PHYSIOLOGY OF THE MUSCULOSKELETAL SYSTEM

Skeletal System
A. Bone structure.
1. Periosteum: dense fibrous membrane covering the bone; periosteal vessels supply bone tissue.
2. Epiphysis: a widened area found at the end of a long bone.
3. Epiphyseal plate (growth plate): a cartilaginous area in children’s bones that provides for longitudinal growth of the bone.
4. Red bone marrow: primary function is production of red blood cells.
B. Bone maintenance and healing.
1. Regulatory factors determining bone formation and resorption.
   a. Weight-bearing stress stimulates local bone resorption and formation; therefore in states of immobility where weight bearing is prevented, calcium is lost from the bone.
   b. Vitamin D promotes absorption of calcium from the gastrointestinal (GI) tract and accelerates mobilization of calcium from the bone to increase or maintain serum calcium levels.
C. Musculoskeletal changes in the older adult (Box 16-1).

Connective Tissue: Joints and Cartilage
A. Joints.
   1. The action of joints permits bones to change position and facilitate body movement.
   2. Synovial joints contain synovial fluid, which lubricates the joints and facilitates joint mobility.
   3. Cartilage is rigid fibrous tissue that forms a capsule over the end of the bone and joins the end of each bone together.
B. Ligaments and tendons are tough fibrous connective tissue that provides stability while continuing to permit movement.
   1. Tendons attach muscles to the bone.
   2. Ligaments attach bones to joints.

Skeletal Muscle
A. Muscles are attached to tendons, bones, and connective tissue.
B. Lower motor neurons control the activity of skeletal muscle.

C. Energy is consumed when skeletal muscles contract in response to a stimulus.
D. Muscle contraction.
   1. Muscles accomplish movement only by contraction.
      a. Flexion: bending at a joint.
      b. Extension: straightening of a joint.
      c. Abduction: action moving away from the body.
      d. Adduction: action moving toward the body.

✔ NURSING PRIORITY: When caring for clients with orthopedic or musculoskeletal problems, it is essential to know the terms used for referring to movement of the joints.

2. Hypertrophy, or increased muscle mass, will occur if muscle is exercised repeatedly.
3. Atrophy, or decreased muscle mass, will occur with muscle disuse.

System Data Collection
A. History.
   1. History of musculoskeletal injuries, neuromuscular disabilities, inflammatory and metabolic conditions directly or indirectly affecting the musculoskeletal system.
   2. Familial predisposition to orthopedic problems.

BOX 16-1 OLDER ADULT CARE FOCUS
Musculoskeletal Changes
- Decreased bone density leads to more frequent fractures.
- Decrease in subcutaneous tissue results in less soft tissue over bony prominences.
- Degenerative changes in the spine alter posture and gait; disk compression causes a loss in height.
- Degenerative changes in cartilage and ligaments result in decreased joint movement as well as causing joint stiffness and pain.
- Decreased range of motion of extremities; older adult may need increased assistance with activities of daily living.
- Slowed movement and decreased muscle strength lead to decreased response time.
3. Level of normal activity.
   a. Occupation, exercise, recreation.
   b. Level of normal activity, ability to maintain own ADLs.
4. Existence of other chronic health problems.

B. Physical assessment.
1. Initial inspection for gross deformities, asymmetry, swelling, and edema.
2. Nutritional status: appropriateness of client’s weight and body frame.
3. Joints
   a. Movement: active and passive; examine active movement first; compare movement and range of motion to opposite side.
   b. Inflammation and tenderness: with or without movement.
   c. Presence of joint deformities or dislocations.
   d. Palpate joints for the presence of crepitus.
4. Evaluate client’s spinal alignment, posture, and gait.
5. Evaluate skeletal muscle.
   a. Muscle strength bilaterally.
   b. Coordination of movement.
   c. Presence of atrophy or hypertrophy.
   d. Presence of involuntary muscle movement.
6. Assess peripheral pulses and peripheral circulation; capillary refill should normally take about 2 to 3 seconds.
7. Assess for presence of and characteristics of pain.
   a. Most musculoskeletal pain is relieved by rest.
   b. Identify precipitating activities and/or precipitating factors.
   c. Type of pain and location.
8. Assess for any alteration of normal sensation in extremities.
9. Assess for use of proper body mechanics (Box 16-2).
10. Assess for changes in musculoskeletal system related to aging (Box 16-1).
11. Principles of body mechanics for health care personnel (Box 16-2, Appendix 3-1).

Data Collection (Newborn)
A. Ortolani sign: With the infant supine, knees flexed, and hips fully abducted, a click is heard or felt as the hip is abducted.
B. Asymmetrical gluteal and thigh folds.
C. Shortening of the leg on the affected side.
D. Limited hip abduction on affected side.

Treatment
A. Treatment should be initiated as soon as condition is identified.
B. Abduction devices.
   1. Pavlik harness is a fabric harness that maintains the legs in the flexed, abducted position at the hip, it will hold the affected hip in an abduction position, and prevent extension and adduction. It may be removed for bathing but the infant will wear it full-time until the hip is stable.
   2. Hip spica cast may be used when an adduction contracture is present
C. Surgery may be done if the correction is not feasible with abduction devices.

Nursing Interventions
- **Goal**: To identify problem in the newborn before discharge.
- **Goal**: To assist parents to understand mechanism to maintain reduction.
  A. Pavlik harness.

### Developmental Dysplasia of the Hip

- Malformations of the hip that occur as a result of imperfect development of the femoral head, the acetabulum, or both.
1. Put an undershirt on the infant and place the brace on the outside of the shirt; always place the brace straps on the outside of the diaper.
2. Check the skin under the harness for irritation or pressure areas.
3. Do not apply oils or lotions under the harness.
4. Evaluate peripheral circulation and maintain cleanliness.
B. Teach parents cast care if hip spica cast is applied.

