CHAPTER 11

Musculoskeletal disorders

❖ Introduction

- The musculoskeletal system provides the structure and leverage that permits mobility
  - Bones of the skeletal system serve as a reservoir for calcium and a manufacturing facility for red blood cells, white blood cells (WBCs), and platelets
  - Alterations in the musculoskeletal system can result from soft-tissue injury, bone fractures, infections, and tumors
- Various tests are used to assess musculoskeletal integrity

❖ Nursing history

- The nurse asks the patient about his *chief complaint*
  - The patient with a joint injury may report a joint deformity, pain, stiffness, swelling, or sensory alteration
  - A patient with a fracture may report deformity or pain
  - A patient with a muscular injury may report pain, swelling, weakness, or sensory alteration
- The nurse then questions the patient about his *present illness*
  - Ask the patient about his symptom, including when it started, associated symptoms, location, radiation, intensity, duration, frequency, and precipitating and alleviating factors
  - Ask the patient if activities of daily living (ADLs) are affected; question him about the use of assistive devices, such as a cane, walker, or crutches
  - Ask about the use of prescription and over-the-counter drugs, herbal remedies, and vitamin and nutritional supplements
- The nurse asks about *medical history*
  - Question the patient about other musculoskeletal disorders, such as arthritis, gout, osteoporosis, and trauma
  - Ask the female patient whether she uses an oral contraceptive or is undergoing hormone therapy and whether she's premenopausal or postmenopausal
- The nurse then assesses the *family history*
  - Ask about a family history of musculoskeletal problems
  - Also ask about a family history of chronic and genetic disorders
- The nurse obtains a *social history*
  - Ask about work, exercise, diet, use of recreational drugs and alcohol, and hobbies
  - Also ask about stress, support systems, and coping mechanisms
  - Assess how the patient functions at home; determine his ability to get around, climb stairs, and drive
- Physical assessment
  - The nurse begins with *inspection*
    - Note the size and shape of joints, limbs, and body regions; note body symmetry
    - Inspect the skin and tissues around the joint, limb, or body region for color, swelling, masses, and deformities
    - Observe how the patient stands and moves; watch him walk, noting his gait, posture, arm movements, and coordination

- Inspect the curvature of his spine
- To check range of motion (ROM), ask the patient to abduct, adduct, and flex or extend affected joints
- Inspect major muscle groups for tone, strength, symmetry, and abnormalities; note contractures and abnormal movements, such as spasms, tics, tremors, and fasciculations

◆ Next, the nurse uses *palpation*

- Palpate the patient's bones, noting any deformities, masses, or tenderness
- Evaluate the patient's muscle tone, mass, and strength
- Palpate joints for tenderness, nodes, crepitus, and temperature at rest and during passive ROM
- Palpate arterial pulses, and check capillary refill time
- Check neurovascular status, including movement and sensation

❖ Bursitis and tendinitis

■ Description

◆ *Tendinitis* (also called *tendinopathy*) is an inflammatory process that affects the tendons and tendon-muscle attachments; it most commonly affects the shoulder rotator cuff, Achilles' tendon, hip, elbow, and knee

◆ Tendinitis is caused by abnormal body development, hypermobility in calcific tendinitis, musculoskeletal disorders (such as rheumatic diseases and congenital defects), postural malalignment, and trauma (such as overuse or straining during sports activities)

◆ *Bursitis* is a painful inflammation of one or more bursae; it most commonly affects the subdeltoid, subacromial, olecranon, trochanteric, calcaneal, prepatellar, and radiohumeral bursae

◆ Types of bursitis include septic, calcific, acute, and chronic

◆ Causes include common stressors (such as repetitive kneeling, prolonged sitting, or jogging in shoes without proper support) and recurrent trauma; septic bursitis can result from wound infection

◆ Both bursitis and tendonitis typically occur in patients ages 15 to 50; overuse injuries are more likely to occur in high-risk populations, older adults, and athletes

◆ Complications result from scar tissue with subsequent disability

■ Signs and symptoms

◆ Signs and symptoms of tendinitis include pain on palpation over the affected muscle-tendon unit, warmth (in acute tendinitis), and restricted movement; in the elbow, tenderness may occur over the lateral epicondyle; in the knee, palpable tenderness may occur in the hamstring when the knee is flexed at a 90-degree angle; and in the foot, crepitus may occur when the patient moves his foot

◆ Signs and symptoms of bursitis include tenderness over the affected site, erythema, and swelling (with severe bursitis)

■ Diagnosis and treatment

◆ Various serum and urine tests rule out other disorders

◆ X-rays in tendinitis may show bony fragments, osteophyte sclerosis, or calcium deposits

◆ X-rays in calcific bursitis may show calcium deposits in the joint

◆ Ultrasonography in tendinitis reveals increased tendon diameter, localized tendon swelling and thickening, and tendon sheath swelling

◆ MRI in tendinitis shows tendon thickening, edema, and any tears in the tendon

◆ Arthrocentesis may identify causative microorganisms and other causes of inflammation to rule out tendinitis

◆ Arthrography is usually normal in tendinitis, showing only minor irregularities on the tendon under the surface

◆ Treatment of both tendonitis and bursitis involves resting the affected area and providing symptomatic management

◆ Medications include nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids for inflammation and analgesics for pain

◆ Antibiotics are used to treat septic bursitis

- Nursing interventions
  - Apply cold or heat therapies as ordered; protect the patient's skin when applying therapies
  - Encourage rest of the affected area, including immobilization if indicated
  - Elevate the affected area and apply gentle compression (elastic bandage or compression or neoprene sleeve)
  - Inspect the area for changes in swelling or erythema
  - Encourage the patient to participate in self-care to the extent possible, and provide extra time for activities and assistance as necessary
  - Administer medications, such as NSAIDs and analgesics, as ordered
  - Encourage the use of active ROM exercises; reinforce participation in physical therapy as appropriate and indicated
  - Teach the patient about the disease and how to prevent future episodes

❖ Dislocations

- Description
  - A dislocation occurs when the articulating surfaces of a joint come out of position
  - Dislocations may result from trauma, diseases that affect the joint, or congenital weaknesses
  - Dislocations may cause injury to blood vessels and nerves and change in the contour of the joint, length of the extremity, and axis of the dislocated bones
- Signs and symptoms
  - The patient experiences pain at the affected joint
  - Neurovascular compromise may occur, including loss of movement, paresthesia, and pulselessness
- Diagnosis and treatment
  - Diagnosis is based on patient history, physical examination, and X-rays
  - Treatment consists of open or closed reduction, activity limitations as indicated, and pain relief
- Nursing interventions
  - Immobilize and elevate the affected joint; apply cold compresses as indicated
  - Assess neurovascular status before and after reduction, including strength of the pulse, capillary refill time, sensation, movement, pain, and color of the skin

❖ Fractures, femoral

- Description
  - A femoral fracture is a break in the femur anywhere along its shaft
  - Transverse, oblique, and comminuted fractures are the most common types of femoral fractures and may be open or closed (see *Types and causes of fractures*)
  - A femoral fracture can occur at any age, as a result of a fall, an accident, a gunshot wound, or other injury
- Signs and symptoms
  - Pain occurs at the fracture site
  - Discoloration and deformity may also be present
  - The fractured limb can't bear weight and may be shortened and externally rotated
  - Other findings may include an open wound, edema, and bruising
  - Leg fractures may produce any or all of the five Ps: pain, pallor, paralysis, paresthesia, and pulselessness
- Diagnosis and treatment
  - Diagnosis is based on patient history, physical examination, and X-rays that show the type and severity of the fracture
  - Cold therapy is applied to the fracture site
  - An opioid analgesic and a muscle relaxant are given to relieve pain
  - If the patient has an open fracture or has undergone surgery to correct the fracture, an antibiotic is administered; tetanus prophylaxis may also be required
  - Reduction of the fracture restores the displaced bone segments to their normal position
    - With closed reduction, the bones are aligned by manual manipulation or traction; immobilization is by splint, cast, or traction

Types and causes of fractures

Type of fracture	Description	Force causing the fracture
Avulsion	Fracture that pulls bone and other tissues from their usual attachments	Direct force with resisted extension of the bone and joint
Closed	Skin is closed but bone is fractured	Minor force
Compression	Fracture in which the bone is squeezed or wedged together at one side	Compressive, axial force applied directly above the fracture site
Greenstick	Break in only one cortex of the bone	Minor direct or indirect force
Impacted	Fracture with one end wedged into the opposite end or into the fractured fragment	Compressive, axial force applied directly to the distal fragment
Linear	Fracture line runs parallel to bone's axis	Minor or moderate direct force applied to the bone
Oblique	Fracture at an oblique angle across both cortices	Direct or indirect force with angulation and some compression
Open	Skin is open, bone is fractured, and soft tissue trauma may occur	Moderate to severe force that is continuous and exceeds tissue tolerances
Pathologic	Transverse, oblique, or spiral fracture of a bone weakened by tumor	Minor direct or indirect force
Spiral	Fracture curves around both cortices	Direct or indirect twisting force, with the distal part of the bone held or unable to move
Stress	Crack in one cortex of a bone	Repetitive direct force, as from jogging, running, or osteoporosis
Transverse	Horizontal break through the bone	Direct or indirect force toward the bone

- With open reduction, the fracture is surgically reduced and immobilized with rods, plates, screws, and an immobilization device

◆ When a splint or cast fails to maintain the reduction, immobilization requires skin or skeletal traction, using a series of weights and pulleys (see *Skeletal and skin tractions,* page 196)

- With skin traction, elastic bandages and moleskin coverings are used to attach the traction devices to the patient's skin
- With skeletal traction, a pin or wire is inserted through the bone distal to the fracture and attached to a weight, allowing more prolonged traction

■ Nursing interventions

◆ Perform neurovascular checks, which will provide data needed to formulate a care plan (see *Neurovascular checks,* page 198)

◆ Assess vital signs, and monitor the patient for signs of shock because significant blood loss may occur with a femur fracture

◆ Assess the patient for signs of fat embolism—including confusion, dyspnea, hypotension, petechiae on the trunk, tachycardia, and tachypnea—which can occur following the fracture of a long bone

◆ Apply cold packs to the fracture site; cold causes vasoconstriction, which decreases bleeding and edema and lessens pain

Skeletal and skin tractions

Type and description	Purpose	Nursing considerations
Skeletal traction		
Balanced suspension to femur Used in patients age 3 and older on the upper tibia and thigh with 20 to 35 lb (9 to 16 kg) of weight	• Realignment of fractures of the femur • Relief of muscle spasms associated with femoral fractures	• A Steinmann pin or Kirschner wire is inserted through the upper tibia. The thigh and leg are suspended in a splint and leg attachment. • Thigh and leg suspension is counterbalanced by traction to the top of the thigh splint. • The patient should be recumbent, but he can turn about 30 degrees to either side briefly for back care or lift himself up using the trapeze and the uninjured leg and foot. • Neurovascular checks are vital to assess circulatory status and prevent compartmental syndrome. • Tissue pressure monitoring is performed.
Cervical traction via skull tongs Used in patients of any age, but especially in young adults, bilaterally on skull bones with 20 to 30 lb (9 to 14 kg) of weight	• Realignment of fractures of cervical vertebrae • Relief of pressure on cervical nerves	• Patients may be severely injured and may have quadriplegia.
Halo-pelvic traction Used in adolescents and young adults on the skull and pelvis with no weight (bars extending between the skull and pelvic portions hold the body in the desired position)	• Preoperative straightening of scoliosis curvature	• Pins are inserted into the skull in four areas to hold the halo. Pins are inserted through the iliac pelvic bones to hold the pelvis. • Straightening is accomplished by tightening the bars, which overcomes muscle contractions. • Traction is "comfortable" after the patient has recovered from the insertional trauma. • Dressing is complicated because the vertical bars interfere with clothing. • Traction may remain in place postoperatively to be replaced by a brace or cast. • Halo-pelvic traction is a variant of halo-femoral traction, in which the pins are inserted through the distal femurs instead of the pelvic bones, and the skull pins pull away from the femoral pins.
Skin traction		
Buck's extension Most commonly used in adults on one or both legs with 5 to 8 lb (2.5 to 3.5 kg) of weight per leg	• Preoperative traction for hip fractures • "Pulling" contracted muscles • Relief of leg or back muscle spasms	• Patient generally lies recumbent. • Patient may be turned to either side if no fracture is present or turned to the unaffected side if fracture is present. • An older patient's skin is more friable and subject to loosening because of less subcutaneous fat. • Patient may complain of burning under tape, moleskin, or traction boot. • Traction may be removed for skin care even if fracture is present.

Skeletal and skin tractions *(continued)*

Type and description	Purpose	Nursing considerations
Skin traction (continued)		
Cervical head halter Used in adults under the chin and around the face and back of the head with 5 to 15 lb (2.5 to 7 kg) of weight	• Relief of muscle spasms caused by degenerative or arthritic conditions of the cervical vertebrae or by muscle strain	• Halter should be applied so that the pull comes from the occipital area, not through the chin portion. • Patients may be in low- or high-Fowler's position, depending on the purpose of the traction. • If the patient complains of pain in the chin, teeth, or temporomandibular joint, the halter may be incorrectly positioned. Side straps should be adjusted to relieve these complaints. • Patients should be removed from traction for sleeping. • Patients can use this type of traction at home for cervical arthritic conditions.
Cotrel's traction Used in adolescents and young adults with a head halter (5 to 7 lb [2.5 to 3 kg] of weight) and a pelvic belt (10 to 20 lb [4.5 to 9 kg] of weight)	• Preoperative muscle stretching in patients with scoliosis	• Pulling in opposite directions may cause pain or discomfort. • Traction can be removed briefly for massage and skin care.
Dunlop's traction Used in adolescents and young adults on the lower humerus (5 to 7 lb of weight) and forearm (3 to 5 lb [1.5 to 2.5 kg] of weight)	• Realignment of fractures of the humerus	• Body is used for countertraction by slightly elevating side of bed of arm in traction. • Forearm is held at a right angle to the humerus for comfort, by using Buck's extension on the forearm. • Dunlop's traction can be used for skin traction (using Buck's extension to the humerus) or skeletal traction (using a Steinmann pin inserted through the distal humerus); use of skin or skeletal traction depends on the patient's injury. • Traction to the forearm should be removed daily for skin care.
Pelvic belt or girdle Used in older adolescents and adults on the abdomen or pelvis with 20 to 35 lb of weight	• Relief of muscle spasms and pain associated with disk conditions	• Pull comes from iliac crests to relieve spasm. • Patient may be placed in the William's position, which permits 45-degree knee and hip flexion to relax the lumbosacral muscles. • Orders typically are "in traction 2 hours, out 2 hours" and out of traction at night. • Traction straps shouldn't put pressure on sciatic nerves.
Pelvic sling Used in adults under the pelvis and buttocks like a hammock with 20 to 35 lb of weight	• Holding of fractured pelvic bones	• Buttocks must be slightly off the bed. • Patients are comfortable in the sling even with extensive pelvic bruising. • They may become dependent on the sling and may require gradual weaning. • The sling should be kept clean and dry. • Patients can be removed from the sling for care and toileting if facility policy permits.
Russell traction Used in patients age 5 and older on one or both legs with 2 to 5 lb (1 to 2.5 kg) of weight per leg	• Preoperative traction for hip fractures • "Pulling" contracted muscles • Treatment of Legg-Calvé-Perthes disease	• Pulley placement and amount of weight used are based on the principle that "for every force in one direction, there is an equal force in the opposite direction." • Patient is positioned on back for most effective pull. • Knee sling can be loosened for skin care and checking pulses in popliteal area.

Neurovascular checks

Fractures may cause nerve or arterial damage, producing any or all of the five Ps: pain, pallor, paralysis, paresthesia, and pulselessness. When performing a neurovascular check, compare findings bilaterally and above and below the fracture.

Pain

Ask the patient if he's having pain. Assess the location, severity, and quality of the pain as well as anything that seems to relieve or worsen it. Pain that is unrelieved by an opioid or that worsens with elevating the limb (elevation reduces circulation and worsens ischemia) may indicate compartment syndrome.

Pallor

Paleness, discoloration, and coolness of the injured site may indicate neurovascular compromise from decreased blood supply to the area. Check capillary refill time. Tissues should return to normal color within 3 seconds. Palpate skin temperature with the back of your hand.

Paralysis

Note any deficits in movement or strength. If the patient can't move the affected area or if movement causes severe pain and muscle spasms, he might have nerve or tendon damage. For a femoral fracture, assess peroneal nerve injury by checking for sensation over the top of the foot between the first and second toes.

Paresthesia

Ask the patient about changes in sensation, such as numbness or tingling. Check for loss of sensation by touching the injured area with the tip of an open safety pin or the point of a paper clip. Abnormal sensation or loss of sensation indicates neurovascular involvement.

Pulselessness

Palpate peripheral pulses distal to the injury, noting rate and quality. If a pulse is decreased or absent, blood supply to the area is reduced.

- ◆ Check and maintain the traction setup, if used (see *Nursing considerations for patients in skeletal or skin traction*)
- ◆ Provide good cast care to prevent skin breakdown and other complications
- ◆ Provide appropriate postoperative care
  - ◗ Keep the fractured leg elevated on a pillow to reduce edema by increasing venous return
  - ◗ Apply cold therapy reduce bleeding and edema
  - ◗ Help the patient sit in a chair with his leg elevated; upright positions increase peripheral circulation, which decreases edema
  - ◗ Help the patient use an ambulatory aid when prescribed; weight bearing is restricted until some bone union occurs
  - ◗ Administer an opioid analgesic, or monitor the use of patientcontrolled analgesia
  - ◗ Encourage the patient to perform leg and foot exercises to maintain muscle and joint strength and decrease venous stasis
  - ◗ Change dressings as needed, using strict aseptic technique, and administer an antibiotic, if prescribed; the patient is susceptible to wound infection and, possibly, osteomyelitis
  - ◗ Provide good pin care by cleaning the insertion site daily with chlorhexidine solution and assess pin site for signs of inflammation or infection
  - ◗ Assess patient for signs of compartment syndrome (e.g., pallor; paresthesia; paralysis; and pain that is throbbing, intensifies with elevation, is unrelenting, and uncontrolled with analgesics)
  - ◗ Monitor fluid intake and output to ensure fluid balance
- ◆ Help with discharge planning by anticipating the patient's discharge needs

❖ Fractures, hip

■ Description

- ◆ Hip fracture is a fracture of the head, neck, trochanteric, or subtrochanteric regions of the femur

Nursing considerations for patients in skeletal or skin traction

Nursing action	Rationale
Check ropes, knots, pulleys, freedom of movement, and intactness.	These actions help ensure that the traction is functioning properly.
Check the entire traction setup, pin site, and all suspension apparatus for tightness or signs of loosening.	These actions help ensure that the traction is functioning properly.
Check weights to ensure that they're hanging freely.	This action helps ensure that there is a proper amount of traction.
Make sure the weights aren't "lifted" during care.	This action helps to avoid pain caused by sudden muscle contraction and disrupted fragments of the injured or fractured bone. (Patients in skeletal traction should be moved for position changes without lifting or releasing the weights.)
Take care not to bump the weights or weight holders.	This action helps to avoid pain caused by rope movements that affect the traction bow and pin.
Check all skin surfaces for signs of tolerance or pressure areas (especially on the occipital area of the head, shoulder blades, elbows, coccyx, and heels).	These actions may uncover signs of pressure, which include redness, tenderness or pain, soreness caused by excoriation, and numbness.
Provide physical and psychological comfort. Answer questions honestly, answer the call light promptly, provide prompt and thorough care, encourage patient participation in care, provide diversionary activities, and prepare the patient and family for discharge.	These actions help ensure that the patient participates in and is prepared for self-care.

- *Intracapsular* fractures are those of the femoral head and neck, which are inside the hip capsule; the hip capsule is made up of ligaments surrounding the hip joint
- *Extracapsular* fractures are those of the femoral trochanteric and subtrochanteric regions, which lie outside the ligaments of the hip capsule

◆ Hip fractures are most common in older people, particularly elderly women; many are associated with osteoporosis and falls

■ Signs and symptoms

◆ The fractured limb is shortened and rotated externally; it can't bear weight

◆ Other findings include hip discoloration, pain, and tenderness

■ Diagnosis and treatment

◆ Diagnosis is based on patient history, physical examination, and X-rays

◆ Intracapsular fracture requires open reduction with prosthetic replacement because of the high risk of loss of blood supply to the head of the femur, which leads to avascular necrosis

◆ Extracapsular fracture requires insertion of a sliding compression hip nail, hip nail with side plate, or multiple pins

■ Preoperative nursing interventions

◆ Monitor traction setup and functioning; skin traction may be used as a temporary measure to reduce muscle spasms and increase patient comfort and safety

◆ Monitor neurovascular status; trauma disrupts arterial and venous vessels, leading to bruising, edema, pain, and color changes

◆ Monitor vital signs; fluctuating vital signs may be caused by shock (up to 1,000 mL of blood may be lost into the hip joint), trauma, or a preexisting vascular condition; temperature typically is below normal unless a urinary or respiratory tract infection exists

- ◆ Perform other preoperative care, such as giving the patient nothing by mouth, having him empty his bladder, and checking his vital signs
- ◆ Send an abduction pillow to the operating room if the patient is receiving a prosthesis; the pillow helps keep the prosthesis in the hip joint until muscles and ligaments heal

■ Postoperative nursing interventions

- ◆ Monitor vital signs and neurovascular status; surgical repair of hip fracture is traumatic because of bone and tissue injuries and can lead to complications, such as thrombophlebitis and fat or pulmonary embolism
- ◆ Monitor the amount and type of wound drainage; drainage should be serosanguineous and should total no more than 200 mL over 3 days
- ◆ Position the affected limb properly to prevent dislocation; use abduction if a prosthesis was inserted, but use a neutral position if another internal fixation device was inserted
- ◆ Fit an overhead trapeze on the patient's bed so that he can use it to help lift himself off the bed using the unaffected limb
- ◆ Turn the patient on the nonoperative side as prescribed to facilitate circulation and recovery while easing tired muscles and relieving pressure; prop the operative limb with an abduction pillow if the patient has a prosthesis or with pillows if the patient has another internal fixation device
- ◆ Teach the patient isometric quadriceps- and gluteal-setting exercises to strengthen muscles
- ◆ Encourage deep breathing and coughing every 2 hours, and use an incentive spirometer every 1 to 2 hours to prevent pulmonary complications
- ◆ Auscultate all lung lobes for breath sounds, which should be clear
- ◆ Check the color and amount of sputum, which should be clear
- ◆ Monitor fluid intake and output and I.V. infusions; intake should be 3,000 mL daily; output should include 2,300 mL of urine and 300 to 700 mL of insensible water loss and perspiration
- ◆ Provide a regular diet as prescribed, and monitor bowel sounds; a patient with good bowel sounds who is passing flatus can receive regular foods; nerve involvement from the hip may cause mild abdominal distention
- ◆ Assess skin, and provide skin care to pressure areas (e.g., heels, back, sacrum, shoulders, and elbows)
- ◆ Help the patient sit on the bed or in a chair on the first postoperative day; initially, weight-bearing activity is prohibited because it can cause excessive pressure on internal fixation devices; therefore, the patient must use a walker, which provides stability and allows ambulation with little or no weight bearing
- ◆ Make sure the hip isn't flexed more than 90 degrees for up to 2 months after surgery; during the first 10 postoperative days, even less flexion may be allowed
- ◆ Administer an opioid analgesic, or monitor the use of patient-controlled analgesia
- ◆ To prevent thrombophlebitis, administer an anticoagulant as ordered, and use external pneumatic compression devices and thigh-high antiembolism stockings
- ◆ Perform dressing changes as needed using aseptic technique; the wound may be left uncovered after draining ceases
- ◆ Encourage the patient to perform foot and ankle exercises, including dorsiflexion and plantar flexion, to increase venous return and prevent thrombophlebitis
- ◆ Teach the patient about proper use of a walker and use of the prescribed amount of weight bearing

❖ Gout

■ Description

- ◆ Gout is an inflammatory arthritis caused by uric acid and crystal deposits that trigger an immune response
- ◆ Gout results when uric acid crystallizes in blood or body fluids and the precipitate accumulates in connective tissue (tophi)
- ◆ The disorder is characterized by red, swollen, and acutely painful joints; it mostly affects the feet, great toe, ankle, and midfoot
- ◆ The patient may remain symptom-free for years between attacks
- ◆ The first acute attack strikes suddenly and peaks quickly

- Chronic polyarticular gout—the final, unremitting stage of the disease—is marked by persistent, painful polyarthritis
- Causes of primary gout include decreased renal excretion of uric acid or oversecretion of uric acid; a genetic defect in purine metabolism (hyperuricemia); radical dieting practices that involve starvation; a diet high in red organ meats, seafood, or high-fructose corn syrup; and high alcohol consumption, especially of beer
- Secondary gout is associated with certain drugs (such as thiazide diuretics and cyclosporine), diabetes mellitus, hypertension, leukopenia, myeloma, truncal obesity, polycythemia, renal disease, and hypercholesterolemia
- Primary gout is more common in men than women and typically occurs between ages 30 and 60
- Complications include renal calculi, atherosclerotic disease, cardiovascular lesions, and neuropathies

■ Signs and symptoms

- Symptoms of an acute attack appear suddenly and peak quickly; initially, one or a few joints are affected with such symptoms as pain, redness, tenderness, and warmth and inflammation at the affected joint; low-grade fever may also occur
- Symptoms may subside quickly but tend to recur at irregular intervals; severe attacks can persist for days or weeks
- In later stages of the disease after polyarticular gout has developed, polyarthritis develops in multiple joints, and subcutaneous tophi (urate crystal deposits) may occur
- The skin over tophi may ulcerate and release a chalky white exudate or pus

■ Diagnosis and treatment

- Serum uric acid levels and WBC count are elevated during an acute gout attack; urine uric acid levels are chronically elevated in about 20% of patients
- X-ray of the articular cartilage and subchondral bone shows evidence of chronic gout
- Needle aspiration of synovial fluid shows needlelike intracellular crystals and an elevated WBC count
- Treatment aims to bring acute attacks under control, reduce hyperuricemia, and prevent complications
- Dietary restrictions include avoiding alcohol, eating purine-rich foods (such as anchovies, liver, and sardines) sparingly, and increasing fluid intake during acute attacks
- Drug treatment includes the use of NSAIDs such as indomethacin (Indocin) for pain
- Colchicine helps stop acute attacks
- Corticosteroids may also be used
- Allopurinol, febuxostat, probenecid, and sulfinpyrazone are used to treat chronic gout

■ Nursing interventions

- Institute bed rest during the initial phases of an acute attack, focusing on resting the affected joint
- Use a bed cradle, if appropriate, to prevent irritation of and pressure on the affected area
- Administer prescribed drugs, including colchicine, within 24 hours of the onset of an acute attack
- Provide comfort measures and pain relief as needed
- If the patient can tolerate it, encourage liberal fluid intake
- Work with the patient to identify techniques and activities that promote rest and relaxation
- Provide dietary recommendations, review the patient's diet history for high-purine foods, help the patient select appropriate foods, and provide a low-purine diet
- Monitor the patient's serum uric acid levels and fluid balance, including intake and output
- Teach the patient and his family about the disorder and its treatment, and provide support

❖ Lower back pain

■ Description

- Lower back pain is pain that occurs in the lumbar region of the back
- Lower back pain affects most of the population at some time
- Most lower back pain is musculoskeletal; other common causes are degeneration and disk disease
- Risk factors for lower back pain include obesity, poor body mechanics, lifting of heavy objects, and lack of exercise or physical activity

■ Signs and symptoms

- The patient reports lower back pain, which may radiate to one or both legs
- Associated symptoms include impaired bladder and bowel function, paresthesia, and reduced motor function

■ Diagnosis and treatment

- Diagnosis is based on patient history, physical examination, and radiographic procedures, including X-rays, CT scan, MRI, myelogram, electromyogram, diskogram, and somatosensory evoked potentials
- An NSAID and an analgesic are administered for pain, and muscle relaxants may be used to relieve muscle spasms
- Epidural injections with a steroid may help decrease swelling and inflammation of spinal nerves
- Short-term bed rest may be indicated initially
- Physical therapy, ultrasound, heat or ice, whirlpool, and cognitive-behavioral therapy may be helpful
- Surgical intervention may include discectomy, discotomy, laminectomy, and spinal fusion

■ Preoperative nursing interventions

- Help the patient achieve a comfortable position; elevate the head of the bed 30 degrees, and have the patient flex his hips and knees slightly
- Alternate the application of cold and heat, and administer an analgesic as indicated
- Teach the patient the proper use of assistive devices
- Demonstrate proper body mechanics to the patient

■ Postoperative nursing interventions

- Assess the patient's vital signs and level of pain; administer medications as ordered; teach the patient how to use patient-controlled analgesia if appropriate
- Keep the head of the bed flat or elevated no more than 45 degrees for at least 24 hours after surgery; logroll the patient as indicated
- Maintain activity restrictions
- Assist the surgeon with the initial dressing change
- Monitor the patient's intake and output
- Assess the surgical wound and dressings; perform incision site care and dressing changes as appropriate
- Monitor for drainage and bleeding
- Monitor for cerebrospinal fluid leakage
- Assess the patient's motor and neurologic function; compare the results with baseline findings

❖ Osteoarthritis

■ Description

- Osteoarthritis is a noninflammatory joint disease characterized by degenerative changes in the articular cartilage; it primarily affects weight-bearing joints in the hips, knees, and vertebrae but may also affect the ankles, shoulders, wrists, fingers, and toes
- Osteoarthritis affects more than 50 million American men and women, primarily those older than age 45
- Osteoarthritis has been associated with aging, obesity, and wear and tear on the joints; however, a defective gene may account for many cases of idiopathic osteoarthritis
- Osteoarthritis may be *idiopathic* (occurring without a previous injury or known cause) or *secondary* (resulting from another injury or disease)
- Both types of osteoarthritis begin with the breakdown of the hyaline cartilage covering the ends of the bones on either side of the joint; the underlying bones become roughened, and bone cysts, fissures, or spurs develop on the bone surface; eventually, the joint space is lost as cartilage loss increases, and the joint ROM is progressively restricted
- Pain in the affected joints is caused by inflamed synovium, stretching of the joint capsule or ligaments, irritation of nerve endings in the periosteum, and muscle spasms

■ Signs and symptoms

- Joint stiffness and soreness may be accompanied by dull, aching pain that worsens with joint use and weight bearing; rest may relieve the pain
- ROM is decreased, and crepitus may be felt with joint movement

- Joints exhibit deformities, such as Heberden's nodes (bony outgrowths on the distal interphalangeal joints) and Bouchard's nodes (bony outgrowths on the proximal interphalangeal joints); the joints may also appear enlarged and edematous
- Bone spurs may press on peripheral nerves, causing numbness or paralysis and hypoesthesia of the arms, forearms, hands, legs, and feet
- Carpal tunnel syndrome and tarsal tunnel syndrome may result from pressure of bony growths on nerves
- Gait analysis may show a discrepancy in leg length and joint alignments

Diagnosis and treatment

- Patient history, physical examination, X-rays, CT scan, MRI, arthrocentesis, arthrogram, and bone scan may be ordered; serologic studies, including complete blood count, erythrocyte sedimentation rate (ESR), creatinine level, mineral assays, and humoral tests for immunoglobulins, also may be performed
- The patient may require support and stabilization of the joint, with a cane, crutches, a walker, braces, a cervical collar, or traction
- Weight reduction is encouraged in an obese patient
- Moist heat and paraffin dips are applied as needed; ice packs may also be used
- Massage may be helpful
- ROM exercises are performed for all joints, balancing rest with exercise
- Properly fitted shoes are used to help maintain correct posture, decrease pressure on affected tissues, and increase ambulation
- Medications such as salicylates, NSAIDs, acetaminophen, muscle relaxants, and intra-articular steroids may be prescribed to relieve soreness (systemic steroids aren't used to treat osteoarthritis because it isn't primarily an inflammatory disease)
- Studies indicate that glucosamine and chondroitin may be useful in controlling symptoms and reducing functional impairment
- Viscosupplementation—the injection of gel-like substances into the affected joint—may be helpful
- Surgery is considered when other treatments have failed; total or partial joint replacement, joint fusion (arthrodesis), or osteotomy may be performed

Nursing interventions

- Explain the proposed treatment regimen to the patient
- Apply heat, cold, or other ordered treatments to the joint
- Administer medications as prescribed
- Consult a physical therapist about exercise and other treatments
- Help the patient achieve a comfortable position, using pillows as needed, to promote rest
- Teach the patient how to use an ambulatory aid; walkers, canes, and other aids decrease weight on the affected joints and help to minimize cartilage erosion; teach proper body mechanics to prevent injury
- Encourage the patient to perform ADLs when possible to maintain muscle strength and joint ROM
- Provide skin care to maintain skin integrity

❖ Osteomyelitis

Description

- Osteomyelitis is an acute or a chronic infection of the bone or bone marrow
  - The acute form may result from an infection in other tissues (hematogenic osteomyelitis) or from an open fracture with bacterial contamination
  - The chronic form may result from inadequate initial antimicrobial therapy or lack of response to treatment (relapse occurs when the patient's resistance is lowered)
- The metaphyseal area in long bones is usually affected; the longer and larger the bone, the more susceptible it is to osteomyelitis; such bones include the femur, tibia, humerus, and vertebrae
- Common pathogenic organisms are *Staphylococcus aureus* (which causes 90% of osteomyelitis), *Streptococcus pyogenes, Pseudomonas aeruginosa, Escherichia coli, Neisseria gonorrhoeae, Haemophilus influenzae,* and *Salmonella typhi*

- ◆ Once the pathogens locate in the metaphysis, they grow and reproduce until they have formed a mass; leukocytes help wall off and localize the infection; bone cells in the area die, and purulent matter spreads along the bone, eventually penetrating through the tissues to the skin surface

■ Signs and symptoms
- ◆ The patient may complain of site pain and pressure; heat, edema, and tenderness may also be present
- ◆ Associated systemic signs and symptoms include chills, fever, malaise, nausea, and tachycardia
- ◆ The affected limb may be sore with use
- ◆ An open, draining area may appear

■ Diagnosis and treatment
- ◆ Diagnosis may be based on patient history, bone scan, MRI, physical examination, X-rays of the involved bone, culture of the drainage, WBC count, and ESR
- ◆ An antibiotic is administered I.V. in large doses after blood cultures are taken
- ◆ Aspirin or acetaminophen is given to control fever and pain
- ◆ Tetanus toxoid or antitoxin is given if the patient has an open wound
- ◆ Hyperbaric oxygen treatments at twice the atmospheric pressure for 2 hours/day up to six times per week may be prescribed
- ◆ After antibiotic therapy is completed, the bone is surgically scraped to clear away the dead bone and residue of infection
  - ◗ Bone grafts may be used to aid bone healing and prevent fracture
  - ◗ Tubes or catheters may be inserted to flush the site with an antibiotic to clear any residual organisms
  - ◗ An external fixator may be placed above and below the osteomyelitic site to decrease the possibility of bone fracture
- ◆ Surgery to drain infection may be necessary
- ◆ Immobilization of the infected bone may be necessary using a cast, traction, or bed rest

■ Nursing interventions
- ◆ Monitor the type and amount of pain to determine the disease's status
- ◆ Administer an antibiotic, an analgesic, or tetanus toxoid or antitoxin as prescribed
- ◆ Administer I.V. fluids to maintain hydration
- ◆ Perform neurovascular checks, and monitor vital signs
- ◆ Use strict aseptic technique when required; the patient is more susceptible to additional infection or nosocomial infection
- ◆ Help the patient achieve a comfortable position to relieve pressure on the affected tissues
- ◆ Encourage the patient to perform ROM exercises for all unaffected tissues and joints to maintain strength
- ◆ Teach the patient how to use an ambulatory aid (or arm sling)
- ◆ Discuss concerns about the length and types of treatment
- ◆ Provide and encourage diversionary activities to help the patient maintain a positive outlook

❖ Osteoporosis

■ Description
- ◆ Osteoporosis is a systemic disease in which bone density and bone mass decrease because of a disturbance in the balance between bone resorption and bone deposition
- ◆ Osteoporosis begins to develop after age 30 but progresses rapidly in postmenopausal women; 70% of women older than age 45 have osteoporosis
- ◆ Causes of osteoporosis include menopausal decreases in estrogen, family history, immobility, insufficient intake of calcium and vitamin D, alcohol use, smoking, corticosteroid use, and caffeine intake
- ◆ Patients with osteoporosis are susceptible to fractures (particularly of the femur, radius, and ulna) and compression or crush injuries of the vertebrae

■ Signs and symptoms
- ◆ Pain may affect the lower back or thoracic spinal area
- ◆ A loss of height may occur

- ◆ Kyphosis, or dowager's hump, may be present
- ◆ A minor twist or turn can cause a sudden fracture
- ◆ Numbness or tingling in arms or legs may occur

■ Diagnosis and treatment

- ◆ Diagnosis may be based on patient history, physical examination, dual photon absorptiometry, and CT scans
- ◆ Calcium intake is increased to 1,500 mg daily
- ◆ Estrogen and progesterone are prescribed to restore hormonal balance
- ◆ Calcitonin and bisphosphonates (etidronate and panidronate) are prescribed to prevent bone resorption; alendronate, ibandronate, raloxifene, and risedronate are also used to treat osteoporosis
- ◆ Back or neck supports are used to prevent stress fractures
- ◆ Active exercises are encouraged to help retain calcium in the bones

■ Nursing interventions

- ◆ Monitor the amount and type of pain to determine its extent
- ◆ Give an analgesic as prescribed to relieve pain and promote mobility
- ◆ Teach the patient how to use an ambulatory aid to maintain mobility, and apply a neck or back support, if ordered
- ◆ Teach the patient about dietary sources of calcium and calcium supplements; increased calcium intake decreases the risk of fractures
- ◆ Refer the patient to a practitioner for possible estrogen replacement therapy (controversial)
- ◆ Discuss methods of dressing to camouflage kyphosis
- ◆ Discuss how to ensure a safe home environment to decrease the risk of falls, for example, by removing loose rugs and avoiding long, uncovered electrical cords
- ◆ Encourage the patient to participate in active, weight-bearing exercises, such as walking and swimming, to maintain calcium in bones and preserve muscle strength
- ◆ Encourage the patient to modify lifestyle choices by avoiding smoking, alcohol, caffeine, and carbonated beverages, and increasing protein intake

❖ Rhabdomyolysis

■ Description

- ◆ Rhabdomyolysis is the breakdown of muscle tissue and may cause myoglobinuria
- ◆ Muscle tissue breakdown usually follows muscle trauma, especially a crush injury
- ◆ The disorder may lead to renal failure if not treated
- ◆ Causes of rhabdomyolysis, besides trauma, are excessive muscle activity (such as status epilepticus or severe dystonia), familial tendency, infection, medications (such as antihistamines, salcylates, fibric acid derivatives, HMG-CoA reductase inhibitors, neuroleptics, anesthetics, paralytic agents, corticosteroids, tricyclic antidepressants, and selective serotonin reuptake inhibitors), and sporadic strenuous exertion (for example, running in a marathon)

■ Signs and symptoms

- ◆ Tenderness, swelling, and muscle weakness result from muscle trauma and pressure
- ◆ Dark, reddish brown urine is caused by myoglobin release

■ Diagnosis and treatment

- ◆ Diagnosis is based on patient history that reveals myalgias or muscle pain; physical examination; elevated levels of serum myoglobin, creatine kinase, serum potassium, phosphate, and creatinine; and CT scan, MRI, and bone scintigraphy, which detect muscle necrosis
- ◆ Treatment should focus on the underlying cause
- ◆ I.V. crystalloids may be given to increase intravascular volume and glomerular filtration rate
- ◆ Diuretics may be given
- ◆ Dialysis may be required
- ◆ Analgesics may be given for pain

- ◆ If compartment syndrome develops and venous pressure is greater than 25 mm Hg, immediate fasciotomy and debridement may be needed to relieve pressure and prevent tissue death
- ◆ Urine alkalinization and osmotic or loop diuretics may be implemented to prevent renal failure

■ Nursing interventions

- ◆ Administer I.V. fluids and diuretics to reduce nephrotoxicity
- ◆ Monitor intake and output
- ◆ Recommend exercise modification to prevent recurrence of rhadomyolysis

❖ Tumors, bone

■ Description

- ◆ Neoplasms of the musculoskeletal system are of various types, including osteogenic, chondrogenic, fibrogenic, and bone marrow cell tumors
- ◆ Bone tumors may be primary or metastatic from primary cancers elsewhere in the body; metastatic bone tumors occur more commonly than primary bone tumors
- ◆ Benign bone tumors include osteochondromas, bone cysts, osteoid osteomas, and fibromas; benign tumors are slow growing, encapsulated, present few signs and symptoms, and are rarely associated with mortality
- ◆ Giant cell tumors may begin as benign tumors and remain that way for long periods; they have the potential to eventually become malignant
- ◆ Primary malignant bone tumors are relatively rare; several types exist, including sarcomas (such as osteogenic sarcoma, chondrosarcoma, and fibrosarcoma), Ewing's sarcoma, and chordoma (see *Types of primary malignant bone tumors*)
- ◆ Primary malignant bone tumors can be osseous (arising from the bony structure itself) or nonosseous (arising from hematopoietic, vascular, and neural tissues)
- ◆ Osseous bone tumors include osteogenic sarcoma (most common), parosteal osteogenic sarcoma, chondrosarcoma (chondroblastic), and malignant giant cell tumor
- ◆ Nonosseous bone tumors include Ewing's sarcoma, fibrosarcoma (fibroblastic), and chordoma
- ◆ The exact causes of bone tumors are unknown, but they may be related to exposure to carcinogens, hereditary factors, and trauma
- ◆ Bone cancers affect males and females equally; they occur more commonly in children and adolescents, although some types do occur in patients ages 35 to 60 years
- ◆ The most common sites for tumors are the femur, tibia, and humerus

■ Signs and symptoms

- ◆ General symptoms include persistent, localized dull bone pain on weight bearing and at rest, unexplained weight loss, impaired mobility, and a history of pathologic fracture
- ◆ Physical findings include swelling and tenderness at the affected site, a palpable bony or soft tissue mass, and an abnormal gait

■ Diagnosis and treatment

- ◆ Bone X-rays, radioisotope bone and computed tomography (CT) scans, and magnetic resonance imaging (MRI) all aid in diagnosis
- ◆ Incision or aspiration biopsy confirms primary malignancy
- ◆ Treatment depends on the type of tumor

■ Nursing interventions

- ◆ Encourage communication, and help the patient set realistic goals
- ◆ Give prescribed I.V. infusions and medications; administer antinausea agents to minimize nausea
- ◆ Provide small, frequent meals
- ◆ Provide comfort measures to facilitate the administration of chemotherapy as indicated
- ◆ Prepare the patient and family for possible surgery, including limb salvage and associated care
- ◆ Offer support to the patient and family about the condition and effects of treatment, such as loss of part of a limb
- ◆ Obtain blood specimens as ordered to evaluate for bone marrow suppression secondary to chemotherapy
- ◆ Monitor vital signs and the neurovascular status of the affect extremity

Types of primary malignant bone tumors

The chart below lists primary malignant bone tumors of both osseous and nonosseous origin, including their clinical features and treatment.

Type	Clinical features	Treatment
Osseous origin		
Chondrosarcoma	• Develops from cartilage • Painless; grows slowly but is locally recurrent and invasive • Occurs most commonly in pelvis, proximal femur, ribs, and shoulder girdle • Usually occurs in the very young and the very old	• Hemipelvectomy, surgical resection (ribs) • Radiation (palliative) • Chemotherapy
Malignant giant cell tumor	• Arises from benign giant cell tumor • Found most commonly in long bones, especially in the knee area • Usually occurs in people ages 18 to 50	• Curettage • Total excision • Radiation for recurrent disease
Osteogenic sarcoma	• Osteoid tumor present in bone specimen • Tumor arises from bone-forming osteoblast and bone-digesting osteoclast • Occurs most commonly in femur, but also tibia and humerus; occasionally, in fibula, ileum, vertebra, or mandible • Usually occurs in teens and young adults in their 20s	• Surgery (tumor resection, high thigh amputation, hemipelvectomy, interscapulothoracic surgery) • Chemotherapy
Parosteal osteogenic sarcoma	• Develops on surface of bone instead of interior • Progresses slowly • Occurs most commonly in distal femur, but also in tibia, humerus, and ulna • Usually occurs in people ages 30 to 40	• Surgery (tumor resection, possible amputation, interscapulothoracic surgery, hemipelvectomy) • Chemotherapy • Combination of the above
Nonosseous origin		
Chordoma	• Derived from embryonic remnants of notochord • Progresses slowly • Usually found at end of spinal column and in spheno-occipital, sacrococcygeal, and vertebral areas • Characterized by constipation and visual disturbances • Usually occurs in people ages 50 to 60	• Surgical resection (often resulting in neural defects) • Radiation (palliative, or when surgery not applicable, as in occipital area)
Ewing's sarcoma	• Originates in bone marrow and invades shafts of long and flat bones • Usually affects lower extremities, most commonly femur, innominate bones, ribs, tibia, humerus, vertebra, and fibula; may metastasize to lungs • Pain increasingly severe and persistent • Usually occurs in children, teens, and young adults in their early 20s • Has a poor prognosis	• High-voltage radiation (tumor is radiosensitive) • Chemotherapy to slow growth • Amputation only if there's no evidence of metastasis
Fibrosarcoma	• Relatively rare • Originates in fibrous tissue of bone • Invades long or flat bones (femur, tibia, mandible) but also involves periosteum and overlying muscle • Usually occurs in people ages 30 to 40	• Amputation • Radiation • Chemotherapy • Bone grafts (with low-grade fibrosarcoma)

- ◆ Teach the patient and family about the disorder, diagnosis, prognosis, and treatment, including the need for surgery and possible follow-up chemotherapy
- ◆ Teach about the use of assistive devices or prostheses and modifications, as needed
- ◆ Provide support and encouragement, and refer the patient and family to support services as needed

Review questions

1. A patient in balanced suspension traction for a fractured femur needs to be repositioned toward the head of the bed. During repositioning, the nurse should:

- ○ **A.** place slight additional tension on the traction cords.
- ○ **B.** release the weights, and replace them immediately after positioning.
- ○ **C.** lift the traction and the patient during repositioning.
- ○ **D.** maintain the same degree of traction tension.

Correct answer: D Traction is used to reduce the fracture and must be maintained at all times, including during repositioning. Options A, B, and C are incorrect because it isn't appropriate to increase traction tension or release or lift the traction during repositioning.

2. A patient undergoes cast placement for a fractured left radius. The nurse should suspect compartment syndrome if the patient experiences pain that:

- ○ **A.** intensifies with the elevation of the left arm.
- ○ **B.** disappears with the flexion of the left arm.
- ○ **C.** increases with the arm in a dependent position.
- ○ **D.** radiates up the arm to the left scapula.

Correct answer: A Pain is the most common symptom of compartment syndrome. Because the pain is the result of ischemia, elevating the limb reduces circulation, worsens the ischemia, and intensifies the pain. Options B and C are incorrect because these positions don't alter the pain of compartment syndrome. Option D is incorrect because the pain of compartment syndrome doesn't radiate up the arm to the scapula.

