The task of prepping the patient for surgery is usually the responsibility of the circulating nurse.

- The patient's response to nursing care is evaluated by the OR nurse, based on outcome criteria established during the development of the patient's plan of care.

ANESTHESIA

- An absolute contraindication of any anesthetic technique is patient refusal.

- Moderate sedation/analgesia (**conscious sedation**):
  - Is a drug-induced depression of consciousness that retains the patient's ability to maintain her or his own airway and respond appropriately to verbal commands
  - In this type of anesthesia, the patient achieves a level of emotional and physical acceptance of a painful procedure (e.g., colonoscopy).

- **General anesthesia:**
  - May be administered by intravenous, inhalation, or rectal routes, or as a combination of these.
  - Nearly all routine general anesthetics begin with an IV induction agent.

- Inhalation agents:
  - Administered by an endotracheal tube, a laryngeal mask airway, or a tracheostomy and enter the body via the lung alveoli.
  - Complications of inhalation anesthesia include coughing, laryngospasm, bronchospasm, increased secretions, and respiratory depression.

- Drugs to achieve unconsciousness, analgesia, amnesia, muscle relaxation, or autonomic nervous system control are added to an inhalation anesthetic and are termed adjuncts.

- **Local anesthesia** administered either topically or by injection allows for an operative procedure to be performed on a particular part of the body without loss of consciousness or sedation.

- The initial clinical manifestations of anaphylaxis may be masked by anesthesia.

- To prevent **malignant hyperthermia,** it is important for the nurse to obtain a careful family history and be alert to its development perioperatively.

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Key Points

Chapter 20: Nursing Management: Postoperative Care

The postoperative period begins immediately after surgery and continues until the patient is discharged from medical care.

POSTANESTHESIA CARE UNIT

- Priority care in the **postanesthesia care unit** (PACU) includes monitoring and management of respiratory and circulatory function, pain, temperature, and the surgical site.

- Assessment begins with an evaluation of the airway, breathing, and circulation (ABC). Any evidence of respiratory compromise requires prompt intervention.

- Pulse oximetry monitoring is initiated because it provides a noninvasive means of assessing the adequacy of oxygenation.

- Electrocardiographic (ECG) monitoring is initiated to determine cardiac rate and rhythm.

- The initial neurologic assessment focuses on level of consciousness, orientation, sensory and motor status, and size, equality, and reactivity of the pupils.

- Because hearing is the first sense to return, the nurse explains all activities to the patient from the moment of admission to the PACU.

POTENTIAL COMPLICATIONS IN THE PACU

Respiratory

- In the immediate postanesthesia period, the most common causes of airway compromise include **airway obstruction,** hypoxemia, and hypoventilation.

- Patients at risk include those who have had general anesthesia, are older, smoke heavily, have lung disease, are obese, or have undergone airway, thoracic, or abdominal surgery.

- **Hypoxemia,** specifically an arterial oxygen tension (PaO_2) of less than 60 mm Hg, is characterized by a variety of nonspecific clinical signs and symptoms, ranging from agitation to somnolence, hypertension to hypotension, and tachycardia to bradycardia.
    - The most common cause of postoperative hypoxemia is **atelectasis,** which occurs as a result of retained secretions or decreased respiratory excursion.
    - Other causes include pulmonary edema, aspiration, and **bronchospasm.**

- **Hypoventilation** is characterized by a decreased respiratory rate or effort, hypoxemia, and an increasing arterial carbon dioxide tension ($PaCO_2$), which also known as hypercapnia.

- The nurse evaluates airway patency; chest symmetry; and the depth, rate, and character of respirations. The chest wall is observed for symmetry of movement with a hand placed lightly over the xiphoid process. Breath sounds are auscultated anteriorly, laterally, and posteriorly.

- Regular monitoring of vital signs and use of pulse oximetry are necessary for early recognition of respiratory problems.

- The presence of hypoxemia from any cause may be reflected by rapid breathing, gasping, apprehension, restlessness, and a rapid or thready pulse.

- Proper positioning facilitates respiration and protects the airway. Unless contraindicated by the surgical procedure, the unconscious patient is positioned in a lateral "recovery" position. Oxygen therapy will be used if the patient has had general anesthesia and/or the anesthesia care provider (ACP) orders it.

Cardiovascular

- The most common cardiovascular problems include hypotension, hypertension, and dysrhythmias. Patients at greatest risk include those with alterations in respiratory function, a history of cardiovascular disease, the elderly, the debilitated, and the critically ill.

- *Hypotension* is most commonly caused by unreplaced fluid and blood loss, which may lead to hypovolemic shock. Treatment of hypotension begins with oxygen therapy to promote oxygenation of hypoperfused organs.

- *Hypertension* is most frequently the result of pain, anxiety, bladder distention, or respiratory compromise. Treatment of hypertension will center on eliminating the precipitating cause.

- *Dysrhythmias* are often the result of hypokalemia, hypoxemia, hypercarbia, alterations in acid-base status, circulatory instability, hypothermia, pain, surgical stress, and preexisting heart disease. Treatment is directed toward eliminating the cause.

- Vital signs are monitored frequently (i.e., every 15 minutes, or more often until stabilized, and then at less-frequent intervals).

- The anesthesia care provider (ACP) or surgeon should be notified if the following occur:
    - Systolic BP is less than 90 mm Hg or greater than 160 mm Hg.
    - Pulse rate is less than 60 beats per minute or more than 120 beats per minute.
    - Pulse pressure (difference between systolic and diastolic pressures) narrows.
    - BP gradually decreases during several consecutive readings.
    - There is a change in cardiac rhythm.
    - There is a significant variation from preoperative readings.

Neurologic

- **Emergence delirium,** or "waking up wild," can include restlessness, agitation, disorientation, thrashing, and shouting. It may be caused by anesthetic agents, hypoxia, bladder distention, pain, electrolyte abnormalities, or the patient's state of anxiety preoperatively.

- **Delayed emergence** is most commonly caused by prolonged drug action, particularly of opioids, sedatives, and inhalational anesthetics, as opposed to neurologic injury.

- The most common cause of postoperative agitation is hypoxemia.
- Until the patient is awake and able to communicate effectively, it is the responsibility of the PACU nurse to act as a patient advocate and to maintain the patient's safety.
- The patient's level of consciousness, orientation, and memory and ability to follow commands are assessed. The size, reactivity, and equality of the pupils are determined.
- Pain is a common problem and a significant fear for the patient in the PACU.

Body Temperature

- **Hypothermia,** a core temperature less than 96.8º F (36º C), occurs when heat loss is greater than heat production. Heat loss during the perioperative period can be due to radiation, convection, conduction, and evaporation, infusion of cool IV fluids, and ventilation with dry gases.
- Frequent assessment of the patient's temperature is important to detect patterns of hypothermia and/or fever.

POTENTIAL PROBLEMS IN THE CLINICAL UNIT

Respiratory

- Common causes of respiratory problems are atelectasis and pneumonia, especially after abdominal and thoracic surgery.
- Deep breathing is encouraged to facilitate gas exchange. The patient should be encouraged to breathe deeply 10 times every hour while awake.
- The patient's position should be changed every 1 to 2 hours to allow full chest expansion and to increase perfusion of both lungs. Ambulation, not just sitting in a chair, should be aggressively carried out as soon as physician approval is given.

Cardiovascular

- Postoperative fluid and electrolyte imbalances are contributing factors to cardiovascular problems. Fluid overload may occur when IV fluids are administered too rapidly, when chronic (e.g., cardiac, renal) disease exists, or when the patient is an older adult.
- **Syncope** (fainting) may occur as a result of decreased cardiac output, fluid deficits, or defects in cerebral perfusion.
- An accurate intake and output record should be kept, and laboratory findings (e.g., electrolytes, hematocrit) should be monitored.
- The nurse should be alert for symptoms of too slow or too rapid a rate of fluid replacement.

- Hypokalemia causing dysrhythmias can be a consequence of urinary and gastrointestinal (GI) tract losses, and inadequate potassium replacement.

- Deep vein thrombosis (DVT) may form in leg veins as a result of inactivity, body position, and pressure, all of which lead to venous stasis and decreased perfusion.
    - Leg exercises should be encouraged 10 to 12 times every 1 to 2 hours while awake. Early ambulation is the most significant general nursing measure to prevent postoperative complications.
    - Subcutaneous heparin (or low-molecular-weight heparin [LMWH]) in combination with antiembolism stockings are used to prevent DVT.

Neurologic

- Two types of postoperative cognitive impairment are seen in surgical patients: delirium and postoperative cognitive dysfunction.

- Confusion or delirium may arise from a variety of psychologic and physiologic sources, including fluid and electrolyte imbalances, hypoxemia, drug effects, sleep deprivation, and sensory deprivation or overload.

- Alcohol withdrawal delirium is a reaction characterized by restlessness, insomnia and nightmares, irritability, and auditory or visual hallucinations.

- To prevent or manage postoperative delirium, the nurse should address factors known to contribute to the condition.

- The nurse should attempt to prevent psychologic problems in the postoperative period by providing adequate support for the patient.

- Pain is a common problem during the postoperative period. Pain can contribute to dysfunction of the immune system and blood clotting, delayed return of normal gastric and bowel function, and increased risk of atelectasis and impaired respiratory function.

- The patient's self-report is the single most reliable indicator of pain.

- Identifying the location of the pain is important. Incisional pain is to be expected, but other causes of pain, such as a full bladder, may be present.

- The most effective interventions for postoperative pain management include using a variety of analgesics.

- Postoperative pain relief is a nursing responsibility. The nurse should notify the physician and request a change in the order if the analgesic either fails to relieve the pain or makes the patient excessively lethargic or somnolent.

- Patient-controlled analgesia (PCA) and **epidural analgesia** are two alternative

approaches for pain control.

Body Temperature and Infection

- Temperature variation provides valuable information about the patient's status. Fever may occur at any time. A mild elevation (up to 100.4º F [38º C]) during the first 48 hours usually reflects the surgical stress response.

- Wound infection, particularly from aerobic organisms, is often accompanied by a fever that spikes in the afternoon or evening and returns to near-normal levels in the morning.

- Intermittent high fever accompanied by shaking chills and diaphoresis suggests septicemia.

Gastrointestinal

- Numerous factors have been identified as contributing to the development of nausea and vomiting, including gender (female), history of motion sickness or previous postoperative nausea and vomiting, anesthetics or opioids, and duration and type of surgery.
    - If vomiting occurs, it is important to determine the quantity, characteristics, and color of the vomitus.
    - The abdomen is assessed for distention and the presence of bowel sounds. All four quadrants are auscultated to determine the presence, frequency, and characteristics of the sounds.
    - Postoperative nausea and vomiting are treated with the use of antiemetic or prokinetic drugs.
    - Abdominal distention is caused by decreased peristalsis as a result of handling of the intestine during surgery and limited dietary intake before and after surgery.
    - Abdominal distention may be prevented or minimized by early and frequent ambulation.

- A nasogastric tube may be used to decompress the stomach to prevent nausea, vomiting, and abdominal distention.

Urinary

- Low urine output (800 to 1500 ml) in the first 24 hours after surgery may be expected, regardless of fluid intake.

- Acute urinary retention can occur in the postoperative period due to anesthesia, location of the surgery (e.g., lower abdominal, pelvic), pain, immobility, and the recumbent position in bed.
    - The urine of the postoperative patient should be examined for both quantity and quality.
    - Most patients urinate within 6 to 8 hours after surgery. If no voiding occurs, the abdominal contour should be inspected and the bladder assessed for distention.

Wound Infection

- Wound infection may result from contamination of the wound from three major sources: exogenous flora present in the environment and on the skin, oral flora, and intestinal flora.

- The incidence of wound sepsis is higher in patients who are malnourished, immunosuppressed, or older, or who have had a prolonged hospital stay or a lengthy surgical procedure (lasting more than 3 hours).

- Evidence of wound infection usually does not become apparent before the third to the fifth postoperative day.
  - Local manifestations include redness, swelling, and increasing pain and tenderness at the site.
  - Systemic manifestations are fever and leukocytosis.

- Nursing assessment of the wound and dressing requires knowledge of the type of wound, the drains inserted, and expected drainage related to the specific type of surgery.
  - A small amount of serous drainage is common from any type of wound.
  - If a drain is in place, a moderate to large amount of drainage may be expected.
  - Drainage is expected to change from sanguineous (red) to serosanguineous (pink) to serous (clear yellow). The drainage output should decrease over hours or days, depending on the type of surgery.
  - Wound infection may be accompanied by purulent drainage. **Wound dehiscence** (separation and disruption of previously joined wound edges) may be preceded by a sudden discharge of brown, pink, or clear drainage.
  - When drainage occurs on the dressing, the type, amount, color, consistency, and odor of drainage are noted.

DISCHARGE

- The choice of discharge site is based on patient acuity, access to follow-up care, and the potential for postoperative complications.

- The decision to discharge the patient from the PACU is based on written discharge criteria.

- Discharge to the clinical unit:
  - Vital signs should be obtained, and patient status should be compared with the report provided by the PACU. Documentation of the transfer is then completed, followed by a more in-depth assessment. Postoperative orders and appropriate nursing care are then initiated.

- Ambulatory surgery discharge:
  - The patient leaving an ambulatory surgery setting must be mobile and alert to provide a degree of self-care when discharged to home.
  - The nurse specifically documents the discharge instructions provided to the

patient and family.

GERONTOLOGIC CONSIDERATIONS

- Older adults have decreased respiratory function, including decreased ability to cough, decreased thoracic compliance, and decreased lung tissue, placing them at greater risk during the perioperative period.

- Drug toxicity is a potential problem. Renal and liver function must be carefully assessed in the postoperative phase to prevent drug overdosage and toxicity.

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Key Points

Chapter 21: Nursing Assessment: Visual and Auditory Systems

STRUCTURES AND FUNCTIONS

- The visual system includes external tissues and structures surrounding the eye.
    - External structures include the eyebrows, eyelids, eyelashes, lacrimal system, **conjunctiva,** cornea, **sclera,** and extraocular muscles.
    - Internal structures include the iris, **lens,** ciliary body, choroid, and **retina.**

- The cornea, **aqueous humor,** lens, and vitreous must all remain clear for light to reach the retina and stimulate the photoreceptor cells.

- Refraction is the ability of the eye to bend light rays so that they fall on the retina. When light does not focus properly, it is called refractive error.

- Types of refractive errors are **myopia** (nearsightedness) and **hyperopia** (farsightedness).

- **Astigmatism** is caused by corneal unevenness resulting in visual distortion. Presbyopia is a type of hyperopia due to aging.

- The auditory system consists of peripheral and central systems.
    - Peripheral system includes the external, middle, and inner ear and is involved with sound reception and perception.
    - The central system (brain and its pathways) integrates and assigns meaning to what is heard.

- **Presbycusis** can result from aging or insults from a variety of sources. **Tinnitus,** or ringing in the ears, may accompany the hearing loss that results from the aging process.

- External and middle ear portions conduct and amplify sound waves from the environment. Problems located in these areas cause conductive hearing loss with changes in sound perception/sensitivity.

- The inner ear functions in hearing and balance. Problems located in this area or along the nerve pathway from the brain cause sensorineural hearing loss with changes in tone perception/sensitivity.

- Central auditory system problems cause central hearing loss with difficulty in understanding the meaning of words.

ASSESSMENT AND DIAGNOSTIC STUDIES

- Patient information obtained should include past eye/ear health and family history. History also should include specific diseases and medications known to cause vision and hearing problems. Past history of visual and auditory tests and eye/ear trauma is also noted.

- Visual assessment determines visual acuity, ability to judge closeness and distance, extraocular muscle function, evaluating visual fields and pupil function, and measuring intraocular pressure.

- Auditory assessment notes head posturing and appropriateness of responses when speaking to the patient and balance. Problems with balance may present as **nystagmus** or **vertigo.**

- Visual and auditory external structures are assessed by inspection for symmetry and deformity. Some eye structures must be visualized with an ophthalmoscope; an otoscope is used for further assessment of certain ear structures.

- Visual assessment can include color vision and stereopsis with auditory assessment often including whisper/spoken word testing, audiometry, and tuning fork tests.

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Key Points

Chapter 22: Nursing Management: Visual and Auditory Problems

PROBLEMS OF THE EYE

REFRACTIVE ERRORS

- **Refractive errors** are the most common visual problems. They occur when light rays do not converge into a single focus on the retina.
- **Myopia,** or nearsightedness, is the most prevalent refractive error.
- **Hyperopia** refers to farsightedness.
- **Presbyopia** is farsightedness due to decreased accommodative ability of the aging eye.
- Most refractive errors are corrected by lenses (eyeglasses or contact lenses), refractive surgery, or surgical implantation of an artificial lens.

EXTRAOCULAR DISORDERS

- A **hordeolum** (sty) is an infection of sebaceous glands in the lid margin.
- A **chalazion** is a chronic inflammatory granuloma of meibomian (sebaceous) glands in the lid.
- **Blepharitis** is a common chronic bilateral inflammation of the lid margins.
- **Conjunctivitis** is infection or inflammation of the conjunctiva.
    - Acute bacterial conjunctivitis (pinkeye) is common.
    - It occurs initially in one eye and can spread rapidly to the unaffected eye.
    - It is usually self-limiting, but antibiotic drops shorten the course of the disorder.
- Trachoma is a chronic conjunctivitis caused by *Chlamydia trachomatis*.
    - It is a global cause of blindness.
    - It is preventable and transmitted mainly by hands and flies.
- **Keratitis** is corneal inflammation or infection.
    - The cornea can become infected by bacteria, viruses, or fungi.
    - Topical antibiotics are generally effective, but eradicating infection may require antibiotics administered by subconjunctival injection or IV.
    - Other causes are chemical damage, contact lens wear, and contaminated products (e.g., lens care solutions, cosmetics).
    - Tissue loss due to infection produces corneal ulcers.
    - Treatment is aggressive to avoid permanent loss of vision. An untreated ulcer can result in corneal scarring and perforation.

CATARACT

- A **cataract** is an opacity within the lens.

- Symptoms of cataracts are decreased vision, abnormal color perception, and glare.

- Removal of the cataract is the most common surgery for older adults. Most patients undergoing cataract removal have an intraocular lens implanted during surgery.

- After cataract surgery, the eyes are temporarily covered with a patch and protective shield.

- Postoperative nursing goals include teaching about eye care, activity restrictions, medications, follow-up visit schedule, and signs/symptoms of possible complications.

- Healing is complete around 6 to 8 weeks postoperatively.

RETINOPATHY

- **Retinopathy** is microvascular damage to the retina that can lead to blurred and progressive vision loss.

- It is often associated with diabetes mellitus and hypertension.

- Nonproliferative diabetic retinopathy is characterized by capillary microaneuryms, retinal swelling, and hard exudates.
    - Macular edema represents a worsening as plasma leaks from macular blood vessels.
    - It may be treated with laser photocoagulation.

- Hypertensive retinopathy is caused by high blood pressure that creates blockages in retinal blood vessels.
    - On examination, retinal hemorrhages and macula swelling are noted.
    - Sustained, severe hypertension can cause sudden visual loss with optic disc and nerve swelling.
    - Treatment focuses on lowering the blood pressure.

RETINAL DETACHMENT

- **Retinal detachment** is a separation of the retina and underlying epithelium with fluid accumulation between the two layers.

- Detachment is caused by a retinal break, which is interruption in the full thickness of retinal tissue.

- Untreated, symptomatic retinal detachment results in blindness.

- Breaks are classified as tears or holes.

- Symptoms are light flashes, floaters, and/or rings in vision. Once detached, painless loss of peripheral or central vision occurs.

- Treatment of retinal detachment is to first seal retinal breaks and then relieve inward traction on retina.

- Several types of surgery used include laser photocoagulation and cryopexy and then scleral buckling.

- Visual prognosis varies, depending on the extent, length, and area of detachment.

- Discharge planning and teaching are important, with the nurse beginning this process early as the patient is not hospitalized for long.

AGE-RELATED MACULAR DEGENERATION

- **Age-related macular degeneration** (AMD) is the most common cause of irreversible central vision loss in older adults.

- AMD is related to retinal aging. Family history is another strong predictor of risk.

- AMD has two forms: dry (nonexudative) and wet (exudative).
    - Dry AMD is more common, with close vision tasks becoming more difficult. Atrophy of macular cells leads to slow, progressive, and painless vision loss.
    - Wet AMD is more severe, with rapid onset and development of abnormal blood vessels related to the macula. Symptoms are blurred, distorted, and darkened vision with visual field blind spots.
    - Wet AMD treatment includes laser photocoagulation, photodynamic therapy, and intravitreous injectable drugs. Vitamin and mineral supplements may be considered.

GLAUCOMA

- **Glaucoma** is associated with increased intraocular pressure (IOP), optic nerve atrophy, and peripheral visual field loss.

- Glaucoma often occurs with advanced age and is a major cause of permanent blindness.

- Etiology is due to consequences of elevated IOP. Glaucoma is largely preventable with early detection and treatment.

- Two types of glaucoma include: primary angle-closure glaucoma (PACG) and primary open-angle glaucoma (POAG), which is the more common.
    - With POAG, few symptoms exist and it is often not noticed until peripheral vision is severely compromised.
    - Symptoms of PACG include sudden, excruciating eye pain along with nausea and vomiting.

- Therapy is to lower IOP to prevent optic nerve damage through drugs, argon laser trabeculoplasty, trabeculectomy, and iridotomy. The nurse should teach about glaucoma risk and the importance of early detection and treatment.

PROBLEMS OF THE EAR

EXTERNAL OTITIS

- **External otitis** involves inflammation or infection of the auricle and ear canal epithelium due to infection.
- Symptoms are pain, ear canal swelling, and drainage.
- Therapy is analgesics, antibiotics, and compresses.

ACUTE OTITIS MEDIA

- Untreated or repeated attacks of acute otitis media in early childhood may lead to chronic middle ear infection.
- Symptoms include purulent exudate and inflammation that can involve the ossicles, eustachian tube, and mastoid bone.
- It is often painless.
- Treatment may include antibiotics and surgery.

MÉNIÈRE'S DISEASE

- **Ménière's disease** is characterized by symptoms of inner ear disease with episodic vertigo, tinnitus, fluctuating sensorineural hearing loss, and aural fullness.
- The cause is unknown, but results in excessive accumulation of endolymph.
- Attacks may begin with sense of ear fullness, tinnitus, and decreased hearing acuity.
- The duration of attacks is hours to days, and attacks occur several times a year.
- Other symptoms are pallor, sweating, nausea, and vomiting.
- Hearing loss fluctuates, and with continued attacks, recovery lessens, eventually leading to permanent hearing loss.
- Drugs are used between and during attacks.
- If not relieved, surgeries include endolymphatic sac decompression and vestibular nerve

resection.

- Nursing care minimizes vertigo and provides for patient safety with acute attacks.

HEARING DISORDERS

- Hearing disorders are the primary handicapping disability in the United States.

- Conductive hearing loss:
  - Occurs in outer and middle ear and impairs the sound being conducted from outer to inner ear.
  - It is caused by conditions interfering with air conduction, such as otitis media with effusion, impacted cerumen and foreign bodies, middle ear disease, and **otosclerosis.**

- **Sensorineural hearing loss:**
  - Is due to impairment of inner ear or vestibulocochlear nerve (CN VIII).
  - Causes include congenital and hereditary factors, noise trauma, aging, Ménière's disease, and ototoxicity.
  - The main problems are the ability to hear sound but not to understand speech and lack of understanding of the problem.

- Signs of hearing loss include asking others to speak up, answering questions inappropriately, not responding when not looking at speaker, straining to hear, and increasing sensitivity to slight increases in noise level.

- Often the patient is unaware of minimal hearing loss. Assistive devices and techniques include hearing aids, speech reading, and a cochlear implant.

- Prevention of hearing loss focuses on participation in hearing conservation programs in the work environment, monitoring for side effects and level of ototoxic drugs (e.g., salicylates, diuretics, antineoplastics), and avoidance of both continued exposure to high noise levels (above 85 to 95 decibels) and industrial drugs and chemicals (e.g., toluene, carbon disulfide, mercury).

- **Presbycusis** (hearing loss associated with aging) includes loss of peripheral auditory sensitivity, decline in word recognition ability, and associated psychologic and communication issues.

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Key Points

Chapter 23: Nursing Assessment: Integumentary System

STRUCTURES AND FUNCTIONS

- The **epidermis** is the outermost skin layer. The **dermis** is the second skin layer; it contains the collagen bundles while it supports the nerve and vascular network.

- The subcutaneous layer is composed of fat and loose connective tissue.

- The primary function of skin is to protect underlying body tissues by serving as a surface barrier to the external environment. Skin also is a barrier against bacteria, viruses, and excessive water loss. Fat in the subcutaneous layer insulates the body and provides protection from trauma.

- Two major types of epidermal cells include melanocytes (5%) and keratinocytes (90%).
    - **Melanocytes** contain melanin, a pigment giving color to skin and hair and protecting the body from damaging ultraviolet (UV) sunlight. More melanin results in darker skin color.
    - **Keratinocytes** produce fibrous protein, keratin, which is vital to protective barrier function of skin.

- The dermis is the connective tissue below the epidermis. It is highly vascular and assists in the regulation of body temperature and blood pressure.

- The dermis is divided into two layers: upper thin papillary layer and deeper, thicker reticular layer.

- Collagen forms the largest part of the dermis and is responsible for the mechanical strength of the skin.

- Skin appendages include hair, nails, and glands (sebaceous, apocrine, and eccrine). These structures develop from the epidermal layer and receive nutrients, electrolytes, and fluids from the dermis. Hair and nails form from specialized keratin that becomes hardened.

- Nail color ranges from pink to yellow or brown, depending on the skin color. Pigmented longitudinal bands (melanonychea striata) may occur in the nail bed in most people with dark skin.

- **Sebaceous glands** secrete sebum, which is emptied into hair follicles. Sebum prevents skin and hair from becoming dry.

- **Apocrine sweat glands** are located in the axillae, breast areolae, umbilical and anogenital areas, external auditory canals, and eyelids. They secrete a thick, milky substance that becomes odoriferous when altered by skin surface bacteria.

- **Eccrine sweat glands** are widely distributed over the body, except in a few areas such as

lips. These glands cool the body by evaporation, excrete waste products through skin pores, and moisturize surface cells.

- With aging, the following changes occur in the skin: fewer melanocytes (gray and white hair), less volume in the dermis, nail plate thinning, nails become brittle and prone to splitting and yellowing, skin wrinkling, decreased subcutaneous fat, hypothermia, and skin shearing.

ASSESSMENT

- Specific skin areas should be assessed during the examination of other body sites, unless the chief complaint is of dermatologic nature.

- Information related to sensitivities should be obtained. History of chronic or unprotected exposure to UV light, including tanning bed use and radiation treatments, should be noted.

- The patient should be questioned about skin-related problems occurring as result of taking medications, self-care habits related to daily hygiene, family history of any skin disease, and feelings related to altered body image in relation to skin condition.

- Primary skin lesions develop on previously unaltered skin. These include macule, papule, vesicle, plaque, wheal, and pustule.

- Secondary skin lesions change with time or occur because of factors such as scratching or infection and include fissure, scale, scar, ulcer, and excoriation.

- The skin should be inspected for general color and pigmentation, vascularity, bruising, and presence of lesions or discolorations, and palpated for information about temperature, turgor and mobility, moisture, and texture.

- Structures of dark skin are often more difficult to assess. Assessment is easier where the epidermis is thin and pigmentation is not influenced by sun exposure such as lips, mucous membranes, nail beds, and protected areas such as buttocks.

- Palmar and plantar surfaces are lighter than other skin areas in darker-skinned individuals. Rashes are often difficult to observe and may need palpation.

- Individuals with dark skin are predisposed to **pseudofolliculitis, keloids,** and **mongolian spots.** Cyanosis may be difficult to determine because normal bluish hue occurs in dark-skinned persons.

DIAGNOSTIC STUDIES

- Biopsy is one of most common diagnostic tests in evaluation of skin lesions. Techniques include punch, incisional, excisional, and shave biopsies.

- Other diagnostic procedures include stains and cultures for fungal, bacterial, and viral infections.

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Key Points

Chapter 24: Nursing Management: Integumentary Problems

- Health promotion activities for good skin health include asvoidance of environmental hazards, adequate rest and exercise, and proper hygiene and nutrition.

- Sun safety includes sun avoidance, especially during midday hours, protective clothing, and sunscreen.

- Actinic keratoses, basal cell carcinoma, squamous cell carcinoma, and malignant melanoma are problems associated with sun exposure.

- **Actinic keratosis:**
  - Is a premalignant form of squamous cell carcinoma affecting nearly all the older white population.
  - A typical lesion is an irregularly shaped, flat, slightly erythematous papule with indistinct borders and an overlying hard keratotic scale or horn.
  - Treatment includes cryosurgery, fluorouracil (5-FU), surgical removal, tretinoin (Retin-A), chemical peeling agents, and dermabrasion.

- Skin cancer is the most common malignant condition. Patients should be taught to self-examine their skin monthly.

- The cornerstone of self-skin examination is the ABCD rule. Examine skin lesions for **A**symmetry, **B**order irregularity, **C**olor change/variation, and **D**iameter of 6 mm or more.

- Risk factors for skin cancer include fair skin type (blonde or red hair and blue or green eyes), history of chronic sun exposure, family history of skin cancer, and exposure to tar and systemic arsenicals.

- Nonmelanoma skin cancers do not develop from melanocytes, as melanoma skin cancers do. Instead, they are a neoplasm of the epidermis. Most common sites are in sun-exposed areas.

- **Basal cell carcinoma** (BCC):
  - Is a locally invasive malignancy from epidermal basal cells.

  - Is the most common type of skin cancer and the least deadly.
  - Tissue biopsy is needed to confirm the diagnosis.
  - Treatments of electrodessication and **curettage, cryosurgery,** and excision all have cure rate of more than 90%.

- **Squamous cell carcinoma** (SCC):
  - Is a malignant neoplasm of keratinizing epidermal cells.
  - Is less common than BCC.
  - Can be very aggressive, has the potential to metastasize, and may lead to death if not treated early.
  - Pipe, cigar, and cigarette smoking area are also risk factors for SCC; therefore SCC is also found on mouth and lips.
  - Biopsy is performed when a lesion is suspected of being SCC.
  - Treatment includes electrodesiccation and curettage, excision, radiation therapy, intralesional injection of 5-FU or methotrexate, and Mohs' surgery.

- **Malignant melanoma:**
  - Is a tumor arising in melanocytes.
  - Melanomas can metastasize to any organ.
  - Is the most deadly skin cancer, and its incidence is increasing faster than that of any other cancer.
  - Individuals should consult health care provider if moles or lesions show any clinical signs (ABCDs) of melanoma.
  - Melanoma can also occur in eyes, meninges, and lymph nodes.
  - Suspicious lesions should be biopsied using excisional biopsy.
  - Important prognostic factor of melanoma is tumor thickness at time of diagnosis.
  - Initial treatment for melanoma is surgery.
  - Melanoma spread to lymph nodes or nearby sites often requires chemotherapy, biologic therapy (e.g., α-interferon, interleukin-2), and/or radiation therapy.
  - Stage I is 100% curable with stage IV being mostly palliative care.

- Abnormal nevus pattern called dysplastic nevus syndrome identifies individual at increased risk of melanoma. **Dysplastic nevi** (DN), or atypical moles, are nevi >5 mm across with irregular borders and varying color.

- *Staphylococcus aureus* and group A β-hemolytic streptococci are major types of bacteria responsible for primary and secondary skin infections. Herpes simplex, herpes zoster, and warts are the most common viral infections affecting the skin.

- Ultraviolet light, or a combination of two types (UVA and UVB), is used to treat many conditions. UV wavelengths cause erythema, desquamation, and pigmentation and may cause temporary suppression of basal cell mitosis followed by rebound increase in cell turnover.

- Radiation use for treatment of cutaneous malignancies varies greatly. Lasers are used for

many dermatologic problems.

- Antibiotics are used topically and systemically to treat dermatologic problems, and are often used in combination. Common OTC topical antibiotics include bacitracin and polymyxin B.

- Corticosteroids are particularly effective in treating a wide variety of dermatologic conditions and are used topically, intralesionally, or systemically. High-potency corticosteroids may produce side effects when use is prolonged, including skin atrophy, rosacea eruptions, severe exacerbations of acne vulgaris, and dermatophyte infections.

- Oral antihistamines are used to treat conditions that exhibit urticaria, angioedema, and pruritus. Topical immune response modifiers such as pimecrolimus (Elidel) and tacrolimus (Protopic) are newer nonsteroidal medications used in atopic dermatitis.

- Diagnostic and surgical therapy techniques include skin scraping, electrodesiccation and electrocoagulation, curettage, punch biopsy, cryosurgery, and excision.

- Wet dressings are commonly used when skin is oozing from infection and/or inflammation, and to relieve itching, suppress inflammation, and debride a wound.

- Baths are used when large body areas need to be treated. They also have sedative and antipruritic effects.

- Careful hand washing and safe disposal of soiled dressings are the best means of preventing spread of skin problems.

- Cosmetic procedures include chemical peels, toxin injections, collagen fillers, laser surgery, breast enlargement and reduction, laser surgery, face-lift, eyelid-lift, and liposuction. Preoperative management includes informed consent and realistic expectations of what cosmetic surgery can accomplish.

- Skin grafts may be necessary to provide protection to underlying structures or to reconstruct areas for cosmetic or functional purposes. Ideally, wounds heal by primary intention.

- Two types of grafts are free grafts and skin flaps. Soft tissue expansion is a technique for resurfacing a defect, such as a burn scar, removing a disfiguring mark, such as a tattoo, or as a preliminary step in breast reconstruction.

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Key Points

Chapter 25: Nursing Management: Burns

- **Burns** are body tissue injuries due to heat, cold, chemicals, electrical current, or radiation.
- **Smoke and inhalation injuries** result from inhalation of hot air or noxious chemicals.
- The resulting effect of burns is influenced by the temperature of the burning agent, the duration of contact time, and the tissue type injured.
- Burn prevention programs focus on child-resistant lighters; nonflammable children's clothing; stricter building codes; smoke detectors/alarms; and fire sprinklers.
- Nurses need to advocate for scald- and fire risk–reduction strategies in the home. Occupational health nurses need to educate workers to reduce scald, chemical, electrical, and thermal injuries in the work setting.
- Burn treatment is related to injury severity determined by depth. The extent is calculated by the percent of the total body surface area (TBSA), location, and patient risk factors.
- Burns are defined by degrees: first degree (same as sunburn), second degree, and third degree. A more precise definition of second- and third-degree burns includes the depth of skin destruction: **partial-thickness** and **full-thickness.**
- Second- and third-degree burn extent can be determined using total body surface area based on two guides: Lund-Browder chart and Rule of Nines. Burn extent is often revised after edema subsides and demarcation of injury zones occurs.
- Face, neck, and circumferential burns to the chest/back area may inhibit respiratory function with mechanical obstruction secondary to edema or leathery, devitalized tissue (eschar) formation. These injuries may cause inhalation injury and respiratory mucosal damage.
- Hands, feet, and eye burns may make self-care difficult and jeopardize future function. Buttocks or genitalia burns are susceptible to infection. Circumferential burns to extremities can cause circulatory compromise distal to the burn.
- Burn management is organized chronologically into three phases: emergent (resuscitative), acute (wound healing), and rehabilitation (restorative). Overlaps in care exist from one phase to another.

EMERGENT PHASE

- Period of time required to resolve immediate, life-threatening problems. Phase may last from time of burn to 3 or more days, but it usually lasts 24 to 48 hours.

- A primary concern is the onset of hypovolemic shock and edema formation. Toward the end of the phase, if fluid replacement is adequate, the capillary membrane permeability is restored. Fluid loss and edema formation cease. The interstitial fluid gradually returns to the vascular space. Diuresis occurs with low urine specific gravities.

- Manifestations include shock from the pain and hypovolemia. Areas of full-thickness and deep partial-thickness burns are initially anesthetic because the nerve endings are destroyed. Superficial to moderate partial-thickness burns are painful.

- Shivering occurs as a result of chilling, and most patients are alert. Unconsciousness or altered mental status is usually a result of hypoxia associated with smoke inhalation, head trauma, or excessive sedation or pain medication.

- Complications:
    - *Cardiovascular system:* dysrhythmias and hypovolemic shock
    - *Respiratory system:* vulnerable to upper airway injury causing edema formation and obstruction of airway, and inhalation injury
    - *Renal system:* if patient is hypovolemic, kidney blood flow may decrease, causing renal ischemia. If it continues, acute renal failure may develop. With full-thickness and **electrical burns,** myoglobin and hemoglobin are released into the bloodstream and occlude the renal tubules.

- Management includes a rapid and thorough assessment and intervention of airway management, fluid therapy, and wound care. Analgesics are ordered to promote patient comfort. Early in the postburn period, IV pain medications are given.

- Early and aggressive nutritional support decreases mortality and complications, optimizes healing of burn, and minimizes negative effects of **hypermetabolism** and catabolism.

ACUTE PHASE

- Begins with the mobilization of extracellular fluid and subsequent diuresis. Phase concludes when burned area is completely covered by skin grafts or when wounds are healed. This may take weeks or many months.

- Manifestations include eschar from partial-thickness wounds. Once removed, re-epithelialization appears as red or pink scar tissue.

- Margins of full-thickness eschar take longer to separate. As a result, they require surgical **debridement** and skin grafting for healing.

- Because the body is trying to reestablish fluid and electrolyte homeostasis, it is important for the nurse to follow the patient's serum electrolyte levels closely (hypo- or hypernatremia, hypo- or hyperkalemia).

- Complications include wound infection progressing to transient bacteremia as result of

manipulation (e.g., after hydrotherapy and debridement). Same cardiovascular and respiratory system complications as in emergent phase may continue.

- Patient can become extremely disoriented, withdraw, or be combative.

- This is a transient state, lasting from a day to several weeks. Range of motion may be limited and **contractures** can occur. Paralytic ileus results from sepsis. Diarrhea and constipation may also occur.

- Management involves wound care with daily observation, assessment, cleansing, debridement, and dressing reapplication.

- Individualized and consistent pain assessment and care are essential. Note two kinds of pain: continuous, background pain existing throughout day and night, and treatment pain associated with dressing changes, ambulation, and rehabilitation activities.

- First line of treatment is pharmacologic. Then use nonpharmacologic strategies, such as relaxation tapes, visualization, hypnosis, guided imagery, and biofeedback. Rigorous physical therapy throughout recovery is imperative to maintain joint function. Nutritional therapy provides adequate calories and protein to promote healing.

REHABILITATION PHASE

- Begins when wounds have healed and patient is able to resume self-care activity. Phase occurs as early as 2 weeks or as long as 7 to 8 months after the burn.

- Goals are to assist the patient in resuming a functional role in society and accomplish functional and cosmetic reconstructive surgery.

- Manifestations include new skin appearing flat and pink, then raised and hyperemic; itching occurs with healing. Complications are skin and joint contractures and hypertrophic scarring.

- Management includes positioning, splinting, and exercise to minimize contracture. Burned legs may be wrapped with elastic (e.g., tensor/Ace) bandages to assist the circulation to the leg graft and donor sites. Patient education and “hands-on” instruction need to be provided in dressing changes and wound care.

- Continuous exercise and physical/occupational therapy cannot be overemphasized. Encouragement and reassurance are necessary for patient morale, attaining independence, and returning to preburn activities.

- For patient with emotional needs, it is important that the nurse have understanding of circumstances of burn, family relationships, and prior coping experiences with stressful situations. Patient may experience fear, anxiety, anger, guilt, and depression.

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Key Points

Chapter 26: Nursing Assessment: Respiratory System

STRUCTURES AND FUNCTIONS

- The primary purpose of the respiratory system is gas exchange, which involves the transfer of oxygen and carbon dioxide between the atmosphere and the blood.
- The upper respiratory tract includes the nose, pharynx, adenoids, tonsils, epiglottis, larynx, and trachea.
- The lower respiratory tract consists of the bronchi, bronchioles, alveolar ducts, and alveoli.
- In adults, a normal **tidal volume** (V_T), or volume of air exchanged with each breath, is about 500 ml.
- **Ventilation** involves **inspiration** (movement of air into the lungs) and **expiration** (movement of air out of the lungs).
- ABGs are measured to determine oxygenation status and acid-base balance. ABG analysis includes measurement of the PaO_2, $PaCO_2$, acidity (pH), and bicarbonate (HCO_3^-) in arterial blood.
- Arterial oxygen saturation can be monitored continuously using a *pulse oximetry* probe on the finger, toe, ear, or bridge of the nose.
- The respiratory center in the brainstem medulla responds to chemical and mechanical signals from the body.
- A **chemoreceptor** is a receptor that responds to a change in the chemical composition ($PaCO_2$ and pH) of the fluid around it.
- **Mechanical receptors** are stimulated by a variety of physiologic factors, such as irritants, muscle stretching, and alveolar wall distortion.
- The respiratory defense mechanisms include filtration of air, the mucociliary clearance system, the cough reflex, reflex bronchoconstriction, and alveolar macrophages.

ASSESSMENT

- During nursing assessment, a cough should be evaluated by the quality of the cough and sputum.
- During physical examination, the nose, mouth, pharynx, neck, thorax, and lungs should be assessed and the respiratory rate, depth, and rhythm should be observed.
- When listening to the lung sounds, there are three normal breath sounds: vesicular, bronchovesicular, and bronchial.
- **Adventitious sounds** are extra breath sounds that are abnormal and include **crackles, rhonchi, wheezes,** and **pleural friction rub.**

DIAGNOSTIC STUDIES

- A chest x-ray is the most commonly used test for assessment of the respiratory system, as well as the progression of disease and response to treatment.
- Bronchoscopy is a procedure in which the bronchi are visualized through a fiberoptic tube and may be used for diagnostic purposes to obtain biopsy specimens and assess changes resulting from treatment.
- Thoracentesis is the insertion of a large-bore needle through the chest wall into the pleural space to obtain specimens for diagnostic evaluation, remove pleural fluid, or instill medication into the pleural space.
- Pulmonary function tests (PFTs) measure lung volumes and airflow.
- The results of PFTs are used to diagnose pulmonary disease, monitor disease progression, evaluate disability, and evaluate response to bronchodilators.

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Key Points

Chapter 27: Nursing Management: Upper Respiratory Problems

- Problems of the upper respiratory tract include disorders of the nose, pharynx, adenoids, tonsils, epiglottis, larynx, and trachea.

- A **deviated septum** is a deflection of the normally straight nasal septum that is most commonly caused by trauma to the nose or congenital disproportion.

- **Rhinoplasty,** the surgical reconstruction of the nose, is performed for cosmetic reasons or to improve airway function when trauma or developmental deformities result in nasal obstruction.

- **Allergic rhinitis** is the reaction of the nasal mucosa to a specific allergen and is classified as either intermittent or persistent.
    - Intermittent means that the symptoms are present less than 4 days a week or less than 4 weeks per year.
    - Persistent means that the symptoms are present more than 4 days a week and for more than 4 weeks per year.
    - The most important step in managing allergic rhinitis involves identifying and avoiding triggers of allergic reactions.

- Acute viral rhinitis (also known as the common cold or acute coryza):
    - Is caused by an adenovirus that invades the upper respiratory tract and often accompanies an acute upper respiratory infection.
    - Rest, fluids, proper diet, antipyretics, and analgesics are the recommended management of acute viral rhinitis.

- In contrast to acute viral rhinitis, the onset of influenza is typically abrupt with systemic symptoms of cough, fever, and myalgia often accompanied by a headache and sore throat.
    - To combat the likelihood of developing influenza, there are two types of flu vaccines available: inactivated and live, attenuated.
    - The nurse should advocate the use of inactivated influenza vaccination in all patients greater than 50 years of age or who are at high risk during routine office visits or, if hospitalized, at the time of discharge.

- Chronic and acute sinusitis develop when the ostia (exit) from the sinuses is narrowed or blocked by inflammation or hypertrophy (swelling) of the mucosa. Chronic sinusitis lasts longer than 3 weeks and is a persistent infection usually associated with allergies and **nasal polyps.**

- **Acute pharyngitis:**
    - Is an acute inflammation of the pharyngeal walls that may include the tonsils, palate, and uvula.
    - The goals of nursing management for acute pharyngitis are infection control, symptomatic relief, and prevention of secondary complications.

- **Obstructive sleep apnea,** also called obstructive sleep apnea-hypopnea syndrome, is a condition characterized by partial or complete upper airway obstruction during sleep. **Apnea** is the cessation of spontaneous respirations lasting longer than 20 seconds.

- A **tracheotomy** is a surgical incision into the trachea for the purpose of establishing an airway.

- A **tracheostomy:**
    - Is the stoma (opening) that results from the tracheotomy.
    - Indications for a tracheostomy are to (1) bypass an upper airway obstruction, (2) facilitate removal of secretions, (3) permit long-term mechanical ventilation, and (4) permit oral intake and speech in the patient who requires long-term mechanical ventilation.

HEAD AND NECK CANCER

- Arises from mucosal surfaces and is typically squamous cell in origin.

- This category of tumors can involve paranasal sinuses, the oral cavity, and the nasopharynx, oropharynx, and larynx.

- The choice of treatment for head and neck cancer is based on medical history, extent of disease, cosmetic considerations, urgency of treatment, and patient choice.

- Approximately one third of patients with head and neck cancers have highly confined lesions that are stages I or II at diagnosis. Such patients can undergo radiation therapy or surgery with the goal of cure.

- Advanced lesions are treated by a total laryngectomy in which the entire larynx and preepiglottic region is removed and a permanent tracheostomy performed.

- After radical neck surgery, the patient may be unable to take in nutrients through the normal route of ingestion because of swelling, the location of sutures, or difficulty with swallowing. Parenteral fluids will be given for the first 24 to 48 hours.

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Key Points

Chapter 28: Nursing Management: Lower Respiratory Problems

PNEUMONIA

- Is an acute inflammation of the lung parenchyma.

- Is caused by a microbial organism.

- More likely to result when defense mechanisms become incompetent or are overwhelmed by the virulence or quantity of infectious agents.

- Pneumonia can be classified according to the causative organism, such as bacteria, viruses, *Mycoplasma,* fungi, parasites, and chemicals.

- A clinically effective way to classify pneumonia is as follows:
    - **Community-acquired pneumonia** is defined as a lower respiratory tract infection of the lung parenchyma with onset in the community or during the first 2 days of hospitalization.
    - **Hospital-acquired pneumonia** is pneumonia occurring 48 hours or longer after hospital admission and not incubating at the time of hospitalization.

- Aspiration pneumonia refers to the sequelae occurring from abnormal entry of secretions or substances into the lower airway.

- Opportunistic pneumonia presents in certain patients with altered immune responses who are highly susceptible to respiratory infections.

- There are four characteristic stages of pneumonia: congestion, red hepatization, gray hepatization, and resolution.

- Nursing management:
    - In the hospital, the nursing role involves identifying the patient at risk and taking measures to prevent the development of pneumonia.
    - The essential components of nursing care for patients with pneumonia include monitoring physical assessment parameters, facilitating laboratory and diagnostic tests, providing treatment, and monitoring the patient's response to treatment.

TUBERCULOSIS (TB)

- Is an infectious disease caused by *Mycobacterium tuberculosis,* a gram-positive, acid-fast bacillus that is usually spread from person to person via airborne droplets.

- Despite the decline in TB nationwide, rates have increased in certain states and high rates continue to be reported in certain populations.

- The major factors that have contributed to the resurgence of TB have been (1) high rates of TB among patients with HIV infection and (2) the emergence of multidrug resistant strains of *M. tuberculosis.*

- Can present with a number of complications: the spread of the disease with involvement of many organs simultaneously (miliary TB), pleural effusion, emphysema, and pneumonia.

- The tuberculin skin test (Mantoux test) using purified protein derivative (PPD) is the best way to diagnose latent *M. tuberculosis* infection, whereas the diagnosis of tuberculosis disease requires demonstration of tubercle bacilli bacteriologically.

- Most TB patients are treated on an outpatient basis. The mainstay of TB treatment is drug therapy. Drug therapy is used to treat an individual with active disease and to prevent disease in a TB-infected person.

- Patients strongly suspected of having TB should (1) be placed on airborne isolation, (2) receive appropriate drug therapy, and (3) receive an immediate medical workup, including chest x-ray, sputum smear, and culture.

PULMONARY FUNGAL INFECTIONS

- Are found frequently in seriously ill patients being treated with corticosteroids, antineoplastic and immunosuppressive drugs, or multiple antibiotics.

- Are also found in patients with AIDS and cystic fibrosis.

- Community-acquired pulmonary lung infections include aspergillosis, cryptococcosis, and candidiasis. These infections are not transmitted from person to person, and the patient does not have to be placed in isolation.

LUNG ABSCESS

- Is a pus-containing lesion of the lung parenchyma that gives rise to a cavity.

- In many cases the causes and pathogenesis of lung abscess are similar to those of pneumonia.

- The onset of a lung abscess is usually insidious, especially if anaerobic organisms are the primary cause. A more acute onset occurs with aerobic organisms.

- Antibiotics given for a prolonged period (up to 2 to 4 months) are usually the primary method of treatment.

ENVIRONMENTAL LUNG DISEASES

- Environmental or occupational lung diseases are caused or aggravated by workplace or environmental exposure and are preventable.

- **Pneumoconiosis** is a general term for a group of lung diseases caused by inhalation and retention of dust particles.

- The best approach to management of environmental lung diseases is to try to prevent or decrease environmental and occupational risks.

LUNG CANCER

- Cigarette smoking is the most important risk factor in the development of lung cancer. Smoking is responsible for approximately 80% to 90% of all lung cancers.

- Primary lung cancers are often categorized into two broad subtypes: non–small cell lung cancer (80%) and small cell lung cancer (20%).

- CT scanning is the single most effective noninvasive technique for evaluating lung cancer. Biopsy is necessary for a definitive diagnosis.

- Staging of non–small cell lung cancer is performed according to the TNM staging system. Staging of small cell lung cancer by TNM has not been useful because the cancer is very aggressive and always considered systemic.

- Treatment options for lung cancer include:
    - Surgical resection is the treatment of choice in non–small cell lung cancer Stages I and II, because the disease is potentially curable with resection.
    - Radiation therapy used with the intent to cure may be moderated in the individual who is unable to tolerate surgical resection due to comorbidities. It may also be used as adjuvant therapy after resection of the tumor.
    - Chemotherapy may be used in the treatment of nonresectable tumors or as adjuvant therapy to surgery in non–small cell lung cancer.

- The overall goals of nursing management of a patient with lung cancer will include (1) effective breathing patterns, (2) adequate airway clearance, (3) adequate oxygenation of tissues, (4) minimal to no pain, and (5) a realistic attitude toward treatment and prognosis.

PNEUMOTHORAX

- Refers to air in the pleural space. As a result of the air in the pleural space, there is partial or complete collapse of the lung.

- Types of pneumothorax include:
    - **Closed pneumothorax** has no associated external wound. The most common form is a spontaneous pneumothorax, which is accumulation of air in the pleural space without an apparent antecedent event.
    - **Open pneumothorax** occurs when air enters the pleural space through an opening in the chest wall. Examples include stab or gunshot wounds and surgical thoracotomy.
    - **Tension pneumothorax** is a pneumothorax with rapid accumulation of air in the pleural space causing severely high intrapleural pressures with resultant tension on the heart and great vessels. It may result from either an open or a closed pneumothorax.
    - **Hemothorax** is an accumulation of blood in the intrapleural space. It is frequently found in association with open pneumothorax and is then called a hemopneumothorax.

  - **Chylothorax** is lymphatic fluid in the pleural space due to a leak in the thoracic duct. Causes include trauma, surgical procedures, and malignancy.

- Treatment depends on the severity of the pneumothorax and the nature of the underlying disease.

FLAIL CHEST

- Results from multiple rib fractures, causing an unstable chest wall. The diagnosis of flail chest is made on the basis of fracture of two or more ribs, in two or more separate locations, causing an unstable segment.

- Initial therapy consists of airway management, adequate ventilation, supplemental oxygen therapy, careful administration of IV solutions, and pain control.

- The definitive therapy is to reexpand the lung and ensure adequate oxygenation.

CHEST TUBES AND PLEURAL DRAINAGE

- The purpose of chest tubes and pleural drainage is to remove the air and fluid from the pleural space and to restore normal intrapleural pressure so that the lungs can reexpand.

- Chest tube malposition is the most common complication.

- Routine monitoring is done by the nurse to evaluate if the chest drainage is successful by observing for tidaling in the water-seal chamber, listening for breath sounds over the lung fields, and measuring the amount of fluid drainage.

CHEST SURGERY

- **Thoracotomy** (surgical opening into the thoracic cavity) surgery is considered major surgery because the incision is large, cutting into bone, muscle, and cartilage. The two types of thoracic incisions are median sternotomy, performed by splitting the sternum, and lateral thoracotomy.

- Video-assisted thoracic surgery (VATS) is a thorascopic surgical procedure that in many cases can avoid the impact of a full thoracotomy. The procedure involves three to four 1-inch incisions made on the chest that allow the thorascope (a special fiberoptic camera) and instruments to be inserted and manipulated.

PLEURAL EFFUSION

- **Pleural effusion** is a collection of fluid in the pleural space. It is not a disease but rather a sign of a serious disease.

- Pleural effusion is frequently classified as transudative or exudative according to whether the protein content of the effusion is low or high, respectively.
  - A transudate occurs primarily in noninflammatory conditions and is an accumulation of protein-poor, cell-poor fluid.

  - An exudative effusion is an accumulation of fluid and cells in an area of inflammation.
  - An **empyema** is a pleural effusion that contains pus.

- The type of pleural effusion can be determined by a sample of pleural fluid obtained via **thoracentesis** (a procedure done to remove fluid from the pleural space).

- The main goal of management of pleural effusions is to treat the underlying cause.

PLEURISY

- **Pleurisy (pleuritis)** is an inflammation of the pleura. The most common causes are pneumonia, TB, chest trauma, pulmonary infarctions, and neoplasms.

- Treatment of pleurisy is aimed at treating the underlying disease and providing pain relief.

ATELECTASIS

- Is a condition of the lungs characterized by collapsed, airless alveoli.

- The most common cause of atelectasis is airway obstruction that results from retained exudates and secretions. This is frequently observed in the postoperative patient.

IDIOPATHIC PULMONARY FIBROSIS

- Idiopathic pulmonary fibrosis is characterized by scar tissue in the connective tissue of the lungs as a sequela to inflammation or irritation.

- The clinical course is variable and the prognosis poor, with a 5-year survival rate of 30% to 50% after diagnosis.

SARCOIDOSIS

- Sarcoidosis is a chronic, multisystem granulomatous disease of unknown cause that primarily affects the lungs. The disease may also involve the skin, eyes, liver, kidney, heart, and lymph nodes.

- The disease is often acute or subacute and self-limiting, but in others it is chronic with remissions and exacerbations.

PULMONARY EDEMA

- **Pulmonary edema** is an abnormal accumulation of fluid in the alveoli and interstitial spaces of the lungs.

- It is considered a medical emergency and may be life-threatening.

- The most common cause of pulmonary edema is left-sided heart failure.

PULMONARY EMBOLISM

- **Pulmonary embolism** (PE) is the blockage of pulmonary arteries by a thrombus, fat, or air emboli, or tumor tissue.
- Most pulmonary embolisms arise from thrombi in the deep veins of the legs.
- The most common risk factors for pulmonary embolism are immobilization, surgery within the last 3 months, stroke, history of deep vein thrombosis, and malignancy.
- Pulmonary infarction (death of lung tissue) and pulmonary hypertension are common complications of pulmonary embolism.
- The objectives of treatment are to (1) prevent further growth or multiplication of thrombi in the lower extremities, (2) prevent embolization from the upper or lower extremities to the pulmonary vascular system, and (3) provide cardiopulmonary support if indicated.

PULMONARY HYPERTENSION

- **Pulmonary hypertension** can occur as a primary disease (primary pulmonary hypertension) or as a secondary complication of a respiratory, cardiac, autoimmune, hepatic, or connective tissue disorder (secondary pulmonary hypertension).
- Primary pulmonary hypertension is a severe and progressive disease. It is characterized by mean pulmonary arterial pressure greater than 25 mm Hg at rest (normal 12 to 16 mm Hg) or greater than 30 mm Hg with exercise in the absence of a demonstrable cause.
- Primary pulmonary hypertension is a diagnosis of exclusion. All other conditions must be ruled out.
- Although there is no cure for primary pulmonary hypertension, treatment can relieve symptoms, increase quality of life, and prolong life.
- Secondary pulmonary hypertension (SPH) occurs when a primary disease causes a chronic increase in pulmonary artery pressures. Secondary pulmonary hypertension can develop as a result of parenchymal lung disease, left ventricular dysfunction, intracardiac shunts, chronic pulmonary thromboembolism, or systemic connective tissue disease.

COR PULMONALE

- **Cor pulmonale** is enlargement of the right ventricle secondary to diseases of the lung, thorax, or pulmonary circulation. Pulmonary hypertension is usually a preexisting condition in the individual with cor pulmonale.
- The most common cause of cor pulmonale is COPD.
- The primary management of cor pulmonale is directed at treating the underlying pulmonary problem that precipitated the heart problem.

LUNG TRANSPLANTATION

- There are four types of transplant procedures available: single lung transplant, bilateral lung transplant, heart-lung transplant, and transplant of lobes from living related donor.

- Lung transplant recipients are at high risk for bacterial, viral, fungal, and protozoal infections. Infections are the leading cause of death in the early period after the transplant.

- Immunosuppressive therapy usually includes a three-drug regimen of cyclosporine or tacrolimus, azathioprine (Imuran) or mycophenolate mofetil (CellCept), and prednisone.

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Key Points

Chapter 29: Nursing Management: Obstructive Pulmonary Diseases

ASTHMA

- **Asthma** is a chronic inflammatory lung disease that results in recurrent episodes of airflow obstruction, but it is usually reversible. The chronic inflammation causes an increase in airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and cough, particularly at night or in the early morning.

- Although the exact mechanisms that cause asthma remain unknown, triggers are involved.
    - Allergic asthma may be related to allergies, such as tree or weed pollen, dust mites, molds, animals, feathers, and cockroaches.
    - Asthma that is induced or exacerbated during physical exertion is called exercise-induced asthma. Typically, this type of asthma occurs after vigorous exercise, not during it.
    - Various air pollutants, cigarette or wood smoke, vehicle exhaust, elevated ozone levels, sulfur dioxide, and nitrogen dioxide can trigger asthma attacks.
    - Occupational asthma occurs after exposure to agents of the workplace. These agents are diverse such as wood and vegetable dusts (flour), pharmaceutical agents, laundry detergents, animal and insect dusts, secretions and serums (e.g., chickens, crabs), metal salts, chemicals, paints, solvents, and plastics.
    - Respiratory infections (i.e., viral and not bacterial) or allergy to microorganisms is the major precipitating factor of an acute asthma attack.
    - Sensitivity to specific drugs may occur in some asthmatic persons, especially those with nasal polyps and sinusitis, resulting in an asthma episode.
    - Gastroesophageal reflux disease can also trigger asthma.

  - Crying, laughing, anger, and fear can lead to hyperventilation and hypocapnia which can cause airway narrowing.

- The characteristic clinical manifestations of asthma are wheezing, cough, dyspnea, and chest tightness after exposure to a precipitating factor or trigger. Expiration may be prolonged.

- Asthma can be classified as mild intermittent, mild persistent, moderate persistent, or severe persistent.

- Severe acute asthma can result in complications such as rib fractures, pneumothorax, pneumomediastinum, atelectasis, pneumonia, and status asthmaticus. **Status asthmaticus** is a severe, life-threatening asthma attack that is refractory to usual treatment and places the patient at risk for developing respiratory failure.

- Diagnosis: there is some controversy about how to best diagnose asthma. In general, the health care provider should consider the diagnosis of asthma if various indicators (i.e., clinical manifestations, health history, and peak flow variability) are positive.

- Patient education remains the cornerstone of asthma management and should be carried out by health care providers providing asthma care. Desirable therapeutic outcomes include (1) control or elimination of chronic symptoms such as cough, dyspnea, and nocturnal awakenings; (2) attainment of normal or nearly normal lung function; (3) restoration or maintenance of normal levels of activity; (4) reduction in the number or elimination of recurrent exacerbations; (5) reduction in the number or elimination of emergency department visits and acute care hospitalizations; and (6) elimination or reduction of side effects of medications.

- Medications are divided into two general classifications: (1) long-term–control medications to achieve and maintain control of persistent asthma, and (2) quick-relief medications to treat symptoms and exacerbations.
  - Because chronic inflammation is a primary component of asthma, corticosteroids, which suppress the inflammatory response, are the most potent and effective antiinflammatory medication currently available to treat asthma
  - Mast cell stabilizers are nonsteroidal antiinflammatory drugs that inhibit the IgE-mediated release of inflammatory mediators from mast cells and suppress other inflammatory cells (e.g., eosinophils).
  - The use of leukotriene modifiers can successfully be used as add-on therapy to reduce (not substitute for) the doses of inhaled corticosteroids.
  - Short-acting inhaled β_2-adrenergic agonists are the most effective drugs for relieving acute bronchospasm. They are also used for acute exacerbations of asthma.
  - Methylxanthine (theophylline) preparations are less effective long-term control bronchodilators as compared to β_2-adrenergic agonists.

  - Anticholinergic agents (e.g., ipratropium [Atrovent], tiotropium [Spiriva]) block the bronchoconstricting influence of parasympathetic nervous system.

- One of the major factors for determining success in asthma management is the correct administration of drugs.

- Inhalation devices include metered-dose inhalers, dry powder inhalers, and nebulizers.

- Several nonprescription combination drugs are available over the counter. An important teaching responsibility is to warn the patient about the dangers associated with nonprescription combination drugs.

- A goal in asthma care is to maximize the ability of the patient to safely manage acute asthma episodes via an asthma action plan developed in conjunction with the health care provider. An important nursing goal during an acute attack is to decrease the patient's sense of panic.

- Written asthma action plans should be developed together with the patient and family, especially for those with moderate or severe persistent asthma or a history of severe exacerbations.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

- **Chronic obstructive pulmonary disease** (COPD) is a preventable and treatable disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases, primarily caused by cigarette smoking.

- In addition to cigarette smoke, occupational chemicals, and air pollution, infections are risk factors for developing COPD. Severe recurring respiratory tract infections in childhood have been associated with reduced lung function and increased respiratory symptoms in adulthood.

- **α_1-Antitrypsin deficiency,** an autosomal recessive disorder, is a genetic risk factor that can lead to COPD.

- Aging results in changes in the lung structure, the thoracic cage, and the respiratory muscles, and as people age there is gradual loss of the elastic recoil of the lung. Therefore some degree of emphysema is common in the lungs of the older person, even a nonsmoker.

- The term chronic obstructive pulmonary disease encompasses two types of obstructive airway diseases, chronic bronchitis and emphysema.
  - **Chronic bronchitis** is the presence of chronic productive cough for 3 months in each of 2 consecutive years in a patient in whom other causes of chronic cough have been excluded.

  - **Emphysema** is an abnormal permanent enlargement of the airspaces distal to the terminal bronchioles, accompanied by destruction of their walls and without obvious fibrosis.

- A diagnosis of COPD should be considered in any patient who has symptoms of cough, sputum production, or dyspnea, and/or a history of exposure of risk factors for the disease. An intermittent cough, which is the earliest symptom, usually occurs in the morning with the expectoration of small amounts of sticky mucus resulting from bouts of coughing.

- COPD can be classified as at risk, mild, moderate, severe, and very severe.

- Complications of COPD include the following:
  - **Cor pulmonale** is hypertrophy of the right side of the heart, with or without heart failure, resulting from pulmonary hypertension and is a late manifestation of chronic pulmonary heart disease.
  - Exacerbations of COPD are signaled by a change in the patient's usual dyspnea, cough, and/or sputum that is different than the usual daily patterns. These flares require changes in management.
  - Patients with severe COPD who have exacerbations are at risk for the development of respiratory failure.
  - The incidence of peptic ulcer disease is increased in the person with COPD.
  - Anxiety and depression can complicate respiratory compromise and may precipitate dyspnea and hyperventilation.

- The diagnosis of COPD is confirmed by pulmonary function tests. Goals of the diagnostic workup are to confirm the diagnosis of COPD via spirometry, evaluate the severity of the disease, and determine the impact of disease on the patient's quality of life. When the FEV_1/FVC ratio is less than 70%, it suggests the presence of obstructive lung disease.

- The primary goals of care for the COPD patient are to (1) prevent disease progression, (2) relieve symptoms and improve exercise tolerance, (3) prevent and treat complications, (4) promote patient participation in care, (5) prevent and treat exacerbations, and (6) improve quality of life and reduce mortality.

- Cessation of cigarette smoking in all stages of COPD is the single most effective and cost-effective intervention to reduce the risk of developing COPD and stop the progression of the disease.

- Although patients with COPD do not respond as dramatically as those with asthma to bronchodilator therapy, a reduction in dyspnea and an increase in FEV_1 are usually achieved. Presently no drug modifies the decline of lung function with COPD.

- O_2 therapy is frequently used in the treatment of COPD and other problems associated with hypoxemia. Long-term O_2 therapy improves survival, exercise capacity, cognitive performance, and sleep in hypoxemic patients.

  - O_2 delivery systems are classified as low- or high-flow systems. Most methods of O_2 administration are low-flow devices that deliver O_2 in concentrations that vary with the person's respiratory pattern.
  - Dry O_2 has an irritating effect on mucous membranes and dries secretions. Therefore it is important that O_2 be humidified when administered, either by humidification or nebulization.

- Three different surgical procedures have been used in severe COPD:
  - Lung volume reduction surgery is used to reduce the size of the lungs by removing about 30% of the most diseased lung tissue so the remaining healthy lung tissue can perform better.
  - A bullectomy is used for certain patients and can result in improved lung function and reduction in dyspnea.
  - In appropriately selected patients with very advanced COPD, lung transplantation improves functional capacity and enhances quality of life.

- Respiratory therapy (RT) and physical therapy (PT) rehabilitation activities are performed by respiratory therapists or physical therapists, depending on the institution. RT and/or PT activities include breathing retraining, effective cough techniques, and chest physiotherapy.
  - **Pursed-lip breathing** is a technique that is used to prolong exhalation and thereby prevent bronchiolar collapse and air trapping. Often instinctively patients will perform this technique.
  - The main goals of effective coughing are to conserve energy, reduce fatigue, and facilitate removal of secretions. Huff coughing is an effective technique that the patient can be easily taught.
  - **Chest physiotherapy** consists of percussion, vibration, and postural drainage.

- Weight loss and malnutrition are commonly seen in the patient with severe emphysematous COPD. The patient with COPD should try to keep the body mass index (BMI) between 21 and 25 kg/m^2.

- The patient with COPD will require acute intervention for complications such as exacerbations of COPD, pneumonia, cor pulmonale, and acute respiratory failure.

- Pulmonary rehabilitation should be considered for all patients with symptomatic COPD or having functional limitations. The overall goal is to increase the quality of life.

- Walking is by far the best physical exercise for the COPD patient. Adequate sleep is also extremely important.

CYSTIC FIBROSIS

- **Cystic fibrosis** (CF) is an autosomal recessive, multisystem disease characterized by altered function of the exocrine glands primarily involving the lungs, pancreas, and sweat glands.

- Initially, CF is an obstructive lung disease caused by the overall obstruction of the airways with mucus. Later, CF also progresses to a restrictive lung disease because of the fibrosis, lung destruction, and thoracic wall changes.

- The major objectives of therapy in CF are to (1) promote clearance of secretions, (2) control infection in the lungs, and (3) provide adequate nutrition.

BRONCHIECTASIS

- **Bronchiectasis** is characterized by permanent, abnormal dilation of one or more large bronchi. The pathophysiologic change that results in dilation is destruction of the elastic and muscular structures supporting the bronchial wall.

- The hallmark of bronchiectasis is persistent or recurrent cough with production of large amounts of purulent sputum, which may exceed 500 ml/day.

- Bronchiectasis is difficult to treat. Therapy is aimed at treating acute flare-ups and preventing decline in lung function.