**TEST ALERT: Apply or remove immobilizing equipment.**

- **Goal:** To facilitate developmental progress and adapt nurturing activities to meet needs of infant and parents.
  A. Provide appropriate stimuli and activity for developmental level.
  B. Encourage parents to hold and cuddle child.
  C. Maintain normal home routine.

**Herniated Intervertebral Disk**

* The intervertebral disk forms a cushion between the vertebral bodies of the spinal column. As stress on an injured or degenerated disk occurs, the cartilage material of the disk (nucleus pulposa) herniates inward toward the spinal column, causing compression or tension on the spinal nerve root.

**Data Collection**

A. The problem most commonly occurs in the lumbosacral area.
B. May be caused by an injury or stress to the lower back.
C. Clinical manifestations.
   1. Low back pain radiating down one buttock and the posterior thigh (sciatica pain).
   2. Coughing, straining, sneezing, bending, twisting, and lifting aggravate the pain.
   3. Lying supine and raising the leg in an extended position will precipitate the pain.
D. Diagnostics: Appendix 16-1.

**Treatment**

A. Medical.
   1. Analgesics, muscle relaxants, antiinflammatory medications.
   2. Weight reduction if appropriate.
   3. Cool therapy (ice) may be used for the first 24 to 48 hours after an injury, and then moist heat is applied.
   4. Physical therapy.
   5. Bed rest with good body alignment when pain is acute, then activity modification using good body mechanics.
B. Surgical.
   1. Laminctomy: removal of the herniated portion of the disk.
   2. Microlaminectomy (diskectomy): removal of the herniated disk with the use of a microscope to minimize the incision. There is less trauma in the disk area, improved hemostasis, minimal nerve root involvement, and quicker recovery using this procedure.

**Nursing Interventions**

- **Goal:** To relieve pain via conservative measures and prevent recurrence of problem.
  A. Decrease muscle spasms with bed rest and medications.
  B. Begin ambulation slowly and avoid having client bend, stoop, twist, sit, or lift.
  C. Instruct the client regarding the principles of proper body mechanics (Box 16-2) and any prescribed mobility limitations.
  D. The client will need a firm mattress; client should not sleep or lie in the prone position.
  E. Encourage correct posture; avoid prolonged standing.
  F. Sit in straight-backed chairs with firm seat and arm rests.

- **Goal:** To prepare client for laminectomy.
  A. Follow general preoperative nursing interventions.
  B. Have client practice logrolling preoperatively.
  C. Have a male client practice voiding from supine position.
  D. Explain to client that postoperative pain is very similar to preoperative pain, due to temporary inflammation and edema of the area around the spinal cord.
  E. Evaluate bowel and bladder function.
  F. Record specific characteristics of pain to include in a database so that preoperative pain can later be compared with postoperative pain.
  G. Establish a baseline neurologic assessment for postoperative reference.

- **Goal:** To maintain spinal alignment postoperative laminectomy.
  A. Keep the bed in a flat position.
  B. Logroll client when turning.
  C. Keep pillows between the legs when positioned on the side; do not place pillow under the knees.
  D. Elastic stockings or pneumatic compression devices may be used to increase venous return.
  E. Encourage good pulmonary hygiene (e.g., increase fluid intake; perform coughing, deep breathing, and spirometry exercises).
  F. The client with microdisk surgery will have fewer limitations on mobility. Generally, the client may assume a position of comfort.

- **Goal:** To maintain homeostasis and assess for complications postoperative laminectomy.
NURSING PRIORITY: A hematoma at the incisional area may cause swelling and pressure resulting in neurological deficits in the lower extremities.

A. Evaluate incision area for possible leakage of spinal fluid and bleeding.

NURSING PRIORITY: Notify RN or surgeon if clear fluid is leaking from incision.

B. Evaluate characteristics of pain, administer analgesics.
C. Perform neurovascular checks on extremities.
   1. Evaluate sensation of extremities.
   2. Evaluate ability to move feet and toes.
   3. Evaluate vascular status of legs and feet.
D. Assess for urinary retention and loss of sphincter control. Need to notify RN or physician immediately; it may be an indication of cord compression. Normal bladder function usually returns in 24-48 hours.
E. Ambulate as soon as indicated (frequently on first post-operative day if no fusion was done). Client who has a microdisk laminectomy will have fewer limitations on movement.
F. If fusion was performed, often need to apply a back brace or body brace before ambulation.
G. The client with the microdisk laminectomy generally experiences less pain, is frequently out of bed the day of surgery, and has fewer complications.

NURSING PRIORITY: The laminectomy client frequently has difficulty voiding after surgery. Palpate the suprapubic area to make sure the bladder is not full.

Scoliosis

Adolescent idiopathic scoliosis is a lateral curvature of the spine. Without treatment, it will severely affect the shape of the thoracic cavity and impair ventilation.

Data Collection

A. Most frequently identified at beginning of growth spurt; more common in females.
B. Visible curvature of the spinal column; head and hips are not in alignment.
C. When client bends forward from the waist, there is visible difference in the level of the shoulders. The ribs and shoulder are more prominent on one side.
D. Waistline is uneven, one hip is more prominent.
E. Defect is progressive if not treated.

Treatment

A. Brace if spinal curvature progresses, Cotrel’s traction used for early correction; Milwaukee brace used for high thoracic curvatures.
B. Surgery: spinal fusion and placement of a rod or instrument to maintain alignment of the fused segment. The rod may be left in place permanently unless it becomes displaced or causes discomfort.

Nursing Interventions

Goal: To identify defects early and promote effective conservative therapy.
A. Promote health programs in schools to identify condition.
B. Assist client and parents to properly use braces.
   1. Ensure brace is properly fitted and does not inadvertently rub bony prominences.
   3. Initially the brace is worn 20 to 23 hours per day.
   4. Brace is regularly adjusted to promote correction.
   5. If progress is good, child is weaned from the brace during the daytime and wears it only at night.
   6. Supplemental exercises may be prescribed.