3. A patient received a right hip prosthesis after a fall. In the immediate postoperative period, the nurse should:

- ○ **A.** maintain the leg in an adducted position.
- ○ **B.** maintain the leg in an abducted position.
- ○ **C.** maintain the leg in a neutral position.
- ○ **D.** maintain the leg with the hip flexed greater than 90 degrees.

Correct answer: B After receiving a hip prosthesis, the affected leg should be kept abducted. Adduction (Option A) may dislocate the hip. Option C would be correct if an internal fixation device was used. Option D is incorrect because the hip must not be flexed more than 90 degrees for the first 2 months and even less than that for the first 10 days.

4. A 78-year-old patient has a history of osteoarthritis. Which signs and symptoms would the nurse expect to find on physical assessment?

- ○ **A.** Joint pain, crepitus, Heberden's nodes
- ○ **B.** Hot, inflamed joints; crepitus; joint pain
- ○ **C.** Tophi, enlarged joints, Bouchard's nodes
- ○ **D.** Swelling, joint pain, tenderness on palpation

Correct answer: A Signs and symptoms of osteoarthritis include joint pain, crepitus, Heberden's nodes, Bouchard's nodes, and enlarged joints. Joint pain occurs with movement and is relieved by rest. As the disease progresses, pain may also occur at rest. Heberden's nodes are bony growths that occur at the distal interphalangeal joints. Bouchard's nodes involve the proximal interphalangeal joints. Hot, inflamed joints (Option B) rarely occur with osteoarthritis. Tophi (Option C) are deposits of sodium urate crystals that occur with chronic gout, not osteoarthritis. Swelling, joint pain, and tenderness on palpation (Option D) occur with a sprain injury.

5. The nurse is caring for an elderly female patient who has osteoporosis. When teaching her, the nurse should include information about which major complication?

- ○ **A.** Bone fracture
- ○ **B.** Loss of estrogen
- ○ **C.** Negative calcium balance
- ○ **D.** Scoliosis

Correct answer: A Bone fracture is a major complication of osteoporosis that results when loss of calcium and phosphate increases the fragility of bones. Option B is incorrect because estrogen deficiencies result from menopause, not osteoporosis. Option C is wrong because calcium and vitamin D supplements may be used to support normal bone metabolism, but a negative calcium balance isn't a complication of osteoporosis. Option D is incorrect because, although the cause of scoliosis is unknown, it's not thought to be a complication of osteoporosis.

6. Conservative treatment of a herniated nucleus pulposus would include which measures?

- ○ **A.** Surgery
- ○ **B.** Spinal fusion
- ○ **C.** Bed rest, pain medication, and physiotherapy
- ○ **D.** Strenuous exercise, pain medication, and physiotherapy

Correct answer: C Conservative treatment of a herniated nucleus pulposus may include bed rest, pain medication, and physiotherapy. Aggressive, not conservative, treatment may include surgery (Option A), including spinal fusion (Option B). A regimen of strenuous exercise, pain medication, and physiotherapy (Option D) isn't recommended.

7. Which areas should be included in a neurovascular assessment?

- ○ **A.** Orientation, movement, pulses, and warmth
- ○ **B.** Capillary refill time, movement, pulses, and warmth
- ○ **C.** Orientation, pupillary response, temperature, and pulses
- ○ **D.** Respiratory pattern, orientation, pulses, and temperature

Correct answer: B A correct neurovascular assessment should include capillary refill time, movement, pulses, and warmth. Neurovascular assessment involves nerve and blood supply to an area. Orientation, pupillary response, temperature, and respiratory pattern (Options A, C, and D) aren't part of a neurovascular examination.

8. Which of the following are considered signs and symptoms of a fracture?

- ○ **A.** Tingling, coolness, and loss of pulses
- ○ **B.** Loss of sensation, redness, and coolness
- ○ **C.** Coolness, redness, and a new pain site
- ○ **D.** Discoloration, deformity, and pain at the site of injury

Correct answer: D Signs of a fracture may include discoloration, deformity, and pain at the site of injury. Tingling, coolness (included in Options A, B, and C), and loss of pulses are signs of a vascular problem.

9. What diagnostic test would be used to evaluate the presence of rhabdomyolysis?

- ○ **A.** Glycosylated hemoglobin
- ○ **B.** Serum troponin
- ○ **C.** Serum myoglobin
- ○ **D.** Bone biopsy

Correct answer: C A positive serum or urine myoglobin test indicates rhabdomyolysis. A glycosylated hemoglobin test (Option A) measures the amount of glycosylated hemoglobin in the blood and is used to monitor blood sugar. Serum troponin (Option B) is used to detect acute coronary syndrome. A bone biopsy (Option D) would be used to diagnose osteoporosis.

10. What complication should the nurse be alert for in a diabetic patient who has been placed in skeletal traction after a motor vehicle collision?

- ○ **A.** Osteoarthritis
- ○ **B.** Osteomyelitis
- ○ **C.** Osteoporosis
- ○ **D.** Osteosarcoma

Correct answer: B This patient has a significant risk of developing osteomyelitis secondary to the skeletal pin. Osteoarthritis (Option A) is a degenerative joint disease, osteoporosis (Option C) is a metabolic bone disorder, and osteosarcoma (Option D) is an aggressive form of bone cancer; none occur secondary to skeletal traction.

CHAPTER 14

Endocrine disorders

❖ Introduction

- The endocrine system plays a significant role in human growth, metabolism, and environmental adaptation
- Along with the nervous system, the endocrine system provides a communication system for the body
- By releasing hormones from various ductless glands, the endocrine system carefully regulates many physiologic functions
- Nursing history
  - The nurse asks the patient about his *chief complaint*
    - A patient with an endocrine disorder may report abnormalities of fatigue, mental status changes, polydipsia, polyuria, weakness, and weight change
    - The patient with an endocrine disorder may also report problems of sexual maturity and function
  - The nurse then questions the patient about his *present illness*
    - Ask the patient about his symptom, including when it started, associated symptoms, location, radiation, intensity, duration, frequency, and precipitating and alleviating factors
    - Ask about the use of prescription and over-the-counter drugs, herbal remedies, and vitamin and nutritional supplements
  - The nurse asks about *medical history*
    - Question the patient about other endocrine disorders, such as diabetes mellitus, Addison's disease, and Cushing's disease; height and weight problems; sexual problems; and thyroid disease
    - Ask the female patient about past reproductive problems and use of oral contraceptives and hormones; also ask whether she's premenopausal or postmenopausal
  - The nurse then assesses the *family history*
    - Ask about a family history of endocrine disorders, such as diabetes mellitus and thyroid disorders
    - Question the patient about his cultural background and heredity
  - The nurse obtains a *social history*
    - Ask about work, exercise, diet, use of recreational drugs, alcohol use, and hobbies
    - Also ask about stress, support systems, and coping mechanisms
- Physical assessment
  - The nurse begins with *inspection*
    - Observe the patient's general appearance and development, height, weight, posture, body build, proportionality of body parts, and distribution of body fat and hair
    - Note affect, speech, level of consciousness, orientation, appropriateness of behavior, grooming and dress, and activity level
    - Assess overall skin color, turgor, and moisture and, for areas of abnormal pigmentation, note any bruising, lesions, petechiae, or striae
    - Assess the face for erythematous areas, noting facial expression, shape, and symmetry of the eyes; also note abnormal lid closure, eyeball protrusion, and periorbital edema, if present
    - Inspect the tongue for color, size, lesions, tremor, and positioning
    - Inspect the neck area for symmetry
    - Evaluate the overall size, shape, and symmetry of the chest, noting any deformities, especially around the nipples
    - Check for truncal obesity, supraclavicular fat pads, and buffalo hump

- Inspect the external genitalia for normal development
- Inspect the arms and legs for tremors, muscle development and strength, symmetry, color, hair distribution, and edema
- Examine the feet, noting size, deformities, lesions, marks from shoes and socks, maceration, dryness, or fissures

- Next, the nurse uses *palpation*
  - Palpate the thyroid gland for size, symmetry, and shape; note any nodules or irregularities
  - Palpate the testes for size, symmetry, and shape; note any nodules or deformities
- Then the nurse uses *auscultation*
  - Auscultate the thyroid gland to identify systolic bruits
  - Auscultate the heart, noting heart rhythm disturbances that may occur in endocrine disorders

❖ Addison's disease

Description

- Addison's disease is a chronic adrenocortical insufficiency most commonly caused by autoimmune destruction of the adrenal cortex
- Other causes of adrenal insufficiency include fungal infection and infectious disease such as tuberculosis; hemorrhage; metastatic disease (rarely); therapy with drugs, such as ketoconazole, phenytoin, and rifampin; sudden withdrawal of steroid therapy; surgical removal of both adrenal glands; and human immunodeficiency virus infection
- Addison's disease leads to impaired metabolism, inability to maintain a normal glucose level, and fluid and electrolyte imbalances
- Primary insufficiency results from low levels of glucocorticoids and mineralocorticoids; secondary insufficiency results from inadequate pituitary secretion of corticotropin
- Lack of cortisol (a glucocorticoid) diminishes gluconeogenesis, decreases liver glycogen, and increases the sensitivity of peripheral tissues to insulin
- Lack of aldosteron, a mineralocorticoid, decreases the body's ability to regulate sodium, potassium, and water balance
- Low levels of androgens affect libido, menstrual cycles, and hair distribution
- Because cortisol is required for a normal stress response, patients with cortisol insufficiency can't withstand surgical stress, trauma, or infection

Signs and symptoms

- The patient may have a history of fatigue, muscle weakness, and weight loss
- The skin and mucous membranes may appear bronze from increased levels of melanocyte-stimulating hormone
- GI effects may include anorexia, nausea, vomiting, and diarrhea
- Other effects may include dehydration, hyperkalemia, hypoglycemia, hyponatremia, hypotension, and loss of axillary, extremity, and pubic hair

Diagnosis and treatment

- Laboratory tests may show low levels of plasma and urine cortisol and elevated levels of plasma corticotropin as well as hyperkalemia, hyponatremia, leukocytosis, and metabolic acidosis
- In a corticotropin stimulation test, plasma corticotropin levels may not increase in response to I.V. corticotropin
- Treatment consists of replacing glucocorticoids and mineralocorticoids; cortisone is given in two daily doses (usually on arising and at 6 p.m.) to mimic the body's diurnal variations; doses are increased during periods of stress
- Treatment also includes prevention of adrenal crisis, which may develop after trauma, infection, or GI upset; prevention requires consistent replacement therapy (without abrupt withdrawal); treatment of crisis requires immediate replacement of sodium, water, and cortisone
- Adrenal hemorrhage after septicemia is a rare complication of Addison's disease; it's treated with aggressive antibiotic therapy, an I.V. vasopressor, and massive doses of a steroid

- Nursing interventions
  - Monitor the patient for signs and symptoms of adrenal crisis, such as fever, changes in GI function (which may alter drug absorption), decreased sodium and cortisol levels with increased potassium levels (which may signal an impending crisis), dehydration, headache, hypotension, nausea, severe fatigue, tachycardia, and confusion
  - Ensure strict adherence to the medication schedule to prevent crisis
  - Decrease environmental stressors as much as possible
  - Teach the patient and his family how to prevent complications of Addison's disease by never omitting a dose of medication, notifying the practitioner if the patient can't take the medication, avoiding undue stress, and wearing a medical identification bracelet
  - Instruct the patient and his family to report any symptoms of adrenal crisis to a practitioner

❖ Cushing's syndrome

- Description
  - Cushing's syndrome is hyperfunction of the adrenal cortex caused by an overabundance of cortisol
  - It's classified as corticotropin-dependent or corticotropin-independent
    - With corticotropin-dependent Cushing's syndrome, cortical hyperfunction results from excessive corticotropin secretion by the pituitary gland; in 80% of cases, excessive corticotropin secretion is related to a pituitary adenoma
    - With corticotropin-independent Cushing's syndrome, cortical hyperfunction is independent of corticotropin regulation; high levels of cortisol are caused by a neoplasm in the adrenal cortex, or islet cell tumor
  - Cushing's syndrome may be caused by abnormal cortisol production or excessive corticotropin stimulation (spontaneous disorder) or long-term glucocorticoid (such as prednisone) administration (iatrogenic disorder)
  - For patients with this disorder, excessive cortisol leads to excessive glucose production and interferes with the cells' ability to use insulin; sodium retention, potassium excretion, and protein breakdown occur; body fat is redistributed from the arms and legs to the face, shoulders, trunk, and abdomen; and the immune system becomes less effective at preventing infection
- Signs and symptoms
  - Muscle weakness and atrophy may be accompanied by fat deposits on the trunk, abdomen, over the upper back ("buffalo hump"), and face ("moon face")
  - Skin changes may include acne, bruising, facial flushing, hyperpigmentation, striae, and thinning of the skin
  - Gynecomastia may occur in men; clitoral enlargement and menstrual irregularities, in women
  - Other effects may include arrhythmias, edema, emotional lability, GI disturbances, headaches, hirsutism (fine, downy hair on the face and upper body), infection, vertebral fractures, and weight changes
- Diagnosis and treatment
  - The dexamethasone suppression test and urine-free cortisol test are standard screening tests for Cushing's syndrome
  - Laboratory tests may show coagulopathies, hyperglycemia, hypokalemia, hypernatremia, increased aldosterone and cortisol levels, and suppressed plasma corticotropin levels; computed tomography (CT) scan or magnetic resonance imaging (MRI) may show a tumor
  - The goal of treatment is normal cortisol activity
  - Surgery is used if a tumor is causing corticotropin release
    - For a confirmed pituitary tumor, transsphenoidal resection is recommended; for a suspected pituitary tumor, cobalt irradiation of the pituitary gland
    - For a confirmed adrenal cortex tumor, bilateral adrenalectomy may be done; after surgery, the patient requires lifelong corticosteroid and mineralocorticoid replacement

- ◆ Drug therapy is used if something else is causing corticotropin release; aminoglutethimide, mitotane, and trilostane interfere with adrenal hormone synthesis or corticotropin production; bromocriptine and cyproheptadine interfere with corticotropin secretion; and glucocorticoids (such as cortisone, dexamethasone, and prednisone) treat congenital adrenal hyperplasia

■ Nursing interventions

- ◆ Encourage the patient to express concerns about altered body image
- ◆ Protect the patient from injury related to loss of bone matrix and abnormal fat distribution by maintaining a safe environment, teaching him how to use a walker or cane, encouraging the use of well-fitting shoes or slippers, and attending to complaints of lower back pain or joint pain
- ◆ Protect the patient from injury related to easy bruising and protein wasting by avoiding unnecessary venipunctures, using paper tape for dressing changes, avoiding overinflation of the blood pressure cuff, keeping the skin clean and dry, and using a convoluted foam mattress, a water mattress, or an air bed for a patient with skin breakdown
- ◆ Provide care related to limited mobility and muscle weakness resulting from protein catabolism by planning rest periods, encouraging range-of-motion exercises or daily muscle-strengthening exercises, and referring the patient for physical therapy, if needed
- ◆ Protect the patient from infection related to decreased immune function by using strict aseptic technique (when appropriate) and discouraging ill family members from visiting the patient
- ◆ Provide postoperative care after adrenalectomy, including monitoring vital signs frequently, ensuring adequate pain relief and fluid intake and output, and monitoring for complications of hypoglycemia and signs of adrenal crisis
- ◆ Administer replacement medication as prescribed, and be familiar with its adverse effects
- ◆ Suggest that the patient wear a medical identification bracelet
- ◆ Teach the patient and his family about the disease and its treatment

❖ Diabetes insipidus and syndrome of inappropriate antidiuretic hormone

■ Description

- ◆ Diabetes insipidus is a deficiency of antidiuretic hormone (ADH), resulting in water imbalance; vasopressin is a natural ADH secreted by the posterior pituitary
  - ◗ *Central diabetes insipidus* results from the destruction of vasopressin-producing cells; *nephrogenic diabetes insipidus* results when the renal tubules don't respond to vasopressin
- ◆ Syndrome of inappropriate antidiuretic hormone (SIADH) is caused by the release of excessive ADH, resulting in water retention (see *Comparing diabetes insipidus and SIADH,* page 246)

■ Nursing interventions

- ◆ Support the patient during the water deprivation test
- ◆ *For diabetes insipidus:* Treat altered fluid volume related to excessive urine output by maintaining fluid and electrolyte balance, administering replacement therapy as prescribed, monitoring the patient for signs of therapy-related water intoxication, notifying the practitioner of significant changes in urine output and specific gravity, and observing patient for vital sign changes related to dehydration, such as increased heart rate and decreased blood pressure
- ◆ *For SIADH:* Treat altered fluid volume status related to water retention by weighing the patient at the same time daily, and reporting weight gains or losses to the practitioner; monitor the patient for signs of water retention, such as dyspnea, edema, hypertension, and tachycardia
- ◆ Provide oral and skin care, and reposition the patient frequently to prevent skin breakdown
- ◆ Conserve energy for a patient who is up often during the night to void or drink; encourage short naps to prevent sleep deprivation
- ◆ Protect the patient from injury related to fatigue, weakness, dehydration, or confusion by providing a safe environment, encouraging a weak patient to request assistance in walking to and from the bathroom, teaching a patient to sit up gradually to prevent dizziness resulting from orthostatic hypotension, and taking seizure precautions for a patient with a low serum sodium level
- ◆ Teach the patient and family to recognize the signs of diabetes insipidus and SIADH
- ◆ Teach the patient how to administer intranasal medications

Comparing diabetes insipidus and SIADH

This chart summarizes the major characteristics of central and nephrogenic diabetes insipidus and syndrome of inappropriate antidiuretic hormone (SIADH).

Characteristic	Central diabetes insipidus	Nephrogenic diabetes insipidus	SIADH
Cause	• Head trauma or surgery • Pituitary or hypothalamic tumor • Intracerebral occlusion or infection	• Systemic diseases involving the kidney, such as multiple myeloma and sickle cell anemia • Polycystic kidney disease • Pyelonephritis • Medications such as lithium and demeclocycline	• Central nervous system disorders, such as head trauma, infection, intercerebral hemorrhage, or tumor • Pharmacologic agents, including chemotherapeutic agents, phenothiazines, and tricyclic antidepressants • Respiratory disorders and treatment, such as pneumonia, pneumothorax, bronchiogenic tumors, and positive-pressure ventilation
Pathophysiology	• Loss of vasopressin-producing cells, causing deficiency in antidiuretic hormone (ADH) synthesis or release; deficiency in ADH, resulting in an inability to conserve water, leading to extreme polyuria and polydipsia	• Depression of aldosterone release or inability of the nephrons to respond to ADH, causing extreme polyuria and polydipsia	• Inappropriate release of ADH, causing dilutional hyponatremia, leading to cellular swelling and water retention
Signs and symptoms	• Polyuria with urine output of 5 to 15 L daily • Polydipsia, especially a desire for cold fluids • Marked dehydration, as evidenced by dry mucous membranes, dry skin, and weight loss • Anorexia and epigastric fullness • Nocturia and related fatigue from interrupted sleep	• Same as for central diabetes insipidus	• Excessive or inappropriate water retention • Weight gain and decreased urinary output • Initially, anorexia, headaches, nausea, and vomiting • Later, confusion, irritability, seizures, and coma from severe hyponatremia
Diagnostic test results	• High serum osmolality, usually above 300 mOsm/kg of water • Low urine osmolarity, usually 50 to 200 mOsm/kg of water; low urine-specific gravity of less than 1.005 • Increased creatinine and blood urea nitrogen (BUN) levels resulting from dehydration • Positive response to water deprivation test: Urine output decreases and specific gravity increases	• Same as for central diabetes insipidus, except that plasma vasopressin levels are elevated in relation to plasma osmolality, and there is no response to exogenous vasopressin administration (decreased urine output and increased specific gravity)	• Low serum osmolality • High urine osmolality • Low serum sodium level • High urine sodium level, usually over 20 mEq/L • Decreased creatinine and BUN levels • Negative response to water deprivation test: Urine output increases and specific gravity decreases
Treatments	• Replacement vasopressin therapy with intranasal or I.V. DDAVP (desmopressin acetate) • Correction of dehydration and electrolyte imbalances	• A thiazide diuretic to deplete sodium and increase renal water reabsorption • Restriction of salt and protein intake	• Restriction of water intake to 1 qt (0.9 L) daily • Infusions of 3% to 5% sodium chloride to replace sodium • A diuretic to decrease volume overload • Demeclocycline to reverse hyperosmolarity

❖ Diabetes mellitus

■ Description

- ◆ Diabetes mellitus is a chronic systemic disease that alters carbohydrate, fat, and protein metabolism; it's the most common endocrine disorder and the third leading cause of death in the United States. Four general classifications are recognized:
- ◆ Prediabetes can occur when the fasting blood glucose is greater than 100 mg/dL and less than 126 mg/dL or postprandial blood glucose is greater than 140 mg/dL and less than 200 mg/dL
- ◆ *Type 1 diabetes mellitus* is an absolute deficiency of insulin secretion and may be hereditary; it's associated with histocompatibility antigens, some viruses, abnormal antibodies that attack the islet of Langerhans cells, and toxic chemicals; it causes symptoms when 90% of the pancreatic beta cells have been destroyed
- ◆ *Type 2 diabetes mellitus* may be hereditary, is associated with obesity, and results from different causes than type 1 diabetes; it's caused by defects in insulin secretion and decreased insulin effectiveness; it accounts for 90% of diabetic patients
- ◆ *Gestational diabetes mellitus* causes glucose intolerance during pregnancy; it usually disappears after delivery but may develop into type 1 or type 2 diabetes
- ◆ Other types of diabetes mellitus can be linked to either a disorder (such as an endocrinopathy, a genetic syndrome, an insulin receptor disorder, or an infection) or to the use of a drug or a chemical (such as a corticosteroid, epinephrine, furosemide, glucagon, lithium, or phenytoin)
- ◆ *Impaired glucose tolerance* occurs when glucose levels are outside the normal range following a glucose tolerance test but the patient doesn't meet the criteria for diabetes mellitus
- ◆ Many complications are associated with diabetes mellitus
  - ◗ Microvascular and macrovascular changes can increase the risk of heart disease, accelerate atherosclerotic disease, and cause cerebrovascular accidents, hypertension, and peripheral vascular disease
  - ◗ Microvascular changes can thicken capillary basement membranes and cause changes in the vessels of the kidneys and eyes
  - ◗ Motor and sensory neuropathies may result in weakness, hyperesthesia, hypoesthesia, and pain; autonomic neuropathy generally occurs after many years and may cause cardiac abnormalities, diabetic diarrhea, gastroparesis, impotence, and urine retention
  - ◗ Infections can result from accumulation of serum glucose in the skin and poorly functioning white blood cells
- ◆ With diabetes mellitus, hyperglycemia results from insulin deficiency or insulin resistance, which makes insulin unavailable to cells; the discrepancy between the amount of insulin available to tissues and the amount needed leads to impaired carbohydrate, protein, and fat metabolism

■ Signs and symptoms

- ◆ The classic signs and symptoms are polydipsia, polyphagia, polyuria, and weight loss
- ◆ Other effects may include fatigue and somnolence

■ Diagnosis and treatment

- ◆ Diagnosis may be based on symptoms of diabetes mellitus and a casual plasma glucose level greater than 200 mg/dL, an 8-hour fasting plasma glucose level greater than 126 mg/dL, or a 2-hour postload glucose level greater than 200 mg/dL during an oral glucose tolerance test; testing must be confirmed on a subsequent day
- ◆ Hemoglobin A_{1C} levels reflect the plasma glucose level during the past 2 to 3 months
- ◆ The first goal of treatment is to maintain a normal blood glucose level through oral antidiabetic or insulin therapy, diet control, and physical activity (see *Treatments for diabetes mellitus,* page 248)
- ◆ The second goal of treatment is to prevent or delay the complications
  - ◗ Hypoglycemia (insulin shock) is a condition in which the blood glucose level falls below the level required to sustain homeostasis (usually less than or equal to 70 mg/dL); it may result from too little food, too much insulin or oral antihypoglycemics, or too much exercise and can cause permanent neurologic damage or rebound hyperglycemia

Treatments for diabetes mellitus

A patient with diabetes mellitus commonly follows a regimen that requires medications (an oral antidiabetic or insulin), diet, and physical activity.

Oral antidiabetics

An oral antidiabetic may be prescribed alone or in combination with another drug and/or insulin for a patient with type 2 diabetes mellitus. A sulfonylurea (such as acetohexamide, chlorpropamide, glimepiride, glipizide, glyburide, tolazamide, and tolbutamide) works by stimulating the pancreas to release insulin but doesn't lead to hypoglycemia. Metformin, a biguanide, works by reducing the production of glucose in the liver and by making the tissues more sensitive to insulin; the drug may cause hypoglycemia. Acarbose and miglitol, alpha-glucosidase inhibitors, reduce glucose levels by interfering with glucose absorption in the small intestine; when used alone, these drugs don't cause hypoglycemia. Repaglinide, a benzoic acid derivative, stimulates beta cells to produce insulin; because the drug is quickly metabolized and is short acting, it's less likely to cause hypoglycemia. Thiazolidinediones, such as pioglitazone (Actos), increase insulin sensitivity by activating genes involved in fat synthesis and carbohydrate metabolism; when used alone, the drug doesn't cause hypoglycemia.

Insulin

Insulin therapy may be prescribed for other diabetic patients. Regular insulin is short-acting, with an onset of 30 to 60 minutes, a peak of 1 to 5 hours, and a duration of 6 to 10 hours; lispro (Humalog) and aspart (NovoLog) are rapid-acting insulins with an onset of 5 to 25 minutes, a peak of 30 to 90 minutes, and a duration of 2 to 5 hours. Neutral protamine Hagedorn (NPH) or Lente insulin is used for intermediate-acting therapy. Each of these drugs begins to act in 1 to 4 hours, produces peak action in 6 to 12 hours, and produces effects for 12 to 24 hours. Protamine zinc or Ultralente insulin can be used for long-acting therapy. For these drugs, onset occurs in 4 to 8 hours, action peaks in 16 to 18 hours, and action lasts up to 30 hours. Glargine (Lantus) and detemir (Levemir) insulins are used as basal therapy. They have an onset of 2 to 4 hours, have no peak effectiveness period, and last 20 to 24 hours. An insulin pump may be used to deliver rapid-acting insulin to meet both basal and bolus needs; the pump can be implanted under the skin or worn externally.

Diet

Diet therapy is individualized based on metabolic, nutritional, and lifestyle requirements. Emphasis is placed on achieving glucose, lipid, and blood pressure control. The following restrictions are recommended: Fat intake should equal 20% to 30% of total calories; protein intake, 10% to 20% of total calories; carbohydrate intake, 50% to 60% of calories; cholesterol intake, 300 mg or less; fiber intake, 20 to 30 g daily; and sodium intake, 2 to 3 g daily.

Physical activity

Exercise lowers blood glucose levels, maintains normal cholesterol levels, helps blood vessels perform more effectively, and may reduce the amount of insulin needed. Therefore, the patient should follow a consistent exercise program, engaging in activity when glucose levels are high. (Carbohydrate intake must be increased if the patient exercises when glucose levels are low.)

- Onset occurs in minutes to hours, but most often before meals, especially if meals are delayed or snacks omitted
- Severe signs and symptoms may include bladder spasms; a blood glucose level less than or equal to 70 mg/dL; bradycardia; bradypnea; confusion; cool, moist skin; hallucinations; light-headedness; memory loss; nausea; seizures or coma; slight respiratory acidosis; vision disturbances; and vomiting
- Milder signs and symptoms may include sweating, tremor, tachycardia, palpitations, and hunger
- Hypoglycemia is treated with 15 g of carbohydrates (4 oz apple juice, 4 oz regular soda, 8 oz skim milk, three glucose tablets, or five hard candies) if the patient is awake; if the patient is unconscious, treatment is an I.V. bolus of 50% dextrose solution, or glucagon given subcutaneously or I.M.; the patient requires follow-up glucose monitoring

◗ Hyperglycemia is a condition in which the blood glucose level exceeds 140 mg/dL

- When blood glucose exceeds 180 mg/dL, glucose is excreted in urine along with large amounts of water and electrolytes; excessive thirst, hunger, and ketosis also occur

- Hyperglycemia is treated with short-acting insulin and exercise to lower blood glucose levels

◗ Diabetic ketoacidosis (DKA) results from too little insulin, which prevents glucose from entering cells and causes it to accumulate in the blood

- DKA is treated with regular I.V. insulin, I.V. fluids to supplement intravascular volume, potassium replacement, and sodium bicarbonate if the pH is less than 6.9

◗ Hyperosmolar hyperglycemic nonketotic syndrome (HHNS) resembles DKA, but ketoacidosis doesn't occur; the patient has enough insulin to inhibit lipolysis (see *Understanding the difference between DKA and HHNS*)

- HHNS can be precipitated by infection, myocardial infarction (MI), stroke, pancreatitis, a severe burn treated with a high concentration of sugar, stress, or therapy with thiazide diuretic, a mannitol steroid, phenytoin, or total parenteral nutrition
- It occurs most frequently in persons ages 50 to 70 who have no history of diabetes as well as in those with mild type 2 diabetes
- It's treated with insulin, I.V. fluids with half-normal saline solution or normal saline solution, and potassium replacement when urine output is adequate

■ Nursing interventions

◆ Protect the patient from infection and injury related to circulatory compromise and possible nerve impairment

◗ Report wounds to the practitioner for treatment
◗ Apply lanolin to the feet and ankles
◗ Carefully dry the patient's feet, especially between the toes
◗ Encourage the use of cotton socks to reduce moisture, and suggest wearing well-fitting shoes
◗ Have the patient's toenails clipped by a podiatrist
◗ Teach the patient and family about good skin care
◗ Tell the patient to avoid heating pads and to exercise caution when near open fires because burns are more difficult to treat in diabetic patients

Understanding the difference between DKA and HHNS

Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic nonketotic syndrome (HHNS), both acute complications associated with diabetes, share some similarities, including changes in level of consciousness and extreme volume depletion, but they're two distinct conditions. The following chart helps determine which condition your patient is experiencing.

	Associated with	Onset	Symptoms
DKA	Type 1 diabetes mellitus	Rapid	• Hyperventilation (Kussmaul's respirations) • Acetone breath odor • Blood glucose level above normal (200 to 800 mg/dL) • Mild hyponatremia • Positive or large serum ketones • Serum osmolality slightly elevated • Hyperkalemia initially, then hypokalemia • Metabolic acidosis
HHNS	Type 2 diabetes mellitus	Slow	• Slightly rapid respirations • No breath odor • Blood glucose level markedly elevated (above 600 mg/dL) • Hypernatremia • Negative or small serum ketones • Serum osmolality markedly elevated • Normal serum potassium • Lack of acidosis

- Treat fluid loss caused by hyperglycemia
- Infuse I.V. isotonic (normal) or hypotonic (half-normal) saline solution
- When blood glucose level falls below 200 mg/dL, administer I.V. dextrose 5% in water to prevent hypoglycemia
- Monitor serum glucose levels and urine output hourly; review key laboratory results, such as serum electrolyte levels, arterial pH, serum bicarbonate, blood urea nitrogen, and creatinine, regularly to assess treatment effects
- Monitor potassium level, and replace potassium as needed

◆ Help the patient maintain good nutritional habits
- Obtain a diet history, and note the impact of lifestyle and culture on food intake
- Encourage the patient to follow the American Diabetes Association's calculated diet plan; encourage the obese patient to lose weight
- Explain the importance of exercise and a balanced diet

◆ Teach the patient and his family about the disease, complications, and treatment
- Discuss blood glucose self-testing, skin care, and treatment of minor injuries; discuss which injuries should be reported to a practitioner
- Make sure the patient and his family know the signs of hyperglycemia and hypoglycemia
- Make sure the patient and family know how to adjust insulin doses for changes in diet, exercise, and stress level
- Have the patient or a family member demonstrate the technique for drawing up and administering insulin
- Teach the patient how to adjust doses if an insulin-infusion pump is used
- Educate the patient and his family about care during illness; tell the patient to monitor blood glucose levels more frequently, to increase fluid intake, and not to stop taking his antidiabetic without consulting with the practitioner

◆ Provide care for a diabetic patient with peripheral neuropathy
- Discuss causes of an aching or burning sensation in the legs
- Provide foot cradles to prevent contact with bed linens for a patient in severe pain
- Encourage exercise as tolerated, which may help to relieve pain

◆ Provide care for a diabetic patient with altered bowel and bladder elimination related to neuropathy by providing psychological support, administering prescribed drugs such as metoclopramide hydrochloride, and discussing the signs of bladder infection with the patient and family

◆ Provide care for a diabetic patient with retinopathy by encouraging independence, providing a safe environment, and eliciting the support of community agencies

◆ Provide care for a patient with diabetes who has a sexual dysfunction related to neuropathy by encouraging the expression of feelings; exploring options such as a penile prosthesis; and recommending professional counseling as needed

❖ Hyperparathyroidism

■ Description

◆ Hyperparathyroidism is characterized by a greater-than-normal secretion of parathyroid hormone (PTH), one of the two major hormones that modulates calcium and phosphate homeostasis; the hormone stimulates intestinal absorption of calcium and acts on bone to release calcium

◆ The disorder is classified as primary or secondary
- In primary hyperparathyroidism, one or more of the parathyroid glands enlarges (usually because of an adenoma or gland hyperplasia), causing inappropriately high PTH secretion in relation to serum calcium concentration
- In secondary hyperparathyroidism, the parathyroid gland responds appropriately to a reduced level of extracellular calcium; PTH concentrations rise and calcium is mobilized by increasing intestinal absorption

◆ Causes include adenoma, chronic renal failure, decreased intestinal absorption or insufficient consumption of vitamin D or calcium, and genetic disorders

- Primary hyperparathyroidism can occur at any age but the majority of cases occur in people over age 45; women are affected twice as commonly as men, probably because the increase in bone resorption that follows menopause unmasks parathyroid gland hyperactivity
- Patients may have a history of irradiation to the head and neck 20 to 40 years (on average) before the development of hyperparathyroidism
- Complications may include osteoporosis, renal calculi development, cardiac arrhythmias, cholelithiasis, hypertension, and heart failure
- Hypercalcemic crisis can occur with extreme elevations of serum calcium levels and can result in life-threatening neurologic, cardiovascular, and renal complications

Signs and symptoms

- Signs and symptoms include a history of recurring nephrolithiasis; easy fracturing; osteoporosis; abdominal pain and other GI symptoms, such as anorexia, nausea, and vomiting; muscle weakness, particularly in legs; and lethargy
- Laboratory findings show persistently elevated serum PTH and calcium levels, along with elevated urine calcium levels; serum phosphorus levels are decreased
- X-rays show diffuse bone demineralization, bone cysts, outer cortical bone absorption, and subperiosteal erosion of the phalanges and distal clavicles in primary disease
- Technetium-99m sestamibi imaging, ultrasonography, CT scan, and MRI help identify enlargement and abnormally functioning areas
- Needle biopsy evaluates the function of the parathyroids

Diagnosis and treatment

- The recommended treatment for primary hyperthyroidism is the surgical removal of the abnormal parathyroid tissue
- For secondary disease, the goal is to correct the underlying cause of parathyroid hypertrophy
- Other treatments include hydration therapy and dialysis for renal failure
- Medications include bisphosphonates such as alendronate to reduce bone turnover and maintain bone density, calcimimetics such as cinacalcet to decrease calcium and PTH levels, and loop diuretics such as furosemide to treat hypercalcemia in patients who are well-hydrated

Nursing interventions

- Teach the patient and family about the disease and its treatment; prepare the patient for surgery if indicated, and provide emotional support
- Keep the patient hydrated as tolerated
- Monitor the patient's serum potassium, calcium, phosphate, and magnesium levels
- Watch for hypercalcemic crisis; be prepared to administer calcitonin and corticosteroids
- Postoperatively, monitor the patient's airway patency, and keep a tracheotomy tray at the patient's bedside
- Advance the patient's activity level and diet as tolerated
- Observe for signs of hypocalcemia (tetany, numbness and tingling around the mouth and in the extremities, and spasms)
- Before discharge, teach the patient the signs and symptoms of complications and the importance of follow-up care–including laboratory testing–to evaluate the effectiveness of therapy

❖ Hyperthyroidism

Description

- Hyperthyroidism is the excessive production of thyroid hormone resulting in a hypermetabolic state
- Severe hyperthyroidism can precipitate a thyroid storm or crisis, which is a life-threatening emergency; the crisis can be triggered by minor trauma or stress
- The two types of spontaneous hyperthyroidism are Graves' disease and toxic nodular goiter; signs and symptoms vary with the type and severity of the disease (see *Signs and symptoms of hyperthyroidism,* page 252)
  - Graves' disease commonly occurs in the third or fourth decade of life; it's more common in women than in men, it has a familial predisposition, and it may cause extrathyroidal symptoms, goiter, and symptoms of hypermetabolism and sympathetic nervous system hyperactivity

Signs and symptoms of hyperthyroidism

Different forms of hyperthyroidism can produce various signs and symptoms as summarized below.

Graves' disease *(Signs and symptoms of hypermetabolism and sympathetic overactivity)*

- Brittle hair and friable nails
- Emotional lability, anxiety, and irritability
- Fatigue
- Heat intolerance
- Increased respiratory rate and shortness of breath
- Increased sweating
- Loss of pubic hair in women; premature graying in men
- Muscle weakness and atrophy
- Tachycardia with palpitations
- Tremor
- Warm, moist skin
- Weight loss with increased appetite

Graves' disease *(Extrathyroid signs and symptoms)*

- Exophthalmos
- Eyelid lag, or a slowed movement of the lid in relation to the eyeball
- Periorbital edema
- Pretibial myxedema that produces raised, thickened skin that may be hyperpigmented, itchy, and well-demarcated from normal skin; lesions that appear plaquelike or nodular
- Staring with decreased blinking

Toxic nodular goiter

- Arrhythmias that don't respond to digoxin therapy
- Muscle wasting with weakness
- Staring with decreased blinking
- Weight loss

Thyroid storm or crisis

- Fever, which usually precedes thyroid storm
- Increased blood pressure
- Severe tachycardia
- Altered mental state—delirium and coma
- Anxiety and restlessness
- Chest pain
- General worsening of all symptoms

- ◗ Toxic nodular goiter typically occurs in elderly people; its slow onset causes less severe symptoms than Graves' disease
- ◆ Hyperthyroidism can result from discontinuation or excessive use of antithyroid medication, tumors that stimulate thyroid secretion, or deterioration of a preexisting hyperthyroid state due to DKA, infection, toxemia, trauma, or excessive iodine intake

■ Diagnosis and treatment

- ◆ Laboratory tests show increased levels of thyroid hormones (triiodothyronine [T_3] and thyroxine [T_4]), decreased thyroid-stimulating hormone (TSH) level, and an increased blood glucose level resulting from impaired insulin secretion
- ◆ Electrocardiography (ECG) shows atrial fibrillation, P- and T-wave alterations, and tachycardia; thyroid scan shows increased uptake of radioactive iodine
- ◆ The principal goal of treatment is to reduce thyroid hormone levels
  - ◗ Antithyroid medications are generally used for pretreating patients who are elderly or who have cardiac disease before starting radioactive iodine; methimazole and propylthiouracil are slow-acting drugs that block thyroid synthesis and typically produce improvement after 2 to 4 weeks of therapy; a beta-adrenergic blocker such as propranolol may be used as an adjunct to control activity of the sympathetic nervous system
  - ◗ Surgery (subtotal thyroidectomy) is reserved for patients with a very large gland, or who can't undergo other treatments, or who have thyroid cancer; before surgery, the patient receives antithyroid medication to reduce hormone levels and saturated solution of potassium iodide to decrease surgical complications
  - ◗ Radioactive iodine therapy also is the standard for treating hyperthyroidism; dosing is based on the patient's symptoms; it's contraindicated during pregnancy or breastfeeding, and many patients who receive radioactive iodine become euthyroid or hypothyroid, requiring levothyroxine treatment
- ◆ The second goal of treatment is to prevent thyroid storm
  - ◗ The patient is taught to take medication (including an antipyretic) only as prescribed and to seek care for infection

- Fluids are replaced as needed to prevent the condition from worsening
- A patient who develops thyroid storm requires immediate treatment with antipyretics and a hypothermia mattress, antithyroid drugs, steroids, beta blockers, and I.V. fluids

■ Nursing interventions

◆ Maintain normal fluid and electrolyte balance to prevent arrhythmias
◆ Tell the patient to avoid caffeine, which can stimulate the sympathetic nervous system
◆ Provide a high-calorie, high-protein diet through several small, well-balanced meals
◆ Ensure adequate hydration
◆ Conserve the patient's energy to help decrease metabolism needs
◆ Prevent thyroid crisis by using a cooling mat to achieve normal temperature, keeping the patient's room cool, establishing a calm environment, using relaxation techniques, administering drugs as prescribed, identifying and treating precipitating factors, and teaching the patient and family how to prevent thyroid storm
◆ If the patient has exophthalmos, administer eyedrops or ointment, and encourage the use of sunglasses for comfort and to protect his eyes
◆ If the patient has diaphoresis, keep his skin dry with powders that contain cornstarch, and frequently change his bed linens
◆ If the patient underwent a thyroidectomy, keep him in Fowler's position to promote venous return from the head; assess for signs of respiratory distress and vocal changes; keep a tracheotomy tray at the bedside; monitor him for signs of hemorrhage; assess for hypocalcemia (such as tingling and numbness of the extremities, muscle twitching, laryngeal spasm, and positive Chvostek's sign [inducing spasm or twitching of the mouth, nose, and eye by sharply tapping over the facial nerve] and Trousseau's sign [inducing carpopedal spasm by occluding blood flow to arm with a blood pressure cuff]), which may occur if parathyroid glands are damaged; assess for signs of thyroid storm (such as tachycardia, hyperkinesis, fever, vomiting, and hypertension); and keep calcium gluconate available for emergency I.V. administration

❖ Hypoparathyroidism

■ Description

◆ Hypoparathyroidism occurs when the parathyroid glands don't secrete enough PTH or when there's decreased PTH action
◆ It can be acute or chronic and is classified as idiopathic, acquired, or reversible
◆ Hyperparathyroidism can result from inadvertent removal of the parathyroid glands during thyroidectomy; other causes include autoimmune disorders, radiation to the neck, neoplasms, and trauma
◆ The disorder affects men and women equally
◆ Complications include heart failure, cataracts, tetany, bone deformities, laryngospasm, and vocal cord paralysis

■ Signs and symptoms

◆ Because parathyroid glands primarily regulate calcium balance, neuromuscular signs and symptoms range from paresthesia to tetany
◆ Numbness, tingling, and cramps in the extremities may occur, along with stiffness in the hands and feet; in overt tetany, the patient may experience bronchospasm, laryngeal spasm, and carpopedal spasm
◆ Positive Chvostek's and Trousseau's signs indicate latent tetany
◆ Other signs and symptoms of the disorder include anxiety, irritability, delirium, and ECG changes

■ Diagnosis and treatment

◆ Increased serum phosphate and decreased serum calcium levels indicate hypoparathyroidism
◆ CT scan may show frontal lobe and basal ganglia calcifications
◆ X-rays show increased bone density and bone malformation
◆ Therapy aims to increase serum calcium levels to between 9 and 10 mg/dL and to eliminate symptoms
◆ Administration of parenteral parathormone helps treat acute hypoparathyroidism with functioning parathyroid glands; however, this therapy can trigger an allergic reaction

- ◆ A diet high in calcium and low in phosphorus is prescribed
- ◆ Calcium supplements and vitamin D are given

■ Nursing interventions

- ◆ Teach the patient and family about the disease and its treatment, and provide emotional support
- ◆ Obtain specimens to test for serum electrolyte levels, especially serum calcium and phosphorus levels
- ◆ Check the patient's deep tendon reflexes, and assess for Chvostek's and Trousseau's signs
- ◆ Keep calcium gluconate at the patient's bedside, and prepare to administer in an emergency
- ◆ If the patient underwent surgery, monitor his airway, and keep a tracheotomy tray at his bedside
- ◆ Advance the patient's activity and diet as tolerated; teach him and his family how to follow a high-calcium, low-phosphate diet
- ◆ Before discharge, teach the patient and his family the signs and symptoms of complications and the importance of follow-up care—including laboratory testing—to evaluate the effectiveness of therapy

❖ Hypothyroidism

■ Description

- ◆ Hypothyroidism is the diminished production of thyroid hormone, leading to thyroid insufficiency
- ◆ Primary hypothyroidism is caused by thyroid gland dysfunction; secondary hypothyroidism, from insufficient secretion of TSH by the pituitary gland
- ◆ Hypothyroidism occurs as myxedema in adults, as juvenile hypothyroidism in young children, or as congenital hypothyroidism
- ◆ Thyroid insufficiency causes decreased consciousness, hypometabolism, hypothermia, and hypoventilation
- ◆ Unrecognized and untreated congenital hypothyroidism—cretinism—can result in mental and physical retardation
- ◆ Hypothyroidism may be caused by worsening of a preexisting hypothyroid condition; insufficient thyroid hormone replacement therapy for hyperthyroidism; pituitary gland dysfunction due to infection, surgery, trauma, or tumor; autoimmune disease; iodine deficiency; and drugs (such as lithium and amiodarone)

■ Signs and symptoms

- ◆ Vital sign measurements may reveal bradycardia, decreased respiratory rate with shallow inspirations, hypotension, and hypothermia
- ◆ Hoarseness, impaired hearing, myxedema (nonpitting edema), and a puffy face, hands, and tongue may result from swelling
- ◆ Crackles may stem from pleural effusion
- ◆ Other effects may include intolerance to cold; dry, coarse skin; lethargy, stupor, or coma; menstrual irregularities; fatigue; alopecia; and brittle nails
- ◆ Signs of myxedema coma include seizures, ascites, hypothermia, pericardial effusion, and cardiogenic shock

■ Diagnosis and treatment

- ◆ Diagnostic tests may include measurement of serum TSH, T_3, and T_4, and free T_4 levels; T_3 resin uptake test; and radioisotope thyroid uptake test
- ◆ Laboratory studies may show a decreased serum T_4 level, a decreased blood glucose level, decreased plasma osmolality, a decreased TSH level (with a pituitary or hypothalamic defect) or an increased TSH level (with a thyroid defect), hyponatremia, hyperlipidemia, and lactic acidosis
- ◆ The primary treatment is lifelong replacement of the deficient hormone; synthetic levothyroxine sodium is the preferred thyroid hormone replacement and typically relieves symptoms in 2 to 3 days
- ◆ If myxedema coma develops, immediate I.V. administration of a corticosteroid, glucose, and levothyroxine sodium can reverse this life-threatening condition

■ Nursing interventions

- ◆ Administer replacement therapy as prescribed
- ◆ Avoid sedating the patient, which may further decrease respirations

- Recognize that slower metabolism may slow drug absorption and excretion
- Provide frequent skin care to prevent breakdown and decrease the risk of infection
- Administer fluids as prescribed; correct imbalances without causing fluid overload
- Monitor fluid intake and output, and weigh the patient daily to check for fluid retention
- If the patient has hypothermia, increase body temperature gradually by using warm blankets or increasing the room temperature
- Encourage coughing and deep breathing, and administer oxygen as prescribed
- Ask the patient and his family to demonstrate their understanding of the medication schedule
- Give the patient and his family opportunities to ask about the disease and its treatment
- Provide supportive care for a patient in myxedema coma; maintain a patent airway, monitor vital signs closely, and administer oxygen and I.V. fluid replacement until the patient begins to recover from the coma

❖ Pheochromocytoma

Description

- Pheochromocytoma is a tumor that usually originates from the chromaffin cells of the adrenal medulla; in a minority of patients (less than 10%), it can occur in the extra-adrenal tissue located in or near the aorta, ovaries, spleen, or other organs
- Less than 10% of tumors are malignant
- Pheochromocytoma can occur at any age, but its peak incidence is from ages 40 to 50; it affects men and women equally and has a genetic association

Signs and symptoms

- The type and severity of signs and symptoms depends on the relative proportions of epinephrine and norepinephrine secreted; approximately 8% of patients are completely asymptomatic
- In patients with hypertension, the typical triad of signs and symptoms is headache, diaphoresis, and palpitations; hypertension may be intermittent or persistent
- Other signs and symptoms may include tremor, flushing, anxiety, and hyperglycemia
- The paroxysmal form of pheochromocytoma is typically characterized by acute, unpredictable attacks that last from seconds to several hours, with symptoms typically beginning abruptly and subsiding slowly; the patient becomes extremely anxious, tremulous, and weak and may have such other symptoms as tachycardia, nausea, vomiting, diarrhea, abdominal pain, and a feeling of impending doom
- Severe hypertension can cause serious, life-threatening complications, such as cardiac arrhythmias, dissecting aneurysm, stroke, and acute renal failure
- Postural hypotension occurs in 70% of patients with untreated pheochromocytoma

Diagnosis and treatment

- Pheochromocytoma is suspected in the patient with signs of sympathetic nervous system overactivity, such as hypertension, headache, excessive sweating, hypermetabolism, and hyperglycemia
- Increased urine and plasma levels of catecholamines and metanephrine, a catecholamine metabolite, are the most direct and conclusive tests for overactivity of the adrenal medulla
- If urine and plasma tests of catecholamines are inconclusive, a clonidine suppression test can identify excess catecholamine release that bypasses normal storage and release mechanisms, a characteristic of pheochromocytoma
- Imaging studies, such as CT scanning, MRI, and ultrasonography, can localize the pheochromocytomas and determine whether the patient has more than one tumor
- Initial treatment aims to reduce blood pressure to normal levels; drugs used include alpha-adrenergic, beta-adrenergic, and calcium channel blockers and smooth muscle relaxants
- If other medications don't control blood pressure, catecholamine synthesis inhibitors such as metyrosine (Demser) may be used
- The definitive treatment for pheochromocytoma is surgical removal of the tumor; it's usually accompanied by adrenalectomy
- A patient who has undergone bilateral adrenalectomy requires corticosteroid replacement
- Postoperatively, the patient's blood pressure and catecholamine levels should return to normal; if not, he should be evaluated for retention of pheochromocytoma tissue

- Nursing interventions
  - Monitor the patient's blood pressure, and administer antihypertensive medications as ordered
  - Prepare the patient for surgery; ensure that he's well hydrated to prevent hypotension
  - Manipulation of the tumor during surgical excision may cause the release of stored epinephrine and norepinephrine, with marked increases in blood pressure and heart rate changes; monitor the patient closely
  - Administer corticosteroids as ordered to prevent adrenal insufficiency
  - Monitor for hypoglycemia
  - Collect blood and urine samples for catecholamine and metabolite testing to evaluate complete tumor removal
  - Teach the patient and family about the disease, including treatments and signs of recurrence; teach them how to monitor the patient's blood pressure at home
  - Provide emotional support to the patient and family, who may fear repeated attacks

Review questions

1. A 28-year-old woman is scheduled for a glucose tolerance test. She asks the nurse what results indicate diabetes mellitus. The nurse should respond that the minimum parameter for indication of diabetes mellitus is a 2-hour blood glucose level greater than:

❍ **A.** 120 mg/dL.