- Antibiotics are the mainstay of treatment and are often given empirically, but attempts are made to culture the sputum. Long-term suppressive therapy with antibiotics is reserved for those patients who have symptoms that recur a few days after stopping antibiotics.

- An important nursing goal is to promote drainage and removal of bronchial mucus.

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Key Points

CHAPTER 30: NURSING ASSESSMENT: HEMATOLOGIC SYSTEM

STRUCTURES AND FUNCTIONS

- **Hematology** is the study of blood and blood-forming tissues. This includes the bone marrow, blood, spleen, and lymph system.

- Blood cell production (**hematopoiesis**) occurs within the bone marrow. **Bone marrow** is the soft material that fills the central core of bones.

- Blood is a type of connective tissue that performs three major functions: transportation, regulation, and protection. There are two major components to blood: plasma and blood cells.

- Plasma is composed primarily of water, but it also contains proteins, electrolytes, gases, nutrients, and waste.

- There are three types of blood cells: erythrocytes (RBCs), leukocytes (WBCs), and thrombocytes (platelets).

- **Erythrocytes** are primarily composed of a large molecule called hemoglobin. **Hemoglobin,** a complex protein-iron compound composed of heme (an iron compound) and globin (a simple protein), functions to bind with oxygen and carbon dioxide.

- **Leukocytes** (WBCs) appear white when separated from blood. There are five different types of leukocytes, each of which has a different function.
    - Granulocytes (neutrophils, eosinophils, basophils): the primary function of the granulocytes is **phagocytosis,** a process by which WBCs ingest or engulf any unwanted organism and then digest and kill it. The neutrophil is the most common type of granulocyte.
    - Lymphocytes: the main function of lymphocytes is related to the immune response. Lymphocytes form the basis of the cellular and humoral immune responses.
    - Monocytes: monocytes are phagocytic cells. They can ingest small or large masses of matter, such as bacteria, dead cells, tissue debris, and old or defective RBCs.

- The primary function of **thrombocytes,** or platelets, is to initiate the clotting process by producing an initial platelet plug in the early phases of the clotting process.

- **Hemostasis** is a term used to describe the blood clotting process. This process is important in minimizing blood loss when various body structures are injured.

- Four components contribute to normal hemostasis: vascular response, platelet plug formation, the development of the fibrin clot on the platelet plug by plasma clotting factors, and the ultimate lysis of the clot.

- Another component of the hematologic system is the spleen, which is located in the upper left quadrant of the abdomen. The functions of the spleen can be classified into four major functions: hematopoietic, filtration, immunologic, and storage.

- The lymph system—consisting of lymph fluid, lymphatic capillaries, ducts, and lymph nodes—carries fluid from the interstitial spaces to the blood.

ASSESSMENT

- Much of the evaluation of the hematologic system is based on a thorough health history, and a number of health patterns should be assessed.

- A complete physical examination is necessary to accurately examine all systems that affect or are affected by the hematologic system, including an assessment of lymph nodes, liver, spleen, and skin.

DIAGNOSTIC STUDIES

- The most direct means of evaluating the hematologic system is through laboratory analysis and other diagnostic studies.
- The complete blood count (CBC) involves several laboratory tests, each of which serves to assess the three major blood cells formed in the bone marrow.
- Erythrocyte sedimentation rate (ESR or "sed rate") measures the sedimentation or settling of RBCs and is used as a nonspecific measure of many diseases, especially inflammatory conditions.
- The laboratory tests used in evaluating iron metabolism include serum iron, total iron-binding capacity (TIBC), serum ferritin, and transferrin saturation.
- Radiologic studies for the hematology system involve primarily the use of computed tomography (CT) or magnetic resonance imaging (MRI) for evaluating the spleen, liver, and lymph nodes.
- Bone marrow examination is important in the evaluation of many hematologic disorders. The examination of the marrow may involve aspiration only or aspiration with biopsy.
- Lymph node biopsy involves obtaining lymph tissue for histologic examination to determine the diagnosis, and to help for planning therapy.
- Testing for specific genetic or chromosomal variations in hematologic conditions is often helpful in assisting in diagnosis and staging. These results also help to determine the treatment options and prognosis.

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Key Points

Chapter 31: Nursing Management: Hematologic Problems

ANEMIA

- **Anemia** is a deficiency in the number of erythrocytes (red blood cells [RBCs]), the quantity of hemoglobin, and/or the volume of packed RBCs (hematocrit), which can lead to tissue hypoxia.

- Hemoglobin (Hb) levels are often used to determine the severity of anemia.

- Correcting the cause of the anemia is ultimately the goal of therapy.

- Interventions may include blood or blood product transfusions, drug therapy, volume replacement, oxygen therapy, dietary modifications, and lifestyle changes.

Anemia Caused By Decreased Erythrocyte Production

Iron-Deficiency Anemia

- **Iron-deficiency anemia** may develop from inadequate dietary intake, malabsorption, blood loss, or hemolysis. Also, pregnancy contributes to iron deficiency because of the diversion of iron to the fetus for erythropoiesis, blood loss at delivery, and lactation.

- The main goal of collaborative care for iron-deficiency anemia is to treat the underlying disease causing reduced intake (e.g., malnutrition, alcoholism) or absorption of iron. In addition, efforts are directed toward replacing iron with dietary changes or supplementation.

- It is important for a nurse to recognize groups of individuals who are at an increased risk for the development of iron-deficiency anemia. These include premenopausal and pregnant women, persons from lower–class socioeconomic backgrounds, older adults, and individuals experiencing blood loss.

Thalassemia

- **Thalassemia** is a group of diseases that has an autosomal-recessive genetic basis that involves inadequate production of normal hemoglobin.

- An individual with thalassemia may have a heterozygous or homozygous form of the disease, based on the number of thalassemic genes the individual has.

- Thalassemia minor requires no treatment because the body adapts to the reduced level of normal hemoglobin.

- The symptoms of thalassemia major are managed with blood transfusions or exchange transfusions in conjunction with IV deferoxamine to reduce the iron overloading (**hemochromatosis**) that occurs with chronic transfusion therapy.

MEGALOBLASTIC ANEMIAS

- **Megaloblastic anemias** are a group of disorders caused by impaired DNA synthesis and characterized by the presence of large RBCs.

- Macrocytic (large) RBCs are easily destroyed because they have fragile cell membranes.

- Two common forms of megaloblastic anemia are cobalamin deficiency and folic acid deficiency.
    - Cobalamin (vitamin B_{12}) deficiency is most commonly caused by **pernicious anemia,** which results in poor cobalamin absorption through the GI tract. Parenteral or intranasal administration of cobalamin is the treatment of choice.
    - Folic acid (folate) is required for DNA synthesis leading to RBC formation and maturation and therefore can lead to megaloblastic anemia. Folic acid deficiency is treated by replacement therapy.

Aplastic Anemia

- **Aplastic anemia** is a disease in which the patient has peripheral blood *pancytopenia* (decrease of all blood cell types) and hypocellular bone marrow.

- Management of aplastic anemia is based on identifying and removing the causative agent (when possible) and providing supportive care until the pancytopenia reverses.

Anemia Caused By Blood Loss

Acute Blood Loss

- Acute blood loss occurs as a result of sudden hemorrhage.

- Causes of acute blood loss include trauma, complications of surgery, and conditions or diseases that disrupt vascular integrity.

- Collaborative care is initially concerned with replacing blood volume to prevent shock and identifying the source of the hemorrhage and stopping the blood loss.

Chronic Blood Loss

- The sources of chronic blood loss are similar to those of iron-deficiency anemia (e.g., bleeding ulcer, hemorrhoids, menstrual and postmenopausal blood loss).

- Management of chronic blood loss anemia involves identifying the source and stopping the bleeding. Supplemental iron may be required.

Anemia Caused By Increased Erythrocyte Destruction (Hemolytic Anemia)

SICKLE CELL DISEASE

- **Sickle cell disease** is a group of inherited, autosomal recessive disorders characterized by the presence of an abnormal form of hemoglobin in the erythrocyte.

- The major pathophysiologic event of this disease is the sickling of RBCs. Sickling episodes are most commonly triggered by low oxygen tension in the blood.

- With repeated episodes of sickling there is gradual involvement of all body systems, especially the spleen, lungs, kidneys, and brain.

- Collaborative care for a patient with sickle cell disease is directed toward alleviating the symptoms from the complications of the disease and minimizing end target-organ damage. There is no specific treatment for the disease.

Acquired Hemolytic Anemia

- Extrinsic causes of hemolysis can be separated into three categories: (1) physical factors, (2) immune reactions, and (3) infectious agents and toxins.

- Physical destruction of RBCs results from the exertion of extreme force on the cells.

- Antibodies may destroy RBCs by the mechanisms involved in antigen-antibody reactions.

- Infectious agents foster hemolysis in four ways: (1) by invading the RBC and destroying its contents, (2) by releasing hemolytic substances, (3) by generating an antigen-antibody reaction, and (4) by contributing to splenomegaly as a means of increasing removal of damaged RBCs from the circulation.

HEMOCHROMATOSIS

- **Hemochromatosis** is an autosomal recessive disease characterized by increased intestinal iron absorption and, as a result, increased tissue iron deposition.

- The goal of treatment is to remove excess iron from the body and minimize any symptoms the patient may have.

POLYCYTHEMIA

- **Polycythemia** is the production and presence of increased numbers of RBCs. The increase in RBCs can be so great that blood circulation is impaired as a result of the increased blood viscosity and volume.

- Treatment is directed toward reducing blood volume/viscosity and bone marrow activity. Phlebotomy is the mainstay of treatment.

THROMBOCYTOPENIA

- **Thrombocytopenia** is a reduction of platelets below 150,000/µl (150×10^9/L).

- Platelet disorders can be inherited, but the vast majority of them are acquired. The causes of acquired disorders include autoimmune diseases, increased platelet consumption, splenomegaly, marrow suppression, and bone marrow failure.

- The most common acquired thrombocytopenia is a syndrome of abnormal destruction of circulating platelets termed *immune thrombocytopenic purpura* (ITP). Multiple therapies are used to manage the patient with ITP, such as corticosteroids or splenectomy.

- One of the risks associated with the broad and increasing use of heparin is the development of the life-threatening condition called *heparin-induced thrombocytopenia and thrombosis syndrome* (HITTS). Heparin must be discontinued when HITTS is first recognized, which is usually if the patient's platelet count has fallen 50% or more from its baseline or if a thrombus forms while the patient is on heparin therapy.

- For the nurse, the overall goals are that the patient with thrombocytopenia will (1) have no gross or occult bleeding, (2) maintain vascular integrity, and (3) manage home care to prevent any complications related to an increased risk for bleeding.

HEMOPHILIA AND VON WILLEBRAND DISEASE

- **Hemophilia** is a sex-linked recessive genetic disorder caused by defective or deficient coagulation factor. The two major forms of hemophilia, which can occur in mild to severe forms, are hemophilia A and hemophilia B.

- Von Willebrand disease is a related disorder involving a deficiency of the von Willebrand coagulation protein.

- Replacement of deficient clotting factors is the primary means of supporting a patient with hemophilia. In addition to treating acute crises, replacement therapy may be given before surgery and before dental care as a prophylactic measure.

- Home management is a primary consideration for the patient with hemophilia because the disease follows a progressive, chronic course.

- The patient with hemophilia must be taught to recognize disease-related problems and to learn which problems can be resolved at home and which require hospitalization.

DISSEMINATED INTRAVASCULAR COAGULATION

- **Disseminated intravascular coagulation** (DIC) is a serious bleeding and thrombotic disorder.

- It results from abnormally initiated and accelerated clotting. Subsequent decreases in clotting factors and platelets ensue, which may lead to uncontrollable hemorrhage.

- DIC is always caused by an underlying disease or condition. The underlying problem must be treated for the DIC to resolve.

- It is important to diagnose DIC quickly, stabilize the patient if needed (e.g., oxygenation, volume replacement), institute therapy that will resolve the underlying causative disease or problem, and provide supportive care for the manifestations resulting from the pathology of DIC itself.

NEUTROPENIA

- **Neutropenia** is a reduction in neutrophils, a type of granulocyte, and therefore is sometime referred to as granulocytopenia. The neutrophilic granulocytes are closely monitored in clinical practice as an indicator of a patient's risk for infection.

- Neutropenia is a clinical consequence that occurs with a variety of conditions or diseases. It can also be an expected effect, a side effect, or an unintentional effect of taking certain drugs.

- Occasionally the cause of the neutropenia can be easily treated (e.g., nutritional deficiencies). However, neutropenia can also be a side effect that must be tolerated as a necessary step in therapy (e.g., chemotherapy, radiation therapy). In some situations the neutropenia resolves when the primary disease is treated (e.g., tuberculosis).

- The nurse needs to monitor the neutropenic patient for signs and symptoms of infection and early septic shock.

MYELODYSPLASTIC SYNDROME

- **Myelodysplastic syndrome** (MDS) is a group of related hematologic disorders characterized by a change in the quantity and quality of bone marrow elements. Although it can occur in all age groups, the highest prevalence is in people over 60 years of age.

- Supportive treatment consists of hematologic monitoring, antibiotic therapy, or transfusions with blood products. The overall goal is to improve hematopoiesis and ensure age-related quality of life.

LEUKEMIA

- **Leukemia** is the general term used to describe a group of malignant disorders affecting the blood and blood-forming tissues of the bone marrow, lymph system, and spleen.

- Classification of leukemia can be done based on acute versus chronic and on the type of WBC involved, whether it is of myelogenous origin or of lymphocytic origin.
    - The onset of acute myelogenous leukemia (AML) is often abrupt and dramatic. AML is characterized by uncontrolled proliferation of myeloblasts, the precursors of granulocytes.
    - Acute lymphocytic leukemia (ALL) is the most common type of leukemia in children.
    - Chronic myelogenous leukemia (CML) is caused by excessive development of mature neoplastic granuloctyes in the bone marrow, which move into the peripheral blood in massive numbers and ultimately infiltrate the liver and spleen. The natural history of CML is a chronic stable phase, followed by the development of a more acute, aggressive phase referred to as the blastic phase.
    - Chronic lymphocytic leukemia (CLL) is characterized by the production and accumulation of functionally inactive but long-lived, small, mature-appearing lymphocytes. The lymphocytes infiltrate the bone marrow, spleen, and liver, and lymph node enlargement is present throughout the body.

  - Hairy cell leukemia is a chronic disease of lymphoproliferation predominantly involving B lymphocytes that infiltrate the bone marrow and spleen. Cells have a "hairy" appearance under the microscope.

- Once a diagnosis of leukemia has been made, collaborative care is focused on the initial goal of attaining remission. In some cases, such as nonsymptomatic patients with CLL, watchful waiting with active supportive care may be appropriate.

- Cytotoxic chemotherapy is the mainstay of the treatment for leukemia. Hematopoietic stem cell transplantation is another type of therapy used for patients with different forms of leukemia.

- The overall nursing goals are that the patient with leukemia will (1) understand and cooperate with the treatment plan, (2) experience minimal side effects and complications associated with both the disease and its treatment, and (3) feel hopeful and supported during the periods of treatment, relapse, or remission.

LYMPHOMAS

- **Lymphomas** are malignant neoplasms originating in the bone marrow and lymphatic structures resulting in the proliferation of lymphocytes.
- There are two major types of lymphomas—Hodgkin's lymphoma and non-Hodgkin's lymphoma (NHL).

Hodgkin's Lymphoma

- **Hodgkin's lymphoma,** also called Hodgkin's disease**,** is a malignant condition characterized by proliferation of abnormal giant, multinucleated cells, called *Reed-Sternberg cells,* which are located in lymph nodes.

- Although the cause of Hodgkin's lymphoma remains unknown, the main interacting factors include infection with Epstein-Barr virus, genetic predisposition, and exposure to occupational toxins. The incidence of Hodgkin's lymphoma is increased in incidence among human immunodeficiency virus infected patients.

- The nursing care for Hodgkin's lymphoma is largely based on managing problems related to the disease (e.g., pain due to tumor), pancytopenia, and other side effects of therapy.

Non-Hodgkin's Lymphomas

- **Non-Hodgkin's lymphomas** (NHLs) are a heterogeneous group of malignant neoplasms of primarily B or T cell origin affecting all ages. A variety of clinical presentations and courses are recognized from indolent (slowly developing) to rapidly progressive disease.

- NHLs can originate outside the lymph nodes, the method of spread can be unpredictable, and the majority of patients have widely disseminated disease at the time of diagnosis.

- Treatment for NHL involves chemotherapy and sometimes radiation therapy. Nursing care is largely based on managing problems related to the disease (e.g., pain due to the tumor, spinal cord compression, tumor lysis syndrome), pancytopenia, and other side effects of therapy.

MULTIPLE MYELOMA

- **Multiple myeloma,** or *plasma cell myeloma,* is a condition in which neoplastic plasma cells infiltrate the bone marrow and destroy bone.

- Multiple myeloma develops slowly and insidiously. The patient often does not manifest symptoms until the disease is advanced.

- Multiple myeloma is seldom cured, but treatment can relieve symptoms, produce remission, and prolong life. Chemotherapy is usually the first treatment recommended for multiple myeloma.

- Maintaining adequate hydration is a primary nursing consideration to minimize problems from hypercalcemia. Because of the potential for pathologic fractures, the nurse must be careful when moving and ambulating the patient.

BLOOD COMPONENT THERAPY

- Blood component therapy is frequently used in managing hematologic diseases. However, blood component therapy only temporarily supports the patient until the underlying problem is resolved.

- When the blood or blood components have been obtained from the blood bank, positive identification of the donor blood and recipient must be made. Improper product-to-patient identification causes 90% of hemolytic transfusion reactions.

- The blood should be administered as soon as it is brought to the patient. It should not be refrigerated on the nursing unit.

- Autotranfusion, or autologous transfusion, consists of removing whole blood from a person and transfusing that blood back into the same person. The problems of incompatibility, allergic reactions, and transmission of disease can be avoided.

- A blood transfusion reaction is an adverse reaction to blood transfusion therapy that can range in severity from mild symptoms to a life-threatening condition. Blood transfusion reactions can be classified as acute or delayed.

Acute Transfusion Reactions

- The most common cause of hemolytic reactions is transfusion of ABO-incompatible blood.

- Febrile reactions are most commonly caused by leukocyte incompatibility. Many individuals who receive five or more transfusions develop circulating antibodies to the small amount of WBCs in the blood product.

- Allergic reactions result from the recipient's sensitivity to plasma proteins of the donor's blood. These reactions are more common in an individual with a history of allergies.

- An individual with cardiac or renal insufficiency is at risk for developing circulatory overload. This is especially true if a large quantity of blood is infused in a short period of time, particularly in an elderly patient.

- Transfusion-related lung injury is characterized by the sudden development of noncardiogenic pulmonary edema (acute lung injury).

- An acute complication of transfusing large volumes of blood products is termed massive blood transfusion reaction. Massive blood transfusion reactions can occur when replacement of RBCs or blood exceeds the total blood volume within 24 hours.

Delayed Transfusion Reactions

- Delayed transfusion reactions include delayed hemolytic reactions, infections, iron overload, and graft-versus-host disease.

- Infectious agents transmitted by blood transfusion include hepatitis B and C viruses, HIV, human herpesvirus type 6, Epstein-Barr virus, human T cell leukemia, cytomegalovirus, and malaria.

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Key Points

Chapter 32: Nursing Assessment: Cardiovascular System

STRUCTURES AND FUNCTIONS

- The heart is a four-chambered organ that lies in the mediastinal space in the thorax.

- The heart is divided by the septum, forming the right and left atrium and the right and left ventricle.

- Valves separate the chambers of the heart:
    - Mitral valve separates the left atrium and the left ventricle.
    - Aortic valve separates the left ventricle and the aorta.

  - Tricuspid valve separates the right atrium and the right ventricle.
  - Pulmonic valve separates the right ventricle and the pulmonary artery.

- The heart is:
  - Composed of three layers: endocardium, myocardium, and epicardium.
  - Surrounded by a fibroserous sac called the pericardium.

- The right side of the heart receives blood from the body (via the vena cava) and pumps it to the lungs where it is oxygenated. Blood returns to the left side of the heart (via the pulmonary arteries) and is pumped to the body via the aorta.

- The coronary circulation provides blood to the myocardium. The right and left coronary arteries are the first branches of the aorta.

- The conduction system consists of specialized cells that create and transport electrical impulses. These electrical impulses initiate depolarization (contraction) of the myocardium and ultimately a cardiac contraction.

- Each electrical impulse starts at the SA node (located in the right atrium), travels to the AV node (located at the atrioventricular junction), through the bundle of His, down the right and left bundle branches (located in the ventricular septum), terminating in the Purkinje fibers.

- The electrical activity of the heart is recorded on the electrocardiogram (ECG).

- **Systole,** contraction of the myocardium, results in ejection of blood from the ventricles. Relaxation of the myocardium, or **diastole,** allows for filling of the ventricles.

- **Cardiac output** (CO) is the amount of blood pumped by each ventricle in 1 minute. It is calculated by multiplying the amount of blood ejected from the ventricle with each heartbeat, the stroke volume (SV), by the heart rate (HR) per minute: $CO = SV \times HR$.

- Factors affecting SV are preload, afterload, and contractility. **Preload** is the volume of blood in the ventricles at the end of diastole, and **afterload** represents the peripheral resistance against which the left ventricle must pump.

- **Cardiac reserve** refers to the heart's ability to alter the CO in response to an increase in demand (e.g., exercise, hypovolemia).

- Stimulation of the sympathetic nervous system increases HR, speed of conduction through the AV node, and force of atrial and ventricular contractions, whereas stimulation of the parasympathetic nervous system decreases HR.

- Baroreceptors, located in the aortic arch and carotid sinus, respond to stretch or pressure within the arterial system. Stimulation of these receptors results in temporary inhibition of the sympathetic nervous system and an increase in parasympathetic influence.

- Chemoreceptors, located in the aortic arch and carotid body, can initiate changes in HR and arterial pressure in response to decreased arterial O_2 pressure, increased arterial CO_2 pressure, and decreased plasma pH.

- **Arterial blood pressure** (BP) measures the pressure exerted by blood against the walls of the arterial system.

- The **systolic blood pressure** (SBP) is the peak pressure exerted against the arteries when the heart contracts. The **diastolic blood pressure** (DBP) is the residual pressure of the arterial system during ventricular relaxation (or filling). Normal blood pressure is systolic BP less than 120 mm Hg and diastolic BP less than 80 mm Hg.

- The two main factors influencing BP are cardiac output (CO) and systemic vascular resistance (SVR), which is the force opposing the movement of blood.

- BP can be measured by invasive (catheter inserted in an artery) and noninvasive techniques (using a sphygmomanometer and a stethoscope).

- **Pulse pressure** is the difference between the SBP and DBP and it is normally about one third of the SBP.

- **Mean arterial pressure (MAP)** is the perfusion pressure felt by organs in the body, and a MAP of greater than 60 is necessary to sustain the vital organs of an average person under most conditions.

ASSESSMENT

Health History

When conducting a health assessment of the cardiovascular system, a thorough history should include the following:

- Any past history of chest pain, shortness of breath, alcoholism and/or tobacco use, anemia, rheumatic fever, streptococcal sore throat, congenital heart disease, stroke, syncope, hypertension, thrombophlebitis, intermittent claudication, varicosities, and edema

- Current and past use of medications

- Information about specific treatments, past surgeries, or hospital admissions related to cardiovascular problems

- Information about cardiovascular risk factors (i.e., elevated serum lipids, hypertension)
- Family history with cardiovascular illnesses of blood relatives
- The patient's current weight and weight history
- A typical day's diet
- Problems with urinary (e.g., nocturia) or bowel elimination (e.g., constipation)
- The types of exercise performed and the occurrence of any unwanted effects
- Identification of paroxysmal nocturnal dyspnea, sleep apnea, and the number of pillows needed for comfort
- Information about the patient's gender, race, and age
- Any problems in sexual performance
- Information about stressful situations should be explored (e.g., marital relationships)
- Information about a patient's values and beliefs

Physical Examination

When conducting a health assessment of the cardiovascular system, a thorough physical examination should include the following:

- General appearance, vital signs, including orthostatic (postural) BPs and HRs
- Inspection of the skin, extremities, and the large veins of the neck
- Bilateral and simultaneous palpation of the upper and lower extremities
- Bilateral and simultaneous palpation of the pulses in the extremities
- Capillary refill
- Auscultation of carotid arteries, abdominal aorta, and femoral arteries
- Inspection and palpation of the thorax, epigastric area, and mitral valve area
- Auscultation of the heart with the bell and diaphragm of the stethoscope
- Auscultation for extra heart sounds (S_3 or S_4) with the bell of the stethoscope

DIAGNOSTIC STUDIES

The most common procedures used to diagnose cardiovascular disease include the following:

- Blood studies
  - Creatine kinase (CK)-MB: levels increase with myocardial infarction (MI)
  - Cardiac-specific troponin: levels rise with myocardial injury
  - Myoglobin: sensitive indicator of early myocardial injury
  - Serum lipoproteins: including triglycerides, cholesterol, and phospholipids
  - C-reactive protein (CRP): emerging as an independent risk factor for CAD and a predictor of cardiac events
  - Homocysteine (Hcy): elevated levels have been linked to an increased risk of a first cardiac event and should be measured in patients with a familial predisposition for early cardiovascular disease
  - Cardiac natriuretic peptide markers: emerged as the marker of choice for distinguishing a cardiac or respiratory cause of dyspnea

- Chest x-ray

- Electrocardiogram
  - Deviations from the normal sinus rhythm can indicate abnormalities in heart function.
  - Continuous ambulatory ECG (Holter monitoring): recorder is worn for 24 to 48 hours, and the resulting ECG information is then stored until it is played back for printing and evaluation.
  - Transtelephonic event recorders: portable monitor uses electrodes to transmit a limited ECG over the phone to a receiving device.

- Exercise or stress testing
  - Used to evaluate the cardiovascular response to physical stress

- 6-Minute walk test
  - Used for patients with heart or peripheral arterial disease to measure response to medical interventions and determine functional capacity for daily physical activities

- Echocardiogram
  - Uses ultrasound waves to record the movement of the structures of the heart.
  - Provides information about (1) valvular structure and motion, (2) cardiac chamber size and contents, (3) ventricular muscle and septal motion and thickness, (4) pericardial sac, (5) ascending aorta, and (6) **ejection fraction** (EF) (percentage of end-diastolic blood volume that is ejected during systole).

- Nuclear cardiology
  - Multigated acquisition (MUGA) or cardiac blood pool scan

        - Provides information on wall motion during systole and diastole, cardiac valves, and EF.
    - Single-photon emission computed tomography (SPECT)
        - Used to evaluate the myocardium at risk of infarction and to determine infarction size.
    - Positron emission tomography (PET) scanning
        - Uses two isotopes to distinguish viable and nonviable myocardial tissue.
    - Perfusion imaging with exercise testing
        - Determines whether the coronary blood flow changes with increased activity.
        - Used to diagnose CAD, determine the prognosis in already diagnosed CAD, assess the physiologic significance of a known coronary lesion, and assess the effectiveness of various therapeutic modalities such as coronary artery bypass surgery, percutaneous coronary intervention, or thrombolytic therapy.
    - Magnetic resonance imaging (MRI)
        - Allows detection and localization of areas of MI in a 3-D view. It is sensitive enough to detect small MIs not apparent with SPECT imaging and can assist in the final diagnosis of MI.
    - Magnetic resonance angiography (MRA)
        - Used for imaging vascular occlusive disease and abdominal aortic aneurysms.

- Computed tomography (CT) with spiral technology
    - A noninvasive scan used to quantify calcium deposits in coronary arteries. Electron beam computed tomography (EBCT), also known as ultrafast CT, uses a scanning electron beam to quantify the calcification in the coronary arteries and the heart valves.

- Cardiac catheterization and coronary angiography
    - Contrast media (introduced via a catheter inserted in a large peripheral artery) and fluoroscopy are used to obtain information about the coronary arteries, heart chambers and valves, ventricular function, intracardiac pressures, O_2 levels in various parts of the heart, CO, and EF.

- Intracoronary ultrasound (ICUS) or intravascular ultrasound (IVUS)
    - Performed during coronary angiography. Obtains 2-D or 3-D ultrasound images to provide a cross-sectional view of the arterial walls of the coronary arteries.

- Electrophysiology study (EPS)
    - Studies and manipulates the electrical activity of the heart using electrodes placed inside the cardiac chambers. Provides information on SA node function, AV node conduction, ventricular conduction, and source treatment dysrhythmias.

- Duplex imaging

- Uses contrast media, injected into arteries or veins (arteriography and venography) to diagnose occlusive disease in the peripheral blood vessels and thrombophlebitis.

- Hemodynamic monitoring

Uses intraarterial and pulmonary artery catheters to monitor arterial BP, intracardiac pressures, CO, and central venous pressure (CVP

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Key Points

Chapter 33: Nursing Management: Hypertension

- **Hypertension,** or high **blood pressure** (BP), is defined as a persistent systolic blood pressure (SBP) greater than or equal to 140 mm Hg, diastolic blood pressure (DBP) greater than or equal to 90 mm Hg, or current use of antihypertensive medication. There is a direct relationship between hypertension and cardiovascular disease (CVD).

- Contributing factors to the development of hypertension include cardiovascular risk factors combined with socioeconomic conditions and ethnic differences.

- Hypertension is generally an asymptomatic condition. Individuals who remain undiagnosed and untreated for hypertension present the greatest challenge and opportunity for health care providers.

REGULATION OF BLOOD PRESSURE

- BP is the force exerted by the blood against the walls of the blood vessel. It must be adequate to maintain tissue perfusion during activity and rest.

- Regulation of BP involves nervous, cardiovascular, endothelial, renal, and endocrine functions.
    - Sympathetic nervous system (SNS) activation increases heart rate (HR) and cardiac contractility, produces widespread vasoconstriction in the peripheral arterioles, and promotes the release of renin from the kidneys.
    - Baroreceptors, located in the carotid artery and the arch of the aorta, sense changes in BP. When BP is increased, these receptors send inhibitory impulses to the sympathetic vasomotor center in the brainstem resulting in decreased HR, decreased force of contraction, and vasodilation in peripheral arterioles.
    - A decrease in BP leads to activation of the SNS resulting in constriction of the peripheral arterioles, increased HR, and increased contractility of the heart.
    - In the presence of long-standing hypertension, the baroreceptors become adjusted to elevated levels of BP and recognize this level as "normal."
    - Norepinephrine (NE), released from SNS nerve endings, activates receptors located in the sinoatrial node, myocardium, and vascular smooth muscle.
    - Vascular endothelium produces vasoactive substances and growth factors.
        - Nitric oxide, an endothelium-derived relaxing factor (EDRF), helps maintain low arterial tone at rest, inhibits growth of the smooth muscle layer, and inhibits platelet aggregation.
        - Endothelin (ET), produced by the endothelial cells, is an extremely potent vasoconstrictor.
    - Kidneys contribute to BP regulation by controlling sodium excretion and extracellular fluid (ECF) volume.
        - Sodium retention results in water retention, which causes an increased ECF volume. This increases the venous return to the heart, increasing the stroke volume, which elevates the BP through an increase in CO.
    - Endocrine system:
        - The adrenal medulla releases epinephrine in response to SNS stimulation. Epinephrine activates β_2-adrenergic receptors causing vasodilation. In peripheral arterioles with only α_1-adrenergic receptors (skin and kidneys), epinephrine causes vasoconstriction.
        - The adrenal cortex is stimulated by A-II to release aldosterone. Aldosterone stimulates the kidneys to retain sodium and water. This increases BP by increasing CO.
        - ADH is released from the posterior pituitary gland in response to an increased blood sodium and osmolarity level. ADH increases the ECF volume by promoting the reabsorption of water in the distal and collecting tubules of the kidneys resulting in an increase in blood volume and BP.

CLASSIFICATION OF HYPERTENSION

- Hypertension is classified as follows:
    - **Prehypertension:** BP 120 to 139 / 80 to 89 mm Hg
    - Hypertension, Stage 1: BP 140 to 159 / 90 to 99 mm Hg
    - Hypertension, Stage 2: systolic BP greater than or equal to 160 or diastolic BP greater than or equal to 100 mm Hg.

- Subtypes of hypertension:
  - Isolated systolic hypertension (ISH): average SBP greater than or equal to 140 mm Hg coupled with an average DBP less than 90 mm Hg. ISH is more common in older adults. Control of ISH decreases the incidence of stroke, heart failure, cardiovascular mortality, and total mortality.
  - Pseudohypertension (false hypertension) occurs with advanced arteriosclerosis. Pseudohypertension is suspected if arteries feel rigid or when few retinal or cardiac signs are found relative to the pressures obtained by cuff.

ETIOLOGY OF HYPERTENSION

- **Primary (essential or idiopathic) hypertension:** elevated BP without an identified cause; accounts for 90% to 95% of all cases of hypertension.

- **Secondary hypertension:** elevated BP with a specific cause; accounts for 5% to 10% of hypertension in adults.

PATHOPHYSIOLOGY OF PRIMARY HYPERTENSION

- The hemodynamic hallmark of hypertension is persistently increased SVR.

- Water and sodium retention:
  - A high-sodium intake may activate a number of pressor mechanisms and cause water retention.

- Altered renin-angiotensin mechanism:
  - High plasma renin activity (PRA) results in the increased conversion of angiotensinogen to angiotensin I causing arteriolar constriction, vascular hypertrophy, and aldosterone secretion.

- Stress and increased SNS activity:
  - Arterial pressure is influenced by factors such as anger, fear, and pain.
  - Physiologic responses to stress, which are normally protective, may persist to a pathologic degree, resulting in prolonged increase in SNS activity.
  - Increased SNS stimulation produces increased vasoconstriction, increased HR, and increased renin release.

- Insulin resistance and hyperinsulinemia:
  - Abnormalities of glucose, insulin, and lipoprotein metabolism are common in primary hypertension.
  - High insulin concentration in the blood stimulates SNS activity and impairs nitric oxide–mediated vasodilation.
  - Additional pressor effects of insulin include vascular hypertrophy and increased renal sodium reabsorption.

- Endothelial cell dysfunction:

  - Some hypertensive people have a reduced vasodilator response to nitric oxide.
  - Endothelin produces pronounced and prolonged vasoconstriction.

CLINICAL MANIFESTATIONS OF HYPERTENSION

- Often called the "silent killer" because it is frequently asymptomatic until it becomes severe and target organ disease occurs.

- Target organ diseases occur in the heart (hypertensive heart disease), brain (cerebrovascular disease), peripheral vasculature (peripheral vascular disease), kidney (nephrosclerosis), and eyes (retinal damage).

- Hypertension is a major risk factor for coronary artery disease (CAD).

- Sustained high BP increases the cardiac workload and produces left ventricular hypertrophy (LVH). Progressive LVH, especially in association with CAD, is associated with the development of heart failure.

- Hypertension is a major risk factor for cerebral atherosclerosis and stroke.

- Hypertension speeds up the process of atherosclerosis in the peripheral blood vessels, leading to the development of peripheral vascular disease, aortic aneurysm, and aortic dissection.

- Intermittent claudication (ischemic muscle pain precipitated by activity and relieved with rest) is a classic symptom of peripheral vascular disease involving the arteries.

- Hypertension is one of the leading causes of end-stage renal disease, especially among African Americans. The earliest manifestation of renal dysfunction is usually nocturia.

- The retina provides important information about the severity and duration of hypertension. Damage to retinal vessels provides an indication of concurrent vessel damage in the heart, brain, and kidney. Manifestations of severe retinal damage include blurring of vision, retinal hemorrhage, and loss of vision.

DIAGNOSTIC STUDIES

- Basic laboratory studies are performed to (1) identify or rule out causes of secondary hypertension, (2) evaluate target organ disease, (3) determine overall cardiovascular risk, or (4) establish baseline levels before initiating therapy.

- Routine urinalysis, BUN, serum creatinine, and creatinine clearance levels are used to screen for renal involvement and to provide baseline information about kidney function.

- Measurement of serum electrolytes, especially potassium levels, is done to detect hyperaldosteronism, a cause of secondary hypertension.

- Blood glucose levels assist in the diagnosis of diabetes mellitus.

- Lipid profile provides information about additional risk factors that predispose to atherosclerosis and cardiovascular disease.

- Uric acid levels are determined to establish a baseline, because the levels often rise with diuretic therapy.

- ECG and echocardiography provide information about the cardiac status.

- Ambulatory blood pressure monitoring (ABPM) is a noninvasive, fully automated system that measures BP at preset intervals over a 24-hour period.
    - Some patients with hypertension do not show a normal, nocturnal dip in BP and are referred to as "nondippers."
    - The absence of diurnal variability has been associated with more target organ damage and an increased risk for cardiovascular events. The presence or absence of diurnal variability can be determined by ABPM.

NURSING AND COLLABORATIVE MANAGEMENT

- Treatment goals are to lower BP to less than 140 mm Hg systolic and less than 90 mm Hg diastolic for most persons with hypertension (less than 130 mm Hg systolic and less than 80 mm Hg diastolic for those with diabetes mellitus and chronic kidney disease).

- Lifestyle modifications are indicated for all patients with prehypertension and hypertension and include the following:
    - Weight reduction. A weight loss of 10 kg (22 lb) may decrease SBP by approximately 5 to 20 mm Hg.
    - Dietary Approaches to Stop Hypertension (DASH) eating plan. Involves eating several servings of fish each week, eating plenty of fruits and vegetables, increasing fiber intake, and drinking a lot of water. The DASH diet significantly lowers BP.
    - Restriction of dietary sodium to less than 6 g of salt (NaCl) or less than 2.4 g of sodium per day.
    - This involves avoiding foods known to be high in sodium (e.g., canned soups) and not adding salt in the preparation of foods or at meals.
    - There is evidence that greater levels of dietary potassium, calcium, vitamin D, and omega-3 fatty acids are associated with lower BP in those with hypertension.
    - Restriction of alcohol to no more than two drinks per day for men and no more than one drink per day for women
    - Regular aerobic physical activity (e.g., brisk walking) at least 30 minutes a day most days of the week. Moderately intense activity such as brisk walking, jogging, and swimming can lower BP, promote relaxation, and decrease or control body weight.
    - It is strongly recommended that tobacco use be avoided.
    - Stress can raise BP on a short-term basis and has been implicated in the

development of hypertension. Relaxation therapy, guided imagery, and biofeedback may be useful in helping patients manage stress, thus decreasing BP.

Drug Therapy

- Drug therapy is not recommended for those persons with prehypertension unless it is required by another condition, such as diabetes mellitus or chronic kidney disease.

- The overall goals for the patient with hypertension include (1) achievement and maintenance of the goal BP; (2) acceptance and implementation of the therapeutic plan; (3) minimal or no unpleasant side effects of therapy; and (4) ability to manage and cope with illness.

- Drugs currently available for treating hypertension work by (1) decreasing the volume of circulating blood, and/or (2) reducing SVR.
    - Diuretics promote sodium and water excretion, reduce plasma volume, decrease sodium in the arteriolar walls, and reduce the vascular response to catecholamines.
    - Adrenergic-inhibiting agents act by diminishing the SNS effects that increase BP. Adrenergic inhibitors include drugs that act centrally on the vasomotor center and peripherally to inhibit norepinephrine release or to block the adrenergic receptors on blood vessels.
    - Direct vasodilators decrease the BP by relaxing vascular smooth muscle and reducing SVR.
    - Calcium channel blockers increase sodium excretion and cause arteriolar vasodilation by preventing the movement of extracellular calcium into cells.
    - Angiotensin-converting enzyme (ACE) inhibitors prevent the conversion of angiotensin I to angiotensin II and reduce angiotensin II (A-II)–mediated vasoconstriction and sodium and water retention.
    - A-II receptor blockers (ARBs) prevent angiotensin II from binding to its receptors in the walls of the blood vessels.
    - Thiazide-type diuretics are used as initial therapy for most patients with hypertension, either alone or in combination with one of the other classes.
    - When BP is more than 20/10 mm Hg above SBP and DBP goals, a second drug should be considered. Most patients who are hypertensive will require two or more antihypertensive medications to achieve their BP goals.
    - Side effects and adverse effects of antihypertensive drugs may be so severe or undesirable that the patient does not comply with therapy.
        - Hyperuricemia, hyperglycemia, and hypokalemia are common side effects with both thiazide and loop diuretics.
        - ACE inhibitors lead to high levels of bradykinin, which can cause coughing. An individual who develops a cough with the use of ACE inhibitors may be switched to an ARB.
        - Hyperkalemia can be a serious side effect of the potassium-sparing diuretics and ACE inhibitors.
        - Sexual dysfunction may occur with some of the diuretics.

  - Orthostatic hypotension and sexual dysfunction are two undesirable effects of adrenergic-inhibiting agents.
  - Tachycardia and orthostatic hypotension are potential adverse effects of both vasodilators and angiotensin inhibitors.
  - Patient and family teaching related to drug therapy is needed to identify and minimize side effects and to cope with therapeutic effects. Side effects may be an initial response to a drug and may decrease with continued use of the drug.

- Resistant hypertension is the failure to reach goal BP in patients who are adhering to full doses of an appropriate three-drug therapy regimen that includes a diuretic.

Blood Pressure Monitoring

- The majority of cases of hypertension are identified through routine screening procedures such as insurance, preemployment, and military physical examinations.

- The auscultatory method of BP measurement is recommended. Initially, the BP is taken at least twice, at least 1 minute apart, with the average pressure recorded as the value for that visit. Size and placement of BP cuff are important for accurate measurement. The forearm is supported at heart level and Korotkoff sounds are auscultated over the radial artery.

- BP measurements of both arms should be performed initially to detect any differences between arms. The arm with the higher reading should be used for all subsequent BP measurements.

- Orthostatic (or postural) changes in BP and pulse should be measured in older adults, in people taking antihypertensive drugs, and in patients who report symptoms consistent with reduced BP upon standing (e.g., light-headedness, dizziness, syncope).

- **Orthostatic hypotension** is defined as a decrease of 20 mm Hg or more in SBP, a decrease of 10 mm Hg or more in DBP, and/or an increase of 20 beats/minute or more in pulse from supine to standing.

- BP monitoring should focus on controlling BP in the person already identified as having hypertension; identifying and controlling BP in at-risk groups such as African Americans, obese people, and blood relatives of people with hypertension; and screening those with limited access to the health care system.

NURSING MANAGEMENT

- The primary nursing responsibilities for long-term management of hypertension are to assist the patient in reducing BP and complying with the treatment plan. Nursing actions include patient and family teaching, detection and reporting of adverse treatment effects, compliance assessment and enhancement, and evaluation of therapeutic effectiveness.

- Patient and family teaching includes the following: (1) nutritional therapy, (2) drug therapy, (3) physical activity, (4) home monitoring of BP (if appropriate), and (5) tobacco cessation (if applicable).
    - Home monitoring of BP should include daily BP readings when treatment is initiated or medications are adjusted and weekly once the BP has stabilized. A log of the BP measurements should be maintained by the patient. Devices that have memory or printouts of the readings are recommended to facilitate accurate reporting.
    - A major problem in the long-term management of the patient with hypertension is poor compliance with the prescribed treatment plan. The reasons include inadequate patient teaching, unpleasant side effects of drugs, return of BP to normal range while on medication, lack of motivation, high cost of drugs, lack of insurance, and lack of a trusting relationship between the patient and the health care provider.

GERONTOLOGIC CONSIDERATIONS

- The prevalence of hypertension increases with age. The lifetime risk of developing hypertension is approximately 90% for middle-aged (age 55 to 65) and older (age >65) normotensive men and women.

- A number of age-related physical changes contribute to the pathophysiology of hypertension in the older adult.

- In some older people, there is a wide gap between the first Korotkoff sound and subsequent beats (auscultatory gap). Failure to inflate the cuff high enough may result in underestimating the SBP.

- Older adults are sensitive to BP changes. Reducing SBP to less than 120 mm Hg in a person with long-standing hypertension could lead to inadequate cerebral blood flow.

- Older adults produce less renin and are more resistant to the effects of ACE inhibitors and angiotensin II receptor blockers.

- Orthostatic hypotension occurs often in older adults because of impaired baroreceptor reflex mechanisms.

- Orthostatic hypotension in older adults is often associated with volume depletion or chronic disease states, such as decreased renal and hepatic function or electrolyte imbalance.

- To reduce the likelihood of orthostatic hypotension, antihypertensive drugs should be started at low doses and increased cautiously.

HYPERTENSIVE CRISIS

- **Hypertensive crisis** is a severe and abrupt elevation in BP, arbitrarily defined as a DBP

more than 140 mm Hg.
    - Hypertensive crisis occurs most often in patients with a history of hypertension who have failed to comply with their prescribed medications or who have been undermedicated.
    - Hypertensive crisis related to cocaine or crack use is becoming a more frequent problem. Other drugs such as amphetamines, phencyclidine (PCP), and lysergic acid diethylamide (LSD) may also precipitate hypertensive crisis that may be complicated by drug-induced seizures, stroke, MI, or encephalopathy.

- Hypertensive emergency develops over hours to days and is defined as BP that is severely elevated (more than 180/120 mm Hg) with evidence of acute target organ damage.
    - Hypertensive emergencies can precipitate encephalopathy, intracranial or subarachnoid hemorrhage, acute left ventricular failure with pulmonary edema, MI, renal failure, dissecting aortic aneurysm, and retinopathy.
    - Hypertensive emergencies require hospitalization, intravenous (IV) administration of antihypertensive drugs, and intensive care monitoring.

- Antihypertensive drugs include vasodilators, adrenergic inhibitors, and the ACE inhibitor enalaprilat. Sodium nitroprusside is the most effective IV drug for the treatment of hypertensive emergencies.

- Mean arterial pressure (MAP) is generally used instead of systolic and diastolic readings to guide therapy. MAP is calculated as follows: MAP = (SBP + 2 DBP) ÷ 3.

- The use of an intraarterial line or an automated, noninvasive BP machine to monitor the MAP and BP is required. The rate of drug administration is titrated according to the level of MAP or BP.

- The initial treatment goal is to decrease MAP by no more than 25% within minutes to 1 hour. If the patient is stable, the target goal for BP is 160/100 to 110 mm Hg over the next 2 to 6 hours.

- Lowering BP excessively may decrease cerebral, coronary, or renal perfusion and could precipitate a stroke, acute MI, or renal failure.

- Additional gradual reductions toward a normal BP should be implemented over the next 24 to 48 hours if the patient is clinically stable.

- Regular, ongoing assessment (e.g., ECG monitoring, vital signs, urinary output, level of consciousness, visual changes) is essential to evaluate the patient with severe hypertension.

- Hypertensive urgency develops over days to weeks and is defined as a BP that is severely elevated but with no clinical evidence of target organ damage.
    - Hypertensive urgencies usually do not require IV medications but can be managed

with oral agents.
- If a patient with hypertensive urgency is not hospitalized, outpatient follow-up should be arranged within 24 hours.

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Key Points

Chapter 34: Nursing Management: Coronary Artery Disease and Acute Coronary Syndrome

- **Coronary artery disease** (CAD) is a type of blood vessel disorder included in the general category of atherosclerosis.
- **Atherosclerosis** is characterized by a focal deposit of cholesterol and lipids within the intimal wall of the artery. Inflammation and endothelial injury play a central role in the development of atherosclerosis.
- CAD is a progressive disease that develops in stages and when it becomes symptomatic, the disease process is usually well advanced.
- Normally some arterial anastomoses or connections, termed **collateral circulation,** exist within the coronary circulation. The growth and extent of collateral circulation are attributed to two factors: (1) the inherited predisposition to develop new blood vessels (angiogenesis), and (2) the presence of chronic ischemia.
- Many risk factors have been associated with CAD.
  - Nonmodifiable risk factors are age, gender, ethnicity, family history, and genetic inheritance.
  - Modifiable risk factors include elevated serum lipids, hypertension, tobacco use, physical inactivity, obesity, diabetes, metabolic syndrome, psychologic states, and homocysteine level.
    - Elevated serum lipid levels are one of the four most firmly established risk factors for CAD.
    - Lipids combine with proteins to form lipoproteins and are vehicles for fat mobilization and transport. The different types of lipoproteins are classified as high-density lipoproteins (HDLs), low-density lipoproteins (LDLs), and very-low-density lipoproteins (VLDLs).
      - HDLs carry lipids away from arteries and to the liver for metabolism. High serum HDL levels are desirable.
      - HDL levels are increased by physical activity, moderate alcohol consumption, and estrogen administration.
      - Elevated LDL levels correlate most closely with an increased incidence of atherosclerosis and CAD.
    - Hypertension, defined as a BP greater than or equal to 140/90 mm Hg, is a

major risk factor in CAD.
        - Tobacco use is also a major risk factor in CAD. The risk of developing CAD is two to six times higher in those who smoke tobacco than in those who do not.
        - Obesity is defined as a body mass index (BMI) of less than 30 kg/m^2. The increased risk for CAD is proportional to the degree of obesity.
    - Diabetes, metabolic syndrome, and certain behavioral states (i.e., stress) have also been found to be contributing risk factors for CAD.

CORONARY ARTERY DISEASE

- Prevention and early treatment of CAD must involve a multifactorial approach and needs to be ongoing throughout the lifespan
- A complete lipid profile is recommended every 5 years beginning at age 20. Persons with a serum cholesterol level greater than 200 mg/dl are at high risk for CAD.
- Management of high-risk persons starts with controlling or changing the additive effects of modifiable risk factors.
    - A regular physical activity program should be implemented.
    - Therapeutic lifestyle changes to reduce the risk of CAD include lowering LDL cholesterol by adopting a diet that limits saturated fats and cholesterol and emphasizes complex carbohydrates (e.g., whole grains, fruit, vegetables).
    - Low-dose aspirin is recommended for people at risk for CAD. Aspirin therapy is not recommended for women with low risk for CAD before age 65. Common side effects of aspirin therapy include GI upset and bleeding. For people who are aspirin intolerant, clopidogrel (Plavix) can be considered.
- If levels remain elevated despite modifiable changes, drug therapy is considered.
    - Statin drugs work by inhibiting the synthesis of cholesterol in the liver. Liver enzymes must be regularly monitored.
    - Niacin, a water-soluble B vitamin, is highly effective in lowering LDL and triglyceride levels by interfering with their synthesis. Niacin also increases HDL levels better than many other lipid-lowering drugs.
    - Fibric acid derivatives work by accelerating the elimination of VLDLs and increasing the production of apoproteins A-I and A-II.
    - Bile-acid sequestrants increase conversion of cholesterol to bile acids and decrease hepatic cholesterol content. The primary effect is a decrease in total cholesterol and LDLs.
    - Certain drugs selectively inhibit the absorption of dietary and biliary cholesterol across the intestinal wall.
- The incidence of cardiac disease is greatly increased in the elderly and is the leading cause of death in older persons. Strategies to reduce CAD risk are effective in this age group but are often underprescribed.
- Aggressive treatment of hypertension and hyperlipidemia will stabilize plaques in the coronary arteries of older adults, and cessation of tobacco use helps decrease the risk for CAD at any age.

CHRONIC STABLE ANGINA

- **Chronic stable angina** refers to chest pain that occurs intermittently over a long period with the same pattern of onset, duration, and intensity of symptoms.
    - Angina is rarely sharp or stabbing, and it usually does not change with position or breathing. Many people with angina complain of indigestion or a burning sensation in the epigastric region.
    - Anginal pain usually lasts for only a few minutes (3 to 5 minutes) and commonly subsides when the precipitating factor is relieved. Pain at rest is unusual.
- The treatment of chronic stable angina is aimed at decreasing oxygen demand and/or increasing oxygen supply and reducing CAD risk factors.
    - In addition to antiplatelet and cholesterol-lowering drug therapy, the most common drugs used to manage chronic stable angina are nitrates.
        - Short-acting nitrates are first-line therapy for the treatment of angina. Nitrates produce their principal effects by dilating peripheral blood vessels, coronary arteries, and collateral vessels.
        - Long acting nitrates are also used to reduce the incidence of anginal attacks.
        - β-Adrenergic blockers are the preferred drugs for the management of chronic stable angina.
        - Calcium channel blockers are used if β-adrenergic blockers are contraindicated, are poorly tolerated, or do not control anginal symptoms. The primary effects of calcium channel blockers are (1) systemic vasodilation with decreased SVR, (2) decreased myocardial contractility, and (3) coronary vasodilation.
        - Certain high-risk patients (e.g., patients with diabetes) with chronic stable angina may benefit from the addition of an angiotensin-converting enzyme (ACE) inhibitor.
- Common diagnostic tests for a patient with a history of CAD or CAD include a chest x-ray, a 12-lead ECG, laboratory tests (e.g., lipid profile); nuclear imaging; exercise stress testing, and coronary angiography.

ACUTE CORONARY SYNDROME

- **Acute coronary syndrome** (ACS) develops when ischemia is prolonged and not immediately reversible. ACS encompasses the spectrum of unstable angina, non–ST-segment-elevation myocardial infarction (NSTEMI), and ST-segment-elevation myocardial infarction (STEMI).
- ACS is associated with deterioration of a once stable atherosclerotic plaque. This unstable lesion may be partially occluded by a thrombus (manifesting as UA or NSTEMI) or totally occluded by a thrombus (manifesting as STEMI).
- **Unstable angina** (UA) is chest pain that is new in onset, occurs at rest, or has a worsening pattern. UA is unpredictable and represents an emergency.
- **Myocardial infarction (MI)** occurs as a result of sustained ischemia, causing irreversible myocardial cell death. Eighty percent to 90% of all MIs are due to the development of a thrombus that halts perfusion to the myocardium distal to the occlusion. Contractile function of the heart stops in the infracted area(s).

  - Cardiac cells can withstand ischemic conditions for approximately 20 minutes. It takes approximately 4 to 6 hours for the entire thickness of the heart muscle to infarct.
  - Infarctions are described based on the location of damage (e.g., anterior, inferior, lateral, or posterior wall infarction).
  - Severe, immobilizing chest pain not relieved by rest, position change, or nitrate administration is the hallmark of an MI. The pain is usually described as a heaviness, pressure, tightness, burning, constriction, or crushing.
  - Complications after MI
    - The most common complication after an MI is dysrhythmias, and dysrhythmias are the most common cause of death in patients in the prehospital period.
    - HF is a complication that occurs when the pumping power of the heart has diminished.
    - Cardiogenic shock occurs when inadequate oxygen and nutrients are supplied to the tissues because of severe left ventricular failure. When it occurs, it has a high mortality rate.
    - Papillary muscle dysfunction may occur if the infarcted area includes or is adjacent to the papillary muscle that attaches to the mitral valve. Papillary muscle dysfunction causes mitral valve regurgitation and is detected by a systolic murmur at the cardiac apex radiating toward the axilla.
    - Papillary muscle rupture is a rare but life-threatening complication that causes massive mitral valve regurgitation, resulting in dyspnea, pulmonary edema, and decreased CO.
    - Ventricular aneurysm results when the infarcted myocardial wall becomes thinned and bulges out during contraction.
    - Pericarditis may occur 2 to 3 days after an acute MI as a common complication of the infarction.
- Primary diagnostic studies used to determine whether a person has UA or an MI include an ECG and serum cardiac markers.

Drug Therapy

- Initial management of the patient with chest pain includes aspirin, sublingual nitroglycerin, morphine sulfate for pain unrelieved by nitroglycerin, and oxygen.
- IV nitroglycerin, aspirin, β-adrenergic blockers, and systemic anticoagulation with either low molecular weight heparin given subcutaneously or IV unfractionated heparin (UH) are the initial drug treatments of choice for ACS.
- IV antiplatelet agents (e.g., glycoprotein IIb/IIIa inhibitor) may also be used if percutaneous coronary intervention (PCI) is anticipated.
- ACE inhibitors help prevent ventricular remodeling and prevent or slow the progression of HF. They are recommended following anterior wall MIs or MIs that result in decreased left ventricular function (ejection fraction [EF] less than 40%) or pulmonary congestion and should be continued indefinitely. For patients who cannot tolerate ACE inhibitors, angiotensin receptor blockers should be considered.

- Calcium channel blockers or long-acting nitrates can be added if the patient is already on adequate doses of β-adrenergic blockers or cannot tolerate β-adrenergic blockers, or has Prinzmetal's angina.
- Stool softeners are given to facilitate and promote the comfort of bowel evacuation. This prevents straining and the resultant vagal stimulation from the Valsalva maneuver. Vagal stimulation produces bradycardia and can provoke dysrhythmias.
- Initially, patients may be NPO (nothing by mouth) except for sips of water until stable (e.g., pain free, nausea resolved). Diet is advanced as tolerated to a low-salt, low-saturated-fat, and low-cholesterol diet.

Surgical Therapy

- **Coronary revascularization** with coronary artery bypass graft (CABG) surgery is recommended for patients who (1) fail medical management, (2) have left main coronary artery or three-vessel disease, (3) are not candidates for PCI (e.g., lesions are long or difficult to access), or (4) have failed PCI with ongoing chest pain.
- Minimally invasive direct coronary artery bypass (MIDCAB) surgery can be used for patients with single-vessel disease.
- The off-pump coronary artery bypass (OPCAB) procedure uses full or partial sternotomy to enable access to all coronary vessels. OPCAB is also performed on a beating heart using mechanical stabilizers and without cardiopulmonary bypass (CPB).
- Transmyocardial laser revascularization (TMR) is an indirect revascularization procedure used for patients with advanced CAD who are not candidates for traditional bypass surgery and who have persistent angina after maximum medical therapy.

Nursing Management: Chronic Stable Angina and Acute Coronary Syndrome

- The following nursing measures should be instituted for a patient experiencing angina: (1) administration of supplemental oxygen, (2) determination of vital signs, (3) 12-lead ECG, (4) prompt pain relief first with a nitrate followed by an opioid analgesic if needed, (5) auscultation of heart sounds, and (6) comfortable positioning of the patient.
- Initial treatment of a patient with ACS includes pain assessment and relief, physiologic monitoring, promotion of rest and comfort, alleviation of stress and anxiety, and understanding of the patient's emotional and behavioral reactions.
    - Nitroglycerin, morphine sulfate, and supplemental oxygen should be provided as needed to eliminate or reduce chest pain.
    - Continuous ECG monitoring is initiated and maintained throughout the hospitalization.
    - Frequent vital signs, intake and output (at least once a shift), and physical assessment should be done to detect deviations from the patient's baseline parameters. Included is an assessment of lung sounds and heart sounds and inspection for evidence of early HF (e.g., dyspnea, tachycardia, pulmonary congestion, distended neck veins).
- Bed rest may be ordered for the first few days after an MI involving a large portion of the ventricle. A patient with an uncomplicated MI (e.g., angina resolved, no signs of

complications) may rest in a chair within 8 to 12 hours after the event. The use of a commode or bedpan is based on patient preference.

- It is important to plan nursing and therapeutic actions to ensure adequate rest periods free from interruption. Comfort measures that can promote rest include frequent oral care, adequate warmth, a quiet atmosphere, use of relaxation therapy (e.g., guided imagery), and assurance that personnel are nearby and responsive to the patient's needs.
- Cardiac workload is gradually increased through more demanding physical tasks so that the patient can achieve a discharge activity level adequate for home care.
- Anxiety is present in all patients with ACS to various degrees. The nurse's role is to identify the source of anxiety and assist the patient in reducing it.
- The emotional and behavioral reactions of a patient are varied and frequently follow a predictable response pattern. The role of the nurse is to understand what the patient is currently experiencing, to assist the patient in testing reality, and to support the use of constructive coping styles. Denial may be a positive coping style in the early phase of recovery from ACS.
- The major nursing responsibilities for the care of the patient following PCI involves monitoring for signs of recurrent angina; frequent assessment of vital signs, including HR and rhythm; evaluation of the groin site for signs of bleeding; and maintenance of bed rest per institution policy.
- For patients having CABG surgery, care is provided in the intensive care unit for the first 24 to 36 hours, where ongoing monitoring of the patient's ECG and hemodynamic status is critical.
- Cardiac rehabilitation restores a person to an optimal state of function in six areas: physiologic, psychologic, mental, spiritual, economic, and vocational.
- Patient teaching begins with the ED nurse and progresses through the staff nurse to the community health nurse. Careful assessment of the patient's learning needs helps the nurse set goals and objectives that are realistic.
- Physical activity is necessary for optimal physiologic functioning and psychologic well-being. A regular schedule of physical activity, even after many years of sedentary living, is beneficial.
    - Activity level is gradually increased so that by the time of discharge the patient can tolerate moderate-energy activities of 3 to 6 METs.
    - Patients with UA that has resolved or an uncomplicated MI are in the hospital for approximately 3 to 4 days and by day 2 can ambulate in the hallway and begin limited stair climbing (e.g., three to four steps).
    - Because of the short hospital stay, it is critical to give the patient specific guidelines for physical activity so that overexertion will not occur. Patients should "listen to what the body is saying."
    - Patients should be taught to check their pulse rate and the parameters within which to exercise. The more important factor is the patient's response to physical activity in terms of symptoms rather than absolute HR, especially since many patients are on β-adrenergic blockers and may not be able to reach a target HR.
- Many patients will be referred to an outpatient or home-based cardiac rehabilitation

program. Maintaining contact with the patient appears to be the key to the success of these programs.

- One factor that has been linked to poor adherence to a physical activity program after MI is depression. Both men and women experience mild to moderate depression post-MI that should resolve in 1 to 4 months.
- Sexual counseling for cardiac patients and their partners should be provided. The patient's concern about resumption of sexual activity after hospitalization for ACS often produces more stress than the physiologic act itself.
    - Before the nurse provides guidelines on resumption of sexual activity, it is important to know the physiologic status of the patient, the physiologic effects of sexual activity, and the psychologic effects of having a heart attack. Sexual activity for middle-aged men and women with their usual partners is no more strenuous than climbing two flights of stairs.
    - The inability to perform sexually after MI is common and sexual dysfunction usually disappears after several attempts.
    - Patients should know that drugs used for erectile dysfunction should not be used with nitrates as severe hypotension and even death have been reported.
    - Typically, it is safe to resume sexual activity 7 to 10 days after an uncomplicated MI.

SUDDEN CARDIAC DEATH

- **Sudden cardiac death** (SCD) is unexpected death from cardiac causes.
- CAD is the most common cause of SCD and accounts for 80% of all SCDs.
- SCD involves an abrupt disruption in cardiac function, producing an abrupt loss of cardiac output and cerebral blood flow. Death usually occurs within 1 hour of the onset of acute symptoms (e.g., angina, palpitations).
- The majority of cases of SCD are caused by acute ventricular dysrhythmias (e.g., ventricular tachycardia, ventricular fibrillation).
- Persons who experience SCD as a result of CAD fall into two groups: (1) those who had an acute MI and (2) those who did not have an acute MI. The latter group accounts for the majority of cases of SCD. In this instance, victims usually have no warning signs or symptoms.
- Patients who survive are at risk for recurrent SCD due to the continued electrical instability of the myocardium that caused the initial event to occur.
- Risk factors for SCD include left ventricular dysfunction (EF less than 30%), ventricular dysrhythmias following MI, male gender (especially African American men), family history of premature atherosclerosis, tobacco use, diabetes mellitus, hypercholesterolemia, hypertension, and cardiomyopathy.
- Most SCD patients have a lethal ventricular dysrhythmia and require 24-hour Holter monitoring or other type of event recorder, exercise stress testing, signal-averaged ECG, and electrophysiologic study (EPS).
- The most common approach to preventing a recurrence and improving survival is the use of an implantable cardioverter-defibrillator (ICD).
- Drug therapy may be used in conjunction with an ICD to decrease episodes of ventricular dysrhythmias.

- Survivors of SCD develop a “time bomb” mentality, fearing the recurrence of cardiopulmonary arrest. They and their families may become anxious, angry, and depressed.
- Patients and families also may need to deal with additional issues such as possible driving restrictions and change in occupation. The grief response varies among SCD survivors and their families.

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Key Points

Chapter 35: Nursing Management: Heart Failure

ETIOLOGY AND PATHOPHYSIOLOGY

- **Heart failure** (HF) is an abnormal clinical condition involving impaired cardiac pumping that results in the characteristic pathophysiologic changes of vasoconstriction and fluid retention.

- HF is characterized by ventricular dysfunction, reduced exercise tolerance, diminished quality of life, and shortened life expectancy.

- Risk factors include coronary artery disease (CAD) and advancing age. Hypertension, diabetes, cigarette smoking, obesity, and high serum cholesterol also contribute to the development of HF.

CLASSIFICATION

- Heart failure is classified as systolic or diastolic failure.
  - **Systolic failure,** the most common cause of HF, results from an inability of the heart to pump blood.
  - **Diastolic failure** is an impaired ability of the ventricles to relax and fill during diastole. Decreased filling of the ventricles will result in decreased stroke volume and cardiac output (CO).

CLINICAL MANIFESTATIONS

- HF can have an abrupt onset or it can be an insidious process resulting from slow, progressive changes. Compensatory mechanisms are activated to maintain adequate CO.

- To maintain balance in HF, several counter regulatory processes are activated, including the production of hormones from the heart muscle to promote vasodilation.

- *Cardiac compensation* occurs when compensatory mechanisms succeed in maintaining an adequate CO that is needed for tissue perfusion.

- *Cardiac decompensation* occurs when these mechanisms can no longer maintain adequate CO and inadequate tissue perfusion results.

- The most common form of HF is left-sided failure from left ventricular dysfunction. Blood backs up into the left atrium and into the pulmonary veins causing pulmonary congestion and edema. HF is usually manifested by biventricular failure.

- Acute decompensated heart failure (ADHF) typically manifests as **pulmonary edema,** an acute, life-threatening situation.

- Clinical manifestations of chronic HF depend on the patient's age and the underlying type and extent of heart disease. Common symptoms include fatigue, dyspnea, tachycardia,

edema, and unusual behavior.

- Pleural effusion, atrial fibrillation, thrombus formation, renal insufficiency, and hepatomegaly are all complications of HF.

DIAGNOSTIC STUDIES

- The primary goal in diagnosis of HF is to determine the underlying etiology of HF.
    - A thorough history, physical examination, chest x-ray, electrocardiogram (ECG), laboratory data (cardiac enzymes, b-type natriuretic protein (BNP), serum chemistries, liver function studies, thyroid function studies, and complete blood count), hemodynamic assessment, echocardiogram, stress testing, and cardiac catheterization are performed.

NURSING AND COLLABORATIVE MANAGEMENT: ADHF AND PULMONARY EDEMA

- The goals of therapy for both ADHF and chronic HF are to decrease patient symptoms, reverse ventricular remodeling, improve quality of life, and decrease mortality and morbidity.

- Treatment strategies should include the following:
    - Decreasing intravascular volume with the use of diuretics to reduce venous return and preload.
    - Decreasing venous return (preload) to reduce the amount of volume returned to the LV during diastole.
    - Decreasing afterload (the resistance against which the LV must pump) improves CO and decreases pulmonary congestion.
    - Gas exchange is improved by the administration of IV morphine sulfate and supplemental oxygen.
    - Inotropic therapy and hemodynamic monitoring may be needed in patients who do not respond to conventional pharmacotherapy (e.g., diuretics, vasodilators, morphine sulfate).
    - Reduction of anxiety is an important nursing function, since anxiety may increase the SNS response and further increase myocardial workload.

COLLABORATIVE CARE: CHRONIC HEART FAILURE

- The main goal in the treatment of chronic HF is to treat the underlying cause and contributing factors, maximize CO, provide treatment to alleviate symptoms, improve ventricular function, improve quality of life, preserve target organ function, and improve mortality and morbidity.

- Administration of oxygen improves saturation and assists greatly in meeting tissue oxygen needs and helps relieve dyspnea and fatigue.

- Physical and emotional rest allows the patient to conserve energy and decreases the need for additional oxygen. The degree of rest recommended depends on the severity of HF.