Goal: To maintain spinal alignment postoperative correction (see preceding postoperative laminectomy goal).

Goal: To maintain homeostasis and assess for complications postoperative correction (see preceding postoperative laminectomy goal).

Fractures

A disruption or break in the continuity of a bone; generally occurs from a traumatic injury.
A. Pathological fractures occur secondary to a disease process.
B. Classification of fractures.
   1. Type.
      a. Comminuted: fracture with multiple bone fragments; more common in adults.
      b. Greenstick: an incomplete fracture with bending and splintering of the bone; more common in children.
      c. Complete: fracture line extends through the entire bone; the periosteum is disrupted on both sides of the bone.
      d. Impacted: complete fracture with bone fragments being driven into each other.
   2. Classified according to location on the bone: proximal, middle, or distal.
   3. Simple, closed fracture: does not produce a break in the skin.
   4. Complex, open, or compound: fracture involves an open wound through which the bone has protruded.
**Data Collection**

A. Clinical manifestations.
   1. Edema, swelling of soft tissue around the injured site.
   2. Pain: immediate and often severe.
   3. Abnormal positioning of extremity; deformity.
   4. Loss of normal function due to disruption of bone integrity.
   5. False movement; movement occurs at the fracture site.
   6. Crepitation: palpable or audible crunching as the ends of the bones rub together.
   7. Discoloration of the skin around the affected area.
   8. Sensation may be impaired if there is nerve damage.

B. Diagnostics - Clinical manifestations and history.
   (Appendix 16-1).

**Treatment**

A. Immediate immobilization of suspected fracture area.
B. Fracture reduction.
   1. Closed reduction: nonsurgical, manual realignment of the bones; injured extremity is usually placed in a cast for continued immobilization until healing occurs.
   2. Open reduction and internal fixation (ORIF): surgical correction to maintain bone alignment with steel plates and screws.
   3. External fixation: application of a rigid external device consisting of pins placed through the bone and held in place by a metal frame (Figure 16-1).
      a. May be used to treat open complicated fractures.
      b. Requires meticulous care of pin insertion site to prevent infection.
      c. Provides early mobility for the client
C. Traction (Figure 16-2).
   1. Purposes.
      a. Immobilization of fractures until surgical correction is performed; immobilization or alignment of fracture until edema is decreased enough to permit casting.
      b. Decrease, prevent, or correct deformities associated with muscle diseases and bone injury.
      c. Decrease or prevent muscle spasms.
   2. Types.
      a. Skeletal: wire or metal pin is inserted into or through the bone and a system of weights and pulleys are used to maintain an external force of pull to the bone for immobilization of fracture site (e.g., Crutchfield tongs).
      b. Skin: force of pull is applied directly to the skin and indirectly to the bone at the fracture site to maintain fracture reduction.
D. Cast application to maintain immobility of affected area above and below the injured area.

**Complications**

A. Infection
   1. Osteomyelitis: infection in the bone
      a. Most often has a sudden onset.
      b. Tenderness and pain at the site.
      c. More common in older adults with open wounds that have caused a break in the periosteum.
   2. Infection at site of wound or incision, may progress to osteomyelitis.
      a. Infection may occur under the cast, around pin sites or in the incision.
      b. Unpleasant odor.
      c. Purulent drainage, either through the cast, or at incision or pin sites.
      d. Elevated body temperature.
      e. Increased warmth on cast over injured area.
B. Compartment syndrome.
   1. Caused by internal pressure within or around the compartments of tissue lined by fascia; the fascia does not expand in response to an increase in the contents of the compartment (Figure 16-3).
   2. Any increase in the size of the compartment due to bleeding or swelling will put pressure on the structures (nerves and vessels) within that compartment.
   3. May be caused by external pressure from a cast or dressing that is too tight.
   4. Either external or internal pressure may cause permanent damage if not relieved as soon as possible – it is possible for permanent damage to occur within hours.
5. An early sign of compartment syndrome is paresthesia; weak pulse or pulselessness is a late sign. Clients may complain of a throbbing, severe pain unrelieved by analgesics.

6. Evidence of decreased circulation distal to the involved area.
   a. Decreased quality of pulses distal to the injury.
   b. Pain and edema.
   c. Pale, cool, dusky extremity.
   d. Decreased capillary refill time.

7. Evidence of pressure on a nerve.
   a. Decreased sensation to touch.
   b. Paresthesia, tingling.
   c. Impaired motion.

8. Treatment is directed toward immediate release of pressure. If the client has a cast, the cast may be “bivalved.” The cast is split in half, and the halves are secured around the extremity by a wrap such as an elastic bandage.

9. Volkmann’s contracture: a type of compartment syndrome that occurs when pressure is exerted on the radial or ulnar nerves at the wrist, causing a flexion contraction of the hand. Most commonly occurs with fractures to the elbow and forearm. The flexion contraction may be permanent.

C. Venous stasis and thrombus formation related to immobility (see Chapter 11).

D. Fat embolism.
   1. Often associated with fractures of long bones; primarily occurs in adults.

2. Clinical manifestations most often occur within the first 48 hours of injury.

3. Fat globule moves through the venous system to the lungs.
   a. Change in mental status.
   b. Respiratory distress – tachypnea, tachycardia, petechiae over upper torso.
   c. Anxiety and decreasing pulse oximetry.

FIGURE 16-2 Examples of common types of traction (From deWit, S. Medical surgical nursing: concepts and practices, St Louis, 2009, Saunders/Elsevier).

FIGURE 16-3 Compartment syndrome. (From Monahan: Phipp’s W. Medical-surgical nursing: Health and illness perspectives, ed 8, St Louis, 2007, Mosby.)
Nursing Interventions

**Goal:** To provide immobility and emergency care before transporting victim.

A. Evaluate circulation distal to injury.
B. Splint and immobilize extremity before transfer.
C. If traction is initiated for immobilization, do not release it until further evaluation and treatment is available.