❍ **B.** 150 mg/dL.

❍ **C.** 200 mg/dL.

❍ **D.** 250 mg/dL.

Correct answer: C A glucose tolerance test indicates a diagnosis of diabetes mellitus when the 2-hour blood glucose level is greater than 200 mg/dL. Confirmation occurs when at least one subsequent result is greater than 200 mg/dL. Options A and B are incorrect because they're below the minimum parameter; Option D is incorrect because it's above the minimum parameter.

2. A patient is diagnosed with hyperthyroidism. The nurse should expect clinical signs and symptoms similar to:

❍ **A.** hypovolemic shock.

❍ **B.** sympathetic nervous system stimulation.

❍ **C.** benzodiazepine overdose.

❍ **D.** Addison's disease.

Correct answer: B Hyperthyroidism is a hypermetabolic state characterized by such signs and symptoms as anxiety, increased blood pressure, and tachycardia—all seen in sympathetic nervous system stimulation. Symptoms of hypovolemic shock (Option A), benzodiazepine overdose (Option C), and Addison's disease (Option D) are more similar to a hypometabolic state.

3. A patient with thyroid cancer undergoes a thyroidectomy. After surgery, the patient develops peripheral numbness and tingling and muscle twitching and spasms. The nurse should expect to administer:

❍ **A.** a thyroid supplement.

❍ **B.** an antispasmodic.

❍ **C.** a barbiturate.

❍ **D.** I.V. calcium gluconate.

Correct answer: D Damage to the parathyroid glands during thyroidectomy can cause hyposecretion of parathyroid hormone, leading to calcium deficiency. Symptoms of calcium deficiency include muscle spasms, numbness, and tingling. Treatment includes immediate I.V. administration of calcium gluconate. Thyroid supplementation (Option A) is necessary following thyroidectomy but isn't specifically related to the identified problem. An antispasmodic (Option B) doesn't treat the problem. A barbiturate (Option C) isn't indicated.

4. A patient with intractable asthma develops Cushing's syndrome. Development of this complication can most likely be attributed to long-term or excessive use of:

- ○ **A.** prednisone.
- ○ **B.** theophylline.
- ○ **C.** metaproterenol (Alupent).
- ○ **D.** cromolyn (Intal).

Correct answer: A Cushing's syndrome results from long-term or excessive use of a glucocorticoid such as prednisone. Theophylline (Option B), metaproterenol (Option C), and cromolyn (Option D) don't cause Cushing's syndrome.

5. Which nursing diagnosis is most likely for a patient with an acute episode of diabetes insipidus?

- ○ **A.** Imbalanced nutrition: More than body requirements
- ○ **B.** Deficient fluid volume
- ○ **C.** Impaired gas exchange
- ○ **D.** Ineffective tissue perfusion: Cardiopulmonary

Correct answer: B Diabetes insipidus causes a pronounced loss of intravascular volume; therefore, the most prominent risk to the patient is deficient fluid volume. The patient is at risk for imbalanced nutrition, impaired gas exchange, and ineffective tissue perfusion (Options A, C, and D), but these risks stem from the deficient fluid volume.

6. A patient presents with diaphoresis, palpitations, jitters, and tachycardia approximately 1½ hours after taking his regular morning insulin. Which treatment option is appropriate for this patient?

- ○ **A.** Blood glucose level monitoring and carbohydrate administration
- ○ **B.** Nitroglycerin administration and ECG
- ○ **C.** Pulse oximetry monitoring and oxygen therapy
- ○ **D.** Salt restriction, diuretic administration, and paracentesis

Correct answer: A The patient is experiencing signs and symptoms of hypoglycemia. It's appropriate to monitor his blood glucose level and administer carbohydrates to increase his blood glucose level. Nitroglycerin administration and ECG (Option B) are treatments for MI. Monitoring the patient's pulse oximetry and providing oxygen therapy (Option C) won't increase the patient's blood glucose level. Salt restriction, diuretic administration, and paracentesis (Option D) are treatments for ascites.

7. When teaching a newly diagnosed diabetic patient about diet and exercise, the nurse should teach the patient how to:

- ○ **A.** use fiber laxatives and bulk-forming agents.
- ○ **B.** manage fluids, proteins, and electrolytes.
- ○ **C.** reduce calorie intake before exercising.
- ○ **D.** manage caloric goals, diet, and physical activity.

Correct answer: D Diabetic patients must be taught to manage caloric goals, diet, and physical activity. Fiber laxatives and bulk-forming agents (Option A) are treatments for constipation. Managing fluids, proteins, and electrolytes (Option B) is important for a patient with acute renal failure. The diabetic patient may need additional calories—not reduced calories (Option C)—before exercising.

8. A 52-year-old patient reports weight gain and fatigue. On assessment, her vital signs are a blood pressure of 120/74 mm Hg, a pulse rate of 52 beats/minute, a respiratory rate of 20 breaths/minute, and a temperature of 98° F (36.7° C). Laboratory results show low T_4 and T_3 levels. The nurse knows these signs and symptoms are associated with which condition?

- ○ **A.** Tetany
- ○ **B.** Hypothyroidism
- ○ **C.** Hyperthyroidism
- ○ **D.** Hypokalemia

Correct answer: B Weight gain, fatigue, and a slow pulse rate, along with decreased levels of T_3 and T_4—thyroid hormones that affect growth and development as well as metabolic rate–indicate hypothyroidism. Tetany (Option A) causes low calcium levels. Hyperthyroidism (Option C) results in increased levels of the T_3 and T_4. Hypokalemia (Option D) is defined as a low potassium level.

9. A patient is admitted with a diagnosis of hyperparathyroidism. Which of the following signs would the nurse expect to find?

- ○ **A.** Bulging eyes
- ○ **B.** Renal calculi
- ○ **C.** Weight gain
- ○ **D.** Weight loss

Correct answer: B Hyperparathyroidism is overproduction of parathyroid hormone, characterized by bone calcification or renal calculi. Bulging eyes (Option A) and weight loss (Option D) are signs of hyperthyroidism, and weight gain (Option C) is a sign of hypothyroidism.

10. A 37-year-old patient complains of muscle weakness, anorexia, and darkening of his skin. The nurse reviews his laboratory data and notes findings of low serum sodium and high serum potassium levels. The nurse recognizes that these signs and symptoms are associated with which condition?

- ○ **A.** Addison's disease
- ○ **B.** Cushing's syndrome
- ○ **C.** Diabetes insipidus
- ○ **D.** Thyroid storm

Correct answer: A The clinical picture of Addison's disease includes muscle weakness, anorexia, darkening of the skin's pigmentation, and low sodium and high potassium levels. Cushing's syndrome (Option B) causes obesity, "buffalo hump," "moon face," and thin extremities. Signs of diabetes insipidus (Option C) include excretion of large volumes of dilute urine, leading to hypernatremia and dehydration. Thyroid storm (Option D) can occur with severe hyperthyroidism.

CHAPTER 10

Neurologic disorders

❖ Introduction

- The nervous system is the communications center of the body
- It coordinates all sensory and motor activities essential to proper physiologic functioning; it also plays a significant role in maintaining homeostasis
- Nursing history
  - The nurse asks the patient about his *chief complaint*
    - The most common complaints concerning the neurologic system include changes in level of consciousness (LOC), confusion, memory loss, dizziness, faintness, headache, numbness and tingling in extremities, seizures, weakness, and difficulty walking or moving
    - The patient may also report a change in balance or gait
  - The nurse then questions the patient about his *present illness*
    - Ask the patient about his symptom, including when it started, associated signs and symptoms, location, radiation, intensity, duration, frequency, and precipitating and alleviating factors
    - Ask the patient about any dizziness, numbness, paralysis, seizures, tingling, tremors, or weakness
    - Question him about problems with any of his senses or with keeping his balance, swallowing, urinating, or walking
    - Ask about headaches and photophobia
    - Ask the patient how he rates his memory and ability to concentrate
    - Question him about trouble speaking or understanding people
    - Ask about difficulties reading or writing
  - The nurse asks about *medical history*
    - Question the patient about other neurologic disorders
    - Ask about chronic diseases, major illnesses, accidents, injuries, surgeries, and allergies
  - The nurse then assesses the *family history*
    - Ask about a family history of neurologic diseases, such as amyotrophic lateral sclerosis, cerebrovascular accident (stroke), migraines, and seizures
    - Question the patient about a family history of diabetes mellitus, coronary artery disease, and hypertension
  - The nurse obtains a *social history*
    - Ask about work, exercise, diet, use of recreational drugs, alcohol, and hobbies
    - Also ask about stress, support systems, and coping mechanisms
- Physical assessment
  - The nurse assesses neurologic function in these five areas: mental status and speech, cranial nerve function, sensory function, motor function, and reflexes
  - The nurse assesses *mental status* and *speech*
    - Note the patient's appearance, mannerisms, posture, facial expression, grooming, emotions, speech, and tone of voice
    - Check for orientation to person, place, and time and for memory of recent and past events
    - To test intellect, ask the patient to count backward from 100 by 7s, to read aloud, or to interpret a common proverb, and see how well he understands and follows commands
    - Describe the patient's response to verbal, motor, and sensory stimuli; use the Glasgow Coma Scale for a standardized assessment

- The nurse assesses *cranial nerve function*
  - Assess each of the 12 pairs of cranial nerves
  - Note whether the patient has motor or sensory deficits, or both
- The nurse assesses *sensory function*
  - Assess the patient for sensation to superficial pain, light touch, vibration, position, and discrimination
  - Compare the patient's responses bilaterally
- The nurse assesses *motor function*
  - To test cerebellar function, inspect muscle size, contour, and symmetry, observing the patient for abnormal movements, such as tics, tremors, and fasciculations; note coordination, gait, and balance
  - Assess the patient's muscle tone and strength
  - Compare assessment findings bilaterally
- The nurse assesses *reflexes*
  - Test the patient's deep tendon, superficial, and primitive reflexes
  - Compare the findings bilaterally

❖ Alzheimer's disease

Description

- Alzheimer's disease is a progressive, degenerative disorder of the cerebral cortex; it's irreversible
- It's associated with brain cell atrophy, decreased levels of acetylcholine, enlarged ventricles, neuritic plaques in brain tissue, and neurofibrillar tangles
- The exact cause is unknown; it may be caused by abnormal protein in the brain, environmental toxins, genetic factors (e.g., a variant of apolipoprotein E), and inadequate cerebral blood flow

Signs and symptoms

- Altered behavior and memory may include recent memory loss and impaired judgment (see *Stages of Alzheimer's disease*)
- Muscle rigidity, myoclonic jerks, and restlessness may occur
- Obsessive behaviors may develop
- The patient may develop anomia (inability to remember one's name) and aphasia (impaired ability to communicate verbally or in writing due to brain center dysfunctions)
- During the final stages, the patient loses almost all mental abilities, including self-care skills, speech, and voluntary movement

Diagnosis and treatment

- Alzheimer's disease typically is diagnosed when other dementia-producing conditions have been ruled out
- A definitive diagnosis can be made only if neuritic plaques and neurofibrillar tangles are found in the brain during a postmortem examination

Stages of Alzheimer's disease

Early stage	Intermediate stage	End stage
• Recent memory loss • Inability to learn and retain new information • Difficulty finding words • Personality changes and mood swings • Progressive difficulty performing activities of daily living	• Inability to learn and recall new information • Reduced ability to remember past events • Increased need for assistance with activities of daily living • Wandering • Agitation, hostility, or physical aggressiveness • Lack of orientation to time and place • Bladder and bowel incontinence	• Inability to walk • Total incontinence • No recent or remote memory • Inability to swallow and eat • No intelligible speech

- Treatment calls for supportive measures, such as relieving specific symptoms, providing for patient safety, and providing emotional support to the patient and family
- The anticholinergics donepezil (Aricept) and tacrine (Cognex) may improve memory in the early stages of the disease

Nursing interventions

- Make sure the patient carries identification, such as an ID card or bracelet, so that if he wanders off, he can be brought home
- Speak in calm, friendly tones; even if the patient can't understand the content of what's being said, he can perceive emotional undertones
- Give simple instructions; the patient may become frustrated trying to follow complicated directions
- Plan a full schedule of daily activities, especially music therapy and stretching to music, to facilitate sleep at night and provide diversion from an otherwise monotonous day
- Provide a quiet, calm environment. Most Alzheimer's patients can't tolerate overstimulation, including bright colors and noises
- Maintain the patient's nutritional status; the patient may not eat unless reminded to do so, may not be able to use utensils, and may need help preparing food and eating
- Assist the patient with dressing and toileting
- Give the patient and family information about Alzheimer's disease; refer family members to a local support group to enhance their ability to cope
- Provide a safe environment for the patient, and discuss with the family the possible need for a home care aide; the patient may lack the judgment to drive safely, use appliances, or manage personal finances
- As soon as a diagnosis is made, discuss the possibility of power of attorney with the patient and family
- Provide emotional support and affection; the family may be so exhausted and frustrated that they can't display affection toward the patient

❖ Amyotrophic lateral sclerosis

Description

- Amyotrophic lateral sclerosis (ALS)—also known as Lou Gehrig disease—is a chronic, rapidly progressive, and debilitating neurologic disease that's incurable and invariably fatal
- In ALS, motor neurons located in the anterior horns of the spinal column degenerate and the muscles they serve begin to atrophy
- The disease is characterized by weakness that begins in the upper extremities; it progressively involves the neck and throat, eventually leading to disability, respiratory failure, and death
- The exact cause is unknown, but factors associated with ALS include an autoimmune mechanism, viral infection, autosomal-dominant inheritance, and metabolic interference in nucleic acid production by the nerve fibers
- Factors that precipitate acute deterioration include stress, trauma, infections, and exhaustion
- The disease affects more men than women
- Complications include respiratory infections and (ultimately) respiratory failure, complications of immobility, and aspiration

Signs and symptoms

- Signs and symptoms include twitching and involuntary movements accompanied by atrophy and weakness in the muscles of the forearms, hands, legs, and trunk
- Focal wasting of muscle groups also occurs
- The patient may have slurred speech, difficulty chewing and swallowing, and drooling
- Other symptoms include dyspnea and shortness of breath

Diagnosis and treatment

- Levels of glutamate in cerebrospinal fluid (CSF) and serum are increased
- Electromyography and muscle biopsy may help diagnosis ALS
- Treatment is supportive and aims to prevent complications; rehabilitative measures include occupational, physical, and speech therapy

- High treatment priorities include airway protection and preventing aspiration and respiratory infections; patients may ultimately need mechanical ventilation
- Muscle relaxants, mucolytics, antidepressants, and anxiolytics may be used
- Riluzole, a glutamate antagonist, may help slow disease progression

■ Nursing interventions

- Implement a rehabilitation program that helps the patient maintain as much independence as he can for as long as possible
- Help obtain supportive equipment, such as a walker or wheelchair, as needed
- Prevent complications of immobility; help the patient change position frequently and perform active range-of-motion (ROM) activities
- Monitor the patient's respiratory status, and provide supplemental oxygen as needed
- Initiate a diet of easy-to-swallow soft foods, and monitor for potential aspiration
- Provide supportive care to both the patient and family, and teach them about the disease process and treatment options

❖ Arteriovenous malformations

■ Description

- Arteriovenous malformations (AVMs) are tangled masses of thin-walled, dilated blood vessels that form abnormal connections between arteries and veins; AVMs range in size from a few millimeters to large malformations that extend from the cerebral cortex to the ventricles; typically, more than one AVM is present
- AVMs are primarily located in the posterior portion of the cerebral hemispheres
- Most AVMs result from congenital defects in capillary development; traumatic injury may also be a cause
- Most AVMs are present at birth; however, symptoms typically don't occur until young adulthood
- Typically, high-pressured arterial flow moves into the venous system through the connecting channels to increase venous pressure, engorging and dilating the venous structures
- If the AVM is large enough, the shunting can deprive the surrounding tissue of adequate blood flow
- Thin-walled vessels may develop aneurysms and ooze small amounts of blood or actually rupture, causing hemorrhage into the brain or subarachnoid space

■ Signs and symptoms

- AVMs can cause persistent headaches unresponsive to treatment
- Other signs and symptoms include changes in mental status and intellectual acuity, dizziness, and visual disturbances
- Seizures and neurologic deficits may also occur

■ Diagnosis and treatment

- Cerebral arteriography confirms the presence of AVMs and evaluates blood flow
- Doppler ultrasonography of the cerebrovascular system indicates abnormal, turbulent blood flow
- Computed tomography (CT) scanning and magnetic resonance imaging (MRI) can help differentiate an AVM from a clot or tumor
- EEG can help localize the AVM
- Treatment depends on the size and location of the AVM, the feeder vessels supplying it, and the patient's condition
- Treatments include embolization, proton-beam radioablation, laser surgery, and surgical excision

■ Nursing interventions

- Provide supportive measures, including aneurysm precautions (placing the patient on bed rest or with limited activity, maintaining a quiet atmosphere, and keeping the patient calm [with sedatives, if needed]) to prevent possible rupture
- Institute seizure precautions, and monitor for signs of increased intracranial pressure
- Prepare for surgery, and administer I.V. fluids and medications as ordered
- Postoperatively, control hypertension, monitor the patient's neurologic status, and provide pain relief
- Teach the patient and family about the disorder, including the signs and symptoms of complications
- If the patient develops deficits from the AVM, provide for adaptive measures

❖ Encephalitis

- Description
  - Encephalitis is a severe, acute inflammation of the brain
  - In this disorder, intense lymphocytic infiltration of brain tissues and the leptomeninges results in cerebral edema, degeneration of the brain's ganglion cells, and diffuse nerve cell destruction (gray more than white matter)
  - Causes include adenoviruses, enteroviruses in urban areas (such as coxsackievirus, poliovirus, and echovirus), herpesvirus, human immunodeficiency virus, arboviruses, mumps and measles viruses, and amebic infection
  - Determining the true incidence of encephalitis is difficult because reporting policies vary
  - Males and females appear to be affected equally; the very young and very old are at highest risk
  - Some seasonal variation occurs, with arborviruses typically occurring in spring and summer, enteroviruses peaking in later summer or early fall, and mumps and varicella occurring in spring
  - Complications may include paralysis, epilepsy, mental deterioration, parkinsonism, and death
- Signs and symptoms
  - Signs and symptoms include fever, malaise, myalgias, headache, muscle stiffness, photophobia
  - Altered LOC, confusion, seizures, and other signs of increased ICP can all occur
  - Other signs and symptoms include nausea and vomiting, exaggerated deep tendon reflexes and absent superficial reflexes, paresis or paralysis of the extremities, and a positive Brudzinski's sign
  - Certain anthropoid-borne viruses may cause a rash
- Diagnosis and treatment
  - CSF may contain elevated white blood cell and protein levels and decreased glucose levels; the causative organism may also be cultured from CSF
  - Antibodies to certain viruses may be present in serum
  - MRI may demonstrate inflammation in affected areas in the brain
  - EEG shows changes in encephalitis
  - Treatment focuses on correcting the underlying cause and preventing injury from increased ICP
- Nursing interventions
  - Monitor for signs of increasing ICP to allow for early control and management
  - Administer nonopioid analgesics, and provide a quiet, nonstimulating environment
  - Administer anti-infective agents as ordered, and watch for therapy-related complications
  - Administer antipyretics and antiseizure medications as ordered
  - Teach the patient and family about the disease process and treatment, and provide supportive care

❖ Guillain-Barré syndrome

- Description
  - Guillain-Barré syndrome is an acute, rapidly progressing, and potentially fatal form of polyneuritis
  - In this syndrome, the body's autoimmune system attacks peripheral nerve myelin, resulting in rapid segmental demyelination of peripheral nerves and some cranial nerves; this produces ascending weakness with dyskinesias (inability to execute voluntary movements), hyporeflexia, and paresthesias
  - A viral infection often precedes the clinical presentation
  - Guillain-Barré syndrome is the most common cause of acute flaccid paralysis in the United States; it most often affects males between the ages of 16 to 25 and 45 to 60
  - The syndrome has a mortality rate of about 5%; up to 75% of patients recover completely over the course of a few months to several years
  - Complications include paralysis, permanent muscle weakness, contractures, muscle wasting, and respiratory and cardiac compromise
- Signs and symptoms
  - Minor febrile illness (respiratory or diarrheal) may precede signs and symptoms of Guillain-Barré by 1 to 3 weeks
  - Symptoms of Guillain-Barré include tingling and numbness (paresthesia) in the legs; symptom progress to the arms, trunk and, finally, the face

- Other signs and symptoms include stiffness and pain in the legs and back; acute, symmetrical ascending weakness of the limbs; sensory loss, usually in the legs and spreading to the arms; difficulty talking, chewing, and swallowing; paralysis of the ocular, facial, and oropharyngeal muscles; loss of position sense; and diminished or absent deep tendon reflexes

Diagnosis and treatment

- CSF shows elevated protein levels
- Evoked potential studies may show a progressive loss of nerve conduction velocity
- Because Guillain-Barré is a medical emergency, with rapid progression and neuromuscular respiratory failure, treatment may include aggressive respiratory therapy and mechanical ventilation along with oxygen support
- Treatment includes supportive hemodynamic measures
- The patient may also require plasmapheresis

Nursing interventions

- Monitor the patient's cardiac and respiratory status
- Administer oxygen as needed
- If possible, establish a means of communication before the patient requires intubation
- Monitor the patient's intake and output
- Take measures to prevent complications of immobility, such as deep vein thrombosis, pressure ulcer formation, and muscle wasting
- Provide adequate nutrition
- Provide supportive care to the patient and family

❖ Head trauma

Description

- Head trauma, a term that encompasses several types of injuries, is the leading cause of disability
- Head trauma is a general term for injuries to the head, ranging from a minor concussion to life-threatening hematoma and herniation
- Primary injuries are directly caused by the trauma; secondary injuries are indirectly caused by the trauma (see *Types of head injury*, page 172)

Signs and symptoms

- Depending on the severity and location of the injury, the patient will have varying neurologic deficits, such as motor and sensory changes, pupillary changes, reduced LOC, and seizures
- If the patient has increased ICP, he may experience bradycardia, decerebrate or decorticate posturing, focal neurologic signs, headache, increased blood pressure, pupillary changes (including sluggish or absent response to light and unequal size), reduced LOC (including agitation, coma, confusion, lethargy, and restlessness), seizures, vomiting, and widened pulse pressure
- If CSF leakage occurs, the patient may experience frequent swallowing, otorrhea, and rhinorrhea

Diagnosis and treatment

- Diagnosis may be based on skull X-ray, CT scan of the head and cervical spine, MRI, lumbar puncture, cerebral angiography, and EEG
- A cervical collar may be placed on the patient's neck until a cervical injury is ruled out
- Treatment depends on the severity of the injury
  - For a concussion, neurologic function is monitored for 24 hours
  - For a contusion, neurologic function is monitored in a controlled environment for possibly increased ICP
  - For laceration, diagnostic procedures are implemented for early identification of secondary injuries
- Continuous ICP monitoring may be indicated
- If present, clots are removed surgically; hematomas may need to be evacuated; in the presence of hydrocephalus, a drain may be placed in the ventricles
- Supportive measures—such as drug therapy for increased ICP (see *Increased intracranial pressure*, page 175), intubation and mechanical ventilation, invasive hemodynamic monitoring, and invasive ICP monitoring—are initiated

Types of head injury

Primary and secondary head injuries result from trauma in different ways.

Injury	Description	Mechanisms
Primary injuries		
Concussion	Brief period of cerebral paralysis; full recovery usually occurs in 12 hours, but post-concussion syndrome (characterized by difficulty concentrating, fatigue, headache, and photophobia) sometimes occurs	Sudden blow to the head that causes anterograde and retrograde brain injury
Contusion	Bruising of the brain; may be a *coup* injury (hemorrhage and edema under the injury site) or a *contrecoup* injury (hemorrhage and edema opposite from the injury site)	Sudden impact, commonly resulting from acceleration-deceleration forces, that displaces cerebrospinal fluid and causes the brain to hit the inside of the skull
Laceration	Tearing of the cortical surface	High-velocity acceleration-deceleration injury or a penetrating trauma, such as a stab wound or gunshot wound
Secondary injuries		
Cerebellar herniation	Pushing of the cerebellar tonsils through the foramen magnum	Force that pushes the brain contents into another compartment, compressing the medulla
Epidural hemorrhage or hematoma	Arterial bleeding between the dura and the skull; initially causes loss of consciousness, followed by a brief lucid period and progressive neurologic deterioration	Tearing of the medial meningeal artery by a temporal bone fracture
Intracerebral hemorrhage or hematoma	Bleeding within the cerebrum; may lead to increased intracranial pressure and permanent neurologic damage	Contusion or laceration
Subarachnoid hemorrhage or hematoma	Arterial bleeding in the subarachnoid space; sudden symptoms can include chills, decreased level of consciousness, diaphoresis, dizziness, nausea, severe headache, and vomiting	Force that causes bleeding immediately or long after an injury
Subdural hemorrhage	Venous bleeding between the dura and arachnoid membrane	Acute process (causing symptoms within 48 hours of injury), subacute process (causing symptoms within 2 to 14 days), or chronic process (causing symptoms 2 or more weeks after the injury)
Supratentorial (central) herniation	Pushing of the cerebral ventricles through the incisura of tentorium	Force, such as a supratentorial mass, that pushes the brain contents into another compartment, compressing the diencephalon and midbrain
Uncal (lateral transtentorial) herniation	Shifting of the temporal lobe across the tentorium into the posterior fossa	Force that shifts the brain contents into another compartment, compressing the midbrain and brain stem

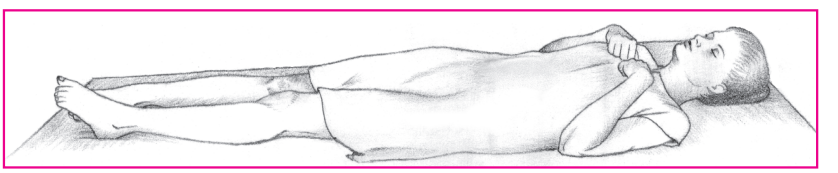
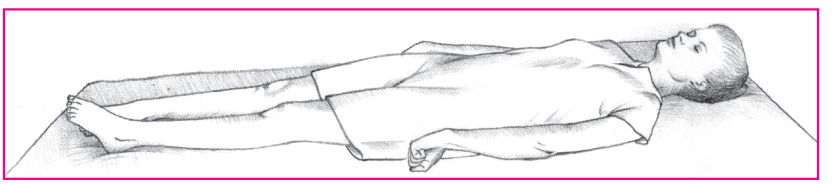
- Nursing interventions
  - Monitor vital signs every 15 minutes until the patient's condition is stable to detect increased ICP
  - Perform neurologic assessments every 15 minutes until the patient's condition is stable to detect increased ICP; assess LOC according to the Glasgow Coma Scale (see *Using the Glasgow Coma Scale,* page 174)
  - Initiate I.V. therapy while strictly monitoring intake and output to maintain hydration and prevent cerebral edema
    - Excessive urine output may indicate diabetes insipidus (antidiuretic hormone deficiency) due to pituitary gland damage; it's treated with vasopressin
    - Fluid retention may indicate syndrome of inappropriate antidiuretic hormone (SIADH) due to craniocerebral trauma; it's treated with fluid restriction
  - Provide respiratory care to maintain a patent airway and adequate ventilation; turn and encourage frequent deep breathing in a nonintubated patient, suction an intubated patient, and remember that hypoxemia and hypercapnia increase ICP
  - Provide a safe, quiet, dimly lit environment
  - Take seizure precautions and keep emergency equipment nearby; a patient with head trauma is at risk for seizures and respiratory insufficiency
  - Provide bed rest with positioning appropriate to the injury
    - Elevate the head of the bed as prescribed to reduce cerebral edema; immediately after cranial surgery, the patient may need to lie in a supine position for 24 hours; early elevation of the head of the bed after infratentorial craniotomy can increase the risk of postoperative herniation
    - Change the patient's position frequently to prevent complications stemming from immobility, and position him accordingly to prevent deformity
  - Watch for signs of acute respiratory distress syndrome and traumatic delirium; if the patient experienced an open head injury, look for signs of infection, which could point to meningitis or brain abscess
  - Initiate ROM exercises (unless contraindicated by increased ICP) to prevent complications of immobility
  - Provide appropriate nutritional support, including enteral or parenteral feedings if the patient can't eat; nutritional deficits impede healing and lead to muscle wasting; check cough and gag reflexes to prevent aspiration
  - Provide emotional support to the patient and his family; remember that the injury may be fatal or severely alter the patient's lifestyle and that the patient may require extensive rehabilitation

❖ Huntington's disease

- Description
  - Huntington's disease (also called Huntington's chorea, hereditary chorea, chronic progressive chorea, and adult chorea) is a degenerative disease of the brain that causes dementia
  - Death usually occurs 10 to 15 years after the onset of the disease
  - Degeneration in the cerebral cortex and basal ganglia leads to chronic progressive chorea (dancelike movements); the exact disease mechanism is still under investigation
  - It's transmitted as an autosomal-dominant trait (transmitted and inherited by either sex)
  - About 1 in every 10,000 people of both sexes and all races may develop Huntington's disease in midlife; the juvenile form of the disease typically occurs before age 20
- Signs and symptoms
  - Huntington's disease is characterized by abnormal, involuntary body movements and, often, emotional disturbances
  - As the disease progresses, patients develop a constant writhing, twisting, uncontrollable series of movements that may involve the entire body, including the face, resulting in tics and grimaces; the gait is also affected
  - Speech becomes slurred, hesitant, and explosive
  - Chewing and swallowing become difficult
  - Patients lose bowel and bladder function
  - Personality changes occur, with impairment progressing until dementia ensues

Using the Glasgow Coma Scale

The Glasgow Coma Scale provides an easy way to describe a patient's baseline mental status and to help detect and interpret changes from baseline findings. To use the scale, test the patient's ability to respond to verbal, motor, and sensory stimulation and grade your findings according to the scale. If a patient is alert, can follow simple commands, and is oriented to person, place, and time, his score will total 15 points, the highest possible score. A low score in one or more categories may signal an impending neurologic crisis. A total score of 7 or less indicates severe neurologic damage.

Test	Score	Patient's response
Eye opening response		
Spontaneously	4	Opens eyes spontaneously
To speech	3	Opens eyes when told to
To pain	2	Opens eyes only on painful stimulus
Never	1	Doesn't open eyes in response to stimulus
Motor response		
Obeys commands	6	Shows two fingers when asked
Localizes pain	5	Reaches toward painful stimulus and tries to remove it
Withdraws	4	Moves away from painful stimulus
Abnormal flexion	3	Assumes a decorticate posture (in which the hands are toward the cord, shown below)
		
Abnormal extension	2	Assumes a decerebrate posture (shown below)
		
None	1	No response; just lies flaccid (an ominous sign)
Verbal response		
Oriented	5	Tells correct date
Confused conversation	4	Tells incorrect year
Inappropriate words	3	Replies randomly with incorrect words
Incomprehensible	2	Moans or screams
None	1	No response
Total score		

- Diagnosis and treatment
  - Diagnosis depends on the patient's clinical presentation, a positive family history or a genetic marker, and the exclusion of other diagnoses
  - CT scans and MRI reveal brain atrophy
  - Positron-emission tomography scans may show reduced glucose use and lowered dopamine receptor binding
  - Because no known cure exists, treatment aims to control signs and symptoms
  - Tranquilizers and antidepressants may be used along with psychotherapy
  - Thiothixene hydrochloride (Navane) and haloperidol decanoate (Haldol) block dopamine receptors and may improve chorea in some patients
  - Levodopa and other antiparkinsonian medications may be used for patients with rigidity
- Nursing interventions
  - Provide psychological support to the patient and family; allow them time to verbalize their concerns and feelings, and assist with positive coping strategies
  - Identify self-care deficits; assist with activities of daily living as necessary, and encourage the patient's participation as much as possible
  - Encourage the patient to be independent
  - Provide communication aids, speak slowly and clearly to the patient, allow time for the patient to respond, and ensure that the patient has understood what was said
  - Provide assistance with ambulation; encourage the use of assistive devices, such as a cane or walker, as indicated
  - If the patient is on bed rest, maintain a turning schedule, repositioning the patient at least every 2 hours; pad bony prominences, perform passive ROM exercises on the extremities to maintain joint function and mobility, and encourage the patient to participate as able
  - Provide adequate nutrition and provide for increased calorie needs
  - Elevate the head of the bed while the patient is eating to help prevent choking and aspiration
  - Give medications as ordered
  - Monitor the patient's mental status, and be alert for neurologic changes

❖ Increased intracranial pressure

- Description
  - ICP is a measure of the pressure in the cranial cavity; 0 to 15 mm Hg is normal, 16 to 20 mm Hg is mildly elevated, 21 to 30 mm Hg is moderately elevated, and 31 mm Hg or more is severely elevated
  - The adult skull has a fixed volume of intracranial components, which consist of 80% brain tissue, 10% blood, and 10% CSF
    - According to the Monro-Kellie doctrine, an increase in any of the three components must be offset by a decrease in the others
    - If this balancing out doesn't occur, ICP increases
  - Autoregulation adjusts cerebral blood flow and CSF production and reabsorption to maintain normal ICP; it can no longer maintain normal pressure when ICP exceeds 33 mm Hg or the mean arterial pressure (MAP) exceeds 160 mm Hg
  - Cerebral perfusion pressure (CPP) is the pressure at which the brain cells are perfused; CPP = MAP – ICP; CPP is normally 70 to 100 mm Hg
  - Several factors may increase ICP: cerebral edema resulting from infection, intracranial or subarachnoid bleeding, or brain tumor; cytotoxic cerebral edema resulting from a metabolic disorder; interstitial cerebral edema caused by blocked CSF reabsorption; intracranial or subarachnoid bleeding; or vasogenic cerebral edema caused by trauma
- Signs and symptoms
  - An altered LOC is usually the earliest sign of increased ICP
    - The patient may exhibit partial or total loss of motor and sensory function
    - Pupillary changes may occur, such as unequal size, constriction, dilation, or reduced or absent responses to light
    - Cushing's triad (bradycardia, bradypnea, and hypertension) is a late sign of increased ICP

- Other signs and symptoms include changes in respiratory patterns, headache, seizures, vomiting, and a widening pulse pressure

■ Diagnosis and treatment

- Diagnosis is based on CT scan, skull X-rays, and ICP monitoring
- The goal of treatment is to normalize ICP and avoid complications, such as brain herniation, diabetes insipidus, and SIADH
- Pressures are carefully monitored by means of epidural monitoring, subarachnoid screw and bolt, or intraventricular monitoring
- CSF blockage is corrected by surgical placement of shunts; a tumor or hematoma also is removed surgically; craniectomy or burr holes may be required for decompression
- Drug therapy may include an antibiotic to treat or prevent infection, an anticonvulsant to prevent seizures, and a diuretic to prevent cerebral edema
- Hyperventilation therapy is used to reduce the partial pressure of carbon dioxide in arterial blood level, which decreases cerebral edema and ICP
- Metabolic disorders are corrected
- Lumbar puncture is contraindicated in a patient with increased ICP because it can cause life-threatening herniation (shifting of brain contents into another compartment)

■ Nursing interventions

- Provide bed rest, with the head of the bed elevated 30 to 45 degrees to promote venous drainage from the cranium
- Avoid neck extension, flexion, and rotation to promote optimal venous drainage
- Avoid hip flexion above 60 degrees, which can lead to increased intra-abdominal pressure that increases ICP
- Monitor and document fluid intake and output until the patient's condition is stable to ensure proper hydration
  - Excessive urine output may indicate diabetes insipidus due to posterior pituitary gland damage; it's treated with vasopressin
  - Fluid retention may indicate SIADH due to craniocerebral trauma; it's treated with fluid restriction
- Slowly infuse I.V. bolus medications; rapid infusion can trigger an abrupt increase in brain fluid volume
- Administer an analgesic, an antibiotic, an anticonvulsant, and a diuretic as prescribed
- Perform neurologic assessments hourly until the patient's condition is stable to help prevent complications, and then every 4 hours or as prescribed; watch for changes in LOC and motor responses using the Glasgow Coma Scale (see *Using the Glasgow Coma Scale*, page 174)
- Monitor vital signs hourly until the patient's condition is stable
- Monitor the patient for signs of bleeding and hypovolemia—for example, by checking stools, urine, and vomitus for occult blood; systemic bleeding may signal coagulopathy, which increases the risk of intracranial bleeding
- Place pads loosely over the ears or under the nose to absorb leaking CSF (a clear liquid that leaves yellow halos on linen and tests positive for glucose); change pads frequently to prevent pathogens from migrating through the CSF to the brain
- Use aseptic technique to prevent systemic or intracranial infection, which increases the risk of further increases in ICP
- Closely monitor respiratory status by auscultating breath sounds and checking tissue oxygenation with noninvasive pulse oximeters; encourage deep breathing
  - Hypoxemia and hypercapnia further elevate ICP; coughing and inspired spirometry temporarily increase ICP
  - Bed rest and altered LOC increase the risks of atelectasis and pneumonia
- Assist with turning in bed, and teach the patient to breathe while moving to avoid straining, which can increase ICP
- Maintain a quiet environment: limit noise, light, visitors, and emotional stress; overstimulation can increase ICP

- ◆ Provide nutritional support as appropriate to maintain normal fluid and electrolyte balance; tube feedings may be required
- ◆ Teach the patient to avoid performing Valsalva's maneuver; also, tell him to avoid coughing, holding his breath while lifting, sneezing, straining during defecation, and vomiting; all of these actions increase ICP
- ◆ Provide emotional support to the patient and his family

❖ Meningitis

■ Description

- ◆ Meningitis is an inflammation of the subarachnoid space and meninges; it can be classified as septic (caused by bacterial infection) or aseptic (caused by viral infection)
- ◆ Exudate formation causes meningeal irritation and increased ICP
- ◆ Meningococcal meningitis is caused by *Neisseria meningitidis,* a highly contagious organism
- ◆ *Haemophilus influenzae* meningitis is the most common bacterial meningitis in infants and children
- ◆ Pneumococcal meningitis is caused by *Streptococcus pneumoniae;* it can be a severe complication of an upper respiratory tract infection, is the most common type of meningitis after neurosurgery, and has a high mortality rate
- ◆ Tuberculous meningitis is a bacterial infection caused by *Mycobacterium tuberculosis;* it's generally self-limiting and benign
- ◆ Infecting organisms gain entry to the subarachnoid space through basilar skull fractures with dural tears, chronic otitis media or sinusitis, neurosurgical contamination, penetrating head wounds, septicemia, or bloodstream infections

■ Signs and symptoms

- ◆ The cardinal signs and symptoms of meningitis are those of infection (including chills, fever, and malaise) and those of increased ICP (including headache and vomiting)
- ◆ Other signs and symptoms include changes in LOC, irritability, and seizures
- ◆ Signs and symptoms of brain and spinal cord irritation may include Brudzinski's sign (leg adduction and flexion when the neck is flexed), Kernig's sign (resistance to extension when thigh is flexed up to the abdomen), nuchal rigidity, and severe headache
- ◆ Irritation of cranial nerve (CN) II may cause blindness and papilledema; of CN III, IV, and VI, diplopia, impaired ocular movement, ptosis, and unequal pupils; of CN V, photophobia; of CN VII, facial paresis; and of CN VIII, tinnitus or deafness and vertigo

■ Diagnosis and treatment

- ◆ Diagnosis may be based on physical examination findings and the results of lumbar puncture, serologic studies, and cultures of blood, urine, nasal or pharyngeal mucosa, sputum, and skin lesions
- ◆ Meningitis is treated with organism-specific antibiotic therapy
- ◆ An anticonvulsant may be administered to decrease the risk of seizures; an analgesic may be given to reduce headache, which is common with meningitis
- ◆ Prophylactic antibiotic therapy may be prescribed for family members and other people who have had close contact with a patient who has bacterial meningitis
- ◆ Supportive measures include reducing fever, ensuring adequate hydration and nutrition, providing mechanical ventilation, if necessary, and preventing and treating increased ICP

■ Nursing interventions

- ◆ Perform neurologic examinations, and check vital signs hourly; early detection of increased ICP, hyperthermia, hydrocephalus, and shock can help prevent complications
- ◆ Implement isolation techniques if the causative agent is highly contagious; bacterial meningitis is transmitted by direct and sometimes indirect contact with respiratory droplets from infected people and carriers
- ◆ Report meningococcal meningitis to local health authorities; report other bacterial meningitis in endemic areas only
- ◆ Monitor fluid intake and output to prevent overhydration, which can lead to cerebral edema and increased ICP

- ◆ Provide nutritional support to maintain immune response and fluid and electrolyte balance; enteral feedings may be required
- ◆ Provide proper positioning, skin care, and ROM exercises to prevent complications of immobility, such as contracture deformities, muscle wasting, pneumonia, and pressure ulcers
- ◆ Provide a comfortable, quiet, dimly lit environment to help prevent seizures and to reduce the discomfort of photophobia
- ◆ Give emotional support to the patient and family
- ◆ Provide referrals for rehabilitation if neurologic deficits are permanent

❖ Multiple sclerosis

■ Description

- ◆ Multiple sclerosis is a progressive neurologic disease caused by destruction, injury, or malformation of the myelin sheaths that cover nerves
- ◆ Plaques (areas of demyelination) can occur anywhere in the nervous system but are most common on the white matter of the brain and spinal cord and the optic nerves; plaques slow or stop saltatory conduction, the normally rapid conduction of nerve impulses
- ◆ Although the exact cause is unknown, multiple sclerosis may be triggered by a slow, progressive viral disease; an autoimmune disorder; or an allergic reaction to an infection
- ◆ Multiple sclerosis is characterized by unpredictable exacerbations and remissions; symptoms worsen with each episode

■ Signs and symptoms

- ◆ Symptoms of multiple sclerosis may be transient, variable, and bizarre
- ◆ The first symptoms are usually sensory and visual problems, such as burning, electrical sensations, and pins and needles
- ◆ Ocular disturbances may include blurred vision, diplopia, nystagmus, ophthalmoplegia, and optic neuritis
- ◆ Muscle dysfunction—including gait ataxia, hyperreflexia, intention tremor, paralysis ranging from monoplegia to quadriplegia, spasticity, and weakness—may also occur
- ◆ Urinary disturbances may include frequency, incontinence, urgency, and frequent infections
- ◆ Bowel problems include constipation and involuntary evacuation
- ◆ Fatigue is usually the most debilitating symptom; speech disturbance may also occur

■ Diagnosis and treatment

- ◆ Diagnostic tests may include lumbar puncture, CT scan, evoked response, and MRI of the brain and spinal cord to detect plaques from multiple sclerosis; optic atrophy typically is present, and evoked potential of the brain stem and rolandic somatosensory responses may be abnormal
- ◆ Because multiple sclerosis has no cure, treatment aims to decrease the length and severity of exacerbations and diminish or reverse the deficits caused by exacerbations
- ◆ Drug therapy consists of a corticosteroid and a muscle relaxant; interferon beta-1b may be used to reduce the frequency of exacerbations in patients with relapsing-remitting multiple sclerosis; glatiramer acetate may also be helpful in reducing the frequency of relapses in such patients
- ◆ Occupational, physical, and speech therapies and nutritional counseling are used to help the patient manage the disorder's effects
- ◆ The patient may also need home care, or he may need to stay in an extended-care facility