- Nonpharmacologic therapies used in the management of HF patients who are receiving maximum medical therapy, continue to have NYHA Functional Class III or IV symptoms, and have a widened QRS interval include the following:
    - Cardiac resynchronization therapy (CRT) or biventricular pacing. Involves pacing both the right and left ventricles to achieve coordination of right and left ventricle contractility.
    - Cardiac transplantation. Strict criteria are used to select the few patients with advanced HF who can even hope to receive a transplanted heart.
    - Intraaortic balloon pump (IABP) therapy. The IABP can be useful in the hemodynamically unstable HF patient because it decreases SVR, PAWP, and PAP as much as 25%, leading to improved CO. However, the limitations of bed rest, infection, and vascular complications preclude long-term use.
    - Ventricular assist devices (VADs). VADs provide highly effective long-term support for up to 2 years and have become standard care in many heart transplant centers. VADs are used as a bridge to transplantation.
    - Destination therapy. The use of a permanent, implantable VAD, known as destination therapy, is an option for patients with advanced NYHA Functional Class IV HF who are not candidates for heart transplantation.

- General therapeutic objectives for drug management of chronic HF include: (1) identification of the type of HF and underlying causes, (2) correction of sodium and water retention and volume overload, (3) reduction of cardiac workload, (4) improvement of myocardial contractility, and (5) control of precipitating and complicating factors.
    - Diuretics are used in HF to mobilize edematous fluid, reduce pulmonary venous pressure, and reduce preload.
        - Thiazide diuretics may be the first choice in chronic HF because of their convenience, safety, low cost, and effectiveness. They are particularly useful in treating edema secondary to HF and in controlling hypertension.
        - Loop diuretics are potent diuretics. These drugs act on the ascending loop of Henle to promote sodium, chloride, and water excretion. Problems in using loop diuretics include reduction in serum potassium levels, ototoxicity, and possible allergic reaction in the patient who is sensitive to sulfa-type drugs.
        - Spironolactone (Aldactone) is an inexpensive, potassium-sparing diuretic that promotes sodium and water excretion but blocks potassium excretion. This aldosterone receptor antagonist also blocks the harmful neurohormonal effects of aldosterone on the heart blood vessels.
            - Spironolactone adds to the benefits of angiotensin-converting enzyme (ACE) inhibitors, and is appropriate to use while renal function is adequate.
            - Spironolactone may also be used in conjunction with other diuretics, such as furosemide.
        - Vasodilator drugs have been shown to improve survival in HF. The goals of vasodilator therapy in the treatment of HF include (1) increasing venous

capacity, (2) improving EF through improved ventricular contraction, (3) slowing the process of ventricular dysfunction, (4) decreasing heart size, (5) avoiding stimulation of the neurohormonal responses initiated by the compensatory mechanisms of HF, and (6) enhancing neurohormonal blockade.

- ACE inhibitors (e.g., captopril [Capoten], benazepril [Lotensin], enalapril [Vasotec]) are useful in both systolic and diastolic HF, and they are the first-line therapy in the treatment of chronic HF.
- Angiotensin II receptor blockers (e.g., losartan [Cozaar], valsartan [Diovan]) may be used in patients who are ACE inhibitor intolerant.
- Nitrates are used to treat HF by acting directly on the smooth muscle of the vessel wall. Major effects include a decrease in preload and vasodilation of coronary arteries.
- Nesiritide, a synthetic form of human BNP, being studied for its use in the ongoing treatment of patients with chronic HF.
- β-Adrenegic blockers, specifically carvedilol (Coreg) and metoprolol (Toprol-XL), have improved survival of patients with HF.

▪ Positive inotropic agents improve cardiac contractility and CO, decrease LV diastolic pressure, and decrease SVR.

- Digitalis glycosides [e.g., digoxin (Lanoxin)] remain the mainstay in the treatment of HF, however, they have not been shown to prolong life.
- Calcium sensitizers are novel positive inotropic agents in the treatment of HF. They improve cardiac performance by interacting directly with contractile proteins without affecting intracellular calcium concentrations or increasing myocardial oxygen demand.
- BiDil, a combination drug containing isosorbide dinitrate and hydralazine, approved only for the treatment of HF in African Americans who are already being treated with standard therapy.

o Diet education and weight management are critical to the patient's control of chronic HF.

▪ Diet and weight management recommendations must be individualized and culturally sensitive if the necessary changes are to be realized.
▪ A detailed diet history should be obtained and should include the sociocultural value of food to the patient.
▪ The Dietary Approaches to Stop Hypertension (DASH) diet is effective as a first-line therapy for many individuals with hypertension, and this diet is widely used for the patient with HF.
▪ The edema of chronic HF is often treated by dietary restriction of sodium.
▪ Fluid restrictions are not commonly prescribed for the patient with mild to moderate HF. However, in moderate to severe HF and renal insufficiency, fluid restrictions are usually implemented.
▪ Patients should weigh themselves daily to monitor fluid retention, as well

as weight reduction. If a patient experiences a weight gain of 3 lb (1.4 kg) over 2 days or a 3- to 5-lb (2.3 kg) gain over a week, the primary care provider should be called.

NURSING MANAGEMENT: CHRONIC HEART FAILURE

- The overall goals for the patient with HF include (1) a decrease in symptoms (e.g., shortness of breath, fatigue), (2) a decrease in peripheral edema, (3) an increase in exercise tolerance, (4) compliance with the medical regimen, and (5) no complications related to HF.

- Treatment or control of underlying heart disease is key to preventing HF and episodes of ADHF.
    - For example, valve replacement should be planned before lung congestion develops, and early and continued treatment of CAD and hypertension is critical.
    - The use of antidysrhythmic agents or pacemakers is indicated for people with serious dysrhythmias or conduction disturbances.

- Patients with HF should be counseled to obtain vaccinations against the flu and pneumonia.

- Preventive care should focus on slowing the progression of the disease.
    - Patient teaching must include information on medications, diet, and exercise regimens. Exercise training (e.g., cardiac rehabilitation) does improve symptoms of chronic HF but is often underprescribed.
    - Home nursing care for follow-up care and to monitor the patient's response to treatment may be required.

- Successful HF management is dependent on the following principles: (1) HF is a progressive disease, and treatment plans are established with quality-of-life goals; (2) symptom management is controlled by the patient with self-management tools (e.g., daily weights, drug regimens, diet and exercise plans); (3) salt and water must be restricted; (4) energy must be conserved; and (5) support systems are essential to the success of the entire treatment plan.

- Important nursing responsibilities in the care of a patient with HF include (1) teaching the patient about the physiologic changes that have occurred, (2) assisting the patient to adapt to both the physiologic and psychologic changes, and (3) integrating the patient and the patient's family or support system in the overall care plan.
    - Many patients with HF are at high risk for anxiety and depression, and major depression is more prevalent in female patients and patients less than 60 years of age.
    - Patients with HF can live productive lives with chronic HF.
    - Effective home health care can prevent or limit future hospitalization. Managing HF patients out of the hospital is a priority of care.
    - Patients with HF will take medication for the rest of their lives. This can become

difficult because a patient may be asymptomatic when HF is under control.
    - Patients should be taught to evaluate the action of the prescribed drugs and to recognize the manifestations of drug toxicity.
        - Patients should be taught how to take their pulse rate and to know under what circumstances drugs, especially digitalis and β-adrenergic blockers, should be withheld and a health care provider consulted.
        - It may be appropriate to instruct patients in home BP monitoring, especially for those HF patients with hypertension.
        - Patients should be taught the symptoms of hypo- and hyperkalemia if diuretics that deplete or spare potassium are being taken. Frequently the patient who is taking thiazide or loop diuretics is given supplemental potassium.
    - The nurse, physical therapist, or occupational therapist should instruct the patient in energy-conserving and energy-efficient behaviors after an evaluation of daily activities has been done.
        - Patients may need a prescription for rest after an activity. Many hard-driving persons need the "permission" to not feel "lazy."
        - Sometimes an activity that the patient enjoys may need to be eliminated. In such situations the patient should be helped to explore alternative activities that cause less physical and cardiac stress.
        - The physical environment may require modification in situations in which there is an increased cardiac workload demand (e.g., frequent climbing of stairs). The nurse can help the patient identify areas where outside assistance can be obtained.
    - Home health nursing is an essential component in the care of the HF patient and family.
        - Home health nurses conduct frequent physical assessments, including vital signs and weight.
        - Protocols enable the nurse and patient to identify problems, such as evidence of worsening HF, and institute interventions to prevent hospitalization. This may include altering medications and initiating fluid restrictions.

CARDIAC TRANSPLANTATION

- **Cardiac transplantation** has become the treatment of choice for patients with refractory end-stage HF, cardiomyopathy, and inoperable CAD.

- Once a patient meets the criteria for cardiac transplantation, the goal of the evaluation process is to identify patients who would most benefit from a new heart.
    - After a complete physical examination and diagnostic workup, the patient and family then undergo a comprehensive psychologic profile.
    - The complexity of the transplant process may be overwhelming to a patient with inadequate support systems and a poor understanding of the lifestyle changes required after transplant.

- Once a patient is accepted as a transplant candidate (this may happen rapidly during an acute illness or over a longer period), he or she is placed on a transplant list.
    - Stable patients wait at home and receive ongoing medical care.
    - Unstable patients may require hospitalization for more intensive therapy.
    - The overall waiting period for a transplant is long, and many patients die while waiting for a transplant.

- Most donor hearts are obtained at sites distant from the institution performing the transplant. The maximum acceptable time from harvesting the donor heart to transplantation is 4 to 6 hours.

- The heart recipient is prepared for surgery, and cardiopulmonary bypass is used.
    - The surgical procedure involves removing the recipient's heart, except for the posterior right and left atrial walls and their venous connections.
    - The recipient's heart is then replaced with the donor heart. Care is taken to preserve the integrity of the donor sinoatrial (SA) node so that a sinus rhythm may be achieved postoperatively.
    - Immunosuppressive therapy usually begins in the operating room.

- Endomyocardial biopsies are typically obtained from the right ventricle (via the right internal jugular vein) on a weekly basis for the first month, monthly for the following 6 months, and yearly thereafter to detect rejection.
    - The Heartsbreath test is used along with endomyocardial biopsy to assess organ rejection in heart transplant patients.
        - The test works by measuring the amount of methylated alkanes (natural chemicals found in the breath and air) in a patient's breath. The value is compared with the results of a biopsy performed during the previous month to measure the probability of the transplanted heart being rejected.
        - The Heartsbreath test is used in the first year following heart transplantation and along with the results of a heart biopsy to help guide short-term and long-term medical care of heart transplant patients.
        - The test helps to separate less severe organ rejection (grades 0, 1, and 2) from more severe rejection (grade 3).
    - Peripheral blood T lymphocyte monitoring is also done to assess the recipient's immune status.

- Nursing management throughout the posttransplant period focuses on promoting patient adaptation to the transplant process, monitoring cardiac function, managing lifestyle changes, and providing ongoing teaching of the patient and family.

- Several devices are available as a bridge to transplantation
    - The AB5000™ Circulatory Support System and the BVS® 5000 Biventricular Support System provide temporary support for one or both sides of the heart in circumstances in which the heart has failed but has the potential to recover (e.g., reversible HF, myocarditis, and acute MI).

- The Thoratec Ventricular Assist Device (VAD) system can support one or both ventricles, and it has been approved as a bridging device for transplantation and for recovery of the heart after cardiac surgery.

ARTIFICIAL HEART

- The lack of available transplant hearts and the increasing number of patients in need have triggered the movement to develop artificial hearts.
  - Two implantable artificial hearts, the CardioWest Total Artificial Heart and the AbioCor Implantable Replacement Heart, have been developed.
  - Both are designed with materials that minimize coagulation and contain motor-driven pumping systems (artificial ventricles) that operate on both internal and external batteries.
    - An electronic package in the abdomen monitors the system, including adjusting the heart rate based on the patient's activity.
    - An external battery pack allows for periods of independence from the console.
    - The total artificial heart requires no immunosuppression and may hold promise for short-term survival in patients with end-stage HF.

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Key Points

Chapter 36: Nursing Management: Dysrhythmias

- The ability to recognize normal and abnormal cardiac rhythms, called **dysrhythmias,** is an essential skill for the nurse.

- Four properties of cardiac cells (automaticity, excitability, conductivity, and contractility) enable the conduction system to initiate an electrical impulse, transmit it through the cardiac tissue, and stimulate the myocardial tissue to contract.
  - A normal cardiac impulse begins in the sinoatrial (SA) node in the upper right atrium.
  - The signal is transmitted over the atrial myocardium via Bachmann's bundle and internodal pathways, causing atrial contraction.
  - The impulse then travels to the atrioventricular (AV) node through the bundle of His and down the left and right bundle branches, ending in the Purkinje fibers, which transmit the impulse to the ventricles, resulting in ventricular contraction.

- The autonomic nervous system plays an important role in the rate of impulse formation, the speed of conduction, and the strength of cardiac contraction.
    - Components of the autonomic nervous system that affect the heart are the right and left vagus nerve fibers of the parasympathetic nervous system and fibers of the sympathetic nervous system.

ECG MONITORING

- The **electrocardiogram** (ECG) is a graphic tracing of the electrical impulses produced in the heart.

- ECG waveforms are produced by the movement of charged ions across the semipermeable membranes of myocardial cells.

- There are 12 recording leads in the standard ECG.
    - Six of the 12 ECG leads measure electrical forces in the frontal plane (leads I, II, III, aV_R, aV_L, and aV_F).
    - The remaining six leads (V_1 through V_6) measure the electrical forces in the horizontal plane (precordial leads).
    - The 12-lead ECG may show changes that are indicative of structural changes, damage such as ischemia or infarction, electrolyte imbalance, dysrhythmias, or drug toxicity.

- Continuous ECG monitoring is done using leads II, V_1, and MCL_1.
    - MCL_1 is a modified chest lead that is similar to V_1 and is used when only three leads are available for monitoring.
    - Monitoring leads should be selected based on the patient's clinical situation.

- The ECG can be visualized continuously on a monitor oscilloscope, and a recording of the ECG (i.e., rhythm strip) can be obtained on ECG paper attached to the monitor.

- ECG leads are attached to the patient's chest wall via an electrode pad fixed with electrical conductive paste.

- **Telemetry monitoring** involves the observation of a patient's HR and rhythm to rapidly diagnose dysrhythmias, ischemia, or infarction.

- Normal sinus rhythm refers to a rhythm that originates in the SA node and follows the normal conduction pattern of the cardiac cycle.
    - The P wave represents the depolarization of the atria (passage of an electrical impulse through the atria), causing atrial contraction.
    - The PR interval represents the time period for the impulse to spread through the atria, AV node, bundle of His, and Purkinje fibers.
    - The QRS complex represents depolarization of the ventricles (ventricular contraction), and the QRS interval represents the time it takes for depolarization.
    - The ST segment represents the time between ventricular depolarization and

repolarization. This segment should be flat or isoelectric and represents the absence of any electrical activity between these two events.
  - The T wave represents repolarization of the ventricles.
  - The QT interval represents the total time for depolarization and repolarization of the ventricles.

MECHANISMS OF DYSRHYTHMIAS

- Normally the main pacemaker of the heart is the SA node, which spontaneously discharges 60 to 100 times per minute. Disorders of impulse formation can cause dysrhythmias.

- A pacemaker from another site can lead to dysrhythmias and may be discharged in a number of ways.
  - Secondary pacemakers may originate from the AV node or His-Purkinje system.
  - Secondary pacemakers can originate when they discharge more rapidly than the normal pacemaker of the SA node.
  - Triggered beats (early or late) may come from an ectopic focus (area outside the normal conduction pathway) in the atria, AV node, or ventricles.

EVALUATION OF DYSRHYTHMIAS

- Dysrhythmias result from various abnormalities and disease states, and the cause of a dysrhythmia influences the treatment.

- Several diagnostic tests are used to evaluate cardiac dysrhythmias and the effectiveness of antidysrhythmia drug therapy.
  - Holter monitoring records the ECG while the patient is ambulatory and performing daily activities.
  - Event monitors have improved the evaluation of outpatient dysrhythmias.
  - Signal-averaged ECG (SAECG) is a high-resolution ECG used to identify the patient at risk for developing complex ventricular dysrhythmias.
  - Exercise treadmill testing is used for evaluation of cardiac rhythm response to exercise.
  - An electrophysiologic study (EPS) identifies different mechanisms of tachydysrhythmias, heart blocks, bradydysrhythmias, and causes of syncope.

TYPES OF DYSRHYTHMIAS

- ***Sinus bradycardia*** has a normal sinus rhythm, but the SA node fires at a rate less than 60 beats/minute and is referred to as absolute bradycardia.
  - Clinical associations. Sinus bradycardia may be a normal sinus rhythm (e.g., in aerobically trained athletes), and it may occur in response to carotid sinus massage, Valsalva maneuver, hypothermia, and administration of parasympathomimetic drugs.
  - Disease states associated with sinus bradycardia are hypothyroidism, increased intracranial pressure, obstructive jaundice, and inferior wall myocardial infarction (MI).

  - Treatment consists of administration of atropine (an anticholinergic drug) for the patient with symptoms. Pacemaker therapy may be required.

- ***Sinus tachycardia*** has a normal sinus rhythm, but the SA node fires at a rate greater than 100 beats/minute as a result of vagal inhibition or sympathetic stimulation.
  - Clinical associations. Sinus tachycardia is associated with physiologic and psychologic stressors such as exercise, fever, pain, hypotension, hypovolemia, anemia, hypoxia, hypoglycemia, myocardial ischemia, heart failure (HF), hyperthyroidism, anxiety, and fear. It can also be an effect of certain drugs.
  - Angina may result from sinus tachycardia due to the increased myocardial oxygen consumption that is associated with an increased HR.
  - Treatment is based on the underlying cause. For example, if a patient is experiencing tachycardia from pain, tachycardia should resolve with effective pain management.

- ***Premature atrial contraction*** (PAC) is a contraction originating from an ectopic focus in the atrium in a location other than the sinus node. A PAC may be stopped (nonconducted PAC), delayed (lengthened PR interval), or conducted normally through the AV node.
  - Clinical associations. PACs can result from emotional stress or physical fatigue; from the use of caffeine, tobacco, or alcohol; from hypoxia or electrolyte imbalances; and from disease states such as hyperthyroidism, chronic obstructive pulmonary disease (COPD), and heart disease including coronary artery disease (CAD) and valvular disease.
  - In healthy persons, isolated PACs are not significant. In persons with heart disease, frequent PACs may indicate enhanced **automaticity** of the atria or a reentry mechanism and may warn of or initiate more serious dysrhythmias.
  - Treatment depends on the patient's symptoms. For example, withdrawal of sources of stimulation such as caffeine or sympathomimetic drugs may be warranted.

- ***Paroxysmal supraventricular tachycardia*** (PSVT) is a dysrhythmia originating in an ectopic focus anywhere above the bifurcation of the bundle of His.
  - PSVT occurs because of a reentrant phenomenon (reexcitation of the atria when there is a one-way block) and is usually triggered by a PAC.
  - In the normal heart, PSVT is associated with overexertion, emotional stress, deep inspiration, and stimulants such as caffeine and tobacco. It is also associated with rheumatic heart disease, digitalis toxicity, CAD, and cor pulmonale.
  - Prolonged PSVT with HR greater than 180 beats/minute may precipitate a decreased CO, resulting in hypotension, dyspnea, and angina.
  - Treatment for PSVT includes vagal stimulation and drug therapy (i.e., IV adenosine).

- ***Atrial flutter*** is an atrial tachydysrhythmia identified by recurring, regular, sawtooth-shaped flutter waves that originate from a single ectopic focus in the right atrium.
  - Atrial flutter is associated with CAD, hypertension, mitral valve disorders,

pulmonary embolus, chronic lung disease, cor pulmonale, cardiomyopathy, hyperthyroidism, and the use of drugs such as digoxin, quinidine, and epinephrine.
    - High ventricular rates (over 100/minute) and the loss of the atrial "kick" (atrial contraction reflected by a sinus P wave) can decrease CO and cause serious consequences such as chest pain and HF.
    - Patients with atrial flutter are at increased risk of stroke because of the risk of thrombus formation in the atria from the stasis of blood.
    - The primary goal in treatment of atrial flutter is to slow the ventricular response by increasing AV block.

- ***Atrial fibrillation*** is characterized by a total disorganization of atrial electrical activity due to multiple ectopic foci resulting in loss of effective atrial contraction.
    - Atrial fibrillation usually occurs in the patient with underlying heart disease, such as CAD, rheumatic heart disease, cardiomyopathy, hypertensive heart disease, HF, and pericarditis. It can be caused by thyrotoxicosis, alcohol intoxication, caffeine use, electrolyte disturbances, stress, and cardiac surgery.
    - Atrial fibrillation can often result in a decrease in CO, and thrombi may form in the atria as a result of blood stasis. An embolized clot may develop and pass to the brain, causing a stroke.
    - The goals of treatment include a decrease in ventricular response and prevention of cerebral embolic events.

- ***Junctional dysrhythmias*** refer to dysrhythmias that originate in the area of the AV node, primarily because the SA node has failed to fire or the signal has been blocked. In this situation, the AV node becomes the pacemaker of the heart.
    - Junctional premature beats are treated in a manner similar to that for PACs.
    - Other junctional dysrhythmias include junctional escape rhythm, accelerated junctional rhythm, and junctional tachycardia. These dysrhythmias are treated according to the patient's tolerance of the rhythm and the patient's clinical condition.
    - Junctional dysrhythmias are often associated with CAD, HF, cardiomyopathy, electrolyte imbalances, inferior MI, and rheumatic heart disease. Certain drugs (e.g., digoxin, amphetamines, caffeine, nicotine) can also cause junctional dysrhythmias.
    - Treatment varies according to the type of junctional dysrhythmia.

- ***First-degree AV block*** is a type of AV block in which every impulse is conducted to the ventricles but the duration of AV conduction is prolonged.
    - First-degree AV block is associated with MI, CAD, rheumatic fever, hyperthyroidism, vagal stimulation, and drugs such as digoxin, β-adrenergic blockers, calcium channel blockers, and flecainide.
    - First-degree AV block is usually not serious but can be a precursor of higher degrees of AV block. Patients with first-degree AV block are asymptomatic.
    - There is no treatment for first-degree AV block. Patients should continue to be

monitored for any new changes in heart rhythm.

- ***Second-degree AV block***, Type I (Mobitz I or Wenckebach heart block) is a gradual lengthening of the PR interval. It occurs because of a prolonged AV conduction time until an atrial impulse is nonconducted and a QRS complex is blocked (missing).
  - Type I AV block may result from use of drugs such as digoxin or β-adrenergic blockers. It may also be associated with CAD and other diseases that can slow AV conduction.
  - Type I AV block is usually a result of myocardial ischemia or infarction. It is almost always transient and is usually well tolerated. However, it may be a warning signal of a more serious AV conduction disturbance.
  - If the patient is symptomatic, atropine is used to increase HR, or a temporary pacemaker may be needed.

- ***Second-degree AV block***, Type II (Mobitz II heart block), involves a P wave that is nonconducted without progressive antecedent PR lengthening. This almost always occurs when a block in one of the bundle branches is present.
  - Type II second-degree AV block is a more serious type of block in which a certain number of impulses from the SA node are not conducted to the ventricles.
  - Type II AV block is associated with rheumatic heart disease, CAD, anterior MI, and digitalis toxicity.
  - Type II AV block often progresses to third-degree AV block and is associated with a poor prognosis. The reduced HR often results in decreased CO with subsequent hypotension and myocardial ischemia.
  - Temporary treatment before the insertion of a permanent pacemaker may be necessary if the patient becomes symptomatic (e.g., hypotension, angina) and involves the use of a temporary transvenous or transcutaneous pacemaker.

- ***Third-degree AV block,*** or complete heart block, constitutes one form of AV dissociation in which no impulses from the atria are conducted to the ventricles.
  - Third-degree AV block is associated with severe heart disease, including CAD, MI, myocarditis, cardiomyopathy, and some systemic diseases such as amyloidosis and progressive systemic sclerosis (scleroderma).
  - Third-degree AV block almost always results in reduced CO with subsequent ischemia, HF, and shock. Syncope from third-degree AV block may result from severe bradycardia or even periods of asystole.
  - Treatment. For symptomatic patients, a transcutaneous pacemaker is used until a temporary transvenous pacemaker can be inserted.

- ***Premature ventricular contraction*** (PVC) is a contraction originating in an ectopic focus in the ventricles. It is the premature occurrence of a QRS complex, which is wide and distorted in shape compared with a QRS complex initiated from the normal conduction pathway.
  - PVCs are associated with stimulants such as caffeine, alcohol, nicotine, aminophylline, epinephrine, isoproterenol, and digoxin. They are also associated

with electrolyte imbalances, hypoxia, fever, exercise, and emotional stress. Disease states associated with PVCs include MI, mitral valve prolapse, HF, and CAD.
    - PVCs are usually a benign finding in the patient with a normal heart. In heart disease, depending on frequency, PVCs may reduce the CO and precipitate angina and HF.
    - Treatment is often based on the cause of the PVCs (e.g., oxygen therapy for hypoxia, electrolyte replacement). Drugs that can be considered include β-adrenergic blockers, procainamide, amiodarone, or lidocaine (Xylocaine).

- ***Ventricular tachycardia*** (VT) is a run of three or more PVCs. It occurs when an ectopic focus or foci fire repetitively and the ventricle takes control as the pacemaker.
    - VT is a life-threatening dysrhythmia because of decreased CO and the possibility of deterioration to ventricular fibrillation, which is a lethal dysrhythmia.
    - VT is associated with MI, CAD, significant electrolyte imbalances, cardiomyopathy, mitral valve prolapse, long QT syndrome, digitalis toxicity, and central nervous system disorders.
    - VT can be stable (patient has a pulse) or unstable (patient is pulseless).
    - Treatment. Precipitating causes must be identified and treated (e.g., electrolyte imbalances, ischemia).

- ***Ventricular fibrillation*** (VF) is a severe derangement of the heart rhythm characterized on ECG by irregular undulations of varying shapes and amplitude. Mechanically the ventricle is simply "quivering," and no effective contraction, and consequently no CO, occurs.
    - VF occurs in acute MI and myocardial ischemia and in chronic diseases such as CAD and cardiomyopathy.
    - VF results in an unresponsive, pulseless, and apneic state. If not rapidly treated, the patient will die.
    - Treatment consists of immediate initiation of CPR and advanced cardiac life support (ACLS) measures with the use of defibrillation and definitive drug therapy.

- ***Asystole*** represents the total absence of ventricular electrical activity. No ventricular contraction occurs because depolarization does not occur.
    - Asystole is usually a result of advanced cardiac disease, a severe cardiac conduction system disturbance, or end-stage HF.
    - Patients are unresponsive, pulseless, and apneic.
    - Asystole is a lethal dysrhythmia that requires immediate treatment consisting of CPR with initiation of ACLS measures (e.g., intubation, transcutaneous pacing, and IV therapy with epinephrine and atropine).
- ***Pulseless electrical activity*** (PEA) describes a situation in which electrical activity can be observed on the ECG, but there is no mechanical activity of the ventricles and the patient has no pulse.
    - Prognosis is poor unless the underlying cause can be identified and quickly

corrected.
    - Treatment begins with CPR followed by intubation and IV therapy with epinephrine.

SUDDEN CARDIAC DEATH

- **Sudden cardiac death** (SCD) refers to death from a cardiac cause.
- The majority of SCDs result from ventricular dysrhythmias, specifically ventricular tachycardia or fibrillation.

PRODYSRHYTHMIA

- Antidysrhythmia drugs may cause life-threatening dysrhythmias similar to those for which they are administered. This concept is termed prodysrhythmia.
    - The patient who has severe left ventricular dysfunction is the most susceptible to prodysrhythmias.
    - Digoxin and some antidysrhythmia drugs can cause a prodysrhythmic response.

DEFIBRILLATION

- Defibrillation is the most effective method of terminating VF and pulseless VT.

- Defibrillation is accomplished by the passage of a DC electrical shock through the heart to depolarize the cells of the myocardium. The intent is that subsequent repolarization of myocardial cells will allow the SA node to resume the role of pacemaker.

- Rapid defibrillation can be performed using a manual or automatic device.
    - Manual defibrillators require health care providers to interpret cardiac rhythms, determine the need for a shock, and deliver a shock.
    - **Automatic external defibrillators** (AEDs) are defibrillators that have rhythm detection capability and the ability to advise the operator to deliver a shock using hands-free defibrillator pads.

SYNCHRONIZED CARDIOVERSION

- Synchronized cardioversion is the therapy of choice for the patient with hemodynamically unstable ventricular or supraventricular tachydysrhythmias.
    - A synchronized circuit in the defibrillator is used to deliver a countershock that is programmed to occur on the R wave of the QRS complex of the ECG.
    - The synchronizer switch must be turned on when cardioversion is planned.

- The procedure for synchronized cardioversion is the same as for defibrillation, with some exceptions.

IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR (ICD)

- The ICD is used for patients who (1) have survived SCD, (2) have spontaneous sustained VT, (3) have syncope with inducible ventricular tachycardia/fibrillation during EPS, and (4) are at high risk for future life-threatening dysrhythmias (e.g., have cardiomyopathy).

- The ICD consists of a lead system placed via a subclavian vein to the endocardium.

- A battery-powered pulse generator is implanted subcutaneously, usually over the pectoral muscle on the patient's nondominant side.
    - The ICD sensing system monitors the HR and rhythm and identifies VT or VF.
        - Approximately 25 seconds after the sensing system detects a lethal dysrhythmia, the defibrillating mechanism delivers a shock to the patient's heart.
        - If the first shock is unsuccessful, the generator recycles and can continue to deliver shocks.

- In addition to defibrillation capabilities, ICDs are equipped with antitachycardia and antibradycardia pacemakers.
- Education of the patient who is receiving an ICD is of extreme importance.

PACEMAKERS

- The artificial **cardiac pacemaker** is an electronic device used to pace the heart when the normal conduction pathway is damaged or diseased.

- Pacemakers were initially indicated for symptomatic bradydysrhythmias. They now provide antitachycardia and overdrive pacing.

- A permanent pacemaker is one that is implanted totally within the body.

- A specialized type of cardiac pacing has been developed for the management of HF.
    - Cardiac resynchronization therapy (CRT) is a pacing technique that resynchronizes the cardiac cycle by pacing both ventricles, thus promoting improvement in ventricular function.
    - Several devices are available that have combined CRT with an ICD for maximum therapy.

- A temporary pacemaker is one that has the power source outside the body. There are three types of temporary pacemakers: transvenous, epicardial, and transcutaneous pacemakers.

- Patients with temporary or permanent pacemakers will be ECG monitored to evaluate the status of the pacemaker.

- Complications of invasive temporary (i.e., transvenous) or permanent pacemaker insertion include infection and hematoma formation at the site of insertion of the pacemaker power source or leads, pneumothorax, failure to sense or capture with possible symptomatic bradycardia, perforation of the atrial or ventricular septum by the pacing lead, and appearance of "end-of-life" battery parameters on testing the pacemaker.

RADIOFREQUENCY CATHETER ABLATION THERAPY

- Radiofrequency catheter ablation therapy is a relatively new development in the area of antidysrhythmia therapy. Ablation therapy is done after EPS has identified the source of the dysrhythmia.

- An electrode-tipped ablation catheter is used to "burn" or ablate accessory pathways or ectopic sites in the atria, AV node, and ventricles.

- Catheter ablation is considered the nonpharmacologic treatment of choice for AV nodal reentrant tachycardia or for reentrant tachycardia related to accessory bypass tracts, and to control the ventricular response of certain tachydysrhythmias.

- The ablation procedure is a successful therapy with a low complication rate. Care of the patient following ablation therapy is similar to that of a patient undergoing cardiac catheterization.

ECG CHANGES ASSOCIATED WITH ACUTE CORONARY SYNDROME

- The 12-lead ECG is the primary diagnostic tool used to evaluate patients presenting with ACS.

- There are definitive ECG changes that occur in response to ischemia, injury, or infarction of myocardial cells and will be seen in the leads that face the area of involvement.

- Typical ECG changes seen in myocardial ischemia include ST-segment depression and/or T wave inversion.

- The typical ECG change seen during myocardial injury is ST-segment elevation.

- An ST-segment elevation and a pathologic Q wave may be seen on the ECG with myocardial infarction.

- Patient monitoring guidelines for patients with suspected ACS include continuous, multilead ECG and ST-segment monitoring. The leads selected for monitoring should minimally include the leads that reflect the area of ischemia, injury, or infarction.

SYNCOPE

- Syncope, a brief lapse in consciousness accompanied by a loss in postural tone (fainting), is a common diagnosis of patients coming into the emergency department.

- The causes of syncope can be categorized as cardiovascular or noncardiovascular.
    - Common cardiovascular causes of syncope include (1) neurocardiogenic syncope or "vasovagal" syncope (e.g., carotid sinus sensitivity) and (2) primary cardiac dysrhythmias (e.g., tachycardias, bradycardias).
    - Noncardiovascular causes can include hypoglycemia, hysteria, unwitnessed seizure, and vertebrobasilar transient ischemic attack.

- The diagnostic workup for a patient with syncope from a suspected cardiac cause begins with ruling out structural and/or ischemic heart disease.
  - Echocardiography and stress testing are performed.
  - In the older patient, who is more likely to have ischemic and structural heart disease, EPS is used to diagnose atrial and ventricular tachydysrhythmias, as well as conduction system disease causing bradydysrhythmias.
  - In patients without structural heart disease or in whom EPS testing is not diagnostic, head-upright tilt table testing may be performed.
  - Other diagnostic tests for syncope include various recording devices.
    - Holter monitors and event monitors can be used.
    - A subcutaneously implanted loop recording device can also be used to record the ECG during presyncopal and syncopal events.

Lewis et al: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 7th edition

Key Points

Chapter 37: Nursing Management: Inflammatory and Structural Heart Disorders

INFECTIVE ENDOCARDITIS

- **Infective endocarditis** (IE) is an infection of the endocardial surface of the heart that affects the cardiac valves. It is treated with penicillin.

- Two forms of IE include the subacute form (typically affecting those with preexisting valve disease) and the acute form (typically affecting those with healthy valves).

- The most common causative organisms of IE are *Staphylococcus aureus* and *Streptococcus viridans*.

- The principal risk factors for IE are prior endocarditis, prosthetic valves, acquired valvular disease, and cardiac lesions.

- Vegetations, the primary lesions of IE, adhere to the valve surface or endocardium and can embolize to various organs (particularly the lungs, brain, kidneys, and spleen) and to the extremities, causing limb infarction.

- The infection may spread locally to cause damage to the valves or to their supporting structures resulting in dysrhythmias, valvular incompetence, and eventual invasion of the myocardium, leading to heart failure (HF), sepsis, and heart block.

- Clinical findings in IE are nonspecific and can include the following:
  - Low-grade fever, chills, weakness, malaise, fatigue, and anorexia
  - Arthralgias, myalgias, back pain, abdominal discomfort, weight loss, headache, and clubbing of fingers
  - Splinter hemorrhages (black longitudinal streaks) in the nail beds
  - Petechiae (a result of fragmentation and microembolization of vegetative lesions) in the conjunctivae, the lips, the buccal mucosa, and the palate and over the ankles, the feet, and the antecubital and popliteal areas
  - **Osler's nodes** (painful, tender, red or purple, pea-size lesions) on the fingertips or toes and **Janeway's lesions** (flat, painless, small, red spots) on the palms and soles
  - Hemorrhagic retinal lesions called Roth's spots
  - A new or changing murmur in the aortic or mitral valve
  - HF

- Definitive diagnosis of IE exists if two of the following major criteria are present:

positive blood cultures, new or changed cardiac murmur, or intracardiac mass or vegetation noted on echocardiography.

- Collaborative care consists of antibiotic prophylaxis for patients with specific cardiac conditions before dental, respiratory tract, gastrointestinal (GI), and genitourinary (GU) procedures and for high-risk patients who (1) are to undergo removal or drainage of infected tissue, (2) receive renal dialysis, or (3) have ventriculoatrial shunts for management of hydrocephalus.

- Drug therapy consists of long-term treatment with IV antibiotic therapy with subsequent blood cultures to evaluate the effectiveness of antibiotic therapy.

- Early valve replacement followed by prolonged (6 weeks or longer) drug therapy is recommended for patients with fungal infection and prosthetic valve endocarditis.

- Fever is treated with aspirin, acetaminophen (Tylenol), ibuprofen (Motrin), fluids, and rest.

- Complete bed rest is usually not indicated unless the temperature remains elevated or there are signs of HF.

- Overall goals for the patient with IE include (1) normal or baseline cardiac function, (2) performance of activities of daily living (ADLs) without fatigue, and (3) knowledge of the therapeutic regimen to prevent recurrence of endocarditis.

- Patients and families must be taught to recognize signs and symptoms of life-threatening complications of IE, such as cerebral emboli (e.g., change in mental status), pulmonary edema (e.g., dyspnea), and HF (e.g., chest pain).
    - Fever (chronic or intermittent) is a common early sign that the drug therapy is ineffective.

- Laboratory data and blood cultures are monitored to determine the effectiveness of the antibiotic therapy.

ACUTE PERICARDITIS

- **Pericarditis** is caused by inflammation of the pericardial sac (the pericardium).

- Acute pericarditis most often is idiopathic but can be caused by uremia, viral or bacterial infection, acute myocardial infarction (MI), tuberculosis, neoplasm, and trauma.

- Pericarditis in the acute MI patient may be described as two distinct syndromes: (1) acute pericarditis (occurs within the initial 48 to 72 hours after an MI), and (2) Dressler syndrome (late pericarditis which appears 4 to 6 weeks after an MI).

- Clinical manifestations include the following:

  - Progressive, frequently severe chest pain that is sharp and pleuritic in nature and worse with deep inspiration and when lying supine. The pain is relieved by sitting.
  - Pain can be referred to the trapezius muscle (shoulder, upper back).
  - The hallmark finding in acute pericarditis is the **pericardial friction rub.**

- Complications include **pericardial effusion** and **cardiac tamponade.**

- Collaborative care includes the following:
  - Antibiotics
  - Corticosteroids for pericarditis secondary to systemic lupus erythematosus, patients already taking corticosteroids for a rheumatologic or other immune system condition, or patients who do not respond to nonsteroidal antiinflammatory drugs (NSAIDs)
  - Pain and inflammation are usually treated with NSAIDs or high-dose salicylates (e.g., aspirin).
  - Colchicine, an antiinflammatory agent used for gout, may be considered for patients who have recurrent pericarditis.
  - **Pericardiocentesis** is usually performed for pericardial effusion with acute cardiac tamponade, purulent pericarditis, and a high suspicion of a neoplasm.
    - Complications from pericardiocentesis include dysrhythmias, further cardiac tamponade, pneumomediastinum, pneumothorax, myocardial laceration, and coronary artery laceration.

- The management of the patient's pain and anxiety during acute pericarditis is a primary nursing consideration.

- ECG monitoring can aid in distinguishing ischemic pain from pericardial pain as ischemia involves localized ST-segment changes, as compared to the diffuse ST-segment changes present in acute pericarditis.

- Pain relief measures include maintaining bed rest with the head of the bed elevated to 45 degrees and providing an overbed table for support, and antiinflammatory medications.

CHRONIC CONSTRICTIVE PERICARDITIS

- **Chronic constrictive pericarditis** results from scarring with consequent loss of elasticity of the pericardial sac and begins with an initial episode of acute pericarditis followed by fibrous scarring, thickening of the pericardium from calcium deposition, and eventual obliteration of the pericardial space.

- The end result is that the fibrotic, thickened, and adherent pericardium impairs the ability of the atria and ventricles to stretch adequately during diastole.

- Clinical manifestations mimic HF and cor pulmonale and include dyspnea on exertion, peripheral edema, ascites, fatigue, anorexia, and weight loss.

- The most prominent finding is jugular venous distention.
- Auscultation reveals a pericardial knock, which is a loud early diastolic sound often heard along the left sternal border.
- Treatment of choice for chronic constrictive pericarditis is a pericardiectomy.
- Pericardiectomy involves complete resection of the pericardium through a median sternotomy with the use of cardiopulmonary bypass.

MYOCARDITIS

- **Myocarditis** is a focal or diffuse inflammation of the myocardium caused by viruses, bacteria, fungi, radiation therapy, and pharmacologic and chemical factors.
- Myocarditis is frequently associated with acute pericarditis, particularly when it is caused by coxsackievirus B strains.
- Myocarditis results in cardiac dysfunction and has been linked to the development of dilated cardiomyopathy.
- Clinical manifestations include the following:
  - Fever, fatigue, malaise, myalgias, pharyngitis, dyspnea, lymphadenopathy, and nausea and vomiting are early systemic manifestations of the viral illness.
  - Early cardiac manifestations appear 7 to 10 days after viral infection and include pleuritic chest pain with a pericardial friction rub and effusion.
  - Late cardiac signs relate to the development of HF and may include an S_3 heart sound, crackles, jugular venous distention, syncope, peripheral edema, and angina.
- Collaborative care includes the following:
  - Managing associated cardiac decompensation with:
    - Digoxin (Lanoxin) to treat ventricular failure
    - Diuretics to reduce fluid volume and decrease preload
    - Nitroprusside (Nitropress), inamrinone (Inocor), and milrinone (Primacor) to reduce afterload and improve cardiac output
    - The use of anticoagulation therapy may be considered in patients with a low ejection fraction who are at risk for thrombus formation from blood stasis in the cardiac chambers.
  - Immunosuppressive therapy to reduce myocardial inflammation and to prevent irreversible myocardial damage.
  - Oxygen therapy, bed rest, and restricted activity.
  - Intraaortic balloon pump therapy and ventricular assist devices.

- Nursing interventions focus on assessment for the signs and symptoms of HF and include assessing the level of anxiety, instituting measures to decrease anxiety, and keeping the patient and family informed about therapeutic measures.

- Most patients with myocarditis recover spontaneously, although some may develop dilated cardiomyopathy. If severe HF occurs, the patient may require heart transplantation.

RHEUMATIC FEVER AND HEART DISEASE

- **Rheumatic fever** is an inflammatory disease of the heart potentially involving all layers of the heart.

- **Rheumatic heart disease** is a chronic condition resulting from rheumatic fever that is characterized by scarring and deformity of the heart valves.

- **Acute rheumatic fever** (ARF) is a complication that occurs as a delayed sequela of a group A streptococcal pharyngitis and affects the heart, joints, central nervous system (CNS), and skin.

- About 40% of ARF episodes are marked by carditis, meaning that all layers of the heart are involved, and this is referred to as rheumatic pancarditis.
    - Rheumatic endocarditis is found primarily in the valves. Vegetation forms and valve leaflets may fuse and become thickened or even calcified, resulting in stenosis or regurgitation.
    - Myocardial involvement is characterized by **Aschoff's bodies.**
    - Rheumatic pericarditis affects the pericardium, which becomes thickened and covered with a fibrinous exudate, and often involves pericardial effusion.
    - The lesions of rheumatic fever are systemic, especially involving the connective tissue, as well as the joints, skin, and CNS.

- Clinical manifestations of ARF include the following:
    - The presence of two major criteria or one major and two minor criteria plus evidence of a preceding group A streptococcal infection.
        - Major criteria:
            - Carditis results in three signs: (1) murmurs of mitral or aortic regurgitation, or mitral stenosis; (2) cardiac enlargement and HF; (3) pericarditis.
            - Mono- or polyarthritis causes swelling, heat, redness, tenderness, and limitation of motion.
            - Chorea (Sydenham's chorea) involves involuntary movements, especially of the face and limbs, muscle weakness, and disturbances of speech and gait.
            - Erythema marginatum lesions are bright pink, nonpruritic, maplike macular lesions that occur mainly on the trunk and proximal extremities.

        - Subcutaneous nodules are firm, small, hard, painless swellings located over extensor surfaces of the joints.
    - Minor criteria:
        - Clinical findings: fever, polyarthralgia
        - Laboratory findings: elevated ESR, elevated WBC, elevated CRP

- Complications of ARF include chronic rheumatic carditis.

- Skin should be assessed for subcutaneous nodules and erythema marginatum.

- The overall goals for a patient with rheumatic fever include (1) normal or baseline heart function, (2) resumption of daily activities without joint pain, and (3) verbalization of the ability to manage the disease.

- Health promotion emphasizes prevention of rheumatic fever by early detection and treatment of group A streptococcal pharyngitis with antibiotics, specifically penicillin.
    - The success of treatment requires strict adherence to the full course of antibiotic therapy.
    - The primary goals of managing a patient with ARF are to control and eradicate the infecting organism; prevent cardiac complications; and relieve joint pain, fever, and other symptoms with antibiotics; optimal rest; and antipyretics, NSAIDs, and corticosteroids.
    - Secondary prevention aims at preventing the recurrence of rheumatic fever with monthly injections of long-acting penicillin. Additional prophylaxis is necessary if a patient with known rheumatic heart disease has dental or surgical procedures involving the upper respiratory, GI (e.g., endoscopy), or GU tract.

- The expected outcomes for the patient with rheumatic fever and heart disease include (1) ability to perform ADLs with minimal fatigue and pain, (2) adherence to treatment regimen, and (3) expression of confidence in managing disease.

VALVULAR HEART DISEASE

- Valvular **stenosis** refers to a constriction or narrowing of the valve opening.

- Valvular **regurgitation** (also called valvular incompetence or insufficiency) occurs with incomplete closure of the valve leaflets and results in the backward flow of blood.

Mitral Valve Stenosis

- Adult mitral valve stenosis results from rheumatic heart disease. Less commonly, it can occur congenitally, from rheumatoid arthritis and from systemic lupus erythematosus.

- Clinical manifestations of mitral stenosis include exertional dyspnea, fatigue, palpitations from atrial fibrillation, and a loud first heart sound and a low-pitched, rumbling diastolic murmur.

Mitral Regurgitation

- Mitral regurgitation (MR) is caused by MI, chronic rheumatic heart disease, mitral valve prolapse, ischemic papillary muscle dysfunction, and IE.
- In chronic MR, the additional volume load results in atrial enlargement, ventricular dilation, and eventual ventricular hypertrophy.
- In acute MR, there is a sudden increase in pressure and volume that is transmitted to the pulmonary bed, resulting in pulmonary edema and life-threatening shock.
- Clinical manifestations of acute MR include thready, peripheral pulses and cool, clammy extremities; and a new systolic murmur.
- Patients with asymptomatic MR should be monitored carefully, and surgery considered before significant left ventricular failure or pulmonary hypertension develops.

Mitral Valve Prolapse

- **Mitral valve prolapse** (MVP) is an abnormality of the mitral valve leaflets and the papillary muscles or chordae that allows the leaflets to prolapse, or buckle, back into the left atrium during systole. The etiology of MVP is unknown but is related to diverse pathogenic mechanisms of the mitral valve apparatus.
- In many patients MVP found by echocardiography is not accompanied by any other clinical manifestations of cardiac disease, and the significance of the finding is unclear.
- Clinical manifestations of MVP can include a murmur from regurgitation that gets more intense through systole, chest pain, dyspnea, palpitations, and syncope.

Aortic Valve Stenosis

- In older patients, **aortic stenosis** is a result of rheumatic fever or senile fibrocalcific degeneration that may have an etiology similar to coronary artery disease.
- Aortic stenosis results in left ventricular hypertrophy and increased myocardial oxygen consumption, and eventually, reduced cardiac output leading to pulmonary hypertension and HF.
- Clinical manifestations include a systolic, crescendo-decrescendo murmur and the classic triad of angina, syncope, and exertional dyspnea.

Aortic Valve Regurgitation

- **Acute aortic regurgitation** (AR) is caused by IE, trauma, or aortic dissection.
- Chronic AR is generally the result of rheumatic heart disease, a congenital bicuspid aortic valve, syphilis, or chronic rheumatic conditions.

- Clinical manifestations of acute AR include severe dyspnea, chest pain, and hypotension indicating left ventricular failure and shock that constitute a medical emergency.

- Clinical manifestations of chronic AR include exertional dyspnea, orthopnea, and paroxysmal nocturnal dyspnea after considerable myocardial dysfunction has occurred.

Tricuspid and Pulmonic Valve Disease

- Diseases of the tricuspid and pulmonic valves are uncommon, with stenosis occurring more frequently than regurgitation.

- Tricuspid valve stenosis occurs almost exclusively in patients with rheumatic mitral stenosis, in IV drug abusers, or in patients treated with a dopamine agonist.

- Pulmonary stenosis is almost always congenital.

- Tricuspid and pulmonic stenosis both result in the backward flow of blood to the right atrium and right ventricle, respectively.

- Tricuspid stenosis results in right atrial enlargement and elevated systemic venous pressures. Pulmonic stenosis results in right ventricular hypertension and hypertrophy.

Collaborative Care of Valvular Heart Disease

- Collaborative care of valvular heart disease includes the prevention of recurrent rheumatic fever and IE and the prevention of exacerbations of HF, acute pulmonary edema, and thromboembolism.

- Anticoagulant therapy is used to prevent and treat systemic or pulmonary embolization and is used prophylactically in patients with atrial fibrillation.

- An alternative treatment for valvular heart disease is percutaneous transluminal balloon valvuloplasty (PTBV) to split open the fused commissures. It is used for mitral, tricuspid, and pulmonic stenosis, and less often for aortic stenosis.

- Surgical intervention is based on the clinical state of the patient and depends on the valves involved, the valvular pathology, the severity of the disease, and the patient's clinical condition.

- Valve repair (e.g., mitral commissurotomy [valvulotomy], is typically the surgical procedure of choice.

- Open surgical valvuloplasty involves repair of the valve by suturing the torn leaflets, chordae tendineae, or papillary muscles and is used to treat mitral or tricuspid regurgitation.

- Annuloplasty entails reconstruction of the annulus, with or without the aid of prosthetic rings (e.g., a Carpentier ring).
- Prosthetic mechanical valves are made from manmade materials.
- Prosthetic biologic valves are constructed from bovine, porcine, and human cardiac tissue and usually contain some human-made materials.
- Mechanical prosthetic valves are more durable and last longer than biologic valves but have an increased risk of thromboembolism, necessitating long-term anticoagulation therapy.
- Biologic valves do not require anticoagulation therapy due to their low thrombogenicity. However, they are less durable due to the tendency for early calcification, tissue degeneration, and stiffening of the leaflets.
- Auscultation of the heart should be performed to monitor the effectiveness of digoxin, β-adrenergic blockers, and antidysrhythmic drugs.
- Prophylactic antibiotic therapy is necessary to prevent IE and, if the valve disease was caused by rheumatic fever, ongoing prophylaxis is necessary.
- Patients on anticoagulation therapy after valve replacement surgery must have the international normalized ratio (INR) checked regularly (usually monthly) to assess the adequacy of therapy. Therapeutic values are 2.5 to 3.5.
- The nurse must teach the patient to seek medical care if any manifestations of infection or HF, any signs of bleeding, and any planned invasive or dental procedures are planned.
- Patients on anticoagulation therapy should be encouraged to wear a medical alert bracelet.

CARDIOMYOPATHY

- **Cardiomyopathy** (CMP) constitutes a group of diseases that directly affect the structural or functional ability of the myocardium.
- CMP is classified as primary (refers to those conditions in which the etiology of the heart disease is unknown) or secondary (the cause of the myocardial disease is known and is secondary to another disease process).
- Cardiomyopathies can lead to cardiomegaly and HF, and are the leading cause for heart transplantation.

Dilated Cardiomyopathy

- **Dilated cardiomyopathy** is characterized by a diffuse inflammation and rapid degeneration of myocardial fibers that results in ventricular dilation, impairment of systolic function, atrial enlargement, and stasis of blood in the left ventricle.

- Clinical manifestations develop acutely after an infectious process or insidiously over a period of time.
    - Symptoms include decreased exercise capacity, fatigue, dyspnea at rest, paroxysmal nocturnal dyspnea, orthopnea, palpitations, abdominal bloating, nausea, vomiting, and anorexia.
    - Signs include an irregular heart rate with an abnormal S_3 and/or S_4, tachycardia or bradycardia, pulmonary crackles, edema, weak peripheral pulses, pallor, hepatomegaly, and jugular venous distention.
    - Heart murmurs and dysrhythmias are common.

- Interventions focus on controlling HF by enhancing myocardial contractility and decreasing afterload with drug therapy.

- Nutritional therapy and cardiac rehabilitation may help alleviate symptoms of HF and improve CO and quality of life.

- Dilated CMP does not respond well to therapy, and patients may benefit from a ventricular assist device (VAD) to allow the heart to rest and recover from acute HF or as a bridge to heart transplantation.

- Cardiac resynchronization therapy and an implantable cardioverter-defibrillator may be considered in appropriate patients. The patient's family must learn cardiopulmonary resuscitation (CPR) and how to access emergency care.

- The goal of therapy is to keep the patient at an optimal level of function and out of the hospital.

Hypertrophic Cardiomyopathy

- **Hypertrophic cardiomyopathy** (HCM) is asymmetric left ventricular hypertrophy without ventricular dilation.

- The four main characteristics of HCM are: (1) massive ventricular hypertrophy; (2) rapid, forceful contraction of the left ventricle; (3) impaired relaxation (diastole); and (4) obstruction to aortic outflow (not present in all patients). The end result is impaired ventricular filling as the ventricle becomes noncompliant and unable to relax.

- HCM is the most common cause of SCD in otherwise healthy young people.

- Patients with HCM may be asymptomatic or may have exertional dyspnea, fatigue, angina, syncope, and dysrhythmias.

- Goals of intervention are to improve ventricular filling by reducing ventricular contractility and relieving left ventricular outflow obstruction.

- Drug therapy for HCM includes β-adrenergic blockers or calcium channel blockers. Digitalis preparations are contraindicated unless they are used to treat atrial fibrillation, and antidysrhythmics are used as needed.

- For patients at risk for SCD, the implantation of a cardioverter-defibrillator is recommended.

- Atrioventricular pacing can be beneficial for patients with HCM and outflow obstruction.

- Some patients may be candidates for a surgical procedure called ventriculomyotomy and myectomy, which involves incision of the hypertrophied septal muscle and resection of some of the hypertrophied ventricular muscle.

- Nursing interventions for HCM focus on relieving symptoms, observing for and preventing complications, and providing emotional and psychologic support.

Restrictive Cardiomyopathy

- **Restrictive cardiomyopathy,** the least common CMP, impairs diastolic filling and stretch though systolic function remains unaffected.

- The specific etiology of restrictive CMP is unknown.

- Clinical manifestations include fatigue, exercise intolerance, and dyspnea because the heart cannot increase CO by increasing the heart rate without further compromising ventricular filling.

- Currently no specific treatment for restrictive CMP exists and interventions are aimed at improving diastolic filling and the underlying disease process.
    - Treatment includes conventional therapy for HF and dysrhythmias.
    - Heart transplant may also be a consideration.
    - Nursing care is similar to the care of a patient with HF.

Lewis et al: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 7th edition

Key Points

Chapter 38: Nursing Management: Vascular Disorders

PERIPHERAL ARTERIAL DISEASE

- **Peripheral arterial disease** (PAD) is a progressive narrowing and degeneration of the arteries of the neck, abdomen, and extremities. In most cases, it is a result of

atherosclerosis.

- PAD typically appears in the sixth to eighth decades of life. It occurs at an earlier age in persons with diabetes mellitus and more frequently in African Americans.

- The four most significant risk factors for PAD are cigarette smoking (most important), hyperlipidemia, hypertension, and diabetes mellitus.

- The most common locations for PAD are the coronary arteries, carotid arteries, aortic bifurcation, iliac and common femoral arteries, profunda femoris artery, superficial femoral artery, and distal popliteal artery.

ANEURYSMS

- Aortic **aneurysms** are outpouchings or dilations of the arterial wall.

- The primary causes of aortic aneurysms can be classified as degenerative, congenital, mechanical, inflammatory, or infectious.

- Aortic aneurysms may involve the aortic arch, thoracic aorta, and/or abdominal aorta, but most are found in the abdominal aorta below the level of the renal arteries.

- Thoracic aorta aneurysms are often asymptomatic, but the most common manifestations are deep, diffuse chest pain that may extend to the interscapular area; hoarseness as a result of pressure on the recurrent laryngeal nerve; and dysphagia from pressure on the esophagus.

- Abdominal aortic aneurysms (AAAs) are often asymptomatic but symptoms may mimic pain associated with abdominal or back disorders.

- The most serious complication related to an untreated aneurysm is rupture and bleeding.

- Diagnostic tests for AAAs include chest x-ray, electrocardiogram (to rule out myocardial infarction), echocardiography, CT scan, and magnetic resonance imaging scan.

- The goal of management is to prevent the aneurysm from rupturing.

- Surgical repair of AAA involves (1) incising the diseased segment of the aorta, (2) removing intraluminal thrombus or plaque, (3) inserting a synthetic graft, and (4) suturing the native aortic wall around the graft.

- Minimally invasive endovascular grafting is an alternative to conventional surgical repair of AAA and involves the placement of a sutureless aortic graft into the abdominal aorta inside the aneurysm via a femoral artery cutdown.

- Preoperatively, the patient is monitored for indications of aneurysm rupture.

- Preoperative teaching should include a brief explanation of the disease process, the planned surgical procedure(s), preoperative routines, and what to expect immediately after surgery.

- The overall goals for a patient undergoing aortic surgery include (1) normal tissue perfusion, (2) intact motor and sensory function, and (3) no complications related to surgical repair, such as thrombosis or infection.

- Postoperatively, the patient will have an endotracheal tube for mechanical ventilation, an arterial line, a central venous pressure or pulmonary artery catheter, peripheral intravenous lines, an indwelling urinary catheter, a nasogastric tube, and continuous ECG and pulse oximetry monitoring.
    - Monitoring for graft patency and adequate renal perfusion are priorities; maintenance of an adequate BP is extremely important.
    - Antibiotics are given to prevent infection.
    - Peripheral pulses, skin temperature and color, capillary refill time, and sensation and movement of the extremities are assessed and recorded per hospital policy.
    - Hourly urine outputs and daily weights are recorded.

- On discharge, the patient should be instructed to gradually increase activities but to avoid heavy lifting for at least 4 to 6 weeks.

- Expected outcomes for the patient who undergoes aortic surgery include (1) patent arterial graft with adequate distal perfusion, (2) adequate urine output, (3) normal body temperature, and (4) no signs of infection.

AORTIC DISSECTION

- **Aortic dissection** occurs most commonly in the thoracic aorta and is the result of a tear in the intimal (innermost) lining of the arterial wall allowing blood to "track" between the intima and media and creates a false lumen of blood flow.

- The exact cause of aortic dissection is uncertain, and most people with dissection are older and have chronic hypertension.

- Clinical manifestations include a sudden, severe pain in the anterior part of the chest or intrascapular pain radiating down the spine into the abdomen or legs that is described as "tearing" or "ripping."

- Diagnostic studies used to assess aortic dissection are similar to those performed for AAA.

- The initial goal of therapy for aortic dissection without complications is to lower the BP and myocardial contractility with drug therapy.

- Surgery is indicated when drug therapy is ineffective or when complications of aortic dissection are present.

PERIPHERAL ARTERIAL DISEASE OF THE LOWER EXTREMITIES

- PAD of the lower extremities affects the aortoiliac, femoral, popliteal, tibial, or peroneal arteries.

- The classic symptom of PAD of the lower extremities is **intermittent claudication,** which is defined as ischemic muscle ache or pain that is precipitated by a consistent level of exercise, resolves within 10 minutes or less with rest, and is reproducible.

- Paresthesia, manifested as numbness or tingling in the toes or feet, may result from nerve tissue ischemia. Gradually diminishing perfusion to neurons produces loss of both pressure and deep pain sensations.

- Physical findings include thin, shiny, and taut skin; loss of hair on the lower legs; diminished or absent pedal, popliteal, or femoral pulses; pallor or blanching of the foot in response to leg elevation (elevation pallor); and reactive hyperemia (redness of the foot) when the limb is in a dependent position (dependent rubor).

- Rest pain most often occurs in the forefoot or toes, is aggravated by limb elevation, and occurs when there is insufficient blood flow to maintain basic metabolic requirements of the tissues and nerves of the distal extremity.

- Complications of PAD include nonhealing ulcers over bony prominences on the toes, feet, and lower leg, and gangrene. Amputation may be required if blood flow is not restored.

- Tests used to diagnose PAD include Doppler ultrasound with segmental blood pressures at the thigh, below the knee, and at ankle level. A falloff in segmental BP of more than 30 mm Hg indicates PAD.

- Angiography is used to delineate the location and extent of the disease process.

- The first treatment goal is to aggressively modify all cardiovascular risk factors in all patients with PAD, with smoking cessation a priority.

- Drug therapy includes antiplatelet agents and ACE inhibitors. Two drugs are approved to treat intermittent claudication, pentoxifylline (Trental) and cilostazol (Pletal).

- The primary nonpharmacologic treatment for claudication is a formal exercise-training program with walking being the most effective exercise.

- Ginkgo biloba has been found to increase walking distance for patients with intermittent claudication.

- **Critical limb ischemia** is a chronic condition characterized by ischemic rest pain, arterial leg ulcers, and/or gangrene of the leg due to advanced PAD.

- Interventional radiologic procedures for PAD include percutaneous transluminal balloon angioplasty. There is a relatively high rate of restenosis after balloon angioplasty.

- The most common surgical procedure for PAD is a peripheral arterial bypass operation with autogenous vein or synthetic graft material to bypass or carry blood around the lesion.

- The overall goals for the patient with lower extremity PAD include (1) adequate tissue perfusion, (2) relief of pain, (3) increased exercise tolerance, and (4) intact, healthy skin on extremities.

- After surgical or radiologic intervention, the operative extremity should be checked every 15 minutes initially and then hourly for skin color and temperature, capillary refill, presence of peripheral pulses, and sensation and movement of the extremity.

- All patients with PAD should be taught the importance of meticulous foot care to prevent injury.

- **Acute arterial ischemia** is a sudden interruption in the arterial blood supply to tissue, an organ, or an extremity that, if left untreated, can result in tissue death.

- Signs and symptoms of an acute arterial ischemia usually have an abrupt onset and include the "six *P*s:" pain, pallor, pulselessness, paresthesia, paralysis, and poikilothermia (adaptation of the ischemic limb to its environmental temperature, most often cool).

- Treatment options include anticoagulation, thrombolysis, embolectomy, surgical revascularization, or amputation.

THROMBOANGIITIS OBLITERANS (BUERGER'S DISEASE)

- **Thromboangiitis obliterans** is a somewhat rare nonatherosclerotic, segmental, recurrent inflammatory vaso-occlusive disorder of the small and medium-sized arteries, veins, and nerves of the upper and lower extremities.

- Patients may have intermittent claudication of the feet, hands, or arms.

- As the disease progresses, rest pain and ischemic ulcerations develop.

- There are no laboratory or diagnostic tests specific to Buerger's disease.

- Treatment includes complete cessation of tobacco use in any form (including secondhand smoke). Other therapies can be considered but have had limited success.

- Surgical options include revascularization and sympathectomy, with the most common being sympathectomy (transection of a nerve, ganglion, and/or plexus of the sympathetic nervous system).

RAYNAUD'S PHENOMENON

- **Raynaud's phenomenon** is an episodic vasospastic disorder of small cutaneous arteries, most frequently involving the fingers and toes. The exact etiology of Raynaud's phenomenon remains unknown.

- Clinical symptoms include vasospasm-induced color changes of the fingers, toes, ears, and nose (white, blue, and red). An episode usually lasts only minutes but in severe cases may persist for several hours.

- Symptoms usually are precipitated by exposure to cold, emotional upsets, caffeine, and tobacco use.

- There is no simple diagnostic test for Raynaud's phenomenon, and diagnosis is based on persistent symptoms for at least 2 years.

- Patient teaching should be directed toward prevention of recurrent episodes: temperature extremes and all tobacco products should be avoided.

- Calcium channel blockers are the first-line drug therapy.

VENOUS THROMBOSIS

- **Venous thrombosis** is the most common disorder of the veins and involves the formation of a thrombus (clot) in association with inflammation of the vein.

- **Superficial thrombophlebitis** occurs in about 65% of all patients receiving IV therapy and is of minor significance.

- **Deep vein thrombosis** (DVT) involves a thrombus in a deep vein, most commonly the iliac and femoral veins, and can result in embolization of thrombi to the lungs.

- Three important factors (called **Virchow's triad**) in the etiology of venous thrombosis are (1) venous stasis, (2) damage of the endothelium, and (3) hypercoagulability of the blood.

- Superficial thrombophlebitis presents as a palpable, firm, subcutaneous cordlike vein. The area surrounding the vein may be tender to the touch, reddened, and warm. A mild systemic temperature elevation and leukocytosis may be present.
    - Treatment of superficial thrombophlebitis includes elevating the affected extremity to promote venous return and decrease the edema and applying warm, moist heat.

  - Mild oral analgesics such as acetaminophen or aspirin are used to relieve pain.

- The patient with DVT may or may not have unilateral leg edema, extremity pain, warm skin, erythema, and a systemic temperature greater than 100.4° F (38° C).

- The most serious complications of DVT are pulmonary embolism (PE) and chronic venous insufficiency. Chronic venous insufficiency (CVI) results from valvular destruction, allowing retrograde flow of venous blood.

- Interventions for patients at risk for DVT include early mobilization of surgical patients. Patients on bed rest need to be instructed to change position, dorsiflex their feet, and rotate their ankles every 2 to 4 hours.

- The usual treatment of DVT in hospitalized patients involves bed rest, elevation of the extremity, and anticoagulation.

- Patients with hyperhomocysteinemia are treated with vitamins B_6, B_{12}, and folic acid to reduce homocysteine levels.

- The goal of anticoagulation therapy for DVT prophylaxis is to prevent DVT formation; the goals in the treatment of DVT are to prevent propagation of the clot, development of any new thrombi, and embolization.

- Indirect thrombin inhibitors include unfractionated heparin (UH) and low-molecular-weight heparin (LMWH).
  - UH affects both the intrinsic and common pathways of blood coagulation by way of the plasma cofactor antithrombin.
  - LMWH is derived from heparin and also acts via antithrombin, but has an increased affinity for inhibiting factor Xa.

- Direct thrombin inhibitors can be classified as hirudin derivatives or synthetic thrombin inhibitors. Hirudin binds specifically with thrombin, thereby directly inhibiting its function without causing plasma protein and platelet interactions.

- Factor Xa inhibitors inhibit factor Xa directly or indirectly, producing rapid anticoagulation.
  - Fondaparinux (Arixtra) is administered subcutaneously and is approved for DVT prevention in orthopedic patients and treatment of DVT and PE in hospitalized patients when administered in conjunction with warfarin.
  - Both direct thrombin inhibitors and factor Xa inhibitors have no antidote.

- For DVT prophylaxis, low-dose UH, LMWH, fondaparinux, or warfarin can be prescribed.
  - LMWH has replaced heparin as the anticoagulant of choice to prevent DVT for most surgical patients.

  - DVT prophylaxis typically lasts the duration of the hospitalization.
  - Patients undergoing major orthopedic surgery may be prescribed prophylaxis for up to 1 month postdischarge.

- Vena cava interruption devices, such as the Greenfield filter, can be inserted percutaneously through right femoral or right internal jugular vein to filter clots without interrupting blood flow.

- Nursing diagnoses and collaborative problems for the patient with venous thrombosis can include the following:
  - Acute pain related to venous congestion, impaired venous return, and inflammation
  - Ineffective health maintenance related to lack of knowledge about the disorder and its treatment
  - Risk for impaired skin integrity related to altered peripheral tissue perfusion
  - Potential complication: bleeding related to anticoagulant therapy
  - Potential complication: pulmonary embolism related to embolization of thrombus, dehydration, and immobility

- The overall goals for the patient with venous thrombosis include (1) relief of pain, (2) decreased edema, (3) no skin ulceration, (4) no complications from anticoagulant therapy, and (5) no evidence of pulmonary emboli.
  - Depending on the anticoagulant prescribed, ACT, aPTT, INR, hemoglobin, hematocrit, platelet levels, and/or liver enzymes are monitored.
  - Platelet counts are monitored for patients receiving UH or LMWH to assess for HIT.
  - UH, warfarin, and direct thrombin inhibitors are titrated according to the results of clotting studies.
  - The nurse observes for signs of bleeding, including epistaxis, gingival bleeding, hematuria, and melena.