**Goal:** To identify complications early, perform frequent peripheral nerve and vascular assessment distal to the area of injury (before treatment and ongoing after immobilization of injury).

A. Five Ps of neurocirculatory assessment (Figure 16-4).
   1. **Pain.**
      a. Location.
      b. Increasing or decreasing, throbbing, response to analgesics.
      c. Precipitating factors.

   NURSING PRIORITY: Immediately report pain that is unrelieved by analgesics.

   2. Presence of peripheral Pulses.
   3. **Pallor** of skin.
      a. Skin pale and cool to touch.
      b. Nail beds: normal capillary refill occurs within 3 seconds.
   4. **Paresthesia** (nerve compression).
      a. Decreased sensation.
      b. Numbness, tingling.
   5. **Paralysis** (nerve compression).

B. Evaluate for presence of compartmental syndrome – if any symptoms are present, obtain assistance immediately.

NURSING PRIORITY: It is important for the nurse to be aware of the symptoms of compartment syndrome, identify it early and report it immediately.

C. Fat emboli.
   a. Monitor client for changes in mental status – change in level of consciousness, confusion, disorientation, and lethargy.
   b. Assess respiratory status, if hypoxic place client in semi to high Fowler's position, begin oxygen and stay with client.
   c. An emergent crisis, stay with client and request assistance immediately.

TEST ALERT: Identify client at increased risk for compromised circulation; implement measures to prevent neurovascular complications; recognize client at increased risk for complications.

D. Monitor for presence of infection.

**Goal:** To maintain immobilization via traction (see Figure 16-2).

A. Assume that traction is continuous unless designated otherwise.
B. Carefully assess pressure points for skin breakdown, especially under the client.
C. Do not change or remove traction weights on a client with continuous traction.
D. The traction ropes and weights should hang free from any obstructions.
E. Traction applied in one direction requires an equal counter traction to be effective; client’s weight is the countertraction.
   1. Do not let the client’s feet touch the end of the bed; it will cause the counter traction to be lost.
   2. Do not allow the traction weights to rest on any thing at the end of the bed; this negates the pull of the traction.
F. Carefully assess the pin sites for evidence of infection in clients with skeletal traction, or with external fixation.
G. Position the client in the center of the bed with the traction pull in a straight line.

TEST ALERT: Maintain client traction devices; implement measures to promote venous return.

**Goal:** To maintain immobilization via cast.

A. Allow plaster cast to dry adequately before handling or moving the client.
   1. Do not cover the cast with a blanket.
   2. Encourage cast to dry by using fans and maintaining adequate circulation.
   3. Synthetic casts dry in about 20 minutes; cast will feel warm during the drying process.
   4. Plaster casts take several hours to dry completely; the cast will also feel warm during drying.
   5. Avoid handling a wet cast to prevent indentions, which may cause pressure areas inside the cast.
6. Reposition client every 2 hours to facilitate the drying of all cast surfaces.
7. “Petaling” a cast is done to cover the rough, crumbling edges of a plaster cast. Small strips of waterproof adhesive are used to cover the case edges.

B. Continue to assess for compartment syndrome.
C. Body jacket cast and hip spica cast.
   1. Evaluate for abdominal discomfort due to cast compression of mesenteric artery against duodenum.
   2. Relief of gastric distention: may be necessary to relieve gastric distention by a nasogastric tube and gastric suction.
   3. Evaluate for pressure areas over iliac crest.
D. Do not allow cast to become excessively damp or to get wet.
E. Elevate casted extremity, especially during the first 24 hours after application.
F. Apply ice packs directly over the area of injury during the first 24 hours, being careful not to allow the cast to become wet.

NURSING PRIORITY: Do not apply any type of heat to a cast to enhance drying.

G. Assess for evidence of infection.
   Goal: To provide care to a client with an external fixation device.
   A. Assess for neurovascular complications.
   B. Inspect exposed skin and pin insertion sites for signs of infection.
   C. Do not use frame to pull or lift client.
   D. Frame will be removed when fracture has healed.
   Goal: To prevent complications of immobility (see Chapter 3).

Home Care

A. Client should not:
   1. Bear weight on the cast until instructed to do so.
   2. Allow the plaster cast to get wet; discuss alternatives for bathing.
   3. Insert anything under or in the cast.
   4. Remove any of the padding under the cast.
B. Client should report any symptoms associated with swelling or increased pain.

NURSING PRIORITY: Check for complications caused by cast, traction, external fixation device or other immobilizing equipment.

Specific Fractures

A. Colles’ fracture.
   1. Fracture of the distal radius.
   2. Primary complication is compartmental syndrome.
B. Fractured pelvis.
   1. Frequently occurs in older adults and is associated with falls.
   2. May cause serious intraabdominal and urinary tract injury.
   4. Combination of external fixation and ORIF may be used to treat complex fractures.
   5. Turn client only on specific orders.
C. Fractured hip.
   1. Common in women over 60 years of age, increased risk in clients with osteoporosis.
   2. Clinical manifestations.
      a. External rotation and adduction of the affected extremity.
      b. Shortening of the length of the affected extremity.
      c. Severe pain and tenderness.
   3. Treatment.
      a. Initially, Buck’s or Russell’s traction with sand bags and trochanter roll to immobilize fracture, decrease muscle spasms, and control external rotation (see Figure 16-2).
      b. Surgical repair when client’s condition allows (permits earlier mobility and prevents complications of immobility).
   4. Nursing interventions postoperatively (Box 16-3).
      a. Circulatory and neurological checks distal to area of injury/surgery.
      b. Position to prevent flexion, adduction, and internal rotation, which may cause dislocation of the prosthesis.