■ Nursing interventions

- ◆ Teach the patient and his family about the disease and strategies for avoiding stress, fatigue, and infections, factors that can exacerbate it
- ◆ Administer carbamazepine, phenytoin, or amitriptyline to control pain from dysesthesias or other pain syndromes such as trigeminal neuralgia; transcutaneous electrical nerve stimulation and alternative measures such as relaxation techniques can also help
- ◆ Encourage the patient to participate in physical therapy to maintain muscle strength and decrease spasms
- ◆ Encourage the patient to eat a balanced diet to maintain proper functioning of the immune system and avoid constipation

- Initiate bowel and bladder training; loss of muscle and sphincter tone may require self-catheterization and daily suppositories
- Encourage good respiratory hygiene; tell the patient and family to contact the health care provider if the patient develops dyspnea, shortness of breath, or pulmonary infection
- Teach the patient and caregivers how to prevent complications of immobility; if bed rest or a wheelchair is required, discuss transfer techniques and proper turning and positioning to prevent deformity
- Develop alternative forms of communication for use during exacerbations, such as eyelid blinking or using letter or picture boards
- Teach the patient to alternate rest and activity, avoid temperature extremes, and reduce stress
- Refer the patient to a support group or a local chapter of the Multiple Sclerosis Society

❖ Myasthenia gravis

Description

- Myasthenia gravis is a chronic autoimmune disorder of neuromuscular transmission characterized by extreme, abnormal muscle weakness during activity; weakness can be relieved by rest
- It may be caused by a defect of the postsynaptic receptor sites or acetylcholine deficiency
- It affects neuromuscular transmission at the myoneural junction, leaving sensation intact and preventing muscle atrophy

Signs and symptoms

- The dominant symptoms of myasthenia gravis are skeletal muscle fatigability and weakness; typically, muscles are strongest in the morning but weaken throughout the day, especially after exercise
- The first indications may include weak eye closure, diplopia, and ptosis
- The face may be blank and expressionless; the voice, nasal
- The patient experiences difficulty chewing and swallowing
- Weakened respiratory muscles may make breathing difficult, leading to respiratory distress

Diagnosis and treatment

- Diagnostic tests may include thymus scan (to rule out the presence of thymoma and thymic hyperplasia, both of which are associated with myasthenia gravis), chest X-ray, thyroid studies, electromyography, and the Tensilon test (to evaluate muscle contractility); if the Tensilon test is inconclusive, a neostigmine test is done
- An anticholinesterase alleviates symptoms but is ineffective during a crisis
- Corticosteroid and immunosuppressive therapy and thymectomy (if thymomas are present) may alter the course of the disease
- Plasmapheresis may relieve symptoms; it may be used to prepare the patient for thymectomy and during a respiratory crisis
- Ventilator support may be needed during a myasthenic crisis

Nursing interventions

- Support respiratory function, encourage coughing and deep breathing, and use nasotracheal or oral tracheal suction when necessary to keep the airway open; use mechanical ventilation or a tracheostomy tube, if prescribed
- Schedule activity 20 to 30 minutes after medication is given, when strength is greatest, and space activities to avoid fatigue
- If the patient can't chew and swallow solid food, provide a semisoft diet; make sure he doesn't choke on liquids as a result of cranial nerve weakness
- Assess the patient for signs and symptoms of myasthenic crisis, such as anxiety, fever, increased weakness, problems with chewing and swallowing, and respiratory distress
- Assess the patient for signs and symptoms of cholinergic crisis, such as abdominal cramps, bradycardia, diarrhea, dyspnea, general weakness, lacrimation, muscle cramps, myasthenic crisis, nausea, respiratory distress, salivation, sweating, vomiting, and wheezing
- Teach the patient and his family about the disease, and suggest lifestyle changes such as scheduling activities during energy peaks
- Teach the patient and his family the signs of anticholinesterase toxicity—such as diaphoresis, dyspnea, increased muscle weakness, nausea, and ptosis—to ensure prompt intervention

- Teach the patient and his family the signs of respiratory distress and failure
- Provide emotional support, and refer the patient to the Myasthenia Gravis Foundation of America

❖ Parkinson's disease

Description

- Parkinson's disease is a chronic, degenerative disease of the basal ganglia, substantia nigra, and corpus striatum of the brain; it's associated with a deficiency of the neurotransmitter dopamine
- Although the exact cause of Parkinson's disease is unknown, possible causes include exposure to a toxic agent such as carbon monoxide and manganese, genetic factors, vascular (arteriosclerotic) changes, and viral infection
- Iatrogenic Parkinson's disease can result from the use of major tranquilizers, methyldopa, and reserpine; it's generally reversible within 2 weeks of discontinuing the drug

Signs and symptoms

- Movement changes may include bradykinesia (extreme slowness of movement), cogwheel tremor or rigidity (jerky limb movement), festination (tendency to speed up each step to compensate for a displaced center of gravity), pill-rolling tremor (repeated rotary movement of the thumb and forefinger), and a slow, shuffling gait
- Other symptoms include decreased blinking; dysarthria; dysphagia; excessive drooling; micrographia (handwriting that becomes progressively smaller); oculogyric crisis (involuntary deviation and fixation of the eyeballs); slow, slurred, monotone speech; and a wide-eyed, blank facial expression

Diagnosis and treatment

- Physical examination and health history findings may be confirmed by electromyography
- Treatment aims at slowing the progression of symptoms and providing supportive care
- Antiparkinsonians are prescribed: Levodopa decreases muscle rigidity and an anticholinergic decreases rigidity and tremors
- The antiviral amantadine is used early on to reduce tremors and rigidity
- The dopamine receptor agonists bromocriptine (Parlodel), pergolide, pramipexole dihydrochloride (Mirapex), and ropinirole (Requip) activate dopamine receptors in the basal ganglia
- The monoamine oxidase type B inhibitor selegiline allows conservation of dopamine and enhances the therapeutic effect of levodopa
- The catechol-O-methyltransferase inhibitors entacapone (Comtan) and tolcapone (Tasmar) inhibit the breakdown of dopamine and may be useful as adjuncts to levodopa
- Patients may benefit from physical therapy
- Referrals may be provided for home health assistants, visiting nurses, adult day care, or nursing home placement

Nursing interventions

- Administer medications as prescribed
- Encourage physical therapy to maintain muscle function as long as possible
- Teach the patient and family about the disease and the drugs' adverse effects
- Teach the patient and family about home safety; suggest they remove throw rugs and loose carpeting and install grab bars and elevated toilet seats in the bathrooms; recommend the use of a cane or walker for a patient in the later stages of Parkinson's disease
- Teach the patient and his family about preventing constipation by encouraging adequate nutrition and hydration; stress the importance of establishing a regular pattern of elimination
- Provide emotional support for the patient and family, and refer them to Parkinson's disease support groups

❖ Seizure disorders

Description

- Seizures are sudden paroxysmal discharges of a group of neurons that interfere with normal mental and behavioral activities
- Seizures may be triggered by toxic states, electrolyte imbalances, tumors, anoxia, CNS inflammation, increased ICP, or idiopathic causes

Differentiating seizures

Seizures can be classified as partial or generalized. Some patients may be affected by more than one type.

Partial seizures

Partial seizures arise from a localized area in the brain and cause specific symptoms. In some patients, partial seizure activity spreads to the entire brain, causing a generalized seizure. Partial seizures include simple partial (Jacksonian motor-type and sensory-type), complex partial (psychomotor or temporal lobe), and secondarily generalized partial seizures.

Simple partial (Jacksonian motor-type) seizure

A simple partial seizure begins as a localized motor seizure, which is characterized by a spread of abnormal activity to adjacent areas of the brain. Typically, the patient experiences a stiffening or jerking in one extremity, accompanied by a tingling sensation in the same area. For example, the seizure may start in the thumb and spread to the entire hand and arm. The patient seldom loses consciousness, although the seizure may secondarily progress to a generalized tonic-clonic seizure.

Simple partial (sensory-type) seizure

Perception is distorted in a simple partial seizure. Symptoms can include hallucinations, flashing lights, tingling sensations, a foul odor, vertigo, or déjà vu (the feeling of having experienced something before).

Complex partial (psychomotor or temporal lobe) seizure

Symptoms of a complex partial seizure vary but usually include purposeless behavior. The patient may experience an aura and exhibit overt signs, including a glassy stare, picking at his clothes, aimless wandering, lip-smacking or chewing motions, and unintelligible speech. The seizure may last for a few seconds or as long as 20 minutes. Afterward, mental confusion may last for several minutes; as a result, an observer may mistakenly suspect psychosis or intoxication with alcohol or drugs. The patient has no memory of his actions during the seizure.

Secondarily generalized partial seizure

A secondarily generalized partial seizure can be either simple or complex and can progress to generalized seizures. An aura may precede the progression. Loss of consciousness occurs immediately or within 1 to 2 minutes of the start of the progression.

Generalized seizures

As the term suggests, generalized seizures cause a generalized electrical abnormality in the brain. They include several distinct types, including absence (petit mal), myoclonic, generalized tonic-clonic (grand mal), and akinetic.

Absence (petit mal) seizure

An absence seizure commonly occurs in children but also may affect adults. It usually begins with a brief change in the level of consciousness, indicated by blinking or rolling of the eyes, a blank stare, and slight mouth movements. The patient retains his posture and continues preseizure activity without difficulty. Typically, the seizure lasts from 1 to 10 seconds. The impairment is so brief that the patient is sometimes unaware of it. If not properly treated, these seizures can recur as often as 100 times a day. An absence seizure can progress to a generalized tonic-clonic seizure.

Myoclonic seizure

A myoclonic seizure—also called bilateral massive epileptic myoclonus—is marked by brief, involuntary muscular jerks of the body or extremities, which may occur in a rhythmic manner, and a brief loss of consciousness.

Generalized tonic-clonic (grand mal) seizure

Typically, a generalized tonic-clonic seizure begins with a loud cry, precipitated by air rushing from the lungs through the vocal cords. The patient falls to the ground, losing consciousness. The body stiffens (tonic phase) and then alternates between episodes of muscle spasm and relaxation (clonic phase). Tongue biting, incontinence, labored breathing, apnea, and subsequent cyanosis may also occur. The seizure stops in 2 to 5 minutes, when abnormal electrical conduction of the neurons is completed. The patient then regains consciousness but is somewhat confused and may have difficulty talking. If he can talk, he may complain of drowsiness, fatigue, headache, muscle soreness, and arm or leg weakness. He may fall into a deep sleep after the seizure.

Akinetic seizure

An akinetic seizure is characterized by a general loss of postural tone and a temporary loss of consciousness. This type of seizure occurs in young children. Sometimes it's called a drop attack because it causes the child to fall.

- Signs and symptoms
  - Seizure symptoms vary with the type of seizure (see *Differentiating seizures*)
  - Seizures have three phases
    - The prodromal phase occurs before the seizure and produces auras (sensory signals that warn of an approaching seizure), such as a flash of light, mood or behavior changes, or a sudden sensation of smell or taste; this phase lasts from seconds to days
    - The ictal phase is the seizure itself

- The postictal phase occurs after the seizure and may produce amnesia, confusion, inability to be aroused for minutes or hours, or sleepiness

■ Diagnosis and treatment

- Diagnosis may be based on CT scan, MRI, EEG, cerebral angiography, medical history, and neurologic examination
- Lumbar puncture may be performed to rule out an infectious cause
- An anticonvulsant is prescribed to prevent seizures
- If the seizures don't respond to drug therapy, the seizure focus may be resected
- Brain tumors, if present, are surgically removed

■ Nursing interventions

- Take seizure precautions during hospitalization to prevent injury
- Protect the patient during a seizure
  - Don't insert a tongue blade into the patient's mouth during an active seizure; forcing one in may break his teeth and lead to aspiration
  - Safeguard the patient from nearby objects, but don't restrain him; restraining limbs can fracture bones; loosen tight clothing
  - To maintain a patent airway, turn the patient to his side to prevent aspiration of saliva or stomach contents
- After a seizure occurs, document your observations
  - Note prodromal signs and the time of onset
  - Write down the specific types of movements and the order in which they occurred, including body parts involved
  - Note changes in the patient's respiratory pattern
  - Document eye deviation and pupillary response
  - Record the time the seizure stopped and any postictal response
- Teach the patient and his family about the therapeutic and adverse effects of the prescribed anticonvulsant, the importance of taking medications exactly as prescribed to maintain therapeutic levels, and the need to return for laboratory work to monitor serum drug levels and detect adverse reactions
- Advise the patient to avoid oral thermometers, which can be swallowed or broken if a seizure occurs
- Instruct the patient to avoid alcohol and nicotine; these stimulants can precipitate a seizure
- Tell the patient he should always carry identification stating that he has seizures and listing the name and phone number of his practitioner
- Refer the patient to the Epilepsy Foundation for additional support and strategies for living with epilepsy

❖ Spinal cord injury

■ Description

- Spinal cord injury usually results from traumatic force on the vertebral column, which, in turn, injures the spinal cord
- Spinal cord injury includes concussion, contusion, hemorrhage, herniated disk syndrome, laceration, transection, and vertebral fractures (see *Types of spinal cord injury*)
- *Complete spinal cord injury* or lesion causes loss of voluntary motor function, all sensations, and proprioception below the level of the lesion
  - Paraplegia (paralysis of both legs) results from spinal cord injuries from the level of T1 down
  - Quadriplegia (paralysis of all arms and legs) results from spinal cord injuries of one or more cervical vertebrae
- *Incomplete spinal cord injury* or lesion leaves some motor or sensory function intact
  - Central cord syndrome is damage to the central fibers of the spinal cord; it commonly results from a forced hyperextension injury, causes arterial disruption to the spinal cord, and leads to motor function deficit in the arms and, possibly, the legs
  - Anterior cord syndrome is damage to the anterior two-thirds of the spinal cord; it usually results from a flexion injury, disrupts the anterior spinal artery, and leads to paralysis and loss of

Types of spinal cord injury

Different spinal cord injuries produce different effects.

Injury	Description	Possible effects
Concussion	Severe shaking	Temporary loss of function for 24 to 48 hours
Contusion	Bruising of the spinal cord	Spinal cord compression by bleeding and edema, causing varying degrees of damage
Dislocated vertebrae	Rupture of spinal ligaments and disruption of vertebral alignment	Spinal cord disruption
Hemorrhage	Bleeding from an aneurysm or other rupture	Spinal cord irritation by blood and edema, causing neurologic deficits
Herniated disk syndrome	Anterior, lateral, or posterior displacement of intervertebral disk, especially in lumbar and lumbosacral areas	Spinal cord injury caused by displaced tissue that compresses nerve roots and narrows the spinal canal
Laceration	Tear in the spinal cord	Spinal cord compression by bleeding and edema, causing permanent damage
Transection	Severing of the spinal cord	Complete or incomplete loss of spinal cord function
Vertebral fracture		
• Comminuted (burst)	Shattering of vertebrae	Fragment penetration of spinal cord
• Compressed	Compression or anterior wedging of vertebrae	Spinal cord compression
• Odontoid (hangman's)	Fracture of odontoid process of second cervical vertebra	Typically fatal injury of spinal cord and all organs below the fracture
• Simple	Single break, usually of a transverse or spinous process	Spinal cord unaffected if vertebrae remain aligned
• Stable	Fracture without bone displacement	No permanent damage if properly immobilized
• Unstable	Fracture with bone displacement	Spinal cord injury, instant quadriplegia, and loss of respiratory function

pain and temperature sensation below the lesion (senses of touch, vibration, position, and motion remain intact)

◗ Posterior cord syndrome is damage to the posterior gray and white matter of the spinal cord; it usually results from an extension injury and impairs vibratory sensation, light touch, and proprioception (motor function, pain, and temperature sensation remain intact)

◗ Brown-Séquard syndrome is damage to one side of the spinal cord; it results from a penetrating injury (such as a gunshot or stab wound)

- Rotation-flexion injury causes unilateral damage
- Ipsilateral damage below the lesion affects motor function, pressure and touch sensations, and the senses of vibration and position
- Contralateral damage causes loss of pain and temperature sensations

◗ Horner syndrome can occur as part of Brown-Séquard syndrome or result from damage to the midbrain; it occurs ipsilaterally to a cervical lesion and causes anhidrosis (lack of sweat), ptosis, and pupillary contraction on the affected side of the face

Mechanisms of spinal cord injury

Spinal cord injury may result from various types of trauma.

Mechanism	Possible effects
Compression injury Caused by vertical fall, such as diving into shallow water	• Vertebral and spinal cord damage
Flexion Caused by violent impact to back of head	• Anterior dislocation of vertebrae • Rupture of posterior ligaments
Hyperextension (whiplash) Caused by violent impact to the chin	• Rupture of anterior ligaments • Rupture of intervertebral disks and vertebrae
Penetrating injury Caused by a gunshot wound or stab injury	• Spinal cord damage that disrupts tissue function
Rotation injury Caused by violent rotation in opposite directions of top and bottom of body	• Rupture of ligaments, vertebrae, and disks

- ◆ Spinal cord injury may result from trauma (see *Mechanisms of spinal cord injury*); it also can result from organic causes, such as arteriovenous malformation, emboli, hematoma, infection, and tumor

■ Motor loss caused by spinal cord injury

- ◆ Paralysis is a temporary or permanent loss of function
  - ◗ Spastic paralysis is the loss of voluntary movement caused by damage to upper motor neurons; the lower motor neurons may be intact, in which case, the reflex arc remains intact
  - ◗ Flaccid paralysis is the loss of voluntary movement caused by damage to the lower motor neurons; reflexes, including deep tendon reflexes, are lost
- ◆ Deep tendon reflexes include the biceps reflex, triceps reflex, brachioradialis reflex, patellar reflex, and Achilles tendon reflex; they're graded as 0 (absent), 1+ (diminished), 2+ (normal), 3+ (increased), or 4+ (hyperactive)
- ◆ Superficial reflexes comprise the abdominal reflex, cremasteric reflex, plantar reflex, and gluteal reflex; they're graded as 0 (absent), +/− (diminished or inconsistent), or + (normal)

■ Level of spinal cord injury and associated motor loss

- ◆ Injury to the cord at the C1 to C4 level causes quadriplegia and loss of respiratory function
- ◆ Injury to the cord at the C4 to C5 level causes quadriplegia and may affect respiratory function if edema damages the phrenic nerve
- ◆ Injury to the cord at the C5 to C6 level causes quadriplegia; gross motor movement of the arms remains intact with use of the scapular elevators; diaphragmatic breathing remains intact but may not be able to support ventilation because of the loss of intercostal muscle innervation
- ◆ Injury to the cord at the C6 to C7 level causes quadriplegia; diaphragmatic breathing remains intact but may not be able to support ventilation; arm muscles remain innervated and capable of elbow flexion, wrist extension, and weak thumb grasp
- ◆ Injury to the cord at the C7 to C8 level causes quadriplegia; diaphragmatic breathing remains intact, but ventilation and airway secretion removal may be compromised because of loss of intercostal muscle innervation; biceps and triceps muscles respond to voluntary control, and wrist flexion may be possible

- Injury to the cord between the T1 and L1 to L2 levels causes paraplegia; voluntary motor function of the arms remains intact; loss of some intercostal muscle innervation may impede ventilation and secretion removal
- Injury to the cauda equina causes mixed loss of motor, sensory, bowel, bladder, and sexual function and depends on which roots are damaged
- Injury to the sacral spinal nerves causes loss of bowel, bladder, and sexual function

Spinal shock

- Spinal shock is caused by sudden, severe spinal cord damage and initially produces flaccid paralysis; areflexia below the level of the lesion and loss of cutaneous and proprioceptive sensations occur in the first few hours and may last for weeks
- Recovery occurs over time; reflex activity returns in 3 to 6 weeks; flexion spasms affect paralyzed limbs 6 to 16 weeks after injury; alternating flexion and extension spasms affect paralyzed limbs about 6 months after injury; extension spasms predominate after 6 months

Autonomic dysreflexia

- Autonomic dysreflexia is a complication of complete spinal cord injury
- Injuries at or above T6 present the greatest risk, but autonomic dysreflexia has been observed in injuries occurring at the T8 level
- Autonomic dysreflexia is a clinical emergency and is caused by stimulation of the autonomic reflexes below the level of the lesion
- Autonomic dysreflexia causes decreased heart rate, pallor, pilomotor spasm (goose bumps and hair erection), and severe, persistent hypertension
- Other findings include blotchy skin, diaphoresis, flushing, nasal congestion, pounding headache, and vasodilation above the lesion
- Autonomic dysreflexia can be precipitated by various sensory stimuli, including a full bladder or rectum, painful stimuli (such as pressure on the skin, pressure ulcers, and surgical incisions), other skin stimulation (such as pressure on the glans penis or perianal or periurethral area), and visceral contractions (such as bladder spasms and uterine contractions of pregnancy)
- Treatment aims to control blood pressure while locating and removing the sensory stimulus

Diagnosis and treatment

- Diagnosis is based on anterior and lateral X-rays of the spine, CT scan, and MRI
- Emergency life support is required to maintain vital function and avoid further injury; priorities include maintaining a patent airway; ensuring adequate ventilation (spontaneous or mechanical); maintaining adequate circulation; and performing neurologic assessments
- To prevent further injury, the spine is immobilized with a cervical collar, cervical traction or cervical tongs (such as Gardner-Wells, Crutchfield, Barton, Cone, and Vinke), kinetic bed with cervical tongs for skeletal traction, halo brace with vest (for long-term use), or surgery (by means of Harrington rods, Weiss springs, laminectomy, or spinal fusion)
- Clots, fragments, and tumors are surgically decompressed
- A steroid is administered for the first 24 hours after the injury to reduce edema and inflammatory response
- An analgesic and an opioid may be administered to control pain
- A muscle relaxant is given to reduce muscle spasm
- An antacid and an antihistamine are given to prevent gastric ulcers (traumatic events, such as spinal cord injury, can precipitate gastric ulcer formation)
- Anticoagulant therapy is initiated to prevent deep vein thrombosis; therapy may include low doses of heparin, thigh-high antiembolism stockings (which compress superficial veins and prevent peripheral blood pooling), and sequential pneumatic compression devices (which massage the veins, mimic muscle action, and prevent peripheral blood pooling and thrombus formation)
- Rehabilitative management includes surgical release of tendons for persistent muscle spasm of paralyzed muscles and surgical correction for cervical support (laminectomy and spinal fusions)
- Rehabilitation referrals include those for occupational and physical therapies, nutritional counseling, social services, and psychiatric evaluation and assistance

- Nursing interventions
  - Provide respiratory support for a patient with a spinal cord injury above L1 to L2; support ranges from deep-breathing exercises to diaphragmatic coughing (exertion of abdominal pressure during coughing) to mechanical ventilation
  - Continuously monitor and assess neurologic function to detect early signs of deterioration
  - Modify the patient's environment to decrease dependence on others and increase his feelings of self-worth; discuss modifications with the patient and his family before discharge; modifications may include manual or electric wheelchairs, ramps, widened doorways, structural changes to bathroom facilities, and home care aides
  - Provide frequent and proper positioning, skin care, and proper hydration and nutrition to prevent complications of immobility
  - Teach the patient and his family about the recovery process, therapeutic and adverse effects of prescribed drugs, possible drug interactions, nutritional needs, exercise, bowel and bladder training, ways to prevent constipation and urinary tract infection, self-catheterization techniques, skin care, proper positioning, ways to avoid infection (especially respiratory infection), symptoms to report to the practitioner, and local support groups
  - Provide emotional support to the patient and family; permanent physical disabilities can be devastating to self-concept, relationships, and lifestyle; emotional support, particularly from others with similar experiences, can facilitate healing

❖ Stroke

- Description
  - Stroke is a disruption in cerebral circulation, causing permanent neurologic deficits
  - An embolic stroke may result from atherosclerotic plaque, an embolism, or vasospasm
  - A thrombotic ischemic stroke occurs when the occlusion evolves from partial to complete and may be heralded by a transient ischemic attack
  - A hemorrhagic stroke may result from a ruptured or leaking aneurysm, an arteriovenous malformation, a bleeding disorder, trauma, or an arterial rupture (as caused by hypertension)
- Signs and symptoms
  - Symptoms of stroke vary with the affected artery (see *Signs and symptoms of stroke*)
  - Symptoms also vary according to the severity of the damage and the extent of collateral circulation
- Diagnosis and treatment
  - CT scan, MRI, cerebral arteriography, lumbar puncture, Doppler flow studies, and EEG may be used to diagnose stroke
  - Carotid endarterectomy removes plaque to improve cerebral blood flow
  - Surgical evacuation of the clot or hematoma relieves increased ICP
  - Although anticoagulants are contraindicated in a patient with a hemorrhagic stroke, they may be useful in a patient with a nonhemorrhagic thrombolytic event
  - An anticonvulsant is used to prevent or treat seizures
  - Tissue plasminogen activator can improve neurologic function when given within 3 hours of the onset of symptoms in a patient with a thrombotic stroke
  - An analgesic is used to relieve discomfort such as headache
  - An antihypertensive is used to lower blood pressure and, thus, prevent additional bleeding
  - A diuretic is used to lower blood pressure and reduce cerebral edema
  - Physical therapy and occupational therapy help maintain muscle and joint function while teaching the patient needed home management techniques
- Nursing interventions
  - Provide emergency care; the patient may require lifesaving measures because of cardiopulmonary arrest triggered by the injury; administer oxygen, if needed, to promote oxygenation within the cerebral tissue
  - Maintain a patent airway; the patient may be unable to protect his airway because of impaired cough and gag reflexes and inability to support his head; suction the patient as necessary

Signs and symptoms of stroke

Signs and symptoms of stroke vary with the artery affected, the severity of the damage, and the extent of collateral circulation. Typical arteries affected and their associated signs and symptoms are described below.

Middle cerebral artery

When a stroke occurs in the middle cerebral artery, the patient may experience:
- altered level of consciousness (LOC)
- aphasia
- contralateral hemiparesis (more severe in the face and arm than in the leg)
- contralateral sensory deficit
- dysgraphia
- dysphagia
- dyslexia
- visual field cuts

Carotid artery

When a stroke occurs in the carotid artery, the patient may experience:
- altered LOC
- aphasia
- bruits over the carotid artery
- headaches
- numbness, paralysis, sensory changes, transient vision loss, and weakness on the affected side
- ptosis

Vertebrobasilar artery

When a stroke occurs in the vertebrobasilar artery, the patient may experience:
- amnesia
- ataxia
- diplopia
- dizziness
- dysphagia
- numbness around the lips and mouth
- poor coordination
- slurred speech
- visual field cuts
- weakness on the affected side

Anterior cerebral artery

When a stroke occurs in the anterior cerebral artery, the patient may experience:
- confusion
- impaired motor and sensory function
- incontinence
- loss of coordination
- numbness and weakness on the affected side
- personality changes

Posterior cerebral arteries

When a stroke occurs in the posterior cerebral arteries, paralysis is usually absent; however, the patient may experience:
- coma
- cortical blindness
- dyslexia
- sensory impairment
- visual field cuts

◆ Make sure the patient maintains bed rest until the cause of the stroke is known because activity can cause bleeding to recur
◆ Position the patient to prevent deformity; loss of muscle tone leads to flexion contractures; turn and position him every 2 hours to prevent pressure ulcers
◆ Implement physical therapy to maintain strength and prevent contractures; provide passive ROM exercises to prevent venous thrombosis and contractures
◆ Speak slowly and simply; the patient may not be able to understand rapid speech and may become confused
◆ Monitor vital signs at least hourly until the patient's condition is stable; alterations can indicate further injury
◆ Assess neurologic status hourly until the patient's condition is stable; early identification and treatment of increased ICP (signs include abnormal posturing, bradycardia, decreased LOC, decreased motor response, increased systolic blood pressure, and widened pulse pressure) may prevent further injury
◆ Monitor fluid input and output hourly to ensure hydration until the patient's condition is stable
◆ Ensure nutritional status by helping the patient to eat or by providing enteral or parenteral feedings when necessary

- Provide for toileting needs; use aseptic technique with indwelling urinary catheters to prevent infections, and begin a bowel retraining program to reestablish continence
- Modify nursing care for left- and right-hemisphere stroke
  - Left-hemisphere stroke causes expressive, global, or receptive aphasia (in most people, the left side is dominant for speech); right-sided hemiparesis or hemiplegia; right visual field deficit; and slow, cautious behavior
  - Right-hemisphere stroke causes apparent unawareness of the deficits of the affected side, leading to accidents; distractibility, impulsive behavior, and poor judgment; left-sided hemiparesis or hemiplegia; left visual field deficit; and spatial-perceptual deficits
- Teach the patient and his family how to use assistive devices, such as walkers and braces
- Refer the patient and his family to the American Stroke Association for support groups

❖ Tumors, brain

Description

- Brain tumors, which grow in the cranial cavity, can be malignant or benign, primary or metastatic
- Brain tumors may cause serious consequences as they compress or invade adjacent tissue; symptoms are caused by the destruction of neurons, displacement of brain structures, and increased intracranial pressure (ICP)
- Common primary sites for metastatic cranial tumors are the lungs, breasts, and colon
- The most common primary brain tumors in adults are gliomas and meningiomas

Signs and symptoms

- Symptoms vary not only by cell type but also by tumor location
- Generalized signs and symptoms include dizziness, headache, mental changes, progressive neurologic deficits, and seizures
- Signs and symptoms of increased ICP include alteration in LOC, bradycardia, difficulty with temperature regulation, headache, nausea and vomiting, personality changes, pupillary changes, respiratory pattern alterations, visual disturbances, and widened pulse pressure
- Frontal tumors can lead to expressive aphasia, memory loss, and personality changes; occipital tumors, to visual changes or blindness; temporal tumors, to seizures that are precipitated by olfactory or visual auras, receptive aphasia, or dysarthria; tumors in the dominant hemisphere, to communication problems; tumors near the optic tract, to visual difficulties; acoustic tumors, to hearing difficulties; and pituitary tumors, to symptoms of hormonal disruption

Diagnosis and treatment

- Diagnosis of brain tumors involves various tests, including CT scan, EEG, MRI, and skull X-ray
- Stereotactic surgery is the definitive diagnostic method to acquire tumor tissue and make an exact tissue diagnosis
- Specific treatments vary with the tumor's histologic type, radiosensitivity, and location and may include surgery, radiation therapy, chemotherapy, and decompression of increased ICP with drugs or shunting of CSF

Nursing interventions

- Assess neurologic status, including signs of increased ICP to establish a baseline and facilitate early intervention
- Maintain a patent airway to ensure adequate oxygenation; monitor and report respiratory changes
- Maintain seizure precautions, and administer an anticonvulsant as ordered
- Monitor the patient's temperature; fever commonly follows hypothalamic anoxia, but it can also indicate meningitis; use hypothermia blankets before and after surgery to keep the patient's temperature down and minimize cerebral metabolic demands
- Turn and position the patient every 2 hours to prevent pressure ulcer development and encourage lung expansion
- After surgery, monitor the patient's neurologic status, and look for signs of increasing ICP, such as changes in LOC; after supratentorial craniotomy, position the patient with the head of the bed elevated about 30 degrees to promote venous drainage; after infratentorial craniotomy, keep the patient flat for 48 hours

◆ Consult with occupational and physical therapists to encourage independence in daily activities; assist with self-care as required; if the patient is aphasic, arrange for consultation with a speech pathologist
◆ Provide emotional support to the patient and his family to help them cope with the diagnosis, treatment, potential disabilities, and changes in lifestyle

Review questions

1. The nurse is caring for a patient with a C7 spinal cord injury who develops bradycardia, hypertension, and sweating. Which intervention should the nurse perform first?

❍ **A.** Palpating the patient's bladder

❍ **B.** Lying the patient flat in bed

❍ **C.** Covering the patient with a blanket

❍ **D.** Performing a rectal examination

Correct answer: A Bradycardia, hypertension, and sweating are signs of autonomic dysreflexia, a complication that may occur with a spinal cord injury at or above T6. Because a distended bladder is one of the most common causes of autonomic dysreflexia, the nurse should palpate the patient's bladder for fullness. If the patient has an indwelling urinary catheter, the nurse should check it for patency and kinks. Option B is incorrect because appropriate interventions for autonomic dysreflexia include elevating the head of the bed to promote cerebral venous return; dangling the patient's feet over the side of the bed, if possible, to promote an orthostatic reduction in blood pressure; and keeping the patient from lying flat. Option C is incorrect because anything that may stimulate the skin, such as a blanket or shoes, should be removed. Although a distended rectum is another common cause of autonomic dysreflexia, option D is incorrect because the nurse shouldn't check for fecal impaction until an anesthetic has been applied to reduce stimulation.

2. The nurse is caring for a comatose patient who has suffered a closed head injury. Which intervention should the nurse implement to prevent increases in ICP?

❍ **A.** Suctioning the airway every hour and as needed

❍ **B.** Elevating the head of the bed 30 to 45 degrees

❍ **C.** Turning the patient and changing his position every 2 hours

❍ **D.** Maintaining a well-lit room

Correct answer: B To facilitate venous drainage and avoid jugular compression, the nurse should elevate the head of the bed 30 to 45 degrees. Option A is incorrect because patients with increased ICP poorly tolerate suctioning and shouldn't be suctioned on a regular basis. Option C is incorrect because turning from side to side increases the risk of jugular compression and rises in ICP. Option D is incorrect because the room should be kept quiet and dimly lit.

3. The nurse is teaching the patient with multiple sclerosis. When teaching the patient how to reduce fatigue, the nurse should tell the patient to:

❍ **A.** take a hot bath.

❍ **B.** rest in an air-conditioned room.

❍ **C.** increase the dose of his muscle relaxant.

❍ **D.** avoid naps during the day.

Correct answer: B Fatigue is a common symptom in patients with multiple sclerosis. Lowering the body temperature by resting in an air-conditioned room may relieve fatigue; however, extreme cold should be avoided. Option A is incorrect because a hot bath or shower can increase body temperature and produce fatigue. Option C is incorrect because muscle relaxants are prescribed to reduce spasticity and can cause drowsiness and fatigue. Option D is incorrect because taking frequent rest periods and naps can relieve fatigue. Other measures to reduce fatigue in the patient with multiple sclerosis include treating depression, using occupational therapy to learn energy conservation techniques, and reducing spasticity.

4. To encourage adequate nutritional intake for a patient with Alzheimer's disease, the nurse should:

- ○ **A.** stay with the patient, and encourage him to eat.
- ○ **B.** help the patient fill out his menu.
- ○ **C.** give the patient privacy during meals.
- ○ **D.** fill out the menu for the patient.

Correct answer: A Staying with the patient and encouraging him to feed himself will ensure adequate food intake. A patient with Alzheimer's disease can forget to eat. Filling out the patient's menu (Option B), allowing privacy during meals (Option C), or filling out the menu for the patient (Option D) don't ensure adequate nutritional intake.

5. The nurse is teaching a patient and his family about dietary practices related to Parkinson's disease. A priority for the nurse to address is risk of:

- ○ **A.** fluid overload and drooling.
- ○ **B.** aspiration and anorexia.
- ○ **C.** choking and diarrhea.
- ○ **D.** dysphagia and constipation.

Correct answer: D Eating problems associated with Parkinson's disease include aspiration, choking, constipation, and dysphagia. Option A is incorrect since fluid overload isn't specifically related to Parkinson's disease and, although drooling occurs with Parkinson's disease, it doesn't take priority. Anorexia (Option B) and diarrhea (Option C) aren't specifically associated with Parkinson's disease.

6. An elderly patient has just suffered a stroke that has left him with amnesia. Amnesia is a symptom associated with damage to which vessel?

- ○ **A.** Carotid artery
- ○ **B.** Anterior cerebral arteries
- ○ **C.** Vertebrobasilar artery
- ○ **D.** Middle cerebral artery

Correct answer: C Damage to the vertebrobasilar artery can produce amnesia. Damage to the other arteries (Options A, B, and D) doesn't produce amnesia.

7. Which condition places a patient at risk for an embolic stroke?

- ○ **A.** Atrial fibrillation
- ○ **B.** Bradycardia
- ○ **C.** Deep vein thrombosis
- ○ **D.** A history of MI

Correct answer: A Atrial fibrillation results from the irregular and rapid discharge from multiple ectopic atrial foci that causes quivering of the atria without atrial systole. This asynchronous atrial contraction predisposes the patient to mural thrombi, which may embolize, leading to a stroke. Bradycardia (Option B), deep vein thrombosis (Option C), and a history of MI (Option D) don't lead to arterial embolization.

8. After a patient experiences a brain stem infarction, the nurse should observe for which condition?

- ○ **A.** Aphasia
- ○ **B.** Bradypnea
- ○ **C.** Contralateral hemiplegia
- ○ **D.** Numbness and tingling to the face or arm

Correct answer: B The brain stem contains the medulla and the vital cardiac, vasomotor, and respiratory centers. A brain stem infarction leads to vital sign changes such as bradypnea. Aphasia (Option A) is associated with lobar strokes in the cerebral hemispheres. Although contralateral hemiplegia (Option C) and numbness and tingling in the face or arm (Option D) may occur with certain types of strokes, they generally don't occur with brain stem infarction.

9. In a patient with meningitis, irritation to which CN could cause photophobia?

- ○ **A.** III
- ○ **B.** IV
- ○ **C.** V
- ○ **D.** VI

Correct answer: C Irritation to CN V may cause photophobia. Irritation to CN III (Option A), IV (Option B), and VI (Option D) may cause diplopia, impaired ocular movement, ptosis, and unequal pupils.

10. A patient with a subdural hematoma becomes restless and confused, with dilation of the ipsilateral pupil. The physician orders mannitol for which reason?

- ○ **A.** To reduce intraocular pressure
- ○ **B.** To prevent acute tubular necrosis
- ○ **C.** To promote osmotic diuresis to decrease ICP
- ○ **D.** To draw water into the vascular system to increase blood pressure

Correct answer: C Mannitol promotes osmotic diuresis by increasing the pressure gradient, drawing fluid from intracellular to intravascular spaces. Although mannitol also reduces intraocular pressure (Option A), helps prevent acute tubular necrosis (Option B), and draws water into the vascular system to increase blood pressure (Option D), its most pressing use for this patient is to reduce ICP.

CHAPTER 7

Cardiovascular disorders

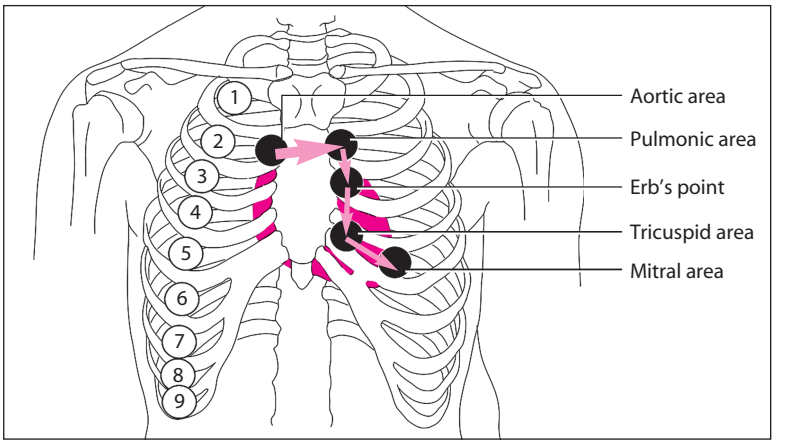
❖ Introduction

- Proper functioning of the cardiovascular system ensures the adequate delivery of nutrients to and the removal of wastes from body cells
- Disruptions in the cardiovascular system can lead to alterations in organ function, disability, and death
- Nursing history
  - The nurse asks the patient about his *chief complaint*
    - The patient with a cardiovascular problem will likely cite a specific complaint, including chest, jaw, arm, or neck pain; irregular heartbeat or palpitations; shortness of breath on exertion, lying down, or at night; cough; cyanosis or pallor; weakness; fatigue; unexplained weight change; swelling of the extremities; dizziness; high or low blood pressure
    - The patient with a cardiovascular problem may also report peripheral skin changes, such as decreased hair distribution, skin color changes, or a thin, shiny appearance to the skin; and pain in the extremities, such as leg pain or cramps
  - The nurse then questions the patient about his *present illness*
    - Ask the patient about his symptom, including when it started, associated signs and symptoms, location, radiation, intensity, duration, frequency, and precipitating and alleviating factors; if pain is the symptom, ask him to rate it on a scale of 0 to 10 (with 0 being no pain and 10 worst pain experienced)
    - Ask about the use of prescription and over-the-counter drugs, herbal remedies, vitamin and nutritional supplements, and alternative or complementary therapies used
  - The nurse asks about *medical history*
    - Question the patient about other cardiac and related disorders, such as hypertension, diabetes mellitus, hyperlipidemia, stroke, scarlet fever, rheumatic fever, strep throat, anemia, syncope, and congenital heart defects
    - Ask the female patient about the use of oral contraceptives and hormones and whether she's premenopausal or postmenopausal
  - The nurse then assesses the *family history*
    - Ask about a family history of hypertension, coronary artery disease (CAD), vascular disease, congenital heart disease, or hyperlipidemia
    - Also ask the patient if he has a family history of diabetes mellitus
  - The nurse obtains a *social history*
    - Ask about work, exercise, diet, caffeine intake, use of recreational drugs, alcohol use, and hobbies
    - Also ask about stress, support systems, coping mechanisms, and his cultural and religious background

Auscultatory sequence

When auscultating for heart sounds, place the stethoscope over the four different valve sites and at Erb's point. Follow the same auscultation sequence during every cardiovascular assessment:

- First, place the stethoscope in the second intercostal space along the right sternal border, as shown. In the aortic area, blood moves from the left ventricle during systole, crossing the aortic valve and flowing through the aortic arch.
- Then move to the pulmonic area, located in the second intercostal space at the left sternal border. In the pulmonic area, blood ejected from the right ventricle during systole crosses the pulmonic valve and flows through the main pulmonary artery.
- Next, listen at Erb's point, located in the third intercostal space at the left sternal border. At Erb's point, you'll hear aortic and pulmonic sounds.



- At the fourth auscultation site, listen over the tricuspid area, which lies in the fifth intercostal space along the left sternal border. In the tricuspid area, sounds reflect blood movement from the right atrium across the tricuspid valve, filling the right ventricle during diastole.
- Finally, listen in the mitral area, located in the fifth intercostal space near the midclavicular line. (If the patient's heart is enlarged, the mitral area may be closer to the anterior axillary line.) In the mitral (apical) area, sounds represent blood flow across the mitral valve and left ventricular filling during diastole.

Physical assessment

- The nurse begins with *inspection*
  - Observe the patient's general appearance: Is he thin, cachectic, or obese? Is he alert or anxious? What's his respiratory rate and breathing pattern? Check his hair distribution
  - Note the skin color: Is it pink, pale, or cyanotic?
  - Note any clubbing, edema, and skin lesions
  - Observe the chest and thorax: The lateral diameter should be twice the anteroposterior diameter; note any deviations from the typical chest shape
  - Inspect the neck for visible pulsations and jugular vein distention
  - Look for pulsations, symmetry of movement, retractions, or heaves; note the location of the apical impulse
- Next, the nurse uses *palpation*
  - Palpate the precordium for heaves, thrills, and the point of maximum impulse; also palpate the sternoclavicular, aortic, pulmonic, tricuspid, and epigastric areas
  - Palpate pulses in the extremities and neck for strength, rhythm, and equality
  - Palpate the extremities for skin temperature, edema, capillary refill time, and turgor
- Then the nurse *percusses* the heart
  - Percuss the left border of the heart, noting the sound change from resonance to dullness
  - Try to percuss the right border of the heart; in most people, it's under the sternum and can't be percussed
- The nurse continues by *auscultating* the heart and vessels
  - Use the diaphragm of the stethoscope to listen over the mitral or apical area for 1 minute; note heart rate and rhythm
  - Proceed sequentially through the auscultatory landmarks and listen for first and second heart sounds (S_1 and S_2) (see *Auscultatory sequence*)

- Listen for extra sounds, such as a third and fourth heart sound (S_3 and S_4), murmurs, clicks, snaps, and rubs
- Repeat the sequence, using the bell of the stethoscope
- An S_3 (ventricular gallop) is low pitched and best heard over, the apex of the heart; the rhythm is similar to a horse gallop, and the cadence sounds like "Kentucky"
- An S_4 occurs during atrial contraction, just before S_1; its cadence sounds like "Tennessee"
- The S_3 and S_4 sounds are best heard with the bell of the stethoscope placed at the apical area while the patient is supine or lying on his left side
- Auscultate for bruits over the abdominal aorta and the carotid and femoral arteries

❖ Acute coronary syndrome

Description

- Acute coronary syndrome (ACS) includes three major thrombotic effects of CAD and the resulting myocardial ischemia (see *Acute coronary syndromes*)
  - Unstable angina
  - Non-ST-segment elevation myocardial infarction (non-STEMI)
  - STEMI
- ACS results when a rupture or erosion of plaque occurs in one or more coronary arteries, resulting in platelet adhesions, activation of thrombin, and clot formation, reducing myocardial blood flow
- ACS requires prompt evaluation to differentiate noncardiac pain from cardiac pain, so proper treatment can be quickly initiated
- Complications of myocardial infarction (MI) may include heart failure, mitral valve insufficiency, cardiogenic shock, arrhythmias, and death

❖ Aneurysm, aortic

Description

- An aortic aneurysm is a localized or diffuse dilation of the wall of the aorta, particularly the abdominal aorta below the renal arteries
- Causes of aortic aneurysm include atherosclerosis, severe hypertension, pregnancy (when hormonal changes affect the smooth muscle and media of the aorta), trauma, congenital abnormalities, infectious arteritis, syphilis, and Marfan syndrome (which increases aortic wall elasticity)

Signs and symptoms

- An abdominal aortic aneurysm may cause abdominal pulsations, abdominal aortic bruit, abdominal aching, dull lower back pain with radiation to flank and groin, nausea, and vomiting; if it ruptures, it may produce severe abdominal or lower back pain with nausea and vomiting
- A thoracic aortic aneurysm (most common site of dissecting aneurysm) may cause cough, hoarseness, dysphagia (from pressure on the esophagus), abrupt loss of radial and femoral pulses and right and left carotid pulses, and dyspnea (from pressure on the trachea); if it ruptures, it may produce sudden, tearing pain in the chest and back

Diagnosis and treatment

- Diagnostic tests may include chest or abdominal X-rays, aortography, duplex ultrasonic imaging, computed tomography (CT) scan, and magnetic resonance imaging (MRI); these tests help determine the aneurysm's size, location, and shape
- Laboratory tests may include complete blood count (CBC) and blood urea nitrogen (BUN) and creatinine levels
- If the aneurysm is chronic and small, an antihypertensive and a negative inotropic agent may be prescribed to decrease the force of muscle contractions
- If the aneurysm is at risk to rupture or cause damage to other organs, surgical repair may be required

Acute coronary syndromes

Thrombotic effect	Description	Signs & Symptoms	Diagnosis	Treatment	Nursing Considerations
Unstable angina	• Angina increasing in frequency and severity from patient's baseline • Easily induced • Lasts 5 to 15 minutes	• Burning, squeezing, substernal or retrosternal pain spreading across chest; may radiate to inside of arm, neck, jaw, or shoulder blade • Possible associated symptoms: shortness of breath, dizziness, nausea, palpitations, weakness, and cold sweats • Possible associated signs: hypertension or hypotension, tachycardia or bradycardia • Most often occurs with physical activity • Often relieved by rest or nitrates	• Electrocardiogram (ECG) may be normal or may show ischemia with transient T wave or ST-segment changes • Cardiac biomarkers usually remain within normal limits	• Rest • Nitrates to reduce myocardial oxygen consumption • Beta-adrenergic blockers to reduce the workload and oxygen demand • Calcium channel blockers if caused by coronary artery spasm • Oxygen to increase oxygenation of the blood • Antiplatelet drugs to minimize platelet aggregation • Coronary angiography to determine stenosis or obstruction with possible angioplasty or stent placement	• During acute anginal episode, monitor blood pressure and heart rate. • Obtain an ECG before administering nitrates. • Record duration of pain, amount of medication required to relieve pain, and accompanying symptoms. • Obtain cardiac enzyme levels. • Administer oxygen. • Administer medications as ordered.
Non-ST-segment elevation myocardial infarction (MI)	• MI that usually occurs due to occlusion of coronary vessel • Occlusion may be complete or partial	• Burning, squeezing, substernal or retrosternal pain spreading across chest; may radiate to inside of arm, neck, jaw, or shoulder blade; pain more intense than that of angina	• Positive cardiac markers • ECG shows ST-segment depression or may be normal • ECG may have ST-segment elevation for less than 20 minutes	• Oxygen to increase oxygenation of the blood • Nonenteric-coated aspirin for antiplatelet effect	• Administer oxygen. • Administer medications as ordered. • Monitor ECG, vital signs, and level of consciousness (LOC).