- Discharge teaching should focus on elimination of modifiable risk factors for DVT, the importance of compression stockings and monitoring of laboratory values, medication instructions, and guidelines for follow-up.
  - The patient and family should be taught about signs and symptoms of PE such as sudden onset of dyspnea, tachypnea, and pleuritic chest pain.
  - If the patient is on anticoagulant therapy, the patient and family need information on dosage, actions, and side effects, as well as the importance of routine blood tests and what symptoms to report to the health care provider.
  - Home monitoring devices are now available for testing of PT/INR.
  - Patients on LMWH will need to learn how to self-administer the drug or have a friend or family member administer it.
  - Patients on warfarin should be instructed to follow a consistent diet of foods containing vitamin K and to avoid any additional supplements that contain vitamin K.

  - Proper hydration is recommended to prevent additional hypercoagulability.
  - Exercise programs should be developed with an emphasis on walking, swimming, and wading.

- The expected outcomes for the patient with venous thrombosis include (1) minimal to no pain, (2) intact skin, (3) no signs of hemorrhage or occult bleeding, and (4) no signs of respiratory distress.

VARICOSE VEINS

- **Varicose veins,** or varicosities, are dilated, tortuous subcutaneous veins most frequently found in the saphenous system.
  - Primary varicose veins are more common in women and patients with a strong family history and are probably caused by congenital weakness of the veins.
  - Secondary varicose veins typically result from a previous DVT.
  - Secondary varicose veins also may occur in the esophagus, in the anorectal area, and as abnormal arteriovenous connections.
  - Reticular veins are smaller varicose veins that appear flat, less tortuous, and blue-green in color.
  - Telangiectasias (known as spider veins) are very small visible vessels that appear bluish-black, purple, or red.

- The etiology of varicose veins is unknown and risk factors include congenital weakness of the vein structure, female gender, use of hormones (oral contraceptives or HRT), increasing age, obesity, pregnancy, venous obstruction resulting from thrombosis or extrinsic pressure by tumors, or occupations that require prolonged standing.

- The most common symptom of varicose veins is an ache or pain after prolonged standing, which is relieved by walking or by elevating the limb. Nocturnal leg cramps in the calf may occur.

- Treatment usually is not indicated if varicose veins are only a cosmetic problem.

- Collaborative care involves rest with the affected limb elevated, compression stockings, and exercise, such as walking.

- An herbal therapy used for the treatment of varicose veins is horse chestnut seed extract.

- Sclerotherapy involves the injection of a substance that obliterates venous telangiectasias, reticular veins, and small, superficial varicose veins.

- Newer, more costly, noninvasive options for the treatment of venous telangiectasias include laser therapy and high-intensity pulsed-light therapy.

- Surgical intervention is indicated for recurrent thrombophlebitis or when chronic venous insufficiency cannot be controlled with conservative therapy.
    - Surgical intervention involves ligation of the entire vein (usually the greater saphenous) and dissection and removal of its incompetent tributaries.
    - An alternative technique is ambulatory phlebectomy, which involves pulling the varicosity through a "stab" incision, followed by excision of the vein.
    - Newer, less invasive procedures include endovenous occlusion using radiofrequency closure or laser, or transilluminated powered phlebectomy.

- Prevention is a key factor related to varicose veins and the patient should avoid sitting or standing for long periods of time, maintain ideal body weight, take precautions against injury to the extremities, avoid wearing constrictive clothing, and participate in a daily walking program.

CHRONIC VENOUS INSUFFICIENCY AND LEG ULCERS

- **Chronic venous insufficiency** (CVI) is a condition in which the valves in the veins are damaged, which results in retrograde venous blood flow, pooling of blood in the legs, and swelling.

- CVI often occurs as a result of previous episodes of DVT and can lead to venous leg ulcers.

- Causes of CVI include vein incompetence, deep vein obstruction, congenital venous malformation, AV fistula, and calf muscle failure.
    - Over time, the skin and subcutaneous tissue around the ankle are replaced by fibrous tissue, resulting in thick, hardened, contracted skin.
    - The skin of the lower leg is leathery, with a characteristic brownish or "brawny" appearance from the hemosiderin deposition.
    - Edema and eczema, or "stasis dermatitis," are often present, and pruritus is a common complaint.

- Venous ulcers classically are located above the medial malleolus.
    - The wound margins are irregularly shaped, and the tissue is typically a ruddy color.
    - Ulcer drainage may be extensive, especially when the leg is edematous.
    - Pain is present and may be worse when the leg is in a dependent position.

- Compression is essential to the management of CVI, venous ulcer healing, and prevention of ulcer recurrence.
    - Options include elastic wraps, custom-fitted compression stockings, elastic tubular support bandages, a Velcro wrap, intermittent compression devices, a paste bandage with an elastic wrap, and multilayer (three or four) bandage systems.
    - Moist environment dressings are the mainstay of wound care and include transparent film dressings, hydrocolloids, hydrogels, foams, calcium alginates,

impregnated gauze, gauze moistened with saline, and combination dressings.
    - Nutritional status and intake should be evaluated in a patient with a venous leg ulcer.
    - Routine prophylactic antibiotic therapy typically is not indicated.
    - Clinical signs of infection in a venous ulcer include change in quantity, color, or odor of the drainage; presence of pus; erythema of the wound edges; change in sensation around the wound; warmth around the wound; increased local pain, edema, or both; dark-colored granulation tissue; induration around the wound; delayed healing; and cellulitis.
        - The usual treatment for infection is sharp debridement, wound excision, and systemic antibiotics.
        - If the ulcer fails to respond to conservative therapy, alternative treatments may include use of a radiant heat bandage, vacuum-assisted closure therapy, and coverage with a split-thickness skin graft, cultured epithelial autograft, allograft, or bioengineered skin.
    - An herbal therapy used for the treatment of CVI is horse chestnut seed extract.

- Long-term management of venous leg ulcers should focus on teaching the patient about self-care measures because the incidence of recurrence is high.
    - Proper foot and leg care is essential to avoid additional trauma to the skin.
    - The patient with CVI with or without a venous ulcer is instructed to avoid standing or sitting with the feet dependent for long periods.
    - Venous ulcer patients are instructed to elevate their legs above the level of the heart to reduce edema.
        - Once an ulcer is healed, a daily walking program is encouraged.
        - Prescription compression stockings should be worn daily and replaced every 4 to 6 months to reduce the occurrence of CVI.

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Key Points

Chapter 39: Nursing Assessment: Gastrointestinal System

STRUCTURES AND FUNCTIONS

- The main function of the gastrointestinal (GI) system is to supply nutrients to body cells.

- The GI tract is innervated by the autonomic nervous system. The parasympathetic system is mainly excitatory, and the sympathetic system is mainly inhibitory.

- The two types of movement of the GI tract are mixing *(segmentation)* and propulsion *(peristalsis)*.

- The secretions of the GI system consist of enzymes and hormones for **digestion,** mucus to provide protection and lubrication, water, and electrolytes.

- Mouth:
  - The mouth consists of the lips and oral (buccal) cavity.
  - The main function of saliva is to lubricate and soften the food mass, thus facilitating swallowing.

- Pharynx: a musculomembranous tube that is divided into the nasopharynx, oropharynx, and laryngeal pharynx.

- Esophagus:
  - A hollow, muscular tube that receives food from the pharynx and moves it to the stomach by peristaltic contractions.
  - Lower esophageal sphincter (LES) at the distal end remains contracted except during swallowing, belching, or vomiting.

- Stomach:
  - The functions are to store food, mix the food with gastric secretions, and empty contents into the small intestine at a rate at which digestion can occur.
  - The secretion of HCl acid makes gastric juice acidic.
  - Intrinsic factor promotes cobalamin absorption in the small intestine.

- Small intestine: two primary functions are digestion and **absorption.**

- Large intestine:
  - The four parts are (1) the cecum and appendix; (2) the colon (ascending, transverse, descending, sigmoid colon); (3) the rectum; and (4) the anus.
  - The most important function of the large intestine is the absorption of water and electrolytes.

- Liver:
  - Hepatocytes are the functional unit of the liver.
  - Is essential for life. It functions in the manufacture, storage, transformation, and excretion of a number of substances involved in metabolism.

- Biliary tract:
  - Consists of the gallbladder and the duct system.
  - Bile is produced in the liver and stored in the gallbladder. Bile consists of **bilirubin,** water, cholesterol, bile salts, electrolytes, and phospholipids.

- Pancreas:
  - The exocrine function of the pancreas contributes to digestion.
  - The endocrine function occurs in the islets of Langerhans, whose beta cells secrete insulin; alpha cells secrete glucagon; and delta cells secrete somatostatin.

GERONTOLOGIC CONSIDERATIONS

- Aging causes changes in the functional ability of the GI system.
- Xerostomia (decreased saliva production) or dry mouth is common.
- Taste buds decrease, the sense of smell diminishes, and salivary secretions diminish, which can lead to a decrease in appetite.
- Although constipation is a common complaint of elderly patients, age-related changes in colonic secretion or motility have not been consistently shown.
- The liver size decreases after 50 years of age, but liver function tests remain within normal ranges. There is decreased ability to metabolize drugs and hormones.

ASSESSMENT

- Subjective data:
  - Important health information: the patient is asked about abdominal pain, nausea and vomiting, diarrhea, constipation, abdominal distention, jaundice, anemia, heartburn, dyspepsia, changes in appetite, hematemesis, food intolerance or allergies, excessive gas, bloating, melena, hemorrhoids, or rectal bleeding.
  - The patient is asked about (1) history or existence of diseases such as gastritis, hepatitis, colitis, gallbladder disease, peptic ulcer, cancer, or hernias; (2) weight history; (3) past and current use of medications and prior hospitalizations for GI problems.
  - Many chemicals and drugs are potentially hepatotoxic and result in significant patient harm unless monitored closely.
- Objective data:
  - Anthropometric measurements (height, weight, skinfold thickness) and blood studies (e.g., serum protein, albumin, hemoglobin) may be performed.
  - Physical examination
    - Mouth. The lips are inspected for symmetry, color, and size. The lips, tongue, and buccal mucosa are observed for lesions, ulcers, fissures, and pigmentation.
    - Abdomen. The skin is assessed for changes (color, texture, scars, striae, dilated veins, rashes, lesions), symmetry, contour, observable masses, and movement.
    - Auscultation of the four quadrants of the abdomen includes listening for increased or decreased bowel sounds and vascular sounds.

- Percussion of the abdomen is done to determine the presence of distention, fluid, and masses. The nurse lightly percusses all four quadrants of the abdomen.
- Light palpation is used to detect tenderness or cutaneous hypersensitivity, muscular resistance, masses, and swelling.
- Deep palpation is used to delineate abdominal organs and masses. Rebound tenderness indicates peritoneal inflammation.
- During inspiration the liver edge should feel firm, sharp, and smooth. The surface and contour and any tenderness are described.
- The spleen is normally not palpable. If palpable, manual compression of an enlarged spleen may cause it to rupture.
- The perianal and anal areas should be inspected for color, texture, lumps, rashes, scars, erythema, fissures, and external hemorrhoids.

DIAGNOSTIC STUDIES

- Many of the diagnostic procedures of the GI system require measures to cleanse the GI tract, as well as the use of a contrast medium or a radiopaque tracer.
- An upper GI series with small bowel follow-through provides visualization of the esophagus, stomach, and small intestine.
- A lower GI series (barium enema) x-ray examination is done to detect abnormalities in the colon.
- Ultrasonography is used to show the size and configuration of organs.
- Virtual colonoscopy combines computed tomography (CT) scanning or magnetic resonance imaging (MRI).
- **Endoscopy** refers to the direct visualization of a body structure through a lighted fiberoptic instrument.
- Retrograde cholangiopancreatography (ERCP) is an endoscopic procedure that visualizes the pancreatic, hepatic, and common bile ducts.
- Endoscopy of the GI tract is often done with biopsy and cytologic studies. A complication of GI endoscopy is perforation.
- Capsule endoscopy is a noninvasive approach to visualize the GI tract.
- Liver biopsy is performed to obtain tissue for diagnosis of fibrosis, cirrhosis, and neoplasms.
- Liver function tests reflect hepatic disease and function.

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Key Points

Chapter 40: Nursing Management: Nutritional Problems

- Good **nutrition** in the absence of any underlying disease process results from the ingestion of a balanced diet.
- The MyPyramid (formerly the Food Guide Pyramid) consists of food groups that are presented in proportions appropriate for a healthy diet, including grains, vegetables, fruits, oils, milk, and meat and beans.
- The National Research Council recommends that at least half of the body's energy needs should come from carbohydrates, especially complex carbohydrates.
- The Dietary Guidelines for Americans 2005 from *Healthy People 2010* recommends that people reduce their fat intake to 20% to 35% of their total daily caloric intake.
- An average adult requires an estimated 20 to 35 calories per kilogram of body weight per day, leaning toward the higher end if the person is critically ill or very active and the lower end if the person is sedentary.
- The recommended daily protein intake is 0.8 to 1 g/kg of body weight.
- Vegetarians can have vitamin or protein deficiencies unless their diets are well planned.
- Culture, personal preferences, socioeconomic status, and religious preferences can influence food choices.
- The nurse should include cultural and ethnic considerations when assessing the patient's diet history and implementing interventions that require dietary changes.

MALNUTRITION

- **Malnutrition** is common in hospitalized patients.
- With starvation, the body initially uses carbohydrates (glycogen) rather than fat and protein to meet metabolic needs. Once carbohydrate stores are depleted, protein begins to be converted to glucose for energy.

- Factors that contribute to malnutrition include socioeconomic status, cultural influences, psychologic disorders, medical conditions, and medical treatments.
- Regardless of the cause of the illness, most sick persons have increased nutritional needs.
- Each degree of temperature increase on the Fahrenheit scale raises the basal metabolic rate (BMR) by about 7%.
- Prolonged illness, major surgery, sepsis, draining wounds, burns, hemorrhage, fractures, and immobilization can all contribute to malnutrition.
- On physical examination, the most obvious clinical signs of inadequate protein and calorie intake are apparent in the skin, eyes, mouth, muscles, and the central nervous system.
- The malnourished person is more susceptible to all types of infection.
- Across all settings of care delivery, the nurse must be aware of the nutritional status of the patient.
- The protein and calorie intake required in the malnourished patient depends on the cause of the malnutrition, the treatment being employed, and other stressors affecting the patient.
- The older patient is at risk for nutritional problems due to the following factors:
    - Changes in the oral cavity
    - Changes in digestion and motility
    - Changes in the endocrine system
    - Changes in the musculoskeletal system
    - Decreases in vision and hearing
- High-calorie oral supplements may be used in the patient whose nutritional intake is deficient.

TUBE FEEDINGS

- **Tube feeding** (also known as **enteral nutrition**) may be ordered for the patient who has a functioning GI tract but is unable to take any or enough oral nourishment.
- A gastrostomy tube may be used for a patient who requires tube feedings over an extended time.
- The most accurate assessment for correct tube placement is by x-ray visualization.

PARENTERAL NUTRITION

- **Parenteral nutrition** (PN) is used to meet the patient's nutritional needs and to allow growth of new body tissue.

- All parenteral nutrition solutions should be prepared by a pharmacist or a trained technician using strict aseptic techniques under a laminar flow hood.

- Complications of parenteral nutrition include infectious, metabolic, and mechanical problems.

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Key Points

CHAPTER 41: NURSING MANAGEMENT: OBESITY

OBESITY

- **Obesity** is the most common nutritional problem, affecting almost one third of the population.

- Approximately 13% of Americans have a **body mass index** (BMI) greater than 35 kg/m^2.

- Obesity is the second leading cause of preventable disease in the United States, after smoking.

- The cause of obesity involves significant genetic/biologic susceptibility factors that are highly influenced by environmental and psychosocial factors.

- The degree to which a patient is classified as underweight, healthy (normal) weight, **overweight,** or **obese** is assessed by using a BMI chart.

- Individuals with fat located primarily in the abdominal area (apple-shaped body) are at a greater risk for obesity-related complications than those whose fat is primarily located in the upper legs (pear-shaped body).

- Complications or risk factors related to obesity include the following:
    - Cardiovascular disease in both men and women
    - Severe obesity may be associated with sleep apnea and obesity/hypoventilation syndrome.
    - Type 2 diabetes mellitus; as many as 80% of patients with type 2 diabetes are obese

  - Osteoarthritis, probably because of the trauma to the weight-bearing joints and gout
  - Gastroesophageal reflux disease (GERD), gallstones, and nonalcoholic steatohepatitis (NASH)
  - Breast, endometrial, ovarian, and cervical cancer is increased in obese women

- When patients who are obese have surgery, they are likely to suffer from other comorbidities, including diabetes, altered cardiorespiratory function, abnormal metabolic function, hemostasis, and atherosclerosis that place them at risk for complications related to surgery.

- Measurements used with the obese person may include skinfold thickness, height, weight, and BMI.

- The overall goals for the obese patient include the following:
  - Modifying eating patterns
  - Participating in a regular physical activity program
  - Achieving weight loss to a specified level
  - Maintaining weight loss at a specified level
  - Minimizing or preventing health problems related to obesity

- Obesity is considered a chronic condition that necessitates day-to-day attention to lose weight and maintain weight loss.

- Persons on low-calorie and very-low-calorie diets need frequent professional monitoring because the severe energy restriction places them at risk for multiple nutrient deficiencies.

- Restricted food intake is a cornerstone for any weight loss or maintenance program.

- Motivation is an essential ingredient for successful achievement of weight loss.

- Exercise is an important part of a weight control program. Exercise should be done daily, preferably 30 minutes to an hour a day.

- Useful basic techniques for behavioral modification include self-monitoring, stimulus control, and rewards.

- Drugs approved for weight loss can be classified into two categories, including those that decrease the following:
  - Food intake by reducing appetite or increasing *satiety* (sense of feeling full after eating)
  - Nutrient absorption

- **Bariatric surgery** is currently the only treatment that has been found to have a successful and lasting impact for sustained weight loss for severely obese individuals.
    - Wound infection is one of the most common complications after surgery.
    - Early ambulation following surgery is important for the obese patient.
    - Late complications following bariatric surgery include anemia, vitamin deficiencies, diarrhea, and psychiatric problems.

- Obesity in older adults can exacerbate age-related declines in physical function and lead to frailty and disability.

METABOLIC SYNDROME

- **Metabolic syndrome** is a collection of risk factors that increase an individual's chance of developing cardiovascular disease and diabetes mellitus.

- Lifestyle therapies are the first-line interventions to reduce the risk factors for metabolic syndrome.

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Key Points

Chapter 42: Nursing Management: Upper Gastrointestinal Problems

NAUSEA AND VOMITING

- **Nausea** and **vomiting** are found in a wide variety of gastrointestinal (GI) disorders.

- They are also found in conditions that are unrelated to GI disease, including pregnancy, infectious diseases, central nervous system (CNS) disorders (e.g., meningitis), cardiovascular problems (e.g., myocardial infarction), metabolic disorders (e.g., diabetes mellitus), side effects of drugs (e.g., chemotherapy, opioids), and psychologic factors (e.g., fear).

- Vomiting can occur when the GI tract becomes overly irritated, excited, or distended.
    - It can be a protective mechanism to rid the body of spoiled or irritating foods and liquids.
    - Pulmonary aspiration is a concern when vomiting occurs in the patient who is elderly, is unconscious, or has other conditions that impair the gag reflex.
    - The color of the emesis aids in identifying the presence and source of bleeding.

- Drugs that control nausea and vomiting include anticholinergics (e.g., scopolamine), antihistamines (e.g., promethazine [Phenergan]), phenothiazines (e.g., chlorpromazine

[Thorazine], prochlorperazine [Compazine]), and butyrophenones (e.g., droperidol [Inapsine]).

- The patient with severe or prolonged vomiting is at risk for dehydration and acid-base and electrolyte imbalances. The patient may require intravenous (IV) fluid therapy with electrolyte and glucose replacement until able to tolerate oral intake.

Upper Gastrointestinal Bleeding

- The mortality rate for upper GI bleeding remains at 6% to 10% despite advances in intensive care, hemodynamic monitoring, and endoscopy.

- The severity of bleeding depends on whether the origin is venous, capillary, or arterial.

- Bleeding ulcers account for 50% of the cases of upper GI bleeding.

- Drugs such as aspirin, nonsteroidal antiinflammatory agents, and corticosteroids are a major cause of upper GI bleeding.

- Although approximately 80% to 85% of patients who have massive hemorrhage spontaneously stop bleeding, the cause must be identified and treatment initiated immediately.

- The immediate physical examination includes a systemic evaluation of the patient's condition with emphasis on blood pressure, rate and character of pulse, peripheral perfusion with capillary refill, and observation for the presence or absence of neck vein distention. Vital signs are monitored every 15 to 30 minutes.

- The goal of endoscopic hemostasis is to coagulate or thrombose the bleeding artery. Several techniques are used including thermal (heat) probe, multipolar and bipolar electrocoagulation probe, argon plasma coagulation, and neodymium:yttrium-aluminum-garnet (Nd:YAG) laser.

- The patient undergoing vasopressin therapy is closely monitored for its myocardial, visceral, and peripheral ischemic side effects.

- The nursing assessment for the patient with upper GI bleeding includes the patient's level of consciousness, vital signs, appearance of neck veins, skin color, and capillary refill. The abdomen is checked for distention, guarding, and peristalsis.

- The patient who requires regular administration of ulcerogenic drugs, such as aspirin, corticosteroids, or NSAIDs, needs instruction regarding the potential adverse effects related to GI bleeding.

- During the acute bleeding phase an accurate intake and output record is essential so that the patient's hydration status can be assessed.

- Once fluid replacement has been initiated, the older adult or the patient with a history of cardiovascular problems is observed closely for signs of fluid overload.

- The majority of upper GI bleeding episodes cease spontaneously, even without intervention.

- Monitoring the patient's laboratory studies enables the nurse to estimate the effectiveness of therapy.

- The patient and family are taught how to avoid future bleeding episodes. Ulcer disease, drug or alcohol abuse, and liver and respiratory diseases can all result in upper GI bleeding.

Oral Infections and Inflammations

- May be specific mouth diseases, or they may occur in the presence of systemic disorders such as leukemia or vitamin deficiency.

- The patient who is immunosuppressed (e.g., patient with acquired immunodeficiency syndrome or receiving chemotherapy) is most susceptible to oral infections. The patient on oral corticosteroid inhaler treatment for asthma is also at risk.

- Management of oral infections and inflammation is focused on identification of the cause, elimination of infection, provision of comfort measures, and maintenance of nutritional intake.

Oral (or Oropharyngeal) Cancer

- May occur on the lips or anywhere within the mouth (e.g., tongue, floor of the mouth, buccal mucosa, hard palate, soft palate, pharyngeal walls, tonsils).

- Head and neck squamous cell carcinoma is an umbrella term for cancers of the oral cavity, pharynx, and larynx. Accounts for 90% of malignant oral tumors.

- The overall goals are that the patient with carcinoma of the oral cavity will (1) have a patent airway, (2) be able to communicate, (3) have adequate nutritional intake to promote wound healing, and (4) have relief of pain and discomfort.

GASTROESOPHAGEAL REFLUX DISEASE (GERD)

- There is no one single cause of **gastroesophageal reflux disease** (GERD). It can occur when there is reflux of acidic gastric contents into the esophagus.

- Predisposing conditions include hiatal hernia, incompetent lower esophageal sphincter, decreased esophageal clearance (ability to clear liquids or food from the esophagus into the stomach) resulting from impaired esophageal motility, and decreased gastric emptying.

- A complication of GERD is **Barrett's esophagus** (esophageal metaplasia), which is considered a precancerous lesion that increases the patient's risk for esophageal cancer.

- Most patients with GERD can be successfully managed by lifestyle modifications and drug therapy.

- Drug therapy for GERD is focused on improving LES function, increasing esophageal clearance, decreasing volume and acidity of reflux, and protecting the esophageal mucosa.

- Because of the link between GERD and Barrett's esophagus, patients are instructed to see their health care provider if symptoms persist.

HIATAL HERNIA

- The two most common types of **hiatal hernia** are sliding and paraesophageal (rolling).

- Factors that predispose to hiatal hernia development include increased intraabdominal pressure, including obesity, pregnancy, ascites, tumors, tight girdles, intense physical exertion, and heavy lifting on a continual basis. Other factors are increased age, trauma, poor nutrition, and a forced recumbent position (e.g., prolonged bed rest).

Esophageal Cancer

- Two important risk factors for **esophageal cancer** are smoking and excessive alcohol intake.

Gastritis

- **Gastritis** occurs as the result of a breakdown in the normal gastric mucosal barrier.

- Drugs such as aspirin, nonsteroidal antiinflammatory drugs (NSAIDs), digitalis, and alendronate (Fosamax) have direct irritating effects on the gastric mucosa. Dietary indiscretions can also result in acute gastritis.

- The symptoms of acute gastritis include anorexia, nausea and vomiting, epigastric tenderness, and a feeling of fullness.

Peptic Ulcer Disease

- Gastric and duodenal ulcers, although defined as **peptic ulcer disease** (PUD), are different in their etiology and incidence.

- Duodenal ulcers are more common than gastric ulcers.

- The organism *Helicobacter pylori* is found in the majority of patients with PUD.

- Alcohol, nicotine, and drugs such as aspirin and nonsteroidal antiinflammatory drugs play a role in gastric ulcer development.

- The three major complications of chronic PUD are hemorrhage, perforation, and gastric outlet obstruction. All are considered emergency situations and are initially treated conservatively.

- Endoscopy is the most commonly used procedure for diagnosis of PUD.

- Treatment of PUD includes adequate rest, dietary modifications, drug therapy, elimination of smoking, and long-term follow-up care. The aim is to decrease gastric acidity, enhance mucosal defense mechanisms, and minimize the harmful effects on the mucosa.

- The drugs most commonly used to treat PUD are histamine (H_2)-receptor blockers, proton pump inhibitors, and antacids. Antibiotics are employed to eradicate *H. pylori* infection.

- The immediate focus of management of a patient with a perforation is to stop the spillage of gastric or duodenal contents into the peritoneal cavity and restore blood volume.

- The aim of therapy for gastric outlet obstruction is to decompress the stomach, correct any existing fluid and electrolyte imbalances, and improve the patient's general state of health.

- Overall goals for the patient with PUD include compliance with the prescribed therapeutic regimen, reduction or absence of discomfort, no signs of GI complications, healing of the ulcer, and appropriate lifestyle changes to prevent recurrence.

- Surgical procedures for PUD include partial gastrectomy, vagotomy, and/or pyloroplasty.

STOMACH Cancer

- Stomach (gastric) cancers often spread to adjacent organs before any distressing symptoms occur.

- The nursing role in the early detection of stomach cancer is focused on identification of the patient at risk because of specific disorders such as pernicious anemia and achlorhydria.

E. coli O157:H7O157:H7

- It is the organism most commonly associated with food-borne illness.

- It is found primarily in undercooked meats, such as hamburger, roast beef, ham, and turkey.

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Key Points

Chapter 43: Nursing Management: Lower Gastrointestinal Problems

Diarrhea

- **Diarrhea** is most commonly defined as an increase in stool frequency or volume, and an increase in the looseness of stool.

- Diarrhea can result from alterations in gastrointestinal motility, increased secretion, and decreased absorption.

- All cases of acute diarrhea should be considered infectious until the cause is known.

- Patients receiving antibiotics (e.g., clindamycin [Cleocin], ampicillin, amoxicillin, cephalosporin) are susceptible to *Clostridium difficile (C. difficile),* which is a serious bacterial infection.

Fecal Incontinence

- **Fecal incontinence,** the involuntary passage of stool, occurs when the normal structures that maintain continence are disrupted.

- Risk factors include constipation, diarrhea, obstetric trauma, and fecal impaction.

- Prevention and treatment of fecal incontinence may be managed by implementing a bowel training program.

CONSTIPATION

- **Constipation** can be defined as a decrease in the frequency of bowel movements from what is “normal” for the individual; hard, difficult-to-pass stools; a decrease in stool volume; and/or retention of feces in the rectum.

- The overall goals are that the patient with constipation is to increase dietary intake of fiber and fluids; increase physical activity; have the passage of soft, formed stools; and not have any complications, such as bleeding hemorrhoids.

- An important role of the nurse is teaching the patient the importance of dietary measures to prevent constipation.

Abdominal Pain, Trauma, and Inflammatory Disorders

- Acute abdominal pain is a symptom of many different types of tissue injury and can arise from damage to abdominal or pelvic organs and blood vessels.
- Pain is the most common symptom of an acute abdominal problem.
- The goal of management of the patient with acute abdominal pain is to identify and treat the cause and monitor and treat complications, especially shock.
- Bowel sounds that are diminished or absent in a quadrant may indicate a complete bowel obstruction, acute peritonitis, or paralytic ileus.
- Expected outcomes for the patient with acute abdominal pain include resolution of the cause of the acute abdominal pain; relief of abdominal pain and discomfort; freedom from complications (especially hypovolemic shock and septicemia); and normal fluid, electrolyte, and nutritional status.
- Common causes of chronic abdominal pain include **irritable bowel syndrome** (IBS), diverticulitis, peptic ulcer disease, chronic pancreatitis, hepatitis, cholecystitis, pelvic inflammatory disease, and vascular insufficiency.
- The abdominal pain or discomfort associated with IBS is most likely due to increased visceral sensitivity.

Abdominal Trauma

- Blunt trauma commonly occurs with motor vehicle accidents and falls and may not be obvious because it does not leave an open wound.
- Common injuries of the abdomen include lacerated liver, ruptured spleen, pancreatic trauma, mesenteric artery tears, diaphragm rupture, urinary bladder rupture, great vessel tears, renal injury, and stomach or intestine rupture.

Appendicitis

- **Appendicitis** results in distention, venous engorgement, and the accumulation of mucus and bacteria, which can lead to gangrene and perforation.
- Appendicitis typically begins with periumbilical pain, followed by anorexia, nausea, and vomiting. The pain is persistent and continuous, eventually shifting to the right lower quadrant and localizing at McBurney's point.
- Until a health care provider sees the patient, nothing should be taken by mouth (NPO) to ensure that the stomach is empty in the event that surgery is needed.

Peritonitis

- **Peritonitis** results from a localized or generalized inflammatory process of the peritoneum.

- Assessment of the patient's abdominal pain, including the location, is important and may help in determining the cause of peritonitis.

Gastroenteritis

- **Gastroenteritis** is an inflammation of the mucosa of the stomach and small intestine.

- Clinical manifestations include nausea, vomiting, diarrhea, abdominal cramping, and distention. Most cases are self-limiting and do not require hospitalization.

- If the causative agent is identified, appropriate antibiotic and antimicrobial drugs are given.

- Symptomatic nursing care is given for nausea, vomiting, and diarrhea.

Inflammatory Bowel Disease

- **Crohn's disease** and **ulcerative colitis** are immunologically related disorders that are referred to as **inflammatory bowel disease** (IBD).

- IBD is characterized by mild to severe acute exacerbations that occur at unpredictable intervals over many years.

- Ulcerative colitis usually starts in the rectum and moves in a continual fashion toward the cecum. Although there is sometimes mild inflammation in the terminal ileum, ulcerative colitis is a disease of the colon and rectum.

- Crohn's disease can occur anywhere in the GI tract from the mouth to the anus, but occurs most commonly in the terminal ileum and colon. The inflammation involves all layers of the bowel wall with segments of normal bowel occurring between diseased portions, the so-called "skip lesions."

- With Crohn's disease, diarrhea and colicky abdominal pain are common symptoms. If the small intestine is involved, weight loss occurs due to malabsorption. In addition, patients may have systemic symptoms such as fever. The primary symptoms of ulcerative colitis are bloody diarrhea and abdominal pain.

- The goals of treatment for IBD include rest the bowel, control the inflammation, combat infection, correct malnutrition, alleviate stress, provide symptomatic relief, and improve quality of life.

- Nutritional problems are especially common with Crohn's disease when the terminal ileum is involved.

- The following five major classes of medications are used to treat IBD:
  - Aminosalicylates
  - Antimicrobials
  - Corticosteroids
  - Immunosuppressants
  - Biologic therapy
- Surgery is indicated if the patient with IBD fails to respond to treatment; exacerbations are frequent and debilitating; massive bleeding, perforation, strictures, and/or obstruction occur; tissue changes suggest that dysplasia is occurring; or carcinoma develops.

- During an acute exacerbation of IBD, nursing care is focused on hemodynamic stability, pain control, fluid and electrolyte balance, and nutritional support.

- Nurses and other team members can assist patients to accept the chronicity of IBD and learn strategies to cope with its recurrent, unpredictable nature.

Intestinal Obstruction

- The causes of **intestinal obstruction** can be classified as mechanical or nonmechanical.

- Intestinal obstruction can be a life-threatening problem.

- Cancer is the most common cause of large bowel obstruction, followed by volvulus and diverticular disease.

- Emergency surgery is performed if the bowel is strangulated, but many bowel obstructions resolve with conservative treatment.

- With a bowel obstruction, there is retention of fluid in the intestine and peritoneal cavity, which can result in a severe reduction in circulating blood volume and lead to hypotension and hypovolemic shock.

Polyps

- Adenomatous polyps are characterized by neoplastic changes in the epithelium and are closely linked to colorectal adenocarcinoma.

- Familial adenomatous polyposis (FAP) is the most common hereditary polyp disease.

Colorectal Cancer

- Colorectal cancer is the third most common form of cancer and the second leading cause of cancer-related deaths in the United States.

- Most people with colorectal cancer have hematochezia (passage of blood through rectum) or melena (black, tarry stools), abdominal pain, and/or changes in bowel habits.

- The American Cancer Society recommends that a person who has no established risk factors should have a fecal occult blood test (FOBT) or a fecal immunochemical test (FIT) yearly, a double-contrast enema every 5 years, a sigmoidoscopy every 5 years, or a colonoscopy every 10 years starting at age 50.

- Colonoscopy is the gold standard for colorectal cancer screening.

- Surgery for a rectal cancer may include an abdominal-perineal resection. Potential complications of abdominal-perineal resection include delayed wound healing, hemorrhage, persistent perineal sinus tracts, infections, and urinary tract and sexual dysfunctions.

- Chemotherapy is used both as an adjuvant therapy following colon resection and as primary treatment for nonresectable colorectal cancer.

- The goals for the patient with colorectal cancer include normal bowel elimination patterns, quality of life appropriate to disease progression, relief of pain, and feelings of comfort and well-being.

- Psychologic support for the patient with colorectal cancer and family is important. The recovery period is long, and the cancer could return.

- An **ostomy** is used when the normal elimination route is no longer possible.

- The two major aspects of nursing care for the patient undergoing ostomy surgery are (1) emotional support as the patient copes with a radical change in body image, and (2) patient teaching about the many aspects of **stoma** care and the ostomy.

- Bowel preparations are used to empty the intestines before surgery to decrease the chance of a postoperative infection caused by bacteria in the feces.

- Postoperative nursing care includes assessment of the stoma and provision of an appropriate pouching system that protects the skin and contains drainage and odor.

- The patient should be able to perform a pouch change, provide appropriate skin care, control odor, care for the stoma, and identify signs and symptoms of complications.

- Colostomy irrigations are used to stimulate emptying of the colon in order to achieve a regular bowel pattern. If control is achieved, there should be little or no spillage between irrigations.

- The patient with an **ileostomy** should be observed for signs and symptoms of fluid and electrolyte imbalance, particularly potassium, sodium, and fluid deficits.

- Bowel surgery can disrupt nerve and vascular supply to the genitals. Radiation therapy, chemotherapy, and medications can also alter sexual function.

- Concerns of people with stomas include the ability to resume sexual activity, altering clothing styles, the effect on daily activities, sleeping while wearing a pouch, passing gas, the presence of odor, cleanliness, and deciding when or if to tell others about the stoma.

Diverticular Disease

- Diverticular disease covers a spectrum from asymptomatic, uncomplicated diverticulosis to diverticulitis with complications such as perforation, abscess, fistula, and bleeding.

- Diverticular disease is a common disorder that affects 5% of the U.S. population by age 40 years and 50% by age 80 years.

- The majority of patients with diverticular disease are asymptomatic.

- Symptomatic diverticular disease can be further broken down into the following:
    - Painful diverticular disease
    - Diverticulitis (inflammation of the diverticuli)

- Complications of diverticulitis include perforation with peritonitis.

- A high-fiber diet, mainly from fruits and vegetables, and decreased intake of fat and red meat are recommended for preventing diverticular disease.

HERNIA

- A **hernia** is a protrusion of a viscus through an abnormal opening or a weakened area in the wall of the cavity in which it is normally contained.

- If the hernia becomes strangulated, the patient will experience severe pain and symptoms of a bowel obstruction, such as vomiting, cramping abdominal pain, and distention.

MALABSORPTION SYNDROME

- Malabsorption results from impaired absorption of fats, carbohydrates, proteins, minerals, and vitamins.

- Causes of malabsorption include the following:
    - Biochemical or enzyme deficiencies
    - Bacterial proliferation
    - Disruption of small intestine mucosa
    - Disturbed lymphatic and vascular circulation
    - Surface area loss

Celiac Disease

- Three factors necessary for the development of **celiac disease** (gluten intolerance) are genetic predisposition, gluten ingestion, and an immune-mediated response.

- Early diagnosis and treatment of celiac disease can prevent complications such as cancer (e.g., intestinal lymphoma), osteoporosis, and possibly other autoimmune diseases.

- Celiac disease is treated with lifelong avoidance of dietary gluten. Wheat, barley, oats, and rye products must be avoided.

LACTASE DEFICIENCY

- The symptoms of lactose intolerance include bloating, flatulence, cramping abdominal pain, and diarrhea. They usually occur within 30 minutes to several hours after drinking a glass of milk or ingesting a milk product.

- Treatment consists of eliminating lactose from the diet by avoiding milk and milk products and/or replacement of lactase with commercially available preparations.

Other Lower GI Disorders

- **Short bowel syndrome** (SBS) results from surgical resection, congenital defect, or disease-related loss of absorption.
    - SBS is characterized by failure to maintain protein-energy, fluid, electrolyte and micronutrient balances on a standard diet.
    - The length and portions of small bowel resected are associated with the number and severity of symptoms. Short bowel syndrome is characterized by failure to maintain protein-energy, fluid, electrolyte, and micronutrient balances on a standard diet.

- **Hemorrhoids** are dilated hemorrhoidal veins. They may be *internal* (occurring above the internal sphincter) or *external* (occurring outside the external sphincter). Nursing management for the patient with hemorrhoids includes teaching measures to prevent constipation, avoidance of prolonged standing or sitting, proper use of over-the-counter (OTC) drugs, and the need to seek medical care for severe symptoms of hemorrhoids (e.g., excessive pain and bleeding, prolapsed hemorrhoids) when necessary.

- An **anal fissure** is a skin ulcer or a crack in the lining of the anal wall that is caused by trauma, local infection, or inflammation.

- A **pilonidal sinus** is a small tract under the skin between the buttocks in the sacrococcygeal area. Nursing care for the patient with a pilonidal cyst or abscess includes warm, moist heat applications.

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Key Points

Chapter 44: Nursing Management: Liver, Pancreas, and Biliary Tract Problems

JAUNDICE

- **Jaundice,** a yellowish discoloration of body tissues, results from an alteration in normal bilirubin metabolism or flow of bile into the hepatic or biliary duct systems.

- The three types of jaundice are hemolytic, hepatocellular, and obstructive.
    - Hemolytic (prehepatic) jaundice is due to an increased breakdown of red blood cells (RBCs), which produces an increased amount of unconjugated bilirubin in the blood.
    - Hepatocellular (hepatic) jaundice results from the liver's altered ability to take up bilirubin from the blood or to conjugate or excrete it.
    - Obstructive (posthepatic) jaundice is due to decreased or obstructed flow of bile through the liver or biliary duct system.

HEPATITIS

- **Hepatitis** is an inflammation of the liver. Viral hepatitis is the most common cause of hepatitis. The types of viral hepatitis are A, B, C, D, E, and G.

- ***Hepatitis A***
    - HAV is an RNA virus that is transmitted through the fecal-oral route.
    - The mode of transmission of HAV is mainly transmitted by ingestion of food or liquid infected with the virus and rarely parenteral.

- ***Hepatitis B***
    - HBV is a DNA virus that is transmitted perinatally by mothers infected with HBV; percutaneously (e.g., IV drug use); or horizontally by mucosal exposure to infectious blood, blood products, or other body fluids.
    - HBV is a complex structure with three distinct antigens: the surface antigen (HBsAg), the core antigen (HBcAg), and the e antigen (HBeAg).
    - Approximately 6% of those infected when older than age 5 develop chronic HBV.

- ***Hepatitis C***
    - HCV is an RNA virus that is primarily transmitted percutaneously.
    - The most common mode of HCV transmission is the sharing of contaminated needles and paraphernalia among IV drug users.
    - There are 6 genotypes and more than 50 subtypes of HCV.

- ***Hepatitis D, E, G***

  - Hepatitis D virus (HDV) is an RNA virus that cannot survive on its own. It requires HBV to replicate.
  - Hepatitis E virus (HEV) is an RNA virus that is transmitted by the fecal-oral route.
  - Hepatitis G virus (HGV) is a sexually transmitted virus. HGV coexists with other viral infections, including HBV, HCV, and HIV.

- Clinical manifestations:
  - Many patients with hepatitis have no symptoms.
  - Symptoms of the acute phase include malaise, anorexia, fatigue, nausea, occasional vomiting, and abdominal (right upper quadrant) discomfort. Physical examination may reveal hepatomegaly, lymphadenopathy, and sometimes splenomegaly.

- Many HBV infections and the majority of HCV infections result in chronic (lifelong) viral infection.

- Most patients with acute viral hepatitis recover completely with no complications.

- Approximately 75% to 85% of patients who acquire HCV will go on to develop chronic infection.

- Fulminant viral hepatitis results in severe impairment or necrosis of liver cells and potential liver failure.

- There is no specific treatment or therapy for acute viral hepatitis.

- Drug therapy for chronic HBV and HBC is focused on decreasing the viral load, aspartate aminotransferase (AST) and aspartate aminotransferase (ALT) levels, and the rate of disease progression.
  - Chronic HBV drugs include interferon, lamivudine (Epivir), adefovir (Hepsera), entecavir (Baraclude), and telbivudine (Tyzeka).
  - Treatment for HCV includes pegylated α-interferon (Peg-Intron, Pegasys) given with ribavirin (Rebetol, Copegus).

- Both hepatitis A vaccine and immune globulin (IG) are used for prevention of hepatitis A.

- Immunization with HBV vaccine is the most effective method of preventing HBV infection. For postexposure prophylaxis, the vaccine and hepatitis B immune globulin (HBIG) are used.

- Currently there is no vaccine to prevent HCV.

- Most patients with viral hepatitis will be cared for at home, so the nurse must assess the patient's knowledge of nutrition and provide the necessary dietary teaching.

AUTOIMMUNE HEPATITIS

- Autoimmune hepatitis is a chronic inflammatory disorder of unknown cause. It is characterized by the presence of autoantibodies, high levels of serum immunoglobulins, and frequent association with other autoimmune diseases.

- Autoimmune hepatitis (in which there is evidence of necrosis and cirrhosis) is treated with corticosteroids or other immunosuppressive agents.

WILSON'S DISEASE

- **Wilson's disease** is a progressive, familial, terminal neurologic disease accompanied by chronic liver disease leading to cirrhosis.

- It is associated with increased storage of copper.

PRIMARY BILIARY CIRRHOSIS

- Primary biliary cirrhosis (PBC) is characterized by generalized pruritus, hepatomegaly, and hyperpigmentation of the skin.

NONALCOHOLIC FATTY LIVER DISEASE

- **Nonalcoholic fatty liver disease** (NAFLD) is a group of disorders that is characterized by hepatic steatosis (accumulation of fat in the liver) that is not associated with other causes such as hepatitis, autoimmune disease, or alcohol.

- The risk for developing NAFLD is a major complication of obesity. NAFLD can progress to liver cirrhosis.

- NAFLD should be considered in patients with risk factors such as obesity, diabetes, hypertriglyceridemia, severe weight loss (especially in those whose weight loss was recent), and syndromes associated with insulin resistance.

CIRRHOSIS

- **Cirrhosis** is a chronic progressive disease characterized by extensive degeneration and destruction of the liver parenchymal cells.

- Common causes of cirrhosis include alcohol, malnutrition, hepatitis, biliary obstruction, and right-sided heart failure. Excessive alcohol ingestion is the single most common cause of cirrhosis followed by chronic hepatitis (B and C).

- Manifestations of cirrhosis include jaundice, skin lesions (**spider angiomas**), hematologic problems (thrombocytopenia, leucopenia, anemia, coagulation disorders), endocrine problems, and peripheral neuropathy.

- Major complications of cirrhosis include **portal hypertension, esophageal and gastric varices,** peripheral edema and **ascites,** hepatic encephalopathy, and **hepatorenal syndrome.**
    - **Hepatic encephalopathy** is a neuropsychiatric manifestation of liver damage. It is considered a terminal complication in liver disease.
    - A characteristic symptom of hepatic encephalopathy is **asterixis** (flapping tremors).

- Diagnostic tests for cirrhosis include elevations in liver enzymes, decreased total protein, fat metabolism abnormalities, and liver biopsy.

- There is no specific therapy for cirrhosis. Management of ascites is focused on sodium restriction, diuretics, and fluid removal.
    - Peritoneovenous shunt is a surgical procedure that provides continuous reinfusion of ascitic fluid into the venous system.
    - The main therapeutic goal for esophageal and gastric varices is avoidance of bleeding and hemorrhage.
    - Transjugular intrahepatic portosystemic shunt (TIPS) is a nonsurgical procedure in which a tract (shunt) between the systemic and portal venous systems is created to redirect portal blood flow.
    - Management of hepatic encephalopathy is focused on reducing ammonia formation and treating precipitating causes.

- An important nursing focus is the prevention and early treatment of cirrhosis.

- If the patient has esophageal and/or gastric varices in addition to cirrhosis, the nurse observes for any signs of bleeding from the varices (e.g., hematemesis, melena).

- The focus of nursing care of the patient with hepatic encephalopathy is on maintaining a safe environment, sustaining life, and assisting with measures to reduce the formation of ammonia.

- **Fulminant hepatic failure,** or acute liver failure, is a clinical syndrome characterized by severe impairment of liver function associated with hepatic encephalopathy.

LIVER TRANSPLANTATION

- Indications for liver transplant include chronic viral hepatitis, congenital biliary abnormalities (biliary atresia), inborn errors of metabolism, hepatic malignancy (confined to the liver), sclerosing cholangitis, fulminant hepatic failure, and chronic end-stage liver disease.

- Postoperative complications of liver transplant include rejection and infection.

- The patient who has had a liver transplant requires highly skilled nursing care.

ACUTE PANCREATITIS

- **Acute pancreatitis** is an acute inflammatory process of the pancreas. The primary etiologic factors are biliary tract disease (most common cause in women) and alcoholism (most common cause in men).

- Abdominal pain usually located in the left upper quadrant is the predominant symptom of acute pancreatitis. Other manifestations include nausea, vomiting, hypotension, tachycardia, and jaundice.

- Two significant local complications of acute pancreatitis are pseudocyst and abscess. A pancreatic **pseudocyst** is a cavity continuous with or surrounding the outside of the pancreas.

- The primary diagnostic tests for acute pancreatitis are serum amylase and lipase.

- Objectives of collaborative care for acute pancreatitis include relief of pain; prevention or alleviation of shock; reduction of pancreatic secretions; control of fluid and electrolyte imbalances; prevention or treatment of infections; and removal of the precipitating cause.

- Because hypocalcemia can also occur, the nurse must observe for symptoms of tetany, such as jerking, irritability, and muscular twitching.

CHRONIC PANCREATITIS

- **Chronic pancreatitis** is a continuous, prolonged, inflammatory, and fibrosing process of the pancreas. The pancreas becomes progressively destroyed as it is replaced with fibrotic tissue. Strictures and calcifications may also occur in the pancreas.

- Clinical manifestations of chronic pancreatitis include abdominal pain, symptoms of pancreatic insufficiency, including malabsorption with weight loss, constipation, mild jaundice with dark urine, steatorrhea, and diabetes mellitus.

- Measures used to control the pancreatic insufficiency include diet, pancreatic enzyme replacement, and control of the diabetes.

PANCREATIC CANCER

- The majority of pancreatic cancers have metastasized at the time of diagnosis. The signs and symptoms of pancreatic cancer are often similar to those of chronic pancreatitis.

- Transabdominal ultrasound and CT scan are the most commonly used diagnostic imaging techniques for pancreatic diseases, including cancer.

- Surgery provides the most effective treatment of cancer of the pancreas; however, only 15% to 20% of patients have resectable tumors.

GALLBLADDER DISORDERS

- The most common disorder of the biliary system is **cholelithiasis** (stones in the gallbladder). **Cholecystitis** (inflammation of the gallbladder) is usually associated with cholelithiasis.
- Ultrasonography is commonly used to diagnose gallstones.
- Medical dissolution therapy is recommended for patients with small radiolucent stones who are mildly symptomatic and are poor surgical risks.
- Cholelithiasis develops when the balance that keeps cholesterol, bile salts, and calcium in solution is altered and precipitation occurs. Ultrasonography is commonly used to diagnose gallstones.
- Initial symptoms of acute cholecystitis include indigestion and pain and tenderness in the right upper quadrant.
- Complications of cholecystitis include gangrenous cholecystitis, subphrenic abscess, pancreatitis, cholangitis (inflammation of biliary ducts), biliary cirrhosis, fistulas, and rupture of the gallbladder, which can produce bile peritonitis.
- Postoperative nursing care following a laparoscopic cholecystectomy includes monitoring for complications such as bleeding, making the patient comfortable, and preparing the patient for discharge.
- The nurse should assume responsibility for recognition of predisposing factors of gallbladder disease in general health screening.

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Key Points

Chapter 45: Nursing Assessment: Urinary System

STRUCTURES AND FUNCTIONS

- The urinary system consists of two kidneys, two ureters, a urinary bladder, and a urethra.
- The bladder provides storage, and the ureters and urethra are the drainage channels for the urine after it is formed by the kidneys.

Kidneys

- The primary functions of the kidneys are (1) to regulate the volume and composition of extracellular fluid (ECF), and (2) to excrete waste products from the body.

- The kidneys function to control blood pressure, produce erythropoietin, activate vitamin D, and regulate acid-base balance.
- The outer layer of the kidney is termed the *cortex,* and the inner layer is called the *medulla.*
- The **nephron** is the functional unit of the kidney. Each kidney contains 800,000 to 1.2 million nephrons.
- A nephron is composed of a glomerulus, Bowman's capsule, and a tubular system. The tubular system consists of the proximal convoluted tubule, the loop of Henle, the distal convoluted tubule, and a collecting tubule.
- The kidneys receive 20% to 25% of cardiac output.
- The primary function of the kidneys is to filter the blood and maintain the body's internal homeostasis.
- Urine formation is the result of a multistep process of filtration, reabsorption, secretion, and excretion of water, electrolytes, and metabolic waste products.

Glomerular Function

- Blood is filtered in the **glomerulus.**
- The hydrostatic pressure of the blood within the glomerular capillaries causes a portion of blood to be filtered across the semipermeable membrane into Bowman's capsule.
- The ultrafiltrate is similar in composition to blood except that it lacks blood cells, platelets, and large plasma proteins.
- The amount of blood filtered by the glomeruli in a given time is termed the **glomerular filtration rate** (GFR). The normal GFR is about 125 ml/min.

Tubular Function

- The functions of the tubules and collecting ducts include reabsorption and secretion. *Reabsorption* is the passage of a substance from the lumen of the tubules through the tubule cells and into the capillaries. *Tubular secretion* is the passage of a substance from the capillaries through the tubular cells into the lumen of the tubule.
    - The loop of Henle is important in conserving water and thus concentrating the filtrate. In the loop of Henle, reabsorption continues.
    - Two important functions of the distal convoluted tubules are final regulation of water balance and acid-base balance.
        - Antidiuretic hormone (ADH) is required for water reabsorption in the kidney.

        - Aldosterone acts on the distal tubule to cause reabsorption of sodium ions (Na^+) and water. In exchange for Na^+, potassium ions (K^+) are excreted.
    - Acid-base regulation involves reabsorbing and conserving most of the bicarbonate (HCO_3^-) and secreting excess H^+.
    - Atrial natriuretic peptide (ANP) acts on the kidneys to increase sodium excretion.
    - Parathyroid hormone (PTH) acts on renal tubules to increase reabsorption of calcium.

Other Functions of the Kidney

- The kidneys produce erythropoietin in response to hypoxia and decreased renal blood flow. Erythropoietin stimulates the production of red blood cells (RBCs) in the bone marrow.

- Vitamin D is activated in kidneys. Vitamin D is important for calcium balance and bone health.

- Renin, which is produced and secreted by juxtaglomerular cells, is important in the regulation of blood pressure.

- Prostaglandin (PG) synthesis (primarily PGE_2 and PGI_2) occurs in the kidney, primarily in the medulla. These PGs have a vasodilating action, thus increasing renal blood flow and promoting Na^+ excretion.

Ureters

- The ureters are tubes that carry urine from the renal pelvis to the bladder.

- Circular and longitudinal smooth muscle fibers, arranged in a meshlike outer layer, contract to promote the peristaltic one-way flow of urine.

Bladder

- The urinary bladder is a distensible organ positioned behind the symphysis pubis and anterior to the vagina and rectum.

- Its primary functions are to serve as a reservoir for urine and to help the body eliminate waste products.

- Normal adult urine output is approximately 1500 ml/day, which varies with food and fluid intake.

- On the average, 200 to 250 ml of urine in the bladder causes moderate distention and the urge to urinate.

Urethra

- The urethra is a small muscular tube that leads from the bladder neck to the external meatus.

- The primary function of the urethra is to serve as a conduit for urine from the bladder neck to outside the body during voiding.

- The female urethra is significantly shorter than that of the male.

Urethrovesical Unit

- Together, the bladder, urethra, and pelvic floor muscles form the urethrovesical unit. It receives neuronal input from the autonomic nervous system.

- Normal voluntary control of this unit is defined as *continence.*

- Any disease or trauma that affects function of the brain, spinal cord, or nerves that directly innervate the bladder, bladder neck, external sphincter, or pelvic floor can affect bladder function.

Effects of Aging on the Urinary System

- By the seventh decade of life, 30% to 50% of glomeruli have lost their function.

- Atherosclerosis has been found to accelerate the decrease of renal size with age.

- Older individuals maintain body fluid homeostasis unless they encounter diseases or other physiologic stressors.

ASSESSMENT

- Subjective data:
    - Past health history
    - The patient is asked about the presence or history of diseases that are related to renal or urologic problems. Diseases include hypertension, diabetes mellitus, gout and other metabolic problems, connective tissue disorders (e.g., systemic lupus erythematosus), skin or upper respiratory infections of streptococcal origin, tuberculosis, hepatitis, congenital disorders, neurologic conditions (e.g., stroke), or trauma.
    - Medications: an assessment of the patient's current and past use of medications is important. This should include over-the-counter drugs, prescription medications, and herbs. Many drugs are known to be nephrotoxic.
    - Surgery or other treatments: the patient is asked about any previous hospitalizations related to renal or urologic diseases and all urinary problems during past pregnancies. Past surgeries, particularly pelvic surgeries, or urinary tract instrumentation is documented.

- Objective data:
    - Physical examination

- Inspection: the nurse should assess for changes in the following:
  - Skin: pallor, yellow-gray cast, excoriations, changes in turgor, bruises, texture (e.g., rough, dry skin)
  - Mouth: stomatitis, ammonia breath odor
  - Face and extremities: generalized edema, peripheral edema, bladder distention, masses, enlarged kidneys
  - Abdomen: striae, abdominal contour for midline mass in lower abdomen (may indicate urinary retention) or unilateral mass (occasionally seen in adult, indicating enlargement of one or both kidneys from large tumor or polycystic kidney)
  - Weight: weight gain secondary to edema; weight loss and muscle wasting in renal failure
  - General state of health: fatigue, lethargy, and diminished alertness

- Palpation: A landmark useful in locating the kidneys is the **costovertebral angle** (CVA) formed by the rib cage and the vertebral column.
  - The normal-size kidney is usually not palpable.
  - If the kidney is palpable, its size, contour, and tenderness should be noted. Kidney enlargement is suggestive of neoplasm or other serious renal pathologic condition.
  - The urinary bladder is normally not palpable unless it is distended with urine.

- Percussion: Tenderness in the flank area may be detected by fist percussion (kidney punch).
  - Normally a firm blow in the flank area should not elicit pain.
  - Normally a bladder is not percussible until it contains 150 ml of urine. If the bladder is full, dullness is heard above the symphysis pubis. A distended bladder may be percussed as high as the umbilicus.

- Auscultation: With a stethoscope the abdominal aorta and renal arteries are auscultated for a *bruit* (an abnormal murmur), which indicates impaired blood flow to the kidneys.

DIAGNOSTIC STUDIES

- Urine studies:
  - **Urinalysis.** This test may provide information about possible abnormalities, indicate what further studies need to be done, and supply information on the progression of a diagnosed disorder.
  - Creatinine clearance. Because almost all **creatinine** in the blood is normally excreted by the kidneys, creatinine clearance is the most accurate indicator of renal function. The result of a creatinine clearance test closely approximates that of the GFR.
  - Urodynamic tests study the storage of urine within the bladder and the flow of urine through the urinary tract to the outside of the body.

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Key Points

Chapter 46: Nursing Management: Renal and Urologic Problems

URINARY TRACT INFECTIONS

- Urinary tract infections (UTIs) are the second most common bacterial disease, and the most common bacterial infection in women.
- UTIs include cystitis, pyelonephritis, and urethritis.
- Risk factors for UTIs include pregnancy, menopause, instrumentation, and sexual intercourse. *Escherichia coli (E. coli*) is the most common pathogen causing a UTI.
- UTIs that are hospital-acquired are called *nosocomial infections*.
- UTI symptoms include dysuria, frequent urination (more than every 2 hours), urgency, and suprapubic discomfort or pressure. Flank pain, chills, and the presence of a fever indicate an infection involving the upper urinary tract (pyelonephritis).
- UTIs are diagnosed by dipstick urinalysis to identify the presence of nitrites (indicating bacteriuria), WBCs, and leukocyte esterase (an enzyme present in WBCs indicating pyuria). A voided midstream technique yielding a clean-catch urine sample is preferred.
- Trimethoprim-sulfamethoxazole (TMP-SMX) or nitrofurantoin (Macrodantin) is often used to empirically treat uncomplicated or initial UTIs. Additional drugs may be used to relieve discomfort.
- Health promotion activities include teaching preventive measures such as (1) emptying the bladder regularly and completely, (2) evacuating the bowel regularly, (3) wiping the perineal area from front to back after urination and defecation, and (4) drinking an adequate amount of liquid each day.

PYELONEPHRITIS

- **Pyelonephritis** is an inflammation of the renal parenchyma and collecting system (including the renal pelvis). The most common cause is bacterial infection which begins in the lower urinary tract. Recurring infection can result in *chronic pyelonephritis.*
- Clinical manifestations vary from mild fatigue to the sudden onset of chills, fever, vomiting, malaise, flank pain, and the lower UTI characteristics.

- Interventions include teaching about the disease process with emphasis on (1) the need to continue drugs as prescribed, (2) the need for a follow-up urine culture to ensure proper management, and (3) identification of risk for recurrence or relapse.

INTERSTITIAL CYSTITIS

- **Interstitial cystitis** (IC) is a chronic, painful inflammatory disease of the bladder characterized by symptoms of urgency/frequency and pain in the bladder and/or pelvis.

IMMUNOLOGIC DISORDERS OF THE KIDNEY

Glomerulonephritis

- Immunologic processes involving the urinary tract predominantly affect the renal glomerulus (**glomerulonephritis**).

- Clinical manifestations of glomerulonephritis include varying degrees of hematuria (ranging from microscopic to gross) and urinary excretion of various formed elements, including RBCs, WBCs, proteins, and casts.

- *Acute poststreptococcal glomerulonephritis* (APSGN) develops 5 to 21 days after an infection of the tonsils, pharynx, or skin (e.g., streptococcal sore throat, impetigo) by nephrotoxic strains of group A β-hemolytic streptococci. Manifestations include generalized body edema, hypertension, oliguria, hematuria with a smoky or rusty appearance, and proteinuria.

- APSGN management focuses on symptomatic relief. This includes rest, edema and hypertension management, and dietary protein restriction when an increase in nitrogenous wastes (e.g., elevated BUN value) is present.

- One of the most important ways to prevent the development of APSGN is to encourage early diagnosis and treatment of sore throats and skin lesions.

- **Goodpasture syndrome** is a rare autoimmune disease characterized by the presence of circulating antibodies against glomerular and alveolar basement membrane.

- *Rapidly progressive glomerulonephritis* (RPGN) is glomerular disease associated with acute renal failure where there is rapid, progressive loss of renal function over days to weeks.

- *Chronic glomerulonephritis* is a syndrome that reflects the end stage of glomerular inflammatory disease. It is characterized by proteinuria, hematuria, and development of uremia. Treatment is supportive and symptomatic.

- **Nephrotic syndrome** results when the glomerulus is excessively permeable to plasma protein, causing proteinuria that leads to low plasma albumin and tissue edema.

- Nephrotic syndrome is associated with systemic illness such as diabetes or systemic lupus erythematosus.
- Treatment is focused on symptom management.
- The major nursing interventions for a patient with nephrotic syndrome are related to edema. Edema is assessed by weighing the patient daily, accurately recording intake and output, and measuring abdominal girth or extremity size.

OBSTRUCTIVE UROPATHIES

Urinary Stones

- Factors involved in the development of urinary stones include metabolic, dietary, genetic, climatic, lifestyle, and occupational influences. Other factors are obstruction with urinary stasis and urinary tract infection.

- The five major categories of stones (*lithiasis*) are (1) calcium phosphate, (2) calcium oxalate, (3) uric acid, (4) cystine, and (5) struvite.

- Urinary stones cause clinical manifestations when they obstruct urinary flow. Common sites of complete obstruction are at the UPJ (the point where the ureter crosses the iliac vessels) and at the ureterovesical junction (UVJ).

- Management of a patient with renal lithiasis consists of treating the symptoms of pain, infection, or obstruction.

- **Lithotripsy** is used to eliminate calculi from the urinary tract. Outcome for lithotripsy is based on stone size, stone location, and stone composition.

- The goals are that the patient with urinary tract calculi will have (1) relief of pain, (2) no urinary tract obstruction, and (3) an understanding of measures to prevent further recurrence of stones.

- To prevent stone recurrence, the patient should consume an adequate fluid intake to produce a urine output of approximately 2 L/day. Additional preventive measures focus on reducing metabolic or secondary risk factors.

Urethral Stricture

- A **stricture** is a narrowing of the lumen of the ureter or urethra. Ureteral strictures can affect the entire length of the ureter.

- A *urethral stricture* is the result of fibrosis or inflammation of the urethral lumen.
  - Causes of urethral strictures include trauma, urethritis, iatrogenic, or a congenital defect.
  - Clinical manifestations associated with a urethral stricture include a diminished force of the urinary stream, straining to void, sprayed stream, postvoid dribbling, or a split urine stream.

RENAL VASCULAR PROBLEMS

- Vascular problems involving the kidney include (1) nephrosclerosis, (2) renal artery stenosis, and (3) renal vein thrombosis.

- **Renal artery stenosis** is a partial occlusion of one or both renal arteries and their major branches due to atherosclerotic narrowing. The goals of therapy are control of BP and restoration of perfusion to the kidney.

HEREDITARY RENAL DISEASES

- **Polycystic kidney disease** (PKD) is the most common life-threatening genetic disease. It is characterized by cysts that enlarge and destroy surrounding tissue by compression.

- Diagnosis is based on clinical manifestations, family history, IVP, ultrasound (best screening measure), or CT scan.

RENAL INVOLVEMENT IN METABOLIC AND CONNECTIVE TISSUE DISEASES

- Diabetic nephropathy is the primary cause of end-stage renal failure in the United States. Diabetes mellitus affects the kidneys by causing microangiopathic changes.

- Systemic sclerosis (scleroderma) is a disease of unknown etiology characterized by widespread alterations of connective tissue and by vascular lesions in many organs.

- Gout, a syndrome of acute attacks of arthritis caused by hyperuricemia, can also result in significant renal disease.

- Systemic lupus erythematosus is a connective tissue disorder characterized by the involvement of several tissues and organs, particularly the joints, skin, and kidneys. It results in clinical manifestations similar to glomerulonephritis.

URINARY TRACT TUMORS

- **Kidney cancer:**
  - There are no early symptoms of kidney cancer. Many patients with kidney cancer go undetected.
  - Diagnostic tests include IVP with nephrotomography, ultrasound, percutaneous needle aspiration, CT, and MRI.

- **Bladder cancer:**
  - Risk factors for bladder cancer include cigarette smoking, exposure to dyes used in the rubber and cable industries, chronic abuse of phenacetin-containing analgesics, and chronic, recurrent renal calculi
  - Microscopic or gross, painless hematuria (chronic or intermittent) is the most common clinical finding with bladder cancer.
  - Surgical therapies for bladder cancer include transurethral resection with fulguration, laser photocoagulation, and open loop resection.

- Postoperative management following bladder cancer surgery includes instructions to drink a large volume of fluid each day for the first week following the procedure and to avoid intake of alcoholic beverages.
- Intravesical therapy is chemotherapy that is locally instilled. Chemotherapeutic or immune-stimulating agents can be delivered directly into the bladder by a urethral catheter. BCG is the treatment of choice for carcinoma in situ.

URINARY INCONTINENCE AND RETENTION

- **Urinary incontinence** (UI) is an uncontrolled leakage of urine. The prevalence of incontinence is higher among older women and older men, but it is not a natural consequence of aging.

- Causes of UI include confusion or depression, infection, atrophic vaginitis, urinary retention, restricted mobility, fecal impaction, or drugs.

- **Urinary retention** is the inability to empty the bladder despite micturition or the accumulation of urine in the bladder because of an inability to urinate.

- Urinary retention is caused by two different dysfunctions of the urinary system: bladder outlet obstruction and deficient detrusor (bladder muscle) contraction strength.

- Evaluation for UI and urinary retention includes a focused history, physical assessment, and a bladder log or voiding record whenever possible.

- Management strategies for UI include lifestyle interventions such as an adequate volume of fluids and reduction or elimination of bladder irritants from the diet. Behavioral treatments include scheduled voiding regimens (timed voiding, habit training, and prompted voiding), bladder retraining, and pelvic floor muscle training.

- *Acute urinary retention* is a medical emergency that requires prompt recognition and bladder drainage.

- Short-term urinary catheterization may be performed to obtain a urine specimen for laboratory analysis. Complications from long-term use (>30 days) of indwelling catheters include bladder spasms, periurethral abscess, pain, and urosepsis.

- While the patient has a catheter in place, nursing actions should include maintaining patency of the catheter, managing fluid intake, providing for the comfort and safety of the patient, and preventing infection.

- The ureteral catheter is placed through the ureters into the renal pelvis. The catheter is inserted either (1) by being threaded up the urethra and bladder to the ureters under cystoscopic observation, or (2) by surgical insertion through the abdominal wall into the ureters.

- The suprapubic catheter is used in temporary situations such as bladder, prostate, and urethral surgery. The suprapubic catheter is also used long term in selected patients.

SURGERY OF THE URINARY TRACT

- Common indications for nephrectomy include a renal tumor, polycystic kidney disease (PKD) that is bleeding or severely infected, massive traumatic injury to the kidney, and the elective removal of a kidney from a donor. A kidney can be removed by laparoscopic nephrectomy.

- In the immediate postoperative period following renal surgery, urine output should be determined at least every 1 to 2 hours.

- Numerous urinary diversion techniques and bladder substitutes are possible, including an incontinent urinary diversion, a continent urinary diversion catheterized by the patient, or an orthotopic bladder so that the patient voids urethrally.

- Common peristomal skin problems associated with an **ileal conduit** include dermatitis, yeast infections, product allergies, and shearing-effect excoriations.

- Discharge planning after an ileal conduit includes teaching the patient symptoms of obstruction or infection and care of the ostomy.

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Key Points

Chapter 47: Nursing Management: Acute Renal Failure and Chronic Kidney Disease

- *Renal failure* is the partial or complete impairment of kidney function resulting in an inability to excrete metabolic waste products and water.