BOX 16-3 OLDER ADULT CARE FOCUS

Musculoskeletal Nursing Implications

• It is more difficult to maintain immobility in these clients after fractures; therefore surgical intervention (e.g., ORIF) is frequently used for treatment.
• The older client heals more slowly, so use of the affected extremity and weight bearing are frequently delayed.
• Complications of immobility occur more frequently; mobilize hospitalized clients as early as possible.
• Do not rely on fever as the primary indication of infection; decreasing mental status is more common.
• Contractures are more common. Encourage use of assistive devices (canes and walkers).
(1) Do not adduct the affected leg past the neutral (midline) position.
(2) Maintain the affected leg in an abducted position; initially with an A-frame pillow or by keeping pillows between the knees.
(3) It is important to prevent internal or external rotation and/or adduction of the operative hip by the use of sandbags, pillows, or trocanter rolls at each thigh.
(4) Avoid greater than 90-degree flexion of the operative hip, when out of bed position client in a chair that provides support, but not sitting at a 90-degree angle of flexion.
(5) Do not allow legs to cross at the knees or the feet.

✔ **NURSING PRIORITY:** Check with the RN regarding the positioning for clients with fractured hip; positioning for these clients is critical.

c. Evaluate blood loss.
   (1) Check under the client for hemorrhage.
   (2) Measure the diameter of the thigh to evaluate the presence of internal bleeding.

d. Client is frequently mobilized on first or second postoperative day to prevent complications of immobility.

e. The client is prone to complications of immobility; use thigh-high anti-embolism stockings or pneumatic compression devices on legs; encourage foot flexion; low-dose heparin may be used prophylactically.

D. Rib fractures.
   1. Usually heal in 3 to 6 weeks with no residual impairment.
   2. Painful respirations cause client’s to breath more shallow and refrain from coughing, this increased problems of atelectasis.
   3. Chest taping or strapping is not usually done because it prevents thoracic excursion and deep breathing.
   4. Multiple rib fractures may precipitate the development of a pneumothorax or a tension pneumothorax (see Chapter 10).

E. Mandible fracture.
   1. Wiring of jaws (intermaxillary fixation) is common treatment.
   2. Postoperative problems: airway obstruction and aspiration of vomitus.
   3. Wire cutters at bedside in case of emergency
      a. Suction client via nasopharyngeal and or oral methods if vomiting occurs.
      b. Cut the wires only as last resort in an emergency (cardiac or respiratory arrest).

   c. Wire cutters should remain with the client at all times.
   4. Oral hygiene is very important – use normal saline rinses after eating and a soft catheter or water pik for a more thorough oral cleansing.
   5. Tracheostomy set at bedside.
   6. Establish system for communication - a pad/pencil or picture board to communicate post-op.
   7. Discharge teaching: oral hygiene, techniques for handling secretions, diet (problems with constipation due to low fiber in diet), always keep wire cutters with them.

**Hip Replacement**

A. Hip replacement surgery may be performed to correct a pathological fracture or as treatment for a disease process such as rheumatoid arthritis.

B. Preoperative care.
   1. Encourage client to practice using either crutches or a walker, whichever is anticipated to be used post operatively (see Appendix 16-4).
   2. Encourage client to practice moving from the bed to the chair in the same manner client will perform this transfer postoperatively.
   3. Client should discontinue use of NSAID’s and or aspirin about a week prior to surgery.

**Nursing Implications**

A. Postoperative care (see Chapter 2).
   1. Position client to prevent complications.
      a. Supine with head slightly elevated, maintain abduction of affected leg, do not use knee gatch on bed.
      b. Do not allow the client’s hip to flex greater than 90 degrees; therefore do not elevate the bed greater than 60 degrees.
      c. Maintain abduction and prevent external rotation of extremity.
      d. When sitting, keep client’s knees below level of hip.
      e. Legs should not be crossed, either at the knee or the ankle.
   2. Client may be out of bed to stand at the bedside on the first postoperative day.
   3. Encourage postoperative exercises to maintain muscle tone and prevent DVT.
   4. Perform neurovascular assessment with vital sign checks.
   5. Monitor wound drainage; frequently this client will have a portable wound suction device.
   6. Prevent complications of immobility
      a. Carefully monitor skin for areas of pressure.
      b. Keep client’s heels off the bed to prevent skin break down.
c. Client is usually out of bed on first or second postoperative day.
d. Antiembolism stockings and/or sequential compression pumps on lower extremity to prevent venous stasis.
e. Low-molecular-weight heparin (see Appendix 11-3) may be given to prevent thrombophlebitis and deep vein thrombosis.

**NURSING PRIORITY:** After surgery, do not allow the repaired hip to flex greater than 90 degrees; avoid adduction and internal rotation of extremity. Flexion and adduction will dislocate the hip prosthesis (use raised toilet seats, reclining wheelchairs).

7. Observe for signs of possible hip dislocation.
   a. Increased hip pain.
   b. Shortening of affected leg.
   c. External leg rotation.
   d. If these symptoms are observed, contact the RN immediately.

8. Pain management.
   a. Pain control is frequently difficult secondary to age, respiratory status, and need to mobilize client.
   b. Evaluate pain using a pain scale.
   c. Epidural or intraspinal analgesia, or a PCA may be used; client frequently on oral pain medication on the 2nd or 3rd postoperative day.
   d. Utilize non-pharmacologic methods for pain relief (see Chapter 3).

9. Closely observe the incisional area for evidence of infection; fever is not a common sign of infection in the older adult, assess for change in orientation status and confusion.

**Total Knee Replacement**

A. This surgery is often performed to treat joint complications of arthritis.

B. Postoperative care
   1. Client usually returns from surgery with a compression dressing; monitor neurovascular status of extremity distal to the operative site.
   2. Apply cold packs to incision site to decrease edema and bleeding.
   3. Client may have a portable wound suction device to remove drainage from wound.
   4. A continuous passive motion (CPM) device may be used; it promotes healing by increasing circulation and movement of joint.
      a. Check settings for schedule of designated hours and for degree of flexion.
      b. Make sure joint is positioned correctly on equipment.
   c. Assess client’s tolerance of motion.
   d. Turn machine off for meals in bed.
   e. Provide padding to prevent pressure points.