(continued)

Acute coronary syndromes *(continued)*

Thrombotic effect	Description	Signs & Symptoms	Diagnosis	Treatment	Nursing Considerations
Non-ST-segment elevation (MI) *(continued)*		• Associated symptoms: shortness of breath, dizziness, nausea, palpitations, weakness, and cold sweats • Associated signs: hypertension or hypotension, tachycardia or bradycardia • Pain not relieved with rest • Difficult to distinguish from angina • S_3 and S_4 may be present		• Beta-adrenergic blockers to reduce the workload and oxygen demand • Angiotensin-converting enzyme (ACE) inhibitor to reduce afterload and preload	• Obtain cardiac markers. • Monitor cardiopulmonary status frequently and notify practitioner of changes.
ST-segment elevation (MI)	• MI that usually occurs due to complete occlusion of coronary vessel	• Burning, squeezing, substernal or retrosternal pain spreading across chest; may radiate to inside of arm, neck, jaw, or shoulder blade; pain more intense than that of angina • Associated symptoms: shortness of breath, dizziness, nausea, palpitations, weakness, and cold sweats • Associated signs: hypertension or hypotension, tachycardia or bradycardia • Pain not relieved with rest • S_3 and S_4 may be present	• Positive cardiac markers • ECG shows ST-segment elevation or new left bundle-branch block in leads associated with occluded artery • Nuclear imaging studies show areas of ischemia	• Oxygen to increase oxygenation of the blood • Nonenteric-coated aspirin for antiplatelet effect • Fibrinolytic therapy for eligible patients • Coronary angioplasty with percutaneous coronary intervention • Beta-adrenergic blockers to reduce the workload and oxygen demand • ACE inhibitor to reduce afterload and preload	• Administer oxygen. • Administer medications as ordered. • Monitor ECG, vital signs, and LOC. • Obtain cardiac markers as ordered. • If patient received fibrinolytic, monitor for bleeding. • Monitor cardiopulmonary status frequently and notify practitioner of changes.

- Nursing interventions
  - Monitor vital signs
  - Monitor hemodynamic variables; look for hypotension, tachycardia, bradycardia, cool and clammy skin, and tachypnea
  - Reduce anxiety by encouraging the patient to verbalize concerns and by providing emotional support
  - Relieve pain by pharmacologic and nonpharmacologic methods
  - Prepare the patient and family for surgery, if needed; discuss the procedure and their concerns about it

❖ Aneurysm, femoral and popliteal

- Description
  - In femoral and popliteal aneurysms, progressive atherosclerotic changes occur in the walls (medial layer) of the femoral and popliteal arteries, resulting in a dilation or outpouching
  - The aneurysms may be fusiform (spindle-shaped) or saccular (pouch-like)
  - These aneurysms are usually progressive, eventually ending in thrombosis, embolization, and gangrene
  - Causes include atherosclerosis, bacterial infection, congenital weakness in the arterial wall (rare), and trauma (blunt or penetrating)
- Signs and symptoms
  - Characteristic signs and symptoms include a pulsating mass that disturbs peripheral circulation distal to it; pain and swelling in the affected extremity, groin, or thigh develop because of pressure on adjacent nerves and veins
  - Other signs and symptoms in the affected extremity include skin changes, a loss of pulse and color, and coldness
  - Distal petechial hemorrhages (from aneurysmal emboli) can form
- Diagnosis and treatment
  - Diagnostic tests include duplex ultrasonography to diagnose the aneurysm and computed tomography angiography to determine its size, length, and extent; arteriography may be performed to evaluate the level of proximal and distal involvement
  - Treatment consists of surgical bypass, reconstruction of the artery, or both, usually with an autogenous saphenous vein graft replacement, or replacement grafts or endovascular repair using a stent graft or wall graft (a Dacron or polytetrafluoroethylene graft with external structures made from a variety of materials, such as nitinol, titanium, and stainless steel, for additional support)
- Nursing interventions
  - Before corrective surgery, evaluate the patient's circulatory status, noting the location and quality of peripheral pulses in the affected arm or leg
  - Administer a prophylactic antibiotic or anticoagulant as ordered
  - Discuss expected postoperative procedures with the patient, and review the surgical procedure
  - After surgery, correlate the condition of the extremity with preoperative circulatory assessment, marking the sites on the patient's skin where pulses are palpable to make repeated checks easier
  - Administer analgesics as ordered for pain
  - Help the patient walk soon after surgery to prevent venostasis and thrombus formation
  - Check the vein donor site for warmth, color, sensation, and pulses

❖ Arrhythmias

- Description
  - During a cardiac arrhythmia, abnormal electrical conduction or automaticity changes heart rate and rhythm

◆ Arrhythmias vary in severity, from mild and asymptomatic ones that require no treatment (such as sinus arrhythmia, in which heart rate increases and decreases with respirations) to catastrophic ventricular fibrillation, which necessitates immediate resuscitation

◆ Arrhythmias are generally classified according to their origin (atrial or ventricular); their effect on cardiac output and blood pressure, partially influenced by the site of origin, determines their clinical significance (see *The 8-step method of rhythm strip analysis*)

◆ Causes of arrhythmias include congenital heart disease, degeneration of the conduction system, drug effects or toxicity, heart disease, myocardial ischemia, stress, alcohol, electrolyte imbalance, acid-base imbalances, cellular hypoxia, and conditions such as anemia, anorexia, thyroid dysfunction, adrenal insufficiency, and pulmonary disease (see *Cardiac arrhythmias,* pages 104 to 106)

■ Signs and symptoms

◆ The patient with an arrhythmia may be asymptomatic or may report palpitations, chest pain, dizziness, weakness, fatigue, and feelings of impending doom

◆ Other signs and symptoms include an irregular heart rhythm, bradycardia or tachycardia, hypotension, syncope, reduced level of consciousness, diaphoresis, pallor, nausea, vomiting, and cold, clammy skin

◆ Life-threatening arrhythmias may result in pulselessness, absence of respirations, and no palpable blood pressure

■ Nursing interventions

◆ Monitor the pulse for an irregular pattern or an abnormally rapid or slow rate; if the patient is receiving continuous cardiac monitoring, observe him for arrhythmias

◆ Assess the patient for signs and symptoms of hemodynamic compromise

◆ If the patient has an arrhythmia, promptly assess his airway, breathing, and circulation

◆ Initiate basic life support measures if indicated, until other advanced cardiac life support measures are available and successful

◆ Perform defibrillation early for ventricular tachycardia and ventricular fibrillation

◆ Administer medications as needed, and prepare for medical procedures (for example, cardioversion or pacemaker insertion) if indicated

◆ Monitor the patient for fluid and electrolyte imbalance and signs of drug toxicity, especially digoxin; correct the underlying cause and adjust medications as needed

◆ Provide adequate oxygen and reduce the heart's workload, while carefully maintaining metabolic, neurologic, respiratory, and hemodynamic status

(Text continues on page 106.)

The 8-step method of rhythm strip analysis

Rhythm strip analysis requires a sequential and systematic approach. The following eight steps provide a good outline for you to follow.

Step 1: Determine rhythm

To determine the heart's atrial and ventricular rhythms, use either the pen-and-pencil method or the caliper method.

To determine the atrial rhythm, measure the P-P intervals, the intervals between consecutive P waves. These intervals should occur regularly, with only small variations associated with respirations. Then compare the P-P intervals in several cycles. Consistently similar P-P intervals indicate regular atrial rhythm; dissimilar P-P intervals indicate irregular atrial rhythm.

To determine the ventricular rhythm, measure the intervals between two consecutive R waves in the QRS complexes. If an R wave isn't present, use either Q waves or S waves of consecutive QRS complexes. The R-R intervals should occur regularly. Then compare the R-R intervals in several cycles. As with atrial rhythms, consistently similar intervals mean a regular rhythm; dissimilar intervals point to an irregular rhythm.

After completing your measurements, ask yourself:

- Is the rhythm regular or irregular? Consider a rhythm with only slight variations (up to 0.04 second) to be regular.
- If the rhythm is irregular, is it slightly irregular or markedly irregular? Does the irregularity occur in a pattern (a regularly irregular pattern)?

The 8-step method of rhythm strip analysis *(continued)*

Step 2: Calculate rate

You can use one of three methods to determine the atrial and ventricular heart rates from an electrocardiogram (ECG) waveform. Although these methods can provide accurate information, you shouldn't rely solely on them when assessing your patient. Keep in mind that the ECG waveform represents electrical, not mechanical, activity. Therefore, although an ECG can show that ventricular depolarization has occurred, it doesn't mean that ventricular contraction has occurred. To determine this, you must assess the patient's pulse.

- *Times-ten method.* The simplest, quickest, and most common way to calculate rate is the times-ten method, especially if the rhythm is irregular. ECG paper is marked in increments of 3 seconds, or 15 large boxes. To calculate the atrial rate, obtain a 6-second strip, count the number of P waves that appear on it, and multiply this number by 10. Ten 6-second strips equal 1 minute. Calculate the ventricular rate the same way, using the R waves.
- *1,500 method.* If the heart rhythm is regular, use the 1,500 method, so named because 1,500 small squares equal 1 minute. Count the number of small squares between identical points on two consecutive P waves, and then divide 1,500 by that number to determine the atrial rate. To obtain the ventricular rate, use the same method with two consecutive R waves.
- *Sequence method.* The third method of estimating heart rate is the sequence method, which requires memorizing a sequence of numbers. For the atrial rate, find a P wave that peaks on a heavy black line, and assign the following numbers to the next six heavy black lines: 300, 150, 100, 75, 60, and 50. Then find the next P-wave peak, and estimate the atrial rate, based on the number assigned to the nearest heavy black line. Estimate the ventricular rate the same way, using the R wave.

Step 3: Evaluate P waves

When examining a rhythm strip for P waves, ask yourself:

- Are P waves present?
- Do the P waves have a normal configuration?
- Do all of the P waves have a similar size and shape?
- Is there one P wave for every QRS complex?

Step 4: Determine PR interval duration

To measure the PR interval, count the small squares between the start of the P wave and the start of the QRS complex; then multiply the number of squares by 0.04 second. After you perform this calculation, ask yourself:

- Does the duration of the PR interval fall within normal limits, 0.12 to 0.20 second (or 3 to 5 small squares)?
- Is the PR interval constant?

Step 5: Determine QRS complex duration

When determining QRS complex duration, make sure to measure straight across from the end of the PR interval to the end of the S wave, not just to the peak. Remember, the QRS complex has no horizontal components. To calculate duration, count the number of small squares between the beginning and the end of the QRS complex, and multiply this number by 0.04 second. Then ask yourself the following questions:

- Does the duration of the QRS complex fall within normal limits, 0.06 to 0.10 second?
- Are all QRS complexes the same size and shape? (If not, measure each one and describe them individually.)
- Does a QRS complex appear after every P wave?

Step 6: Evaluate T wave

Examine the T waves on the ECG strip. Then ask yourself:

- Are T waves present?
- Do all of the T waves have a normal shape?
- Could a P wave be hidden in a T wave?
- Do all of the T waves have a normal amplitude?
- Do the T waves have the same deflection as the QRS complexes?

Step 7: Determine QT interval duration

Count the number of small squares between the beginning of the QRS complex and the end of the T wave, where the T wave returns to the baseline. Multiply this number by 0.04 second. Ask yourself:

- Does the duration of the QT interval fall within normal limits, 0.36 to 0.44 second?

Step 8: Evaluate other components

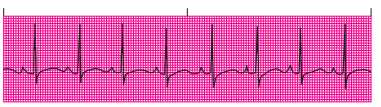
Note the presence of ectopic or aberrantly conducted beats or other abnormalities. Also, check the ST segment for abnormalities, and look for the presence of a U wave.

Next, interpret your findings by classifying the rhythm strip according to one or all of the following features:

- *Site of origin of the rhythm.* For example, sinus node, atria, atrioventricular node, or ventricles.
- *Rate.* Normal (60 to 100 beats/minute), bradycardia (less than 60 beats/minute), or tachycardia (greater than 100 beats/minute).
- *Rhythm.* Normal or abnormal; for example, flutter, fibrillation, heart block, escape rhythm, or other arrhythmias.

Cardiac arrhythmias

Normal sinus rhythm



- Ventricular and atrial rates of 60 to 100 beats/minute (BPM)
- QRS complexes and P waves regular and uniform
- PR interval 0.12 to 0.2 second
- Duration of QRS complex < 0.12 second
- Identical atrial and ventricular rates, with constant PR interval

Sinus tachycardia

Description

- Rate > 100 BPM; rarely > 160 BPM
- Every QRS complex follows a P wave

Treatment

- Correction of underlying cause; a beta-adrenergic blocker or calcium channel blocker, if symptomatic or cardiac related

Sinus bradycardia

Description

- Rate < 60 BPM
- QRS complex follows each P wave

Treatment

- For low cardiac output, dizziness, weakness, altered level of consciousness, or low blood pressure, advanced cardiac life support (ACLS) protocol for administration of atropine I.V.
- Dopamine, epinephrine, if atropine fails
- Transcutaneous pacemaker (TCP)

Paroxysmal atrial tachycardia or paroxysmal supraventricular tachycardia

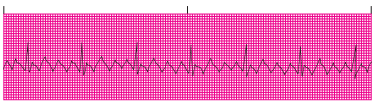
Description

- Heart rate > 140 BPM; rarely exceeds 250 BPM
- P waves regular but aberrant; difficult to differentiate from preceding T wave
- Sudden onset and termination of arrhythmia
- May cause palpitations and lightheadedness

Treatment

- Vagal maneuvers
- Adenosine by rapid I.V. push
- Other treatments: beta-adrenergic blockers, verapamil, diltiazem, and digoxin (if it isn't the cause of arrhythmia) to alter atrioventricular (AV) node conduction
- Elective cardioversion, if patient symptomatic and unresponsive to drugs
- Radiofrequency catheter ablation

Atrial flutter



Description

- Ventricular rate depends on degree of AV block (may be 60 to 100 BPM; however, 150 BPM; isn't uncommon)
- Atrial rate 250 to 400 BPM and regular
- QRS complexes uniform in shape, but typically irregular in rate
- P waves may have sawtooth configuration (F waves)

Treatment

- If patient is stable, ACLS protocol for cardioversion and drug therapy including calcium channel blockers, beta-adrenergic blockers, or antiarrhythmics
- If patient is unstable with a ventricular rate > 150 BPM, immediate cardioversion
- Radiofrequency ablation to control rhythm
- Possible anticoagulation therapy

Atrial fibrillation

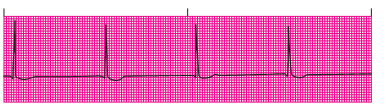
Description

- Atrial rate > 400 BPM; ventricular rate varies
- QRS complexes uniform in shape but at irregular intervals
- PR interval indiscernible
- No P waves, or P waves appear as erratic, irregular baseline F waves

Treatment

- If patient is unstable with a ventricular rate > 150 BPM, immediate cardioversion
- If patient is stable, ACLS protocol and drug therapy including calcium channel blockers, beta-adrenergic blockers, or antiarrhythmics
- In some patients uncontrolled by drugs, radiofrequency ablation
- Anticoagulation therapy to reduce risk of thromboemboli

AV junctional rhythm (nodal rhythm)



Description

- Ventricular rate usually 40 to 60 BPM (60 to 100 BPM is accelerated junctional rhythm)
- P waves may precede, be hidden within, or follow a QRS complex; if visible, they're altered

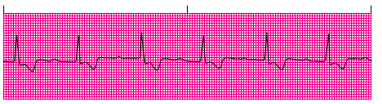
Cardiac arrhythmias *(continued)*

- Duration of QRS complex normal, except in aberrant conduction
- Patient may be asymptomatic unless ventricular rate very slow

Treatment

- Correction of underlying cause
- Atropine or pacemaker for slow rate
- If patient taking digoxin, it's discontinued

First-degree AV block



Description

- PR interval prolonged > 0.20 second
- QRS complex normal

Treatment

- Digoxin (cautiously)
- Correction of underlying cause; otherwise, monitoring for increasing block
- Possibly atropine, if severe symptomatic bradycardia develops

Second-degree AV block Mobitz Type I (Wenckebach)

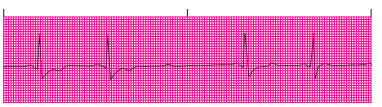
Description

- PR interval becomes progressively longer with each cycle until QRS complex disappears (dropped beat); after a dropped beat, PR interval shorter
- Ventricular rate irregular; atrial rhythm regular

Treatment

- Atropine, if patient symptomatic
- May discontinue digoxin
- Temporary pacing, if ventricular rate slow

Second-degree AV block Mobitz Type II



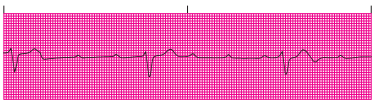
Description

- PR interval constant, with QRS complexes dropped
- Ventricular rhythm may be irregular, with varying degree of block
- Atrial rate regular

Treatment

- Temporary pacemaker, sometimes followed by permanent pacemaker
- If patient taking digoxin, it's discontinued
- Atropine, dopamine, or epinephrine for symptomatic bradycardia

Third-degree AV block (complete heart block)



Description

- Atrial rate regular; ventricular rate slow and regular
- No relationship between P waves and QRS complexes
- No constant PR interval
- QRS interval normal (nodal pacemaker); wide and bizarre (ventricular pacemaker)

Treatment

- Usually requires TCP, followed by permanent pacemaker
- Dopamine and epinephrine to maintain blood pressure
- Atropine for symptomatic bradycardia
- Cardiopulmonary resuscitation (CPR) until pacing initiated

Premature ventricular contraction (PVC)

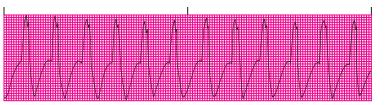
Description

- Beat occurs prematurely, usually followed by complete compensatory pause after a PVC; irregular pulse
- QRS complex wide and distorted
- Can occur singly, in pairs, or in threes; can alternate with normal beats; focus can be from one or more sites
- PVCs most ominous when clustered, multifocal, and with R wave on T pattern

Treatment

- May not be treated if patient's condition is stable
- If warranted, lidocaine, amiodarone, or procainamide I.V.
- If induced by digoxin, cessation of drug; if induced by hypokalemia, potassium chloride I.V.; if induced by hypomagnesemia, magnesium sulfate I.V.
- An oral type III agent (such as amiodarone or sotalol), if maintenance therapy necessary

Ventricular tachycardia



Description

- Ventricular rate 100 to 220 BPM; may be regular
- Three or more PVCs in a row
- QRS complexes wide, bizarre, and independent of P wave
- QRS complexes may be monomorphic (look alike) or polymorphic (look different)
- Usually no visible P waves
- Can produce chest pain, anxiety, palpitations, dyspnea, shock, coma, and death

Treatment

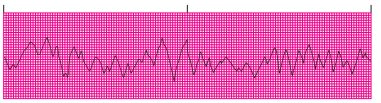
- If pulses are absent, CPR, following ACLS protocol for defibrillation and administration of epinephrine I.V. or vasopressin, followed by amniodarone, lidocaine, magnesium, or procainamide
- If pulse present with polymorphic QRS complexes and normal QT interval, beta-adrenergic blockers, lidocaine, amiodarone, procainamide, or sotalol (following ACLS protocol); if drug unsuccessful, cardioversion
- If pulse present with polymorphic QRS and prolonged QT interval, magnesium I.V., then overdrive pacing if rhythm persists

(*continued*)

Cardiac arrhythmias *(continued)*

- If pulse present and patient's condition stable with monomorphic QRS complexes, procainamide, sotalol, amiodarone, or lidocaine (follow ACLS protocol); if drugs ineffective, cardioversion
- Correction of underlying cause
- Maintenance therapy with drugs, such as amiodarone and sotalol
- Implanted cardiovert tachycardia defibrillator if recurrent ventricular tachycardia

Ventricular fibrillation



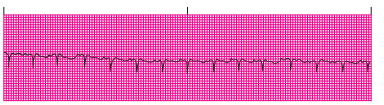
Description

- Ventricular rhythm rapid and chaotic
- No QRS complexes; no visible P waves
- Loss of consciousness, with no peripheral pulses, blood pressure, or respirations; possible seizures; sudden death

Treatment

- CPR, following ACLS protocol for defibrillation and administration of epinephrine, vasopressin, amiodarone, or lidocaine and, if ineffective, magnesium sulfate or procainamide
- Implanted cardioverter defibrillator if risk for recurrent ventricular fibrillation

Pulseless electrical activity (electromechanical dissociation)



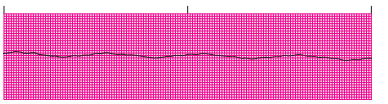
Description

- Organized electrical activity without pulse or other evidence of effective myocardial contraction
- Any rhythm possible

Treatment

- CPR
- Epinephrine
- Atropine for bradycardia
- Correction of underlying cause

Ventricular standstill (asystole)



Description

- *Primary ventricular standstill:* regular P waves, no QRS complexes
- *Secondary ventricular standstill:* QRS complexes wide and slurred, occurring at irregular intervals; agonal heart rhythm
- Loss of consciousness, no peripheral pulses, blood pressure, or respirations

Treatment

- CPR
- ACLS protocol for endotracheal intubation, TCP, and epinephrine and atropine administration

◆ Provide support to the patient and family
◆ Tell the patient signs and symptoms of an arrhythmia to report, and teach him how to take his pulse
◆ Explain all procedures such as pacemaker insertion to the patient

❖ Arterial occlusive disease

■ Description

◆ Arterial occlusive disease is an obstructive, usually degenerative arterial disorder representing a late stage of arteriosclerosis; it's the most common form of obstructive disease after age 30
◆ Other causes of arterial occlusive disease include thrombosis, embolism, and arteritis
◆ Risk factors include smoking, advanced age, hypertension, hyperlipidemia, diabetes mellitus, and genetic predisposition
◆ In arterial occlusive disease, atheromas partially or completely occlude arteries; the aorta and its major branches, along with the carotid, vertebral, femoral, iliac, and other arteries, may be involved; arteries in the legs are the most commonly affected
◆ This disorder produces symptoms when the arteries can no longer provide enough blood to supply oxygen and nutrients to the limbs and remove the waste products of metabolism

■ Signs and symptoms

◆ Acute arterial occlusion may produce the following five classic signs: paralysis, pain, paresthesia, pallor, and pulselessness
◆ Other characteristic symptoms of arterial occlusive disease include intermittent claudication and pain in the affected limb that occurs with exercise and is relieved with rest

- Signs and symptoms can also include cool feet and hands with poor hair growth, differences in the color and size of the lower legs, altered arterial pulsations and bruits over the affected area, ischemic ulcers, a burning sensation in the feet and toes, changes to nails, and decreased or absent pulses

■ Diagnosis and treatment
- Diagnostic tests may include arteriography, Doppler ultrasonography, CT scan, and MRI
- Treatment aims to prevent circulatory compromise
  - Patients are encouraged to stop smoking
  - They're encouraged to exercise, eat a proper diet, and lose weight, if necessary
  - They're advised on proper posture and the need to wear nonconstrictive clothing
  - Medications such as pentoxifylline may be prescribed to improve blood flow through the capillaries
  - Hypertension is controlled through drug therapy and lifestyle modifications
  - An antilipemic may be necessary to lower elevated cholesterol levels; antiplatelets may also be prescribed along with antihypertensives
  - Thrombolytic therapy may be given to treat arterial thrombosis
- Surgery is used to correct the obstruction if the disease progresses rapidly and the patient otherwise is in good health
  - Angioplasty and laser therapy may be performed to reestablish blood flow
  - Bypass grafting may use an artificial or autologous graft
  - Patch grafting replaces a damaged segment of the artery with a vein patch
  - Endarterectomy strips plaques from the intimal lining

■ Nursing interventions
- Check arterial pulses frequently
- Have the patient sleep with the head of the bed slightly elevated to aid perfusion to the lower extremities
- Don't massage the affected extremities because massage could further damage tissue
- Tell the patient to dress warmly and to avoid exposing the affected extremity to extreme temperatures
- Discuss gradual exercise programs, proper diet, and skin care
- Perform appropriate postoperative care
  - Assess the affected extremity and check distal and proximal pulses
  - Maintain the patient on bed rest for 12 to 24 hours after surgery
  - Avoid sharp flexion of the affected extremity
  - Assess for signs and symptoms of infection

❖ Buerger's disease

■ Description
- Buerger's disease, also called thromboangiitis obliterans, is an inflammatory, nonatheromatous occlusive condition that causes segmental lesions and subsequent thrombus formation in the small and medium arteries (and sometimes the veins), resulting in decreased blood flow to the feet and legs
- It usually occurs in men between ages 20 and 30 and in heavy smokers

■ Signs and symptoms
- Buerger's disease typically causes intermittent claudication of the instep or legs, which is aggravated by exercise and relieved by rest
- Pulses are diminished or absent, and the patient may experience coldness, numbness, tingling, or burning in the affected extremity
- As the disease progresses, redness, heat, tingling, or cyanosis may appear when the extremity is in a dependent position, and ulcers and gangrene may appear

■ Diagnosis and treatment
- Diagnostic tests may include Doppler ultrasonography, plethysmography, arteriography, venography, and digital subtraction angiography

- ◆ For patients with severe disease, lumbar sympathectomy may improve blood flow through vasodilation
- ◆ Amputation may be necessary for nonhealing ulcers, intractable pain, or gangrene
- ◆ Vasodilator therapy hasn't proved to be effective, but pentoxifylline (Pentoxil), calcium channel blockers, and thromboxane inhibitors may be helpful, especially if vasospasm is present

■ Nursing interventions

- ◆ Warn the patient that he must stop smoking to avoid worsening of his symptoms
- ◆ Tell him to avoid excessive cold temperatures to reduce vasoconstriction
- ◆ Avoid the use of vasoconstricting medications
- ◆ Teach the patient to take measures to protect the extremities from trauma and infection
- ◆ Encourage the patient to participate in progressive exercise

❖ Cardiomyopathy

■ Description

- ◆ Cardiomyopathy is a disease of the heart muscle, reducing cardiac output and eventually resulting in heart failure
- ◆ Cardiomyopathy is classified according to the structural and functional abnormalities of the heart muscle; types include dilated, or congestive (most common form; dilated cardiac chambers contract poorly, causing blood to pool and thrombi to form); hypertrophic obstructive (hypertrophied left ventricle is small, unable to relax and fill properly); restrictive (rare form; stiff ventricles are resistant to filling); arrhythmogenic right ventricular; and unclassified
- ◆ Causes of dilated cardiomyopathy include chronic alcoholism, viral or bacterial infection, metabolic and immunologic disorders, and pregnancy and postpartum disorders; causes of hypertrophic cardiomyopathy include congenital disorders and hypertension; restrictive cardiomyopathy may be idiopathic, or it may stem from amyloidosis, cancer, or heart transplant; arrhythmogenic right ventricular cardiomyopathy most likely has a genetic cause and results from the infiltration of fibrous and adipose tissue into the myocardium; unclassified cardiomyopathy doesn't fit into other categories and can have various causes

■ Signs and symptoms

- ◆ Signs and symptoms of heart failure are present, including tachycardia, S_3 and S_4 heart sounds, exertional dyspnea, paroxysmal nocturnal dyspnea, cough, fatigue, jugular venous distention, dependent pitting edema, peripheral cyanosis, and hepatomegaly
- ◆ Heart murmurs and arrhythmias may also occur

■ Diagnosis and treatment

- ◆ Diagnostic tests include electrocardiogram (ECG), echocardiogram, cardiac catheterization, radionuclide studies, and chest X-ray
- ◆ Medications for dilated cardiomyopathy include an angiotensin-converting enzyme (ACE) inhibitor or hydralazine plus a nitrate (the mainstay of therapy), a beta-adrenergic blocker, digoxin, a diuretic, and an anticoagulant
- ◆ Medications for hypertrophic cardiomyopathy include a beta-adrenergic blocker and a calcium channel blocker
- ◆ No specific medications are used to treat restrictive cardiomyopathy; however, diuretics, digoxin, nitrates, and other vasodilators can worsen the condition and should be avoided
- ◆ An antiarrhythmic, a pacemaker, or an implantable cardiac defibrillator may be necessary to control arrhythmias
- ◆ Surgery, such as heart transplantation or cardiomyoplasty (for dilated cardiomyopathy) or ventricular myotomy or myectomy (for hypertrophic obstructive cardiomyopathy) may be indicated if medications fail

■ Nursing interventions

- ◆ Monitor ECG results, cardiovascular status, vital signs, and hemodynamic variables to detect heart failure and arrhythmias and assess the patient's response to medications

- If the patient is receiving a diuretic, monitor his serum electrolyte levels to detect abnormalities such as hypokalemia
- Administer oxygen and keep the patient in semi-Fowler's position to promote oxygenation
- Make sure the patient restricts activity if necessary to reduce oxygen demands on the heart
- Teach the patient the signs and symptoms of heart failure he should report to the practitioner
- Explain the importance of checking his weight daily and reporting an increase of 3 lb (1.4 kg) or more (1 liter of fluid equals 1 kg or 2.2 lb)
- Encourage the patient to express his feelings such as a fear of dying

❖ Coronary artery disease

Description

- In CAD, plaques partially or totally occlude the coronary artery vasculature; it's the leading cause of death and disease in the United States
- Some risk factors for CAD can't be modified: old age, male gender, and family history of heart disease
- Other risk factors can be modified: increased levels of triglycerides, low-density lipoprotein, and very-low-density lipoprotein; high-fat diet; hypertension; obesity; diabetes; cigarette smoking; sedentary lifestyle; and high stress level
- CAD begins when endothelial cells in the arterial lining are injured, making them permeable to lipoproteins
  - Clot-forming platelets adhere to the injury site, and lipoproteins build up around smooth-muscle cells, causing fatty streaks
  - Fibrofatty plaques form from repeated injury to the endothelial cells; as the process is repeated, the vessel progressively narrows
  - Plaques can rupture, causing emboli, or can worsen and compromise myocardial oxygenation and blood flow, thus precipitating angina or MI

Signs and symptoms

- Anginal pain is a classic symptom of CAD (see *Angina,* page 110)
- Others include the secondary effects of CAD, such as MI, heart failure, sudden cardiac death, cardiomegaly, valvular insufficiencies, cardiogenic shock, and stroke

Diagnosis and treatment

- Diagnostic tests may include ECG, exercise ECG (stress test), cardiac catheterization, coronary angiography, intravascular ultrasound, myocardial perfusion imaging, and echocardiography
- Laboratory tests for cardiac isoenzymes (CK-MB and LD_1), troponin, myoglobin, cholesterol, lipoproteins, and triglycerides also may be performed
- Treatment aims to modify risk factors for CAD to prevent acute myocardial events (for example, smoking cessation, decreased intake of dietary fat, and increased activity level); treatment may also include medication for anginal pain as well as beta-adrenergic blockers, calcium channel blockers, antiplatelet, antilipemic, antihypertensive drugs, and oxygen therapy
- Surgical treatment, such as angioplasty, rotational atherectomy or stent placement, percutaneous transluminal coronary angioplasty, or coronary artery bypass grafting (CABG), may be required to prevent progression to MI (see *Nursing care of the cardiac surgical patient requiring CABG,* page 111)

Nursing interventions

- Increase the patient's knowledge of the relationship between risk factors and the development of CAD
- Teach the patient and family how to modify risk factors
- Encourage the patient to establish healthful habits, such as regular exercise and a low-fat diet
- Encourage participation in a smoking cessation program
- Emphasize the importance of prevention in treating heart disease
- Administer medication for anginal pain as ordered

Angina

Description

- Four types of angina exist: stable (angina that hasn't increased in severity or frequency over several months), unstable (angina that has increased in frequency, severity, or duration or has changed in quality and occurs with minimal exertion and rest), Prinzmetal's or variant (angina that occurs at rest, long after exercise, or during sleep), and microvascular (angina-like chest pain due to impairment of vasodilator reserve in patients with normal coronary arteries)
- Angina may result from atherosclerosis of coronary arteries, vasospasm, or hypotension that decreases blood flow through these arteries

Signs and symptoms

- The major symptom is substernal or anterior chest pain that may radiate to the arms, neck, jaw, and shoulders; it may be described as mild-to-moderate pressure, tightness, squeezing, burning, smothering, indigestion, choking, or mild soreness; the patient may exhibit Levine's sign (clenched fist over sternum)
- Atypical chest pain, such as arm or shoulder pain; jaw, neck, or throat pain; toothache; back pain; or pain under the breastbone or in the stomach is likely to be seen in women
- Related signs and symptoms include shortness of breath, diaphoresis, nausea, increased heart rate, pallor, weak or numb feelings in the arms and hands, and unexplained anxiety

Diagnosis and treatment

- Diagnostic tests may include electrocardiogram (ECG) (a patient with stable or unstable angina may have ST-segment depression; a patient with Prinzmetal's angina, ST-segment elevation), exercise ECG (stress test), cardiac catheterization, radioisotope imaging, and echocardiogram
- Laboratory tests may include levels of cardiac isoenzymes (creatine kinase, CK-MB, and lactate dehydrogenase), troponin, myoglobin, cholesterol, lipoproteins, triglycerides, high-sensitivity C-reactive protein, and homocysteine
- Treatment aims to decrease myocardial oxygen demand and increase myocardial oxygen supply
- Precipitating factors—such as exercise, overexertion, emotional upset, cold weather, and large meals—are identified and avoided if possible
- Exercise programs are prescribed to build collateral circulation and increase myocardial efficiency
- A nitrate (e.g., nitroglycerin in oral, sublingual, spray, ointment, or patch forms; isosorbide dinitrate; or isosorbide mononitrate), a beta-adrenergic blocker, a calcium channel blocker, or an antiplatelet drug (e.g., aspirin, clopidogrel (Plavix), or ticlopidine [Ticlid]) also may be prescribed to relieve symptoms
- A calcium channel blocker may be useful for a patient with Prinzmetal's or variant angina (see *Nursing implications in clinical pharmacology,* page 364)
- Angioplasty, stent placement, laser therapy, or atherectomy may be necessary to treat stable but debilitating anginal pain

Nursing interventions

- Tell the patient to call an ambulance and seek medical attention immediately if the angina persists or changes in quality or severity or if other symptoms develop
- Inform the patient and family that angina is more easily evoked in cold weather and in times of emotional upset or extreme stress; these conditions should be avoided if possible
- Discuss structured exercise regimens, and encourage family support
- Instruct the patient to plan rest periods between activities to prevent fatigue
- Tell the patient to take medications exactly as prescribed and not to change the medications without first consulting the practitioner
- Educate the patient about nitroglycerin
- Teach the patient how to take nitroglycerin before certain activities to prevent angina and how to take it for acute anginal episodes (e.g., to sit down when taking the tablet; to take one tablet at 5-minute intervals but not to exceed three tablets; and to be aware that a burning sensation will be felt under the tongue)
- Tell the patient to dispose of nitroglycerin that has been open for more than 6 months and to keep the tablets in a container protected from heat, light, and moisture
- Tell the patient and family to carry antianginal medications and nitroglycerin when traveling, even on short trips
- Emphasize to the family the importance of learning cardiopulmonary resuscitation and basic life support
- Prepare the patient and family for surgery (if indicated), and offer psychological and emotional support
- Reinforce the importance of lifestyle modifications, such as diet, exercise, stress reduction, and smoking cessation

❖ Endocarditis

Description

- Endocarditis is an infection of the lining of the endocardium, heart valves, or a cardiac prosthesis resulting from bacterial (particularly streptococci, staphylococci, or enterococci) or fungal invasion
- Conditions that increase the risk of endocarditis are having a prosthetic heart valve or having a damaged heart valve—for example, from rheumatic fever, syphilis, a congenital heart or heart valve defect, mitral valve prolapse with a murmur, hypertrophic cardiomyopathy, Marfan syndrome, or I.V. drug abuse

Signs and symptoms

- Nonspecific signs and symptoms include chills, diaphoresis, fatigue, weakness, anorexia, weight loss, pleuritic pain, and arthralgia (intermittent fever and night sweats may recur for weeks)
- The classic physical sign of endocarditis is a loud, regurgitant heart murmur, or sudden change in an existing murmur, or the discovery of a new murmur along with fever
- Other signs include petechiae of the skin and mucous membranes and splinter hemorrhages under the nails

Nursing care of the cardiac surgical patient requiring CABG

The medical-surgical nurse is an integral part of the multidisciplinary team caring for the patient undergoing coronary artery bypass grafting (CABG). The nurse's astute assessments and prompt interventions can affect the patient's experience of and recovery from CABG.

Preoperative care	Intraoperative procedure	Postoperative care
• Obtain an accurate and complete medical history. The degree of cardiac impairment is demonstrated by the patient's lifestyle limitations. • Assess the patient's physiologic status before surgery. Baseline vital signs, integrity of pulses and extremities, neurologic status, respiratory status, height, weight, nutritional status, elimination patterns, and psychological status should be assessed and recorded. • Teach the patient and family about the surgery and the immediate postoperative period in the intensive care unit. Prepare them for postoperative equipment that will be used, such as pulmonary artery lines, chest tubes, I.V. lines, indwelling urinary catheters, and equipment for mechanical ventilation and cardiac monitoring. • Discuss specific issues with the patient and family. For example, the patient should always report pain. (Reassure a patient who will be intubated and unable to speak that pain will be detected by facial	• The patient is placed on a cardiopulmonary bypass machine, which drains blood from the left ventricle and atrium and passes it through a pulsatile or roller pump to the femoral artery or descending aorta. Pulmonary circulation isn't interrupted. • Myocardial tissue is preserved during surgery by arresting the heart with a cardioplegic solution, which usually is cold (39.4° F [4.1° C]). External cooling also may be achieved with a slush saline solution administered into the pericardium. • After the patient is cooled sufficiently, bypass grafts, which are usually harvested from saphenous veins in the legs, are placed surgically from the aorta to sites distal to the occlusions on coronary arteries.	• Achieve and maintain body temperature. Monitor cardiovascular function with serial blood pressure, hemodynamic monitoring (cardiac output, central venous pressure, pulmonary artery wedge pressure, systemic vascular resistance), and electrocardiogram evaluations, and maintain it with various medications. Monitor drainage from chest tubes in the mediastinal area, and assess peripheral pulses. • Turn the patient every 2 hours to promote drainage. A sudden change in drainage color to bright red, hemorrhaging that lasts more than 1 minute, or cessation of drainage are abnormal; report them to the practitioner immediately. • Monitor respiratory status. Maintain an open airway at all times. Promote aggressive pulmonary hygiene. • Inform the practitioner if the patient doesn't awaken 1 to 3 hours after surgery. Report any neurologic change from the baseline value.

(continued)

Nursing care of the cardiac surgical patient requiring CABG *(continued)*

Preoperative care	Intraoperative procedure	Postoperative care
grimaces and other physiologic measures.) Bloody drainage in the chest tube is normal, as is feeling the need to void while the urinary catheter is in place. The tubes and lines may restrict patient movement, but the nurse should help the patient to prevent injury. • Ask the patient if he has an advanced directive in place.	The internal mammary artery may also be rerouted to bypass an occlusion. • After the procedure is completed, the blood in the bypass machine is slowly warmed, and the patient's body temperature is returned to normal. While the incisions are closed, epicardial pacing wires are placed and grounded, and chest tubes are inserted.	• Maintain adequate renal circulation. Postoperative renal insufficiency is caused by complications of extracorporeal circulation during surgery and can lead to the need for hemodialysis if permanent damage occurs. • Document daily weight and fluid intake and output. Monitor serum electrolytes frequently. • Make the patient as comfortable as possible; for example, by administering an opioid analgesic or positioning for comfort. • Organize activities so that the patient can rest frequently. A structured program of early, progressive ambulation and activity can be helpful, but must allow for individual differences. • Provide a program of cardiac risk modification. Encourage participation in a cardiac rehabilitation program.

- ◆ Rarely, endocarditis produces Osler's nodes (tender, raised subcutaneous lesions on the fingers or toes), Roth's spots (hemorrhagic areas with white centers on the retina), and Janeway lesions (purplish macules on the palms or soles)
- ◆ Embolization from vegetating lesions or diseased valve tissues may produce specific signs and symptoms of infarction of splenic, renal, cerebral, pulmonary, or peripheral vascular infarction

■ Diagnosis and treatment

- ◆ Diagnostic tests may include echocardiogram and ECG
- ◆ Laboratory tests may include white blood cell count (WBC), erythrocyte sedimentation rate, and serum rheumatoid factor
- ◆ Three or more blood cultures in a 24- to 48-hour period identify the causative organism
- ◆ An antibiotic is prescribed, based on the infecting organism; an I.V. antibiotic lasting 4 to 6 weeks is usually prescribed, followed by a course of oral antibiotics
- ◆ Surgery may be necessary to repair or replace a defective heart valve

■ Nursing interventions

- ◆ Make sure the patient maintains bed rest to reduce myocardial oxygen demands
- ◆ Encourage adequate fluid intake
- ◆ Watch for signs and symptoms of embolization (such as hematuria, flank pain, pleuritic chest pain, dyspnea, left upper quadrant pain, neurologic deficits, and numbness and tingling of the extremities)
- ◆ Assess the patient for signs and symptoms of heart failure, such as dyspnea, tachycardia, tachypnea, crackles, neck vein distention, edema, and weight gain
- ◆ Suggest quiet diversionary activities to prevent excessive physical exertion
- ◆ Teach the patient about the need for prophylactic antibiotics when undergoing invasive procedures, such as dental work; genitourinary, GI, or gynecologic procedures; or childbirth
- ◆ Tell the patient about signs and symptoms of endocarditis that should immediately be reported to the practitioner

❖ Heart failure

■ Description

- ◆ Heart failure is a condition in which the heart can no longer pump enough blood to meet the body's demands
- ◆ Left-sided heart failure may be caused by anterior MI, ventricular septal defect, cardiomyopathy, cardiac tamponade, constrictive pericarditis, increased circulating blood volume, aortic stenosis and insufficiency, or mitral stenosis and insufficiency
- ◆ Right-sided heart failure may be caused by left-sided heart failure, a right ventricular MI, atrial septal defect, fluid overload and sodium retention, mitral stenosis, pulmonary embolism, pulmonary outflow stenosis, chronic obstructive pulmonary disease, pulmonary hypertension (cor pulmonale), or thyrotoxicosis
- ◆ With left-sided heart failure, the diseased left ventricle can't pump effectively because of decreased cardiac output, decreased contractility, increased volume, and increased left ventricular pressure
  - ◗ The left atrium can't empty into the left ventricle, causing increased pressure in the left atrium; this pressure increase affects the lungs, causing pulmonary congestion that leads to decreased oxygenation
  - ◗ Increased pressure in the lungs causes increased right-sided heart pressure; the right ventricle can't relieve the pressure by emptying into the lungs, which impairs venous return to the right side of the heart
  - ◗ As systemic pressure builds, body organs become congested with venous blood
- ◆ Heart failure may also be classified as systolic or diastolic dysfunction
  - ◗ With systolic dysfunction, poor ventricular contraction results in inadequate emptying of the ventricle
  - ◗ With diastolic dysfunction, reduced ventricular compliance results in increased resistance to ventricular filling
- ◆ High-output failure may occur in high-output states, such as anemia, pregnancy, thyrotoxicosis, beriberi, and arteriovenous fistula
  - ◗ High-output failure results in high cardiac output and leads to ventricular dysfunction
  - ◗ Despite increased cardiac output, the heart is unable to meet the body's increased metabolic needs

■ Signs and symptoms

- ◆ Both right- and left-sided heart failure may cause chest discomfort, shortness of breath, paroxysmal nocturnal dyspnea, bloating, edema in the extremities, jugular venous distention, and decreased urine output
- ◆ Left-sided heart failure also may produce anxiety, orthopnea, dyspnea on exertion and at night, Cheyne-Stokes respirations, cough with frothy sputum, diaphoresis, crackles, rhonchi, cyanosis of extremities, respiratory acidosis, hypoxia, increased pulmonary artery pressures (determined with a pulmonary artery catheter), mental confusion, abnormal heart sounds (S_3 and S_4), fatigue, lethargy, mitral insufficiency murmur, oliguria, edema, anoxia, and nausea
- ◆ Right-sided heart failure also may produce hepatomegaly, anorexia, nausea, splenomegaly, dependent edema, hepatojugular reflex, bounding peripheral pulses, oliguria, arrhythmias, increased right- and left-sided heart pressures (determined with a pulmonary artery catheter), Kussmaul's respirations, abnormal heart sounds (S_3 and S_4), fatigue, lethargy, abdominal pain, and weight gain

■ Diagnosis and treatment

- ◆ Diagnostic tests may include ECG, chest X-ray, echocardiography, pulmonary artery catheter insertion, and arterial blood gas studies
- ◆ Laboratory tests may include a CBC; liver function tests; serum creatinine, BUN, electrolyte, glucose; albumin levels (patients with atrial fibrillation should have thyroid function tests performed); and B-type natriuretic peptide
- ◆ The goals of treatment are to decrease cardiac workload, increase cardiac output and contractility, decrease fluid and sodium retention, and decrease venous congestion
- ◆ Activity is restricted to decrease cardiac workload
- ◆ Oxygen may be administered to counteract desaturation

- ◆ Drug therapy includes an ACE inhibitor (the cornerstone of therapy) to decrease afterload; a diuretic to decrease preload and afterload; digoxin to increase contractility and cardiac efficiency and decrease heart rate; and a beta-adrenergic blocker to reduce heart rate and myocardial oxygen consumption
  - ◗ Diuretics and vasodilators should be avoided in patients with diastolic dysfunction because they may not be able to tolerate reduced blood pressure or reduced volume
  - ◗ Other drugs that may be useful in treating heart failure include vasodilators (such as hydralazine) combined with a nitrate (such as isosorbide), angiotensin II receptor blockers in patients who can't tolerate ACE inhibitors, or nesiritide (a human B-type natriuretic peptide) to augment diuresis and decrease afterload
  - ◗ Patients with acute pulmonary edema may also be treated with nitroglycerin I.V., morphine sulfate, oxygen, and mechanical ventilation
- ◆ If the patient has high-output failure, correct the underlying cause

■ Nursing interventions

- ◆ Monitor the patient for common signs and symptoms of heart failure, such as chest discomfort, shortness of breath, and paroxysmal nocturnal dyspnea
- ◆ Also watch for signs and symptoms of left-sided heart failure, such as anxiety, orthopnea, and abnormal breath sounds
- ◆ Monitor for signs and symptoms of right-sided heart failure, such as jugular venous distension, hepatomegaly, splenomegaly, peripheral edema, and bounding peripheral pulses
- ◆ Encourage bed rest in semi-Fowler's position for ease of breathing
- ◆ Provide rest intervals between periods of activity
- ◆ Restrict fluids as prescribed
- ◆ Administer medications as prescribed, and monitor for their therapeutic and adverse effects (see *Nursing implications in clinical pharmacology*, page 364)
- ◆ Monitor fluid intake and output
- ◆ Administer oxygen as prescribed
- ◆ Monitor vital signs carefully, especially when administering vasoactive drugs
- ◆ Check the patient's weight daily
- ◆ Frequently assess for cardiac and respiratory signs of heart failure
- ◆ Note changes that suggest worsening of heart failure or fluid imbalance
- ◆ Explain procedures and provide reassurance to decrease patient and family anxiety
- ◆ Teach the patient and family about medications and the importance of careful management of fluids, sodium intake, and weight

❖ Hypertension

■ Description

- ◆ Hypertension is persistent high blood pressure, usually defined as a systolic pressure above 140 mm Hg or a diastolic pressure above 90 mm Hg based on two or more consecutive readings over a 2-week period (see *Classifying blood pressure readings*)
- ◆ Three types of hypertension exist: essential or idiopathic (elevated blood pressure of unknown cause); secondary (elevated blood pressure of known cause, such as renovascular disease, pregnancy, and coarctation of the aorta); and malignant (severe, fulminant form with a diastolic pressure above 140 mm Hg)
- ◆ Hypertension may result from renovascular disease, toxemia of pregnancy, pheochromocytoma, pituitary tumor, coarctation of the aorta, adrenocortical hyperfunction, Cushing's syndrome, polycythemia, atherosclerosis, and some medications; a genetic predisposition, smoking, diabetes, stress, sedentary lifestyle, and obesity increase the risk of developing hypertension

■ Signs and symptoms

- ◆ The cardinal sign is consistently elevated blood pressure although there may be no other symptoms or physical findings

Classifying blood pressure readings

In 2003, the National Institutes of Health issued the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Categories now are normal, prehypertension, and stages 1 and 2 hypertension.