- Renal failure causes functional disturbances of all body systems.

- Renal failure is classified as acute or chronic.

ACUTE RENAL FAILURE (ARF)

- **Acute renal failure** (ARF) usually develops over hours or days with progressive elevations of blood urea nitrogen (BUN), creatinine, and potassium with or without **oliguria.** It is a clinical syndrome characterized by a rapid loss of renal function with progressive **azotemia.**

- ARF is often associated with oliguria (a decrease in urinary output to <400 ml/day).

- The causes of ARF are multiple and complex. They are categorized according to similar pathogenesis into prerenal (most common), intrarenal (or intrinsic), and postrenal causes.
  - *Prerenal* causes are factors external to the kidneys (e.g., hypovolemia) that reduce renal blood flow and lead to decreased glomerular perfusion and filtration.
  - *Intrarenal* causes include conditions that cause direct damage to the renal tissue, resulting in impaired nephron function. Causes include prolonged ischemia, nephrotoxins, hemoglobin released from hemolyzed RBCs, or myoglobin released from necrotic muscle cells. **Acute tubular necrosis** (ATN) is an intrarenal condition caused by ischemia, nephrotoxins, or pigments. ATN is potentially reversible if the basement membrane is not destroyed and the tubular epithelium regenerates.
  - *Postrenal* causes involve mechanical obstruction of urinary outflow. Common causes are benign prostatic hyperplasia, prostate cancer, calculi, trauma, and extrarenal tumors.

- Clinically, ARF may progress through four phases: initiating, oliguric, diuretic, and recovery. In some situations, the patient does not recover from ARF and chronic kidney disease (CKD) results, eventually requiring dialysis or a kidney transplant.

Oliguric Phase

- Fluid and electrolyte abnormalities and **uremia** occur during the oliguric phase. The kidneys cannot synthesize ammonia or excrete acid products of metabolism, resulting in acidosis.

- Damaged tubules cannot conserve sodium resulting in normal or below-normal levels of serum sodium. Uncontrolled hyponatremia or water excess can lead to cerebral edema. Fluid intake must be closely monitored.

- Hyperkalemia is a serious complication of ARF. The serum potassium levels increase because the ability of the kidneys to excrete potassium is impaired. Acidosis worsens hyperkalemia as hydrogen ions enter the cells and potassium is driven out of the cells.

- When potassium levels exceed 6 mEq/L (6 mmol/L) or dysrhythmias are identified, treatment must be initiated immediately.

- Hematologic disorders associated with ARF include anemia due to impaired erythropoietin production and platelet abnormalities leading to bleeding from multiple sources.

- A low serum calcium level results from the inability of the kidneys to activate vitamin D. When hypocalcemia occurs, the parathyroid gland secretes parathyroid hormone, which stimulates bone demineralization, thereby releasing calcium from the bones. Phosphate is also released, leading to elevated serum phosphate levels.

- The two most common causes of death in patients with ARF are infection and cardiorespiratory complications.

- The best serum indicator of renal failure is creatinine because it is not significantly altered by other factors.

- Neurologic changes can occur as the nitrogenous waste products increase. Symptoms can include fatigue and difficulty concentrating, later escalating to seizures, stupor, and coma.

Diuretic Phase

- The diuretic phase begins with a gradual increase in daily urine output of 1 to 3 L/day, but may reach 3 to 5 L or more. The nephrons are still not fully functional. The uremia may still be severe, as reflected by low creatinine clearances, elevated serum creatinine and BUN levels, and persistent signs and symptoms.

Recovery Phase

- The recovery phase begins when the GFR increases, allowing the BUN and serum creatinine levels to plateau and then decrease. Renal function may take up to 12 months to stabilize.

Collaborative Management

- Because ARF is potentially reversible, the primary goals of treatment are to eliminate the cause, manage the signs and symptoms, and prevent complications while the kidneys recover.

- Common indications for dialysis in ARF are (1) volume overload; (2) elevated potassium level with ECG changes; (3) metabolic acidosis; (4) significant change in mental status; and (5) pericarditis, pericardial effusion, or cardiac tamponade.

- **Hemodialysis** (HD) is used when rapid changes are required in a short period of time. **Peritoneal dialysis** (PD) is simpler than HD, but it carries the risk of peritonitis, is less efficient in the catabolic patient, and requires longer treatment times. **Continuous renal replacement therapy** (CRRT) may also be used in the treatment of ARF, particularly in those who are hemodynamically unstable.

- Prevention of ARF is primarily directed toward identifying and monitoring high-risk populations, controlling exposure to nephrotoxic drugs and industrial chemicals, and preventing prolonged episodes of hypotension and hypovolemia.

- The patient with ARF is critically ill and suffers not only from the effects of renal disease but also from the effects of comorbid diseases or conditions (e.g., diabetes, cardiovascular disease).

- The nurse has an important role in managing fluid and electrolyte balance during the oliguric and diuretic phases. Observing and recording accurate intake and output and body weight are essential.

- Because infection is the leading cause of death in ARF, meticulous aseptic technique is critical. The nurse should be alert for local manifestations of infection (e.g., swelling, redness, pain) as well as systemic manifestations (e.g., malaise, leukocytosis) because an elevated temperature may not be present.

- Respiratory complications, especially pneumonitis, can be prevented. Humidified oxygen; incentive spirometry; coughing, turning, and deep breathing; and ambulation are measures to help maintain adequate respiratory ventilation.

- Skin care and measures to prevent pressure ulcers should be performed because of edema and decreased muscle tone. Mouth care is important to prevent stomatitis.

- Recovery from ARF is highly variable and depends on the underlying illness, the general condition and age of the patient, the length of the oliguric phase, and the severity of nephron damage. Good nutrition, rest, and activity are necessary. Protein and potassium intake should be regulated in accordance with renal function.

- The long-term convalescence of 3 to 12 months may cause psychosocial and financial hardships for the family, and appropriate counseling, social work, and psychiatrist/psychologist referrals are made as needed. If the kidneys do not recover, the patient will eventually need dialysis or transplantation.

Gerontologic Considerations

- The older adult is more susceptible than the younger adult to ARF as the number of functioning nephrons decreases with age.

- Causes of ARF include dehydration, hypotension, diuretic therapy, aminoglycoside therapy, prostatic hyperplasia, surgery, infection, and radiocontrast agents.

CHRONIC KIDNEY DISEASE

- **Chronic kidney disease** (CKD) involves progressive, irreversible loss of kidney function.

- CKD usually develops slowly over months to years and necessitates the initiation of dialysis or transplantation for long-term survival. The prognosis of CKD is variable depending on the etiology, patient's condition and age, and adequacy of follow-up.

- Uremia is a syndrome that incorporates all the signs and symptoms seen in the various systems throughout the body in CKD.

- In the early stage of renal insufficiency, polyuria results from the inability to concentrate urine. As the GFR decreases, the BUN and serum creatinine levels increase.

- Clinical manifestations of uremia develop. Fatigue, lethargy, and pruritus are often the early symptoms. Hypertension and proteinuria are often the first signs. Hyperglycemia, hyperinsulinemia, and abnormal glucose tolerance tests may be seen.

- Many patients with uremia develop hyperlipidemia, with elevated very-low-density lipoproteins (VLDLs), normal or decreased low-density lipoproteins (LDLs), and decreased high-density lipoproteins (HDLs).

- Hyperkalemia results from the decreased excretion by the kidneys, the breakdown of cellular protein, bleeding, and metabolic acidosis. Potassium may also come from the food consumed, dietary supplements, drugs, and IV infusions.

- Because of impaired sodium excretion, sodium along with water is retained resulting in dilutional hyponatremia. Sodium retention can contribute to edema, hypertension, and heart failure.

- Metabolic acidosis results from the impaired ability to excrete the acid load (primarily ammonia) and from defective reabsorption and regeneration of bicarbonate.

- Normocytic or normochromic anemia is due to decreased production of erythropoietin. The most common cause of bleeding is a qualitative defect in platelet function.

- Infectious complications are common in CKD. Clinical findings include lymphopenia, lymphoid tissue atrophy, decreased antibody production, and suppression of the delayed hypersensitivity response.

- The most common cardiovascular abnormality is hypertension, which is usually present pre-ESRD and is aggravated by sodium retention and increased extracellular fluid volume. Diabetes mellitus is an additional risk factor.

- Cardiac dysrhythmias may result from hyperkalemia, hypocalcemia, and decreased coronary artery perfusion.

- Respiratory changes include Kussmaul respiration, dyspnea from fluid overload, pulmonary edema, uremic pleuritis (pleurisy), pleural effusion, and a predisposition to respiratory infections.

- Neurologic changes are due to increased nitrogenous waste products, electrolyte imbalances, metabolic acidosis, axonal atrophy, and demyelination. Depression of the CNS results in lethargy, apathy, decreased ability to concentrate, fatigue, irritability, and altered mental ability.

- Peripheral neuropathy may result in restless legs syndrome, paresthesias, bilateral footdrop, muscular weakness and atrophy, and loss of deep tendon reflexes.

- The treatment for neurologic problems is dialysis or transplantation. Altered mental status is often the signal that dialysis must be initiated.

- **Renal osteodystrophy** is a syndrome of skeletal changes that is a result of alterations in calcium and phosphate metabolism. *Osteomalacia* is demineralization resulting from slow bone turnover and defective mineralization of newly formed bone. *Osteitis fibrosa cystica* results from decalcification of the bone and replacement of bone tissue with fibrous tissue.

- Pruritus results from a combination of the dry skin, calcium-phosphate deposition in the skin, and sensory neuropathy.

- Both sexes experience infertility and a decreased libido. Sexual dysfunction may also be caused by anemia, peripheral neuropathy, and psychologic problems, physical stress, and side effects of drugs.

- Personality and behavioral changes, emotional lability, withdrawal, depression, fatigue, and lethargy are commonly observed. Changes in body image caused by edema, integumentary disturbances, and access devices lead to further anxiety and depression.

- Adverse outcomes of CKD can often be prevented or delayed through early detection and treatment. First, conservative therapy is attempted before maintenance dialysis begins. Efforts are made to detect and treat potentially reversible causes of renal failure. The progression of CKD can be delayed by controlling hypertension.

- Strategies to reduce serum calcium levels include IV glucose and insulin, IV 10% calcium gluconate, and sodium polystyrene sulfonate (Kayexalate).

- The antihypertensive drugs most commonly used are diuretics (e.g., furosemide [Lasix]), β-adrenergic blockers (e.g., metoprolol [Lopressor]), calcium channel blockers (e.g., nifedipine [Procardia]), angiotensin-converting enzyme inhibitors (e.g., captopril [Capoten]), and angiotensin receptor blocker agents (e.g., losartan [Cozaar]).

- Erythropoietin is used for the treatment of anemia. It can be administered IV or subcutaneously. Statins (HMG-CoA reductase inhibitors) are the most effective drugs for lowering LDL cholesterol levels.

- Drug doses and frequency of administration must be adjusted based on the severity of the kidney disease.

- Dietary protein is restricted because urea nitrogen and creatinine are end products of protein metabolism. Once the patient starts dialysis, protein intake can be increased. Sufficient calories from carbohydrates and fat are needed to minimize catabolism of body protein and to maintain body weight.

- Water intake depends on the daily urine output. Generally, 600 ml (from insensible loss) plus an amount equal to the previous day's urine output is allowed for a patient who is not receiving dialysis. Phosphate should be limited to approximately 1000 mg/day.

- The overall goals are that a patient with CKD will (1) demonstrate knowledge and ability to comply with treatment, (2) participate in decision-making, (3) demonstrate effective coping strategies, and (4) continue with activities of daily living within limitations.

- People at risk for CKD include those with a history (or a family history) of renal disease, hypertension, diabetes mellitus, and repeated urinary tract infection. These individuals should have regular checkups including serum creatinine, BUN, and urinalysis and be advised that any changes in urine appearance, frequency, or volume must be reported to the health care provider.

Dialysis

- **Dialysis** is a technique in which substances move from the blood through a semipermeable membrane and into a dialysis solution (dialysate).
- The two methods of dialysis are **peritoneal dialysis** (PD) and **hemodialysis** (HD).

Peritoneal Dialysis

- Two types of PD are **automated peritoneal dialysis** (APD) and **continuous ambulatory peritoneal dialysis** (CAPD).
    - PD is indicated when there are vascular access problems. The three phases of the PD cycle (called an exchange) are *inflow* (fill), *dwell* (equilibration), and *drain*.
    - The patient dialyzing at home will receive about four exchanges per day. Contraindications for PD are history of multiple abdominal surgeries, recurrent abdominal wall or inguinal hernias, excessive obesity with large fat deposits, preexisting vertebral disease, and severe obstructive pulmonary disease.

- Dialysis solutions have an electrolyte composition similar to that of plasma. Using dry heat, the dialysis solution is warmed to body temperature to increase peritoneal clearance, prevent hypothermia, and enhance comfort.

- CAPD is carried out manually by exchanging 1.5 to 3 L (usually 2 L) of peritoneal dialysate at least 4 times daily, with dwell times of 4 to 10 hours. PD is associated with a short training program, independence, and ease of traveling.

- Infection of the peritoneal catheter exit site is most commonly caused by *Staphylococcus aureus* or *S. epidermidis* (from skin flora). Peritonitis results from contamination of the dialysate or tubing or from progression of an exit site infection.

- Pain is a common complication of PD. A change in the position of the catheter should correct this problem. A decrease in infusion rate may also help. Additional complications include hernias, lower back pain, protein loss, encapsulating sclerosing peritonitis, and bleeding. Atelectasis, pneumonia, and bronchitis may occur from repeated upward displacement of the diaphragm.

Hemodialysis

- The types of vascular access include arteriovenous fistulas (AVFs) and grafts (AVGs), temporary and semipermanent catheters, subcutaneous ports, and shunts.

- Shunts are not frequently used except for the patient with continuous renal replacement therapy (CRRT) because of the numerous complications (e.g., infection, thrombosis).

- An AVF is created most commonly in the forearm with an anastomosis between an artery (usually radial or ulnar) and a vein (usually cephalic). Native fistulas have the best overall patency rates and least number of complications.

- **Arteriovenous grafts** (AVGs) are made of synthetic materials and form a "bridge" between the arterial and venous blood supplies. Grafts are placed under the skin and are surgically anastomosed between an artery (usually brachial) and a vein (usually antecubital).

- BP measurements, insertion of IVs, and venipuncture should never be performed on the affected extremity.

- When immediate vascular access is required, percutaneous cannulation of the internal jugular or femoral vein may be performed.

- Before beginning treatment, the nurse must complete an assessment that includes fluid status (weight, BP, peripheral edema, lung and heart sounds), condition of vascular access, temperature, and general skin condition.

- Hypotension that occurs during HD results from rapid removal of vascular volume, decreased cardiac output, and decreased systemic intravascular resistance. Treatment includes decreasing the volume of fluid being removed and infusion of 0.9% saline solution (100 to 300 ml).

- Painful muscle cramps due to rapid removal of sodium and water are a common problem. Treatment includes reducing the ultrafiltration rate and infusing hypertonic saline or a normal saline bolus.

- The causes of hepatitis B and C (most common) in dialysis patients include blood transfusions or the lack of adherence to precautions used to prevent the spread of infection.

- *Disequilibrium syndrome* develops as a result of very rapid changes in the composition of the extracellular fluid. Manifestations include nausea, vomiting, confusion, restlessness, headaches, twitching and jerking, and seizures.

- Individual adaptation to maintenance HD varies considerably. The primary nursing goals are to help the patient regain or maintain positive self-esteem and control of his or her life and to continue to be productive in society.

Continuous Renal Replacement Therapy

- **Continuous renal replacement therapy** (CRRT) is an alternative or adjunctive treatment.

- Uremic toxins and fluids are removed, while acid-base status and electrolytes are adjusted slowly and continuously from a hemodynamically unstable patient.

- Vascular access is achieved through the use of a double-lumen catheter placed in the femoral, jugular, or subclavian vein. Anticoagulation is used to prevent blood clotting during CRRT.

Kidney Transplantation

- One-year graft survival rates for kidney transplantation are 90% for deceased donor transplants and 95% for live donor transplants.

- Contraindications to transplantation include disseminated malignancies, refractory or untreated cardiac disease, chronic respiratory failure, extensive vascular disease, chronic infection, and unresolved psychosocial disorders.

- Kidneys for transplantation may be obtained from compatible-blood-type deceased donors, blood relatives, emotionally related living donors, and altruistic living donors.

- Live donors must undergo an extensive evaluation to be certain that they are in good health and have no history of disease that would place them at risk for developing kidney failure or operative complications.

- Deceased (cadaver) kidney donors are relatively healthy individuals who have suffered an irreversible brain injury. Permission from the donor's legal next of kin is required after brain death is determined even if the donor carried a signed donor card.

- For a live donor transplant, the donor nephrectomy is performed either through an open incision or laparoscopically. The short cold ischemic time is the primary reason for the success of living donor transplants.

- The transplanted kidney is usually placed extraperitoneally in the right iliac fossa to facilitate anastomoses and minimize the occurrence of ileus. Nursing care of the patient in the preoperative phase includes emotional and physical preparation for surgery.

- The usual postoperative care for the living donor is similar to that following conventional or laparoscopic nephrectomy.

- For the kidney transplant recipient the first priority during this period is maintenance of fluid and electrolyte balance. Very large volumes of urine may be produced soon after the blood supply to the transplanted kidney is reestablished. This is due to (1) the new kidney's ability to filter BUN, which acts as an osmotic diuretic; (2) the abundance of fluids administered during the operation; and (3) initial renal tubular dysfunction, which inhibits the kidney from concentrating urine normally.

- Postoperative teaching should include the prevention and treatment of rejection, infection, and complications of surgery and the purpose and side effects of immunosuppression.

- Rejection, a major problem following kidney transplantation, can be hyperacute, acute, or chronic. Immunosuppressive therapy is used to prevent rejection while maintaining sufficient immunity to prevent overwhelming infection.

- Infection is a significant cause of morbidity and mortality after kidney transplantation. Transplant recipients usually receive prophylactic antifungal drugs. Viral infections can be primary or reactivation of existing disease. CMV is one of the most common viral infections.

- Cardiovascular disease is the leading cause of death after renal transplantation. Hypertension, hyperlipidemia, diabetes mellitus, smoking, rejection, infections, and increased homocysteine levels can all contribute to cardiovascular disease.

- The overall incidence of malignancies in kidney transplant recipients is 100 times greater than in the general population. The primary cause is the immunosuppressive therapy.

- Aseptic necrosis of the hips, knees, and other joints can result from chronic corticosteroid therapy and renal osteodystrophy.

Gerontologic Considerations

- Approximately 35% to 65% of patients who have CKD are 65 or older. Physiologic changes in the older CKD patient include diminished cardiopulmonary function, bone loss, immunodeficiency, altered protein synthesis, impaired cognition, and altered drug metabolism.

- Most elderly ESRD patients select home dialysis. However, establishing vascular access for HD may be challenging due to atherosclerotic changes.

- The most common cause of death in the elderly ESRD patient is cardiovascular disease (MI, stroke), followed by withdrawal from dialysis.

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Key Points

Chapter 48: Nursing Assessment: Endocrine System

STRUCTURES AND FUNCTIONS

- **Hormones** exert their effects on **target tissue**.

- The specificity of hormone–target cell interaction is determined by receptors in a "lock-and-key" type of mechanism.

- The regulation of hormone levels in the blood depends on a highly specialized mechanism called feedback.

- With **negative feedback,** the gland responds by increasing or decreasing the secretion of a hormone based on feedback from various factors.

- The hypothalamus and pituitary gland integrate communication between the nervous and endocrine systems.

Anterior Pituitary

- Several hormones secreted by the anterior pituitary are referred to as **tropic hormones** because they control the secretion of hormones by other glands.
  - *Thyroid-stimulating hormone* (TSH) stimulates the thyroid gland to secrete thyroid hormones.
  - *Adrenocorticotropic hormone* (ACTH) stimulates the adrenal cortex to secrete corticosteroids.
  - *Follicle-stimulating hormone* (FSH) stimulates secretion of estrogen and the development of ova in the female and sperm development in the male.
  - *Luteinizing hormone* (LH) stimulates ovulation in the female and secretion of sex hormones in both the male and female.

- **Growth hormone** (GH) has effects on all body tissues.

- **Antidiuretic hormone** (ADH) regulates fluid volume by stimulating reabsorption of water in the kidneys.

- **Oxytocin** stimulates ejection of milk into mammary ducts and contraction of uterine smooth muscle.

Thyroid Gland

- The major function of the thyroid gland is the production, storage, and release of the thyroid hormones, **thyroxine** (T_4) and **triiodothyronine** (T_3).
  - Iodine is necessary for the synthesis of thyroid hormones.
  - T_4 and T_3 affect metabolic rate, carbohydrate and lipid metabolism, growth and development, and nervous system activities.

- **Calcitonin** is a hormone produced by C cells (parafollicular cells) of the thyroid gland in response to high circulating calcium levels.

Parathyroid Gland

- The parathyroid glands are four small, oval structures usually arranged in pairs behind each thyroid lobe. They secrete **parathyroid hormone** (PTH), which regulates the blood level of calcium.

Adrenal Gland

- The adrenal glands are small, paired, highly vascularized glands located on the upper portion of each kidney.
  - The adrenal medulla secretes the **catecholamines** epinephrine (the major hormone [75%]), norepinephrine (25%), and dopamine.
  - The adrenal cortex secretes **cortisol,** which is the most abundant and potent glucocorticoid. Cortisol is necessary to maintain life. Its functions include regulation of blood glucose concentration, inhibition of inflammatory action, and support in response to stress.
  - **Aldosterone** is a potent mineralocorticoid that maintains extracellular fluid volume.
  - The adrenal cortex secretes small amounts of androgens. Adrenal androgens stimulate pubic and axillary hair growth and sex drive in females.

Pancreas

- The pancreas secretes several hormones, including glucagon and insulin.
  - **Glucagon** increases blood glucose by stimulating glycogenolysis, gluconeogenesis, and ketogenesis.
  - **Insulin** is the principal regulator of the metabolism and storage of ingested carbohydrates, fats, and proteins.

Gerontologic Considerations

- Normal aging results in decreased hormone production and secretion, altered hormone metabolism and biologic activity, decreased responsiveness of target tissues to hormones, and alterations in circadian rhythms.

- Subtle changes of aging often mimic manifestations of endocrine disorders.

ASSESSMENT

- Hormones affect every body tissue and system, causing great diversity in the signs and symptoms of endocrine dysfunction.

- Endocrine dysfunction may result from deficient or excessive hormone secretion, transport abnormalities, an inability of the target tissue to respond to a hormone, or inappropriate stimulation of the target-tissue receptor.

- Subjective data:
  - The nurse should inquire about use of hormone replacements, previous hospitalizations, surgery, chemotherapy, and radiation therapy (especially of the neck).

- Objective data:
  - Most endocrine glands are inaccessible to direct examination.

- Physical examination:
  - Clinical manifestations of endocrine function vary significantly, depending on the gland involved.
  - Assessment includes a history of growth and development, weight distribution and changes, and comparisons of these factors with normal findings.
  - Disorders can commonly cause changes in mental and emotional status.
  - The nurse should note the color and texture of the skin, hair, and nails. The skin should be palpated for skin texture and presence of moisture.
  - When inspecting the thyroid gland, observation should be made first in the normal position (preferably with side lighting), then in slight extension, and then as the patient swallows some water.
  - The thyroid is palpated for its size, shape, symmetry, and tenderness and for any nodules.
  - The size, shape, symmetry, and general proportion of hand and feet size should be assessed.
  - The hair distribution pattern of the genitalia should be inspected.

DIAGNOSTIC STUDIES

- Laboratory tests usually involve blood and urine testing.

- Ultrasound may be used as a screening tool to localize endocrine growths such as thyroid nodules.

- Laboratory studies may include direct measurement of the hormone level, or involve an indirect indication of gland function by evaluating blood or urine components affected by the hormone (e.g., electrolytes).

- Notation of sample time on the laboratory slip and sample is important for hormones with circadian or sleep-related secretion.

- The studies used to assess function of the anterior pituitary hormones relate to GH, prolactin, FSH, LH, TSH, and ACTH.

- Tests to assess abnormal thyroid function include TSH (most common), total T_4, free T_4, and total T_3.

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Key Points

Chapter 49: Nursing Management: Diabetes Mellitus

- **Diabetes mellitus** is a chronic multisystem disorder of glucose metabolism related to absent or insufficient insulin supplies and/or poor utilization of the insulin that is available.

- The two most common types of diabetes are classified as type 1 or type 2 diabetes mellitus. Gestational diabetes, prediabetes, and secondary diabetes are other classifications of diabetes commonly seen in clinical practice.

TYPE 1 DIABETES

- *Type 1 diabetes mellitus* most often occurs in people who are under 30 years of age, with a peak onset between ages 11 and 13, but can occur at any age.

- Type 1 diabetes is the end result of a long-standing process where the body's own T cells attack and destroy pancreatic beta cells, which are the source of the body's insulin.

- Because the onset of type 1 diabetes is rapid, the initial manifestations are usually acute. The classic symptoms are *polyuria, polydipsia,* and *polyphagia.*

- The individual with type 1 diabetes requires a supply of insulin from an outside source *(exogenous insulin),* such as an injection, in order to sustain life. Without insulin, the

patient will develop diabetic ketoacidosis (DKA), a life-threatening condition resulting in metabolic acidosis.

PREDIABETES

- **Prediabetes** is a condition where blood glucose levels are higher than normal but not high enough for a diagnosis of diabetes. Most people with prediabetes are at increased risk for developing type 2 diabetes and if no preventive measures are taken, they will usually develop it within 10 years.

- Long-term damage to the body, especially the heart and blood vessels, may already be occurring in patients with prediabetes.

TYPE 2 DIABETES

- *Type 2 diabetes mellitus* is, by far, the most prevalent type of diabetes, accounting for over 90% of patients with diabetes.

- In type 2 diabetes, the pancreas usually continues to produce some *endogenous* (self-made) insulin. However, the insulin that is produced is either insufficient for the needs of the body and/or is poorly used by the tissues.

- The most important risk factors for developing type 2 diabetes are believed to be obesity, specifically abdominal and visceral adiposity. Also, individuals with metabolic syndrome are at an increased risk for the development of type 2 diabetes.

- Some of the more common manifestations associated with type 2 diabetes include fatigue, recurrent infections, recurrent vaginal yeast or monilia infections, prolonged wound healing, and visual changes.

GESTATIONAL DIABETES

- *Gestational diabetes* develops during pregnancy and is detected at 24 to 28 weeks of gestation, usually following an oral glucose tolerance test.

- Although most women with gestational diabetes will have normal glucose levels within 6 weeks postpartum, their risk for developing type 2 diabetes in 5 to 10 years is increased.

- A diagnosis of diabetes is based on one of three methods: (1) fasting plasma glucose level, (2) random plasma glucose measurement, or (3) 2-hour oral glucose tolerance test.

- The goals of diabetes management are to reduce symptoms, promote well-being, prevent acute complications of hyperglycemia, and prevent or delay the onset and progression of

long-term complications. These goals are most likely to be met when the patient is able to maintain blood glucose levels as near to normal as possible.

INSULIN THERAPY

- Exogenous (injected) insulin is needed when a patient has inadequate insulin to meet specific metabolic needs.

- Insulin is divided into two main categories: short-acting (bolus) and long-acting (basal) insulin. Basal insulin is used to maintain a background level of insulin throughout the day and bolus insulin is used at mealtime.

- A variety of insulin regimens are recommended for patients depending on the needs of the patient and their preference.

- Routine administration of insulin is most commonly done by means of subcutaneous injection, although intravenous administration of regular insulin can be done when immediate onset of action is desired.

- The technique for insulin injections should be taught to new insulin users and reviewed periodically with long-term users.

- The speed with which peak serum concentrations are reached varies with the anatomic site for injection. The fastest absorption is from the abdomen.

- Continuous subcutaneous insulin infusion can be administered using an **insulin pump,** a small battery-operated device that resembles a standard paging device in size and appearance. The device is programmed to deliver a continuous infusion of rapid-acting or short-acting insulin 24 hours a day and at mealtime, the user programs the pump to deliver a bolus infusion of insulin.

- An alternative to injectable insulin is inhaled insulin. Exubera is a rapid-acting, dry powder form of insulin that is inhaled through the mouth into the lungs prior to eating via a specially designed inhaler.

- Hypoglycemia, allergic reactions, lipodystrophy, and the Somogyi effect are problems associated with insulin therapy.
    - **Lipodystrophy** (atrophy of subcutaneous tissue) may occur if the same injection sites are used frequently.
    - The **Somogyi effect** is a rebound effect in which an overdose of insulin induces hypoglycemia. Usually occurring during the hours of sleep, the Somogyi effect produces a decline in blood glucose level in response to too much insulin.
    - The **dawn phenomenon** is characterized by hyperglycemia that is present on awakening in the morning due to the release of counterregulatory hormones in the predawn hours.

ORAL AGENTS

- Oral agents (OAs) are not insulin, but they work to improve the mechanisms by which insulin and glucose are produced and used by the body. OAs work on the three defects of type 2 diabetes, including (1) **insulin resistance,** (2) decreased insulin production, and (3) increased hepatic glucose production.

- Sulfonylureas are frequently the drugs of choice in treating type 2 diabetes due to the decreased chance of prolonged hypoglycemia. The primary action of the sulfonylureas is to increase insulin production from the pancreas.

- Like the sulfonylureas, meglitinides increase insulin production from the pancreas. But because they are more rapidly absorbed and eliminated, they offer a reduced potential for hypoglycemia.

- Metformin (Glucophage) is a biguanide glucose-lowering agent. The primary action of metformin is to reduce glucose production by the liver.

- α-Glucosidase inhibitors, also known as "starch blockers," these drugs work by slowing down the absorption of carbohydrate in the small intestine.

- Sometimes referred to as "insulin sensitizers," thiazolidinediones are most effective for people who have insulin resistance. They improve insulin sensitivity, transport, and utilization at target tissues.

OTHER DRUG THERAPIES

- Pramlintide (Symlin) is a synthetic analog of human amylin, a hormone secreted by the *β* cells of the pancreas. When taken concurrently with insulin, it provides for better glucose control.

- Exanatide (Byetta) is a synthetic peptide that stimulates the release of insulin from the pancreatic β cells. Exanatide is administered using a subcutaneous injection.

NUTRITIONAL THERAPY AND EXERCISE

- The overall goal of nutritional therapy is to assist people with diabetes in making healthy nutritional choices, eating a varied diet, and maintaining exercise habits that will lead to improved metabolic control.

- For those with type 1 diabetes, day-to-day consistency in timing and amount of food eaten is important for those individuals using conventional, fixed insulin regimens. Patients using rapid-acting insulin can make adjustments in dosage before the meal based on the current blood glucose level and the carbohydrate content of the meal.

- The emphasis for nutritional therapy in type 2 diabetes should be placed on achieving glucose, lipid, and blood pressure goals.

- The nutritional energy intake should be constantly balanced with the energy output of the individual, taking into account exercise and metabolic body work.

- In a general diabetic meal plan, carbohydrates and monounsaturated fat should provide 45% to 65% of the total energy intake each day. Fats should compose no more than 25% to 30% of the meal plan's total calories, with less than 7% of calories from saturated fats, and protein should contribute less than 10% of the total energy consumed.

- Alcohol is high in calories, has no nutritive value, and promotes hypertriglyceridemia. Patients should be cautioned to honestly discuss the use of alcohol with their health care providers because its use can make blood glucose more difficult to control.

- Regular, consistent exercise is considered an essential part of diabetes and prediabetes management. Exercise increases insulin receptor sites in the tissue and can have a direct effect on lowering the blood glucose levels.

MONITORING BLOOD GLUCOSE

- **Self-monitoring of blood glucose** (SMBG) is a cornerstone of diabetes management. By providing a current blood glucose reading, SMBG enables the patient to make self-management decisions regarding diet, exercise, and medication.

- The frequency of monitoring depends on several factors, including the patient's glycemic goals, the type of diabetes that the patient has, the patient's ability to perform the test independently, and the patient's willingness to test.

PANCREAS TRANSPLANTATION

- Pancreas transplantation can be used as a treatment option for patients with type 1 diabetes mellitus. Most commonly it is done for patients who have end-stage renal disease and who have had or plan to have a kidney transplant.

- Kidney and pancreas transplants are often performed together, or a pancreas may be transplanted following a kidney transplant. Pancreas transplants alone are rare.

NURSING MANAGEMENT

- Nursing responsibilities for the patient receiving insulin include proper administration, assessment of the patient's response to insulin therapy, and education of the patient regarding administration, adjustment to, and side effects of insulin.

- Proper administration, assessment of the patient's use of and response to the OA, and education of the patient and the family about OAs are all part of the nurse's function.

- The goals of diabetes self-management education are to enable the patient to become the most active participant in his or her care, while matching the level of self-management to the ability of the individual patient.

ACUTE COMPLICATIONS OF DIABETES MELLITUS

- **Diabetic ketoacidosis** (DKA), also referred to as *diabetic acidosis* and *diabetic coma,* is caused by a profound deficiency of insulin and is characterized by hyperglycemia, ketosis, acidosis, and dehydration. It is most likely to occur in people with type 1 diabetes.
    - DKA is a serious condition that proceeds rapidly and must be treated promptly.
    - Because fluid imbalance is potentially life threatening, the initial goal of therapy is to establish intravenous access and begin fluid and electrolyte replacement.

- **Hyperosmolar hyperglycemic syndrome** (HHS) is a life-threatening syndrome that can occur in the patient with diabetes who is able to produce enough insulin to prevent DKA but not enough to prevent severe hyperglycemia, osmotic diuresis, and extracellular fluid depletion**.**

- Hypoglycemia, or low blood glucose, occurs when there is too much insulin in proportion to available glucose in the blood. Causes of hypoglycemia are often related to a mismatch in the timing of food intake and the peak action of insulin or oral hypoglycemic agents that increase endogenous insulin secretion.

CHRONIC COMPLICATIONS OF DIABETES MELLITUS

- Chronic complications of diabetes are primarily those of end-organ disease from damage to blood vessels secondary to chronic hyperglycemia. These chronic blood vessel dysfunctions are divided into two categories: macrovascular complications and microvascular complications.
    - *Macrovascular complications* are diseases of the large and medium-sized blood vessels that occur with greater frequency and with an earlier onset in people with diabetes.
    - *Microvascular complications* result from thickening of the vessel membranes in the capillaries and arterioles in response to conditions of chronic hyperglycemia.

- **Diabetic retinopathy** refers to the process of microvascular damage to the retina as a result of chronic hyperglycemia in patients with diabetes.

- **Diabetic nephropathy** is a microvascular complication associated with damage to the small blood vessels that supply the glomeruli of the kidney.

- **Diabetic neuropathy** is nerve damage that occurs because of the metabolic derangements associated with diabetes mellitus. The two major categories of diabetic neuropathy are sensory neuropathy, which affects the peripheral nervous system, and autonomic neuropathy.
    - The most common form of *sensory neuropathy* is distal symmetric neuropathy, which affects the hands and/or feet bilaterally. This is sometimes referred to as “stocking-glove neuropathy.”

- *Autonomic neuropathy* can affect nearly all body systems and lead to hypoglycemic unawareness, bowel incontinence and diarrhea, and urinary retention.

COMPLICATIONS OF THE FEET AND LOWER EXTREMITIES

- Foot complications are the most common cause of hospitalization in the person with diabetes.
- Sensory neuropathy is a major risk factor for lower extremity amputation in the person with diabetes. Loss of protective sensation often prevents the patient from becoming aware that a foot injury has occurred.
- Proper care of a diabetic foot ulcer is critical to prevention of infections.

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Key Points

Chapter 50: Nursing Management: Endocrine Problems

ACROMEGALY

- **Acromegaly** results from excess secretion of growth hormone (GH).
- It is a rare condition of bone and soft tissue overgrowth.
- Bones increase in thickness and width but not length.
- Manifestations include enlargement of hands and feet, thickening and enlargement of face and head bony and soft tissue, sleep apnea, signs of diabetes mellitus, cardiomegaly, and hypertension.
- Treatment focuses on returning GH levels to normal through surgery, radiation, and drug therapy. The prognosis depends on age at onset, age when treatment is initiated, and tumor size.
- Nursing care for surgical patients postoperatively includes avoidance of vigorous coughing, sneezing, and straining at stool to prevent cerebrospinal fluid leakage from where the sella turcica was entered.

- After surgery with a transsphenoidal approach, the head of the bed is elevated to a 30-degree angle at all times, and neurologic status is monitored. Mild analgesia is used for headaches, and toothbrushing is avoided for at least 10 days.

- If hypophysectomy is done or the pituitary is damaged, antidiuretic hormone (ADH), cortisol, and thyroid hormone replacement must be taken for life. Patient teaching is essential with hormone replacement therapy.

HYPOPITUITARISM

- **Hypopituitarism** is rare, and involves a decrease in one or more of the pituitary hormones:
    - The anterior pituitary gland secretes adrenocorticotrophic hormone (ACTH), thyroid-stimulating hormone (TSH), follicle-stimulating hormone (FSH), luteinizing hormone (LH), GH, and prolactin.
    - The posterior pituitary gland secretes ADH and oxytocin.

- Most deficiencies associated with hypopituitarism involve GH and gonadotropins (e.g., LH, FSH) due to a pituitary tumor.

SYNDROME OF INAPPROPRIATE ANTIDIURETIC HORMONE

- **Syndrome of inappropriate antidiuretic hormone** (SIADH) results from an overproduction or oversecretion of ADH.

- SIADH results from abnormal production or sustained secretion of ADH and is characterized by fluid retention, serum hypoosmolality, dilutional hyponatremia, hypochloremia, concentrated urine in presence of normal or increased intravascular volume, and normal renal function.

- The most common cause is lung cancer.

- Treatment is directed at underlying cause, with a goal to restore normal fluid volume and osmolality. Fluid restriction results in gradual, daily weight reductions, progressive rise in serum sodium concentration and osmolality, and symptomatic improvement. With chronic SIADH, the patient must learn self-management.

DIABETES INSIPIDUS

- **Diabetes insipidus** (DI) is associated with deficiency of production or secretion of ADH or decreased renal response to ADH.

- Decreases in ADH cause fluid and electrolyte imbalances due to increased urinary output and increased plasma osmolality.

- Depending on the cause, DI may be transient or chronic lifelong condition.

- Types of DI include:

  - *Central DI* (or *neurogenic DI*) occurs when an organic lesion of the hypothalamus, infundibular stem, or posterior pituitary interferes with ADH synthesis, transport, or release.
  - *Nephrogenic DI* occurs when there is adequate ADH, but a decreased kidney response to ADH. Lithium is a common cause of drug-induced nephrogenic DI. Hypokalemia and hypercalcemia may also lead to nephrogenic DI.
  - *Psychogenic DI* is associated with excessive water intake, caused by lesion in thirst center or by psychosis.

- DI is characterized by polydipsia and polyuria.

- If oral fluid intake cannot keep up with urinary losses, severe fluid volume deficit results as manifested by weight loss, constipation, poor tissue turgor, hypotension, and shock.

- Severe dehydration and hypovolemic shock may occur.

- Treating the primary cause is central to management. Therapeutic goal is maintenance of fluid and electrolyte balance.

- Nursing care includes early detection, maintenance of adequate hydration, and patient teaching for long-term management.

GOITER

- **Goiter** is thyroid gland hypertrophy and enlargement caused by excess TSH stimulation, which can be caused by inadequate circulating thyroid hormones.

- Goiter is also found in Graves' disease.

- TSH and T4 levels are measured to determine if goiter is associated with hyperthyroidism, hypothyroidism, or normal thyroid function.

- Thyroid antibodies are measured to assess for thyroiditis.

- Treatment with thyroid hormone may prevent further thyroid enlargement.

- Surgery to remove large goiters may be done.

THYROID NODULES

- A **thyroid nodule,** a palpable deformity of the thyroid gland, may be benign or malignant.

- Benign nodules are usually not dangerous, but can cause tracheal compression if they become too large.

- Malignant tumors of thyroid gland are rare.

- A major sign of thyroid cancer is presence of hard, painless nodule or nodules on enlarged thyroid gland.
- Surgical tumor removal is usually indicated with cancer.
- Procedures include unilateral total lobectomy with removal of isthmus to total thyroidectomy with bilateral lobectomy.
- Radiation therapy may also be indicated.
- Nursing care for thyroid tumors is similar to care for patient who has undergone thyroidectomy.

THYROIDITIS

- **Thyroiditis** is an inflammatory process in the thyroid gland.
- Subacute and acute forms of thyroiditis have abrupt onset, and the thyroid gland is painful.
- *Chronic autoimmune thyroiditis* (Hashimoto's thyroiditis) can lead to hypothyroidism.
- *Hashimoto's thyroiditis* is a chronic autoimmune disease in which thyroid tissue is replaced by lymphocytes and fibrous tissue. It is most common cause of goiterous hypothyroidism.
- Recovery may be complete in weeks or months without treatment.

HYPERTHYROIDISM

- **Hyperthyroidism** is thyroid gland hyperactivity with sustained increase in synthesis and release of thyroid hormones.
- **Thyrotoxicosis** refers to physiologic effects or clinical syndrome of hypermetabolism resulting from excess circulating levels of T4, T3, or both.
- Hyperthyroidism and thyrotoxicosis usually occur together as in Graves' disease.
- The most common form of hyperthyroidism is Graves' disease.
- Other causes include toxic nodular goiter, thyroiditis, exogenous iodine excess, pituitary tumors, and thyroid cancer.

Graves' Disease

- **Graves' disease** is an autoimmune disease marked by diffuse thyroid enlargement and excessive thyroid hormone secretion.

- Factors such as insufficient iodine supply, infection, and stressful life events may interact with genetic factors to cause Graves' disease.
- Manifestations relate to the effect of thyroid hormone excess.
- When thyroid gland is large, a goiter may be noted, and auscultation of thyroid gland may reveal bruits.
- A classic finding is **exophthalmos,** a protrusion of eyeballs from the orbits.
- Treatment options are antithyroid medications, radioactive iodine therapy, and subtotal thyroidectomy.

Thyrotoxic Crisis

- **Thyrotoxic crisis**, also known as *thyroid storm,* is an acute, rare condition in which all hyperthyroid manifestations are heightened.
- Although it is a life-threatening emergency, death is rare when treatment is vigorous and initiated early.
- Manifestations include severe tachycardia, shock, hyperthermia, seizures, abdominal pain, diarrhea, delirium, and coma.
- Treatment focuses on reducing circulating thyroid hormone levels by drug therapy.

HYPOTHYROIDISM

- **Hypothyroidism** is one of most common medical disorders.
- It results from insufficient circulating thyroid hormone.
- This condition may be primary (related to destruction of thyroid tissue or defective hormone synthesis), or secondary (related to pituitary disease with decreased TSH secretion or hypothalamic dysfunction with decreased thyrotropin-releasing hormone [TRH] secretion).
- Hypothyroidism also can be transient and related to thyroiditis or from a discontinuation of thyroid hormone therapy.
- Iodine deficiency is the most common cause worldwide**.**
- In areas with adequate iodine intake, the most common cause is thyroid gland atrophy (end result of Hashimoto's thyroiditis and Graves' disease).

- Manifestations include fatigue, lethargy, personality and mental changes, decreased cardiac output, anemia, and constipation.

- Patients with severe long-standing hypothyroidism may display **myxedema,** an accumulation of hydrophilic mucopolysaccharides in dermis and other tissues. This mucinous edema causes characteristic facies of hypothyroidism (i.e., puffiness, periorbital edema, and masklike affect).

- A myxedema coma can be precipitated by infection, drugs (especially opioids, tranquilizers, and barbiturates), exposure to cold, and trauma. This condition is characterized by subnormal temperature, hypotension, and hypoventilation. To survive, vital functions are supported and IV thyroid hormone replacement administered.

- The overall treatment in hypothyroidism is restoration of euthyroid state as safely and rapidly as possible with hormone replacement therapy.

- Levothyroxine (Synthroid) is the drug of choice.

- Patient teaching is imperative, and the need for lifelong drug therapy is stressed.

HYPERPARATHYROIDISM

- **Hyperparathyroidism** involves increased secretion of parathyroid hormone (PTH).

- Excess PTH leads to hypercalcemia and hypophosphatemia.

- Manifestations include weakness, loss of appetite, constipation, emotional disorders, and shortened attention span.

- Major signs include osteoporosis, fractures, and kidney stones.

- Neuromuscular abnormalities are muscle weakness in proximal muscles of lower extremities.

- Parathyroidectomy leads to a reduction in chronically high calcium levels.

- Continued ambulation, avoidance of immobility, a high fluid intake and moderate calcium intake are important.

- Several drugs are helpful in lowering calcium levels: bisphosphonates (e.g., alendronate [Fosamax]) estrogen or progestin therapy, oral phosphate, diuretics, and calcimimetic agents (e.g., cinacalcet [Sensipar]).

HYPOPARATHYROIDISM

- **Hypoparathyroidism** is rare, and results from inadequate circulating PTH.

- It is characterized by hypocalcemia resulting from a lack of PTH to maintain serum calcium levels.

- The most common cause is iatrogenic, due to accidental removal of parathyroid glands or damage to these glands during neck surgery.

- Sudden decreases in serum calcium cause tetany, which is characterized by tingling of lips, fingertips, and increased muscle tension with paresthesias and stiffness.

- Painful tonic spasms of smooth and skeletal muscles (extremities and face), and laryngospasms and a positive Chvostek sign and Trousseau sign are usually present.

- Focus of patient care is to treat tetany, maintain normal serum calcium levels, and prevent long-term complications. Emergency treatment of tetany requires IV calcium.

- Instruction about lifelong treatment and follow-up care includes monitoring of calcium levels.

CUSHING SYNDROME

- **Cushing syndrome** is a spectrum of clinical abnormalities caused by excessive corticosteroids, particularly glucocorticoids.

- The most common cause is iatrogenic administration of exogenous corticosteroids (e.g., prednisone).

- Most cases of endogenous Cushing syndrome are due to adrenocorticotrophic hormone (ACTH) secreting pituitary tumor (Cushing's disease).

- Key signs include centripedal or generalized obesity, "moon facies" (fullness of face), purplish red striae below the skin surface, hirsutism in women, hypertension, and unexplained hypokalemia.

- Treatment is dependent on the underlying cause, and includes surgery and drug therapy to normalize hormone levels.

- Discharge instructions are based on patient's lack of endogenous corticosteroids and resulting inability to react to stressors physiologically.

- Lifetime replacement therapy is required by many patients.

ADDISON'S DISEASE

- In the patient with **Addison's disease,** all three classes of adrenal corticosteroids (glucocorticoids, mineralocorticoids, and androgens) are reduced.

- The etiology is mostly autoimmune where adrenal cortex is destroyed by autoantibodies.

- Manifestations have a slow onset and include weakness, weight loss, and anorexia.

- Skin hyperpigmentation is seen in sun-exposed areas of body, at pressure points, over joints, and in palmar creases.

- The treatment is replacement therapy. Hydrocortisone, the most commonly used form of replacement therapy, has both glucocorticoid and mineralocorticoid properties. During times of stress, glucocorticoid dosage is increased to prevent addisonian crisis.

- Mineralocorticoid replacement with fludrocortisone acetate (Florinef) is given daily with increased dietary salt. Patient teaching covers medications, techniques for stress management, and that patient must always wear an identification bracelet (Medic Alert).

Addisonian Crisis

- Patients with Addison's disease are at risk for an acute adrenal insufficiency (addisonian crisis), a life-threatening emergency caused by insufficient or sudden decrease in adrenocortical hormones.

- Addisonian crisis is triggered by stress (e.g., surgery, trauma, hemorrhage, or psychologic distress); sudden withdrawal of corticosteroid hormone replacement therapy; and post-adrenal surgery.

- Manifestations include postural hypotension, tachycardia, dehydration, hyponatremia, hyperkalemia, hypoglycemia, fever, weakness, and confusion.

- Treatment is shock management and high-dose hydrocortisone replacement. Large volumes of 0.9% saline solution and 5% dextrose are given to reverse hypotension and electrolyte imbalances until blood pressure normalizes.

LONG-TERM ADMINISTRATION OF CORTICOSTEROIDS

- The use of long-term corticosteroids in therapeutic doses often leads to serious complications and side effects.

- Therapy is reserved for diseases in which there is a risk of death or permanent loss of function, and conditions in which short-term therapy is likely to produce remission or recovery.

- The potential treatment benefits must always be weighed against risks.

- The danger of abrupt cessation of corticosteroid therapy must be emphasized to patients and significant others.

- Corticosteroids taken longer than 1 week will suppress adrenal production and oral corticosteroids should be tapered.

- Nurses must ensure that increased doses of corticosteroids are prescribed in acute care or home care situations with increased physical or emotional stress.

HYPERALDOSTERONISM

- **Hyperaldosteronism** is characterized by excessive aldosterone secretion commonly caused by small solitary adrenocortical adenoma.
- The main effects are sodium retention and potassium and hydrogen ion excretion.
- A key sign of this disease is hypertension with hypokalemic alkalosis.
- The preferred treatment is surgical removal of adenoma (adrenalectomy).
- Patients with bilateral adrenal hyperplasia are treated with drugs. Calcium channel blockers may be used to control BP.
- Patients are taught to monitor own BP and need for monitoring.

PHEOCHROMOCYTOMA

- **Pheochromocytoma** is a rare condition characterized by an adrenal medulla tumor that produces excessive catecholamines (epinephrine, norepinephrine).
- The tumor is benign in most cases.
- The secretion of excessive catecholamines results in severe hypertension.
- If undiagnosed and untreated, pheochromocytoma may lead to diabetes mellitus, cardiomyopathy, and death.
- Manifestations include severe, episodic hypertension accompanied by classic triad of (1) severe, pounding headache, (2) tachycardia with palpitations and profuse sweating, and (3) unexplained abdominal or chest pain.
- Attacks may be provoked by many medications, including antihypertensives, opioids, radiologic contrast media, and tricyclic antidepressants.
- The treatment consists of surgical removal of tumor.

Key Points

Chapter 51: Nursing Assessment: Reproductive System

STRUCTURES AND FUNCTIONS

- The primary roles of male reproductive system are production and transportation of sperm, deposition of sperm in female reproductive tract, and secretion of hormones.
    - The primary male reproductive organs are the testes.

- The primary roles of female reproductive system are production of ova, secretion of hormones, and protection and facilitation of the development of the fetus in a pregnant female.
    - The primary female reproductive organs are the ovaries.

- The hypothalamus, pituitary gland, and **gonads** secrete numerous hormones that regulate the processes of ovulation, spermatogenesis, fertilization, and formation and function of secondary sex characteristics.

- In women, follicle-stimulating hormone (FSH) production by anterior pituitary stimulates growth and maturity of ovarian follicles.
    - Mature follicle produces estrogen, which in turn suppresses the release of FSH. In men, FSH stimulates seminiferous tubules to produce sperm.

- Estrogen and progesterone are produced by the ovaries.
    - Estrogen is essential to development and maintenance of secondary sex characteristics, proliferative phase of menstrual cycle immediately after menstruation, and pregnancy uterine changes.
    - Progesterone is also involved in body changes of pregnancy.

- The major gonadal hormone of men is testosterone, which is produced by the testes. Testosterone is responsible for development and maintenance of secondary sex characteristics and **spermatogenesis.**

- **Menarche** is the first episode of menstrual bleeding, indicating that a female has reached puberty.
    - This usually occurs at 12 to 13 years of age.
    - The length of the **menstrual cycle** generally ranges from 20 to 40 days.

- The major functions of ovaries are ovulation and secretion of hormones. These functions are accomplished during the menstrual cycle.

- If fertilization occurs, high levels of estrogen and progesterone continue to be secreted due to continued activity of corpus luteum from stimulation by human chorionic gonadotropin (hCG).

  - If fertilization does not take place, menstruation occurs because of a decrease in estrogen production and progesterone.

- **Menopause** is the physiologic cessation of menses associated with declining ovarian function. It is usually considered complete after 1 year of **amenorrhea.**

- The sexual response is a complex interplay of psychologic and physiologic phenomena influenced by a number of variables, including daily stress, illness, and crisis.
  - Changes that occur during sexual excitement are similar for men and women.
  - Sexual response can be described in terms of the excitement, plateau, orgasmic, and resolution phases.

Gerontologic Considerations

- In women, many changes relate to the altered estrogen production of menopause.

- A reduction in circulating estrogen along with an increase in androgens in postmenopausal women is associated with breast and genital atrophy, reduction in bone mass, and increased rate of atherosclerosis.

- Changes in aging men include an increase in prostate size, decreased testosterone level and sperm production, decreased scrotum muscle tone and size and firmness of the testicles. Erectile dysfunction and sexual dysfunction can occur as result of these changes.

ASSESSMENT

- Nurses have an important role in providing accurate and unbiased information about sexuality and age. Nurses should emphasize normalcy of sexual activity in older adults.

- Reproduction and sexual issues are often considered extremely personal and private.
  - A professional demeanor is important when taking a reproductive or sexual history.
  - The nurse needs to be sensitive, ask gender-neutral questions, and maintain awareness of patient's culture and beliefs.
  - It is helpful if the nurse begins with least sensitive information (e.g., menstrual history) before asking questions about more sensitive issues such as sexual practices or sexually transmitted diseases.

- Women should have a complete menstrual and gynecologic history taken, including oral contraceptive use.
  - The nurse should question the patient regarding current health status and presence of any acute or chronic health problems as problems in other body systems often relate to problems with reproductive system.

- Physical examination:

- *Male external genitalia:* inspection and palpation of pubis, penis, scrotum and testes, inguinal region and spermatic cord, anus and prostate.
- *Female:* begins with inspection and palpation of breasts and then proceeds to abdomen and external genitalia including **mons pubis,** labia majora, labia minora, perineum, and anal region.
- Pelvic and bimanual examinations are considered advanced skills.

DIAGNOSTIC STUDIES

- Serum hormone test, hCG, is used to identify pregnancy.
- Prolactin assay is used for patient with amenorrhea.
- Serum progesterone and estradiol can also help in ovarian function assessment, particularly for amenorrhea.
- Hormonal blood studies are essential for a fertility workup.

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Key Points

Chapter 52: Nursing Management: Breast Disorders

- Screening guidelines for early detection of breast cancer are yearly mammograms starting at age 40, and clinical breast examinations every 3 years for women between ages 20 and 30 and every year for women beginning at age 40.
- Women should report any breast changes promptly to their health care provider.
- Breast self-examination is an option for women.
- Women at increased breast cancer risk (family history, genetic tendency, past breast cancer) should talk with their health care provider about benefits and limitations of starting mammography screening earlier, having additional tests (breast ultrasound), or having more frequent examinations.
- Mammography is used to visualize internal structures of the breast using x-rays. This procedure can detect tumors and cysts not felt by palpation.
- Ultrasound is another procedure used to differentiate a benign tumor from a malignant tumor. It is useful for women with fibrocystic changes whose breasts are very dense.

- Definitive diagnosis of breast cancer is made by histologic examination of biopsied tissue. Biopsy techniques include fine-needle aspiration (FNA) biopsy, stereotactic or handheld core biopsy, and open surgical biopsy.

- Mastalgia (breast pain):
  - **Mastalgia** is the most common breast-related benign complaint in women.
  - It is described as diffuse breast tenderness or heaviness.
  - Breast pain may last 2 to 3 days or most of month.
  - Symptoms often decrease with menopause.
  - Some relief may occur with caffeine and dietary fat reduction; hormonal therapy, taking vitamins, and gamma-linolenic acid (evening primrose oil); and wearing of support bra.

- Mastitis:
  - **Mastitis** is a breast inflammatory condition that occurs most frequently in lactating women.
  - *Lactational mastitis* manifests as a localized area that is erythematous, painful, and tender to palpation.
  - Fever is usually present. Infection develops when organisms, usually staphylococci, gain access to breast through cracked nipple.
  - In its early stages, mastitis can be cured with antibiotics.

- Fibrocystic changes in breast:
  - **Fibrocystic changes** is a common benign condition characterized by changes in breast tissue including development of excess fibrous tissue, hyperplasia of epithelial lining of mammary ducts, proliferation of mammary ducts, and cyst formation.
  - These changes produce pain by nerve irritation from edema in connective tissue and by fibrosis from nerve pinching.
  - Types of treatment that might help fibrocystic breast disease include use of good support bra, dietary therapy (low-salt diet, restriction of methylxanthines such as coffee and chocolate), vitamin E therapy, analgesics, danazol, diuretics, hormone therapy, and antiestrogen therapy.
  - **Fibroadenoma** is a common cause of benign breast lumps in young women. A possible cause may be increased estrogen sensitivity in localized area of breast. Treatment includes surgical excision or *cryoablation.*
  - **Gynecomastia** is a transient, noninflammatory enlargement of one or both breasts and is the most common benign breast problem in men.

BREAST CANCER

- Breast cancer is the most common malignancy in American women except for skin cancer.

- Although the etiology of breast cancer is not completely understood, a number of factors

are thought to relate to breast cancer including a family history, environmental factors, genetics, early menarche and late menopause, and age 60 or over. However, most women who develop breast cancer have no identifiable risk factors.

- Noninvasive breast cancers include *ductal carcinoma in situ* (DCIS) and *lobular carcinoma in situ* (LCIS).
    - DCIS tends to be unilateral and most likely would progress to invasive breast cancer if left untreated.
    - LCIS is a risk factor for developing breast cancer, but it is not known to be a premalignant lesion. No treatment is necessary for LCIS. Tamoxifen may be given as a chemoprevention.

- Paget's disease:
    - **Paget's disease** is a rare breast malignancy characterized by a persistent lesion of the nipple and areola with or without a palpable mass.
    - Treatment is a simple or modified radical mastectomy.

- Inflammatory breast cancer:
    - *Inflammatory breast cancer* is the most malignant form of all breast cancers.
    - The skin of the breast looks red, feels warm, with a thickened appearance described as resembling an orange peel (peau d'orange).
    - Metastases occur early and widely. Radiation, chemotherapy, and hormone therapy are more likely to be used for treatment than surgery.

- Breast cancer is detected as a lump or mammographic abnormality in the breast. It occurs most often in upper, outer quadrant of breast.

- If palpable, breast cancer is usually hard, and may be irregularly shaped, poorly delineated, nonmobile, and nontender. Nipple discharge may also be present.

- In addition to earlier listed tests, other tests useful in predicting risk of recurrence or metastatic breast disease include axillary lymph node status, tumor size, estrogen and progesterone receptor status, and cell proliferative indices.

- Patients with breast cancer should discuss all treatment options with their health care provider, including local excision, **mastectomy** with breast reconstruction, breast-conserving treatment (lumpectomy), radiation therapy, and/or tamoxifen.

- Common options for resectable breast cancer include breast conservation surgery with radiation therapy and modified radical mastectomy with or without reconstruction.

- Breast conservation surgery (**lumpectomy**) involves removal of entire tumor along with a margin of normal tissue. Modified radical mastectomy includes removal of breast and axillary lymph nodes, but it preserves pectoralis major muscle.

- **Lymphedema** can occur due to surgical excision or radiation of lymph nodes. Symptoms are heaviness, pain, impaired motor function in the arm, and numbness and paresthesia of the fingers as a result of lymphedema.

- Following surgery, radiation therapy is delivered to the entire breast, ending with a boost to the tumor bed. If there is evidence of systemic disease, then chemotherapy may be given before radiation therapy.

- Radiation therapy may be used for breast cancer as a primary treatment to prevent local breast recurrences after breast conservation surgery, adjuvant treatment following mastectomy to prevent local and nodal recurrences, and palliative treatment for pain caused by local recurrence and metastases.

- Breast cancer is one of the solid tumors most responsive to chemotherapy with the use of combinations of drugs, which is clearly superior to use of single drug therapy.

- Hormonal therapy removes or blocks the source of estrogen, thus promoting tumor regression.

- Nursing interventions at time of breast cancer diagnosis include exploring woman's usual decision-making patterns, helping the woman accurately evaluate advantages and disadvantages of options, and providing information and support relevant to treatment decisions.

- The woman with breast conservation surgery usually has an uneventful postoperative course with only a moderate amount of pain. If an axillary lymph node dissection or mastectomy is done, drains are often left in place.

- Postoperative discomfort is minimized by administering analgesics 30 minutes before initiating exercises. With showering, the flow of warm water over the involved shoulder often has a soothing effect and reduces joint stiffness.

- Mammoplasty:
    - **Mammoplasty** is a surgical change in size or shape of the breast.
    - It may be done electively for cosmetic purposes to either augment or reduce the size of breasts or to reconstruct the breast after mastectomy.
    - In augmentation, an implant is placed in a surgically created pocket between the capsule of the breast and the pectoral fascia.
    - Reduction mammoplasty is performed by resecting wedges of tissue from upper and lower quadrants of breast.

- Breast reconstructive surgery may be done simultaneously with mastectomy or some time afterward to achieve symmetry and to restore or preserve body image.

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Key Points

Chapter 53: Nursing Management: Sexually Transmitted Diseases

- **Sexually transmitted diseases** (STDs) are infectious diseases transmitted most commonly through sexual contact.
- Types of STD infections include bacterial (gonorrhea, chlamydia, syphilis) and viral (genital herpes, genital warts).
- Most infections start as lesions on the genitalia and other sexually exposed mucous membranes. Wide dissemination to other body areas can then occur.
- A latent, or subclinical, phase is present with all STDs. This can lead to a long-term persistent infection and transmission of disease from asymptomatic (but infected) person to another contact.
- Different STDs can coexist within one person.

GONORRHEA

- **Gonorrhea** is the second most frequently reported STD in United States.
- It is caused by *Neisseria gonorrhoeae,* a gram-negative diplococcus.
- Gonorrhea is spread by direct physical contact with an infected host, usually during sexual activity (vaginal, oral, or anal).
- The initial site of gonorrhea infection in men is usually the urethra.
- Symptoms of urethritis consist of dysuria and profuse, purulent urethral discharge developing 2 to 5 days after infection.
- Women with gonorrhea are often asymptomatic or have minor symptoms that are often overlooked. A few women may complain of vaginal discharge, dysuria, or frequency of urination.
- Complications of gonorrhea in men are prostatitis, urethral strictures, and sterility from orchitis or epididymitis.

- Because women with gonorrhea who are asymptomatic seldom seek treatment, complications are more common and include pelvic inflammatory disease (PID), Bartholin's abscess, ectopic pregnancy, and infertility.

- Typical clinical manifestations of gonorrhea, combined with a positive finding in a Gram-stained smear of the purulent discharge from the penis, gives an almost certain diagnosis in men. A culture must be performed to confirm the diagnosis in women.

- The most common treatment for gonorrhea is a single IM dose of ceftriaxone (Rocephin). Patients with coexisting syphilis are likely to be cured by same drugs used for gonorrhea.

- All sexual contacts of patients with gonorrhea must be evaluated and treated to prevent reinfection after resumption of sexual relations.

SYPHILIS

- The cause of **syphilis** is *Treponema pallidum,* a spirochete which enters the body through very small breaks in skin or mucous membranes.

- In addition to sexual contact, syphilis may be spread through contact with infectious lesions and sharing of needles among IV drug users.

- If syphilis is not treated, specific stages are characteristic of disease progression.

- In the *primary stage,* **chancres** appear. During this time, draining of microorganisms into lymph nodes causes regional lymphadenopathy. Genital ulcers may also be present.

- Without treatment, syphilis progresses to a *secondary* (systemic) *stage.* Manifestations include flu-like symptoms of fever, sore throat, headaches, fatigue, and generalized adenopathy.

- The *third stage* is most severe stage. Manifestations include gummas, aneurysms, heart valve insufficiency, and heart failure, and general paresis.

- Syphilis is commonly diagnosed by a serologic test. Benzathine penicillin G (Bicillin) or aqueous procaine penicillin G remains the treatment for all stages of syphilis.

CHLAMYDIAL INFECTIONS

- **Chlamydial infections** are the most commonly reported STD in the United States.

- They are caused by *Chlamydia trachomatis,* a gram-negative bacterium that is transmitted during vaginal, anal, or oral sex.

- Chlamydial infections are associated with gonococcal infections, which makes clinical differentiation difficult. In men, urethritis, epididymitis, and proctitis may occur in both diseases. In women, bartholinitis, cervicitis, and salpingitis (inflammation of the fallopian

tube) can occur in both diseases. Therefore, both *Chlamydia* and gonorrhea are usually treated concurrently even without diagnostic evidence.

- Complications from chlamydial infections in men result in epididymitis with possible infertility and reactive arthritis.
- Complications from chlamydial infections in women may result in PID, which can lead to chronic pelvic pain and infertility.
- DNA amplification tests are the most sensitive diagnostic methods available to detect chlamydial infections.
- Chlamydial infections respond to treatment with doxycycline (Vibramycin) or azithromycin (Zithromax).

GENITAL HERPES

- **Genital herpes** is caused by herpes simplex virus type 2 (HSV-2).
- The virus enters through mucous membranes or breaks in skin during contact with infected person.
- In general, HSV type 1 (HSV-1) causes infection above waist, involving gingivae, dermis, upper respiratory tract, and CNS.
- HSV type 2 (HSV-2) most frequently infects the genital tract and perineum (locations below waist).
- In a *primary episode* of genital herpes the patient may complain of burning or tingling at the site of inoculation. Multiple small, vesicular lesions may appear on penis, scrotum, vulva, perineum, perianal region, vagina, or cervix.
- *Recurrent genital herpes* occurs in 50% to 80% of individuals during the year following the primary episode. Stress, fatigue, sunburn, and menses are noted triggers. Symptoms of recurrent episodes are less severe, and lesions usually heal within 8 to 12 days.
- The diagnosis of genital herpes is confirmed through isolation of the virus from active lesions by means of tissue culture.
- Three antiviral agents are available for treatment: acyclovir (Zovirax), valacyclovir (Valtrex), and famciclovir (Famvir). These drugs inhibit herpetic viral replication and are prescribed for primary and recurrent infections.

GENITAL WARTS

- Genital warts are caused by the human papillomavirus (HPV). There are over 100 types of papillomaviruses, and about 40 of these affect the genital tract.

- Most individuals who have HPV infection do not know they are infected because symptoms are often not present.

- Some HPV types appear to be harmless and self-limiting, whereas others are linked to cervical and vulvar cancer in women and anorectal and squamous cell carcinoma of the penis in men.

- Genital warts are discrete single or multiple papillary growths that are white to gray and pink-flesh colored. They may grow and coalesce to form large, cauliflower-like masses.

- In men, warts may occur on the penis and scrotum, around the anus, or in the urethra. In women, warts may be located on the vulva, vagina, or cervix and in the perianal area.

- Diagnosis of genital warts can be made on the basis of gross appearance of lesions.

- Genital warts are difficult to treat and often require multiple office visits with a variety of treatments.

- Treatment consists of chemical or ablative (removal with laser or electocautery) methods. Because treatment does not destroy the virus, recurrences and reinfection are possible, and careful long-term follow-up is advised.

- A vaccine is now available to prevent precancerous genital lesions and genital warts due to human HPV (types 6, 11, 16, and 18).

NURSING MANAGEMENT

- Nurses should be prepared to discuss decreasing exposure to STDs with all patients, not only those who are perceived to be at risk.

- “Safe” sex practices include abstinence, monogamy with the uninfected partner, avoidance of certain high-risk sexual practices, and use of condoms and other barriers to limit contact with potentially infectious body fluids or lesions.

- Nurses can actively encourage communities to provide better education about STDs for their citizens. Teenagers have a high incidence of infection and should be a prime target for such educational programs.

- An STD may be met with many emotions, such as shame, guilt, anger, and a desire for vengeance. The nurse should provide counseling and try to help patient verbalize feelings related to the STD.

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Key Points

Chapter 54: Nursing Management: Female Reproductive Problems

INFERTILITY

- **Infertility** is the inability to achieve a pregnancy after at least 1 year of regular intercourse without contraception.
- Diagnostic studies include ovulatory studies, tubal patency studies, and postcoital studies.
- Management depends on the cause and can include supplemental hormone therapy and antibiotic therapy.