5. When client is out of bed in a chair, the knee-immobilizing device may be applied; elevate the extremity.

6. Client has weight-bearing limitations postoperatively; weight bearing gradually increases with healing.

7. Pain management
   a. Provide comfort; promote increased activity and joint mobility.
   b. See pain control for total hip replacement, may also use peripheral nerve blocks.
   c. Evaluate pain using a pain scale.

8. Maintain knee in a neutral position, do not allow external or internal rotation.

9. Assess for development of anemia, infection, and DVT.

10. Client is frequently ambulatory at discharge with use of assistive devices. (Appendix 16-4)

**Osteoporosis**

* A metabolic bone disease that involves an imbalance between new bone formation and bone resorption.

A. Primary osteoporosis is most common type; occurs most often in women after menopause.

B. Bone loss occurs predominantly in the vertebral bodies of the spine and the femoral neck in the hip. As bone mass declines, the bone becomes brittle and weak.

**OLDER ADULT PRIORITY:** Aging is the major risk factor; protect older adult clients from falls.

**Data Collection**

A. Clinical manifestations (Figure 16-5).
   1. May be asymptomatic until x-rays demonstrate skeletal weakening. Bone loss in excess of 25% occurs before osteoporosis can be identified on standard x-rays.
   2. Spinal deformity and “dowager’s hump.”
      a. May be diagnosed after a fracture or a vertebral compression fracture.
      b. Gradual loss of height.
      c. Increase in spinal curvature (kyphosis).
   3. Vertebral fractures may occur spontaneously or as a result of minimal trauma.
   4. Chronic low thoracic and midline back pain.
   5. Height loss may precipitate thoracic problems, such as a decrease in deep breathing and exercise tolerance.
   6. Hip fractures and vertebral compression are frequent complications.
B. Diagnostics.
   1. Serum lab values of calcium, phosphorus, and alkaline phosphatase are usually normal.
   2. Computed tomography to evaluate bone loss.
   3. Bone scan to identify bone density.

Treatment

A. Dietary: increased intake of protein, calcium, and vitamin D.
B. Calcium supplements, and medications to increase bone density (see Appendix 16-2).
C. Vitamin D supplements to enhance utilization of calcium.
E. Exercise: activities that place moderate stress on bones by working them against gravity. Weight-bearing exercise is believed to decrease the development of osteoporosis and possibly increase new bone formation.
   1. Swimming and yoga may not be as beneficial because of lack of stress on bone mass.
   2. Walking for 30 minutes 3-5 times a week is most effective exercise, along with lifting weights.
F. Compression fractures of the vertebrae usually heal without surgical intervention.

Complications

Bone fractures occurring in the vertebral bodies, distal radius, or the hip.

Nursing Interventions

❖ **Goal:** To decrease pain and promote activities to diminish the progress of the disease.
A. Encourage pain relief measures.
   1. Bed rest initially with a firm mattress.
   2. Narcotic analgesics initially followed by NSAIDs.
B. Assess bowel and bladder function; client will be prone to constipation and paralytic ileus if vertebrae are involved.
C. Encourage regular, daily weight-bearing exercise; encourage outdoor exercises because sunlight increases utilization of vitamin D.
D. Discourage use of caffeine, alcohol, and cigarettes.

Home Care

A. Decrease falls and injury by maintaining a safe home environment; use assistive devices.
B. Understand need to continue medications, even if they do not make the client feel better. Important for client to understand that the calcium supplements are to prevent further damage.
C. Do not exercise if pain occurs.
D. Avoid heavy lifting, stooping, and bending. Review and demonstrate good body mechanics with the client (Box 16-2).

Osteomyelitis

❖ An infection of the bone, bone marrow, and surrounding tissue. The most common causative organism is Staphylococcus.

Data Collection

A. Tenderness, swelling, and warmth in affected area.
B. Drainage from infected site or wound.
C. Fever, chills.
D. Constant pain in affected area – gets worse with activity.
E. May be a chronic process with persistent problems and exacerbations.

Diagnostics

A. Wound and/or blood cultures.

Treatment

A. Prevention is primary goal.
B. Intensive intravenous (IV) antibiotics.
C. Immobilization of affected area.
D. Surgical debridement may be necessary.

Nursing Interventions

❖ **Goal:** To decrease pain, promote comfort, and decrease spread of infection.
A. Maintain correct body alignment.
   1. Move affected extremity gently and with support.
   2. Prevent contractures by encouraging joint mobility, especially of affected extremity.
   3. Apply warm, moist soaks to increase circulation and healing.
B. If there is an open wound, maintain wound contact precautions (see Chapter 5).
C. Client is usually discharged with antibiotics and should maintain close follow-up care.
TEST ALERT: Monitor client’ wounds for infection; identify signs and symptoms of infection.

**Malignant Bone Tumors**

A. The most common primary bone cancer is osteogenic sarcoma; it advances very rapidly with metastasis to the lungs via the blood (see Chapter 2). Bones may be a primary site or a metastatic cancer site.

1. Most commonly affects the long bones, especially the distal end of the femur.
2. Primary malignancy most often occurs in males 10 to 25 years old.

B. Metastatic bone cancer occurs when there is a malignancy in another part of the body that has metastasized to the bone (e.g., breast and prostate cancer).