The revised categories are based on the average of two or more readings taken on separate visits after an initial screening. They apply to adults age 18 and older. (If the systolic and diastolic pressures fall into different categories, use the higher of the two readings to classify the readings.)

Patients with prehypertension are at increased risk of developing hypertension and should follow health-promoting lifestyle modifications to prevent cardiovascular disease.

Category	Systolic		Diastolic
Normal	< 120 mm Hg	*and*	< 80 mm Hg
Prehypertension	120 to 139 mm Hg	*or*	80 to 89 mm Hg
Hypertension			
Stage 1	140 to 159 mm Hg	*or*	90 to 99 mm Hg
Stage 2	≥160 mm Hg	*or*	≥100 mm Hg

- Related signs and symptoms may include headache (usually in the morning), dizziness, bruits, flushed face, epistaxis, blurred vision, retinopathy, retinal hemorrhages, restlessness, crackles, and dyspnea (if the lungs are involved)

■ Diagnosis and treatment

- Diagnostic tests depend on the suspected cause or effects of hypertension
  - For example, kidney function tests, such as urinalysis and creatinine and BUN levels, may be performed because renal damage can cause hypertension
  - ECG, chest X-ray, and echocardiography may be done to determine if hypertension has affected cardiac function
  - Ophthalmic examination may reflect retinal damage
- Diet, exercise, and lifestyle modifications (such as smoking cessation, reducing alcohol intake, stress management, and weight reduction) are recommended first
- If nonpharmacologic measures fail to maintain blood pressure within normal limits, antihypertensives, such as diuretics, ACE inhibitors, beta-adrenergic blockers, calcium channel blockers, angiotensin II receptor blockers, alpha-adrenergic blockers, and combined alpha- and beta-adrenergic blockers, are prescribed

■ Nursing interventions

- Monitor the patient's blood pressure regularly, and assess for other signs and symptoms of hypertension, such as headache and retinal hemorrhages
- Provide a calm, quiet environment
- Teach the patient and family about weight control, stress reduction, and smoking cessation
- Discuss the importance of a low-sodium diet; include the dietitian in teaching low-sodium recipes and recipe modification for the patient and the person who does the cooking
- Teach the patient how to take his blood pressure

- ◆ Administer antihypertensive medications as prescribed; teach the patient to take medications at the same time every day
- ◆ Advise the patient to stand up slowly when on antihypertensive therapy because antihypertensive medications can cause dizziness
- ◆ Emphasize the importance of adhering to the medication regimen
- ◆ Advise the patient to avoid alcohol during antihypertensive therapy

❖ Myocarditis

Description

- ◆ Myocarditis is a focal or diffuse inflammatory process involving the myocardium; it may be acute or chronic
- ◆ The underlying cause is most often an infectious organism that triggers an autoimmune, cellular, and humoral reaction; the heart muscle weakens and contractility decreases; the conduction system can also be affected
- ◆ The disorder can result in heart dilation, heart failure, thrombi on the heart wall (mural thrombi), infiltration of circulating blood cells around coronary vessels and between muscle fibers, and degeneration of the muscle fibers themselves
- ◆ Most patients with mild signs and symptoms recover completely, but some develop cardiomyopathy, heart failure, and arrhythmias

Signs and symptoms

- ◆ The signs and symptoms of acute myocarditis depend on the type of infection, the degree of myocardial damage, and the capacity of the myocardium to recover
- ◆ Patients may be asymptomatic, with an infection that resolves on its own
- ◆ Initially, flulike signs and symptoms typically occur
- ◆ Mild to moderate symptoms include fatigue, dyspnea, palpitations, and occasional discomfort in the chest and upper abdomen
- ◆ Severe congestive heart failure can quickly develop, and sudden cardiac death can occur

Diagnosis and treatment

- ◆ Laboratory tests include cardiac enzyme levels, including creatine kinase (CK), CK-MB, aspartate aminotransferase, and lactate dehydrogenase, which are elevated; troponin T and I levels are also elevated
- ◆ WBC count, C-reactive protein, and erythrocyte sedimentation rate are all elevated
- ◆ Antibody titers such as antistreptolysin-O titer in rheumatic fever are elevated
- ◆ Stool cultures, throat or pharyngeal washings, and other body fluid cultures show the causative bacteria or virus
- ◆ Diagnostic tests include two-dimensional echocardiography, which may reveal impaired systolic or diastolic ventricular function or both
- ◆ A chest X-ray may show cardiomegaly, pulmonary edema, and possible pleural effusions
- ◆ Cardiac angiography helps rule out cardiac ischemia as a cause
- ◆ MRI reveals the extent of inflammation and cellular edema
- ◆ Biopsy of the endomyocardium can confirm the diagnosis
- ◆ Although electrocardiography can produce highly variable results, it may show sinus tachycardia; diffuse ST-segments; T-wave abnormalities, such as T-wave inversion, ST-segment elevation, and bundle-branch block; conduction defects (prolonged PR interval); and ventricular and supraventricular ectopic arrhythmias

Nursing interventions

- ◆ Assess the patient for resolution of tachycardia, fever, and any other clinical manifestations
- ◆ Focus your cardiovascular assessment on signs and symptoms of heart failure and arrhythmias
- ◆ For a patient with arrhythmias, provide continuous cardiac monitoring, with personnel and equipment readily available to treat life-threatening arrhythmias
- ◆ Provide ventricular assistance if needed

- Keep in mind that patients with myocarditis are sensitive to digitalis; closely monitor the patient for indications of digitalis toxicity, such as arrhythmias, anorexia, nausea, vomiting, headache, and malaise
- Use antiembolism stockings and provide passive and active range-of-motion exercises for patients on bed rest to help prevent embolization from venous thrombosis and mural thrombi

❖ Pericarditis

Description

- Pericarditis refers to an inflammation and irritation of the pericardium, the fibroserous sac that envelops, supports, and protects the heart
- It may develop as a primary illness or secondary to medical disorders or surgical procedures and may be classified as acute or chronic
- The acute form is characterized by serous, purulent, or hemorrhagic exudates; the chronic form is characterized by dense, fibrous pericardial thickening that constricts the heart
- Pericarditis may be idiopathic, or it may result from infection that causes inflammation, connective tissue disorders, immune reactions, MI, pneumonia, pleural disease, cancer, trauma, or renal failure
- Complications include pericardial effusion, cardiac tamponade, and heart failure

Signs and symptoms

- Pericarditis may be asymptomatic; when symptoms do occur, the most common is a sharp, piercing, sudden chest pain that typically starts over the sternum and radiates to the neck, shoulders, back, and arms
- Other symptoms include pleuritic pain that increases with deep inspiration and decreases when the patient sits up and leans forward, dyspnea, dry cough, low-grade fever, pericardial friction rub, hypotension, and tachycardia

Diagnosis and treatment

- Diagnostic tests may include echocardiography, which shows the extent of pericardial effusion; CT scanning; and ECG, which may show ST-segment elevation in multiple leads
- Laboratory tests may include WBC count, sedimentation rate, and C-reactive protein, which are all elevated
- Identifying and treating the underlying cause guides therapy
- Drug therapy may include analgesics and nonsteroidal anti-inflammatory drugs, such as aspirin or ibuprofen (Motrin), for pain relief during the acute phase
- Pericardiocentesis removes some of the pericardial fluid, reduces pressure, and can be cultured to reveal the causative infectious agent
- Surgical removal of the tough encasing pericardium (pericardiectomy) may be necessary to release both ventricles from the constrictive and restrictive inflammation and scarring

Nursing interventions

- Administer pain medications as needed as well as steroids and other anti-inflammatory agents; give with food to minimize the risk of GI complications
- Administer an antibiotic or antifungal agent based on the underlying causative organism
- Prepare the patient for pericardiocentesis if signs and symptoms of cardiac tamponade develop, which may begin with shortness of breath, chest tightness, or dizziness; developing signs include progressive restlessness and a drop of 10 mm Hg or more in the systolic blood pressure during inspiration (pulsus paradoxus)
- Prepare the patient for pericardectomy or pericardotomy (pericardial window)
- Provide appropriate postoperative care
- Supply oxygen therapy as needed
- Monitor the patient's hemodynamics
- Place the patient upright to relieve dyspnea and chest pain; allow for frequent rest periods, and cluster activities to reduce energy expenditure and oxygen demand
- Encourage the patient to express concerns about the effects of activity restrictions on his normal routines and responsibilities

❖ Raynaud's disease

- Description
  - ◆ Raynaud's disease is characterized by episodic vasospasm in the small peripheral arteries and arterioles, precipitated by exposure to cold or stress
  - ◆ This disease is most prevalent in women and usually develops between puberty and age 40
  - ◆ Raynaud's disease may be primary or secondary; primary disease is idiopathic, and symptoms occur without an underlying disease or associated condition
  - ◆ Secondary Raynaud's disease is a condition commonly associated with connective tissue disorders—such as scleroderma, systemic lupus erythematosus, and polymyositis—and has a progressive course, leading to ischemia, gangrene, and amputation
- Signs and symptoms
  - ◆ After exposure to cold or stress, the skin of the fingers typically blanches, then becomes cyanotic before changing to red; numbness and tingling may also occur
  - ◆ In long-standing disease, trophic changes, such as sclerodactyly, ulcerations, or chronic paronychia may result (ulceration and gangrene are rare)
- Diagnosis and treatment
  - ◆ Diagnostic tests may include Doppler studies, arteriography, plethysmography, and antinuclear antibody titer
  - ◆ Drug treatment includes vasodilators, such as phenoxybenzamine, calcium channel blockers, and adrenergic blockers; pentoxifylline may also be effective
  - ◆ Sympathectomy may be performed if conservative measures fail to prevent ischemic ulcers
- Nursing interventions
  - ◆ Teach the patient to avoid exposure to the cold
  - ◆ Advise the patient to avoid stressful situations and to stop smoking; teach the patient biofeedback and relaxation exercises
  - ◆ Teach the patient to inspect the skin and to seek immediate treatment for signs of skin breakdown or infection

❖ Thrombophlebitis

- Description
  - ◆ Thrombophlebitis is marked by inflammation of the venous wall and thrombus formation of the deep or superficial veins
  - ◆ Deep vein thrombophlebitis may lead to occlusion of the vessels or systemic embolization such as pulmonary embolism
  - ◆ Several conditions may lead to thrombophlebitis, including hypercoagulability (such as from cancer, blood dyscrasias, or oral contraceptives); injury to the venous wall (such as from I.V. injections, fractures, antibiotics, or infection); and venous stasis (such as from varicose veins, pregnancy, heart failure, or prolonged bed rest)
- Signs and symptoms
  - ◆ Deep vein thrombophlebitis will sometimes cause no clinical symptoms or physicial findings; when they do occur, they may include cramping pain, edema, positive Homans' sign, tenderness to touch, fever, chills, and malaise
  - ◆ Superficial thrombophlebitis produces visible and palpable signs, such as heat, pain, swelling, rubor, tenderness, and induration along the affected vein's length
- Diagnosis and treatment
  - ◆ Diagnostic tests may include photoplethysmography, Doppler ultrasonography, and venography; laboratory tests include a CBC
  - ◆ Superficial thrombophlebitis may require no specific therapy other than treatment for symptoms

- ◆ An anticoagulant (initially I.V. heparin or low-molecular-weight heparin followed by oral warfarin [Coumadin]) is administered to prolong clotting time
- ◆ Thrombolytic therapy (such as streptokinase [Streptase]) is indicated for acute, extensive deep vein thrombophlebitis
- ◆ Embolectomy, venous ligation, or insertion of a vena caval umbrella or filter may also be indicated

■ Nursing interventions

- ◆ If the patient is receiving a thrombolytic, heparin, or warfarin (Coumadin), monitor him for signs and symptoms of bleeding
- ◆ If the patient is receiving heparin, measure partial thromboplastin time (PTT) regularly; if the patient is receiving warfarin, measure prothrombin time (PT) and international normalized ratio (INR) (therapeutic values for PTT and PT are 1½ to 2 times control values; for INR, between 2 and 3)
- ◆ Assess the patient for signs and symptoms of pulmonary embolism, such as crackles, dyspnea, tachypnea, hemoptysis, tachycardia, and chest pain
- ◆ Make sure the patient maintains bed rest and elevates the affected extremity
- ◆ Apply moist, warm compresses to improve circulation to the affected area and relieve pain
- ◆ Tell the patient to avoid prolonged sitting and standing to help prevent recurrence
- ◆ Teach the patient how to properly apply and use antiembolism stockings
- ◆ To prevent thrombophlebitis in high-risk patients, perform range-of-motion exercises while the patient is on bed rest, use intermittent pneumatic calf massage during lengthy surgical or diagnostic procedures, apply antiembolism stockings or pneumatic compression devices postoperatively, and encourage early ambulation

❖ Valvular heart disease

■ Description

- ◆ Three types of mechanical disruption can occur in patients with valvular heart disease: narrowing (stenosis) of the valve opening, incomplete closure of the valve (insufficiency), or prolapse of the valve
- ◆ Valvular heart disease may result from conditions such as endocarditis (most common), rheumatic fever, congenital defects, or inflammation and can lead to heart failure
- ◆ The most common forms of valvular heart disease include mitral stenosis, mitral insufficiency, mitral valve prolapse, aortic stenosis, aortic insufficiency, and tricuspid insufficiency (see *Types of valvular heart disease,* pages 120 to 121)

■ Treatment

- ◆ Medications are administered to treat heart failure and arrhythmias
- ◆ An anticoagulant may be prescribed to prevent thrombus formation around diseased or replaced valves
- ◆ Surgery to repair or replace valves is indicated when medical management can no longer control symptoms

■ Nursing interventions

- ◆ Offer a low-sodium diet, and maintain fluid restrictions
- ◆ Place the patient in an upright position to relieve dyspnea
- ◆ Instruct the patient on the use of anticoagulants, including signs and symptoms of bleeding to report, the need for frequent monitoring, and precautions to take while taking the drug
- ◆ Explain that he'll need to take a prophylactic antibiotic if he undergoes dental work, surgery, or another invasive procedure

Types of valvular heart disease

Causes and incidence	Clinical features	Diagnostic measures
Aortic insufficiency		
• Results from rheumatic fever, syphilis, hypertension, or endocarditis, or may be idiopathic • Associated with Marfan syndrome • Most common in males • Associated with ventricular septal defect, even after surgical closure	• Dyspnea, cough, fatigue, palpitations, angina, syncope • Pulmonary vein congestion, heart failure, pulmonary edema (left-sided heart failure), "pulsating" nail beds (Quincke's sign) • Rapidly rising and collapsing pulses (pulsus biferiens), cardiac arrhythmias, wide pulse pressure in severe insufficiency • Auscultation reveals a third heart sound (S_3) and a diastolic blowing murmur at left sternal border • Palpation and visualization of apical impulse in chronic disease	• Cardiac catheterization: reduction in arterial diastolic pressures, aortic insufficiency, other valvular abnormalities, and increased left ventricular end-diastolic pressure • X-ray: left ventricular enlargement, pulmonary vein congestion • Echocardiography: left ventricular enlargement, alterations in mitral valve movement (indirect indication of aortic valve disease), and mitral thickening • Electrocardiography (ECG): sinus tachycardia, left ventricular hypertrophy, and left atrial hypertrophy in severe disease
Aortic stenosis		
• Results from congenital aortic bicuspid valve (associated with coarctation of the aorta), congenital stenosis of valve cusps, degenerative calcifications caused by mechanical stress, diabetes mellitus, hypercholesterolemia, or hypertension • Most common in males	• Exertional dyspnea, paroxysmal nocturnal dyspnea, fatigue, syncope, angina, palpitations • Pulmonary vein congestion, heart failure, pulmonary edema • Diminished carotid pulses, decreased cardiac output, cardiac arrhythmias; may have pulsus alternans • Auscultation reveals systolic murmur at base or in carotids and, possibly, a fourth heart sound (S_4)	• Cardiac catheterization: pressure gradient across valve (indicating obstruction), increased left ventricular end-diastolic pressures • X-ray: valvular calcification, left ventricular enlargement, and pulmonary venous congestion • Echocardiography: thickened aortic valve and left ventricular wall • ECG: left ventricular hypertrophy
Mitral insufficiency		
• Results from rheumatic fever, hypertrophic cardiomyopathy, mitral valve prolapse, myocardial infarction, severe left-sided heart failure, or ruptured chordae tendineae • Associated with other congenital anomalies such as transposition of the great arteries • Rare in children without other congenital anomalies	• Orthopnea, dyspnea, fatigue, angina, palpitations • Peripheral edema, jugular vein distention, hepatomegaly (right-sided heart failure) • Tachycardia, crackles, pulmonary edema • Auscultation reveals a holosystolic murmur at apex, possible split second heart sound (S_2), and an S_3	• Cardiac catheterization: mitral insufficiency with increased left ventricular end-diastolic volume and pressure, increased atrial pressure and pulmonary artery wedge pressure (PAWP), and decreased cardiac output • X-ray: left atrial and ventricular enlargement, pulmonary venous congestion • Echocardiography: abnormal valve leaflet motion, left atrial enlargement • ECG: may show left atrial and ventricular hypertrophy, sinus tachycardia, and atrial fibrillation
Mitral stenosis		
• Results from rheumatic fever (most common cause), atrial myxoma, or endocarditis • Most common in females • May be associated with other congenital anomalies	• Exertional dyspnea, paroxysmal nocturnal dyspnea, orthopnea, weakness, fatigue, palpitations • Peripheral edema, jugular vein distention, ascites, hepatomegaly (right-sided heart failure in severe pulmonary hypertension) • Crackles, cardiac arrhythmias (atrial fibrillation), signs of systemic emboli • Auscultation reveals a loud first heart sound (S_1) or opening snap and a diastolic murmur at the apex	• Cardiac catheterization: diastolic pressure gradient across valve; elevated left atrial pressure and PAWP with severe pulmonary hypertension and pulmonary artery pressures; elevated right-sided heart pressure; decreased cardiac output; and abnormal contraction of the left ventricle • X-ray: left atrial and ventricular enlargement, enlarged pulmonary arteries, and mitral valve calcification • Echocardiography: thickened mitral valve leaflets, left atrial enlargement • ECG: left atrial hypertrophy, atrial fibrillation, right ventricular hypertrophy, and right axis deviation

Types of valvular heart disease *(continued)*

Causes and incidence	Clinical features	Diagnostic measures
Mitral valve prolapse syndrome		
• Cause unknown; researchers speculate that metabolic or neuroendocrine factors cause constellation of signs and symptoms • Most commonly affects young women but may occur in both sexes and in all age-groups	• May produce no signs or may produce signs and symptoms of mitral insufficiency • Chest pain, palpitations, headache, fatigue, exercise intolerance, dyspnea, syncope, light-headedness, mood swings, anxiety, panic attacks • Auscultation typically reveals a mobile, midsystolic click, with or without a mid-to-late systolic murmur	• Two-dimensional echocardiography: prolapse of mitral valve leaflets into left atrium • Color-flow Doppler studies: mitral insufficiency • Resting ECG: ST-segment changes, biphasic or inverted T waves in leads II, III, or A_V • Exercise ECG: evaluates chest pain and arrhythmias
Pulmonic insufficiency		
• May be congenital or may result from pulmonary hypertension • May rarely result from prolonged use of pressure monitoring catheter in the pulmonary artery	• Dyspnea, weakness, fatigue, chest pain • Peripheral edema, jugular vein distention, hepatomegaly (right-sided heart failure) • Auscultation reveals diastolic murmur in pulmonic area	• Cardiac catheterization: pulmonic insufficiency, increased right ventricular pressure, and associated cardiac defects • X-ray: right ventricular and pulmonary arterial enlargement • ECG: right ventricular or right atrial enlargement
Pulmonic stenosis		
• Results from congenital stenosis of valve cusp or rheumatic heart disease (infrequent) • Associated with other congenital heart defects such as tetralogy of Fallot	• Asymptomatic or symptomatic with exertional dyspnea, fatigue, chest pain, syncope • May lead to peripheral edema, jugular vein distention, hepatomegaly (right-sided heart failure) • Auscultation reveals a systolic murmur at the left sternal border, a split S_2 with a delayed or absent pulmonic component	• Cardiac catheterization: increased right ventricular pressure, decreased pulmonary artery pressure, and abnormal valve orifice • ECG: may show right ventricular hypertrophy, right axis deviation, right atrial hypertrophy, and atrial fibrillation
Tricuspid insufficiency		
• Results from right-sided heart failure, rheumatic fever and, rarely, trauma and endocarditis • Associated with congenital disorders	• Dyspnea and fatigue • May lead to peripheral edema, jugular vein distention, hepatomegaly, ascites (right-sided heart failure) • Auscultation reveals possible S_3 and systolic murmur at lower left sternal border that increases with inspiration	• Right-sided heart catheterization: high atrial pressure, tricuspid insufficiency, and decreased or normal cardiac output • X-ray: right atrial dilation, right ventricular enlargement • Echocardiography: shows systolic prolapse of tricuspid valve, right atrial enlargement • ECG: right atrial or right ventricular hypertrophy, atrial fibrillation
Tricuspid stenosis		
• Results from rheumatic fever • May be congenital • Associated with mitral or aortic valve disease • Most common in females	• May be symptomatic with dyspnea, fatigue, syncope • Possibly peripheral edema, jugular vein distention, hepatomegaly, ascites (right-sided heart failure) • Auscultation reveals diastolic murmur at lower left sternal border that increases with inspiration	• Cardiac catheterization: increased pressure gradient across valve, increased right atrial pressure, and decreased cardiac output • X-ray: right atrial enlargement • Echocardiography: leaflet abnormality, right atrial enlargement • ECG: right atrial hypertrophy, right or left ventricular hypertrophy, and atrial fibrillation

Review questions

1. While auscultating the heart sounds of a patient with mitral insufficiency, the nurse hears an extra heart sound immediately after the second heart sound (S_2). The nurse should document this extra heart sound as:

- ○ **A.** a first heart sound (S_1).
- ○ **B.** a third heart sound (S_3).
- ○ **C.** a fourth heart sound (S_4).
- ○ **D.** a mitral murmur.

Correct answer: B An S_3 is heard following an S_2, indicating that the patient is experiencing heart failure and results from increased filling pressures. Option A (S_1) is a normal heart sound made by the closing of the mitral and tricuspid valves. Option C (S_4) is heard before S_1 and is caused by resistance to ventricular filling. Option D (murmur of mitral insufficiency) occurs during systole and is heard when there's turbulent blood flow across the valve.

2. A 55-year-old black male is found to have a blood pressure of 150/90 mm Hg during a work site health screening. What should the nurse do?

- ○ **A.** Consider this to be a normal finding for his age and race.
- ○ **B.** Recommend he have his blood pressure rechecked in 1 year.
- ○ **C.** Recommend he have his blood pressure rechecked within 2 weeks.
- ○ **D.** Recommend he go to the emergency department for further evaluation.

Correct answer: C A blood pressure of 150/90 mm Hg should be rechecked within 2 weeks according to current recommendations. If confirmed, assessment and treatment should be initiated by the practitioner. Option A is incorrect because although hypertension is more prevalent among blacks, a blood pressure of 150/90 mm Hg isn't considered normal. Option B is incorrect because a person with a blood pressure of 150/90 mm Hg shouldn't wait as long as 1 year to have it rechecked. Option D is incorrect because he doesn't need to be treated on an emergency basis, but he should have his blood pressure monitored.

3. The nurse is administering warfarin (Coumadin) to a patient with deep vein thrombophlebitis. Which laboratory value indicates warfarin is at therapeutic levels?

- ○ **A.** PTT 1½ to 2 times the control
- ○ **B.** PT 1½ to 2 times the control
- ○ **C.** INR of 3 to 4
- ○ **D.** Hematocrit of 32%

Correct answer: B Warfarin is at therapeutic levels when the patient's PT is 1½ to 2 times the control. Higher values indicate increased risk of bleeding and hemorrhage, and lower values indicate increased risk of blood clot formation. Option A is incorrect because heparin, not warfarin, prolongs PTT. Option C is incorrect because although the INR may also be used to determine if warfarin is at a therapeutic level, an INR of 2 to 3 is considered therapeutic. Option D is incorrect because hematocrit doesn't provide information on the effectiveness of warfarin; however, a falling hematocrit in a patient taking warfarin may be a sign of hemorrhage.

4. A patient is receiving captopril for heart failure. The nurse should notify the practitioner that the medication therapy is ineffective if an assessment reveals:

- ❍ **A.** a skin rash.
- ❍ **B.** peripheral edema.
- ❍ **C.** a dry cough.
- ❍ **D.** postural hypotension.

Correct answer: B Peripheral edema is a sign of fluid volume overload and worsening heart failure. The other options (a skin rash, dry cough, and postural hypotension) are adverse reactions to captopril, but they don't indicate that therapy isn't effective.

5. A 60-year-old male patient is suspected of having coronary artery disease. Which noninvasive diagnostic method would the nurse expect to be ordered to evaluate cardiac changes?

- ❍ **A.** Cardiac biopsy
- ❍ **B.** Cardiac catheterization
- ❍ **C.** MRI
- ❍ **D.** Pericardiocentesis

Correct answer: C MRI is a noninvasive procedure that aids in the diagnosis and detection of thoracic aortic aneurysm and evaluation of coronary artery disease, pericardial disease, and cardiac masses. Cardiac biopsy (Option A), cardiac catheterization (Option B), and pericardiocentesis (Option D) are invasive techniques used to evaluate cardiac changes.

6. When evaluating an ECG strip of a patient on a telemetry unit, the nurse notices the patient is having premature ventricular contractions (PVCs). What criterion on the ECG strip does the nurse use to evaluate the presence of PVCs?

- ❍ **A.** An indiscernible PR interval
- ❍ **B.** P waves that appear erratic
- ❍ **C.** P waves that have a sawtooth configuration
- ❍ **D.** A QRS complex followed by a compensatory pause

Correct answer: D In PVCs, the ECG shows a QRS complex followed by a compensatory pause that ends when the underlying rhythm resumes. Options A and B are ECG criteria used to evaluate atrial fibrillation. Option C is used to describe criteria for atrial flutter.

7. When locating Erb's point to hear aortic and pulmonic sounds, the nurse should place the stethoscope at the:

- ❍ **A.** fifth intercostal space near the midclavicular line.
- ❍ **B.** fifth intercostal space along the left sternal border.
- ❍ **C.** second intercostal space at the left sternal border.
- ❍ **D.** third intercostal space at the left sternal border.

Correct answer: D Erb's point is located at the third intercostal space at the left sternal border. The fifth intercostal space near the midclavicular line (Option A) is used to listen to the mitral area. The fifth intercostal space along the left sternal border (Option B) is the location for the tricuspid area. The second intercostal space at the left sternal border (Option C) is the location for the pulmonic area.

8. When caring for a patient with arterial occlusive disease, which of the following home health care instructions is most appropriate for the nurse to give to the patient?

- ○ **A.** "You should massage your legs to relieve pain."
- ○ **B.** "It's best to sit and rest for several hours a day."
- ○ **C.** "Make sure the head of your bed is slightly elevated when sleeping."
- ○ **D.** "It's best to wear tight socks instead of no socks."

Correct answer: C The patient should make sure the head of the bed is slightly elevated to aid perfusion to the lower extremities. The patient shouldn't massage his legs (Option A) because doing so could further damage tissue. Sitting for several hours a day (Option B) isn't recommended. The patient should wear loose clothing, not constrictive clothing such as socks with tight elastic (Option D), to avoid compressing the vessels in the legs.

9. The nurse prepares to administer an ACE inhibitor to a patient with an acute MI for which reason?

- ○ **A.** To minimize platelet aggregation
- ○ **B.** To reduce preload and afterload
- ○ **C.** To reduce myocardial oxygen consumption
- ○ **D.** To decrease myocardial oxygen demand

Correct answer: B ACE inhibitors reduce preload and afterload. Antiplatelet drugs minimize platelet aggregation (Option A). Nitrates reduce myocardial oxygen consumption (Option C). Beta-adrenergic blockers reduce the workload of the heart and myocardial oxygen demand (Option D).

10. Which of the following conditions can cause right-sided heart failure?

- ○ **A.** A ventricular septal defect
- ○ **B.** An anterior MI
- ○ **C.** An atrial septal defect
- ○ **D.** Constrictive pericarditis

Correct answer: C An atrial septal defect can lead to right-sided heart failure. Left-sided heart failure can result from a ventricular septal defect (Option A), an anterior MI (Option B), or constrictive pericarditis (Option D).

CHAPTER 9

Respiratory disorders

❖ Introduction

- The function of the respiratory system is to exchange gases (oxygen and carbon dioxide) with the external environment; the respiratory system maintains the level of these gases within a narrow range, regardless of the demand for oxygen
- Respiration, which the central nervous system controls, is regulated by metabolic demands and cardiac output
- Nursing history
  - The nurse asks the patient about his *chief complaint*
    - A patient with a respiratory disorder may report the following signs or symptoms: chest pain, cough, dyspnea, orthopnea, shortness of breath, or wheezing
    - The patient may also report hemoptysis, increased sputum production, or a change in the characteristics of his sputum
  - The nurse then questions the patient about his *present illness*
    - Ask the patient about his symptom, including when it started, associated symptoms, location, duration, frequency, and precipitating and alleviating factors
    - If the patient has dyspnea, ask him to rate it on a scale of 0 to 10, in which 0 means no dyspnea and 10 means the worst dyspnea experienced
    - If the patient has orthopnea, ask him how many pillows he uses to sleep
    - Ask if the patient's cough is productive or nonproductive. Is the cough recent? If not recent, how long has he experienced it? Has it changed recently?
    - When a patient produces sputum, ask him to estimate the amount produced in teaspoons or another common measurement; ask him at what time of day he coughs the most; question him about the color and consistency of his sputum; ask whether its character has changed recently. If so, how? Does he cough up blood?
    - If a patient wheezes, ask when the wheezing occurs. What makes the patient wheeze? Does he wheeze loudly enough for others to hear it? What helps stop the wheezing?
    - If the patient has chest pain, ask him where the pain is located, what it feels like, what characteristics it has, whether it moves or radiates, how long it lasts, what causes it to occur, and what makes it better; have him rate the pain on a scale of 0 to 10 (with 0 being no pain and 10 worst pain experienced)
    - Ask about the use of prescription and over-the-counter drugs, herbal remedies, vitamin and nutritional supplements, and alternative or complementary therapies used
  - The nurse asks about *medical history*
    - Question the patient about other respiratory disorders—such as allergies, asthma, cystic fibrosis, pneumonia, tuberculosis, and upper respiratory tract infections
    - Ask the patient if he has undergone chest or lung surgery
  - The nurse then assesses the *family history*
    - Ask about a family history of chronic obstructive pulmonary disease (COPD), pneumonia, or tuberculosis
    - Determine if there's a family history of lung cancer
  - The nurse obtains a *social history*
    - Ask about smoking habits and environmental exposure to irritants such as asbestos
    - Question the patient about his tolerance for exercise

- Physical assessment
  - The nurse begins with *inspection*
    - Observe the patient's general appearance; note the patient's position. Is he sitting upright? Leaning forward? In a tripod position?
    - Take note of his level of awareness and general appearance. Does he appear relaxed? Anxious? Uncomfortable? Is he having trouble breathing?
    - Note deformities, masses, or scars of the chest; look for chest wall symmetry at rest and with inspiration; note the anterior-posterior chest diameter; observe chest wall movement. Is it paradoxical, or uneven?
    - Note tracheal deviation; look for spinal abnormalities such as kyphosis; note whether the costal angle is enlarged
    - Observe the patient's respirations, noting rate, depth, rhythm, and inspiratory-expiratory ratio; look for the use of accessory muscles with breathing, pursed lip breathing, nostril flaring, and retracting
    - Observe the color of the patient's skin, lips, mucous membranes, and nail beds; check nails for clubbing
  - Next, the nurse uses *palpation*
    - Palpate the chest for temperature, dryness, crepitus, pain, and tactile fremitus
    - Check for respiratory excursion
  - Then the nurse *percusses* the heart
    - Percuss the anterior and posterior chest, noting lung boundaries and movement of the diaphragm
    - Also note percussion sounds; describe any abnormal ones, including the location and size of the area
  - The nurse continues with *auscultation*
    - Auscultate the anterior, posterior, and lateral chest, comparing breath sounds
    - Classify each sound according to its intensity, location, pitch, duration, and characteristic; note whether the sound occurs during inhalation, exhalation, or both
    - Auscultate for vocal fremitus, noting bronchophony, egophony, and whispered pectoriloquy

❖ Acute respiratory distress syndrome

- Description
  - Acute respiratory distress syndrome (ARDS), a severe form of lung injury, occurs when the lungs can't maintain the oxygen–carbon dioxide balance
  - Although its exact cause is unknown, ARDS occurs as a result of diffuse alveolar damage; its mortality rate is 50% or higher; death is usually due to a multisystem failure or an infection
  - Risk factors for ARDS include aspiration pneumonia, drug overdose, fat or amniotic emboli, head injury, hemorrhagic shock, massive blood transfusions or transfusion reactions, near drowning, pulmonary contusion, sepsis, smoke inhalation, and trauma
  - With ARDS, capillaries leak, causing interstitial edema; this decreases blood flow to the lungs and causes platelet aggregation
    - The respiratory membrane becomes inflamed; alveolar edema develops, leading to pulmonary edema
    - Lung compliance decreases, and patches of atelectasis develop; the patient hyperventilates, thereby causing hypocapnia and hypoxemia and leading to multisystem organ dysfunction syndrome
    - A ventilation-perfusion mismatch occurs
- Signs and symptoms
  - Vital sign measurements reveal increased blood pressure, tachycardia, and tachypnea (along with increased respiratory effort and accessory muscle use)

- Other signs and symptoms may include barotrauma symptoms, bibasilar crackles, crepitus, cyanosis, decreased breath sounds, diaphoresis, dyspnea, progressive hypoxemia despite oxygen therapy, restlessness, and thick, frothy sputum

■ Diagnosis and treatment

- Early diagnosis and prompt treatment allow for successful management of ARDS
- Arterial blood gas (ABG) studies reveal decreased partial pressure of arterial oxygen (Pao_2) unresponsive to supplemental oxygen
- A pulmonary artery (PA) catheter inserted to measure pressures reveals pulmonary artery wedge pressure (PAWP) of less than 18 mm Hg
- Chest X-ray shows bilateral infiltrates (in early stages) and lung fields with ground-glass appearance, irreversible hypoxemia, and massive consolidation seen as "white lung" (in later stages)
- Mechanical ventilation may be necessary
  - Raising the fraction of inspired oxygen (FIO_2) with a ventilator helps to reverse hypoxemia but may increase the risk of oxygen toxicity and pulmonary fibrosis
  - Supplementing mechanical ventilation with positive end–expiratory pressure (PEEP) provides a constant pressure that prevents the alveoli from collapsing
  - PEEP allows the use of a lower FIO_2 to obtain an adequate Pao_2
  - Pressure control ventilation that prevents overdistention of the alveoli and inverse ratio ventilation in which inspiration is longer than expiration may also be used
- A diuretic may be administered to reduce pulmonary edema
- An antibiotic is used to treat any respiratory tract infection or underlying systemic infection
- Pharmacologic paralysis is used to decrease oxygen consumption; the patient must be sedated for this treatment
- Vasopressors are given to maintain blood pressure
- Electrolyte and acid-base imbalances are corrected to maintain cellular integrity

■ Nursing interventions

- Make sure the patient maintains bed rest in semi-Fowler's or the prone position, if possible, to improve oxygenation
- Provide oxygen therapy (and mechanical ventilation, if indicated) to maintain Pao_2 above 60 mm Hg; this will maintain oxygenation and help to reverse hypoxemia
- Implement chest physiotherapy to loosen secretions
- If the patient isn't on mechanical ventilation, teach him effective coughing and deep-breathing exercises to maximize lung expansion and reexpand collapsed alveoli
- Suction the patient's airway as needed to maintain patency and to clear secretions; sterile technique prevents bacterial contamination of lower airways
- Administer drugs to relieve pain and discomfort as needed
- If the patient is on mechanical ventilation, administer a paralyzant and a sedative as necessary
- Monitor fluid intake and output to determine the effectiveness of diuretic therapy
- Frequently reposition the patient to prevent complications of immobility, help loosen secretions, and promote lung perfusion
- Provide 2,500 calories daily to prevent weakness and increase immune response; use enteral or parenteral feeding if needed
- Teach relaxation techniques, and encourage the patient not to fight the ventilator
- Because a mechanically ventilated patient can't speak, provide communication alternatives, such as letter and picture boards

❖ Acute respiratory failure

■ Description

- In acute respiratory failure, the lungs' inability to adequately maintain arterial oxygenation or eliminate carbon dioxide results in inadequate ventilation

- The disorder is classified as hypoxemic (type I) or hypercapnic (type II)
- Primarily hypercapnic respiratory failure results from inadequate alveolar ventilation caused by a ventilation-perfusion ($\dot{V}/\dot{Q}$) mismatch and shunting
- Primarily hypoxemic respiratory failure results from inadequate oxygen exchange between the alveoli and capillaries
- The disorder also commonly occurs as a combination of hypercapnic and hypoxemic respiratory failure
- Causes include accumulated secretions secondary to cough suppression; airway irritants; any condition that increases the work of breathing and decreases the respiratory drive of patients with COPD; bronchospasm; central nervous system depression; disorders of the peripheral nervous system, respiratory muscles, and chest wall; endocrine or metabolic disorders; gas exchange failure; heart failure; myocardial infarction (MI); and pulmonary embolism

Signs and symptoms

- Signs include changes in mental status, such as confusion, somnolence, and cyanosis of the oral mucosa, lips, and nail beds
- Assessment may reveal absent breath sounds, wheezes, rhonchi, and crackles in the lung fields
- Other signs and symptoms include yawning and use of accessory muscles, pursed-lip breathing, nasal flaring, ashen skin, and tachypnea

Diagnosis and treatment

- ABG analysis reveals hypercapnia (partial pressure of arterial carbon dioxide [$Paco_2$] greater than 50 mm Hg) and hypoxemia (Pao_2 less than 60 mm Hg) on room air
- If a bacterial infection is involved, laboratory tests show an increased serum white blood cell (WBC) count; blood cultures, Gram stain, and sputum cultures reveal the pathogen
- Serum hemoglobin and hematocrit show decreased oxygen-carrying capacity
- Chest X-rays may reveal underlying pulmonary diseases or conditions, such as emphysema, atelectasis, lesions, pneumothorax, infiltrates, and effusions
- Electrocardiography (ECG) may show arrhythmias, cor pulmonale, or myocardial ischemia
- Pulse oximetry may show decreased arterial oxygen saturation
- Treatment may include mechanical ventilation with an endotracheal or a tracheostomy tube
- If the underlying cause is heart failure, the patient will need fluid restriction
- Initially, the patient is maintained on bed rest, progressing to activity as tolerated
- Oxygen therapy increases the pressure of arterial oxygen
- Antibiotics treat any underlying infection
- Bronchodilators, such as terbutaline, albuterol, theophylline, and ipratropium bromide, alleviate obstruction and bronchospasm
- Corticosteroids reduce inflammation
- Positive inotropic agents, such as dopamine or dobutamine, maintain perfusion
- Nitrates, such as nitroglycerin or nitroprusside, reduce myocardial oxygen demand
- Morphine serves as an adjunct treatment for acute pulmonary edema
- Diuretics alleviate heart failure

Nursing interventions

- Monitor the patient's vital signs, pulse oximetry readings, and ECG
- Administer prescribed drugs as indicated (via inhalation, the oral route, nebulization, or I.V., as appropriate)
- Orient the patient frequently
- Administer humidified, supplemental oxygen as ordered
- Maintain a patent airway
- Help clear the patient's secretions with postural drainage and chest physiotherapy; also suction as necessary
- Encourage pursed-lip breathing
- Encourage the use of an incentive spirometer to promote lung expansion
- Reposition the patient every 1 to 2 hours to help mobilize secretions
- Perform or assist with oral hygiene

- Position the patient for comfort, with the head of the bed elevated, if appropriate, to promote optimal gas exchange
- Maintain a normal body temperature with antipyretics
- Cluster nursing activities and schedule care to provide frequent rest periods
- Prepare for intubation and mechanical ventilation if needed
- Provide sedation as necessary
- Provide education and emotional support to the patient and family

❖ Asthma

Description

- Asthma is a chronic reactive airway disorder that involves episodic, reversible airway obstruction resulting from bronchospasms, increased mucus secretions, and mucosal edema
- It's characterized by airway inflammation, intermittent airflow obstruction, and bronchial hyperresponsiveness
- Asthma can result from several types of triggers
  - exposure to tobacco or wood smoke
  - breathing polluted air
  - inhaling other respiratory irritants, such as perfumes or cleaning products
  - exposure to airway irritants at the workplace
  - breathing in allergy-causing substances (allergens), such as molds, dust, or animal dander
  - upper respiratory tract infection, such as a cold, influenza, sinusitis, or bronchitis
  - exposure to cold
  - dry weather
  - emotional excitement or stress
  - physical exertion or exercise (exercise-induced asthma)
  - reflux of stomach acid (gastroesophageal reflux disease, or GERD)
  - ingestion of sulfites, an additive found in some foods and wine
- Comorbidities include GERD, drug-induced asthma, and other allergic reactions, such as eczema, rashes, and temporary edema

Signs and symptoms

- Overall signs and symptoms of asthma range from mild wheezing and dyspnea to life-threatening respiratory failure; signs and symptoms of bronchial airway obstruction may persist between acute episodes
- An asthma attack may begin dramatically, with simultaneous onset of severe, multiple signs and symptoms, or insidiously, with gradually increasing respiratory distress (see *Determining asthma's severity*, page 146)
- Exposure to a particular allergen is followed by a sudden onset of dyspnea and wheezing and by tightness in the chest accompanied by a cough that produces thick, clear, or yellow sputum (cough, dyspnea, and wheezing are the three most common signs and symptoms of asthma)
- An attack often starts during the night or in the early morning
- Physical findings may include visible dyspnea, use of accessory respiratory muscles, complaints of chest tightness, diaphoresis, increased anteroposterior thoracic diameter, and hyperresonance
- Tachycardia, tachypnea, mild systolic hypertension, and pulsus paradoxus may occur as the exacerbation progresses
- Inspiratory and expiratory wheezes may occur, along with wheezing and coughing (which may be exercise-induced), a prolonged expiratory phase of respiration, and diminished breath sounds
- The occurrence of cyanosis, confusion, and lethargy indicate the onset of life-threatening status asthmaticus and respiratory failure

Diagnosis and treatment

- ABG analysis provides the best indication of an attack's severity and may reveal hypoxemia during an acute attack; in acutely severe asthma, Pao_2 is less than 60 mm Hg, $Paco_2$ is 40 mm Hg or more,

Determining asthma's severity

The severity of asthma is classified by the:

- frequency, severity, and duration of symptoms
- degree of airflow obstruction (spirometry measure) or peak expiratory flow (PEF)
- frequency of nighttime symptoms and the degree that the asthma interferes with daily activities.

Severity can change over time, and even milder cases can become severe in an uncontrolled attack. Long-term therapy depends on whether the patient's asthma is classified as mild intermittent, mild persistent, moderate persistent, or severe persistent. For all patients, quick relief can be obtained by using a short-acting bronchodilator (two to four puffs of a short-acting inhaled beta2-adrenergic agonist as needed for symptoms). However, the use of a short-acting bronchodilator more than twice a week in patients with intermittent asthma or daily or increasing use in patients with persistent asthma may indicate the need to initiate or increase long-term control therapy.

Mild intermittent asthma

The signs and symptoms of mild intermittent asthma include:

- daytime symptoms that occur no more than twice a week
- nighttime symptoms that occur no more than twice a month
- lung function testing (either PEF or forced expiratory volume in 1 second) of 80% of predicted value or higher
- PEF that varies no more than 20%.