ABORTION

- **Abortion** is the loss or termination of a pregnancy before the fetus has developed to a state of viability.
- Abortions are classified as *spontaneous* (those occurring naturally) or *induced* (those occurring as a result of mechanical or medical intervention).
- Nursing management includes the use of comfort measures to provide needed physical and mental rest. The support of the patient and her family is essential.

PREMENSTRUAL SYNDROME

- **Premenstrual syndrome** (PMS) is a common disorder of physical and psychologic symptoms during the last few days of the menstrual cycle and before onset of menstruation.
- PMS is thought to have a biologic trigger with compounding psychosocial factors.
- Physical symptoms include breast discomfort, abdominal bloating, sensation of weight gain, episodes of binge eating, and headache. Anxiety, depression, irritability, and mood swings are some of the emotional symptoms.
- No single treatment is available to relieve symptoms. The goal is to reduce symptom severity.

DYSMENORRHEA

- **Dysmenorrhea** is abdominal cramping pain or discomfort associated with menstrual flow.
  - *Primary dysmenorrhea* is caused by an excess of prostaglandin $F_2\alpha$ ($PGF_2\alpha$) and/or an increased sensitivity to it.
  - *Secondary dysmenorrhea* is acquired after adolescence; pelvic causes include

endometriosis, chronic pelvic inflammatory disease, and uterine fibroids.

- Treatment for primary dysmenorrhea includes heat, exercise, and drug therapy. For secondary dysmenorrhea, it depends on the cause.

- Abnormal vaginal or uterine bleeding is a common gynecologic concern and is caused by dysfunction of hypothalamic-pituitary-ovarian axis, infection, and stressful changes in lifestyle. Treatment varies depending on the cause but can include drug therapy and surgery.

ECTOPIC PREGNANCY

- An **ectopic pregnancy** is the implantation of the fertilized ovum anywhere outside the uterine cavity.

- Any blockage of the tube or reduction of tubal peristalsis that impedes or delays the zygote passing to the uterine cavity can result in tubal implantation.

- Risk factors include a history of pelvic inflammatory disease, prior ectopic pregnancy, current progestin-releasing intrauterine device (IUD), progestin-only birth control failure, and prior pelvic or tubal surgery.

- Eventually the tube ruptures with acute peritoneal symptoms of abdominal/ pelvic pain, missed menses, and irregular vaginal bleeding. Less acute symptoms begin 6 to 8 weeks after last normal menstrual period.

- Surgery is usually the treatment.

MENOPAUSE

- **Menopause** is the physiologic cessation of menses associated with declining ovarian function. It is usually considered complete after 1 year of amenorrhea.

- Ovarian changes start the cascade of events that result in menopause.

- Premenopausal symptoms include hot flashes, irregular vaginal bleeding, fat redistribution, and a tendency to gain weight.

- Treatment might include hormone replacement, drug therapy, and alternative therapies.

INFECTION AND INFLAMMATION OF VAGINA, CERVIX, AND VULVA

- Infection and inflammation of vagina, cervix, and vulva commonly occur when natural defenses of the acid vaginal secretions (maintained by sufficient estrogen levels) and presence of *Lactobacillus* are disrupted.

- Abnormal vaginal discharge and reddened vulvar lesions are often noted with itching and dysuria.

- Treatment includes antibiotics and antifungal preparations.

PELVIC INFLAMMATORY DISEASE

- **Pelvic inflammatory disease** (PID) is an infectious condition of pelvic cavity that may involve infection of fallopian tubes (salpingitis), ovaries (oophoritis), and pelvic peritoneum (peritonitis).
- PID is often the result of untreated cervicitis.
- The main symptom is constant lower abdominal pain.
- Long-term complications include ectopic pregnancy, infertility, and chronic pelvic pain.
- PID is usually treated with antibiotics.

ENDOMETRIOSIS

- **Endometriosis** is the presence of normal endometrial tissue in sites outside endometrial cavity.
- One cause is retrograde menstrual flow through the fallopian tubes carrying viable endometrial tissues into the pelvis.
- Symptoms are secondary dysmenorrhea, infertility, pelvic pain, dyspareunia, and irregular bleeding.
- Drug therapy reduces symptoms with surgery for a potential cure.

LEIOMYOMAS

- **Leiomyomas** (uterine fibroids) are benign smooth-muscle tumors that occur within the uterus.
- Symptoms may include abnormal uterine bleeding, and pain.
- Treatment depends on size of tumor and may include surgery.

CERVICAL CANCER

- There is a strong relationship between sexual exposure of papillomavirus (HPV) and dysplasia.
- Later signs are leukorrhea, intermenstrual bleeding, and pain.
- The finding of an abnormal Pap test indicates need for follow-up.
- Invasive disease is treated with surgery, radiation, and chemotherapy.

- A new vaccine can protect against most types of cervical cancer.

ENDOMETRIAL CANCER

- The major risk factor of endometrial cancer is unopposed estrogen.
- It has low mortality rate, as most cases are diagnosed early.
- The first sign of endometrial cancer is abnormal uterine bleeding.
- Treatment is total hysterectomy and bilateral salpingo-oophorectomy with lymph node biopsies. Radiation and chemotherapy may also be given.

OVARIAN CANCER

- The etiology of ovarian cancer is generally not known.
- Most women with ovarian cancer have advanced disease at diagnosis.
- The greatest risk factor is family history.
- In the early stages, manifestations are vague and may consist of abdominal discomfort (gas, indigestion, pressure, bloating, cramps) and change in bowel habits.
- Yearly bimanual pelvic examinations should be performed to identify an ovarian mass.
- Treatment includes surgery, chemotherapy, and radiation.
- Nurses can teach women importance of routine screening for cancers of the reproductive system.

UTERINE PROLAPSE

- **Uterine prolapse** is the downward displacement of uterus into the vaginal canal.
- Symptoms are dyspareunia, dragging or heavy pelvic feeling, backache, and bowel or bladder problems if **cystocele** or **rectocele** is also present.
- Therapy depends on degree of prolapse and can include strengthening exercises, and a pessary.

SEXUAL ASSAULT

- **Sexual assault** is the forcible perpetration of a sexual act on a person without his or her consent. It can include sodomy, forced vaginal or anal intercourse, oral copulation, and assault with a foreign object.
- Physical injuries may include bruising and lacerations to perineum, hymen, vulva,

vagina, cervix, and anus.

- Feelings of humiliation, degradation, embarrassment, anger, self-blame, and fear of another assault are commonly expressed.
- Ensuring the woman's emotional and physical safety is the highest priority.
- Follow-up physical and psychologic care is essential.

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Key Points

Chapter 55: Nursing Management: Male Reproductive Problems

BENIGN PROSTATIC HYPERPLASIA (BPH)

- **Benign prostatic hyperplasia** (BPH) is prostate gland enlargement due to increased epithelial cells and stromal tissue.
- BPH results from endocrine changes associated with the aging process.
- The compression of the urethra leads to clinical symptoms including decrease in caliber and force of the urinary stream, difficulty in initiating voiding, intermittency and dribbling.
- Conservative and initial treatment is "watchful waiting" when there are no symptoms or only mild ones. Drug therapy may also be used.
- Invasive treatment of symptomatic BPH involves prostate resection or ablation.

PROSTATE CANCER

- **Prostate cancer** is the most common cancer among men, excluding skin cancer.
- Risk factors include family history, age, and ethnicity.
- Symptoms of prostate cancer are similar to those for BPH, including dysuria, hesitancy, dribbling, frequency, and urgency.
- Elevated levels of **prostate-specific antigen** (PSA) indicate prostatic pathology, although not necessarily prostate cancer.
- The conservative approach to management is "watchful waiting."

- Invasive therapies include **radical prostatectomy** and cryosurgery. Treatment may also include drugs, hormones, chemotherapy, and radiation.

- The nursing role is to encourage patients, in consultation with health care providers, to have annual prostate screening (PSA and digital rectal examination) starting at age 50 or younger if risk factors present.

PROSTATITIS

- The term **prostatitis** describes a group of inflammatory and noninflammatory conditions affecting the prostate gland.

- It includes acute bacterial prostatitis, chronic bacterial prostatitis, chronic prostatitis/chronic pelvic pain syndrome, and asymptomatic inflammatory prostatitis.

- Antibiotics are used for acute and chronic bacterial prostatitis.

EPIDIDYMITIS

- **Epididymitis** is an acute, painful inflammatory process of the epididymis secondary to an infectious process, trauma, or urinary reflux down the vas deferens.

- Antibiotic use is important for both partners if transmission was through sexual contact.

- Conservative treatment consists of bed rest with elevation of scrotum, use of ice packs, and analgesics.

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Key Points

Chapter 56: Nursing Assessment: Nervous System

STRUCTURES AND FUNCTIONS

- The human nervous system is a highly specialized system responsible for the control and integration of the body's many activities.

- The nervous system can be divided into the central nervous system (CNS) and parts of the peripheral nervous system (PNS).
    - The **central nervous system** consists of the brain and spinal cord.
    - The **peripheral nervous system** consists of the cranial and spinal nerves and the autonomic nervous system (ANS).

- The nervous system is made up of two types of cells: neurons and neuroglia.
    - The **neurons** of the nervous system come in many different shapes and sizes, but they all share common characteristics: (1) *excitability,* or the ability to generate a nerve impulse; (2) *conductivity,* or the ability to transmit the impulse to other portions of the cell; and (3) the ability to influence other neurons, muscle cells, and glandular cells by transmitting nerve impulses to them.
    - **Neuroglia,** or glial cells, provide support, nourishment, and protection to neurons.

- Nerve impulses originate within a neuron as an action potential that moves along the body of the cell (*axon*) until it reaches the end of the nerve fiber. From there, it is transmitted across the junction between nerve cells by a chemical interaction and then, the impulse will move across the next neuron as an action potential.
    - A **synapse** is the structural and functional junction between two neurons. It is the point at which the nerve impulse is transmitted from one neuron to another or from neuron to glands or muscles.
    - A **neurotransmitter** is a chemical agent involved in the transmission of an impulse across the synaptic cleft.

CENTRAL NERVOUS SYSTEM

- The major structural components of the CNS are the spinal cord and brain.

Spinal Cord

- The spinal cord is continuous with the brainstem and exits from the cranial cavity through the foramen magnum. A cross section of the spinal cord reveals gray matter that is centrally located and is surrounded by white matter.

- Specific ascending and descending pathways in the white matter can be identified.
    - In general, the ascending tracts carry specific sensory information to higher levels of the CNS.
    - Descending tracts carry impulses that are responsible for muscle movement.

- **Lower motor neurons** are the final common pathway through which descending motor tracts influence skeletal muscle, the effector organ for movement. The cell bodies of these cells are located in spinal cord and the axons innervate the skeletal muscles.

Brain

- The brain consists of the cerebral hemispheres, cerebellum, and brainstem.

- The *cerebrum* is composed of the right and left hemispheres. Both hemispheres can be further divided into four major lobes.

  - The frontal lobe controls higher cognitive function, memory retention, voluntary eye movements, voluntary motor movement, and expressive speech.
  - The temporal lobe contains Wernicke's area, which is responsible for receptive speech and for integration of somatic, visual, and auditory data.
  - The parietal lobe is composed of the sensory cortex, controlling and interpreting spatial information.
  - Processing of sight take place in the occipital lobe.

- The basal ganglia, thalamus, hypothalamus, and limbic system are also located in the cerebrum.

- The *brainstem* includes the midbrain, pons, and medulla. The vital centers concerned with respiratory, vasomotor, and cardiac function are located in the medulla.

- The brainstem contains the centers for sneezing, coughing, hiccupping, vomiting, sucking, and swallowing. Also located in the brainstem is the reticular formation, which relays sensory information, influences excitatory and inhibitory control of spinal motor neurons, and controls vasomotor and respiratory activity.

- The *cerebellum* coordinates voluntary movement and to maintains trunk stability and equilibrium.

- **Cerebrospinal fluid** circulates within the subarachnoid space that surrounds the brain, brainstem, and spinal cord. This fluid provides cushioning for the brain and spinal cord, allows fluid shifts from the cranial cavity to the spinal cavity, and carries nutrients.

PERIPHERAL NERVOUS SYSTEM

- The PNS includes all the neuronal structures that lie outside the CNS. It consists of the spinal and cranial nerves, their associated ganglia (groupings of cell bodies), and portions of the ANS.

- The spinal nerve contains a pair of dorsal (afferent) sensory nerve fibers and ventral (efferent) motor fibers, which innervate a specific region of the neck, trunk, or limbs. This combined motor-sensory nerve is called a *spinal nerve.*

- The **cranial nerves** (CNs) are the 12 paired nerves composed of cell bodies with fibers that exit from the cranial cavity. Unlike the spinal nerves, which always have both afferent sensory and efferent motor fibers, some CNs have only afferent and some only efferent fibers; others have both.

- The **autonomic nervous system** (ANS) governs involuntary functions of cardiac muscle, smooth (involuntary) muscle, and glands. The ANS is divided into two components, the sympathetic and parasympathetic nervous systems.

PROTECTIVE MECHANISMS

- The **blood-brain barrier** is a physiologic barrier between blood capillaries and brain tissue. The structure of brain capillaries differs from that of other capillaries. Some substances that normally pass readily into most tissues are prevented from entering brain tissue.

- The **meninges** are three layers of protective membranes that surround the brain and spinal cord.
    - The thick *dura mater* forms the outermost layer, with the arachnoid layer and pia mater being the next two layers.
    - The *subarachnoid space* lies between the arachnoid layer and the pia mater. This space is filled with CSF.

- The bony skull protects the brain from external trauma. It is composed of 8 cranial bones and 14 facial bones.

- The vertebral column protects the spinal cord, supports the head, and provides flexibility. The vertebral column is made up of 33 individual vertebrae: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral (fused into 1), and 4 coccygeal (fused into 1).

Assessment

- Special attention should be given to obtaining a careful medication history, especially the use of sedatives, opioids, tranquilizers, and mood-elevating drugs.

- The nurse should ask about the patient's health practices related to the nervous system, such as substance abuse and smoking, maintenance of adequate nutrition, safe participation in physical and recreational activities, use of seat belts and helmets, and control of hypertension.

- Bowel and bladder problems are often associated with neurologic problems, such as stroke, head injury, spinal cord injury, multiple sclerosis, and dementia. It is important to determine if the bowel or bladder problem was present before or after the neurologic event to plan appropriate interventions.

- Because the nervous system controls cognition and sensory integration, many neurologic disorders affect these functions. The nurse should assess memory, language, calculation ability, problem-solving ability, insight, and judgment.

- The ability to participate in sexual activity should be assessed because many nervous system disorders can affect sexual response.

- The physical examination assesses six categories of functions: mental status, function of CNs, motor function, cerebellar function, sensory function, and reflex function.

- Assessment of mental status (cerebral functioning) gives an indication of how the patient is functioning as a whole and how the patient is adapting to the environment.
- Each CN should be assessed individually.
- The motor system examination includes assessment of bulk, tone, and power of the major muscle groups of the body, as well as assessment of balance and coordination.
- Several modalities are tested in the somatic sensory examination. Each modality is carried by a specific ascending pathway in the spinal cord before it reaches the sensory cortex.
- A simple muscle stretch reflex is initiated by briskly tapping the tendon of a stretched muscle, usually with a reflex hammer.

Diagnostic Studies

- Lumbar puncture is the most common method of obtaining CSF for analysis. CSF analysis provides information about a variety of CNS diseases.

- Cerebral angiography is indicated when vascular lesions or tumors are suspected.

- The technique of *electroencephalography* (EEG) involves the recording of the electrical activity of the surface cortical neurons of the brain by 8 to 16 electrodes placed on specific areas of the scalp.

- *Electromyography* (EMG) is the recording of electrical activity associated with innervation of skeletal muscle.

- Nerve conduction studies involve application of a brief electrical stimulus to a distal portion of a sensory or mixed nerve and recording the resulting wave of depolarization at some point proximal to the stimulation.

- *Evoked potentials* are recordings of electrical activity associated with nerve conduction along sensory pathways. The activity is generated by a specific sensory stimulus related to the type of study (e.g., checkerboard patterns for visual evoked potentials, clicking sounds for auditory evoked potentials, mild electrical pulses for somatosensory evoked potentials).

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Key Points

Chapter 57: Nursing Management: Acute Intracranial Problems

NORMAL INTRACRANIAL PRESSURE

- **Intracranial pressure** (ICP) is the hydrostatic force measured in the brain CSF compartment. Normal ICP is the total pressure exerted by the three components within the skull: brain tissue, blood, and CSF.

- If the volume of any one of the three components increases within the cranial vault and the volume from another component is displaced, the total intracranial volume will not change.

- ICP can be measured in the ventricles, subarachnoid space, subdural space, epidural space, or brain parenchymal tissue using a pressure transducer. Normal intracranial ICP ranges from 0 to 15 mm Hg.

- A sustained pressure above the upper limit is considered abnormal. ICP may rise due to head trauma, stroke, subarachnoid hemorrhage, brain tumor, inflammation, hydrocephalus, or brain tissue damage from other causes.

CRANIAL BLOOD FLOW

- *Cerebral blood flow* (CBF) is the amount of blood in milliliters passing through 100 g of brain tissue in 1 minute.

- Through a process known as *autoregulation,* the brain has the ability to regulate its own blood flow in response to its metabolic needs despite wide fluctuations in systemic arterial pressure.

- The *cerebral perfusion pressure* (CPP) is the pressure needed to ensure blood flow to the brain. As the CPP decreases, autoregulation fails and CBF decreases, which can lead to ischemia and neuronal death.

- *Compliance* is the expandability of the brain. With low compliance, small changes in volume result in greater increases in pressure.

INCREASED INTRACRANIAL PRESSURE

- Increased ICP is a life-threatening situation that results from an increase in any or all of the three components (brain tissue, blood, CSF) within the skull. **Cerebral edema** is an important factor contributing to increased ICP.

- Elevated ICP is clinically significant because it diminishes CPP, increases risks of brain ischemia and infarction, and is associated with a poor prognosis.

- The clinical manifestations of increased ICP can take many forms, depending on the cause, location, and rate at which the pressure increase occurs. Complications of ICP

include changes in the level of consciousness, changes in vital signs, dilation of pupils, decrease in motor function, headache, and vomiting.

- The earlier the condition is recognized and treated, the better the patient outcome.

- The major complications of uncontrolled increased ICP are inadequate cerebral perfusion and cerebral herniation.

- ICP monitoring is used to guide clinical care when the patient is at risk for or has elevations in ICP. It may be used in patients with a variety of neurologic insults, including hemorrhage, stroke, tumor, infection, or traumatic brain injury.

- The "gold standard" for monitoring ICP is the ventriculostomy, in which a specialized catheter is inserted into the right lateral ventricle and coupled to an external transducer. Other devices now allow for an indirect assessment of cerebral oxygenation and perfusion.

- With the ventricular catheter and certain fiberoptic systems, it is possible to control ICP by removing CSF. The level of the ICP at which to initiate drainage, amount of fluid to be drained, height of the system, and frequency of drainage are ordered by the physician.

- The goals of collaborative care are to identify and treat the underlying cause of increased ICP and to support brain function.

- Drug therapy plays an important part in the management of increased ICP. An osmotic diuretic, corticosteroids, and barbiturates may be prescribed.

- All patients must have their nutritional needs met, regardless of their state of consciousness or health. Early feeding following brain injury may improve outcomes.

- The **Glasgow Coma Scale** is a quick, practical, and standardized system for assessing the degree of impaired consciousness that should be used during nursing assessment. Also during assessment, the pupils are compared to one another for size, shape, movement, and reactivity.

- The overall nursing goals are that the patient with increased ICP will (1) maintain a patent airway, (2) have ICP within normal limits, (3) demonstrate normal fluid and electrolyte balance, and (4) have no complications secondary to immobility and decreased level of consciousness.

- Maintenance of a patent airway is critical in the patient with increased ICP and is a primary nursing responsibility. As the level of consciousness decreases, the patient is at increased risk of airway obstruction from the tongue dropping back and occluding the airway or from accumulation of secretions.

- The patient with increased ICP should be maintained in the head-up position. The nurse must take care to prevent extreme neck flexion, which can cause venous obstruction and contribute to elevated ICP.

- The patient with increased ICP and a decreased level of consciousness needs protection from self-injury. Confusion, agitation, and the possibility of seizures increase the risk for injury.

HEAD INJURY

- **Head injury** includes any trauma to the scalp, skull, or brain. The term *head trauma* is used primarily to signify craniocerebral trauma, which includes an alteration in consciousness, no matter how brief.

- *Scalp lacerations* are an easily recognized type of external head trauma. Because the scalp contains many blood vessels with poor constrictive abilities, the major complications associated with scalp laceration are blood loss and infection.

- *Skull fractures* frequently occur with head trauma. There are several ways to describe skull fractures: (1) linear or depressed; (2) simple, comminuted, or compound; and (3) closed or open.

- A **concussion** is a sudden transient mechanical head injury with disruption of neural activity and a change in the LOC and is considered a minor head injury.

- A **contusion,** a major head injury, is the bruising of the brain tissue within a focal area. A contusion may contain areas of hemorrhage, infarction, necrosis, and edema and frequently occurs at a fracture site.

- *Lacerations,* another major head trauma, involve actual tearing of the brain tissue and often occur in association with depressed and open fractures and penetrating injuries.

- Complications from a head injury may include an **epidural hematoma,** a **subdural hematoma,** and **intracerebral hematoma.**

- CT scan is considered the best diagnostic test to evaluate for craniocerebral trauma because it allows rapid diagnosis and intervention in the acute setting. MRI, PET, and evoked potential studies may also be used in the diagnosis and differentiation of head injuries.

- The most important aspects of nursing assessment are noting the GCS score, assessing and monitoring the neurologic status, and determining whether a CSF leak has occurred.

- The overall nursing goals are that the patient with an acute head injury will (1) maintain adequate cerebral oxygenation and perfusion; (2) remain normothermic; (3) achieve

control of pain and discomfort; (4) be free from infection; and (5) attain maximal cognitive, motor, and sensory function.

- Management at the injury scene can have a significant impact on the outcome of the head injury. The general goal of acute nursing management of the head-injured patient is to maintain cerebral oxygenation and perfusion and prevent secondary cerebral ischemia.

- The major focus of nursing care for the brain-injured patient relates to increased ICP. However, there may be other specific problems that require nursing intervention, such as hyperthermia.

- Once the condition has stabilized, the patient is usually transferred for acute rehabilitation management to prepare the patient for reentry into the community. Many of the principles of nursing management of the patient with a stroke are appropriate.

BRAIN TUMORS

- Brain tumors can occur in any part of the brain or spinal cord. Tumors of the brain may be *primary,* arising from tissues within the brain, or *secondary,* resulting from a metastasis from a malignant neoplasm elsewhere in the body.

- Brain tumors are generally classified according to the tissue from which they arise. The most common primary brain tumors originate in astrocytes and these tumors are called gliomas.

- Unless treated, all brain tumors eventually cause death from increasing tumor volume leading to increased ICP. Brain tumors rarely metastasize outside the central nervous system (CNS) because they are contained by structural (meninges) and physiologic (blood-brain) barriers.

- Wide ranges of possible clinical manifestations are associated with brain tumors. Headache is a common problem and seizures are common in gliomas and brain metastases.

- An extensive history and a comprehensive neurologic examination must be done in the workup of a patient with a suspected brain tumor. A new onset seizure disorder may be the first indication of a brain tumor. The correct diagnosis of a brain tumor can be made by obtaining tissue for histologic study.

- Surgical removal is the preferred treatment for brain tumors. Radiation therapy is commonly used as a follow-up measure after surgery. The effectiveness of chemotherapy has been limited by difficulty getting drugs across the blood-brain barrier, tumor cell heterogeneity, and tumor cell drug resistance.

- The overall nursing goals are that the patient with a brain tumor will (1) maintain normal ICP, (2) maximize neurologic functioning, (3) achieve control of pain and discomfort,

and (4) be aware of the long-term implications with respect to prognosis and cognitive and physical functioning.

- Due to behavioral instability, close supervision of activity, use of side rails, judicious use of restraints, appropriate sedative medications, padding of the rails and the area around the bed, and a calm, reassuring approach to care are all essential techniques in the care of these patients.

CRANIAL SURGERY

- The cause or indication for cranial surgery may be related to a brain tumor, CNS infection (e.g., abscess), vascular abnormalities, craniocerebral trauma, seizure disorder, or intractable pain.

- Stereotactic surgery uses precision apparatus (often computer-guided) to assist the surgeon to precisely target an area of the brain. Stereotactic biopsy can be performed to obtain tissue samples for histologic examination.

- *Stereotactic radiosurgery* is a procedure that involves closed-skull destruction of an intracranial target using ionizing radiation focused with the assistance of an intracranial guiding device. A sophisticated computer program is used while the patient's head is held still in a stereotactic frame.

- Craniotomy is another cranial surgical option. Depending on the location of the pathologic condition, a craniotomy may be frontal, parietal, occipital, temporal, or a combination of any of these.

- The overall goals are that the patient with cranial surgery will (1) return to normal consciousness, (2) achieve control of pain and discomfort, (3) maximize neuromuscular functioning, and (4) be rehabilitated to maximum ability.

- The primary goal of care after cranial surgery is prevention of increased ICP. Frequent assessment of the neurologic status of the patient is essential during the first 48 hours.

- The rehabilitative potential for a patient after cranial surgery depends on the reason for the surgery, the postoperative course, and the patient's general state of health. Nursing interventions must be based on a realistic appraisal of these factors.

INFLAMMATORY CONDITIONS OF THE BRAIN

- Meningitis, encephalitis, and brain abscesses are the most common inflammatory conditions of the brain and spinal cord. Inflammation can be caused by bacteria, viruses, fungi, and chemicals.

Bacterial Meningitis

- **Meningitis** is an acute inflammation of the meningeal tissues surrounding the brain and the spinal cord. Bacterial meningitis is considered a medical emergency.

- Meningitis usually occurs in the fall, winter, or early spring, and is often secondary to viral respiratory disease. Older adults and persons who are debilitated are more often affected than is the general population.

- Fever, severe headache, nausea, vomiting, and **nuchal rigidity** (neck stiffness) are key signs of meningitis.

- The most common acute complication of bacterial meningitis is increased ICP. Most patients will have increased ICP, and it is the major cause of an altered mental status.

- When a patient presents with manifestations suggestive of bacterial meningitis, a blood culture should be done. Diagnosis is usually verified by doing a lumbar puncture with analysis of the CSF.

- When meningitis is suspected, antibiotic therapy is instituted after the collection of specimens for cultures, even before the diagnosis is confirmed.

- All patients suffer some degree of mental distortion and hypersensitivity and may be frightened and misinterpret the environment. Every attempt should be made to minimize environmental stimuli and prevent injury.

- Fever must be vigorously managed because it increases cerebral edema and the frequency of seizures.

- Meningitis generally requires respiratory isolation until the cultures are negative. Meningococcal meningitis is highly contagious whereas other causes of meningitis may pose a minimal to no infection risk with patient contact.

- After the acute period has passed, the patient requires several weeks of convalescence before normal activities can be resumed. In this period, adequate nutrition should be stressed, with an emphasis on a high-protein, high-calorie diet in small, frequent feedings.

Viral Meningitis

- The most common causes of viral meningitis are enteroviruses, arboviruses, human immunodeficiency virus, and herpes simplex virus (HSV).

- Viral meningitis usually presents as a headache, fever, photophobia, and stiff neck. There are usually no symptoms of brain involvement.

- Viral meningitis is managed symptomatically because the disease is self-limiting. Full recovery from viral meningitis is expected.

Encephalitis

- **Encephalitis,** an acute inflammation of the brain, is a serious, and sometimes fatal, disease.

- Encephalitis is usually caused by a virus. Many different viruses have been implicated in encephalitis, some of them associated with certain seasons of the year and endemic to certain geographic areas. Ticks and mosquitoes transmit epidemic encephalitis.

- Signs of encephalitis appear on day two or three and may vary from minimal alterations in mental status to coma. Virtually any CNS abnormality can occur, including hemiparesis, tremors, seizures, cranial nerve palsies, personality changes, memory impairment, amnesia, and dysphasia.

- Collaborative and nursing management of encephalitis, including West Nile virus infection, is symptomatic and supportive. In the initial stages of encephalitis, many patients require intensive care.

Rabies

- Despite the success of vaccines in domestic animals, rabies remains a serious public health concern due to the presence of the disease in wild animals. Once a human contracts rabies and develops symptoms, the disease almost always ends in death.

- Although rabies is generally transmitted via saliva from the bite of an infected animal, it can also be spread by scratches, by mucous membrane contact with infected secretions, and by inhalation of aerosolized virus into the respiratory tract. Any warm-blooded mammal can carry rabies, including livestock.

- Two presentations of rabies include *encephalitic* rabies, which is the most common, and *paralytic* rabies.

- Because rabies is nearly always fatal, management efforts are directed at preventing the transmission and onset of the disease.

Brain Abscess

- **Brain abscess** is an accumulation of pus within the brain tissue that can result from a local or a systemic infection. Direct extension from ear, tooth, mastoid, or sinus infection is the primary cause.

- The manifestations of brain abscess are similar to those of meningitis and encephalitis.

- Antimicrobial therapy is the primary treatment for brain abscess. Other manifestations are treated symptomatically.

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Key Points

Chapter 58: Nursing Management: Stroke

STROKE

- **Stroke** occurs when there is *ischemia* (inadequate blood flow) to a part of the brain or hemorrhage into the brain that results in death of brain cells. Functions, such as movement, sensation, or emotions, that were controlled by the affected area of the brain are lost or impaired.

- The term **brain attack** is increasingly being used to describe stroke. This term communicates the urgency of recognizing the clinical manifestations of a stroke and treating a medical emergency, similar to what would be done with a heart attack.

Risk Factors

- The most effective way to decrease the burden of stroke is prevention. Nonmodifiable risk factors include age, gender, race, and heredity.

- Hypertension is the single most important modifiable risk factor. Other modifiable risk factors include heart disease, diabetes, increased serum cholesterol, smoking, excessive alcohol consumption, obesity, physical inactivity, poor diet, and drug abuse.

- *Atherosclerosis* (hardening and thickening of arteries) is a major cause of stroke. It can lead to thrombus formation and contribute to emboli.

- A **transient ischemic attack** (TIA) is a temporary focal loss of neurologic function caused by ischemia of one of the vascular territories of the brain, lasting less than 24 hours and often lasting less than 15 minutes. Most TIAs resolve within 3 hours. TIAs are a warning sign of progressive cerebrovascular disease.

- Strokes are classified as ischemic or hemorrhagic based on the underlying pathophysiologic findings.

- ***Ischemic stroke:***
    - An **ischemic stroke** results from inadequate blood flow to the brain from partial or complete occlusion of an artery and accounts for approximately 80% of all strokes. Ischemic strokes are further divided into thrombotic and embolic.
    - A **thrombotic stroke** occurs from injury to a blood vessel wall and formation of a blood clot. The lumen of the blood vessel becomes narrowed, and if it becomes occluded, infarction occurs.
    - **Embolic stroke** occurs when an embolus lodges in and occludes a cerebral artery, resulting in infarction and edema of the area supplied by the involved vessel.

- ***Hemorrhagic stroke:***
    - **Hemorrhagic strokes** account for approximately 15% of all strokes and result from bleeding into the brain tissue itself or into the subarachnoid space or ventricles.
    - **Intracerebral hemorrhage** is bleeding within the brain caused by a rupture of a vessel. The prognosis of intracerebral hemorrhage is poor.
    - **Subarachnoid hemorrhage** occurs when there is intracranial bleeding into the cerebrospinal fluid–filled space between the arachnoid and pia mater membranes on the surface of the brain. Subarachnoid hemorrhage is commonly caused by rupture of a cerebral **aneurysm** (congenital or acquired weakness and ballooning of vessels).

Clinical Manifestations and Diagnostic Studies

- A stroke can have an effect on many body functions, including motor activity, bladder and bowel elimination, intellectual function, spatial-perceptual alterations, personality, affect, sensation, swallowing, and communication.
    - Motor deficits include impairment of (1) mobility, (2) respiratory function, (3) swallowing and speech, (4) gag reflex, and (5) self-care abilities.
    - The patient may experience **aphasia** (total loss of comprehension and use of language) when a stroke damages the dominant hemisphere of the brain or **dysphasia** (difficulty related to the comprehension or use of language) due to partial disruption or loss.
    - Many stroke patients also experience **dysarthria,** a disturbance in the muscular control of speech. Impairments may involve pronunciation, articulation, and phonation.
    - Patients who have had a stroke may have difficulty controlling their emotions.
    - Both memory and judgment may be impaired as a result of stroke.
    - Most problems with urinary and bowel elimination occur initially and are temporary.

- The single most important diagnostic tool for patients who have experienced a stroke is the noncontrast CT scan. The CT scan indicates the size and location of the lesion and differentiates between ischemic and hemorrhagic stroke.

Collaborative Care: Prevention

- Measures to prevent the development of a thrombus or embolus are used in patients at risk for stroke. Antiplatelet drugs are usually the chosen treatment to prevent further stroke in patients who have had a TIA related to atherosclerosis.

- Surgical interventions for the patient with TIAs from carotid disease include carotid endarterectomy, transluminal angioplasty, stenting, and extracranial-intracranial bypass.

Collaborative Care: Acute Phase

- The goals for collaborative care during the acute phase are preserving life, preventing further brain damage, and reducing disability. Treatment differs according to the type of stroke and changes as the patient progresses from the acute to the rehabilitation phase.

- Elevated BP is common immediately after a stroke and may be a protective response to maintain cerebral perfusion.

- Fluid and electrolyte balance must be controlled carefully. The goal generally is to keep the patient adequately hydrated to promote perfusion and decrease further brain injury.

- Recombinant tissue plasminogen activator (tPA) administered IV is used to reestablish blood flow through a blocked artery to prevent cell death in patients with the acute onset of ischemic stroke symptoms.

- After the patient has stabilized and to prevent further clot formation, patients with strokes caused by thrombi and emboli may be treated with platelet inhibitors and anticoagulants.

- Surgical interventions for stroke include immediate evacuation of aneurysm-induced hematomas or cerebellar hematomas larger than 3 cm. For ischemic strokes, the mechanical embolus retrieval in cerebral ischemia (Merci) retriever allows physicians to go inside the blocked artery of patients who are experiencing ischemic strokes. The retriever goes to the artery that is blocked, directly to the site of the problem, and pulls the clot out.

- After the stroke has stabilized for 12 to 24 hours, collaborative care shifts from preserving life to lessening disability and attaining optimal function.

Nursing Management

- Typical nursing goals are that the patient will:
  (1) maintain a stable or improved level of consciousness
  (2) attain maximum physical functioning
  (3) attain maximum self-care abilities and skills
  (4) maintain stable body functions (e.g., bladder control)
  (5) maximize communication abilities
  (6) maintain adequate nutrition
  (7) avoid complications of stroke
  (8) maintain effective personal and family coping

Acute Phase

- During the acute phase following a stroke, management of the respiratory system is a nursing priority. Stroke patients are particularly vulnerable to respiratory problems, such as aspiration pneumonia.

- The patient's neurologic status must be monitored closely to detect changes suggesting extension of the stroke, increased ICP, vasospasm, or recovery from stroke symptoms.

- Nursing goals for the cardiovascular system are aimed at maintaining homeostasis. Many patients with stroke have decreased cardiac reserves secondary to cardiac disease.

- The nursing goal for the musculoskeletal system is to maintain optimal function. This is accomplished by the prevention of joint contractures and muscular atrophy.

- The skin of the patient with stroke is particularly susceptible to breakdown related to loss of sensation, decreased circulation, and immobility.

- The most common bowel problem for the patient who has experienced a stroke is constipation. Patients may be prophylactically placed on stool softeners and/or fiber.

- In the acute stage of stroke, the primary urinary problem is poor bladder control, resulting in incontinence. Efforts should be made to promote normal bladder function and to avoid the use of indwelling catheters.

- The patient may initially receive IV infusions to maintain fluid and electrolyte balance, as well as for administration of drugs. Patients with severe impairment may require enteral or parenteral nutrition support. Swallowing ability will need to be assessed.

- Homonymous hemianopsia (blindness in the same half of each visual field) is a common problem after a stroke. Persistent disregard of objects in part of the visual field should alert the nurse to this possibility.

- The patient is usually discharged from the acute care setting to home, an intermediate or long-term care facility, or a rehabilitation facility. Criteria for transfer to rehabilitation may include the patient's ability to participate in therapies for a minimum number of hours per day.

Rehabilitation

- Rehabilitation is the process of maximizing the patient's capabilities and resources to promote optimal functioning related to physical, mental, and social well-being. Regardless of the care setting, ongoing rehabilitation is essential to maximize the patient's abilities.

- Rehabilitation requires a team approach so the patient and family can benefit from the combined, expert care of an interdisciplinary team. The interdisciplinary team is composed of many members, including nurses, physicians, psychiatrist, physical therapist, occupational therapist, speech therapist, registered dietitian, respiratory therapist, vocational therapist, recreational therapist, social worker, psychologist, pharmacist, and chaplains.

- The goals for rehabilitation of the patient with stroke are mutually set by the patient, family, nurse, and other members of the rehabilitation team.

- The nurse initially emphasizes the musculoskeletal functions of eating, toileting, and walking for the rehabilitation of the patient.

- After the acute phase, a dietitian can assist in determining the appropriate daily caloric intake based on the patient's size, weight, and activity level.

- A bowel management program is implemented for problems with bowel control, constipation, or incontinence.

- Patients who have had a stroke frequently have perceptual deficits. For example, patients with a stroke on the right side of the brain usually have difficulty in judging position, distance, and rate of movement.

- The patient with a stroke may experience many losses, including sensory, intellectual, communicative, functional, role behavior, emotional, social, and vocational losses. Nurses should help patients and families cope with these losses.

- Speech, comprehension, and language deficits are the most difficult problems for the patient and family. Speech therapists can assess and formulate a plan of care to support communication.

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Key Points

Chapter 59: Nursing Management: Chronic Neurologic Problems

HEADACHE

- The primary classifications of **headaches** include tension-type, migraine, and cluster headaches.
    - **Tension-type headache,** the most common type of headache, is characterized by its bilateral location and pressing/tightening quality. Tension-type headaches are usually of mild or moderate intensity and not aggravated by physical activity.
    - **Migraine headache** is a recurring headache characterized by unilateral or bilateral throbbing pain, a triggering event or factor, strong family history, and manifestations associated with neurologic and autonomic nervous system dysfunction.
    - **Cluster headaches** are a rare form of headache with a sharp stabbing pain. Cluster headaches involve repeated headaches that can occur for weeks to months at a time, followed by periods of remission.

- Therapies used in the treatment of headaches include drugs, meditation, yoga, biofeedback, cognitive-behavioral therapy, and relaxation training.

- Drug therapies include:
    - Tension-type: nonopioid analgesic is used alone or in combination with a sedative, muscle relaxant, tranquilizer, or codeine.
    - Migraine: analgesic, triptans, and preventive treatment (i.e., topiramate).
    - Cluster: drug therapy is not as useful as it is for the other types of headaches; prophylactic drugs may be prescribed.

- Headaches may be related to an inability to cope with daily stresses. The most effective therapy may be to help patients examine their lifestyle, recognize stressful situations, and learn to cope with them more appropriately.

- In addition to using analgesics and analgesic combination drugs for the symptomatic relief of headache, the patient should be encouraged to use relaxation techniques because they are effective in relieving tension-type and migraine headaches.

SEIZURE DISORDERS AND EPILEPSY

- **Seizure** is a paroxysmal, uncontrolled electrical discharge of neurons in the brain that interrupts normal function. Seizures are often symptoms of an underlying illness.

- **Epilepsy** is a condition in which a person has spontaneously recurring seizures caused by a chronic underlying condition.

- Seizures are divided into two major classes: generalized and partial.

- **Generalized seizures** involve both sides of the brain and are characterized by bilateral synchronous epileptic discharges in the brain from the onset of the seizure. Because the entire brain is affected at the onset of the seizures, there is no warning or aura.
    - **Tonic-clonic seizure** is characterized by loss of consciousness and falling to the ground if the patient is upright, followed by stiffening of the body (tonic phase) for 10 to 20 seconds and subsequent jerking of the extremities (clonic phase) for another 30 to 40 seconds.
    - **Absence (petit mal) seizure** usually occurs only in children and rarely continues beyond adolescence.
    - **Atypical absence seizure,** which is characterized by a staring spell accompanied by other signs and symptoms, includes brief warnings, peculiar behavior during the seizure, or confusion after the seizure.

- **Partial seizures,** also referred to as partial focal seizures, are caused by focal irritations. They manifest with unilateral manifestations that arise from localized brain involvement.
    - *Simple partial seizures* with elementary symptoms do not involve loss of consciousness and rarely last longer than 1 minute.

  - *Complex partial seizures* can involve a variety of behavioral, emotional, affective, and cognitive functions. These seizures usually last longer than 1 minute and are frequently followed by a period of postictal confusion.

- **Status epilepticus** is a state of continuous seizure activity or a condition in which seizures recur in rapid succession without return to consciousness between seizures. It is the most serious complication of epilepsy and is a neurologic emergency.

- Most seizures do not require professional emergency medical care because they are self-limiting and rarely cause bodily injury. However, if status epilepticus occurs, if significant bodily harm occurs, or if the event is a first-time seizure, medical care should be sought immediately.

- Seizure disorders are treated primarily with antiseizure drugs. Therapy is aimed at preventing seizures because cure is not possible.

- A significant number of patients whose epilepsy cannot be controlled with drug therapy are candidates for surgical intervention to remove the epileptic focus or prevent spread of epileptic activity in the brain.

- When a seizure occurs, the nurse should carefully observe and record details of the event because the diagnosis and subsequent treatment often rest solely on the seizure description.

- During the seizure it is important to maintain a patent airway. This may involve supporting and protecting the head, turning the patient to the side, loosening constrictive clothing, or easing the patient to the floor, if seated.

- Because many seizure disorders cannot be cured, drugs must be taken regularly and continuously, often for a lifetime. The nurse should ensure that the patient knows this, as well as the specifics of the drug regimen and what to do if a dose is missed.

MULTIPLE SCLEROSIS

- **Multiple sclerosis** (MS) is a chronic, progressive, degenerative disorder of the CNS characterized by disseminated demyelination of nerve fibers of the brain and spinal cord.

- The cause of MS is unknown, although research findings suggest that MS is related to infectious (viral), immunologic, and genetic factors and is perpetuated as a result of intrinsic factors (e.g., faulty immunoregulation).

- MS is characterized by chronic inflammation, demyelination, and gliosis (scarring) in the CNS.

- The onset of the disease is often insidious and gradual, with vague symptoms occurring intermittently over months or years. Thus the disease may not be diagnosed until long after the onset of the first symptom.

- The disease is characterized by chronic, progressive deterioration in some persons and by remissions and exacerbations in others.

- Common signs and symptoms of MS include motor, sensory, cerebellar, and emotional problems.

- Because there is no definitive diagnostic test for MS, diagnosis is based primarily on history, clinical manifestations, and the presence of multiple lesions over time as measured by MRI.

- Because there is currently no cure for MS, collaborative care is aimed at treating the disease process and providing symptomatic relief.

- Drug therapy used includes immunosuppressants, immunomodulators, and adrenocorticotropic hormone.

- Spasticity is primarily treated with antispasmodic drugs. However, surgery, dorsal-column electrical stimulation, or intrathecal baclofen delivered by pump may be required.

- Exercise improves the daily functioning for patients with MS not experiencing an exacerbation. Various nutritional measures have been used in the management of MS, including megavitamin therapy and diets consisting of low-fat and gluten-free food and raw vegetables.

- During an acute exacerbation the patient may be immobile and confined to bed. The focus of nursing intervention at this phase is to prevent major complications of immobility, such as respiratory and urinary tract infections and pressure ulcers.

- Patient teaching should focus on building general resistance to illness, including avoiding fatigue, extremes of heat and cold, and exposure to infection.

PARKINSON'S DISEASE

- **Parkinson's disease** (PD) is a disease of the basal ganglia characterized by slowness in the initiation and execution of movement, increased muscle tone, tremor at rest, and impaired postural reflexes. It is the most common form of *parkinsonism.*

- The onset of PD is gradual and insidious, with a gradual progression and a prolonged course. It may involve only one side of the body initially. The classic manifestations of PD often include tremor, rigidity, and bradykinesia, which are often called the triad of PD.
    - *Tremor* can involve the hand, diaphragm, tongue, lips, and jaw but rarely causes shaking of the head.
    - *Rigidity* is the increased resistance to passive motion when the limbs are moved through their range of motion.

  - *Bradykinesia* is particularly evident in the loss of automatic movements, such as blinking of the eyelids, swinging of the arms while walking, swallowing of saliva, self-expression with facial and hand movements, and minor movement of postural adjustment.

- In addition to the motor signs of PD, many nonmotor symptoms are common. They include depression, anxiety, apathy, fatigue, pain, constipation, impotence, and short-term memory impairment.

- Because there is no cure for PD, collaborative management is aimed at relieving the symptoms.

- Drug therapy for PD is aimed at correcting an imbalance of neurotransmitters within the CNS. Antiparkinsonian drugs either enhance the release or supply of dopamine (dopaminergic) or antagonize or block the effects of the overactive cholinergic neurons in the striatum (anticholinergic).

- Surgical procedures are aimed at relieving symptoms of PD and are usually used in patients who are unresponsive to drug therapy or who have developed severe motor complications.

- Diet is of major importance to the patient with PD because malnutrition and constipation can be serious consequences of inadequate nutrition. Patients who have dysphagia and bradykinesia need appetizing foods that are easily chewed and swallowed.

- Promotion of physical exercise and a well-balanced diet are major concerns for nursing care. Exercise can limit the consequences of decreased mobility, such as muscle atrophy, contractures, and constipation.

- Because PD is a chronic degenerative disorder with no acute exacerbations, nurses should note that teaching and nursing care are directed toward maintenance of good health, encouragement of independence, and avoidance of complications such as contractures.

MYASTHENIA GRAVIS

- **Myasthenia gravis** (MG) is an autoimmune disease of the neuromuscular junction characterized by the fluctuating weakness of certain skeletal muscle groups.

- MG is caused by an autoimmune process in which antibodies attack acetylcholine (ACh) receptors, resulting in a decreased number of ACh receptor sites at the neuromuscular junction.

- The muscles most often affected by the fluctuating weakness are those used for moving the eyes and eyelids, chewing, swallowing, speaking, and breathing.

- The course of this disease is highly variable. Some patients may have short-term remissions, others may stabilize, and others may have severe, progressive involvement.

- **Myasthenic crisis** is an acute exacerbation of muscle weakness triggered by infection, surgery, emotional distress, drug overdose, or inadequate drugs. The major complications of MG result from muscle weakness in areas that affect swallowing and breathing.

- Drug therapy for MG includes anticholinesterase drugs, alternate-day corticosteroids, and immunosuppressants.

- Because the presence of the thymus gland in the patient with MG appears to enhance the production of AChR antibodies, removal of the thymus gland results in improvement in a majority of patients.

- Plasmapheresis can yield a short-term improvement in symptoms and is indicated for patients in crisis or in preparation for surgery when corticosteroids must be avoided.

- The patient with MG who is admitted to the hospital usually has a respiratory tract infection or is in an acute myasthenic crisis. Nursing care is aimed at maintaining adequate ventilation, continuing drug therapy, and watching for side effects of therapy.

RESTLESS LEGS SYNDROME

- **Restless legs syndrome** (RLS) is characterized by unpleasant sensory (paresthesias) and motor abnormalities of one or both legs. There are two distinct types of RLS, primary (idiopathic) and secondary.

- The majority of cases are primary, and many patients with this type of RLS report a positive family history.

- The pathophysiology of primary RLS is related to abnormal iron metabolism and functional alterations in central dopaminergic neurotransmitter systems.

- The severity of RLS sensory symptoms ranges from infrequent minor discomfort (paresthesias, including numbness, tingling, and “pins and needles” sensation) to severe pain.

- The pain at night can produce sleep disruptions and is often relieved by physical activity such as walking, stretching, rocking, or kicking.

- Nonpharmacologic approaches to RLS management include establishing regular sleep habits, encouraging exercise, avoiding activities that cause symptoms, and eliminating aggravating factors such as alcohol, caffeine, and certain drugs.

- If nonpharmacologic measures fail to provide symptom relief, drug therapy may be started. The main drugs used in RLS are dopaminergic agents, opioids, and benzodiazepines.

AMYOTROPHIC LATERAL SCLEROSIS

- **Amyotrophic lateral sclerosis** (ALS) is a rare progressive neurologic disorder characterized by loss of motor neurons. ALS usually leads to death within 2 to 6 years after diagnosis.

- For unknown reasons, motor neurons in the brainstem and spinal cord gradually degenerate in ALS.

- The typical symptoms of ALS are weakness of the upper extremities, dysarthria, and dysphagia. Death usually results from respiratory infection secondary to compromised respiratory function.

- There is no cure for ALS, but riluzole (Rilutek) slows the progression.

- The illness trajectory for ALS is devastating because the patient remains cognitively intact while wasting away. The challenge of nursing care is to guide the patient in use of moderate intensity, endurance-type exercises for the trunk and limbs, as this may help to reduce ALS spasticity.

HUNTINGTON'S DISEASE

- **Huntington's disease** (HD) is a genetically transmitted, autosomal dominant disorder that affects both men and women of all races.

- The clinical manifestations are characterized by abnormal and excessive involuntary movements *(chorea)*. These are writhing, twisting movements of the face, limbs, and body. The movements get worse as the disease progresses.

- Because there is no cure, collaborative care is palliative. Antipsychotic, antidepressant, and antichorea drugs are prescribed and have some benefit.

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Key Points

Chapter 60: Nursing Management: Alzheimer's Disease and Dementia

DEMENTIA

- **Dementia** is a syndrome characterized by dysfunction or loss of memory, orientation, attention, language, judgment, and reasoning. Personality changes and behavioral problems such as agitation, delusions, and hallucinations may result.

- The two most common causes of dementia are neurodegenerative conditions (e.g., Alzheimer's disease) and vascular disorders. **Vascular dementia,** also called multiinfarct dementia, is the loss of cognitive function resulting from ischemic, ischemic-hypoxic, or hemorrhagic brain lesions caused by cardiovascular disease.

- Depending on the cause of the dementia, the onset of symptoms may be insidious and gradual or more abrupt. Often dementia associated with neurologic degeneration is gradual and progressive over time.

- Regardless of the cause of dementia, the initial symptoms are related to changes in cognitive functioning. Patients may have complaints of memory loss, mild disorientation, and/or trouble with words and numbers.

- An important first step in the diagnosis of dementia is a thorough medical, neurologic, and psychologic history. Also, mental status testing is an important component of the patient evaluation.

- Depression is often mistaken for dementia in older adults, and, conversely, dementia for depression.

MILD COGNITIVE IMPAIRMENT

- **Mild cognitive impairment** (MCI) is a state of cognitive functioning that is below defined norms, yet does not meet the criteria for dementia.

- Causes of MCI may include stress, anxiety, depression, or physical illness.

- The nurse caring for the patient with MCI must recognize the importance of monitoring the patient for changes in memory and thinking skills that would indicate a worsening of symptoms or a progression to dementia.

ALZHEIMER'S DISEASE

- **Alzheimer's disease** (AD) is a chronic, progressive, degenerative disease of the brain. It is the most common form of dementia.

- The exact etiology of AD is unknown. Similar to other forms of dementia, age is the most important risk factor for developing AD.

- Characteristic findings of AD relate to changes in the brain's structure and function: (1) amyloid plaques, (2) **neurofibrillary tangles,** and (3) loss of connections between cells and cell death.

- Multiple genetic factors have been linked to the development of AD. Inflammation is also believed to contribute to AD.

- The manifestations of AD can be categorized similar to those for dementia as mild, moderate, and late.

- An initial sign of AD is a subtle deterioration in memory. With progression of AD, additional cognitive impairments are noted, including dysphasia, apraxia, visual agnosia, and dysgraphia.

- The diagnosis of AD is primarily a diagnosis of exclusion. No single clinical test can be used to diagnose AD.

- At this time there is no cure for AD. The collaborative management of AD is aimed at (1) improving or controlling decline in cognition, and (2) controlling the undesirable behavioral manifestations that the patient may exhibit.

- The diagnosis of AD is traumatic for both the patient and the family. It is not unusual for the patient to respond with depression, denial, anxiety and fear, isolation, and feelings of loss. The nurse is in an important position to assess for depression and suicidal ideation.

- Currently, family members and friends care for the majority of individuals with AD in their homes. Others with AD reside in various facilities, including long-term care and assisted living facilities. Regardless of the setting, the severity of the problems and the amount of nursing care intensify over time.

- As the patient with AD progresses to the late stages (severe impairment) of AD, there is increased difficulty with the most basic functions, including walking and talking. Total care is required.

- Behavioral problems occur in about 90% of patients with AD. These problems include repetitiveness, delusions, illusions, hallucinations, agitation, aggression, altered sleeping patterns, wandering, and resisting care. Nursing strategies that address difficult behavior include redirection, distraction, and reassurance.

- A specific type of agitation is termed **sundowning,** in which the patient becomes more confused and agitated in the late afternoon or evening. Behaviors commonly exhibited include agitation, aggressiveness, wandering, resistance to redirection, and increased verbal activity such as yelling.

- The person with AD is at risk for problems related to personal safety. These risks include injury from falls, injury from ingesting dangerous substances, wandering, injury to others and self with sharp objects, fire or burns, and inability to respond to crisis situations.

- Wandering is a major concern for caregivers. As with other behaviors, the nurse should observe for factors or events that may precipitate wandering.

- Loss of interest in food and decreased ability to feed self, as well as comorbid conditions, can result in significant nutritional deficiencies in the patient with AD. Pureed foods, thickened liquids, and nutritional supplements can be used when chewing and swallowing become problematic for the patient.

- Urinary tract infection and pneumonia are the most common infections to occur in patients with AD. Such infections are ultimately the cause of death in many patients with AD.

- During the middle and late stages of AD, urinary and fecal incontinence lead to increased need for nursing care.

- AD is a disease that disrupts all aspects of personal and family life. Caregivers exhibit adverse consequences relating to their employment and to their emotional and physical health, which then results in family conflict and caregiver strain. The nurse should work with the caregiver to assess stressors and to identify coping strategies to reduce the burden of caregiving.

OTHER NEURODEGENERATIVE DISEASES

- **Lewy body dementia** is a condition characterized by the presence of Lewy bodies (intraneural cytoplasmic inclusions) in the brainstem and cortex. A common cause of dementia, it is often unrecognized by health care providers.

- **Creutzfeldt-Jakob disease** is a rare and fatal brain disorder thought to be caused by a prion protein. A *prion* is a small infectious pathogen containing protein but lacking nucleic acids.

- **Pick's disease,** a type of **frontotemporal dementia,** is a rare brain disorder characterized by disturbances in behavior, sleep, personality, and eventually memory. The major distinguishing characteristic between these disorders and AD is marked symmetric lobar atrophy of the temporal and/or frontal lobes.

- **Normal pressure hydrocephalus** is an uncommon disorder characterized by an obstruction in the flow of CSF, which causes a buildup of this fluid in the brain.

DELIRIUM

- **Delirium,** a state of temporary but acute mental confusion, is a common, life-threatening, and possibly preventable syndrome in older adults.

- Clinically, delirium is rarely caused by a single factor. It is often the result of the interaction of the patient's underlying condition with a precipitating event.

- Acute delirium occurs frequently in hospitalized older adults. This transient condition is characterized by disorganized thinking, difficulty in concentrating, and sensory misperceptions that last from 1 to 7 days.

- Manifestations of delirium are sometimes confused with dementia. A key distinction between delirium and dementia is that the person who exhibits sudden cognitive impairment, disorientation, or clouded sensorium is more likely to have delirium rather than dementia.

- In caring for the patient with delirium, the roles of the nurse include prevention, early recognition, and treatment. Prevention of delirium involves recognition of high risk patients.

- Care of the patient with delirium is focused on eliminating precipitating factors. If it is drug-induced, medications are discontinued. It is important to keep in mind that delirium can also accompany drug and alcohol withdrawal.

- Care of the patient experiencing delirium includes protecting the patient from harm. Priority is given to creating a calm and safe environment.

- Comprehensive, multicomponent interventions to prevent delirium are the most effective and should be implemented through institutional-based programs that are interdisciplinary.

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Key Points

Chapter 61: Nursing Management: Peripheral Nerve and Spinal Cord Problems

CRANIAL NERVE DISORDERS

- Cranial nerve disorders are commonly classified as peripheral neuropathies. The 12 pairs of cranial nerves are considered the peripheral nerves of the brain.

- Two cranial nerve disorders are trigeminal neuralgia and acute peripheral facial paralysis (Bell's palsy).

Trigeminal Neuralgia

- **Trigeminal neuralgia** (*tic douloureux*) is a relatively uncommon cranial nerve disorder. However, it is the most commonly diagnosed neuralgic condition.

- The trigeminal nerve is the fifth cranial nerve (CN V) and has both motor and sensory branches. In trigeminal neuralgia, the sensory or afferent branches, primarily the maxillary and mandibular branches, are involved.

- The classic feature of trigeminal neuralgia is an abrupt onset of paroxysms of excruciating pain described as a burning, knifelike, or lightning-like shock in the lips, upper or lower gums, cheek, forehead, or side of the nose. Intense pain, twitching, grimacing, and frequent blinking and tearing of the eye occur during the acute attack.

- The painful episodes are usually initiated by a triggering mechanism of light cutaneous stimulation at a specific point *(trigger zone)* along the distribution of the nerve branches.

- Although this condition is considered benign, the severity of the pain and the disruption of lifestyle can result in almost total physical and psychologic dysfunction or even suicide.

- The majority of patients obtain adequate relief through antiseizure drugs such as carbamazepine (Tegretol), phenytoin (Dilantin), and valproate (Depakene). Nerve blocking with local anesthetics is another treatment option. If a conservative approach including drug therapy is not effective, surgical therapy is available.

- The overall nursing goals are that the patient with trigeminal neuralgia will (1) be free of pain, (2) maintain adequate nutritional and oral hygiene status, (3) have minimal to no anxiety, and (4) return to normal or previous socialization and occupational activities.

- The nurse must teach the patient about the importance of nutrition, hygiene, and oral care and convey understanding if previous oral neglect is apparent. The nurse should provide lukewarm water and soft cloths or cotton saturated with solutions not requiring rinsing for cleansing the face.

- The nurse is responsible for instruction related to diagnostic studies to rule out other problems, such as multiple sclerosis, dental or sinus problems, and neoplasms, and for preoperative teaching if surgery is planned.

- Regular follow-up care should be planned. The patient needs instruction regarding the dosage and side effects of medications. Although relief of pain may be complete, the patient should be encouraged to keep environmental stimuli to a moderate level and to use stress reduction methods.

Bell's Palsy

- **Bell's palsy** (peripheral facial paralysis, acute benign cranial polyneuritis) is a disorder characterized by a disruption of the motor branches of the facial nerve (CN VII) on one

side of the face in the absence of any other disease such as a stroke. Bell's palsy is an acute, peripheral facial paresis of unknown cause.

- The paralysis of the motor branches of the facial nerve typically results in a flaccidity of the affected side of the face, with drooping of the mouth accompanied by drooling.

- Methods of treatment for Bell's palsy include moist heat, gentle massage, and electrical stimulation of the nerve and prescribed exercises. Bell's palsy is considered benign with full recovery after 6 months in most patients, especially if treatment is instituted immediately.

- The overall nursing goals are that the patient with Bell's palsy will (1) be pain free or have pain controlled, (2) maintain adequate nutritional status, (3) maintain appropriate oral hygiene, (4) not experience injury to the eye, (5) return to normal or previous perception of body image, and (6) be optimistic about disease outcome.

POLYNEUROPATHIES

Guillain-Barré Syndrome

- **Guillain-Barré syndrome** is an acute, rapidly progressing, and potentially fatal form of polyneuritis. It affects the peripheral nervous system and results in loss of myelin and edema and inflammation of the affected nerves, causing a loss of neurotransmission to the periphery.

- The etiology of this disorder is unknown, but it is believed to be a cell-mediated immunologic reaction directed at the peripheral nerves. The syndrome is often preceded by immune system stimulation from a viral infection, trauma, surgery, viral immunizations, or human immunodeficiency virus (HIV).

- The most serious complication of this syndrome is respiratory failure, which occurs as the paralysis progresses to the nerves that innervate the thoracic area. Constant monitoring of the respiratory system provides information about the need for immediate intervention.

- Management is aimed at supportive care, particularly ventilatory support, during the acute phase. Assessment of the patient is the most important aspect of nursing care during the acute phase.

Botulism

- **Botulism** is the most serious type of food poisoning. It is caused by GI absorption of the neurotoxin produced by *Clostridium botulinum,* an organism found in the soil. Improper home canning of foods is often the cause.

- It is thought that the neurotoxin destroys or inhibits the neurotransmission of acetylcholine at the myoneural junction, resulting in disturbed muscle innervation. Neurologic manifestations include development of a descending flaccid paralysis with

intact sensation, photophobia, ptosis, paralysis of extraocular muscles, blurred vision, diplopia, dry mouth, sore throat, and difficulty in swallowing.

- The initial treatment of botulism is IV administration of botulinum antitoxin.

- Primary prevention is the goal of nursing management by educating consumers to be alert to situations that may result in botulism. Particular attention should be given to foods with a low acid content, which support germination and the production of botulin, a deadly poison.

Tetanus

- **Tetanus** (lockjaw) is an extremely severe polyradiculitis and polyneuritis affecting spinal and cranial nerves. It results from the effects of a potent neurotoxin released by the anaerobic bacillus *Clostridium tetani.*

- The spores of the bacillus are present in soil, garden mold, and manure. Thus *Clostridium tetani* enters the body through a traumatic or suppurative wound that provides an appropriate low-oxygen environment for the organisms to mature and produce toxin.

- Initial manifestations of generalized tetanus include stiffness in the jaw *(trismus)* and neck, fever, and other symptoms of general infection. As the disease progresses, the neck muscles, back, abdomen, and extremities become progressively rigid.

- The management of tetanus includes administration of a tetanus and diphtheria toxoid booster (Td) and tetanus immune globulin (TIG) in different sites before the onset of symptoms to neutralize circulating toxins. A much larger dose of TIG is administered to patients with manifestations of clinical tetanus.

Neurosyphilis

- **Neurosyphilis** (tertiary syphilis) is an infection of any part of the nervous system by the organism *Treponema pallidum.* It is the result of untreated or inadequately treated syphilis.

- Neurologic symptoms associated with neurosyphilis are numerous and many times nonspecific.

- Management includes treatment with penicillin, symptomatic care, and protection from physical injury.

SPINAL CORD PROBLEMS

Spinal Cord Injury

- The segment of the population with the greatest risk for spinal cord injury is young adult men between the ages of 16 and 30 years. Causes of spinal cord injury include many types of trauma, with motor vehicle crashes being the most common.

- About 50% of people with acute spinal cord injury experience a temporary neurologic syndrome known as **spinal shock** that is characterized by decreased reflexes, loss of sensation, and flaccid paralysis below the level of the injury. **Neurogenic shock,** in contrast, is due to the loss of vasomotor tone caused by injury and is characterized by hypotension and bradycardia, which are important clinical clues.

- The degree of spinal cord involvement may be either complete or incomplete.
    - *Complete cord involvement* results in total loss of sensory and motor function below the level of the lesion (injury).
    - *Incomplete cord involvement* results in a mixed loss of voluntary motor activity and sensation and leaves some tracts intact.

- Manifestations of spinal cord injury are related to the level and degree of injury.
    - Respiratory complications closely correspond to the level of the injury. Cervical injury above the level of C4 presents special problems because of the total loss of respiratory muscle function.
    - Any cord injury above the level of T6 greatly decreases the influence of the sympathetic nervous system. Bradycardia occurs, peripheral vasodilation results in hypotension, and a relative hypovolemia exists.
    - Urinary retention is a common development in acute spinal cord injuries and spinal shock.
    - If the cord injury has occurred above the level of T5, the primary GI problems are related to hypomotility. In the early period after injury when spinal shock is present and for patients with an injury level of T12 or below, the bowel is areflexic and sphincter tone is decreased.
    - **Poikilothermism** is the adjustment of the body temperature to the room temperature. This occurs in spinal cord injuries because the interruption of the sympathetic nervous system prevents peripheral temperature sensations from reaching the hypothalamus.
    - Deep vein thrombosis (DVT) is a common problem accompanying spinal cord injury during the first 3 months.

- Immediate postinjury problems include maintaining a patent airway, adequate ventilation, and adequate circulating blood volume and preventing extension of cord damage (secondary damage).

- After stabilization at the injury scene, the person is transferred to a medical facility. A thorough assessment is done to specifically evaluate the degree of deficit and to establish the level and degree of injury.

- The decision to perform surgery on a patient with a spinal cord injury often depends on the preference of a particular physician. When cord compression is certain or the neurologic disorder progresses, benefit may be seen following immediate surgery.

Nursing Management

- The patient must be moved in alignment as a unit or "logrolled" during transfers and when repositioning to prevent further injury.

- Proper immobilization is critical to prevent extension of cord damage.

- Spinal cord edema may increase the level of dysfunction and respiratory distress may occur. The nurse needs to regularly assess breath sounds, ABGs, tidal volume, vital capacity, skin color, breathing patterns, subjective comments about the ability to breathe, and the amount and color of sputum.

- Because of unopposed vagal response, the heart rate is slowed, often to below 60 beats per minute. Any increase in vagal stimulation such as turning or suctioning can result in cardiac arrest. Vital signs should be assessed frequently.

- During the first 48 to 72 hours after the injury the GI tract may stop functioning and a nasogastric tube must be inserted. Because the patient cannot have oral intake, fluid and electrolyte needs must be carefully monitored.
    - Once bowel sounds are present or flatus is passed, oral food and fluids can gradually be introduced.
    - Because of severe catabolism, a high-protein, high-calorie diet is necessary for energy and tissue repair.
    - Less voluntary neurologic control over the bowel results in a **neurogenic bowel.**

- Immediately after injury, urine is retained because of the loss of autonomic and reflex control of the bladder and sphincter. Because there is no sensation of fullness, overdistention of the bladder can result in reflux into the kidney with eventual renal failure.
    - Consequently, an indwelling catheter is usually inserted as soon as possible after injury.
    - UTIs are a common problem. The best method for preventing UTIs is regular and complete bladder drainage.
    - A **neurogenic bladder** is any type of bladder dysfunction related to abnormal or absent bladder innervation.

- Because there is no vasoconstriction, piloerection, or heat loss through perspiration below the level of injury, temperature control is largely external to the patient. Therefore the nurse must monitor the environment closely to maintain an appropriate temperature.

- The nurse must compensate for the patient's absent sensations to prevent sensory deprivation. This is done by stimulating the patient above the level of injury. Conversation, music, strong aromas, and interesting flavors should be a part of the nursing care plan.

- The return of reflexes after the resolution of spinal shock means that patients with an injury level at T6 or higher may develop autonomic dysreflexia. **Autonomic dysreflexia** is a massive uncompensated cardiovascular reaction mediated by the sympathetic nervous system.
    - The condition is a life-threatening situation that requires immediate resolution.
    - The most common precipitating cause is a distended bladder or rectum, although any sensory stimulation may cause autonomic dysreflexia.
    - Nursing interventions in this serious emergency are elevation of the head of the bed 45 degrees or sitting the patient upright, notification of the physician, and assessment to determine the cause.

- The physiologic and psychologic rehabilitation of the person with spinal cord injury is complex and involved. Rehabilitation is a multidisciplinary endeavor carried out through a team approach.

- Patients with spinal cord injuries may feel an overwhelming sense of loss. The nurse's role in grief work is to allow mourning as a component of the rehabilitation process.

Spinal Cord Tumors

- Spinal cord tumors are classified as extradural (outside the spinal cord), intradural extramedullary (within the dura but outside the actual spinal cord), and intradural intramedullary (within the spinal cord itself).