**Data Collection**

A. Clinical manifestations: generally nonspecific.
   1. Localized pain and swelling.
   2. Tender, palpable bony mass.

B. Diagnostics. (See Appendix 16-1)

**Treatment**

A. Primary site: extensive resection of area around tumor; amputation may be necessary.

B. Metastatic site: identify and treat primary site if possible.

C. Chemotherapy and radiation may be used. (Chapter 2)

**Nursing Interventions**

- **Goal:** To maintain homeostasis and prevent complications after surgery.
  A. An extensive pressure dressing with wound drains/suction may be present.
  B. ROM is usually begun immediately; continuous passive motion may be used immediately or on first postoperative day for both upper and lower extremity surgery.
  C. Muscle toning is important before weight bearing.
  D. Frequent neurovascular assessment is necessary because of resection of nerves and vessels in area; extremity may also be casted or splinted for support.

- **Goal:** To prevent complications and promote mobility after amputation (see Appendix 16-3).
- **Goal:** To assist the client/child and family to cope with the diagnosis and build basis for rehabilitation.
  A. Provide honest, straightforward information to client and family regarding the situation.
  B. Allow opportunity for client and family to express concerns and fears.
  C. Anticipate sense of loss of control and anger over changes in body.

- D. Encourage normal growth and developmental activities as appropriate; allow client to be as independent as possible.

- **Goal:** To assist the client and family to cope with the side effects of chemotherapy and radiation (see Chapter 2).

**Rheumatoid Arthritis**

A systemic autoimmune disease that affects all areas of the body. It produces a chronic inflammatory process involving connective tissue, especially synovial joints.

A. Exacerbations and remissions occur. Condition tends to be progressive with each exacerbation. Seldom does the client return to the previous level of functioning before the exacerbation.

B. Early diagnosis may prevent or delay permanent damage.

C. May occur in children as juvenile rheumatoid arthritis.

**Data Collection**

A. Clinical manifestations.

1. Gradual onset.
2. Stiffness and pain worse in the morning; generally decrease during the day with moderate activity.
3. Joint involvement is bilateral and symmetrical, most frequently involves the hands and feet.
   a. Warm, tender, red, painful joints.
   b. Decrease in range of motion.
   c. Decrease in strength.
4. Subcutaneous nodules on the fingers.
5. Systemic effects.
   a. Low fever.
   b. Malaise and weakness.
   c. Anorexia and weight loss.
   d. Depression.
   e. Easily fatigued.
6. Chronic deformities develop most often in the hands and feet.

B. Diagnostics (Appendix 16-1).

**Treatment**

A. Nonsteroidal antiinflammatory drugs (NSAIDs).

B. Corticosteroids.

C. Disease-modifying antirheumatic drugs (DMARDs) (see Appendix 16-2).

D. Heat and/or cold applications.

E. Physical and rehabilitative therapy.

F. Surgery: joint replacements.

**Nursing Interventions**

- **Goal:** To relieve pain and preserve joint mobility and muscle strength.
A. Use warm, moist compresses to relieve pain and stiffness of muscle spasms associated with chronic stiffness.

B. If acute inflammation is present, cold compresses may provide relief.

C. Acutely inflamed joints may be immobilized in a device that maintains a functional position.

D. Position client to maintain correct body alignment and prevent contractures, especially flexion contractures.

E. Perform range of motion (ROM) exercises to maintain joint mobility and to decrease pain.

F. Antiinflammatory medications should be taken with meals or food to decrease gastric upset.

G. If client is taking corticosteroids, medical identification should be worn.

**NURSING PRIORITY:** Nursing care of the client with arthritis is directed toward decreasing pain and maintaining joint function.

- **Goal:** To assist client to understand implications of the disease process and measures to prevent joint deformity, relieve pain, and reduce inflammation (Box 16-4).
  
  A. Encourage regularly scheduled rest periods to relieve fatigue and pain; amount of rest varies with the individual and the disease process.
  
  B. Protect small joints.
  1. Maintain joint alignment; avoid positions that precipitate joint contraction (e.g., do not use pillow under the knees; encourage activities that involve pressing down the fingers).
  2. Change position frequently; maintain good body alignment.
  3. Use large muscle groups instead of smaller ones; avoid repetitive movements in small joints.
  4. Modify home routine to decrease or avoid stress on joints; modify dressing activities and other activities of daily living (ADLs) as needed.
  
  C. If joint becomes painful during exercise, and the pain persists for 2 hours after the exercise, the activity should be evaluated.
  
  D. Discuss with client importance of identifying false advertising regarding claims of cure and relief of chronic pain.
  
  E. Encourage client to be independent in ADLs as long as possible – focus on what client can do.

**Osteoarthritis**

- **A progressive degenerative joint disease that primarily affects the synovial joints of weight-bearing long bones. It is nonsystemic and noninflammatory.**

  A. Frequently involves joint that have excessive use – knees in athletes, feet in gymnast and dancers.

  B. Hips and knees are common disease sites.

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**BOX 16-4 OLDER ADULT CARE FOCUS**

**Protecting Joints**

- If pain lasts longer than 1 hour after exercise, need to change exercises that involve that joint.
- Plan activity and work schedule to conserve energy: do important tasks first.
- Alternate activities; do not complete all heavy tasks at one time.
- Minimize stress on joints: sit rather than stand, avoid prolonged repetitive movements, move around frequently, avoid stairs or prolonged grasping.
- Use larger muscles rather than smaller ones: use shoulders or arms rather than hands to push open doors; pick up items without stooping or bending, use leg muscles; women can carry purses on their shoulders rather than in their hands.
- Painful, acutely swollen inflamed joints should not be exercised beyond basic ROM.
- Regularly exercise even when joints are slightly painful and stiff: swimming and bike riding maintain mobility without weight bearing.

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**Data Collection**

A. Clinical manifestations.
   1. Joints involved.
      a. Primarily involves weight-bearing joints.
      b. May be unilateral and involve a single joint.
      c. Joints of hands may be involved.
   2. Pain, swelling and tenderness, stiffness of the joint.
   3. Pain occurs on motion and with weight-bearing activity.
   4. Pain increases in severity with activity – pain be comes worse as day progresses.