Severe exacerbations, separated by long, symptomless periods of normal lung function, indicate mild intermittent asthma. A course of systemic corticosteroids is recommended for these exacerbations; otherwise, daily medication isn't required.

Mild persistent asthma

The signs and symptoms of mild persistent asthma include:

- daytime symptoms that occur 3 to 6 days a week
- nighttime symptoms that occur three to four times a month
- lung function testing of 80% of predicted value or higher
- PEF that varies between 20% and 30%.

The preferred treatment for mild persistent asthma is low-dose inhaled corticosteroids, but alternative treatments include cromolyn, leukotriene modifier, nedocromil, and sustained-release theophylline.

Moderate persistent asthma

The signs and symptoms of moderate persistent asthma include:

- daily daytime symptoms
- nighttime symptoms that occur at least weekly
- lung function testing of 60% to 80% of predicted value
- PEF that varies more than 30%.

The preferred treatment for moderate persistent asthma is low- or medium-dose inhaled corticosteroids combined with a long-acting inhaled beta2-adrenergic agonist. Alternative treatments include increasing inhaled corticosteroids within the medium-dose range or low- or medium-dose inhaled corticosteroids with either leukotriene modifier or theophylline.

For recurring exacerbations, the preferred treatment is to increase inhaled corticosteroids within the medium-dose range and add a long-acting inhaled beta2-adrenergic agonist. The alternative treatment is to increase inhaled corticosteroids within the medium-dose range and add either leukotriene modifier or theophylline.

Severe persistent asthma

The signs and symptoms of severe persistent asthma include:

- continual daytime symptoms
- frequent nighttime symptoms
- lung function testing of 60% of predicted value or lower
- PEF that varies more than 30%.

The preferred treatment for severe persistent asthma includes high-dose inhaled corticosteroids combined with long-acting inhaled beta2-adrenergic agonists. Long-term administration of corticosteroid tablets or syrup (2 mg/kg/day, not to exceed 60 mg/day) may be used to reduce the need for systemic corticosteroid therapy.

and pH is usually decreased; normal $Paco_2$ during an acute attack may signal impending respiratory failure

◆ Radioallergosorbent testing shows increased serum immunoglobulin E levels as a result of an allergic reaction

◆ A complete blood count (CBC) including WBC count and differential shows increased eosinophil count in acute phases

◆ Chest X-rays may show hyperinflation, flattened diaphragms, areas of focal atelectasis, pneumothorax, or pneumomediastinum

- Pulmonary function tests commonly show decreased peak flow rates and forced expiratory volume in 1 second, low-normal or decreased vital capacity, and increased total lung and residual capacities, although results may be normal between attacks
- Skin testing may identify specific allergens
- Bronchial challenge testing shows the clinical significance of allergens identified by skin testing
- Pulse oximetry measurements may show decreased oxygen saturation
- Peak flow monitoring reveals a result of less than 80% of personal best; a reading below 50% of personal best indicates a severe exacerbation
- Treatment involves identifying and avoiding precipitating factors and desensitizing the patient to specific antigens
- Generally, asthma medications are divided into two categories: quick relief for relief of immediate symptoms and long-acting medications to control the underlying inflammation
  - Quick-relief bronchodilators include an albuterol sulfate inhaler used as needed
  - Quick-relief anticholinergics for bronchospasms include ipratropium bromide
  - Corticosteroids, such as systemic methylprednisolone, prednisolone, and prednisone, prevent exacerbation and progression during moderate or severe exacerbations
  - Corticosteroids for persistent asthma include inhaled corticosteroid of fluticasone (Flovent), beclomethasone (QVAR), budesonide inhaled (Pulmicort Turbuhaler), and mometasone inhaled (Asmanex)
  - Long-acting beta-agonist or combination drugs include salmeterol inhaled (Serevent), formoterol inhaled (Foradil), fluticasone and salmeterol inhaled (Advair), and budesonide and formoterol inhaled (Symbicort)
  - Leukotriene antagonists (antileukotrienes) include montelukast (Singulair)
  - Anticholinergic bronchodilators include tiotropium inhaled (Spiriva)
  - Monoclonal antibodies such as omalizumab (Xolair) and anti-inflammatory agents such as nedocromil sodium (Tilade) inhaled before exercise reduce bronchospasm

Nursing interventions

- Give prescribed inhalers and asthma medications
- Place the patient in high Fowler's position
- Encourage pursed-lip and diaphragmatic breathing
- Administer prescribed humidified oxygen
- Adjust oxygen according to the patient's vital signs and ABG values
- Assist with intubation and mechanical ventilation, if appropriate
- Perform postural drainage and chest percussion, if tolerated
- If the patient is intubated, suction as needed
- Treat the patient's dehydration with I.V. or oral fluids as tolerated
- Keep the room temperature comfortable
- Use an air conditioner or a fan in hot, humid weather
- Monitor the patient's vital signs, intake and output, response to treatment, signs and symptoms of theophylline toxicity, breath sounds, ABG results, pulmonary function test results, pulse oximetry, complications of corticosteroid treatment, and anxiety level

❖ Atelectasis

Description

- Atelectasis is the partial or total collapse of the functioning alveoli
- Airway obstruction, COPD, ascites, and lung compression resulting from hemothorax, pneumothorax, or tumor can cause atelectasis; atelectasis also is a common complication of thoracic and upper abdominal surgery that can occur 24 to 48 hours postoperatively
- General anesthesia, immobility, lung disease, obesity, opioid use, pain, and smoking increase the risk of atelectasis
- A patient with atelectasis has decreased ventilation because the collapsed alveoli can't exchange gases; this decreased ventilation leads to hypoxemia
- Stasis of mucus leads to bacterial growth and pneumonia

- Signs and symptoms
  - Vital sign assessment typically reveals fever (which may occur 24 to 48 hours postoperatively), tachycardia, and tachypnea
  - Auscultation may reveal crackles and decreased breath sounds over the affected area
  - Other effects may include cyanosis, dyspnea, and increased sputum production
- Diagnosis and treatment
  - The patient should undergo ABG studies, chest X-ray, and sputum culture
  - A bronchodilator is administered to dilate bronchioles and promote secretion removal
  - An antibiotic is administered to treat infection
  - If present, tumors are removed surgically or treated with radiation therapy
  - A chest tube is inserted for a patient with hemothorax (to drain blood) or pneumothorax (to reinflate the lung)
- Nursing interventions
  - Encourage the patient to cough and breathe deeply to maximize lung expansion and reexpand collapsed alveoli; use an incentive spirometer hourly after surgery
  - Provide adequate hydration to liquefy secretions; thin secretions are easier to expectorate
  - Implement chest physiotherapy to help clear secretions; postural drainage uses gravity to clear secretions, whereas percussion and vibration loosen secretions, making them easier to cough up
  - Suction the patient's airway to maintain patency and to clear secretions
  - Provide oxygen therapy to improve Pao_2 and maintain adequate oxygenation
  - Medicate for pain or discomfort as needed, which will allow the patient to cough and deep-breathe effectively
  - Teach the patient to use a pillow to splint abdominal and chest incisions during coughing exercises
  - Encourage early ambulation and frequent position changes to prevent complications of immobility and promote lung expansion

❖ Cancer, laryngeal

- Description
  - Laryngeal cancer affects the epithelial lining of the mucous membrane of the larynx, most commonly as squamous cell carcinoma; it usually affects men in their 60s and 70s
  - Although laryngeal cancer has no proven cause, two major risk factors are cigarette smoking and alcohol consumption; other risk factors include frequent laryngitis, poor nutrition, and compromised immunity
- Signs and symptoms
  - Hoarseness for more than 2 weeks, an early warning sign, may become progressively worse
  - Dysphagia, dyspnea, and hemoptysis may be present
  - Pain may be referred to the ear or throat if ulceration occurs
  - Cervical lymph nodes may be enlarged
- Diagnosis and treatment
  - Laryngoscopy shows nodules on the vocal cords, and nodule biopsy reveals cancer cells
  - Radiation therapy and surgery may be used alone or together
    - Partial laryngectomy changes the voice and preserves the respiratory tract
    - Total laryngectomy produces a complete loss of voice and creates a permanent tracheostomy opening
- Nursing interventions
  - Encourage deep breathing to maintain respiratory function
  - Suction the patient's airway as needed to maintain patency and to clear secretions
  - Administer oxygen to improve Pao_2 and maintain adequate oxygenation
  - Provide tracheostomy care to prevent infection and maintain the airway
  - Ensure adequate hydration and nutrition while preventing aspiration and aspiration-induced infection
    - Have the patient eat slowly and in the sitting position only
    - Provide frequent small meals, and advance the diet as tolerated
    - Have suction equipment readily available

- Provide pain relief as needed to reduce anxiety, and encourage deep breathing and activity
- If needed, teach the patient and family alternative methods of communication, such as an alphabet board or gesturing
- Discuss and initiate speech therapy, if appropriate, to maximize remaining vocal function

❖ Cancer, lung

Description

- Lung cancers are classified into two major categories: small-cell carcinomas and non–small-cell carcinomas
- Small-cell carcinoma accounts for 15% to 20% of lung cancers; non–small-cell carcinomas account for 80% of lung cancers
- Non–small-cell carcinomas include squamous cell carcinoma (20% to 30%), large-cell carcinoma (15%), and adenocarcinoma (40%)
- Up to 40% of lung cancers are metastatic; breast, GI, prostate, and renal cancers commonly metastasize to the lungs
- Risk factors for lung cancer include cigarette smoking, environmental factors such as air pollution, genetic factors, and occupational exposure to carcinogens
- Adenocarcinoma tends to grow slowly and is peripherally located; this well-circumscribed tumor seldom cavitates but spreads early to regional lymph nodes
- Large-cell carcinoma produces large necrotic masses that tend to grow rapidly and are peripherally located; it tends to cavitate, metastasizes early, and spreads extensively
- Small-cell carcinoma, the most aggressive lung cancer, tends to grow rapidly and is centrally located; it rapidly metastasizes through lymph and blood systems but responds to chemotherapy
- Squamous cell carcinoma, the most common lung cancer, tends to grow slowly and is centrally located; it produces early local symptoms, tends to cavitate, and metastasizes to intrathoracic sites first

Signs and symptoms

- Some lung cancers are asymptomatic; symptoms arise from metastasis to other body areas
- Dyspnea may range from mild dyspnea during extreme exertion to severe dyspnea at rest
- Auscultation may reveal decreased breath sounds, localized wheezing, and pleural rub (with pleural effusion)
- A chronic cough may be nonproductive; however, hemoptysis is common
- Enlarged lymph nodes and fatigue may occur
- Finger clubbing may be a late sign of lung cancer
- Weight loss may occur
- The patient may report bone pain, chest pain or tightness, joint aching, and shoulder and arm pain
- Superior vena cava syndrome may cause edema of the face, neck, and upper torso as well as dilated veins in the abdomen and chest

Diagnosis and treatment

- Chest X-ray, computed tomography (CT) scan, MRI, bronchoscopy, sputum cytology, pulmonary function tests, ABG studies, brain and bone scans, and lymph node biopsy may be prescribed
- Specimens may be obtained for culture by way of bronchoscopy, transthoracic needle biopsy, mediastinoscopy, open lung biopsy (thoracotomy), or thoracentesis
- Surgical procedures—such as lobectomy, pneumonectomy, and wedge resection—are used to treat lung cancer
- Chemotherapy, immunosuppressant therapy, and radiation therapy also may be used (see *Nursing implications in oncology care*, page 357)
- Serial thoracentesis or chest tube placement is used for recurrent pleural effusions
- Laser therapy through a bronchoscope is a palliative measure that relieves endobronchial obstructions caused by nonresectable tumors

Nursing interventions

- Monitor a patient who has undergone surgery
  - Assess the incision for signs of infection

- ◗ Check the dressing for drainage and the chest tube for proper functioning, air leakage, and amount of drainage
- ◗ Assess lungs for signs of atelectasis
- ◗ Assess the intensity, quality, and location of pain
- ◗ Assess the patient for heart failure caused by fluid overload, hyponatremia, and renal failure
- ◗ Monitor electrolyte levels to detect hyponatremia or hyperkalemia
- ◗ Monitor the patient's CBC for anemia and leukopenia
- ◗ Assess fluid intake and output
- ◗ Assess nutritional status

◆ Administer oxygen to improve Pao_2, and maintain adequate oxygenation
◆ Suction the patient's airway as needed to maintain patency and to clear secretions
◆ Provide pain relief as needed to reduce anxiety, and encourage coughing, deep breathing, and early ambulation
◆ Position the patient for comfort and adequate respiration
◆ Teach relaxation techniques to alleviate anxiety
◆ Intervene appropriately for a postoperative patient

- ◗ Ensure adequate hydration to liquefy secretions; thin secretions are easier to expectorate
- ◗ Provide chest physiotherapy; postural drainage uses gravity to clear secretions, and percussion and vibration loosen secretions, making them easier to expectorate
- ◗ Teach effective coughing and deep breathing to promote lung expansion and prevent atelectasis
- ◗ Encourage early ambulation and frequent position changes to prevent complications and promote lung expansion
- ◗ Increase the patient's caloric intake to 2,500 calories daily
  - Although patients may have a poor appetite, their metabolic needs are increased
  - Administer medications to control diarrhea, nausea, and vomiting
  - Encourage the patient to eat frequent, small meals
  - Encourage family members and friends to provide nutritious food that the patient likes
- ◗ Have a patient who has undergone thoracotomy practice arm exercises to promote lung expansion and maintain arm mobility
- ◗ Encourage the patient to express concerns to reduce anxiety, decrease pain, and promote healing
- ◗ If the patient is a smoker, discuss the effects of smoking, and help get him into a smoking cessation program
- ◗ Teach the patient how to improve his quality of life by conserving energy and reorganizing the home so that frequently used items are within reach, and consider employing a homemaking service

❖ Chest trauma

■ Description

◆ *Rib fracture* can result from a blunt or penetrating injury; fractures commonly involve multiple ribs
◆ *Flail chest* is usually caused by blunt trauma; it results when two or more ribs are fractured at two different places on each rib, leaving a rib section that isn't connected at either end
◆ *Pneumothorax,* which can be caused by blunt or penetrating trauma, means that air has entered the pleural cavity; the air causes complete or partial collapse of the lung
◆ *Tension pneumothorax* can be caused by blunt trauma and is life-threatening if untreated because of its effects on respiratory and cardiac function
◆ *Cardiac tamponade* is the accumulation of blood in the pericardial sac, resulting from blunt or penetrating injury to the pericardium or heart; it's life-threatening if untreated (see *Comparing types of chest trauma*)

■ Pathophysiology

◆ With a rib fracture, pain may cause hypoventilation that leads to atelectasis
◆ With a flail chest, the flail segment moves in a manner opposite that of normal rib movement during respirations; as a result, the lungs can't fully expand

Comparing types of chest trauma

Signs and symptoms	Diagnosis and treatment	Nursing care
Cardiac tamponade		
• Varied symptoms, depending on speed of blood accumulation • Chest pain, hypotension, muffled heart sounds, and tachycardia • Cyanosis, diaphoresis, dyspnea, and restlessness • Distended neck veins • Narrowed pulse pressure and paradoxical pulse • When tamponade develops more slowly: ascites, edema in arms and legs, liver enlargement	• Echocardiography can be used to diagnose cardiac tamponade. • Central venous pressure, which is elevated in patients with cardiac tamponade, is monitored. • Pericardiocentesis is used to remove fluid from the pericardial sac. • The injured area is repaired surgically. • I.V. fluids are rapidly infused. • Inotropic drugs are given to improve myocardial contractility.	• Administer oxygen to maintain adequate oxygenation, improve partial pressure of arterial oxygen (Pao_2), and reverse the hypoxemia. • Watch for complications, such as ventricular fibrillation, vasovagal response, or cardiac compression.
Flail chest		
• Cyanosis and dyspnea • Hypercapnia and hypoxemia • Increased respiratory effort • Pain on inspiration and on palpation of the injured area • Paradoxical movement of the flail segment	• Chest X-ray and arterial blood gas (ABG) studies typically are ordered. • Several types of analgesia may be used to relieve pain: patient-controlled analgesia, transcutaneous electrical nerve stimulation, or intercostal nerve block. • A chest tube may be inserted to treat hemothorax or pneumothorax. • Endotracheal intubation and mechanical ventilation may be used to stabilize the chest wall. • The flail segment may need to be repaired surgically.	• Teach the patient techniques for effective coughing and deep breathing to improve airway clearance. • Medicate for pain to promote effective coughing and deep breathing. • Provide hydration to liquefy secretions; thin secretions are easier to cough up. • Administer oxygen to improve Pao_2 and reverse hypoxemia. • Suction the patient's airway as needed to maintain patency and to clear secretions. • Provide pillows and teach the patient to support and splint the flail segment to minimize pain and to allow maximum lung expansion.
Pneumothorax		
• Asymmetrical lung expansion • Chest pain, crepitus, and dyspnea • Decreased or absent breath sounds on the affected side • Restlessness • Signs of mediastinal shift and tension pneumothorax	• Chest X-ray and ABG studies typically are ordered. • Analgesia is provided to relieve pain. • A chest tube may be inserted and attached to a suction device. In a three-chamber device, the first chamber allows for fluid drainage, the second one is a water seal that acts as a one-way valve to prevent air from entering the pleural cavity, and the third one controls the amount of suction, which is needed to remove air from the pleural cavity. • In an emergency, a Cook catheter with a Heimlich valve may be used to prevent air from entering the pleural cavity.	• Administer oxygen to improve Pao_2 and reverse hypoxemia. • Teach the patient techniques for effective coughing and deep breathing to prevent atelectasis and promote lung expansion. • Maintain the integrity of the chest tube system to facilitate air drainage from around the lung and promote lung expansion. Crepitus near the tube insertion site reflects air leakage into tissue and a possible leak in the chest tube system. When an air leak is no longer evident, the lung has healed itself and sealed off the injured area. If the chest drainage system is impaired and loses its seal, place the end of the chest tube in a container of sterile water. • Encourage frequent position changes to prevent complications of immobility and promote lung expansion and perfusion. • Provide an analgesic as needed to reduce anxiety and encourage coughing and deep breathing.

(continued)

Comparing types of chest trauma *(continued)*

Signs and symptoms	Diagnosis and treatment	Nursing care
Rib fractures		
• Pain on inspiration • Pain and tenderness of injured area upon palpation • Ineffective ventilation and retention of secretions • Signs of other injury such as soft-tissue injury	• Chest X-ray and ABG studies typically are ordered. • Analgesia is given to relieve pain. • An epidural catheter may be inserted for administration of narcotic analgesia. • A nerve block into the intercostal nerves above and below the fractured ribs may be used to relieve severe pain.	• Tell the patient not to wear tight or constrictive clothing, which can inhibit lung expansion and decrease effective ventilation. • Encourage the patient to breathe deeply and use an incentive spirometer hourly to maximize lung expansion and reexpand collapsed alveoli. • Medicate for pain or discomfort as needed, which will allow the patient to deep-breathe effectively. • Implement chest physiotherapy, unless contraindicated, to loosen secretions, which makes them easier to expectorate. • Provide adequate hydration to liquefy secretions; thin secretions are easier to cough up.
Tension pneumothorax		
• Asymmetrical lung expansion and tracheal deviation to affected side • Cyanosis, hypotension, and tachycardia • Decreased or absent breath sounds on the affected side • Distended neck veins • Severe chest pain and respiratory distress • Subcutaneous emphysema	• Chest X-ray and ABG studies typically are ordered. • Needle decompression is used for emergency air removal. • A chest tube may be inserted and attached to a suction device, such as a three-chamber device.	• Administer oxygen to improve Pao_2, reverse hypoxemia, and promote lung expansion. • Teach the patient techniques for effective coughing and deep breathing to prevent atelectasis and promote lung expansion. • Maintain the integrity of the chest tube system to facilitate air drainage from around the lung and promote lung expansion, as in pneumothorax. • Encourage frequent position changes to prevent complications of immobility and promote lung expansion and perfusion. • Provide an analgesic as needed to reduce anxiety and encourage coughing and deep breathing.

- ◆ Pneumothorax can result when a fractured rib or penetrating trauma perforates a lung
  - ◗ Air escapes from the lung into the pleural cavity
  - ◗ The lung can't fully expand, gas exchange is compromised, normal intrathoracic pressure is disturbed, and the lung may collapse
- ◆ With tension pneumothorax, trauma causes air to escape from the lung into the pleural cavity, where the air becomes trapped
  - ◗ Pressure builds in the thoracic cavity, causing lung collapse
  - ◗ The mediastinum shifts to the opposite side, compromising the other lung, and the vena cava becomes depressed, causing impaired venous return
- ◆ With cardiac tamponade, intrapericardial pressure increases, compressing the heart; cardiac output decreases, and cardiogenic shock occurs

❖ Chronic obstructive pulmonary disease

■ Description

- ◆ COPD is the term used for preventable and treatable disorders that block the normal flow of air through the lungs, thereby trapping air in the alveoli
- ◆ Chronic bronchitis, and emphysema are types of COPD; asthma, once classified as a type of COPD, is now considered a distinct restrictive rather than obstructive disorder (see *Comparing chronic obstructive pulmonary diseases*)

■ Chronic bronchitis

- ◆ Chronic bronchitis affects the lung parenchyma; it's characterized by a productive cough for at least 3 months a year for 2 or more consecutive years
- ◆ It results from lung irritants, such as air pollution and smoking, as well as from genetic factors
- ◆ With chronic bronchitis, increased bronchial mucus gland production and goblet cell hyperplasia result in increased sputum production; ciliary damage and epithelial metaplasia may occur
- ◆ Bronchial irritants or infection may cause bronchial edema, bronchospasm, impaired mucociliary clearance, impaired ventilation (especially during expiration), increased secretions, and small-airway blockage
- ◆ Impaired diffusion is caused by decreased airflow, mucus plugs, and secondary infection; cyanosis and polycythemia develop as a result of hypoxemia

Comparing chronic obstructive pulmonary diseases

Chronic bronchitis and emphysema have distinctive signs and symptoms and require specific treatments and nursing care.

Signs and symptoms	Diagnosis and treatments	Nursing care
Chronic bronchitis		
• Accessory muscle use, slight increase in anteroposterior chest diameter • Anxiety and depression • Bronchospasm • Chronic productive cough for thick, tenacious sputum that isn't clear and may have mucus plugs • Cyanosis and dyspnea • Decreased activity tolerance • Heart failure, hyponatremia, and renal failure caused by fluid overload late in disease • Lung hyperresonance, decreased breath sounds, diffuse wheezes, crackles and rhonchi, and prolonged expiration • Signs of right-sided heart failure (cor pulmonale)	• Chest X-ray, pulmonary function tests, arterial blood gas (ABG) studies, complete blood count, electrolyte levels, electrocardiogram, and sputum analysis typically are ordered. • An inhaled anticholinergic and an inhaled beta$_2$-adrenergic agonist are the mainstay of therapy; they're delivered by metered-dose inhaler (MDI) or nebulizer to enlarge the airways. • Aminophylline or another methylxanthine is given orally or I.V. to relax bronchial spasms. • An antibiotic is used to prevent or treat infection. • An inhaled or oral steroid is used to decrease the inflammatory response, thus decreasing bronchial edema during acute exacerbations.	• Administer oxygen to maintain a partial pressure of arterial oxygen (Pao_2) of 60 mm Hg or an arterial oxygen saturation of 90%. • Provide adequate hydration to liquefy secretions. Thin secretions are easier to expectorate. • Implement chest physical therapy. Postural drainage uses gravity to clear secretions; percussion and vibration loosen secretions, making them easier to cough up. • Teach the patient how to cough effectively to help clear secretions and to use diaphragmatic and pursed-lip breathing. • Teach the patient how to use an MDI with spacer correctly to ensure delivery of accurate doses to the small airways and to prevent overuse. • Educate the patient about the signs of respiratory tract infections, such as fever, change in sputum color or amount, and increased shortness of breath. Untreated infections may lead to acute respiratory failure. • Teach about proper and safe use of home oxygen equipment. • Teach the patient about the effects of smoking, and help the patient quit. • Recommend yearly influenza vaccines and pneumococcal vaccines every 5 years to reduce the risk of these infections.

(continued)

Comparing chronic obstructive pulmonary diseases *(continued)*

Signs and symptoms	Diagnosis and treatments	Nursing care
Emphysema		
• Accessory muscle use, increased anteroposterior diameter (barrel chest), lowered diaphragm, and reduced chest excursion • Anxiety and depression • Characteristic patient positioning—that is, leaning slightly forward with arms resting on the sides of the chair • Decreased activity tolerance • Dyspnea • Fatigue from increased work of breathing • Pursed-lip breathing and hyperventilation • Lung hyperresonance, decreased breath sounds, expiratory wheezes, and prolonged expiration	• Chest X-ray, pulmonary function tests, ABG studies, and sputum analysis typically are ordered. • The patient is immunized against the flu to prevent infection. If infection occurs, an antibiotic is the treatment of choice. • Smoking cessation is encouraged to prevent continued alveolar damage. • See "*Chronic bronchitis: Diagnosis and treatments,*" page 153, for specific therapies.	• Administer oxygen to a hypoxemic patient to maintain a Pa_{O_2} of 60 mm Hg. Be aware that excessive oxygenation may cause loss of the incentive to breathe. • Teach about pursed-lip and abdominal breathing, which prevent small-airway collapse during exhalation by slowing respiration and increasing bronchiole pressure. • Encourage activity to help prevent muscle wasting, but schedule frequent rest periods to avoid tiring the patient. • Teach the patient to conserve energy by sitting for activities when possible and alternating hard and easy tasks. • Teach relaxation and stress-reduction techniques to prevent anxiety, which can exacerbate the disease. • Provide information about prescribed drugs. • Explain the importance of adequate fluid intake, which liquefies secretions, and a balanced diet, which prevents muscle wasting. • Instruct the patient to eat frequent small meals to prevent constipation and to avoid gas-forming foods to prevent pressure on the diaphragm and increased shortness of breath. • Help prevent infections by telling the patient to avoid crowds, small children, and exposure to persons with respiratory tract infections. • Teach the patient about the symptoms of respiratory tract infections. Untreated infections can lead to acute respiratory failure. • Teach the patient about the effects of smoking, and help the patient quit. • Recommend yearly influenza vaccines and a pneumococcal vaccine every 5 years. • Arrange for home oxygen therapy if needed.

◆ Signs of emphysema may be present, and as the disease progresses, cor pulmonale and pulmonary hypertension may develop

■ Emphysema

◆ Emphysema is a disease of the lung parenchyma characterized by changes in the alveolar wall and enlarged alveoli distal to the nonrespiratory bronchioles

◆ It results from $alpha_1$-antitrypsin deficiency and is associated with smoking and air pollution

◆ Emphysema impairs ventilation by decreasing lung elasticity, collapsing small airways during exhalation, trapping air, and causing poor gas exchange in the alveoli

◆ It impairs diffusion by enlarging distal air spaces (which increases the distance for diffusion) and causing loss of capillary membranes and pulmonary vasoconstriction

◆ It impairs perfusion by causing loss of pulmonary vasculature, pulmonary hypertension, and cor pulmonale

❖ Cor pulmonale

Description

- In cor pulmonale, hypertrophy and dilation of the right ventricle secondary to disease affect the structure or function of the lungs or their vasculature, resulting in right-sided heart failure
- The disorder can occur at the end stage of various chronic disorders of the lungs, pulmonary vessels, chest wall, and respiratory control center
- Pulmonary hypertension increases the heart's workload
- To compensate, the right ventricle hypertrophies to force blood through the lungs
- In response to hypoxia, the bone marrow produces more red blood cells, causing polycythemia; the resulting increased viscosity further aggravates pulmonary hypertension and increases right ventricular workload
- Causes include primary pulmonary hypertension, pulmonary embolism, asthma, connective tissue disorders, COPD (the cause in more than half of all cases), chronic severe tricuspid regurgitation, disorders affecting the pulmonary parenchyma, and neuromuscular disease
- Cor pulmonale accounts for approximately 6% to 8% of all types of heart disease in adults in the United States
- Patients with cor pulmonale are typically older than age 45; males are more likely to be affected than females

Signs and symptoms

- Signs and symptoms include a history of dyspnea, chronic productive cough, fatigue, and weakness
- Other signs and symptoms include tachypnea, wheezing, chest wall retractions, hemoptysis, pitting edema in the extremities, distended jugular veins, an enlarged liver, and tachycardia with pansystolic murmur at the lower left sternal border

Diagnosis and treatment

- ABG analysis reveals decreased Pao_2 (usually less than 70 mm Hg and rarely more than 90 mm Hg), hypercapnia, and hypoxia
- Hematocrit is typically over 50%
- Serum liver enzyme levels may show an elevated level of aspartate aminotransferase
- Brain natriuretic peptide level may be elevated
- Chest x-ray, echocardiography, angiography, and magnetic resonance imaging (MRI) demonstrate right ventricular enlargement
- An ECG shows arrhythmias and may show atrial fibrillation and right bundle-branch block
- Pulmonary function studies reflect underlying pulmonary disease
- A hemodynamic profile shows increased pulmonary vascular resistance
- The key to treatment is correcting the underlying problem
- Oxygen therapy improves oxygenation
- Phlebotomy is indicated for patients with COPD with a hematocrit of 55% or more
- Continuous positive airway pressure or biphasic positive air pressure is indicated for sleep apnea
- The patient should be on moderate sodium restriction and diuretics
- Patients should limit activity as tolerated; during the acute phase, patients should be on bed rest
- Beta selective agonists, such as epoprostenol (Flolan), treprostinil (Remodulin), and iloprost (Ventavis), are used to treat primary pulmonary hypertension
- Bronchodilators administered by nebulizer include ipratropium (Atrovent), metaproterenol, and albuterol (Accuneb)
- For patients with persistent disease, vasodilators include hydralazine, nifedipine (Procardia), diltiazem (Cardizem), and prazosin (Minipress)
- The endothelin-1 receptor antagonists bosentan can help patients with pulmonary hypertension and severe symptoms to improve exertional tolerance and increase walking distance
- Antibiotics treat acute respiratory infections
- Anticoagulants help prevent thromboembolism

Nursing interventions

- Monitor the patient's vital signs, and pay attention to his cardiac and respiratory status

- ◆ Reposition the patient often; elevate the head of the bed to increase thoracic expansion and ease the work of breathing
- ◆ Administer oxygen as ordered based on oxygen saturation levels obtained with pulse oximetry and ABG results
- ◆ Give prescribed drugs; if the patient will receive I.V. diuretics, ensure patent I.V. access
- ◆ Encourage the patient to take slow, deep breaths when using nebulized medications, as appropriate
- ◆ Provide frequent rest periods; cluster nursing activities to minimize oxygen and metabolic demands
- ◆ Teach the patient and family about the disorder, the patient's diagnosis, the underlying cause and its relationship to the patient's current condition, treatment, and follow-up care

❖ Hemothorax

■ Description

- ◆ Hemothorax is the presence of blood in the pleural cavity; it typically accompanies pneumothorax
- ◆ It may result from chest trauma, lacerated liver, penetrating trauma, perforated blood vessels, perforated diaphragm, pleural damage that causes bleeding, or rib fracture
- ◆ In hemothorax, blood collects in the pleural layer, compressing the lung on the affected side; this lung compression compromises gas exchange

■ Signs and symptoms

- ◆ Chest pain, cyanosis, dyspnea, and tachypnea commonly occur
- ◆ With marked blood loss, hypertension and shock may occur
- ◆ Asymmetrical lung expansion is accompanied by decreased breath sounds on the affected side

■ Diagnosis and treatment

- ◆ Chest X-ray, CBC, and ABG studies are commonly prescribed
- ◆ A chest tube is inserted, and a water seal or suction is used to facilitate drainage
- ◆ Thoracotomy may be indicated if blood loss is severe
- ◆ If total blood loss is severe, the patient is treated with I.V. fluids and transfusion

■ Nursing interventions

- ◆ Administer oxygen to maintain adequate oxygenation, improve Pao_2, and reverse hypoxemia
- ◆ Teach techniques for effective coughing and deep breathing to prevent atelectasis and promote lung expansion
- ◆ Maintain the integrity of the chest tube system to facilitate blood drainage from around the lung and promote lung expansion
- ◆ Check the chest tube insertion site for crepitus, which indicates air leakage into tissue and may indicate a leak in the chest tube system
  - ◗ An air leak in the system may indicate that the lung is damaged, causing air to leak from the lung into the pleural space
  - ◗ If the air leak is outside the chest cavity (such as from the chest tube), air entering the system may increase air accumulation in the pleural space
- ◆ Encourage frequent position changes to prevent complications of immobility and promote lung expansion
- ◆ Provide an analgesic as needed to reduce anxiety, relieve pain, and ease coughing and deep breathing

❖ Influenza

■ Description

- ◆ Influenza is an infectious disease caused by ribonucleic acid (RNA) viruses that can affect humans, birds, and other mammals
- ◆ Influenca A, influenza B, and influenza C can all infect humans
- ◆ H1N1 is a subtypes of influenza A; strains are endemic in pigs (swine) and in birds (avian)

■ Avian influenza

- ◆ Infected migratory and domestic birds shed the virus in their saliva, nasal secretions, and feces
- ◆ The strain is known as H5N1

- Transmission has been limited to people, and some animals such as cats, in contact with infected birds
- Should this virus become more easily transmissible person-to-person, it may lead to a pandemic

■ Signs and symptoms
- Symptoms range from typical human influenza-like symptoms, such as fever, cough, sore throat, and muscle aches, to eye infections, pneumonia, and acute respiratory distress
- Diarrhea, vomiting, and abdominal pain may occur

■ Diagnosis and treatment
- Chest X-ray may show pneumonia, infiltrates, or consolidations
- Sputum Gram stains and culture isolate the virus
- Neuraminidase inhibitor class drugs, such as oseltamivir (Tamiflu) and zanamivir (Relenza), can reduce the severity and duration of illness caused by seasonal influenza; efficacy depends on early administration
- M2 inhibitors amantadine and rimantadine could possibly be used for pandemic infuenza, but resistance to these drugs may develop
- The patient may require treatment to maintain fluid and electrolyte balance
- The patient may need mechanical ventilation for acute respiratory distress

■ Nursing interventions
- Follow standard and contact precautions, wear a fit-tested ventilator, and perform frequent hand hygeine
- Wear eye protection within 3 feet of the patient
- Maintain a patent airway, suctioning the patient when necessary
- Notify the National Respiratory and Enteric Virus Surveillance System

❖ Pleural effusion

■ Description
- Pleural effusion is an accumulation of fluid in the pleural space (the thin space between the visceral and parietal pleura); although it isn't a disease itself, it occurs secondary to other disease states
- Empyema is the accumulation of pus and necrotic tissue in the pleural space; blood (hemothorax) and chyle (chylothorax) may also collect in this space
- A pleural effusion can be classified either as exudative (caused by inflammation of the pleura) or transudative (caused by excessive hydrostatic pressure or decreased osmotic pressure)
  - Common causes of exudative effusions are bacterial or fungal empyema or pneumonitis, chest trauma, collagen disease, malignancy, myxedema, pancreatitis, pulmonary embolism, subphrenic abscess, and tuberculosis
  - Common causes of transudative effusions are heart failure, hepatic disease with ascites, hypoalbuminemia, and peritoneal dialysis

■ Signs and symptoms
- The most common symptoms are pleuritic pain and dyspnea
- Physical examination may reveal decreased chest wall movement, decreased breath sounds over the affected area, and dullness on percussion
- Infection from empyema may produce cough, fever, and night sweats

■ Diagnosis and treatment
- Chest X-ray can diagnose pleural effusion; other tests that may be prescribed include CT scan of the chest, bronchoscopy, pleurocentesis, and ultrasonography
- The underlying cause should be treated if it can be identified
- Thoracentesis is performed to remove fluid; chest tubes may be placed for continued drainage
- Thoracotomy may be needed if thoracentesis isn't effective
- An antibiotic is prescribed to treat empyema; the specific antibiotic used depends on the causative organism

■ Nursing interventions
- Explain thoracentesis to the patient, and support him during the procedure
- Watch for respiratory distress or pneumothorax after thoracentesis

- ◆ Administer oxygen to improve oxygenation
- ◆ Encourage deep-breathing exercises and incentive spirometry to promote lung expansion
- ◆ Maintain the integrity of the chest tube drainage system; monitor the amount, color, and consistency of drainage; and check for air leaks

❖ Pneumonia

■ Description

- ◆ Pneumonia is an acute lung infection with inflammation accompanied by accumulation of exudate in the alveoli (see *Pneumocystis jiroveci pneumonia*)
- ◆ The risk of pneumonia increases with aspiration, central nervous system depression, chronic illness, COPD, dehydration, existence of a tracheostomy opening, immobility, immunosuppression, intubation, pain in the thoracic cavity, and use of general anesthesia
- ◆ It may result from a bacterial, fungal, or viral infection or from exposure to a chemical irritant, through aspiration or gas inhalation
- ◆ Pneumonia remains a major cause of morbidity and mortality among elderly and chronically ill people

■ Signs and symptoms

- ◆ Dyspnea or tachypnea, fatigue, and fever commonly occur
- ◆ Signs of cyanosis or hypoxia may occur in those with advanced disease
- ◆ Irritability or restlessness may signal cerebral hypoxia
- ◆ Sputum may vary in amount, color, and consistency, depending on the causative agent
- ◆ Lung auscultation may reveal crackles, rhonchi, bronchial breath sounds over areas of consolidation, or wheezes over the affected areas; breath sounds may be decreased in those with advanced disease

■ Diagnosis and treatment

- ◆ Chest X-ray, ABG studies, sputum culture (for bacterial infection), and serologic testing (for viral infection) may be prescribed
- ◆ Needle or open biopsy may obtain lung tissue specimens (for fungal infection), and cold agglutinins may reveal antibodies associated with *Mycoplasma pneumoniae* infection
- ◆ Pneumonia is treated with antibiotics to eradicate the infecting organism
- ◆ A bronchodilator is used to open narrowed airways

■ Nursing interventions

- ◆ Teach effective coughing and deep breathing to improve airway clearance
- ◆ Provide adequate hydration to liquefy secretions; thin secretions are easier to expectorate
- ◆ Implement chest physiotherapy; postural drainage uses gravity to clear secretions, and percussion and vibration loosen secretions, making them easier to cough up
- ◆ Administer oxygen to aid ventilation, improve Pao_2, and preserve oxygenation
- ◆ Suction the patient's airway as needed to maintain patency and to clear secretions
- ◆ Advise the patient to limit activity and to rest for long periods to decrease oxygen consumption
- ◆ Provide pain medication as needed to allow effective coughing and deep breathing
- ◆ Maintain adequate nutrition to offset the increased use of calories secondary to infection
- ◆ Teach the patient how to contain secretions to reduce the risk of spreading infection
- ◆ Practice good hand hygiene techniques to reduce the risk of spreading infection
- ◆ Teach relaxation and stress-reduction techniques; anxiety can compromise the immune system and increase the risk of infection

❖ Pulmonary edema

■ Description

- ◆ Pulmonary edema is the collection of fluid in the interstitium and alveoli of the lungs as pressure rises in the pulmonary vessels
- ◆ It can result from ARDS, fluid overload, left-sided heart failure, mitral stenosis, MI, or pulmonary emboli
- ◆ With pulmonary edema, the left ventricle can't effectively pump blood from the heart
  - ◗ With increased resistence to left ventricular filling, fluid backs up into the lungs

Pneumocystis jiroveci pneumonia

Pneumocystis jiroveci pneumonia commonly results from an infection of *P. jiroveci* in an immunocompromised patient. Its onset is abrupt and may be a flare-up of a latent disease. Its signs and symptoms may include crackles over the affected areas, cyanosis, dyspnea or tachypnea, fever, hypoxemia, irritability or restlessness, and nonproductive cough.

Diagnostic tests may include chest X-ray, arterial blood gas analysis to check for hypoxemia, and needle or open biopsy to obtain lung tissue specimens for culture. The drugs of choice for treating this type of pneumonia are pentamidine isethionate, an inhaled antibiotic, and co-trimoxazole (also known as sulfamethoxazole-trimethoprim).

Care for a patient with *P. jiroveci* pneumonia resembles that of a patient with other types of pneumonia. Key nursing interventions include administering oxygen and an analgesic as needed, practicing good hand hygiene throughout care, limiting activity and encouraging rest periods, and teaching techniques to reduce the spread of infection and reduce stress.

- Surface tension increases, the alveoli shrink, and the lungs become stiff, making breathing more difficult
- Hypoxemia and an altered $\dot{V}/\dot{Q}$ ratio develop
- Fluid moves into the larger airways, where it's coughed up as pink, frothy sputum

Signs and symptoms

- Tachycardia and tachypnea may be accompanied by narrowed pulse pressures and hypotension; third and fourth heart sounds may be present; skin may be cold and clammy
- Dyspnea, increased respiratory rate, orthopnea, and pulmonary hypertension may occur
- Jugular veins may be distended, and PAWP may be elevated
- Coughing may produce blood-tinged or pink, frothy sputum
- Lung auscultation may reveal dependent crackles
- Other signs and symptoms may include confusion, decreased urine output, diaphoresis, drowsiness, lethargy, and restlessness

Diagnosis and treatment

- Chest X-ray, pulse oximetry, and ABG studies typically are prescribed
- A PA catheter is inserted to measure pressures
- A diuretic is administered to decrease edema
- Other drugs that may be administered include an inotropic drug to increase myocardial contractility, nitroglycerin to reduce preload and afterload, I.V. nitroprusside to reduce preload and afterload, and a vasopressor to maintain blood pressure
- Intubation and mechanical ventilation may be necessary to treat respiratory distress
- Morphine is administered to decrease preload, respiratory rate, and anxiety
- Patients who don't respond to drug therapy may be treated with an intra-aortic balloon pump, which temporarily assists the failed left ventricle, or with surgery (such as angioplasty, coronary artery bypass grafting, or valvular repair), depending on the underlying heart condition

Nursing interventions

- Administer oxygen to aid ventilation, improve Pao_2, and reverse hypoxemia
- Place the patient in semi-Fowler's position to maximize oxygenation and increase comfort
- Carefully monitor fluid intake and output to assess the effectiveness of diuretic therapy and prevent sudden increases in venous return caused by oral and I.V. intake
- Medicate for pain as needed to reduce anxiety and increase comfort
- Frequently change the patient's position to prevent pressure ulcers and encourage lung expansion

❖ Pulmonary embolism

Description

- Pulmonary embolism is a blockage in the pulmonary vasculature
- Risk factors include atrial fibrillation; COPD; a family history of pulmonary embolism; oral contraceptive use; prior thromboembolic disease; venous injury caused by abdominal, pelvic, or thoracic

surgery or leg or pelvic trauma; and venous stasis caused by age (older than age 55), burns, obesity, pregnancy, or prolonged immobility

- Pulmonary embolism is commonly caused by dislodged thrombi from deep veins in the pelvis or legs or from any systemic veins
- In this disorder, an embolism lodges in a branch of the pulmonary vasculature; the embolism may consist of bone, air, fat, amniotic fluid, a thrombus, or a foreign object
  - The area of the lung below the embolism isn't perfused, causing altered $\dot{V}/\dot{Q}$ ratio, which can cause alveolar collapse and lead to atelectasis and hypoxemia
  - Pulmonary infarction may occur, destroying lung tissue
  - A massive pulmonary embolism can cause pulmonary hypertension as a result of increased vascular resistance, right-sided heart failure as a result of increased right ventricular workload, or ventricular hypertrophy as a result of increased right ventricular workload

Signs and symptoms

- Dyspnea may occur suddenly, accompanied by chest pain
- Pleuritic chest pain may indicate pulmonary infarction
- Cough may produce hemoptysis
- Anxiety, increased restlessness, hypotension, and tachycardia may occur
- Lung auscultation may reveal crackles, pleural friction rub, and wheezes
- Low-grade fever and tachypnea may occur
- Signs of cor pulmonale and right-sided heart failure may develop
- If the patient has a massive pulmonary embolism, he may experience arrhythmias, cyanosis, or diaphoresis
- If the patient has a fat embolism, he may experience confusion, dyspnea, or petechiae on his chest and axillae
- The patient's legs may have signs and symptoms of deep vein thrombosis, such as edema, redness, tenderness, and warmth

Diagnosis and treatment

- Several tests are used to diagnose pulmonary embolism: ABG studies, chest X-ray, electrocardiography, lung scintigraphy, MRI, pulmonary angiography, and $\dot{V}/\dot{Q}$ lung scanning
- Several tests are used to diagnose deep vein thrombosis, which can lead to pulmonary embolism: contrast venography, Doppler ultrasonography, impedance plethysmography, and leg scan after injection of fibrinogen
- After an initial I.V. bolus of heparin, a therapeutic heparin infusion is given to inhibit clot formation, prevent emboli development, and maintain the partial thromboplastin time (PTT) between 1.5 and 2 times the control (60 to 70 seconds)
- If the patient needs long-term therapy, warfarin (Coumadin) is administered to maintain the prothrombin time (PT) between 1.5 and 2 times the control (11 to 12 seconds) or the International Normalized Ratio (INR) between 2 and 3; once the therapeutic dose of warfarin is achieved, the heparin infusion may be discontinued
- If the patient has a life-threatening embolism, a thrombolytic is administered, or a surgical embolectomy is performed
- If the patient can't tolerate anticoagulant therapy or continues to develop clots despite taking these drugs, surgical insertion of a vena caval filter may be needed
- A diuretic may be prescribed for a patient with a fat embolism; an antibiotic, for a patient with a septic embolism
- An antiarrhythmic may be used to correct heart rhythm disturbances caused by ischemia

Nursing interventions

- Administer oxygen to improve Pao_2, reverse hypoxemia, and promote lung expansion
- If the patient requires mechanical ventilation, assist as needed
- Teach effective coughing and deep breathing to help clear secretions and prevent atelectasis
- Provide adequate hydration to liquefy secretions; thin secretions are easier to expectorate
- Encourage early ambulation to prevent clot formation in deep veins; encourage range-of-motion (ROM) exercises or perform passive ROM exercises if the patient can't walk

- Use antiembolism stockings or a compression device to divert blood flow to the large veins, prevent emboli formation, and promote venous return
- Don't raise the patient's knees; this obstructs venous flow and increases the risk of deep vein thrombosis
- Elevate the patient's legs to prevent venous stasis
- Maintain the heparin infusion, and monitor the PTT
- Administer warfarin daily, as prescribed, and monitor the PT or INR
- Test all stool for blood caused by anticoagulant-induced GI bleeding
- Provide analgesia and comfort measures to reduce anxiety
- Teach the patient about anticoagulant therapy to reduce the risk of bleeding, and help the patient maintain therapeutic PT or INR
- Have the family or home health nurse check the home for hazards, especially those that may cause falls; a safe environment is necessary because a patient receiving an anticoagulant has an increased tendency to bleed
- Instruct the patient not to cross his legs, sit for long periods, or wear restrictive clothing; these activities inhibit venous return and promote clot formation

❖ Severe acute respiratory syndrome

Description

- Severe acute respiratory syndrome (SARS) is a life-threatening viral infection believed to be coronavirus
- A theory suggests that coronavirus may have mutated from pigs, birds, and other animals, allowing transmission to and infection of humans
- The incubation period is estimated to range from 2 to 7 days (average is 3 to 5 days)
- Risk factors include close contact with an infected person, contact with exhaled droplets and bodily secretions from an infected person, or travel to endemic areas

Signs and symptoms

- In early stages, signs and symptoms include nonproductive cough, rash, high fever, headache, body aches, and pneumonia
- Shortness of breath and respiratory distress occur in later stages

Diagnosis and treatment

- Serum electrophoresis detects antibodies to the coronavirus
- Sputum Gram stain and culture isolates the coronavirus
- SARS-specific polymerase chain reaction tests detect SARS-CoV RNA
- Isolation (strict respiratory and mucosal barrier) prevents the spread of disease
- Antivirals treat viral infection, and a combination of corticosteroids and antimicrobials treat inflammation and infection
- Mechanical ventilation treats respiratory failure

Nursing interventions

- Maintain isolation for the patient
- Practice good hygiene to prevent further transmission
- Maintain a patent airway through suctioning if the patient requires mechanical ventilation
- Monitor the patient's vital signs and nutritional, fluid, and respiratory status

❖ Tuberculosis

Description

- Tuberculosis (TB) is an infectious disease that commonly affects the lungs; it typically occurs only after repeated, close contact with a person infected with *Mycobacterium tuberculosis*
- Risk factors for TB include alcoholism, immunosuppression, low economic status, and malnutrition; elderly people, populations in crowded areas (for example, shelters and prisons), and immigrants from areas with high incidences of TB (such as Africa, Southeast Asia, and the Caribbean islands) are also more susceptible
- The incidence of TB has increased in proportion to the increase in patients who are infected with the human immunodeficiency virus

- *M. tuberculosis* is spread by way of infected airborne droplets; after infected droplets are inhaled into the terminal bronchioles, localized pneumonia develops, initiating an inflammatory response
  - Bacilli are phagocytized by macrophages but remain viable within the phagocyte
  - Tubercles form and grow in the lungs
  - The lesion center forms a yellow, cheesy mass called caseous necrosis
  - Healing begins, walling off the initial infection, and adenopathy occurs
  - Systemic infection may develop in the absence of appropriate treatment
- Within 6 weeks of exposure to the infected droplets, cellular immunity occurs, and skin test results become positive
- Latent TB infection can become active TB disease years after exposure, when resistance is lowered

■ Signs and symptoms
- Anorexia, weight loss, chills, fever, chest pain, coughing up blood or sputum, and night sweats may occur in patients with active TB disease
- Lung ausculation may reveal crackles, pleural effusions, and rhonchi.