- Both sensory and motor problems may result with the location and extent of the tumor determining the severity and distribution of the problem. The most common early symptom of a spinal cord tumor outside the cord is pain in the back with radicular pain simulating intercostal neuralgia, angina, or herpes zoster.

- Treatment for nearly all spinal cord tumors is surgical removal.

POSTPOLIO SYNDROME

- Polio, also known as *poliomyelitis,* is an infectious viral disease transmitted through the oral route by ingestion of contaminated water or food, or contact with infected sources such as unwashed hands.

- Polio survivors who recovered from the disease decades ago, notably those who had paralytic poliomyelitis, are now experiencing a recurrence of neuromuscular symptoms as they age. These late effects of polio are collectively referred to as postpolio syndrome.

- Postpolio syndrome is manifested by a new onset of joint and muscle weakness, easy fatigability, generalized fatigue, and pain. Uncommonly, individuals may also exhibit speech, swallowing, and respiratory difficulties.

- There is no specific treatment for postpolio syndrome. Management approaches are targeted at controlling symptoms, particularly fatigue, weakness, and pain. An interdisciplinary team approach is essential to manage the patient.

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Key Points

Chapter 62: Nursing Assessment: Musculoskeletal System

STRUCTURES AND FUNCTIONS

- The main functions of bone are support, protection of internal organs, voluntary movement, blood cell production, and mineral storage.

- Cylinder-shaped structural units (*haversian* systems) fit closely together in compact bone, creating a dense bone structure.

- Types of bone cells include osteoblasts, osteocytes, and osteoclasts.
    - *Osteoblasts* synthesize organic bone matrix (collagen) and are the basic bone-forming cells.
    - *Osteocytes* are the mature bone cells.
    - *Osteoclasts* participate in bone remodeling by assisting in the breakdown of bone tissue.
    - *Bone remodeling* is removal of old bone by osteoclasts (resorption) and the deposition of new bone by osteoblasts (ossification).

- Each long bone consists of the epiphysis, diaphysis, and metaphysis.
    - *Epiphysis,* the widened area found at end of a long bone, is composed of cancellous bone. Epiphysis is the location of muscle attachment.
    - *Diaphysis* is the main shaft of the bone. It provides structural support and is composed of compact bone. Marrow is in the center.
    - *Metaphysis* is the flared area of cancellous bone between the epiphysis and the diaphysis.

- A *joint* (articulation) is where ends of two bones are in proximity and move in relation to each other. Joints are classified according to degree of movement they allow.

- *Cartilage* is a rigid connective tissue in synovial joints that serves as support for soft tissue and provides articular surface for joint movement. Types of cartilage tissue include hyaline, elastic, and fibrous.

- Types of muscle tissue are *cardiac* (striated, involuntary), *smooth* (nonstriated, involuntary), and *skeletal* (striated, voluntary) muscle.

- A nerve fiber and the skeletal muscle fibers it stimulates are called a motor *endplate.* The junction between axon of nerve cell and adjacent muscle cell is called the *myoneural* or *neuromuscular junction.*

- Ligaments and tendons are composed of dense, fibrous connective tissue. Tendons attach muscles to bones, and ligaments connect bones to bones.

- *Fascia* is defined as layers of connective tissue with intermeshed fibers that can withstand limited stretching.

- *Bursae* are small sacs of connective tissue lined with synovial membrane and contain synovial fluid.

Assessment

- Many functional problems experienced by the aging adult relate to changes of the musculoskeletal system.
    - Increased bone resorption and decreased bone formation cause a loss of bone density, contributing to development of osteoporosis.
    - Tendons and ligaments become less flexible, movement becomes rigid.

- Common symptoms of musculoskeletal impairment include pain, weakness, and deformity, limitation of movement, stiffness, and joint **crepitation.**

- Health history questions should focus on past medical problems, surgeries, and symptoms of arthritic and connective tissue diseases.

- Maintenance of normal body weight, nutrition, avoidance of excessive stress on muscles and joints, and the use of proper body mechanics when lifting objects are noted.

- Inspection is performed starting at head and neck and proceeding to upper extremities, lower extremities, and trunk. The opposite body part is used for comparison when an abnormality is suspected.

- Palpation of both muscles and joints allows for evaluation of skin temperature, local tenderness, swelling, and crepitation.

- Carefully evaluate both passive and active **range of motion;** measurements should be similar for both maneuvers.
    - *Active range of motion* means patient takes his or her own joints through all movements without assistance.
    - *Passive range of motion* occurs when someone else moves patient's joints without his or her participation.

- If patient able to move independently, assess posture and gait by watching patient walk, stand, and sit.

- When length discrepancies or subjective problems are noted, obtain limb length and circumferential muscle mass measurements.

- **Scoliosis** is a lateral S-shaped curvature of thoracic and lumbar spine. Unequal shoulder and scapula height is usually noted when patient is observed from back.

Diagnostic Studies

- **X-rays** provide information about bone deformity, joint congruity, bone density, and calcification in soft tissue.
    - Fracture diagnosis and management are indications for x-ray; also useful in evaluation of hereditary, developmental, infectious, inflammatory, neoplastic, metabolic, and degenerative disorders.

- A fiberoptic tube called an arthroscope is used to directly examine interior of joint cavity in an **arthroscopy.**
    - Torn tissue can be repaired through arthroscopic surgery, eliminating the need for a larger incision and greatly decreasing the recovery time.

- **Arthrocentesis** or joint aspiration is usually performed for a synovial fluid analysis. The fluid is examined grossly for volume, color, clarity, viscosity, and mucin clot formation.

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Key Points

Chapter 63: Nursing Management: Musculoskeletal Trauma and Orthopedic Surgery

- The most common cause of musculoskeletal injuries is a traumatic event resulting in fracture, dislocation, and associated soft tissue injuries.

- Nurses have an important role in public education about the basic principles of safety and accident prevention.

SOFT-TISSUE INJURIES

- A **sprain** is an injury to tendinoligamentous structures surrounding a joint, usually caused by wrenching or twisting motion.
- A **strain** is an excessive stretching of a muscle and its fascial sheath. It often involves the tendon.
- Symptoms of sprains and strains are similar and include pain, edema, decrease in function, and contusion.
- Mild sprains and strains are usually self-limiting, with full function returning within 3 to 6 weeks.
- Severe strains may require surgical suturing of muscle and surrounding fascia.
- RICE (rest, ice, compression, elevation) can decrease inflammation and pain for most of these injuries.
- Stretching and warm-up prior to exercising and before vigorous activity significantly reduces sprains and strains.

DISLOCATION

- **Dislocation** is a severe injury of the ligamentous structures that surround a joint.
- The most obvious sign is deformity, also local pain, tenderness, loss of function of injured part, and swelling of soft tissues in joint region.
- Requires prompt attention with the dislocated joint first realigned in its original anatomic position.
- Extremity then is immobilized by bracing, taping, or using a sling to allow torn ligaments and tissue time to heal.

SUBLUXATION

- **Subluxation** is a partial or incomplete displacement of the joint surface.
- Manifestations are similar to a dislocation but are less severe. Treatment is similar to a dislocation, but subluxation may require less healing time.
- Nursing care of subluxation or dislocation is directed toward pain relief and support and protection of injured joint.

REPETITIVE STRAIN INJURY

- **Repetitive strain injury** (RSI) is a cumulative traumatic disorder resulting from prolonged, forceful, or awkward movements.
- RSI can be prevented through education and ergonomics.
- Treatment includes identifying the precipitating activity, modification of activity, pain management with heat/cold application, drugs, rest, physical therapy for strengthening and conditioning, and lifestyle changes.

CARPAL TUNNEL SYNDROME

- **Carpal tunnel syndrome** (CTS) is caused by compression of the median nerve, which enters the hand through the narrow confines of the carpal tunnel.
- CTS is often caused by pressure from trauma or edema caused by inflammation of tendon (tenosynovitis), rheumatoid arthritis, or soft tissue masses.
- Signs are weakness (especially in thumb), burning pain, and numbness.
- Holding the wrists for 60 seconds produces tingling and numbness over the distribution of the median nerve, a positive Phalen's test.
- Prevention involves educating employees and employers to identify risk factors.
- Early symptoms usually relieved by stopping the aggravating movement and by placing hand and wrist at rest by immobilizing them in a hand splint. Injection of a corticosteroid drug directly into carpal tunnel may provide some relief.
- If CTS continues, median nerve may need to be surgically decompressed. Rehabilitation can last up to 7 weeks.

ROTATOR CUFF INJURY

- Rotator cuff injury may occur gradually from aging, repetitive stress, or injury to the shoulder while falling.
- Manifestations include shoulder weakness and pain and decreased range of motion.
- Conservative treatment involves rest, ice and heat, NSAIDs, corticosteroid injections into joint, and physical therapy.
- Surgery may be done with complete tear or no improvement with conservative therapy.

MENISCUS INJURIES

- Meniscus injuries are associated with ligament sprains that commonly occur in athletes.

- Pain is elicited by flexion, internal rotation, and then knee extension.
- Surgery may be indicated for a torn meniscus.
- Proper stretching may make the patient less prone to meniscal injury when a fall or twisting occurs.

BURSITIS

- **Bursitis** results from repeated or excessive trauma or friction, rheumatoid arthritis, or infection.
- Manifestations are warmth, pain, swelling, and limited ROM in the affected part.
- Rest is often the only treatment needed for bursitis.

FRACTURE

- **Fracture** is a disruption or break in the continuity of the bone structure.
- Traumatic injuries account for the majority of fractures.
- Fractures are often described according to 1) type, 2) communication or noncommunication with the external environment, and 3) anatomic location.
- Signs include immediate localized pain, decreased function, and inability to bear weight or use affected part. Obvious bone deformity may not be present.
- Fractures require nursing assessments of the peripheral vasculature (color, temperature, capillary refill, peripheral pulses, and edema) and neurologic systems (sensation, motor function, and pain).
- Treatment goals are anatomic realignment of bone fragments, immobilization to maintain realignment, and restoration of function.
- Lower extremity injuries are often immobilized by casts, dressings, or splints/immobilizers.
- The majority of fractures heal without complications, which include bone infection, avascular necrosis, **compartment syndrome,** venous thrombosis, fat embolism, and shock.
- Nursing care involves comfort measures for pain, maintenance of nutrition, and prevention of complications associated with immobility.
- A *Colles' fracture* is a fracture of the distal radius. Usually managed by closed manipulation, by immobilization by splint or a cast, or, if displaced, by internal or

external fixation.

- Fractures involving the shaft of the humerus are a common injury among young and middle-aged adults. If surgery is done, skin or skeletal **traction** may be used for reduction and immobilization.

- Pelvic fractures range from benign to life threatening depending on mechanism of injury and associated vascular insult.
    - Physical examination demonstrates local swelling, tenderness, deformity, unusual pelvic movement, and ecchymosis on abdomen.
    - Treatment depends on the injury severity and ranges from limited intervention to pelvic sling traction, hip spica casts, external fixation, and open reduction.

HIP FRACTURES

- Hip fractures are common in older adults.

- Manifestations are external rotation, muscle spasm, shortening of affected extremity, and severe pain in region of fracture.

- Surgical repair is preferred for managing intracapsular and extracapsular fractures.

- After surgery—in addition to teaching on how to prevent prosthesis dislocation—the nurse should place a large pillow between patient's legs when turning, avoid extreme hip flexion, and avoid turning the patient on affected side until approved by surgeon.

- The nurse assists both the patient and family in adjusting to restrictions and dependence imposed by hip fracture.

AMPUTATION

- Older persons have the highest incidence of amputation due to effects of peripheral vascular disease, atherosclerosis, and diabetes.

- Indications for amputation include circulatory impairment resulting from a peripheral vascular disorder, traumatic and thermal injuries, malignant tumors, and infection of the extremity.

- Goal of surgery is to preserve extremity length and function while removing all infected, pathologic, or ischemic tissue.

- Goals for the nurse are that the patient will have pain relief from the underlying health problem, satisfactory pain control, maximum rehabilitation potential, and ability to cope with the body image changes.

JOINT REPLACEMENT SURGERY

- Joint replacement surgery is the most common orthopedic operation performed on older

adults.

- Surgery is aimed at relieving pain, improving joint motion, correcting deformity and malalignment, and removing intraarticular causes of erosion.
- Types of joint surgeries include **synovectomy, osteotomy,** debridement, and *arthroplasty.*
- **Arthrodesis** is the surgical joint fusion which may be done if articular surfaces are too damaged or infected to allow joint replacement or for reconstructive surgery failures.
- Postoperatively, neurovascular assessment is performed to assess nerve function and circulatory status. Anticoagulation therapy, analgesia, and antibiotics are administered.
- Ambulation is encouraged as early as possible to prevent immobility complications.
- Patient discharge teaching includes instructions on reporting complications, including infection and dislocation of the prosthesis (e.g., pain, loss of function, shortening or malalignment of an extremity).

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Key Points

Chapter 64: Nursing Management: Musculoskeletal Problems

OSTEOMYELITIS

- **Osteomyelitis** is a severe infection of bone, bone marrow, and surrounding soft tissue.
- Infecting microorganisms can invade by indirect or direct entry. After entering the blood, they lodge in an area of bone and grow which results in increased pressure, eventually leading to bone ischemia.
- Once ischemia occurs, the bone dies.
- *Chronic osteomyelitis* is a continuous, persistent problem or a process of exacerbations and remission.
- Acute symptoms are fever, night sweats, malaise, and constant bone pain.
- Some immobilization of affected limb (e.g., splint, traction) is indicated to decrease pain.

The patient is frequently on bed rest in the early stages of the acute infection.

- Vigorous and prolonged IV antibiotic therapy is treatment of choice for acute osteomyelitis.

- Oral antibiotics, hyperbaric oxygen therapy, and surgery may be prescribed for chronic disease.

SARCOMA

- Most primary bone cancer is called sarcoma.

- Sarcomas can also develop in cartilage, muscle fibers, fatty tissue, and nerve tissue.

- Common types are osteogenic sarcoma, chondrosarcoma, Ewing's sarcoma, and chordoma.

OSTEOCHONDROMA

- **Osteochondroma** is a primary benign bone tumor characterized by overgrowth of cartilage and bone near end of the bone at the growth plate.

- Manifestations include painless, hard, and immobile mass, one leg or arm longer than other, and pressure or irritation with exercise.

- No treatment necessary if asymptomatic. If patient has pain or neurologic symptoms due to compression, surgical resection is usually done.

- Nursing care does not differ significantly from the care given to patients with a malignant disease of any other body system.

Osteogenic Sarcoma

- **Osteogenic sarcoma** (osteosarcoma) is a primary bone tumor that is extremely aggressive and rapidly metastasizes to distant sites.

- Manifestations are usually associated with gradual onset of pain and swelling, especially around the knee.

- Preoperative (neoadjuvant) chemotherapy is used to decrease tumor size.

- Limb-salvage procedures are considered when there is a clear 6- to 7-cm margin surrounding the lesion.

Metastatic Bone Cancer

- The most common type of malignant bone tumor occurs as a result of metastasis from a primary tumor.

- Metastatic bone lesion is commonly found in vertebrae, pelvis, femur, humerus, or ribs.

- Metastasis to bone may be suspected in patients with local bone pain and past cancer history.

- Treatment may be palliative and consists of radiation and pain management.

LOW BACK PAIN

- Low back pain is common, affecting about 80% of adults during their lifetime.

- *Acute low back pain* is usually associated with activity that causes undue stress (often hyperflexion) on the lower back.
    - If muscle spasms and pain are not severe, treatment includes avoiding activities that aggravate pain, analgesics, muscle relaxants, massage and back manipulation; and heat and cold compresses.
    - Most acute cases spontaneously improve.

- *Chronic low back pain* causes include degenerative disk disease, lack of physical exercise, prior injury, obesity, and structural and postural abnormalities.
    - Treatment can include weight reduction, analgesics, rest periods, heat or cold application, and exercise and activity to keep muscles and joints mobilized.
    - Surgery may be indicated for severe chronic low back pain that is not responding to conservative care.

INTERVERTEBRAL LUMBAR DISK DAMAGE

- Structural degeneration of the lumbar disk is often caused by **degenerative disk disease** (DDD).

- This is a normal process of aging, and results in intervertebral disks losing their elasticity, flexibility, and shock-absorbing capabilities.

- An acute **herniated intervertebral disk** (slipped disk) can be the result of DDD or repeated stress and spinal trauma.

- Radicular pain, which radiates down buttock and below the knee, generally indicates disk herniation.

- Treatment initially is at least 4 weeks of conservative therapy including drug therapy, limitation of spinal movement with brace or corset, local heat or ice, ultrasound and massage, transcutaneous electrical nerve stimulation, and epidural steroid injections. If there is no improvement, various surgical techniques may be used.

- Postoperative nursing interventions focus on maintaining proper alignment of the spine at all times until healing has occurred.

- Once symptoms subside, back strengthening exercises are begun twice a day and encouraged for a lifetime.

FOOT DISORDERS

- Most of the pain and disability is attributed to improperly fitting shoes, which cause toe crowding and inhibition of normal foot muscle movement.
- The older adult is prone to foot problems because of poor circulation, atherosclerosis, and decreased sensation in lower extremities.
- Therapy includes analgesics, shock-wave therapy, icing, physical therapy, alterations in footwear, stretching, warm soaks, orthotics, ultrasound, and corticosteroid injections.
- If there is no relief, then surgery may be done.

OSTEOMALACIA

- **Osteomalacia** is a rare condition of adult bone associated with vitamin D deficiency, resulting in decalcification and softening of bone.
- Common features are localized bone pain, difficulty rising from a chair, and walking.
- Care is directed toward correction of vitamin D deficiency. Vitamin D_3 (cholecalciferol) and vitamin D_2 (ergocalciferol) can be supplemented. Calcium salts or phosphorus supplements may also be prescribed.
- Exposure to sunlight (and ultraviolet rays) is also valuable, along with weight-bearing exercise.

OSTEOPOROSIS

- **Osteoporosis** is a chronic, progressive metabolic bone disease characterized by low bone mass and structural deterioration of bone tissue.
- Bones can eventually become so fragile that they cannot withstand normal mechanical stress.
- At least 10 million persons in the United States (80% are women) have osteoporosis.
- Risk factors are female sex, increasing age, family history of osteoporosis, white or Asian race, small stature, early menopause, sedentary lifestyle, and insufficient dietary calcium.
- People may not know they have osteoporosis until their bones become so weak that a sudden fall causes a hip or vertebral fracture.
- Collapsed vertebrae may initially be manifested as back pain, loss of height, or spinal

deformities such as kyphosis or severely stooped posture.

- Dual-energy x-ray absorptiometry (DEXA) studies are used in diagnosis and to assess the treatment effectiveness.

- Collaborative care focuses on proper nutrition, calcium supplementation, exercise, prevention of fractures, and drugs.

PAGET'S DISEASE

- **Paget's disease** is a skeletal bone disorder in which there is excessive bone resorption followed by replacement of normal marrow by vascular, fibrous connective tissue.

- The etiology is unknown, although a viral cause has been proposed.

- Initial manifestations are usually insidious development of bone pain (may progress to severe intractable pain), fatigue, and progressive development of a waddling gait.

- Pathologic fracture is the most common complication.

- X-rays may demonstrate that the normal contour of the affected bone is curved and the cortex is thickened and irregular.

- Care is usually limited to symptomatic and supportive care and correction of secondary deformities by either surgical intervention or braces.

GERONTOLOGIC CONSIDERATIONS: METABOLIC BONE DISEASES

- Metabolic bone diseases increase the possibility of pathologic fractures.

- The nurse must use extreme caution when patient is turned or moved.

- It is important to keep the patient as active as possible to retard demineralization of bone resulting from disuse or extended immobilization.

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Key Points

Chapter 65: Nursing Management: Arthritis and Connective Tissue Diseases

ARTHRITIS

- **Arthritis** is inflammation of a joint.
- The most prevalent types of arthritis are osteoarthritis, rheumatoid arthritis, and gout.

OSTEOARTHRITIS

- **Osteoarthritis** (OA), the most common form of joint (articular) disease in North America, is a slowly progressive noninflammatory disorder of the diarthrodial (synovial) joints.
- Factors linked to OA include increasing age, genetics, obesity, occupations with frequent kneeling, and lack of exercise.
- OA results from cartilage damage, leading to fissuring, fibrillation, and erosion of articular surfaces.
- Systemic manifestations (fatigue, fever) are *not* present in OA, whereas they are present in inflammatory joint disorders such as rheumatoid arthritis.
- Manifestations range from mild discomfort to significant disability, with joint pain being the major symptom.
- As OA progresses, increasing pain contributes significantly to disability and loss of function.
- Care focuses on managing pain and inflammation, preventing disability, and maintaining and improving joint function.
- Symptoms are initially managed conservatively through medication, joint rest, heat and cold, nutrition, and exercise.
- Arthroscopy to repair cartilage or remove bone bits or cartilage may be recommended with OA progression.
- Teaching should include information about nature and treatment of OA, pain management, posture and body mechanics, use of assistive devices, principles of joint protection and energy conservation.

RHEUMATOID ARTHRITIS

- **Rheumatoid arthritis** (RA) is a chronic, systemic disease with inflammation in connective tissue of the diarthrodial (synovial) joints, often remission and exacerbations.
- The etiology of RA is unknown; it is probably due to autoimmune and genetic factors.
- Onset is typically insidious with fatigue, weight loss, and generalized stiffness.

- Articular signs include pain, stiffness, limitation of motion, and inflammation (e.g., heat, swelling, tenderness). Joint stiffness after periods of inactivity is common.

- As RA progresses, muscle atrophy and destruction of tendons around joint cause one articular surface to slip past the other (subluxation).

- RA can affect nearly every body system. Most common extraarticular signs are rheumatoid nodules and Sjögren's and Felty syndromes.
    - Treatment goals include reduction of inflammation, management of pain, maintenance of joint function, and prevention/correction of joint deformity
    - Initial care usually involves drug therapy and education.

ANKYLOSING SPONDYLITIS

- **Ankylosing spondylitis** (AS) is a chronic inflammatory disease primarily affecting the axial skeleton (sacroiliac joints, intervertebral disk spaces, and costovertebral articulations).

- Most persons are positive for HLA-B27 antigen.

- Extraarticular inflammation can affect eyes, lungs, heart, kidneys, and peripheral nervous system.

- Signs of AS are low back pain, stiffness, and limitation of motion.

- Care is aimed at maintaining maximal skeletal mobility while decreasing pain and inflammation. Heat applications, exercise, and medications are often recommended.

- Surgery may be done for severe deformity and mobility impairment.

PSORIASIS

- *Psoriasis* is a common benign, inflammatory skin disorder with a possible genetic predisposition.

- Approximately 10% of people with psoriasis for reasons unknown develop psoriatic arthritis, a progressive inflammatory disease.

- Psoriasis can occur in different forms, all having a degree of arthritis.

- Treatment includes splinting, joint protection, drugs, and physical therapy.

REACTIVE ARTHRITIS

- **Reactive arthritis** (Reiter's syndrome) occurs more commonly in young men and is associated with a symptom complex that includes urethritis (cervicitis in women), conjunctivitis, and mucocutaneous lesions.

- The etiology is unknown, but it appears to occur after genitourinary or gastrointestinal tract infection.
- The prognosis is favorable; most patients have a complete recovery after 2 to 16 weeks.
- Since reactive arthritis is associated with *C. trachomatis* infection, patients and their sexual partners are often treated with antibiotics.

SEPTIC ARTHRITIS

- **Septic arthritis** (infectious or bacterial arthritis) is caused by invasion of joint cavity with microorganisms.
  - Large joints (knee and hip) are frequently involved, causing severe pain, erythema, and swelling.
  - This condition requires prompt treatment with antibiotics to prevent joint destruction.
  - Nursing care includes assessment and monitoring of joint inflammation, pain, and fever.

LYME DISEASE

- **Lyme disease** is a spirochetal infection transmitted by bite of an infected deer tick.
- A characteristic symptom of the early localized disease is erythema migrans, a skin lesion occurring at site of tick bite 2 to 30 days after exposure.
- Viral-like symptoms, such as fever, chills, headache, swollen lymph nodes, and migratory joint and muscle pain, also occur.
- In late disease, arthritis pain and swelling may occur in large joints.
- Antibiotics are used for active disease and to prevent late disease.
- Reducing exposure to ticks is the best way to prevent Lyme disease.

GOUT

- **Gout** is caused by an increase in uric acid production, underexcretion of uric acid, or increased intake of foods containing purines, which are metabolized to uric acid by the body.
  - Deposits of sodium urate crystals occur in articular, periarticular, and subcutaneous tissues. This leads to recurrent attacks of acute arthritis.
  - Risk factors are obesity (in men), hypertension, diuretic use, and excessive alcohol consumption.

- Affected joints may appear dusky or cyanotic and are extremely tender. Inflammation of great toe (podagra) is a common initial problem.

- Chronic gout is characterized by multiple joint involvement and visible deposits of sodium urate crystals (tophi).

- Treatment includes drug therapy for pain management and to terminate an acute attack.

- Future attacks are prevented by drugs, weight reduction as needed, and possible avoidance of alcohol and food high in purine (red and organ meats).

- Nursing interventions include supportive care of inflamed joints.

SYSTEMIC LUPUS ERYTHEMATOSUS

- **Systemic lupus erythematosus** (SLE) is a chronic multisystem inflammatory disease with immune system abnormalities.

- The etiology of abnormal immune response is unknown; a genetic influence is suspected.

- Extremely variable in its severity, ranging from a relatively mild disorder to rapidly progressive and affecting many organ systems.

- Commonly affected are the skin (butterfly rash over nose, cheeks), muscles (polyarthralgia with morning stiffness), lungs (tachypnea), heart (dysrhythmias), nervous tissue (seizures), and kidneys (nephritis).

- Other signs include anemia, mild leukopenia, and thrombocytopenia. Infection is a major cause of death.

- A major treatment challenge is to manage active disease while preventing treatment complications that cause long-term tissue damage.

- Patients with mild polyarthralgias or polyarthritis are treated with NSAIDs. Corticosteroids are given for severe cutaneous SLE. Antimalarial agents and immunosuppressive drugs may also be used.

- Nursing care emphasizes health teaching and importance of patient cooperation for successful home management.

SYSTEMIC SCLEROSIS

- **Systemic sclerosis** (SS), or scleroderma, is a connective tissue disorder with fibrotic, degenerative, and occasionally inflammatory changes in the skin, blood vessels, synovium, skeletal muscle, and internal organs.

- The cause of SS is unknown. Immunologic dysfunction and vascular abnormalities may

play a role in systemic disease.

- In this disorder, collagen is overproduced. Disruption of cell is followed by platelet aggregation and fibrosis. Proliferation of collagen disrupts normal functioning of internal organs.

- Manifestations range from diffuse cutaneous thickening with rapidly progressive and fatal visceral involvement, to the more benign variant of limited cutaneous SS.

- Clinical manifestations are described by the acronym CREST, including calcinosis, Raynaud's phenomenon, esophageal dysfunction, sclerodactyly, and telangiectasia.

- No specific drug(s) have been proven effective for treating SS. However many drugs can be used in treating the various manifestations of SS.

- Physical and occupational therapy maintains joint mobility, preserves muscle strength, and assists in maintaining functional abilities.

POLYMYOSITIS AND DERMATOMYOSITIS

- **Polymyositis** (PM) and **dermatomyositis** (DM) are diffuse, idiopathic, inflammatory myopathies of striated muscle that produce bilateral weakness, usually most severe in proximal or limb-girdle muscles.

- The exact cause of PM and DM is unknown; theories include infectious agent, neoplasms, drugs or vaccinations, and stress.

- Patients with DM and PM experience weight loss and increasing fatigue, with gradual weakness of muscles that leads to difficulty in performing routine activities.

- DM skin changes include classic violet-colored (heliotrope), cyanotic, or erythematous symmetric rash with edema around eyelids.

- DM and PM diagnosis is confirmed by EMG findings, muscle biopsy, and serum enzyme levels.

- PM and DM are initially treated with high-dose corticosteroids. If corticosteroids are ineffective and/or organ involvement is occurring, immunosuppressive drugs may be given.

- The nurse should assist the patient to organize activities and use pacing techniques to conserve energy.

SJÖGREN'S SYNDROME

- **Sjögren's syndrome** is an autoimmune disease that targets moisture-producing glands, leading to xerostomia (dry mouth) and keratoconjunctivitis sicca (dry eyes).

- It appears to be caused by genetic and environmental factors.
- Lymphocytes attack and damage the lacrimal and salivary glands in this syndrome.
- Treatment is symptomatic, including instillation of preservative-free artificial tears for hydration and lubrication, surgical punctual occlusion, and increased fluids with meals.

MYOFASCIAL PAIN SYNDROME

- **Myofascial pain syndrome** is characterized by musculoskeletal pain and tenderness in one anatomic region of the body.
- Regions of pain are often within taut bands and fascia of skeletal muscles. With pressure, trigger points are thought to activate a pattern of pain.
- Treatment can include massage, physical therapy, acupuncture, and biofeedback.

FIBROMYALGIA SYNDROME

- **Fibromyalgia syndrome** (FMS) is a chronic disorder characterized by widespread, nonarticular musculoskeletal pain and fatigue with multiple tender points.
- Nonrestorative sleep, morning stiffness, irritable bowel syndrome, and anxiety may also be noted.
- The cause and pathology of FMS are being studied. It is known to be a disorder of central processing with neuroendocrine/neurotransmitter dysregulation.
- Treatment is symptomatic and requires a high level of patient motivation, including rest, medication, relaxation strategies, and massage.

CHRONIC FATIGUE SYNDROME

- **Chronic fatigue syndrome** (CFS), also called chronic fatigue and immune dysfunction syndrome, is a disorder characterized by debilitating fatigue.
- The etiology and pathology are largely unknown.
- It is often difficult to distinguish between CFS and FMS, as many of the clinical features are similar.
- There is no definitive treatment. Supportive management is essential.
- This condition does not appear to progress. Most patients recover or at least gradually improve over time.

Lewis et al: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 7th edition

Key Points

Chapter 66: Nursing Management: Critical Care

- Critical care units or intensive care units (ICUs) are designed to meet the special needs of acutely and critically ill patients.

- ICU care has expanded from delivering care in a standard unit to bringing ICU care to patients wherever they might be.
    - The *electronic* or *virtual ICU* is designed to augment the bedside ICU team by monitoring the patient from a remote location.
    - The *rapid response team,* composed of a critical care nurse, a respiratory therapist, and critical care physician or advanced practice nurse, goes outside the ICU to bring rapid and immediate care to unstable patients in non–critical care units.

- Progressive care units, also called high-dependency units, intermediate care units, or stepdown units, serve as transition units between the ICU and the general care unit or discharge.
    - The American Association of Critical Care Nurses' (AACN) offers certification for progressive care nurses (PCCN) working with acutely ill adult patient.

- The critical care nurse is responsible for assessing life-threatening conditions, instituting appropriate interventions, and evaluating the outcomes of the interventions.
    - Critical care nursing requires in-depth knowledge of anatomy, physiology, pathophysiology, pharmacology, and advanced assessment skills, as well as the ability to use advanced biotechnology.
    - The AACN offers critical care certification (CCRN) in adult, pediatric, and neonatal critical care nursing.

- Advanced practice critical care nurses have a graduate (master's or doctorate) degree and are employed in a variety of roles: patient and staff educators, consultants, administrators, researchers, or expert practitioners.
    - A clinical nurse specialist (CNS) typically functions in one or more of these roles. Certification for the CNS in acute and critical care (CCNS) is available through the AACN.
    - An acute care nurse practitioner (ACNP) provides comprehensive care to select critically ill patients and their families that includes conducting comprehensive assessments, ordering and interpreting diagnostic tests, managing health problems and disease-related symptoms, and prescribing treatments. Certification as an ACNP is available through the AACN.

COMMON PROBLEMS OF CRITICAL CARE PATIENTS

- Nutrition:
  - The primary goal of nutritional support is to prevent or correct nutritional deficiencies. This is usually accomplished by the early provision of enteral nutrition (i.e., delivery of calories via the gastrointestinal [GI] tract) or parenteral nutrition (i.e., delivery of calories intravenously).
  - Parenteral nutrition should be considered only when the enteral route is unsuccessful in providing adequate nutrition or contraindicated (e.g., paralytic ileus, diffuse peritonitis, intestinal obstruction, pancreatitis, GI ischemia, intractable vomiting, and severe diarrhea).

- Anxiety:
  - The primary sources of anxiety for patients include the perceived or anticipated threat to physical health, actual loss of control or body functions, and an environment that is foreign.
  - Assessing patients for anxiety is very important and clinical indicators can include agitation, increased blood pressure, increased heart rate, patient verbalization of anxiety, and restlessness.
  - To help reduce anxiety, the nurse should encourage patients and families to express concerns, ask questions, and state their needs; and include the patient and family in all conversations and explain the purpose of equipment and procedures.
  - Antianxiety drugs and complementary therapies may reduce the stress response and should be considered.

- Pain:
  - The control of pain in the ICU patient is paramount as inadequate pain control is often linked with agitation and anxiety and can contribute to the stress response.
  - ICU patients at high risk for pain include patients (1) who have medical conditions that include ischemic, infectious, or inflammatory processes; (2) who are immobilized; (3) who have invasive monitoring devices, including endotracheal tubes; (4) and who are scheduled for any invasive or noninvasive procedures.
  - Continuous intravenous sedation and an analgesic agent are a practical and effective strategy for sedation and pain control.

- Impaired communication:
  - Inability to communicate can be distressing for the patient who may be unable to speak because of sedative and paralyzing drugs or an endotracheal tube.
  - The nurse should explore alternative methods of communication, including the use of devices such as picture boards, notepads, magic slates, or computer keyboards. For patients who do not speak English, the use of an interpreter is recommended.
  - Nonverbal communication is important. Comforting touch with ongoing evaluation of the patient's response should be provided. Families should be

encouraged to touch and talk with the patient even if the patient is unresponsive or comatose.

- Sensory-perceptual problems:
  - Delirium in ICU patients ranges from 15% to 40%.
    - Demographic factors predisposing the patient to delirium include advanced age, preexisting cerebral illnesses, use of medications that block rapid eye movement sleep, and a history of drug or alcohol abuse.
    - Environmental factors that can contribute to delirium include sleep deprivation, anxiety, sensory overload, and immobilization.
    - Physical conditions such as hemodynamic instability, hypoxemia, hypercarbia, electrolyte disturbances, and severe infections can precipitate delirium.
    - Certain drugs (e.g., sedatives, furosemide, antimicrobials) have been associated with the development of delirium.
    - The ICU nurse must identify predisposing factors that may precipitate delirium and improve the patient's mental clarity and cooperation with appropriate therapy (e.g., correction of oxygenation, use of clocks and calendars).
    - If the patient demonstrates unsafe behavior, hyperactivity, insomnia, or delusions, symptoms may be managed with neuroleptic drugs (e.g., haloperidol).
    - The presence of family members may help reorient the patient and reduce agitation.
  - Sensory overload can also result in patient distress and anxiety.
    - Environmental noise levels are particularly high in the ICU and the nurse should limit noise and assist the patient in understanding noises that cannot be prevented.

- Sleep problems:
  - Patients may have difficulty falling asleep or have disrupted sleep because of noise, anxiety, pain, frequent monitoring, or treatment procedures.
  - Sleep disturbance is a significant stressor in the ICU, contributing to delirium and possibly affecting recovery.
  - The environment should be structured to promote the patient's sleep-wake cycle by clustering activities, scheduling rest periods, dimming lights at nighttime, opening curtains during the daytime, obtaining physiologic measurements without disrupting the patient, limiting noise, and providing comfort measures.
  - Benzodiazepines and benzodiazepine-like drugs can be used to induce and maintain sleep.

ISSUES RELATED TO FAMILIES

- Family members play a valuable role in the patient's recovery and should be considered members of the health care team. They contribute to the patient's well-being by:
  - Providing a link to the patient's personal life

  - Advising the patient in health care decisions or functioning as the decision maker when the patient cannot
  - Helping with activities of daily living
  - Providing positive, loving, and caring support

- To provide family-centered care effectively, the nurse must be skilled in crisis intervention.
  - Interventions can include active listening, reduction of anxiety, and support of those who become upset or angry.
  - Other health team members (e.g., chaplains, psychologists, patient representatives) may be helpful in assisting the family to adjust and should be consulted as necessary.

- The major needs of families of critically ill patients have been categorized as informational needs, reassurance needs, and convenience needs.
  - Lack of information is a major source of anxiety for the family. The family needs reassurance regarding the way in which the patient's care is managed and decisions are made and the family should be invited to meet the health care team members, including physicians, dietitian, respiratory therapist, social worker, physical therapist, and chaplain.
  - Rigid visitation policies in ICUs should be reviewed, and a move toward less restrictive, individualized visiting policies is strongly recommended by the AACN.
  - Research has demonstrated that family members of patients undergoing invasive procedures, including cardiopulmonary resuscitation, should be given the option of being present at the bedside during these events.

HEMODYNAMIC MONITORING

- **Hemodynamic monitoring** refers to the measurement of pressure, flow, and oxygenation within the cardiovascular system. Both invasive and noninvasive hemodynamic measurements are made in the ICU.

- Values commonly measured include systemic and pulmonary arterial pressures, central venous pressure (CVP), pulmonary artery wedge pressure (PAWP), cardiac output/index, stroke volume/index, and oxygen saturation of the hemoglobin of arterial blood (SaO_2) and mixed venous blood (SvO_2).

- *Cardiac output* (CO) is the volume of blood pumped by the heart in 1 minute. *Cardiac index* (CI) is the measurement of the CO adjusted for body size.

- The volume ejected with each heartbeat is the *stroke volume* (SV). *Stroke volume index* (SVI) is the measurement of SV adjusted for body size.

- The opposition to blood flow offered by the vessels is called systemic vascular resistance (SVR) or pulmonary vascular resistance (PVR).

- Preload, afterload, and contractility determine SV (and thus CO and blood pressure).
- *Preload* is the volume within the ventricle at the end of diastole.
- PAWP, a measurement of pulmonary capillary pressure, reflects left ventricular end-diastolic pressure under normal conditions.
- CVP, measured in the right atrium or in the vena cava close to the heart, is the right ventricular preload or right ventricular end-diastolic pressure under normal conditions.
- *Afterload* refers to the forces opposing ventricular ejection and includes systemic arterial pressure, the resistance offered by the aortic valve, and the mass and density of the blood to be moved.
- *Systemic vascular resistance* (SVR) is the resistance of the systemic vascular bed. *Pulmonary vascular resistance* (PVR) is the resistance of the pulmonary vascular bed. Both of these measures can be adjusted for body size.
- *Contractility* describes the strength of contraction. Agents that increase or improve contractility are termed *positive inotropes.* Contractility is diminished by *negative inotropes,* such as certain drugs (e.g., calcium channel blockers, β-adrenergic blockers) and conditions (e.g., acidosis).

Principles of Invasive Pressure Monitoring

- To accurately measure pressure, equipment must be referenced and zero balanced to the environment and dynamic response characteristics optimized.
- Referencing means positioning the transducer so that the zero reference point is at the level of the atria of the heart or the **phlebostatic axis.**
- *Zeroing* confirms that when pressure within the system is zero, the monitor reads zero. Zeroing is recommended during initial setup, immediately after insertion of the arterial line, when the transducer has been disconnected from the pressure cable or the pressure cable has been disconnected from the monitor, and when the accuracy of the measurements is questioned.
- Optimizing dynamic response characteristics involves checking that the equipment reproduces, without distortion, a signal that changes rapidly. A *dynamic response test (square wave test)* is performed every 8 to 12 hours and when the system is opened to air or the accuracy of the measurements is questioned.

Types of Invasive Pressure Monitoring

- Continuous arterial pressure monitoring is indicated for patients experiencing acute hypertension and hypotension, respiratory failure, shock, neurologic injury, coronary interventional procedures, continuous infusion of vasoactive drugs, and frequent ABG

sampling.
    - High- and low-pressure alarms should be set based on the patient's current status. Measurements are obtained at end expiration to limit the effect of the respiratory cycle on arterial pressure.
    - Arterial lines carry the risk of hemorrhage, infection, thrombus formation, neurovascular impairment, and loss of limb.
    - To help maintain line patency and limit thrombus formation, a continuous flush irrigation system is used to deliver 3 to 6 ml of heparinized saline per hour.
        - Neurovascular status distal to the arterial insertion site is assessed hourly. Neurovascular impairment can result in loss of a limb and is an emergency.

- Pulmonary artery (PA) pressure monitoring is used to guide acute-phase management of patients with complicated cardiac, pulmonary, and intravascular volume problems.
    - PA diastolic (PAD) pressure and PAWP are sensitive indicators of cardiac function and fluid volume status and are routinely monitored.
    - Monitoring PA pressures can allow precise therapeutic manipulation of preload, which allows CO to be maintained without placing the patient at risk for pulmonary edema.
    - A PA flow-directed catheter (e.g., Swan-Ganz) is used to measure PA pressures, including PAWP. When properly positioned, the distal lumen port (catheter tip) is within the PA and is used to monitor PA pressures and sample mixed venous blood specimens (e.g., to evaluate oxygen saturation).
    - Additional lumens have exit ports in the right atrium or right atrium and right ventricle (if two).
        - The right atrium port is used for measurement of CVP, injection of fluid for CO determination, and withdrawal of blood specimens.
        - If a second proximal port is available, it is used for infusion of fluids and drugs or blood sampling.
    - A thermistor (temperature sensor) lumen port located near the distal tip is used for monitoring blood or core temperature and is used in the thermodilution method of measuring CO.
    - PA measurements are obtained at the end of expiration.
    - PAWP measurement is obtained by slowly inflating the balloon with air (not to exceed balloon capacity) until the PA waveform changes to a PAWP waveform.
        - The balloon should be inflated for no more than four respiratory cycles or 8 to 15 seconds.

- CVP is a measurement of right ventricular preload. It can be measured with a PA catheter using one of the proximal lumens or with a central venous catheter placed in the internal jugular or subclavian vein.

- The PA catheter is commonly used to measure CO via the intermittent bolus thermodilution CO method or the continuous CO method.

- SVR, SVR index, SV, and SV index can be calculated each time that CO is measured.
    - Increased SVR indicates vasoconstriction from shock, hypertension, increased release or administration of epinephrine and other vasoactive inotropes, or left ventricular failure.
    - Decreased SVR indicates vasodilation, which may occur during shock states (e.g., septic, neurogenic) or with drugs that reduce afterload.
    - Changes in SV are becoming more important indicators of the pumping status of the heart than other parameters.

Noninvasive Hemodynamic Monitoring

- **Impedance cardiography** (ICG) is a continuous or intermittent, noninvasive method of obtaining CO and assessing thoracic fluid status.

- Impedance-based hemodynamic parameters (CO, SV, and SVR) can be calculated from Zo, dZ/dt, MAP, CVP, and the ECG.

- Major indications for ICG include early signs and symptoms of pulmonary or cardiac dysfunction, differentiation of cardiac or pulmonary cause of shortness of breath, evaluation of etiology and management of hypotension, monitoring after discontinuing a PA catheter or justification for insertion of a PA catheter, evaluation of pharmacotherapy, and diagnosis of rejection following cardiac transplantation.

Venous Oxygen Saturation

- Both CVP and PA catheters can include sensors to measure oxygen saturation of hemoglobin in venous blood termed *mixed venous oxygen saturation* ($ScvO_2$, SvO_2).

- $SvO_2/ScvO_2$ reflects the dynamic balance between oxygenation of the arterial blood, tissue perfusion, and tissue oxygen consumption (VO_2).
    - Normal $SvO_2/ScvO_2$ at rest is 60% to 80%.
    - Sustained decreases in $SvO_2/ScvO_2$ may indicate decreased arterial oxygenation, low CO, low hemoglobin level, or increased oxygen consumption or extraction. If the $SvO_2/ScvO_2$ falls below 60%, the nurse determines which of these factors has changed.
    - Sustained increases in $SvO_2/ScvO_2$ may indicate a clinical improvement (e.g., increased arterial oxygen saturation, decreased metabolic rate) or problems (e.g., sepsis).

Complications with PA Catheters

- Infection and sepsis are serious problems associated with PA catheters.
    - Careful surgical asepsis for insertion and maintenance of the catheter and attached tubing is mandatory.
    - Flush bag, pressure tubing, transducer, and stopcock should be changed every 96 hours.

- Air embolus is another risk associated with PA catheters.

- Pulmonary infarction or PA rupture from: (1) balloon rupture, releasing air and fragments that could embolize; (2) prolonged balloon inflation obstructing blood flow; (3) catheter advancing into a wedge position, obstructing blood flow; and (4) thrombus formation and embolization.
    - Balloon must never be inflated beyond the balloon's capacity (usually 1 to 1.5 ml of air). And must not be left inflated for more than four breaths (except during insertion) or 8 to 15 seconds.
    - PA pressure waveforms are monitored continuously for evidence of catheter occlusion, dislocation, or spontaneous wedging.
    - PA catheter is continuously flushed with a slow infusion of heparinized (unless contraindicated) saline solution.

- Ventricular dysrhythmias can occur during PA catheter insertion or removal or if the tip migrates back from the PA to the right ventricle and irritates the ventricular wall.

- The nurse may observe that the PA catheter cannot be wedged and may need to be repositioned by the physician or a qualified nurse.

Noninvasive Arterial Oxygenation Monitoring

- *Pulse oximetry* is a noninvasive and continuous method of determining arterial oxygenation (SpO_2), and monitoring SpO_2 may reduce the frequency of ABG sampling.

- SpO_2 is normally 95% to 100%.

- Accurate SpO_2 measurements may be difficult to obtain on patients who are hypothermic, receiving intravenous vasopressor therapy, or experiencing hypoperfusion.

- Alternate locations for placement of the pulse oximetry probe may need to be considered (e.g., forehead, earlobe).

Nursing Management: Hemodynamic Monitoring

- Baseline data regarding the patient's general appearance, level of consciousness, skin color and temperature, vital signs, peripheral pulses, and urine output are obtained.

- Baseline data are correlated with data obtained from biotechnology (e.g., ECG; arterial, CVP, PA, PAWP pressures; SvO_2/$ScvO_2$).

- Single hemodynamic values are rarely significant; the nurse monitors trends in these values and evaluates the whole clinical picture with the goals of recognizing early clues and intervening before problems escalate.

CIRCULATORY ASSIST DEVICES

- **Circulatory assist devices** (CADs) decrease cardiac work and improve organ perfusion when conventional drug therapy is no longer adequate.

- CADs provide interim support in three types of situations: (1) the left, right, or both ventricles require support while recovering from acute injury; (2) the heart requires surgical repair (e.g., a ruptured septum), but the patient must be stabilized; and (3) the heart has failed, and the patient is awaiting cardiac transplantation.

Intraaortic Balloon Pump

- The **intraaortic balloon pump** (IABP) provides temporary circulatory assistance to the compromised heart by reducing afterload (via reduction in systolic pressure) and augmenting the aortic diastolic pressure resulting in improved coronary blood flow and perfusion of vital organs.

- The IABP consists of a sausage-shaped balloon, a pump that inflates and deflates the balloon, control panel for synchronizing the balloon inflation to the cardiac cycle, and fail-safe features.

- IABP therapy is referred to as counterpulsation because the timing of balloon inflation is opposite to ventricular contraction.

- The IAPB assist ratio is 1:1 in the acute phase of treatment, that is, one IABP cycle of inflation and deflation for every heartbeat.

- Complications of IABP therapy may include vascular injuries such as dislodging of plaque, aortic dissection, and compromised distal circulation.
    - Thrombus and embolus formation add to the risk of circulatory compromise to the extremity.
    - Mechanical complications are rare and include improper timing of balloon inflation causing increased afterload, decreased CO, myocardial ischemia, and increased myocardial oxygen demand.
    - To reduce risks of IABP therapy, cardiovascular, neurovascular, and hemodynamic assessments are necessary every 15 to 60 minutes depending on the patient's status.

- The patient is relatively immobile, limited to side-lying or supine positions with the head of the bed elevated less than 45 degrees. The leg in which the catheter is inserted must not be flexed at the hip to avoid kinking or dislodgement of the catheter.

Ventricular Assist Devices

- **Ventricular assist devices** (VADs) provide longer-term support for the failing heart (usually months) and allow more mobility than the IABP.

- VADs are inserted into the path of flowing blood to augment or replace the action of the ventricle. Some VADs are implanted (e.g., peritoneum), and others are positioned externally.

- Some VADs provide biventricular support.

- Indications for VAD therapy include (1) extension of CPB for failure to wean or postcardiotomy cardiogenic shock, (2) bridge to recovery or cardiac transplantation, and (3) patients with New York Heart Association Classification IV who have failed medical therapy.

Nursing Management: Circulatory Assist Devices

- Nursing care of the patient with a VAD is similar to that of the patient with an IABP.
    - Patients are observed for bleeding, cardiac tamponade, ventricular failure, infection, dysrhythmias, renal failure, hemolysis, and thromboembolism.
    - A patient with VAD may be mobile and require an activity plan.

- Ideally, patients with CADs will recover through ventricular improvement, heart transplantation, or artificial heart implantation.

- However, many patients die, or the decision to terminate the device is made and death follows. Both the patient and family require psychologic support.

ARTIFICIAL AIRWAYS

- **Endotracheal intubation** (ET intubation) involves the placement of a tube into the trachea via the mouth or nose past the larynx.

- Indications for ET intubation include (1) upper airway obstruction (e.g., secondary to burns, tumor, bleeding), (2) apnea, (3) high risk of aspiration, (4) ineffective clearance of secretions, and (5) respiratory distress.

- A *tracheotomy* is a surgical procedure that is performed when the need for an artificial airway is expected to be long term.

- *Oral ET intubation* is the procedure of choice for most emergencies because the airway can be secured rapidly, a larger diameter tube can be used thus reducing the work of breathing (WOB) and making it easier to remove secretions and perform fiberoptic bronchoscopy.

- *Nasal ET intubation* is indicated when head and neck manipulation is risky.

Endotracheal Intubation Procedure

- All patients undergoing intubation need to have a self-inflating **bag-valve-mask** (BVM) available and attached to oxygen, suctioning equipment ready and intravenous access.

- Premedication varies, depending on the patient's level of consciousness (e.g., awake, obtunded) and the nature of the procedure (e.g., emergent, nonemergent).

- Rapid sequence intubation (RSI) is the rapid, concurrent administration of a combination

of both a paralytic agent and a sedative agent during emergency airway management to decrease the risks of aspiration, combativeness, and injury to the patient. RSI is not indicated in patients who are comatose or during cardiac arrest.

- Before intubation is attempted, the patient is preoxygenated using a self-inflating BVM with 100% O_2 for 3 to 5 minutes.
    - Each intubation attempt is limited to less than 30 seconds. If unsuccessful, the patient is ventilated between successive attempts using the BVM with 100% O_2.

- Following intubation, the cuff is inflated, and the placement of the ET tube is confirmed while manually ventilating the patient with 100% O_2.
    - An end-tidal CO_2 detector is to confirm proper placement by measuring the amount of exhaled CO_2 from the lungs.
        - The detector is placed between the BVM and the ET tube and either observed for a color change (indicating the presence of CO_2) or a number.
        - If no CO_2 is detected, than the tube is in the esophagus.
    - The lung bases and apices are auscultated for bilateral breath sounds, and the chest is observed for symmetric chest wall movement.
    - A portable chest x-ray is immediately obtained to confirm tube location (3 to 5 cm above the carina in the adult).

- The ET tube is connected either to humidified air, O_2, or a mechanical ventilator.

- ABGs should be obtained within 25 minutes after intubation to determine oxygenation and ventilation status.

- Continuous pulse oximetry monitoring provides an estimate of arterial oxygenation.

Nursing Management: Artificial Airway

- **Maintaining Correct Tube Placement**
    - The nurse must monitor the patient with an ET tube for proper placement at least every 2 to 4 hours.
    - Proper tube position is maintained by confirming that the exit mark on the tube remains constant while at rest, during patient care, repositioning, and patient transport.
    - The nurse observes for symmetric chest wall movement and auscultates to confirm bilateral breath sounds.
    - It is an emergency if the ET tube is not positioned properly.
        - The nurse stays with the patient, maintains the airway, supports ventilation, and secures the appropriate assistance to immediately reposition the tube.
        - It may be necessary to ventilate the patient with a BVM.

- **Maintaining Proper Cuff Inflation**
    - The cuff is an inflatable, pliable sleeve encircling the outer wall of the ET tube that stabilizes and seals the ET tube within the trachea and prevents escape of ventilating

gases.
- The cuff can cause tracheal damage.
  - To avoid damage, the cuff is inflated with air, and the pressure in the cuff is measured and monitored.
  - Normal arterial tracheal perfusion is estimated at 30 mm Hg and cuff pressure should be maintained at 20 to 25 mm Hg.
  - Depending on the institution's policy, cuff pressure is measured and recorded after intubation and on a routine basis (e.g., every 8 hours) using the *minimal occluding volume* (MOV) technique or the *minimal leak technique* (MLT).
    - The steps of the MOV technique are as follows: (1) for the mechanically ventilated patient, place a stethoscope over the trachea and inflate the cuff to MOV by adding air until no air leak is heard at peak inspiratory pressure (end of ventilator inspiration); (2) for the spontaneously breathing patient, inflate until no sound is heard after a deep breath or after inhalation with a BVM; (3) use a manometer to verify that cuff pressure is between 20 and 25 mm Hg; and (4) record cuff pressure in the chart.
    - The procedure for MLT is similar with one exception. A small amount of air is removed from the cuff until a slight leak is auscultated at peak inflation.
    - Both techniques are intended to prevent the risks of tracheal trauma due to high cuff pressures.
    - If adequate cuff pressure cannot be maintained or larger volumes of air are needed to keep the cuff inflated, the cuff could be leaking or there could be tracheal dilation at the cuff site and the ET tube should be repositioned or changed and the physician should be notified.

- **Monitoring Oxygenation and Ventilation**
  - *Oxygenation:* Assessment of ABGs, SpO_2, $SvO_2/ScvO_2$, and clinical signs of hypoxemia such as a change in mental status (e.g., confusion), anxiety, dusky skin, and dysrhythmias.
  - *Ventilation:* Assessment of $PaCO_2$, continuous partial pressure of end-tidal CO_2 ($PETCO_2$), and clinical signs of respiratory distress such as use of accessory muscles, hyperventilation with circumoral and peripheral numbness and tingling, and hypoventilation with dusky skin.
    - Continuous *$PETCO_2$ monitoring* can be used to assess the patency of the airway and the presence of breathing.
    - Gradual changes in $PETCO_2$ values may accompany an increase in CO_2 production (e.g., sepsis) or decrease in CO_2 production (e.g., hypothermia).

- **Maintaining Tube Patency**
  - The patient should be assessed routinely to determine a need for suctioning, but the patient should not be suctioned routinely.
    - Indications for suctioning include (1) visible secretions in the ET tube, (2) sudden onset of respiratory distress, (3) suspected aspiration of secretions, (4)

increase in peak airway pressures, (5) auscultation of adventitious breath sounds over the trachea and/or bronchi, (6) increase in respiratory rate and/or sustained coughing, and (7) sudden or gradual decrease in PaO_2 and/or SpO_2.

- The **closed-suction technique** (CST) uses a suction catheter that is enclosed in a plastic sleeve connected directly to the patient-ventilator circuit.
  - With the CST, oxygenation and ventilation are maintained during suctioning and exposure to secretions is reduced.
  - CST should be considered for patients who require high levels of positive end-expiratory pressure (PEEP), who have bloody or infected pulmonary secretions, who require frequent suctioning, and who experience clinical instability with the **open-suction technique** (OST).
- Potential complications associated with suctioning include hypoxemia, bronchospasm, increased intracranial pressure, dysrhythmias, hyper/hypotension, mucosal damage, pulmonary bleeding, and infection.
  - Assess patient before, during, and after the suctioning procedure.
  - If the patient does not tolerate suctioning (e.g., decreased SpO_2, development of dysrhythmias), stop procedure and manually hyperventilate patient with 100% oxygen or if performing CST, hyperoxygenate until equilibration occurs.
  - Hypoxemia is prevented by hyperoxygenating the patient before and after each suctioning pass and limiting each suctioning pass to 10 seconds or less.
  - If SvO_2/$ScvO_2$ and/or SpO_2 are used, trends should be assessed throughout the suctioning procedure.
  - Tracheal mucosal damage may occur because of excessive suction pressures (>120 mm Hg), overly vigorous catheter insertion, and the characteristics of the suction catheter itself.
  - Secretions may be thick and difficult to suction because of inadequate hydration, inadequate humidification, infection, or inaccessibility of the left mainstem bronchus or lower airways.
    - Adequately hydrating the patient (e.g., oral or intravenous fluids) and providing supplemental humidification of inspired gases may assist in thinning secretions.
    - Instillation of normal saline into the ET tube is discouraged. If infection is the cause of thick secretions, administer antibiotics.
    - Postural drainage, percussion, and turning the patient every 2 hours may help move secretions into larger airways.

- **Providing Oral Care and Maintaining Skin Integrity**
  - Oral care should include teeth brushing twice a day along with use of moistened mouth swabs and oral/pharyngeal suctioning every 2 to 4 hours and as needed to provide comfort and to prevent injury to the gums and plaque accumulation.
  - The ET tube should be repositioned and retaped every 24 hours and as needed.
  - If the patient is anxious or uncooperative, two caregivers should perform the repositioning procedure to prevent accidental dislodgment.
  - Monitor patient for signs of respiratory distress throughout the procedure.

- **Fostering Comfort and Communication**
  - Intubated patients often experience anxiety because of the inability to communicate and not knowing what to expect.
  - The physical discomfort associated with ET intubation and mechanical ventilation often necessitates sedating the patient and administering an analgesic to achieve an acceptable level of patient comfort.
  - Initiating alternative therapies (e.g., music therapy, guided imagery) to complement drug therapy is recommended.

- **Complications of Endotracheal Intubation**
  - Unplanned **extubation** (i.e., removal of the ET tube from the trachea) can be a catastrophic event and is usually due to patient removal of the ET tube or accidental (i.e., result of movement or procedural-related) removal.
    - Signs of unplanned extubation may include patient vocalization, activation of the low-pressure ventilator alarm, diminished or absent breath sounds, respiratory distress, and gastric distention.
    - The nurse is responsible for preventing unplanned extubation by ensuring adequate securement of the ET tube; support of the ET tube during repositioning, procedures, patient transfer; immobilizing the patient's hands through the use of soft wrist restraints; and providing sedation and analgesia as ordered.
    - Should an unplanned extubation occur, the nurse stays with the patient, calls for help, manually ventilates the patient with 100% oxygen, and provides psychologic support to the patient.
  - Aspiration is a potential hazard for the patient with an ET tube as the tube passes through the epiglottis, splinting it in an open position. Some ET tubes provide continuous suctioning of secretions above the cuff.
    - Oral intubation increases salivation, yet swallowing is difficult, so the mouth must be suctioned frequently.
    - Additional risk factors for aspiration include improper cuff inflation, patient positioning, and tracheoesophageal fistula.
    - Frequently, an orogastric (OG) or nasogastric (NG) tube is inserted and connected to low, intermittent suction when a patient is intubated.
    - All intubated patients and patients receiving enteral feedings should have the head of the bed (HOB) elevated a minimum of 30 to 45 degrees unless medically contraindicated.

MECHANICAL VENTILATION

- **Mechanical ventilation** is the process by which the fraction of inspired oxygen (FIO_2) at 21% (room air) or greater is moved into and out of the lungs by a mechanical ventilator.

- Indications for mechanical ventilation include (1) apnea or impending inability to breathe, (2) acute respiratory failure generally defined as pH ≤7.25 with a $PaCO_2$ ≥50 mm Hg, (3) severe hypoxia, and (4) respiratory muscle fatigue.

Types of Mechanical Ventilation

- **Negative pressure ventilation** involves the use of chambers that encase the chest or body and surround it with intermittent subatmospheric or negative pressure.
    - Negative pressure ventilation is delivered as noninvasive ventilation and an artificial airway is not required.
    - Negative pressure ventilators are not used extensively for acutely ill patients. However, some research has demonstrated positive outcomes with the use of negative pressure ventilation in acute exacerbations of chronic respiratory failure.

- **Positive pressure ventilation** (PPV), used primarily with acutely ill patients, pushes air into the lungs under positive pressure during inspiration. Expiration occurs passively as in normal expiration. Modes of PPV are categorized into two groups:
    - **Volume ventilation** involves a predetermined tidal volume (V_T) that is delivered with each inspiration, while the amount of pressure needed to deliver the breath varies based on the compliance and resistance factors of the patient-ventilator system.
    - **Pressure ventilation** involves a predetermined peak inspiratory pressure while the V_T delivered to the patient varies based on the selected pressure and the compliance and resistance factors of the patient-ventilator system.
        - Careful attention must be given to the V_T to prevent unplanned hyperventilation or hypoventilation.

Settings of Mechanical Ventilators

- Mechanical ventilator settings regulate the rate, depth, and other characteristics of ventilation and are based on the patient's status (e.g., ABGs, body weight, level of consciousness, muscle strength). The ventilator is tuned as finely as possible to match the patient's ventilatory pattern.

- Modes of volume ventilation:
    - Ventilator mode is based on how much WOB the patient ought to or can perform and is determined by the patient's ventilatory status, respiratory drive, and ABGs.
    - Ventilator modes are controlled or assisted.
        - With controlled ventilatory support, the ventilator does all of the WOB.
        - With assisted ventilatory support, the ventilator and the patient share the WOB.
    - **Controlled mandatory ventilation** (CMV) delivers breaths that are delivered at a set rate per minute and a set V_T, which are independent of the patient's ventilatory efforts.
        - Patients perform no WOB and cannot adjust respirations to meet changing demands.
    - **Assist-control ventilation** (ACV) delivers a preset V_T at a preset frequency, and when the patient initiates a spontaneous breath, the preset V_T is delivered.
        - The patient can breathe faster than the preset rate but not slower.
        - This mode allows the patient some control over ventilation while providing

some assistance and is used in patients with a variety of conditions (e.g., Guillain-Barré syndrome, pulmonary edema, acute respiratory failure).
        - Patients require vigilant assessment and monitoring of ventilatory status, including respiratory rate, ABGs, SpO_2, and $SvO_2/ScvO_2$.
            - If it is too difficult for the patient to initiate a breath, the WOB is increased and the patient may tire and or develop ventilator asynchrony (i.e., the patient "fights" the ventilator).
    - **Synchronized intermittent mandatory ventilation** (SIMV) delivers a preset V_T at a preset frequency in synchrony with the patient's spontaneous breathing.
        - Between ventilator-delivered breaths, the patient is able to breathe spontaneously.
        - The patient receives the preset FIO_2 concentration during the spontaneous breaths but self-regulates the rate and volume of those breaths.
        - Potential benefits of SIMV include improved patient-ventilator synchrony, lower mean airway pressure, and prevention of muscle atrophy as the patient takes on more of the WOB.

- Modes of pressure ventilation:
    - With **pressure support ventilation** (PSV), positive pressure is applied to the airway only during inspiration and is used in conjunction with the patient's spontaneous respirations.
        - The patient must be able to initiate a breath in this modality.
        - A preset level of positive airway pressure is selected so that the gas flow rate is greater than the patient's inspiratory flow rate.
        - Advantages to PSV include increased patient comfort, decreased WOB, decreased oxygen consumption, and increased endurance conditioning.
    - *Pressure-controlled/ inverse ratio ventilation* (PC-IRV) combines pressure-limited ventilation with an inverse ratio of inspiration (I) to expiration (E). Normal I/E is 1:2.
        - With IRV, the I/E ratio begins at 1:1 and may progress to 4:1.
        - IRV progressively expands collapsed alveoli and the short expiratory time has a PEEP-like effect, preventing alveolar collapse.
        - IRV requires sedation with or without paralysis.
        - PC-IRV is indicated for patients with acute respiratory distress syndrome who continue to have refractory hypoxemia despite high levels of PEEP.

- Other ventilatory maneuvers
    - **Positive end-expiratory pressure** (PEEP) is a ventilatory maneuver in which positive pressure is applied to the airway during exhalation. With PEEP, exhalation remains passive, but pressure falls to a preset level greater than zero, often 3 to 20 cm H_2O.
        - PEEP increases functional residual capacity (FRC) by increasing aeration of patent alveoli, aerating previously collapsed alveoli, and preventing alveolar collapse throughout the respiratory cycle.
        - PEEP is titrated to the point that oxygenation improves without compromising hemodynamics and is termed best or optimal PEEP.

        - 5 cm H_2O PEEP (referred to as physiologic PEEP) is used prophylactically to replace the glottic mechanism, help maintain a normal FRC, and prevent alveolar collapse.
        - Auto-PEEP is a result of inadequate exhalation time. Auto-PEEP is additional PEEP over what is set by the clinician and can be measured at end-expiratory hold button located on most ventilators.
            - Auto-PEEP may result in increased WOB, barotrauma, and hemodynamic instability.
            - Interventions to limit auto-PEEP include sedation and analgesia, large diameter ETT, bronchodilators, short inspiratory times, decreased respiratory rates, and reducing water accumulation in the ventilator circuit by frequent emptying or use of heated circuits.
        - The major purpose of PEEP is to maintain or improve oxygenation while limiting risk of oxygen toxicity.
        - PEEP is generally contraindicated or used with extreme caution in patients with highly compliant lungs (e.g., COPD), unilateral or nonuniform disease, hypovolemia, and low CO. In these situations the adverse effects of PEEP may outweigh any benefits.
    - **Continuous positive airway pressure** (CPAP) restores FRC and is similar to PEEP.
        - The pressure in CPAP is delivered continuously during spontaneous breathing, thus preventing the patient's airway pressure from falling to zero.
        - CPAP is commonly used in the treatment of obstructive sleep apnea and can be administered noninvasively by a tight-fitting mask or an ET or tracheal tube.
        - CPAP increases WOB because the patient must forcibly exhale against the CPAP and so must be used with caution in patients with myocardial compromise.
    - *Bilevel positive airway pressure* (BiPAP) provides two levels of positive pressure support, and higher inspiratory positive airway pressure (IPAP) and a lower expiratory positive airway pressure (EPAP) along with oxygen.
        - It is a noninvasive modality and is delivered through a tight fitting face mask, nasal mask, or nasal pillows.
        - Patients must be able to spontaneously breathe and cooperate with the treatment.
        - Indications include acute respiratory failure in patients with COPD and heart failure, and sleep apnea.
    - **High-frequency ventilation** (HFV) involves delivery of a small tidal volume (usually 1 to 5 ml per kg of body weight) at rapid respiratory rates (100 to 300 breaths per minute) in an effort to recruit and maintain lung volume and reduce intrapulmonary shunting.
        - High-frequency jet ventilation (HFJV) delivers humidified gas from a high pressure source through a small-bore cannula positioned in the airway.
        - High-frequency percussive ventilation (HFPV) attempts to combine the positive effects of both HFV and conventional mechanical ventilation.
        - High-frequency oscillatory ventilation (HFOV) uses a diaphragm or a piston

in the ventilator to generate vibrations (or oscillations) of subphysiologic volumes of gas.
        - Patients receiving HFV must be paralyzed to suppress spontaneous respiration. In addition, patients must receive concurrent sedation and analgesia as necessary adjuncts when inducing paralysis.
    - The use of perflubron (LiquiVent) in **partial liquid ventilation** (PLV) for patients with ARDS is being investigated.
        - Perflubron, an inert, biocompatible, clear, odorless liquid that has an affinity for both oxygen and carbon dioxide and surfactant-like qualities, is trickled down a specially designed ET tube through a side port into the lungs of a mechanically ventilated patient.
        - The amount used is usually equivalent to a patient's FRC.
        - Perflubron evaporates quickly and must be replaced to maintain a constant level during the therapy.
    - *Prone positioning* is the repositioning of a patient from a supine or lateral position to a prone (on the stomach with face down) position.
        - Effects include improved lung recruitment.
        - Proning is used as supportive therapy in critically ill patients with acute lung injury or ARDS to improve oxygenation.
    - *Extracorporeal membrane oxygenation* (ECMO) is an alternative form of pulmonary support for the patient with severe respiratory failure.
        - ECMO is a modification of cardiac bypass and involves partially removing blood from a patient through the use of large bore catheters, infusing oxygen, removing CO_2, and returning the blood back to the patient.