■ Diagnosis and treatment
- The Mantoux TB skin test or the Quanti FERON - TB Gold test, a gamma interferon blood test for TB, can be used to test for *M. tuberculosis* infection
- Abnormalities seen during a chest X-ray may suggest TB, but can't be used to diagnose TB
- The presence of acid-fast bacilli on a sputum smear or other specimen after indicates disease
- A positive culture for *M. tuberculosis* confirms the diagnosis of active TB disease
- Preventive treatment with isoniazid for 9 to 12 months is recommended for other members of the patient's household, those with recently converted positive skin tests, and those with positive skin tests (depending on medical history)
- If the patient has active TB disease, an antituberculotic is used for 6 to 9 months; isoniazid with rifampin usually is the first choice; other antituberculotics include ethambutol, and pyrazinamide

■ Nursing interventions
- Teach the patient how to contain airborne droplets and secretions to reduce the risk of spreading the infection
- Practice good hand hygiene techniques to reduce the risk of spreading the infection
- Explain disease transmission to the patient and the need for prolonged therapy to help increase his compliance with the treatment plan
- Teach the patient about the prescribed drugs, including how to recognize adverse reactions (especially the symptoms of hepatotoxicity)
- Encourage the patient to maintain adequate dietary intake to maintain nutritional status, build strength, and improve the body's defense mechanisms
- Weigh the patient daily to assess nutritional status

Review questions

1. A patient with pneumonia in the right lower lobe is prescribed percussion and postural drainage. When performing percussion and postural drainage, the nurse should position him:

○ **A.** in semi-Fowler's position with his knees bent.

○ **B.** in a right side-lying position with the foot of his bed elevated.

○ **C.** in a prone or supine position with the foot of his bed elevated higher than his head.

○ **D.** bent at the waist leaning slightly forward.

Correct answer: C The aim of percussion and postural drainage is to mobilize pulmonary secretions, so they can be effectively expectorated. When a patient has pneumonia in the right lower lobe, the nurse should position him with his right side up or lower lobes elevated above the upper lobes so that gravity can help mobilize pulmonary secretions. Options A and D are incorrect because semi-Fowler's position and being bent forward at the waist would hamper mobilization of secretions from the right lower lobe. Option B is incorrect because the patient should be positioned with his right side up.

2. A patient with acquired immunodeficiency syndrome (AIDS) develops *P. jiroveci* pneumonia. Which nursing diagnosis has the highest priority for this patient?

- ○ **A.** Impaired gas exchange
- ○ **B.** Impaired oral mucous membranes
- ○ **C.** Imbalanced nutrition: Less than body requirements
- ○ **D.** Activity intolerance

Correct answer: A Although all these nursing diagnoses are appropriate for a patient with AIDS, *Impaired gas exchange* is the priority nursing diagnosis for the patient with *P. jiroveci* pneumonia. Airway, breathing, and circulation take top priority for any patient.

3. A patient has chronic bronchitis. The nurse is teaching him breathing exercises. Which point should the nurse include in her teaching?

- ○ **A.** Make inhalation longer than exhalation.
- ○ **B.** Exhale through an open mouth.
- ○ **C.** Use diaphragmatic breathing.
- ○ **D.** Use chest breathing.

Correct answer: C In patients with chronic bronchitis, the diaphragm is flat and weak. Diaphragmatic breathing helps to strengthen the diaphragm and maximizes ventilation. Option A is incorrect because exhalation should be no longer than inhalation to prevent collapse of the bronchioles. Because a patient with chronic bronchitis should exhale through pursed lips to prolong expiration, keep the bronchioles from collapsing, and prevent air trapping, Option B is incorrect. Option D is incorrect because diaphragmatic breathing, not chest breathing, increases lung expansion.

4. A patient with ARDS is intubated and placed on mechanical ventilation. His Pao_2 is 60 mm Hg on 1.0 FIO_2. To improve his Pao_2 without raising the FIO_2, the patient will most likely be placed on:

- ○ **A.** time-cycled ventilation.
- ○ **B.** volume-cycled ventilation.
- ○ **C.** pressure support.
- ○ **D.** PEEP.

Correct answer: D PEEP is widely used during mechanical ventilation of the patient with ARDS to improve gas exchange over the alveolar capillary membrane. Time- or volume-cycled ventilation, Options A and B, are less likely to be used for a patient with ARDS than pressure-cycled ventilation. Pressure support, Option C, depends on the patient's inspiratory effort and isn't as effective as PEEP in treating ARDS.

5. When auscultating the chest of a patient with pneumonia, the nurse should expect to hear which type of sounds over areas of consolidation?

- ○ **A.** Bronchial
- ○ **B.** Bronchovesicular
- ○ **C.** Tubular
- ○ **D.** Vesicular

Correct answer: A Chest auscultation reveals bronchial breath sounds over areas of consolidation. Bronchovesicular breath sounds (Option B) are normal over midlobe lung regions, tubular sounds (Option C) are commonly heard over large airways, and vesicular breath sounds (Option D) are commonly heard in the bases of the lung fields.

6. A patient's history reveals that he suffers from daytime symptoms of asthma that occur 3 to 6 days a week. How would his asthma severity be described?

- ○ **A.** Mild intermittent
- ○ **B.** Mild persistent
- ○ **C.** Moderate persistent
- ○ **D.** Severe persistent

Correct answer: B In mild persistent asthma, the patient's daytime symptoms of asthma occur 3 to 6 days a week. In mild intermittent asthma (Option A), the patient's daytime symptoms occur no more than twice a week. In moderate persistent asthma (Option C), the patient has daily daytime symptoms. In severe persistent asthma (Option D), the patient has continual daytime symptoms.

7. A 66-year-old patient has marked dyspnea at rest, is thin, and uses accessory muscles to breathe. He is tachypneic, with a prolonged expiratory phase. He has no cough. He leans forward with his arms braced on his knees to support his chest and shoulders for breathing. This patient has signs and symptoms of which respiratory disorder?

- ○ **A.** ARDS
- ○ **B.** Asthma
- ○ **C.** Chronic obstructive bronchitis
- ○ **D.** Emphysema

Correct answer: D These are classic signs and symptoms of a patient with emphysema. Patients with ARDS (Option A) are acutely short of breath and require emergency care; those with asthma (option B) are also acutely short of breath during an attack and appear very frightened. Patients with chronic obstructive bronchitis (Option C) appear bloated and cyanotic.

8. A nurse is preparing to reinforce the teaching plan for a patient who has recently been diagnosed with squamous cell carcinoma of the left lung. Which statement by the nurse is correct?

- ○ **A.** "You have a slow-growing cancer that rarely spreads."
- ○ **B.** "In terms of prognosis, you may have only a few months to live."
- ○ **C.** "Squamous cell cancer is a very rapidly growing cancer."
- ○ **D.** "The cancer has generally metastasized by the time diagnosis is made."

Correct answer: A Squamous cell carcinoma is a type of cancer that grows slowly and rarely metastasizes. It has the best prognosis of all lung cancer types. It's not appropriate for the nurse to tell the patient how long he has to live (Option B). Squamous cell carcinoma does not grow rapidly (Option C) and rarely metastasizes (Option D).

9. Which respiratory disorder is most common in the first 24 to 48 hours after surgery?

- ○ **A.** Atelectasis
- ○ **B.** Bronchitis
- ○ **C.** Pneumonia
- ○ **D.** Pneumothorax

Correct answer: A Atelectasis develops when there's interference with the normal negative pressure that promotes lung expansion. Patients in the postoperative phase often splint their breathing because of pain and positioning, which causes hypoxia. It's uncommon for any of the other respiratory disorders (Options B, C, and D) to develop.

10. A patient with acute asthma showing inspiratory and expiratory wheezes and a decreased forced expiratory volume should be treated immediately with which class of medication?

- ○ **A.** Beta-adrenergic blockers
- ○ **B.** Bronchodilators
- ○ **C.** Inhaled steroids
- ○ **D.** Oral steroids

Correct answer: B Bronchodilators are the first line of treatment for asthma because bronchoconstriction is the cause of reduced airflow. Beta-adrenergic blockers (Option A), which can cause bronchoconstriction, aren't used to treat asthma. Inhaled or oral steroids (Options C and D) may be given to reduce the inflammation but aren't used for emergency relief.

CHAPTER 18

Eye, ear, and nose disorders

❖ Introduction

- Disorders of the eye, ear, and nose can be particularly disruptive to activities of daily living (ADLs)
- Full visual function requires normal brain function, an intact retina, a clear lens, and normal intraocular pressure
- Common vision disorders result from alterations in acuity, trauma, and high intraocular pressure; patients with impaired vision are frightened and anxious and require special nursing care
- Hearing loss is a common disability that affects millions of people and causes significant alterations in ADLs; sclerotic disorders and vestibular dysfunction can be especially upsetting
- Although the nose is the primary organ of smell, nasal disorders can affect taste and the smooth passage of air during respirations
- Nursing history
  - The nurse asks the patient about his *chief complaint*
    - A patient with an eye disorder may report having diplopia, visual floaters, iridescent vision, vision loss, eye pain, or photophobia
    - The patient may also report decreased visual acuity or clarity, defects in color vision, and difficulty seeing at night
    - A patient with an ear disorder may experience hearing loss, tinnitus, pain, discharge, or dizziness
    - A patient with a nose disorder may experience nasal stuffiness, nasal discharge, or epistaxis
  - The nurse then questions the patient about his *present illness*
    - Ask the patient about his symptom, including when it started, associated symptoms, location, radiation, intensity, duration, frequency, and precipitating and alleviating factors
    - Ask about the use of glasses or contact lenses
    - Ask about the use of prescription and over-the-counter (OTC) drugs, herbal remedies, and vitamin and nutritional supplements
  - The nurse asks about the *medical history*
    - Question the patient about a history of allergies, hypertension, diabetes, cerebrovascular accident, multiple sclerosis, syphilis, human immunodeficiency virus, or sleep apnea
    - Ask about corrective eye surgery
    - Ask the patient about previous ear problems or injuries, frequent colds, hay fever, headaches, nose or head trauma, and sinus trouble
  - The nurse then assesses the *family history*
    - Ask about a family history of eye disorders, such as cataracts, glaucoma, or blindness
    - Question the patient about a family history of diabetes and hypertension
    - Question the patient about a family history of eye, ear, and nose problems
  - The nurse obtains a *social history*
    - Ask about work, exercise, diet, use of recreational drugs and alcohol, and hobbies
    - Also ask about stress, support systems, and coping mechanisms
    - Question the patient about exposure to chemicals, flying debris, noise, fumes, or infectious agents; ask about the use of protective eyewear
    - Ask the visually impaired patient how well he can manage ADLs

- Physical assessment
  - Nurse begins with *inspection*
    - Observe the patient's eye movements and ability to focus
    - Note the appearance of the eyelids, eyeballs, and lacrimal apparatus
    - Examine the conjunctiva, sclera, iris, anterior chamber, and cornea
    - Check both pupils for equality of size and shape, pupillary reaction to light, and accommodation
    - Test visual acuity using a Snellen chart and near-vision chart
    - Test extraocular muscles by assessing the corneal light reflex and cardinal positions of gaze
    - Examine intraocular structures using an ophthalmoscope
    - Observe the ears for position and symmetry; inspect the auricles for lesions, nodules, or redness; check the ear canal for hair, foreign bodies, and cerumen
    - Examine the auditory canal, tympanic membrane, and malleus with an otoscope
    - Assess hearing using Weber's and Rinne's tests and pure tone audiometry
    - Observe the nose for position, symmetry, swelling, deformity, and color; note any nasal discharge or flaring
    - Inspect the nasal cavity for septal deviation or perforation; examine the vestibule and turbinates for redness, softness, and discharge
    - Assess the patient's sense of smell
    - Examine the nostrils using a nasal speculum; note color, patency, and the presence of exudate
  - Next, the nurse uses *palpation*
    - Gently palpate the eyelids, noting any swelling or complaints of tenderness; eyeballs should feel equally firm, but not hard or rigid
    - Palpate the lacrimal sac while observing the punctum for excessive tearing or drainage
    - Palpate the mastoid area and ear for tenderness, redness, or warmth
    - Palpate the nose for pain, tenderness, swelling, and deformity
    - Palpate the sinuses for tenderness

❖ Age-related macular degeneration

- Description
  - Age-related macular degeneration (AMD) is characterized by small clusters of yellowish debris (called drusen) beneath the retina
  - When drusen are located in the macular area, they cause visual loss
  - Central vision is most often affected
  - Two types of AMD exist: dry type and wet type
    - *Dry type AMD* is nonexudative and is responsible for 85% to 90% of cases; in this type of AMD, the outer layers of the retina slowly break down
    - *Wet type AMD* is exudative and may have an abrupt onset; symptoms result from the proliferation of abnormal vessels under the retina
  - Although the cause of AMD is unknown, genetic factors may contribute to its development
  - AMD is the most common cause of visual loss in people age 60 and older
- Signs and symptoms
  - In dry type AMD, drusen can be seen beneath the retina; atrophy of the retinal pigment epithelium also occurs
  - In wet type AMD, the patient has subretinal fluid accumulation or hemorrhage with a yellow-green discoloration that's sometimes surrounded by a pigment ring; in the advanced stage, exudates and fibrovascular scarring occur
  - Grayness, haziness, or a blind spot may appear in the area of central vision; words may look blurred on a page, straight lines may appear to have kinks in them, and colors may seem dimmer
  - The disorder may also cause difficulty with night vision and changing light conditions
- Diagnosis and treatment
  - Indirect ophthalmoscopy may show changes in the macular region of the fundus
  - The Amsler grid test may detect visual distortion

- ◆ Fluorescein angiography may show leaking vessels (choroidal neovascular membranes) in the subretinal neovascular net
- ◆ Indocyanine green videoangiography identifies hidden or occult choroidal neovascular membranes
- ◆ Optical coherence tomography may help identify choroidal neovascular membranes, subretinal fluid, and retinal thickening
- ◆ Although no known cure exists for dry type AMD, some evidence indicates that a diet high in beta-carotene, zinc, and vitamins A, C, and E may slow the progression of the disease
- ◆ For wet type AMD, treatment targets the development and progression of angiogenesis; laser treatments may be used
- ◆ Drug therapy may include a vascular endothelial growth factor antagonist or the monoclonal antibody bevacizumab (Avastin)
- ◆ Vitrectomy removes subretinal blood
- ◆ Macular translocation shifts the macula away from the choroidal neovascular membranes
- ◆ Photodynamic therapy may also be helpful

■ Nursing interventions

- ◆ Teach the patient and family about the disorder, including treatment and follow-up care
- ◆ Determine the extent of the patient's vision loss
- ◆ Help the patient obtain optical aids such as magnifiers
- ◆ Assist the patient with adaptations to accommodate his vision changes; promote safety
- ◆ Encourage the patient to increase his consumption of vitamins A, C, and E as well as beta-carotene and zinc
- ◆ Urge the patient to use eye protection such as glasses or sunglasses that block ultraviolet light to protect his eyes from ultraviolet light
- ◆ Offer emotional support
- ◆ Encourage the patient to express his fears and concerns, especially those related to vision loss and its impact on his ability to function
- ◆ Refer the patient to local support organizations as appropriate

❖ Cataracts

■ Description

- ◆ Cataracts, which come in several forms, cause a loss of transparency of the lens of the eye or its capsule (See *Types of cataracts*)
- ◆ It is a common cause of gradual vision loss that usually affects both eyes

Types of cataracts

There are several forms of cataracts. They occur at various points in the life cycle, but the treatment for each is the same.

Type of cataract	Description
Complicated	Develop as secondary effects in patients with uvetitis, glaucoma, retinitis pigmentosa, or retinal detachment or with systemic disease, such as diabetes, hypoparathyroidism, or atopic dermatitis; also develop after exposure to ionizing radiation or infrared rays
Congenital	Develop in utero at the anterior or posterior ocular pole; associated with heredity or maternal rubella infection in the first trimester
Senile	Occur after age 50 as part of aging; the nuclear portion of the lens becomes increasingly dense, transparency decreases, and light rays strike the opaque lens and scatter
Toxic	Result from drug or chemical toxicity with dinitrophenol, ergot, naphthalene, or phenothiazines
Traumatic	Can occur at any age and are caused by mechanical trauma or exposure to chemicals, radiation, or toxic substances; the capsule ruptures, swelling occurs, and opacity increases; usually unilateral

- Signs and symptoms
  - Gradual painless blurring eventually leads to poor reading vision, reduced vision at night and in bright sunlight, and vision loss
  - Other effects may include halos around lights, milky pupils, and unpleasant glares
- Diagnosis and treatment
  - Indirect ophthalmoscopy or slit-lamp examination confirms the diagnosis
  - Cataracts are treated surgically by extracapsular extraction, which removes the anterior capsule and its contents; intracapsular extraction, which removes the entire lens in the capsule; or phacoemulsification, which uses ultrasonic vibration to fragment the lens
  - Corrective lenses may be prescribed to improve vision
    - A plastic intraocular lens implant may be inserted in the eye as part of the surgical procedure
    - Cataract glasses (glasses with magnifying lenses) or contact lenses may be prescribed 6 to 8 weeks after surgery
- Preoperative nursing interventions
  - Explain the importance of compliance in a preadmission interview
  - Make sure that someone can drive the patient to and from the day surgery center
  - Tell the patient to tilt his head backward when shampooing to prevent jarring the eye and increasing intraocular pressure
  - Administer a preoperative laxative to prevent straining during defecation, which increases intraocular pressure
  - Explain preoperative and postoperative care to decrease the patient's anxiety
  - Answer questions and encourage the patient to discuss concerns
- Postoperative nursing interventions
  - Review postoperative instructions to improve compliance and prevent complications; the patient may have difficulty reading instructions because of impaired vision
  - Tell the patient not to bend, strain, lift, cough, sneeze, or rub the eye postoperatively; these actions can increase intraocular pressure, which can lead to complications, such as bleeding, vitreous herniation, vision loss, pain, and wound dehiscence; rubbing also increases the chance of infection
  - Tell the patient not to make quick movements or read, which could irritate the patched eye or dislodge an implanted lens
  - Teach the patient or family member how to administer eye medications properly; tell the patient to avoid using OTC eyedrops
  - Teach the patient how to clean the eye to prevent infection
  - Have the patient wear an eye shield and patch to protect the eye from injury; tell him to keep the eye patch dry and to wear an eye shield while sleeping
  - Tell the patient to call the practitioner if any of these signs or symptoms occur: eye pain that isn't relieved with analgesics, yellow or green discharge, temperature above 100° F (37.8° C), blurred vision, nausea and vomiting, and seeing halos around lights
  - Explain postoperative activity restrictions
    - The patient may walk, climb stairs, watch television, and perform ADLs but should avoid engaging in strenuous physical activity and lifting more than 10 lb (4.5 kg)
    - The patient may bathe or shower but should avoid getting water on the eye patch by tilting his head back when shampooing
    - The patient should avoid bending from the waist and hanging the head forward; a long-handled grabber may be used to pick up objects
  - Make sure the patient is cared for by a family member or friend after surgery
  - Advise the patient to refrain from sexual activity until he receives his practitioner's approval

❖ Deviated nasal septum

- Description
  - The nasal septum, which bisects the nasal cavity, is made up of cartilage and bone; deviations are common

- Although septal deviation typically is asymptomatic, it can cause nasal obstruction and increase the risk of sinusitis and epistaxis
- Deviated nasal septum may be congenital or caused by trauma

Signs and symptoms

- Signs and symptoms of deviated septum include drying, crusting nasal discharge and other mucosal changes as well as bleeding that can block the sinus opening
- The patient may report shortness of breath and difficulty breathing through the nose; he may also report sinusitis and headache
- Upper respiratory tract infection, a blow to the nose, or nasal trauma can exacerbate symptoms

Diagnosis and treatment

- Diagnosis is based on visual inspection of the nasal mucosa with a bright light and nasal speculum
- Short-term treatment consists of decongestants, antihistamines, and nasal saline douches to open the nasal airway and analgesics to relieve headache
- Long-term treatment may require septoplasty or submucous resection of the septum; in these procedures, the septum is surgically straightened and then stabilized with sutures and packing (consisting of petroleum jelly, iodoform, and soft gauze) for 24 to 48 hours
- Indications for surgery include nasal hemorrhage and an inability to pack the nose adequately because of deformity, recurrent sinusitis resulting from blocked sinus openings, and such signs and symptoms as snoring, breathing through the mouth, dry mouth, and shortness of breath
- Surgery is performed under local or general anesthesia and may require overnight hospitalization; its complications include septal hematoma, infection, hemorrhage, septal perforation, anosmia, and cosmetic deformity

Preoperative nursing interventions

- Determine the severity of the nasal airway obstruction; a patient with a blocked nasal airway needs humidification, oral hygiene, and other comfort measures
- Teach the patient about postoperative care to reduce anxiety and promote compliance

Postoperative nursing interventions

- Keep the patient's head elevated 30 degrees to promote drainage, reduce edema, and maintain a patent airway
- Check his vital signs and airway frequently to ensure that the packing hasn't slipped posteriorly, which could block the oral airway; take rectal, ear, or axillary temperatures while the packing is in place because the patient's only airway is his oral airway
- Watch for nasal bleeding and frequent swallowing; inspect the pharynx with a penlight if bleeding is suspected; keep emergency suction equipment at the patient's bedside
- Encourage the patient to expectorate oral secretions; record the amount and describe the secretions
- Change the 2″ × 3″ gauze dressing or drip pad, as needed, and record the frequency and amount of drainage
- Urge the patient to avoid swallowing blood, which can lead to nausea and vomiting
- Provide comfort measures, and administer analgesics, as needed, to decrease pain and promote participation in care
- Use a face tent to provide humidified air, and frequently perform oral hygiene measures; because air breathed in through the mouth isn't humidified like air breathed in through the nose, the oral mucous membranes can become dry
- Inform the patient of limitations and safety measures, such as not blowing his nose to prevent injury to the surgical site; if sneezing is necessary, the patient should open the mouth to release the pressure of the sneeze
- Tell the patient to notify the practitioner if signs or symptoms of infection, hemorrhage, or hematoma occur, including bleeding, pain, swelling, redness, fever, headache, or foul-smelling drainage

❖ Glaucoma

Description

- This group of disorders is characterized by high intraocular pressure (IOP) and optic nerve damage that affects peripheral vision

- There are two main forms of glaucoma:
  - *Open-angle* (also known as *chronic*, *simple*, or *wide angle*) glaucoma begins insidiously and progresses slowly
  - *Angle-closure* (also known as *acute* or *narrow angle*) glaucoma occurs suddenly and can cause permanent vision loss in 48 to 72 hours

Signs and symptoms

- Open-angle glaucoma may cause no symptoms, or it may cause a dull morning headache, mild aching in the eyes, loss of peripheral vision, halos around lights, and reduced visual acuity (especially at night) that's uncorrected by glasses
- Angle-closure glaucoma causes the rapid onset of pain and pressure over the eye, blurred vision, decreased visual acuity, halos around lights, and nausea and vomiting

Diagnosis and treatment

- Tonometry measurements reveal increased IOP; perimetry or visual field tests measure loss of peripheral vision
- Ophthalmoscopy shows the effects of glaucoma on the optic disk (called cupping), whereas gonioscopy measures the angle of the anterior chamber of the eye
- Other diagnostic tests may include slit-lamp examination and fundus photography
- Drugs that may be used to treat glaucoma include topical adrenergic agonists, cholinergic agonists, beta-adrenergic blockers, and topical or oral carbonic anhydrase inhibitors that reduce IOP by decreasing the production of aqueous humor
- Surgery or laser treatments may be peformed for patients who are unresponsive to drug therapy (see *Procedures for glaucoma*)
- Bed rest is recommended for patients with acute angle-closure glaucoma

Nursing interventions

- Encourage patient compliance by teaching the patient about the disease process and treatment
- Postoperatively, give medications, as ordered, to dilate the pupil and topical corticosteroids to rest the pupil and protect the affected eye
- Administer pain medication, antiemetics, and stool softeners, as ordered
- Encourage the patient to be ambulatory immediately after surgery
- Teach the patient to avoid activities that can increase IOP such as straining during bowel movements

Procedures for glaucoma

Argon laser trabeculoplasty (ALT) is a first-line therapy for different types of glaucoma. It's used either instead of drug therapy or if drug therapy can't control the increased intraocular pressure (IOP). Performed as an outpatient procedure, ALT directs 40 to 80 laser beams into the trabecular network, creating holes through which the aqueous humor can return to the venous circulation.

For patients who are unresponsive to drug therapy or ALT, or aren't suitable candidates for these treatments, a trabeculectomy may be performed. In this glaucoma filtration procedure, a flap of sclera is dissected free to expose the trabecular meshwork. This discrete tissue block is then removed, and a surgical hole is made in the periphery of the iris. The opening allows aqueous humor to flow out under the conjunctiva by creating a filtering bleb. Often, drugs such as 5-fluorouracil are applied during or after the procedure to control scarring and reclosure of the hole.

Patients for whom trabeculectomy has failed to maintain lower IOP or who are at high risk for failure may need a tube shunt implanted to keep the drainage pathway artificially open. These shunts are surgically kept closed with an absorbable suture to allow healing time. Because of the time required before the shunt is operational and the difficulty of medically controlling IOP after surgery, the patient may undergo a trabeculectomy at the same time. Usually, this site fails about the same time as the shunt is healed, providing for continuous pressure reduction.

When other treatments have failed to control IOP, transscleral cyclophotocoagulation may be performed. Between 20 and 40 laser beams are directed into the ciliary body of the eye to decrease its production of aqueous fluid.

Laser peripheral iridotomy is used to correct the narrow angle between the iris and the trabecular meshwork that blocks appropriate drainage of aqueous humor in patients with angle-closure glaucoma. A laser beam creates a small hole in the peripheral iris, allowing the fluid to flow to the anterior chamber of the eye, which also results in opening of the angle of the eye.

❖ Otitis externa

Description

- Otitis externa is an acute or chronic inflammation of the external auditory canal
- Causes include water in the ear canal (swimmer's ear), trauma to the skin of the ear and resulting infection, vitamin deficiencies, and endocrine disorders such as diabetes mellitus
- *Staphylococcus aureus* and *Pseudomonas* are the most common types of bacteria that cause otitis externa; *Aspergillus* is the most common fungus that causes the disorder
- Risk factors include swimming in contaminated water, cleaning the ear canal with cotton-tipped applicators, using ear phones or ear plugs, and chronic drainage from a perforated tympanic membrane

Signs and symptoms

- Signs and symptoms include mild to severe ear itching or pain that's aggravated by jaw motion, teeth clenching, opening the mouth, or chewing
- Other signs and symptoms include a feeling of the ear being plugged; a swollen, inflamed ear canal; foul-smelling, yellow-to-green ear discharge; thick, red epithelium in ear canal (in chronic otitis externa); and periauricular adenitis
- Fungal otitis externa may not produce any symptoms

Diagnosis and treatment

- Microscopic examination reveals the causative organism
- Audiometric testing may reveal a partial hearing loss
- Otoscopy shows a swollen external ear canal, periauricular lymphadenopathy and, occasionally, regional cellulitis
- Treatment includes cleaning debris from the ear canal under direct visualization
- With mild, chronic otitis externa, the patient may need specially fitted earplugs for showering or swimming
- Analgesics help control pain
- Other medications include antibiotic/corticosteroid eardrops, such as neomycin/polymyxin B/hydrocortisone, betamethasone, ciprofloxacin/dexamethasone, and gentamicin/betamethasone; antifungal eardrops used include clotrimazole
- If the patient has lymphadenopathy or a severe infection, he may need oral antibiotics
- Excision and abscess drainage is performed as needed

Nursing interventions

- Clean and dry the patient's ear gently and thoroughly
- Use wet soaks on infected skin
- Give prescribed drugs; use a foam or gauze wick, as indicated, to administer otic medications
- To prevent recurrence, tell the patient to avoid potential irritants, such as hair care products and earrings
- Tell the patient to wear earplugs or to keep his head above water when swimming and to instill two or three drops of 42% acetic acid solution in 70% alcohol (diluted 50/50) into the ears after swimming to toughen the skin of the external ear canal
- Warn against cleaning the ears with cotton-tipped applicators or other objects

❖ Otitis media

Description

- Otitis media is an inflammation of the middle ear associated with fluid accumulation; it most commonly results from poorly functioning eustachian tubes
- The disorder may be acute, chronic, serous, or suppurative
  - Acute otitis media occurs when a bacterial or viral infection of the fluid of the middle ear occurs, which causes production of fluid or pus
  - Chronic otitis media occurs when the eustachian tube becomes blocked repeatedly due to allergies, multiple infections, ear trauma, or swelling of the adenoids
  - Chronic serous otitis media is a middle ear infection with effusion without perforation
  - Chronic suppurative otitis media is a perforated tympanic membrane with persistent drainage from the middle ear

- The pathogens that most commonly cause otitis media include *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis*
- Complications of otitis media include rupture of the tympanic membrane, hearing loss, vertigo, meningitis, and septicemia

■ Signs and symptoms

- Otitis media causes severe, deep, throbbing pain in the ear along with fever, dizziness, nausea, and vomiting
- The patient may also experience a sensation of fullness in the ear as well as popping or crackling sounds when swallowing or chewing
- Other signs and symptoms may include purulent discharge from the ear, evidence of hearing loss and, if tympanic membrane ruptures, pain that abruptly ceases

■ Diagnosis and treatment

- The patient's history may include upper respiratory infection or allergies
- Otoscopic examination shows fluid behind the tympanic membrane; in chronic otitis media, it reveals thickening or scarring of the tissue
- Culture and sensitivity testing of the exudate shows the causative organism
- A complete blood count shows leukocytosis (if acute otitis media results from bacteria)
- Radiographic studies demonstrate mastoid involvement
- In acute secretory otitis media, Valsalva's maneuver performed several times a day may be the only treatment required
- Treatment aims to eradicate the underlying cause–for instance, eliminating eustachian tube obstruction
- Medications include antibiotics; first-line agents include amoxicillin or, if the patient is allergic to penicillin, azithromycin; second-line agents include cefdinir, cefpodoxime, cefuroxime, amoxicillin-clavulanate, ceftriaxone, clarithromycin, erythromycin, and trimethoprim-sulfamethoxazole
- Analgesics and antipyretics include acetaminophen; analgesic eardrops include antipyrine/benzocaine
- Surgical procedures include myringotomy and aspiration of middle ear fluid, followed by insertion of a polyethylene tube into the tympanic membrane
- Other procedures may include myringoplasty, tympanoplasty, and mastoidectomy

■ Nursing interventions

- Teach the patient and his family about the disorder, including treatment and follow-up care
- Administer analgesics, antipyretics, and antibiotics as ordered; institute measures to reduce fever
- Allow the patient and his family to verbalize their feelings and concerns; answer all questions and provide emotional support
- When appropriate, offer reassurance that hearing loss caused by serous otitis media is temporary
- Provide clear, concise explanations
- Prepare the patient and his family for possible surgery; provide appropriate postoperative care
- Teach the patient how to recognize upper respiratory tract infections, and encourage early treatment
- If appropriate, teach the patient to promote eustachian tube patency by performing Valsalva's maneuver several times a day, especially during airplane travel
- After tympanoplasty, advise the patient not to blow his nose or get his ear wet when bathing

❖ Otosclerosis

■ Description

- Otosclerosis (or hardening of the ear) is an overgrowth of bone that impedes normal ossicular motion and can fix the stapes to the oval window
- It's the most common cause of progressive conductive hearing loss in adults with normal tympanic membranes
- The disease has a familial tendency and usually occurs between ages 15 and 50; twice as many women are affected as men
- Pregnancy may trigger the onset in women

- Signs and symptoms
  - Progressive hearing loss, which may be unilateral at first and may become bilateral, typically begins at an early age
  - Vertigo also can occur
  - The patient may report hearing his own voice better than the voices of others
- Diagnosis and treatment
  - Diagnostic tests may include audiometry; electronystagmography; caloric testing; magnetic resonance imaging or computed tomography; Weber's, Rinne's, and Romberg's tests; and facial nerve testing
  - Hearing aids are recommended to improve hearing
  - Stapedectomy (surgical removal of the stapes) may be done, and the stapes may be replaced by a prosthesis; complications of this procedure, which is typically performed under local anesthesia, include continued hearing loss, granuloma, oval window rupture that causes perilymph fistula, inflammation, infection, prosthesis displacement, and temporary taste changes
- Preoperative nursing interventions
  - Use alternative communication methods as needed; a patient with severe hearing loss may need written instructions or a signing oral interpreter
  - Discuss preoperative tests and postoperative care to reduce anxiety and promote compliance
  - Encourage the patient to discuss anxieties and expectations; clarify misconceptions, and inform him that his hearing won't improve until 6 weeks after surgery because of edema and packing
- Postoperative nursing interventions
  - Elevate the head of the patient's bed 30 degrees; position him according to the practitioner's orders—on the unaffected side to prevent graft displacement or on the affected side to facilitate drainage
  - Monitor vital signs, and check dressings for bleeding; attempt to quantify bleeding
  - Check for headache, stiff neck, fever, and vertigo, which are signs and symptoms of complications
  - Observe the patient for edema, meningitis, labyrinthitis, and infection
  - Keep dressings intact; when removed, observe the site for bleeding, redness, drainage, and edema
  - Clean the suture line as directed; use aseptic technique to prevent infection, and watch for signs of infection
  - Keep packing intact; it's absorbable, and it shouldn't be removed
  - Assess facial nerve functioning twice daily to detect nerve compromise
  - Administer pain medications, as needed, to allow the patient to participate in care
  - Help the patient get out of bed to prevent falls
  - Remind the patient to avoid rapid head movements, which can cause the dizziness that commonly occurs after surgery
  - Tell the patient not to blow his nose and to keep his mouth wide open when coughing or sneezing; Valsalva's maneuver can displace the graft over the oval window and could introduce bacteria to the middle ear by way of the eustachian tube
- Discharge nursing interventions
  - Provide written instructions to increase compliance
  - Tell the patient to avoid strenuous activity for 1 to 3 weeks but to return to work after 1 week as prescribed; strenuous activity can result in perilymph fistula and may dislodge the prosthesis
  - Instruct the patient to keep the ear dry for 6 weeks; he can shampoo his hair after 1 week; to avoid getting water in the affected ear while bathing, he should plug the ear with a cotton ball coated with petroleum jelly
  - Tell the patient not to travel by air for 2 to 3 weeks to prevent barotrauma
  - Tell the patient to avoid people with colds or upper respiratory tract infections for 4 to 6 weeks; these infections can spread to the middle ear by way of the eustachian tube
  - Instruct the patient to report drainage, fever, otalgia (ear pain), vertigo, redness, and tenderness of the incision site
  - Tell the patient to change the cotton ball covering the ear canal daily and as needed but not to disturb the packing in the ear canal
  - Show the patient how to perform daily incision care

❖ Retinal detachment

- Description
  - ◆ Retinal detachment is the separation of the sensory layers of the retina from the underlying retinal pigment epithelium; without treatment, the entire retina may detach, causing severe vision impairment and possible blindness
  - ◆ It may be caused by degenerative changes in the retina or vitreous gel, intraocular inflammation, or mechanical trauma
  - ◆ In this disorder, vitreous body traction causes retinal tears or holes, which allow vitreous fluid to leak behind the retina and cause it to separate
  - ◆ Retinal detachment may be primary or secondary; a primary detachment occurs spontaneously due to a change in the retina or vitreous; a secondary detachment results from another problem, such as inflammation or trauma
- Signs and symptoms
  - ◆ Signs and symptoms may occur slowly or suddenly
  - ◆ They may include dark or irregular vitreous floaters, flashes of light, and progressive loss of vision in one area (as though a curtain is being pulled before the eye)
- Diagnosis and treatment
  - ◆ Diagnosis depends on ophthalmoscopy (both direct and indirect) after full pupil dilation; fluorescein angiography, visual field examination, and ultrasonography may also be useful
  - ◆ Treatment requires bed rest, with the affected eye patched and the patient's head positioned so that the retinal hole is at the lowest point of the eye
  - ◆ One of several types of surgery may be performed to find and seal retinal holes or tears
    - ◗ *Diathermy* uses extreme heat to seal the hole
    - ◗ *Laser photocoagulation* uses laser-generated heat to injure the tissue and cause scars, which create a fibrous adhesion to seal the hole
    - ◗ *Cryotherapy* uses nitrous oxide (also known as laughing gas) or carbon dioxide to injure the tissue by freezing it; the injury leaves a scar, which seals the retinal hole
    - ◗ *Scleral buckling* places a band around the globe of the eye to bring the choroid into contact with the retina and hold it in place until adhesion occurs
- Preoperative nursing interventions
  - ◆ Place the patient on bed rest, patch the eye as prescribed, and position the patient's head so that the retinal tear or hole is at the lowest point of the eye (if the detachment is toward the outer side of the head, have the patient lie on the affected side with the bed flat); these interventions help prevent further detachment
  - ◆ Provide emotional support to the patient who may be distraught at the potential loss of vision
  - ◆ Prepare the patient for surgery by cleaning his face and giving him antibiotics and eyedrops, as ordered
  - ◆ Teach the patient about the role of the retina and why floaters, flashes of light, and decreased vision occur
  - ◆ Allow the patient and family to discuss their concerns
  - ◆ Explain the preoperative routines and the surgical procedure
- Postoperative nursing interventions
  - ◆ Position the patient as directed; the position varies according to the surgical procedure
  - ◆ Tell the patient to avoid activities that increase IOP, such as sneezing, coughing, vomiting, lifting, straining during defecation, bending from the waist, and rapidly moving the head; increased IOP may cause more fluid to flow behind the retina before healing is complete
  - ◆ Administer eyedrops, antiemetics, analgesics, and antibiotics, as ordered; to reduce corneal edema and discomfort, apply ice packs as ordered
  - ◆ Tell the patient to notify the practitioner if he experiences floaters, flashes of light, blurred vision, or pain that isn't relieved with analgesics; these symptoms indicate recurrence of detachment
  - ◆ Teach the patient to recognize and report the signs and symptoms of infection, such as temperature above 100° F (37.8° C), yellow or green discharge, increased redness or pulling of the eye or lid, and vision loss

- ◆ Show the patient how to administer eye medications and change dressings using sterile technique to decrease the risk of infection
- ◆ Tell the patient to wear the eye shield at night or when napping to prevent accidental injury to the eye
- ◆ Discuss when the patient can return to work, resume ADLs, and drive or perform strenuous activities

Review questions

1. The nurse is caring for a patient who underwent stapedectomy. To prevent postoperative complications, the nurse should instruct the patient to:

- ❍ **A.** sneeze with her mouth open.
- ❍ **B.** frequently blow her nose.
- ❍ **C.** clean her operated ear with a cotton-tipped applicator twice a day.
- ❍ **D.** resume bending and straining when she's no longer experiencing ear pain.

Correct answer: A If sneezing can't be avoided, the patient should sneeze with her mouth open. This will prevent changes of air pressure in the middle ear, which can dislodge the prosthesis and graft. Option B is incorrect because blowing the nose and coughing should be avoided. Option C is incorrect because small objects, such as cotton-tipped applicators, shouldn't be inserted into the ear. Option D is incorrect because straining during a bowel movement and bending should be avoided for at least 2 to 3 weeks, or as instructed by the practitioner.

2. The nurse is assessing a 32-year-old patient with otosclerosis. The nurse should be aware that the patient's hearing loss:

- ❍ **A.** will resolve in 4 to 6 weeks without intervention.
- ❍ **B.** typically affects both ears.
- ❍ **C.** occurred suddenly.
- ❍ **D.** is associated with ear pain.

Correct answer: B The hearing loss associated with otosclerosis is typically bilateral, although one ear may show a greater impairment. Option A is incorrect because otosclerosis is a progressive disorder that is not self-limiting. Option C isn't correct because otosclerosis develops slowly over time. Because otosclerosis doesn't cause ear pain, Option D is incorrect.

3. The nurse is teaching a patient with a detached retina who underwent scleral buckling on the left eye. The procedure included gas injection into the vitreous. Which of the following statements indicates that the patient understands the nurse's instructions?

- ❍ **A.** "I should lie on my abdomen with my head turned to the right."
- ❍ **B.** "I'll lie face down with my head turned to the left."
- ❍ **C.** "I'll lie face up with my head turned to the right."
- ❍ **D.** "I should lie on my back with my head turned to the left."

Correct answer: B In a scleral buckling, the sclera is flattened against the retina. A piece of silicone is attached to the sclera with a band that encircles the eye to keep the retina in contact with the choroid and sclera. Air or other gases may be injected into the vitreous to float up against the retina and promote retinal reattachment. When a gas is used, the patient is positioned on his abdomen with the head turned to the affected eye (in this situation, the left side) so that the gas will float up against the retina and aid in reattachment. The positions in Options A, C, and D don't allow the gas to float up against the retina.

4. The nurse is providing care for a patient following right cataract removal surgery. In which position should the nurse place the patient?

- ○ **A.** Right-side lying
- ○ **B.** Prone
- ○ **C.** Supine
- ○ **D.** Trendelenburg's

Correct answer: C Positioning the patient on his back or inoperative side prevents pressure on the operative eye. Right side-lying (Option A) or prone position (Option B) may put external pressure on the affected eye. Trendelenburg's position (Option D) may increase intraocular pressure.

5. Which position would be the most appropriate for a patient who has undergone stapedectomy?

- ○ **A.** On the affected side
- ○ **B.** On the unaffected side
- ○ **C.** Prone
- ○ **D.** Sims'

Correct answer: B The patient should be positioned on his unaffected side, with the operative ear up. He shouldn't be placed on the affected side (Option A) or prone (Option C). Although Sims' position (Option D) is a side-lying position, it doesn't take into consideration which side is best for after ear surgery.

6. Which symptom would occur in a patient with a detached retina?

- ○ **A.** Flashing lights and floaters
- ○ **B.** Homonymous hemianopia
- ○ **C.** Loss of central vision
- ○ **D.** Ptosis

Correct answer: A Signs and symptoms of retinal detachment include abrupt flashing lights, floaters, loss of peripheral vision (not central vision, as in Option C), and a sudden shadow or curtain in the vision. Occasionally, vision loss is gradual. Homonymous hemianopia (Option B) can occur in stroke and traumatic brain injuries. Ptosis (Option D) can result from a stroke.

7. A 72-year-old patient is being discharged from same-day surgery after having a cataract removed from his right eye. Which discharge instruction should the nurse give the patient?

- ○ **A.** "Sleep on the operative side."
- ○ **B.** "Resume all activities as before."
- ○ **C.** "Don't rub or place pressure on the eyes."
- ○ **D.** "Wear an eye shield all day and remove it at night."

Correct answer: C Rubbing or placing pressure on the eyes increases the risk of accidental injury to ocular structures. The nurse would caution against sleeping on the operative side—not on the operative side (Option A)—to reduce the risk of accidental injury to ocular structures. The nurse shouldn't tell the patient to resume all activities (Option B); activities such as lifting objects, straining, strenuous exercise, and sexual activity can increase IOP. An eye shield should be worn at night, not during the day (Option D); during waking hours, the patient should wear glasses or shaded lenses to protect the eye after the eye dressing has been removed.

8. Which of the following increases a 40-year-old patient's risk of developing cataracts?

- ○ **A.** A history of frequent streptococcal throat infections
- ○ **B.** Maternal exposure to rubella during pregnancy
- ○ **C.** Increased IOP
- ○ **D.** Prolonged use of steroidal anti-inflammatory agents

Correct answer: D Prolonged use of steroidal anti-inflammatory agents increases the risk of developing cataracts. The other risk factors don't contribute to the development of cataracts.

9. In caring for a patient after cataract surgery, the nurse should tell the patient to notify his physician of which of the following conditions?

- ○ **A.** Blurred vision
- ○ **B.** Eye pain
- ○ **C.** Glare
- ○ **D.** Itching

Correct answer: B The patient shouldn't experience pain after cataract surgery; pain may indicate hyphema, or clouding in the anterior chamber, and infection. The patient might normally experience the other symptoms after cataract surgery.

10. When assessing a patient with glaucoma, the nurse would expect which of the following findings?

- ○ **A.** Complaints of double vision
- ○ **B.** Complaints of halos around lights
- ○ **C.** An IOP of 15 mm Hg
- ○ **D.** A soft globe on palpation

Correct answer: B Complaints of halos around lights is a common finding in a patient with glaucoma. Glaucoma doesn't cause double vision (Option A) or a soft globe on palpation (Option D). In addition to halos around lights, signs and symptoms can include loss of peripheral vision or blind spots, reddened sclera, firm globe, decreased accommodation, and occasional eye pain; patients may also be asymptomatic. An IOP of 15 mm Hg (Option C) is within the normal range of 10 to 21 mm Hg.