Complications of Positive Pressure Ventilation

Cardiovascular System

- PPV can affect circulation because of the transmission of increased mean airway pressure to the thoracic cavity.

- With increased intrathoracic pressure, thoracic vessels are compressed resulting in decreased venous return to the heart, decreased left ventricular end-diastolic volume (preload), decreased CO, and hypotension. Mean airway pressure is further increased if titrating PEEP (>5 cm H_2O) to improve oxygenation.

Pulmonary System

- As lung inflation pressures increase, risk of *barotrauma* increases.
    - Patients with compliant lungs (e.g., COPD) are at greater risk for barotraumas.
    - Air can escape into the pleural space from alveoli or interstitium, accumulate, and become trapped causing a pneumothorax.
    - For some patients, chest tubes may be placed prophylactically.

- *Pneumomediastinum* usually begins with rupture of alveoli into the lung interstitium; progressive air movement then occurs into the mediastinum and subcutaneous neck tissue. This is commonly followed by pneumothorax.

- *Volutrauma* in PPV relates to the lung injury that occurs when large tidal volumes are used to ventilate noncompliant lungs (e.g., ARDS).
    - Volutrauma results in alveolar fractures and movement of fluids and proteins into the alveolar spaces.

- Hypoventilation can be caused by inappropriate ventilator settings, leakage of air from the ventilator tubing or around the ET tube or tracheostomy cuff, lung secretions or obstruction, and low ventilation/perfusion ratio.
    - Interventions include turning the patient every 1 to 2 hours, providing chest physical therapy to lung areas with increased secretions, encouraging deep breathing and coughing, and suctioning as needed.

- Respiratory alkalosis can occur if the respiratory rate or V_T is set too high (*mechanical overventilation*) or if the patient receiving assisted ventilation is *hyperventilating.*
    - If hyperventilation is spontaneous, it is important to determine the cause (e.g., hypoxemia, pain, fear, anxiety, or compensation for metabolic acidosis) and treat it.

- *Ventilator-associated pneumonia* (VAP) is defined as a pneumonia that occurs 48 hours or more after endotracheal intubation and occurs in 9% to 27% of all intubated patients with 50% of the occurrences developing within the first 4 days of mechanical ventilation.
    - Clinical evidence suggesting VAP includes fever, elevated white blood cell count, purulent sputum, odorous sputum, crackles or rhonchi on auscultation, and pulmonary infiltrates noted on chest x-ray.
    - Evidenced - based guidelines on VAP prevention include (1) HOB elevation at a minimum of 30 degrees to 45 degrees unless medically contraindicated, (2) no routine changes of the patient's ventilator circuit tubing, and (3) the use of an ET with a dorsal lumen above the cuff to allow continuous suctioning of secretions in the subglottic area. Condensation that collects in the ventilator tubing should be drained away from the patient as it collects.

- Progressive fluid retention often occurs after 48 to 72 hours of PPV especially PPV with PEEP. It is associated with decreased urinary output and increased sodium retention.
    - Fluid balance changes may be due to decreased CO.
    - Results include diminished renal perfusion, the release of renin with subsequent production of angiotensin and aldosterone resulting in sodium and water retention.
    - Pressure changes within the thorax are associated with decreased release of atrial natriuretic peptide, also causing sodium retention.
    - As a part of the stress response, release of antidiuretic hormone (ADH) and cortisol may be increased, contributing to sodium and water retention.

Neurologic System

- In patients with head injury, PPV, especially with PEEP, can impair cerebral blood flow.

- Elevating the head of the bed and keeping the patient's head in alignment may decrease the deleterious effects of PPV on intracranial pressure.

Gastrointestinal System

- Ventilated patients are at risk for developing stress ulcers and GI bleeding.

- Reduction of CO caused by PPV may contribute to ischemia of the gastric and intestinal mucosa and possibly increase the risk of translocation of GI bacteria.

- Peptic ulcer prophylaxis includes the administration of histamine (H_2)-receptor blockers, proton pump inhibitors, and tube feedings to decrease gastric acidity and diminish the risk of stress ulcer and hemorrhage.

- Gastric and bowel dilation may occur as a result of gas accumulation in the GI tract from swallowed air. Decompression of the stomach can be accomplished by the insertion of an NG/OG tube.

- Immobility, sedation, circulatory impairment, decreased oral intake, use of opioid pain medications, and stress contribute to decreased peristalsis. The patient's inability to exhale against a closed glottis may make defecation difficult predisposing the patient to constipation.

Musculoskeletal System

- Maintenance of muscle strength and prevention of the problems associated with immobility are important.

- Progressive ambulation of patients receiving long-term PPV can be attained without interruption of mechanical ventilation.

- Passive and active exercises, consisting of movements to maintain muscle tone in the upper and lower extremities, should be done in bed.

- Prevention of contractures, pressure ulcers, foot drop, and external rotation of the hip and legs by proper positioning is important.

Psychosocial Needs

- Patients may experience physical and emotional stress due to the inability to speak, eat, move, or breathe normally.

- Tubes and machines may cause pain, fear, and anxiety.

- Ordinary activities of daily living such as eating, elimination, and coughing are extremely complicated.

- Patients have identified four needs: need to know (information), need to regain control, need to hope, and need to trust. When these needs were met, they felt safe.

- Patients should be involved in decision making as much as possible.

- The nurse should encourage hope and build trusting relationships with the patient and family.

- Patients receiving PPV usually require some type of sedation and/or analgesia to facilitate optimal ventilation.

- At times the decision is made to paralyze the patient with a neuromuscular blocking agent to provide more effective synchrony with the ventilator and increased oxygenation.
    - If the patient is paralyzed, the nurse should remember that the patient can hear, see, think, and feel.
    - Intravenous sedation and analgesia must always be administered concurrently when the patient is paralyzed.
    - Assessment of the patient should include train-of-four (TOF) peripheral nerve stimulation, physiologic signs of pain or anxiety (changes in heart rate and blood pressure), and ventilator synchrony.

- Many patients have few memories of their time in the ICU, whereas others remember vivid details.

- Although appearing to be asleep, sedated, or paralyzed, patients may be aware of their surroundings and should always be addressed as though awake and alert.

Machine Disconnection or Malfunction

- Most deaths from accidental ventilator disconnection occur while the alarm is turned off, and most accidental disconnections in critical care settings are discovered by low-pressure alarm activation.

- The most frequent site for disconnection is between the tracheal tube and the adapter.

- Alarms can be paused (not inactivated) during suctioning or removal from the ventilator and should always be reactivated before leaving the patient's bedside.

- Ventilator malfunction may also occur and may be related to several factors (e.g., power failure, failure of oxygen supply).

- Patients should be disconnected from the machine and manually ventilated with 100% oxygen if machine failure/malfunction is determined.

Nutritional Therapy: Patient Receiving Positive Pressure Ventilation

- PPV and the hypermetabolism associated with critical illness can contribute to inadequate nutrition.

- Patients likely to be without food for 3 to 5 days should have a nutritional program initiated.

- Poor nutrition and the disuse of respiratory muscles contribute to decreased respiratory muscle strength.

- Inadequate nutrition can delay weaning, decrease resistance to infection, and decrease the speed of recovery.

- Enteral feeding via a small-bore feeding tube is the preferred method to meet caloric needs of ventilated patients.

- Evidence-based guidelines regarding verification of feeding tube placement include: (1) x-ray confirmation before initial use, (2) marking and ongoing assessment of the tube's exit site, and (3) ongoing review of routine x-rays and aspirate.

- A concern regarding the nutritional support of patients receiving PPV is the carbohydrate content of the diet.
  - Metabolism of carbohydrates may contribute to an increase in serum CO_2 levels resulting in a higher required minute ventilation and an increase in WOB.
  - Limiting carbohydrate content in the diet may lower CO_2 production.
  - The dietitian should be consulted to determine the caloric and nutrient needs of these patients.

Weaning from Positive Pressure Ventilation and Extubation

- **Weaning** is the process of reducing ventilator support and resuming spontaneous ventilation.

- The weaning process differs for patients requiring short-term ventilation (up to 3 days) versus long-term ventilation (more than 3 days).
  - Patients requiring short-term ventilation (e.g., after cardiac surgery) will experience a linear weaning process.
  - Patients requiring prolonged PPV will experience a weaning process that consists of peaks and valleys.

- Weaning can be viewed as consisting of three phases. The preweaning, or assessment, phase determines the patient's ability to breathe spontaneously.
    - Weaning assessment parameters include criteria to assess muscle strength and endurance, and minute ventilation and rapid shallow breathing index.
    - Lungs should be reasonably clear on auscultation and chest x-ray.
    - Nonrespiratory factors include the assessment of the patient's neurologic status, hemodynamics, fluid and electrolytes/acid-base balance, nutrition,

and hemoglobin.
        - Drugs should be titrated to achieve comfort without causing excessive drowsiness.
    - Evidenced-based clinical guidelines recommend a spontaneous breathing trial (SBT) in patients who demonstrate weaning readiness, the second phase.
        - An SBT should be at least 30 minutes but no longer than 120 minutes and may be done with low levels of CPAP, low levels of PS or a "T" piece.
        - Tolerance of the trial may lead to extubation but failure to tolerate a SBT should prompt a search for reversible factors and a return to a nonfatiguing ventilator modality.

- The use of a standard approach for weaning or weaning protocols have shown to decrease ventilator days.

- Weaning is usually carried out during the day, with the patient ventilated at night in a rest mode.

- The patient being weaned and the family should be provided with explanations regarding weaning and ongoing psychologic support.

- The patient should be placed in a sitting or semirecumbent position and baseline vital signs and respiratory parameters measured.

- During the weaning trial, the patient must be monitored closely for noninvasive criteria that may signal intolerance and result in cessation of the trial (e.g., tachypnea, tachycardia, dysrhythmias, sustained desaturation [SpO_2 <91%], hypertension, agitation, anxiety, sustained V_T <5 ml/kg, changes in level of consciousness).

- The weaning outcome phase refers to the period when weaning stops and the patient is extubated or weaning is stopped because no further progress is being made.

- After extubation, the patient should be encouraged to deep breathe and cough, and the pharynx should be suctioned as needed.

- Supplemental oxygen should be applied and naso-oral care provided.

- Vital signs, respiratory status, and oxygenation are monitored immediately following extubation, within 1 hour, and per institutional policy.

Lewis et al: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 7th edition

Key Points

Chapter 67: Nursing Management: Shock, Systemic Inflammatory Response Syndrome, and Multiple Organ Dysfunction Syndrome

SHOCK

- **Shock** is a syndrome characterized by decreased tissue perfusion and impaired cellular metabolism resulting in an imbalance between the supply of and demand for oxygen and nutrients.

- Shock can be classified as *low blood flow* (cardiogenic and hypovolemic shock) or *maldistribution of blood flow* (septic, anaphylactic, and neurogenic shock).

Cardiogenic Shock

- **Cardiogenic shock** occurs when either systolic or diastolic dysfunction of the pumping action of the heart results in compromised cardiac output (CO).

- Precipitating causes of cardiogenic shock include myocardial infarction (MI), cardiomyopathy, blunt cardiac injury, severe systemic or pulmonary hypertension, cardiac tamponade, and myocardial depression from metabolic problems.

- Hemodynamic profile will demonstrate an increase in the pulmonary artery wedge pressure (PAWP) and pulmonary vascular resistance.

- Clinical manifestations of cardiogenic shock may include tachycardia, hypotension, a narrowed pulse pressure, tachypnea, pulmonary congestion, cyanosis, pallor, cool and clammy skin, decreased capillary refill time, anxiety, confusion, and agitation.

Hypovolemic Shock

- **Hypovolemic shock** occurs when there is a loss of intravascular fluid volume.

- **Absolute hypovolemia** results when fluid is lost through hemorrhage, gastrointestinal (GI) loss (e.g., vomiting, diarrhea), fistula drainage, diabetes insipidus, hyperglycemia, or diuresis.

- **Relative hypovolemia** results when fluid volume moves out of the vascular space into extravascular space (e.g., interstitial or intracavitary space) and this is called *third spacing.*

- The physiologic consequences of hypovolemia include a decrease in venous return, preload, stroke volume, and CO resulting in decreased tissue perfusion and impaired cellular metabolism.

- Clinical manifestations depend on the extent of injury or insult, age, and general state of health and may include anxiety; an increase in heart rate, CO, and respiratory rate and depth; and a decrease in stroke volume, PAWP, and urine output.

Neurogenic Shock

- **Neurogenic shock** is a hemodynamic phenomenon that can occur within 30 minutes of a spinal cord injury at the fifth thoracic (T5) vertebra or above and last up to 6 weeks, or in response to spinal anesthesia.

- Clinical manifestations include hypotension, bradycardia, temperature dysregulation (resulting in heat loss), dry skin, and *poikilothermia* (taking on the temperature of the environment).

Anaphylactic Shock

- **Anaphylactic shock** is an acute and life-threatening hypersensitivity (allergic) reaction to a sensitizing substance (e.g., drug, chemical, vaccine, food, insect venom).

- Immediate reaction causes massive vasodilation, release of vasoactive mediators, and an increase in capillary permeability resulting in fluid leaks from the vascular space into the interstitial space.

- Clinical manifestations can include anxiety, confusion, dizziness, chest pain, incontinence, swelling of the lips and tongue, wheezing, stridor, flushing, pruritus, urticaria, and angioedema.

Septic Shock

- **Sepsis** is a systemic inflammatory response to a documented or suspected infection. Severe sepsis is sepsis complicated by organ dysfunction.

- **Septic shock** is the presence of sepsis with hypotension despite fluid resuscitation along with the presence of tissue perfusion abnormalities.

- In severe sepsis and septic shock, the initiated body response to an antigen is exaggerated resulting in an increase in inflammation and coagulation, and a decrease in fibrinolysis.

- Endotoxins from the microorganism cell wall stimulate the release of cytokines and other proinflammatory mediators that act through secondary mediators such as platelet-activating factor.
    - Platelet-activating factor results in the formation of microthrombi and obstruction of the microvasculature resulting in damage to the endothelium, vasodilation, increased capillary permeability, neutrophil and platelet aggregation, and adhesion to the endothelium.

- Clinical presentation for sepsis is complex and no single or group of symptoms are specific to the diagnosis.
    - Patients will usually experience a hyperdynamic state characterized by increased CO and decreased SVR.
    - Persistence of a high CO and a low SVR beyond 24 hours is ominous and often

associated with hypotension and multiple organ dysfunction syndrome (MODS).
  - Initially patients will hyperventilate as a compensatory mechanism, resulting in respiratory alkalosis followed by respiratory acidosis and respiratory failure.
  - Other clinical signs include alteration in neurologic status, decreased urine output, and GI dysfunction.

Stages of Shock

- The initial stage of shock that occurs at a cellular level is usually not clinically apparent.

- The *compensatory stage* is clinically apparent and involves neural, hormonal, and biochemical compensatory mechanisms in an attempt to overcome the increasing consequences of anaerobic metabolism and to maintain homeostasis.

- The *progressive stage* of shock begins as compensatory mechanisms fail and aggressive interventions are necessary to prevent the development of MODS.

- In the final stage of shock, the *refractory stage,* decreased perfusion from peripheral vasoconstriction and decreased CO exacerbate anaerobic metabolism and the patient will demonstrate profound hypotension and hypoxemia, and organ failure. In this final stage, recovery is unlikely.

Diagnostic Studies

- The process begins with a thorough history and physical examination.

- Evaluation of serum lactate and a possible base deficit.

- Other diagnostic studies include a 12-lead ECG, continuous cardiac monitoring, chest x-ray, continuous pulse oximetry, and hemodynamic monitoring.

Collaborative Care: General Measures

- Successful management of the patient in shock includes the following: (1) identification of patients at risk for the development of shock; (2) integration of the patient's history, physical examination, and clinical findings to establish a diagnosis; (3) interventions to control or eliminate the cause of the decreased perfusion; (4) protection of target and distal organs from dysfunction; and (5) provision of multisystem supportive care.

- General management strategies for a patient in shock begin with ensuring that the patient has a patent airway and oxygen delivery is optimized. The cornerstone of therapy for septic, hypovolemic, and anaphylactic shock is volume expansion with the administration of the appropriate fluid.

- It is generally accepted that isotonic crystalloids, such as normal saline, are used in the initial resuscitation of shock. If the patient does not respond to 2 to 3 L of crystalloids, blood administration and central venous monitoring may be instituted. Two major complications of fluid resuscitation are hypothermia and coagulopathy.

- The primary goal of drug therapy for shock is the correction of decreased tissue perfusion.
    - Sympathomimetic drugs cause peripheral vasoconstriction and are referred to as vasopressor drugs (e.g., epinephrine, norepinephrine).
        - The goals of vasopressor therapy are to achieve and maintain a mean arterial pressure (MAP) of 60 to 65 mm Hg and the use of these drugs is reserved for patients unresponsive to other therapies.
    - The goal of vasodilator therapy, as in vasopressor therapy, is to maintain MAP at 60 to 65 mm Hg or greater.
        - Vasodilator agents most often used are nitroglycerin (in cardiogenic shock) and nitroprusside (in noncardiogenic shock).

- Protein-calorie malnutrition is one of the primary manifestations of hypermetabolism in shock and nutrition is vital to decreasing morbidity from shock.
    - Enteral nutrition should be initiated within the first 24 hours. Parenteral nutrition is used if enteral feedings are contraindicated or fail to meet at least 80% of the patient's caloric requirements.
    - Serum protein, nitrogen balance, BUN, serum glucose, and serum electrolytes are all monitored to assess nutritional status.

Collaborative Care: Specific Measures

Cardiogenic Shock

- Overall goal is to restore blood flow to the myocardium by restoring the balance between oxygen supply and demand.
- Definitive measures include thrombolytic therapy, angioplasty with stenting, emergency revascularization, and valve replacement.

- Care involves hemodynamic monitoring, drug therapy (e.g., diuretics to reduce preload), and use of circulatory assist devices (e.g., intraaortic balloon pump, ventricular assist device).

Hypovolemic Shock

- The underlying principles of managing patients with hypovolemic shock focus on stopping the loss of fluid and restoring the circulating volume.
    - Fluid replacement is calculated using a 3:1 rule (3 ml of isotonic crystalloid for every 1 ml of estimated blood loss).

Septic Shock

- Patients in septic shock require large amounts of fluid replacement, sometimes as much as 6 to 10 L of isotonic crystalloids and 2 to 4 L of colloids, to restore perfusion.
    - Hemodynamic monitoring and arterial pressure monitoring are often necessary.

- Vasopressor drug therapy may be added and vasopressin may be given to patients refractory to vasopressor therapy.

- Intravenous corticosteroids are recommended for patients who require vasopressor therapy, despite fluid resuscitation, to maintain adequate BP.
- Antibiotics are early component of therapy and are started after obtaining cultures (e.g., blood, wound exudate, urine, stool, sputum).

- Drotrecogin alpha (Xigris), a recombinant form of activated protein C, has demonstrated promise in treating patients with severe sepsis. Bleeding is the most common serious adverse effect.

- Glucose levels should be maintained at less than 150 mg/dl.

- Stress ulcer prophylaxis with histamine (H_2)-receptor blockers and deep vein thrombosis prophylaxis with low dose unfractionated heparin or low molecular weight heparin are recommended.

Neurogenic Shock

- Treatment of neurogenic shock is dependent on the cause.
  - In spinal cord injury, general measures to promote spinal stability are initially used.
  - Definitive treatment of the hypotension and bradycardia involves the use of vasopressors and atropine respectively.
  - Fluids are administered cautiously as the cause of the hypotension is generally not related to fluid loss.
  - The patient is monitored for hypothermia.

Anaphylactic Shock

- Epinephrine is the drug of choice to treat anaphylactic shock.

- Diphenhydramine is administered to block the massive release of histamine.
- Maintaining a patent airway is critical and the use of nebulized bronchodilators is highly effective.
- Endotracheal intubation or cricothyroidotomy may be necessary.

- Aggressive fluid replacement, predominantly with colloids, is necessary.

- Intravenous corticosteroids may be helpful in anaphylactic shock if significant hypotension persists after 1 to 2 hours of aggressive therapy.

Nursing Management: Shock

Nursing Assessment

- The initial assessment is geared toward the ABCs: airway, breathing, and circulation.

- Further assessment focuses on the assessment of tissue perfusion and includes evaluation of vital signs, peripheral pulses, level of consciousness, capillary refill, skin (e.g.,

temperature, color, moisture), and urine output.

Planning

- The overall goals for a patient in shock include (1) assurance of adequate tissue perfusion, (2) restoration of normal BP, (3) return/recovery of organ function, and (4) avoidance of complications from prolonged states of hypoperfusion.

Nursing Implementation

- **Health Promotion**
  - To prevent shock, the nurse needs to identify patients at risk (e.g., patients who are older, those with debilitating illnesses, those who are immunocompromised, surgical or accidental trauma patients).
  - Planning is essential to help prevent shock after a susceptible individual has been identified (e.g., monitoring fluid balance to prevent hypovolemic shock, maintenance of hand washing to prevent spread of infection).

- **Acute Intervention**
  - The role of the nurse in shock involves (1) monitoring the patient's ongoing physical and emotional status to detect subtle changes in the patient's condition; (2) planning and implementing nursing interventions and therapy; (3) evaluating the patient's response to therapy; (4) providing emotional support to the patient and family; and (5) collaborating with other members of the health team when warranted by the patient's condition.
  - Neurologic status, including orientation and level of consciousness, should be assessed every hour or more often.
  - Heart rate/rhythm, BP, central venous pressure, and PA pressures including continuous cardiac output (if available) should be assessed at least every 15 minutes and PAWP every 1 to 2 hours.
    - Trends in these parameters yield more important information than individual numbers.
    - Trendelenburg (head down) position during hypotensive crisis is not supported by research and may compromise pulmonary function and increase intracranial pressure.
    - The patient's ECG should be continuously monitored to detect dysrhythmias that may result from the cardiovascular and metabolic derangements associated with shock. Heart sounds should be assessed for the presence of an S_3 or S_4 sound or new murmurs. The presence of an S_3 sound in an adult usually indicates heart failure. The frequency of this monitoring is decreased as the patient's condition improves.
  - The respiratory status of the patient in shock must be frequently assessed to ensure adequate oxygenation, detect complications early, and provide data regarding the patient's acid-base status.
    - Pulse oximetry is used to continuously monitor oxygen saturation.
    - Arterial blood gases (ABGs) provide definitive information on ventilation and oxygenation status, and acid-base balance.

        - Most patients in shock will be intubated and on mechanical ventilation.
    - Hourly urine output measurements assess the adequacy of renal perfusion and a urine output of less than 0.5 ml/kg/hour may indicate inadequate kidney perfusion.
        - BUN and serum creatinine values are also used to assess renal function.
    - Tympanic or pulmonary arterial temperatures should be obtained hourly if temperature is elevated or subnormal, otherwise every 4 hours.
    - Capillary refill should be assessed and skin monitored for temperature, pallor, flushing, cyanosis, diaphoresis, or piloerection.
    - Bowel sounds should be auscultated at least every 4 hours, and abdominal distention should be assessed.
        - If a nasogastric tube is inserted, drainage should be checked for occult blood as should stools.
    - Oral care for the patient in shock is essential and passive range of motion should be performed three or four times per day.
    - Anxiety, fear, and pain may aggravate respiratory distress and increase the release of catecholamines.

The nurse should talk to the patient, even if the patient is intubated, sedated, and paralyzed or appears comatose. If the intubated patient is capable of writing, a "magic slate" or a pencil and paper should be provided.

        - Family and significant others (1) link the patient to the outside world; (2) facilitate decision-making and advise the patient; (3) assist with activities of daily living; (4) act as liaisons to advise the health care team of the patient's wishes for care; and (5) provide safe, caring, familiar relationships for the patient. Family time with the patient should be facilitated, provided this time is perceived as comforting by the patient.

- **Ambulatory and Home Care**
    - Rehabilitation of the patient who is recovering from shock necessitates correction of the precipitating cause and prevention or early treatment of complications.
        - Complications may include decreased range of motion, decreased physical endurance, chronic kidney disease following acute tubular necrosis, and the development of fibrotic lung disease as a result of ARDS.
        - Patients may require diverse services (e.g., transitional care [for mechanical ventilation weaning], rehabilitation, home health care).

SYSTEMIC INFLAMMATORY RESPONSE SYNDROME AND MULTIPLE ORGAN DYSFUNCTION SYNDROME

- **Systemic inflammatory response syndrome** (SIRS) is a systemic inflammatory response to a variety of insults, including infection (referred to as sepsis), ischemia, infarction, and injury.

- SIRS is characterized by generalized inflammation in organs remote from the initial insult and can be triggered by mechanical tissue trauma (e.g., burns, crush injuries), abscess formation, ischemic or necrotic tissue (e.g., pancreatitis, myocardial infarction), microbial invasion, and global and regional perfusion deficits.

- **Multiple organ dysfunction syndrome** (MODS) results from SIRS and is the failure of two or more organ systems such that homeostasis cannot be maintained without intervention.
    - The respiratory system is often the first system to show signs of dysfunction in SIRS and MODS often culminating in ARDS.
    - Cardiovascular changes include myocardial depression and massive vasodilation in response to increasing tissue demands.
    - Neurologic dysfunction commonly manifests as mental status changes with SIRS and MODS.
    - Acute renal failure (ARF) is frequently seen in SIRS and MODS.
    - In the early stages of SIRS and MODS, blood is shunted away from the GI mucosa, making it highly vulnerable to ischemic injury.
        - Risk for ulceration and GI bleeding.
        - Potential for bacterial translocation from the GI tract into circulation.
    - Both syndromes trigger a hypermetabolic response.
        - Catecholamines and glucocorticoids are released and result in hyperglycemia and insulin resistance.
        - Net result is a catabolic state, and a reduction in lean body mass (muscle).
        - May see liver dysfunction as a result of hypermetabolic state.
    - Failure of the coagulation system manifests as DIC.
    - Electrolyte imbalances, which are common, are related to hormonal and metabolic changes and fluid shifts.
        - These changes exacerbate mental status changes, neuromuscular dysfunction, and dysrhythmias.
        - The release of antidiuretic hormone and aldosterone results in sodium and water retention.

Nursing and Collaborative Management: SIRS and MODS

- The prognosis for the patient with MODS is poor and the most important goal is to prevent the progression of SIRS to MODS.

- A critical component of the nursing role is vigilant assessment and ongoing monitoring to detect early signs of deterioration or organ dysfunction.

- Collaborative care for patients with MODS focuses on (1) prevention and treatment of infection, (2) maintenance of tissue oxygenation, (3) nutritional and metabolic support, and (4) appropriate support of individual failing organs.

- Prevention and treatment of infection:
    - Aggressive infection control strategies are essential to decrease the risk for nosocomial infections.
    - Once an infection is suspected, interventions to control the source must be instituted.

- Maintenance of tissue oxygenation:
  - Interventions that decrease oxygen demand are essential and may include sedation, mechanical ventilation, analgesia, paralysis, and rest.
  - Oxygen delivery may be optimized by maintaining normal levels of hemoglobin and PaO_2, using individualized tidal volumes with positive end-expiratory pressure, increasing preload or myocardial contractility to enhance CO, or reducing afterload to increase CO.

- Nutritional and metabolic needs:
  - Hypermetabolism in SIRS or MODS can result in profound weight loss, cachexia, and further organ failure.
  - Total energy expenditure is often increased 1.5 to 2 times the normal metabolic rate.
  - Plasma transferrin and prealbumin levels are monitored to assess hepatic protein synthesis.
  - The goal of nutritional support is to preserve organ function and the use of the enteral route is preferable to parenteral nutrition.

- Support of failing organs:
  - Support of any failing organ is a primary goal of therapy (e.g., the patient with ARDS requires aggressive oxygen therapy and mechanical ventilation, DIC should be treated appropriately [e.g., blood products], renal failure may require dialysis).

Lewis et al: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 7th edition

Key Points

Chapter 68: Nursing Management: Respiratory Failure and Acute Respiratory Distress Syndrome

ACUTE RESPIRATORY FAILURE

- *Respiratory failure* results when gas exchange, which involves the transfer of oxygen (O_2) and carbon dioxide (CO_2) between the atmosphere and the blood, is inadequate.

- Respiratory failure is not a disease; it is a condition that occurs as a result of one or more diseases involving the lungs or other body systems.

- Respiratory failure can be classified as hypoxemic or hypercapnic.
  - **Hypoxemic respiratory failure:**
    - Commonly defined as a $PaO_2 \leq 60$ mm Hg when the patient is receiving an

inspired O_2 concentration ≥60%.
    - Disorders that interfere with O_2 transfer into the blood include pneumonia, pulmonary edema, pulmonary emboli, heart failure, shock, and alveolar injury related to inhalation of toxic gases and lung damage related to alveolar stress/ventilator-induced lung injury.
    - Four physiologic mechanisms may cause hypoxemia and subsequent hypoxemic respiratory failure: (1) mismatch between ventilation and perfusion, commonly referred to as *V/Q mismatch;* (2) shunt; (3) diffusion limitation; and (4) hypoventilation.
    - Hypoxemic respiratory failure frequently is caused by a combination of two or more of these mechanisms.
  - **Hypercapnic respiratory failure:**
    - Also referred to as *ventilatory failure* since the primary problem is insufficient CO_2 removal.
    - Commonly defined as a $PaCO_2$ >45 mm Hg in combination with acidemia (arterial pH <7.35).
    - Disorders that compromise CO_2 removal include drug overdoses with central nervous system (CNS) depressants, neuromuscular diseases, acute asthma, and trauma or diseases involving the spinal cord and its role in lung ventilation.
    - Hypercapnic respiratory failure results from an imbalance between ventilatory supply and ventilatory demand. *Ventilatory supply* is the maximum ventilation that the patient can sustain without developing respiratory muscle fatigue, and *ventilatory demand* is the amount of ventilation needed to keep the $PaCO_2$ within normal limits.

- Though PaO_2 and $PaCO_2$ determine the definition of respiratory failure, the major threat of respiratory failure is the inability of the lungs to meet the oxygen demands of the tissues. This may occur as a result of inadequate tissue O_2 delivery or because the tissues are unable to use the O_2 delivered to them.

- Manifestations of respiratory failure:
  - Are related to the extent of change in PaO_2 or $PaCO_2$, the rapidity of change (acute versus chronic), and the ability to compensate to overcome this change.
  - Clinical manifestations are variable and it is important to monitor trends in ABGs and/or pulse oximetry to evaluate the extent of change.
  - A change in mental status is frequently the initial indication of respiratory failure.
  - Tachycardia and mild hypertension can also be early signs of respiratory failure.
  - A severe morning headache may suggest that hypercapnia may have occurred during the night, increasing cerebral blood flow by vasodilation and causing a morning headache.
  - Cyanosis is an unreliable indicator of hypoxemia and is a late sign of respiratory failure because it does not occur until hypoxemia is severe (PaO_2 ≤45 mm Hg).
  - **Hypoxemia** occurs when the amount of O_2 in arterial blood is less than the normal value, and **hypoxia** occurs when the PaO_2 falls sufficiently to cause signs

and symptoms of inadequate oxygenation.
  - Hypoxemia can lead to hypoxia if not corrected, and if hypoxia or hypoxemia is severe, the cells shift from aerobic to anaerobic metabolism.

Clinical Manifestations

- Clinical findings include a rapid, shallow breathing pattern or a respiratory rate that is slower than normal. A change from a rapid rate to a slower rate in a patient in acute respiratory distress such as that seen with acute asthma suggests extreme progression of respiratory muscle fatigue and increased probability of respiratory arrest.

- The position that the patient assumes is an indication of the effort associated with breathing.
  - The patient may be able to lie down (mild distress), be able to lie down but prefer to sit (moderate distress), or be unable to breathe unless sitting upright (severe distress). The patient may require pillows to breathe when attempting to lie flat and this is termed orthopnea.
  - A common position is to sit with the arms propped on the overbed table.

- Pursed-lip breathing may be used.

- The patient may speak in sentences (mild or no distress), phrases (moderate distress), or words (severe distress).

- There may be a change in the *inspiratory (I) to expiratory (E) ratio.* Normally, the I:E ratio is 1:2, but in patients in respiratory distress, the ratio may increase to 1:3 or 1:4.

- There may be retractions of the intercostal spaces or the supraclavicular area and use of the accessory muscles during inspiration or expiration. Use of the accessory muscles signifies moderate distress.

- *Paradoxic breathing* indicates severe distress and results from maximal use of the accessory muscles of respiration.

- Breath sounds:
  - Crackles and rhonchi may indicate pulmonary edema and COPD.
  - Absent or diminished breath sounds may indicate atelectasis or pleural effusion.
  - The presence of bronchial breath sounds over the lung periphery often results from lung consolidation that is seen with pneumonia.
  - A pleural friction rub may also be heard in the presence of pneumonia that has involved the pleura.

Diagnostic Studies

- ABGs are done to obtain oxygenation (PaO_2) and ventilation ($PaCO_2$) status, as well as information related to acid-base balance.

- A chest x-ray is done to help identify possible causes of respiratory failure.

- Other diagnostic studies include a complete blood cell count, serum electrolytes, urinalysis, and electrocardiogram.
    - Cultures of the sputum and blood are obtained as necessary to determine sources of possible infection.
    - For the patient in severe respiratory failure requiring endotracheal intubation, end-tidal CO_2 ($EtCO_2$) may be used to assess tube placement within the trachea immediately following intubation.
    - In severe respiratory failure, a pulmonary artery catheter may be inserted to measure heart pressures and cardiac output, as well as mixed venous oxygen saturation (SvO_2).

Nursing and Collaborative Management: Acute Respiratory Failure

- The overall goals for the patient in acute respiratory failure include: (1) ABG values within the patient's baseline, (2) breath sounds within the patient's baseline, (3) no dyspnea or breathing patterns within the patient's baseline, and (4) effective cough and ability to clear secretions.

- Prevention involves a thorough physical assessment and history to identify the patient at risk for respiratory failure and, then, the initiation of appropriate nursing interventions (coughing, deep breathing, incentive spirometry, and ambulation as appropriate).

- The major goals of care for acute respiratory failure include maintaining adequate oxygenation and ventilation.
    - The primary goal of O_2 therapy is to correct hypoxemia.
    - The type of O_2 delivery system chosen for the patient in acute respiratory failure should (1) be tolerated by the patient, and (2) maintain PaO_2 at 55 to 60 mm Hg or more and SaO_2 at 90% or more at the lowest O_2 concentration possible.
    - Additional risks of O_2 therapy are specific to the patient with chronic hypercapnia as this may blunt the response of chemoreceptors in the medulla, a condition termed *CO_2 narcosis*.
    - Retained pulmonary secretions may cause or exacerbate acute respiratory failure and can be mobilized through effective coughing, adequate hydration and humidification, chest physical therapy (chest physiotherapy), and tracheal suctioning.
    - If secretions are obstructing the airway, the patient should be encouraged to cough.
        - *Augmented coughing* is performed by placing the palm of the hand or hands on the abdomen below the xiphoid process. As the patient ends a deep inspiration and begins the expiration, the hands should be moved forcefully downward, increasing abdominal pressure and facilitating the cough. This measure helps increase expiratory flow and thereby facilitates secretion clearance.
        - *Huff coughing* is a series of coughs performed while saying the word

"huff." The huff cough is effective in clearing only the central airways, but it may assist in moving secretions upward.
        - The *staged cough* is performed by having the patient sit in a chair, breathe three or four times in and out through the mouth, and cough while bending forward and pressing a pillow inward against the diaphragm.
    - Positioning the patient either by elevating the head of the bed at least 45 degrees or by using a reclining chair or chair bed may help maximize thoracic expansion, thereby decreasing dyspnea and improving secretion mobilization.
    - Lateral or side-lying positioning may be used in patients with disease involving only one lung and this position is termed good lung down.
    - Adequate fluid intake (2 to 3 L/day) is necessary to keep secretions thin and easy to expel.
        - Assessment for signs of fluid overload (e.g., crackles, dyspnea, increased central venous pressure) at regular intervals is paramount.
        - Aerosols of sterile normal saline, administered by a nebulizer, may be used to liquefy secretions.
        - Mucolytic agents such as nebulized acetylcysteine mixed with a bronchodilator may be used to thin secretions but, as a side effect, may also cause airway erythema and bronchospasm.
    - Chest physical therapy is indicated in patients who produce more than 30 ml of sputum per day or have evidence of severe atelectasis or pulmonary infiltrates.
    - If the patient is unable to expectorate secretions, nasopharyngeal, oropharyngeal, or nasotracheal suctioning is indicated.
        - Suctioning through an artificial airway, such as endotracheal or tracheostomy tubes, may also be performed.
        - A mini-tracheostomy (or mini-trach) may be used to suction patients who have difficulty mobilizing secretions. Contraindications for a mini-trach include an absent gag reflex, history of aspiration, and the need for long-term mechanical ventilation.
    - If intensive measures fail to improve ventilation and oxygenation, positive pressure ventilation (PPV) may be provided invasively through orotracheal or nasotracheal intubation or noninvasively through a nasal or face mask.
    - Noninvasive PPV may be used as a treatment for patients with acute or chronic respiratory failure.
        - With NIPPV it is possible to decrease the work of breathing without the need for endotracheal intubation.
        - Bilevel positive airway pressure (BiPAP) is a form of NIPPV in which different positive pressure levels are set for inspiration and expiration.
        - Continuous positive airway pressure (CPAP) is another form of NIPPV in which a constant positive pressure is delivered to the airway during inspiration and expiration.
        - NIPPV is most useful in managing chronic respiratory failure in patients with chest wall and neuromuscular disease.

- Goals of drug therapy for patients in acute respiratory failure include (1) relief of

bronchospasm, (2) reduction of airway inflammation and pulmonary congestion, (3) treatment of pulmonary infection, and (4) reduction of severe anxiety and restlessness.
    - Short-acting bronchodilators, such as metaproterenol and albuterol, are frequently administered to reverse bronchospasm using either a handheld nebulizer or a metered-dose inhaler with a spacer.
    - Corticosteroids may be used in conjunction with bronchodilating agents when bronchospasm and inflammation are present.
    - Diuretics and nitroglycerin are used to decrease the pulmonary congestion caused by heart failure.
    - If atrial fibrillation is present, calcium channel blockers and β-adrenergic blockers may be used to decrease heart rate and improve cardiac output.
    - If infection is present, IV antibiotics, such as vancomycin or ceftriaxone, are frequently administered to inhibit bacterial growth.
    - Sedation and analgesia with drug therapy such as propofol, benzodiazepines, and narcotics may be used to decrease anxiety, agitation, and pain.
    - Patients who are asynchronous with mechanical ventilation may require neuromuscular blockade with agents such as vecuronium to produce skeletal muscle relaxation by interference with neuromuscular transmission, ultimately producing synchrony with mechanical ventilation.
        - Patients receiving neuromuscular blockade should receive sedation and analgesia to the point of unconsciousness for patient comfort, to eliminate patient awareness, and to avoid the terrifying experience of being awake and in pain while paralyzed.
        - Monitoring levels of sedation in patients receiving neuromuscular blockade is done with noninvasive EEG-based technology, or through the use of a peripheral nerve stimulator.

- Goals of medical therapy are to treat the underlying cause of the respiratory failure, and maintain an adequate cardiac output and hemoglobin concentration.
    - Decreased cardiac output is treated by administration of IV fluids, medications, or both.
        - Cardiac output may be decreased by changes in intrathoracic or intrapulmonary pressures from PPV placing patients at risk for alveolar hyperinflation, increased right ventricular afterload and excessive intrathoracic pressures.
    - A hemoglobin concentration of ≥9 g/dl (90 g/L) typically ensures adequate O_2 saturation of the hemoglobin.

- Maintenance of protein and energy stores is especially important in patients who experience acute respiratory failure because nutritional depletion causes a loss of muscle mass, including the respiratory muscles, and may prolong recovery.
    - Enteral or parenteral nutrition is usually initiated within 24 hours in malnourished patients and within three days in well-nourished patients.
        - A high-carbohydrate diet may need to be avoided in the patient who retains CO_2 because carbohydrates metabolize into CO_2 and increase the

CO_2 load of the patient.

Gerontologic Considerations

- Multiple factors contribute to an increased risk of respiratory failure in older adults, including the reduction in ventilatory capacity, decreased respiratory muscle strength, and delayed responses in respiratory rate and depth to falls in PaO_2 and rises in $PaCO_2$.

ACUTE RESPIRATORY DISTRESS SYNDROME

- **Acute respiratory distress syndrome** (ARDS) is a sudden and progressive form of acute respiratory failure in which the alveolar capillary membrane becomes damaged and more permeable to intravascular fluid.
    - Alveoli fill with fluid, resulting in severe dyspnea, hypoxemia refractory to supplemental O_2, reduced lung compliance, and diffuse pulmonary infiltrates.
    - The most common cause of ARDS is sepsis.
    - Direct lung injury may cause ARDS, or ARDS may develop as a consequence of the systemic inflammatory response syndrome, or multiple organ dysfunction syndrome.

- The pathophysiologic changes of ARDS are thought to be due to stimulation of the inflammatory and immune systems, which causes an attraction of neutrophils to the pulmonary interstitium. The neutrophils cause a release of biochemical, humoral, and cellular mediators that produce changes in the lung.

- The *injury or exudative phase* of ARDS occurs approximately 1 to 7 days (usually 24 to 48 hours) after the initial direct lung injury or host insult.
    - The primary pathophysiologic changes that characterize this phase are interstitial and alveolar edema (noncardiogenic pulmonary edema) and atelectasis resulting in V/Q mismatch, shunting of pulmonary capillary blood, and hypoxemia unresponsive to increasing concentrations of O_2 (termed **refractory hypoxemia**).
    - Hypoxemia and the stimulation of juxtacapillary receptors in the stiff lung parenchyma (J reflex) initially cause an increase in respiratory rate, decrease in tidal volume, respiratory alkalosis, and an increase in cardiac output.

- The *reparative or proliferative phase* of ARDS begins 1 to 2 weeks after the initial lung injury.
    - During this phase, there is an influx of neutrophils, monocytes, and lymphocytes and fibroblast proliferation as part of the inflammatory response.
    - Lung compliance continues to decrease as a result of interstitial fibrosis and hypoxemia.
    - If the reparative phase persists, widespread fibrosis results. If the reparative phase is arrested, the lesions resolve.

- The *fibrotic or chronic phase* of ARDS occurs approximately 2 to 3 weeks after the initial lung injury.
    - The lung is completely remodeled by sparsely collagenous and fibrous tissues and

there is diffuse scarring and fibrosis, resulting in decreased lung compliance.
  - Pulmonary hypertension results from pulmonary vascular destruction and fibrosis.

- Progression of ARDS varies among patients and several factors determine the course of ARDS, including the nature of the initial injury, extent and severity of coexisting diseases, and pulmonary complications.

Clinical Manifestations

- ARDS is considered to be present if the patient has (1) refractory hypoxemia, (2) a chest x-ray with new bilateral interstitial or alveolar infiltrates, (3) a pulmonary artery wedge pressure of 18 mm Hg or less and no evidence of heart failure, and (4) a predisposing condition for ARDS within 48 hours of clinical manifestations.

- Initially the patient may exhibit only dyspnea, tachypnea, cough, and restlessness and chest auscultation may be normal or reveal fine, scattered crackles.

- ABGs usually indicate mild hypoxemia and respiratory alkalosis caused by hyperventilation.

- Chest x-ray may be normal, exhibit evidence of minimal scattered interstitial infiltrates, or demonstrate diffuse and extensive bilateral infiltrates (termed *whiteout* or *white lung*).

- As ARDS progresses, tachypnea and intercostal and suprasternal retractions may be present and pulmonary function tests reveal decreased compliance and decreased lung volumes.

- Tachycardia, diaphoresis, changes in sensorium with decreased mentation, cyanosis, and pallor may develop.

- Pulmonary artery wedge pressure does not increase in ARDS because the cause of pulmonary edema is noncardiogenic.

- Hypoxemia and a PaO_2/FIO_2 ratio below 200 (e.g., 80/0.8 = 100) despite increased FIO_2 are the hallmarks of ARDS.

- Complications may develop as a result of ARDS itself or its treatment.
  - A frequent complication of ARDS is hospital-acquired pneumonia.
    - Strategies to prevent hospital-acquired pneumonia include infection control measures (e.g., strict hand washing and sterile technique during endotracheal suctioning) and elevating the head of the bed 30 to 45 degrees to prevent aspiration.
  - *Barotrauma* may result from rupture of overdistended alveoli during mechanical ventilation leading to pulmonary interstitial emphysema, pneumothorax, subcutaneous emphysema, and tension pneumothorax.
    - To avoid barotraumas, patients may be ventilated with smaller tidal

volumes and positive end-expiratory pressure (PEEP).
        - One consequence of this protocol is an elevation in $PaCO_2$, termed *permissive hypercapnia* because the $PaCO_2$ is allowed (permitted) to rise above normal limits.
    - *Volu-pressure trauma* results in alveolar fractures and movement of fluids and proteins into the alveolar spaces. Smaller tidal volumes or pressure ventilation are used to reduce volu-pressure trauma.
    - Critically ill patients with acute respiratory failure are at high risk for stress ulcers, and prophylactic management (e.g., ranitidine) is recommended.
    - Renal failure can occur from decreased renal tissue oxygenation as a result of hypotension, hypoxemia, or hypercapnia.

Nursing and Collaborative Management: Acute Respiratory Distress Syndrome

- Collaborative care for acute respiratory failure is applicable to ARDS.

- Overall goals for the patient with ARDS include a PaO_2 of at least 60 mm Hg, and adequate lung ventilation to maintain normal pH.

- Goals for a patient recovering from ARDS include (1) PaO_2 within normal limits for age or baseline values on room air (FIO_2 of 21%), (2) SaO_2 greater than 90%, (3) patent airway, and (4) clear lungs on auscultation.

- The general standard for O_2 administration is to give the patient the lowest concentration that results in a PaO_2 of 60 mm Hg or greater.
    - When the FIO_2 exceeds 60% for more than 48 hours, the risk for O_2 toxicity increases.
    - Patients with ARDS need intubation with mechanical ventilation because the PaO_2 cannot otherwise be maintained at acceptable levels.
    - During mechanical ventilation, it is common to apply PEEP (e.g., 10 to 20 cm H_2O) to maintain PaO_2 at 60 mm Hg or greater.
        - PEEP can also cause hyperinflation of the alveoli, compression of the pulmonary capillary bed, a reduction in preload and blood pressure, as well as barotrauma and volu-pressure trauma.
    - Alternative modes of ventilation may be used and include pressure support ventilation, pressure release ventilation, pressure control ventilation, inverse ratio ventilation, high-frequency ventilation, and permissive hypercapnia.
    - Some patients with ARDS demonstrate a marked improvement in PaO_2 when turned from the supine to prone position with no change in inspired O_2 concentration.
    - Other positioning strategies to improve oxygenation that can be considered for patients with ARDS include continuous lateral rotation therapy and kinetic therapy.

- Patients on PPV and PEEP frequently experience decreased cardiac output and may require crystalloid fluids or colloid solutions or lower PEEP. Use of inotropic drugs such as dobutamine or dopamine may also be necessary.

- Hemoglobin level is usually kept at levels of 9 g/dl or more with an oxygen saturation of

90% or greater (when PaO_2 is more than 60 mm Hg).

- Nutrition consults are initiated to determine optimal caloric needs and parenteral or enteral feedings are started to meet the high energy requirements of these patients. Early research has shown that enteral formulas enriched with omega-3 fatty acids may improve the clinical outcomes of patients with ARDS.

SEVERE ACUTE RESPIRATORY SYNDROME

- *Severe acute respiratory syndrome* (SARS) is a serious, acute respiratory infection caused by a coronavirus.

- The virus spreads by close contact between people and is most likely spread via droplets in the air.

- In general, SARS begins with a fever greater than 100.4º F (>38.0º C).
    - Other manifestations may include sore throat, rhinorrhea, chills, rigors, myalgia, headache, and diarrhea.
    - After 2 to 7 days, SARS patients may develop a dry cough and have trouble breathing.

- Treatment needs to be started based on the symptoms and before the cause of the illness is confirmed.
    - Patients who are suspected of having SARS should be placed in isolation.
    - Antiviral medications, antibiotics, and corticosteroids may be used.
    - About 80% to 90% of infected people start to recover after 6 to 7 days.
    - 10% to 20% of infected people will develop respiratory failure and may need intubation and mechanical ventilation.

Lewis et al: Medical-Surgical Nursing: Assessment and Management of Clinical Problems, 7th edition

Key Points

Chapter 69: Nursing Management: Emergency and Disaster Nursing

Most patients with life-threatening or potentially life-threatening problems arrive at the hospital through the emergency department (ED).

Triage refers to the process of rapidly determining the acuity of the patient's problem, and it represents one of the most important assessment skills needed by the emergency nurse.

- The *triage process* is based on the premise that patients who have a threat to life, vision, or limb should be treated before other patients.
    - A triage system categorizes patients so that the most critical ones are treated first.
    - The *Emergency Severity Index* (ESI) is a 5-level triage system that incorporates concepts of illness severity and resource utilization to determine who should be treated first.

After the initial assessment to determine the presence of actual or potential threats to life, appropriate interventions are initiated for the patient's condition.

- The **primary survey** focuses on airway, breathing, circulation, and disability and serves to identify life-threatening conditions so that appropriate interventions can be initiated.
    - If life-threatening conditions related to airway, breathing, circulation, and disability are identified at any point during the primary survey, interventions are started immediately and before proceeding to the next step of the survey.
    - Airway with cervical spine stabilization and/or immobilization:
        - Primary signs and symptoms in a patient with a compromised airway include dyspnea, inability to vocalize, presence of foreign body in the airway, and trauma to the face or neck.
        - Airway maintenance should progress rapidly from the least to the most invasive method and includes opening the airway using the **jaw-thrust maneuver,** suctioning and/or removal of foreign body, insertion of a nasopharyngeal or oropharyngeal airway, and endotracheal intubation.
        - The cervical spine must be stabilized and/or immobilized in any patient with face, head, or neck trauma and/or significant upper torso injuries.
    - Breathing:
        - Breathing alterations are caused by many conditions (e.g., fractured ribs, pneumothorax, allergic reactions, pulmonary emboli, asthma) resulting in dyspnea, paradoxical or asymmetric chest wall movement, decreased or absent breath sounds, cyanosis, tachycardia, and hypotension.
        - High-flow oxygen (100%) via a non-rebreather mask should be administered and the patient's response monitored. Life-threatening conditions may require bag-valve-mask ventilation with 100% oxygen and intubation.
    - Circulation:
        - A central pulse is checked because peripheral pulses may be absent as a result of direct injury or vasoconstriction.
        - Skin is assessed for color, temperature, and moisture.
        - Altered mental status and delayed capillary refill are the most significant signs of shock.
        - Two large-bore IV catheters should be inserted and aggressive fluid resuscitation initiated using normal saline or lactated Ringer's solution.
    - Disability:
        - The degree of disability is measured by the patient's level of consciousness.
        - A simple mnemonic can be used: AVPU: **A** = alert, **V** = responsive to voice, **P** = responsive to pain, and **U** = unresponsive.
        - The Glasgow Coma Scale is used to further assess the arousal aspect of the patient's consciousness.
        - Pupils are assessed for size, shape, response to light, and equality.

- The **secondary survey** is a brief, systematic process that is aimed at identifying all injuries.
    - Exposure/environmental control. All trauma patients should have their clothes removed so that a thorough physical assessment can be performed.

- Full set of vital signs/five interventions/facilitate family presence:
  - A complete set of vital signs, including blood pressure, heart rate, respiratory rate, and temperature, is obtained after the patient is exposed.
  - Five interventions: 1) ECG monitoring is initiated; 2) pulse oximetry is initiated; 3) an indwelling catheter is inserted; 4) an orogastric or a nasogastric tube is inserted; 5) blood for laboratory studies is collected.
  - **Family presence:** family members who wish to be present during invasive procedures and resuscitation view themselves as active participants in the care process and their presence should be supported.
- Give comfort measures. Pain management strategies should include a combination of pharmacologic and nonpharmacologic measures.
- History and head-to-toe assessment:
  - A thorough history of the event, illness, injury is obtained from the patient, family, and emergency personnel.
  - A thorough head-to-toe assessment is necessary.
- Inspect the posterior surfaces. The trauma patient should be logrolled (while maintaining cervical spine immobilization) to inspect the posterior surfaces.

All patients should be evaluated to determine their need for tetanus prophylaxis.

Ongoing patient monitoring and evaluation of interventions are critical and the nurse is responsible for providing appropriate interventions and assessing the patient's response.

Depending on the patient's injuries and/or illness, the patient may be (1) transported for diagnostic tests such as x-ray or CT scan; (2) admitted to a general unit, telemetry, or intensive care unit; or (3) transferred to another facility.

DEATH IN THE EMERGENCY DEPARTMENT

The emergency nurse should recognize the importance of certain hospital rituals in preparing the bereaved to grieve, such as collecting the belongings, arranging for an autopsy, viewing the body, and making mortuary arrangements.

Many patients who die in the ED could potentially be a candidate for *non–heart beating donation;* certain tissues and organs such as corneas, heart valves, skin, bone, and kidneys can be harvested from patients after death.

GERONTOLOGIC CONSIDERATIONS: EMERGENCY CARE

Elderly people are at high risk for injury primarily from falls.

The three most common causes of falls in the elderly are generalized weakness, environmental hazards, and orthostatic hypotension.

When assessing a patient who has experienced a fall, it is important to determine whether the physical findings may have actually caused the fall or may be due to the fall itself.

HEAT EXHAUSTION

- Prolonged exposure to heat over hours or days leads to **heat exhaustion,** a clinical syndrome characterized by fatigue, light-headedness, nausea, vomiting, diarrhea, and feelings of impending doom.
    - Tachypnea, hypotension, tachycardia, elevated body temperature, dilated pupils, mild confusion, ashen color, and profuse diaphoresis are also present.
    - Hypotension and mild to severe temperature elevation (99.6º to 104º F [37.5º to 40º C]) are due to dehydration.

- Treatment begins with placement of the patient in a cool area and removal of constrictive clothing.

- Oral fluid and electrolyte replacement is initiated unless the patient is nauseated; a 0.9% normal saline IV solution is initiated when oral solutions are not tolerated.

- A moist sheet placed over the patient decreases core temperature.

HEATSTROKE

Heatstroke results from failure of the hypothalamic thermoregulatory processes.

Increased sweating, vasodilation, and increased respiratory rate deplete fluids and electrolytes, specifically sodium.

- Eventually, sweat glands stop functioning, and core temperature increases (>104º F (40º C).
- Altered mentation, absence of perspiration, and circulatory collapse can follow.
- Cerebral edema and hemorrhage may occur as a result of direct thermal injury to the brain.

Treatment focuses on stabilizing the patient's ABCs and rapidly reducing the temperature.

Various cooling methods include removal of clothing, covering with wet sheets, and placing the patient in front of a large fan; immersion in an ice water bath; and administering cool fluids or lavaging with cool fluids.

Shivering increases core temperature, complicating cooling efforts, and is treated with IV chlorpromazine.

Aggressive temperature reduction should continue until core temperature reaches 102º F (38.9º C).

Patients are monitored for signs of *rhabdomyolysis,* myoglobinuria, and disseminated intravascular coagulation.

HYPOTHERMIA

Hypothermia is defined as a core temperature <95º F (35º C).

The elderly are more prone to hypothermia, and certain drugs, alcohol, and diabetes are considered risk factors for hypothermia.

Core temperature below 86º F (30º C) is a severe and potentially life-threatening situation.

- Patients with *mild hypothermia* (93.2º to 96.8º F [34º to 36º C]) have shivering, lethargy, confusion, rational to irrational behavior, and minor heart rate changes.
- Shivering disappears at temperatures below 92º F (33.3º C). *Moderate hypothermia* (86º to 93.2º F [30º to 34º C]) causes rigidity, bradycardia, slowed respiratory rate, blood pressure obtainable only by Doppler, metabolic and respiratory acidosis, and hypovolemia.
- Coma results when the core temperature falls below 82.4º F (28º C), and death usually occurs when the core temperature is below 78º F (25.6º C).
- *Profound hypothermia* (below 86º F [30º C]) makes the person appear dead. Profound bradycardia, asystole, or ventricular fibrillation may be present.

Every effort is made to warm the patient to at least 90º F (32.2º C) before the person is pronounced dead. The cause of death is usually refractory ventricular fibrillation.

Treatment of hypothermia focuses on managing and maintaining ABCs, rewarming the patient, correcting dehydration and acidosis, and treating cardiac dysrhythmias.

- Passive or active external rewarming is used for mild hypothermia.
  - *Passive external rewarming* involves moving the patient to a warm, dry place, removing damp clothing, and placing warm blankets on the patient.
  - *Active external rewarming* involves body-to-body contact, fluid- or air-filled warming blankets, or radiant heat lamps.
- *Active core rewarming* is used for moderate to profound hypothermia and refers to the use of heated, humidified oxygen; warmed IV fluids; and peritoneal, gastric, or colonic lavage with warmed fluids.

Rewarming places the patient at risk for *afterdrop,* a further drop in core temperature, and can result in hypotension and dysrhythmias.

Rewarming should be discontinued once the core temperature reaches 95º F (35º C).

SUBMERSION INJURY

Submersion injury results when a person becomes hypoxic due to submersion in a substance, usually water.

Drowning is death from suffocation after submersion in water or other fluid medium. *Near-drowning* is defined as survival from potential drowning. *Immersion syndrome* occurs with immersion in cold water, which leads to stimulation of the vagus nerve and potentially fatal dysrhythmias.

Aggressive resuscitation efforts and the mammalian diving reflex improve survival of near-drowning victims even after submersion in cold water for long periods of time.

Treatment of submersion injuries focuses on correcting hypoxia, acid-base imbalances, and fluid imbalances; supporting basic physiologic functions; and rewarming when hypothermia is present.

- Initial evaluation involves assessment of airway, cervical spine, breathing, and circulation.
- Mechanical ventilation with positive end-expiratory pressure or continuous positive airway pressure may be used to improve gas exchange across the alveolar-capillary membrane when

significant pulmonary edema is present.

Deterioration in neurologic status suggests cerebral edema, worsening hypoxia, or profound acidosis.

All victims of near-drowning should be observed in a hospital for a minimum of 4 to 6 hours. *Delayed pulmonary edema* (also known as secondary drowning) can occur and is defined as delayed death from drowning due to pulmonary complications.

ANIMAL BITES

Children are at greatest risk for animal bites, and the most significant problems associated with animal bites are infection and mechanical destruction of the skin, muscle, tendons, blood vessels, and bone.

Animal bites from dogs and cats are the most common, followed by bites from wild or domestic rodents.

Cat bites cause deep puncture wounds that can involve tendons and joint capsules and result in a greater incidence of infection. Septic arthritis, osteomyelitis, and tenosynovitis are common.

Human bites also cause puncture wounds or lacerations and carry a high risk of infection from oral bacterial flora and the hepatitis virus.

- Hands, fingers, ears, nose, vagina, and penis are the most common sites of human bites and are frequently a result of violence or sexual activity.
- Boxer's fracture, fracture of the fourth or fifth metacarpal, is often associated with an open wound when the knuckles strike teeth.

Initial treatment for animal and human bites includes cleaning with copious irrigation, debridement, tetanus prophylaxis, and analgesics as needed.

- Prophylactic antibiotics are used for animal and human bites at risk for infection such as wounds over joints, those more than 6 to 12 hours old, puncture wounds, and bites of the hand or foot.
- Puncture wounds are left open, lacerations are loosely sutured, and wounds over joints are splinted.
- Consideration of rabies prophylaxis is an essential component in the management of animal bites. An initial injection of rabies immune globulin is given, followed by a series of five injections of human diploid cell vaccine on days 0, 3, 7, 14, and 28 to provide active immunity.

POISONINGS

A poison is any chemical that harms the body, and poisoning can be accidental, occupational, recreational, or intentional.

Severity of the poisoning depends on type, concentration, and route of exposure.

Specific management of toxins involves decreasing absorption, enhancing elimination, and implementation of toxin-specific interventions per the local poison control center

- Options for decreasing absorption of poisons include gastric lavage, activated charcoal, dermal cleansing, and eye irrigation.
    - Patients with an altered level of consciousness or diminished gag reflex must be

intubated before lavage.
    - Lavage must be performed within 2 hours of ingestion of most poisons and is contraindicated in patients who ingested caustic agents, co-ingested sharp objects, or ingested nontoxic substances.
    - The most effective intervention for management of poisonings is administration of activated charcoal orally or via a gastric tube within 60 minutes of poison ingestion.
        - Contraindications to charcoal administration are diminished bowel sounds, ileus, or ingestion of a substance poorly absorbed by charcoal.
        - Charcoal can absorb and neutralize antidotes, and these should not be given immediately before, with, or shortly after, charcoal.
- Skin and ocular decontamination involves removal of toxins from eyes and skin using copious amounts of water or saline. With the exception of mustard gas, most toxins can be safely removed with water or saline.
    - Water mixes with mustard gas and releases chlorine gas.
    - Decontamination takes priority over all interventions except basic life support techniques.
- Elimination of poisons is increased through administration of cathartics, whole-bowel irrigation, hemodialysis, hemoperfusion, urine alkalinization, chelating agents, and antidotes.
    - A cathartic such as sorbitol is given with the first dose of activated charcoal to stimulate intestinal motility and increase elimination.
    - Hemodialysis and hemoperfusion are reserved for patients who develop severe acidosis from ingestion of toxic substances.

VIOLENCE

- **Violence** is the acting out of the emotions of fear or anger to cause harm to someone or something.
    - It may be the result of organic disease, psychosis, or antisocial behavior.
    - Violence can take place in a variety of settings, including the home, community, and workplace. EDs have been identified as high-risk areas for *workplace violence.*

- **Domestic violence** is a pattern of coercive behavior in a relationship that involves fear, humiliation, intimidation, neglect, and/or intentional physical, emotional, financial, or sexual injury.
    - It is found in all professions, cultures, socioeconomic groups, ages, and both genders; although men can be victims of domestic violence, most victims are women, children, and the elderly.
    - It has been reported that 1.5 million women and 834,000 men treated at EDs have been *battered* (assaulted) by spouses, significant others, or individuals known to them.

- Screening for domestic violence is required for any patient who is found to be a victim of abuse. Appropriate interventions should be initiated, including making referrals, providing emotional support, and informing victims about their options.

AGENTS OF TERRORISM

- Terrorism involves overt actions such as the dispensing of disease pathogens (**bioterrorism**) or other agents (e.g., chemical, radiologic/nuclear, explosive devices) as weapons for the expressed purpose of causing harm.
    - The pathogens most likely to be used in a bioterrorist attack are anthrax, smallpox, botulism, plague, tularemia, and hemorrhagic fever.
        - Those agents that cause anthrax, plague, and tularemia can be treated effectively with commercially available antibiotics if sufficient supplies are available and the organisms are not resistant.
        - Smallpox can be prevented or ameliorated by vaccination even when first given after

exposure.
    - Botulism can be treated with antitoxin.
    - There is no established treatment for viruses that cause hemorrhagic fever.
- Chemicals used as agents of terrorism are categorized according to their target organ or effect.
    - Sarin is a highly toxic nerve gas that can cause death within minutes of exposure. Sarin enters the body through the eyes and skin and acts by paralyzing the respiratory muscles; antidotes for nerve agent poisoning include atropine and pralidoxime chloride.
    - Phosgene is a colorless gas normally used in chemical manufacturing. If inhaled at high concentrations for a long enough period, it causes severe respiratory distress, pulmonary edema, and death.
    - Mustard gas is yellow to brown in color and has a garlic-like odor. The gas irritates the eyes and causes skin burns and blisters.
- Radiologic/nuclear agents represent another category of agents of terrorism.
    - *Radiologic dispersal devices, (RRD)* also known as "dirty bombs," consist of a mix of explosives and radioactive material.
    - When the device is detonated, the blast scatters radioactive dust, smoke, and other material into the surrounding environment resulting in radioactive contamination.
    - The main danger from an RRD results from the explosion. The radioactive materials used in an RRD do not usually generate enough radiation to cause immediate serious illness, except to those casualties who are in close proximity to the explosion.
    - Since radiation cannot be seen, smelled, felt, or tasted, measures to limit contamination and decontamination should be initiated.
- *Ionizing radiation* (e.g., nuclear bomb, damage to a nuclear reactor) represents a serious threat to the safety of the casualties and the environment.
    - Exposure to ionizing radiation may or may not include skin contamination with radioactive material; if external radioactive contaminants are present, decontamination procedures must be initiated immediately.
    - Acute radiation syndrome develops after a substantial exposure to ionizing radiation and follows a predictable pattern.
- Explosive devices used as agents of terrorism result in one or more of the following types of injuries: blast, crush, or penetrating.
    - Blast injuries result from the supersonic over-pressurization shock wave that occurs following the explosion, causing damage to the lungs, middle ear, and gastrointestinal tract.
    - Crush injuries often result from explosions that occur in confined spaces and result from structural collapse.
    - Some explosive devices contain materials that are projected during the explosion, leading to penetrating injuries.

EMERGENCY AND MASS CASUALTY INCIDENT PREPAREDNESS

The term **emergency** usually refers to any extraordinary event that requires a rapid and skilled response and that can be managed by a community's existing resources.

An emergency is differentiated from a **mass casualty incident** (MCI) in that an MCI is a manmade (e.g., biologic warfare) or natural (e.g., hurricane) event or disaster that overwhelms a community's ability to respond with existing resources.

- MCIs usually involve large numbers of casualties, involve physical and emotional suffering, and result in permanent changes within a community.
- MCIs always require assistance from people and resources outside the affected community (e.g., American Red Cross, Federal Emergency Management Agency [FEMA]).

When an emergency or MCI occurs, first responders (i.e., police, emergency medical personnel) are dispatched to the scene.
- Triage of casualties of an emergency or MCI differs from the usual triage that occurs in the ED and must be conducted in less than 15 seconds.
- A system of colored tags is used to designate both the seriousness of the injury and the likelihood of survival.
  - A **green** (minor injury) or **yellow** (non–life-threatening injury) tag is used to indicate a non-critical injury.
  - A **red** tag indicates a life-threatening injury requiring immediate intervention.
  - A **black** tag is used to identify those casualties who are deceased or who are expected to die.
- Casualties need to be treated and stabilized, and if there is known or suspected contamination, decontaminated at the scene, and then transported to hospitals.
- Many casualties will arrive at hospitals on their own (i.e., walking wounded).
- The total number of casualties a hospital can expect is estimated by doubling the number of casualties that arrive in the first hour.
- Generally, 30% of casualties will require admission to the hospital, and 50% of these will need surgery within 8 hours.

- Many communities have initiated programs to develop *community emergency response teams* (CERTs).
  - CERTs have been recognized by FEMA as important partners in emergency preparedness, and the training helps citizens to understand their personal responsibility in preparing for a natural or manmade disaster.
  - Citizens are taught what to expect following a disaster and how to safely help themselves, their family, and their neighbors.
  - Training includes the teaching of life-saving skills, with an emphasis on decision-making and rescuer safety.

All health care providers have a role in emergency and MCI preparedness, and knowledge of the hospital's *emergency response plan* and participation in emergency/MCI preparedness drills are required.

Response to MCIs often requires the aid of a federal agency such as the National Disaster Medical System (NDMS), which is a division within the U.S. Department of Homeland Security that is responsible for the coordination of the federal medical response to MCIs.
- One component of the NDMS is to organize and train volunteer disaster medical assistance teams (DMATs).
  - DMATs are categorized according to their ability to respond to an MCI. A Level-1 DMAT can be deployed within 8 hours of notification and remain self-sufficient for 72 hours with enough food, water, shelter, and medical supplies to treat about 250 patients per day.
  - Level-2 DMATs lack enough equipment to be self-sufficient but are used to replace a Level-1 team, using and supplementing the equipment left on site.
  - Many hospitals and DMATs have a *critical incident stress management unit* that arranges group discussions to allow participants to verbalize and validate their feelings and emotions about the experience to facilitate psychologic recovery.