B. Diagnostics – (Appendix 16-1).

**Treatment**

A. NSAIDs may be effective in pain relief.

B. Methotrexate to decrease swelling and pain.

C. Activity balanced with adequate rest.

D. Joint injection with corticosteroids.

E. Physical therapy and exercise.

F. Surgical intervention with joint replacement.

**Nursing Interventions**

- **Goal:** To relieve pain, prevent further stress on the joint, and maintain function.

  A. Maintain functional joint alignment; desired position may not be position of comfort.

  B. Plan ADLs to prevent stress on involved joints and provide adequate rest periods.

  C. Use warm compresses and hot showers to reduce stiffness and pain.

  D. Cold compresses may be used if the joint is acutely inflamed.
E. Acutely inflamed joint may be immobilized with a splint or brace.
F. Maintain regular exercise program, decrease activity in affected joints.

**Goal:** To assist client to understand measures to maintain health. (Box 16-4)
A. Identify activities requiring increased stress on involved joints.
B. Encourage regular exercise program to preserve muscle strength and joint mobility, protect affected joints (activities that do not cause joint stress, such as swimming).
C. Encourage independence in ADLs.

**TEST ALERT:** maintain correct body alignment; monitor client response to interventions to prevent complications; implement measures to maintain range of motion.

**Gout**

* An arthritic condition resulting from a defect in the metabolism of uric acid (hyperuricemia).

**Data Collection**
A. Clinical manifestations.
   1. Characterized by remissions and exacerbations of acute joint pain.
   2. Onset is generally rapid.

**Treatment**
A. Antigout medications (see Appendix 16-2).
B. Decrease dietary intake of purine (see Chapter 3).
C. Avoid aspirin, alcohol, and diuretics, as they may precipitate an attack.

**Nursing Interventions**

**Goal:** To prevent acute attack, promote comfort, and maintain joint mobility.
A. Medications should be taken early in the attack to decrease the severity.
B. Protect affected joint.
   1. Immobilize the joint.
   2. Elevate the joint.
   3. No weight-bearing activity on the joint.
C. Cold packs may decrease pain.
D. Provide client with information regarding a low-purine diet.
E. Encourage high fluid intake to increase excretion of uric acid and to prevent the development of uric acid kidney stones.
F. Frequently requires pain medication.

**Study Questions: Musculoskeletal and Connective Tissue System**

1. What nursing observations would cause the nurse the most concern for a client who is 3 days postoperative for a below-the-knee amputation?
   1. Warmth at the end of the stump.
   2. Serosanguineous drainage on the dressing.
   3. Bright red blood on the dressing.
   4. Bilateral femoral pulses of 80 beats per minute.

2. A client is admitted with a fractured hip. Before surgery the client is placed in Buck’s traction. What is an important nursing intervention for this client?
   1. Remove the traction boot every 4 hours to check circulation.
   2. Check the pin sites for infection and clean them three times a day.
   3. Check for adequate circulation at the fracture site.
   4. Make sure the client’s feet are not touching the end of the bed.

3. The nurse is checking a client for capillary refill. What is the normal time for the nail bed to return to its pink color?
   1. 1 minute.
   2. 2 to 3 seconds.
   3. 10 seconds.
   4. 15 seconds.

4. The client tells the nurse that he is feeling pain in the area where his leg has been removed. What is the best nursing response?
   1. Because there was severe pain in that area previously, this is a subconscious pain.
   2. The pain is referred from another area that is injured.
   3. The injured nerve endings do not accurately reflect the area of the pain.
   4. This is pain that is actually occurring at the stump.

5. A client is being treated with a long leg cast for his leg fracture. What are important nursing measures while the cast is still wet?
   1. The fingertips should be used when handling the cast.
   2. Support the cast on a pillow with a plastic cover.
   3. Apply a heat lamp and a fan to accelerate the drying time.
   4. Do not reposition the client until the cast is dry.
6. A client has a comminuted fracture of the right tibia and fibula. An external fixation device has been applied to the leg for fracture immobilization. This client is at increased risk for what postoperative complication?  
1. Osteomyelitis.  
2. Poor bone realignment.  
3. Hip flexion contraction.  

7. An older adult client had a fractured hip repaired. The client returns to the unit with a wound drainage system that is connected to low suction. Over the next 4 hours, the client has 75 mL of bright red bloody drainage. What is the best nursing action?  
1. Notify the physician of the abnormal amount of bleeding in the container.  
2. Empty the drainage container, record the amount, and continue to observe.  
3. Apply pressure at the incisional area and evaluate for increase in drainage.  
4. Check the operative record for the placement of the drain.

8. The nurse is checking a child in a left hip spica cast and suspects an infection. What findings would validate the nurse’s conclusion?  
1. Increased complaints of pain and a hot spot found over the incision area.  
2. Complaints of itching and discomfort inside the cast.  
3. Dusky colored toes with weak pedal pulses.  
4. Tingling of the leg with a 3-second capillary refill.  

9. A client has a compound fracture of his left femur. He has required an increased amount of pain medication, but without therapeutic results. What complication should the nurse assess for in this client?  
1. Infection.  
2. Compartment syndrome.  

10. A client complains that the plaster cast on his leg is rubbing his skin raw. What is the best nursing action?  
1. Call the physician to have the cast cut back.  
2. Apply aloe vera lotion to the irritated area.  
3. Petal the edges of the cast.  
4. Increase the client’s pain medication.

11. The nurse is caring for a client who is experiencing an exacerbation of her rheumatoid arthritis. Her hands and fingers are painful, swollen, and inflamed. What is an important nursing measure for this client?  
1. Assist with active range-of-motion exercises in the affected extremity.  
2. Place client’s hands in a position of comfort and apply cold packs.  
3. Apply warm packs to increase circulation to the area.  
4. Explain the importance of therapeutic joint exercises to increase mobility.

12. An adolescent is placed in Buck’s traction for temporary reduction of a femoral fracture. The client is scheduled for an open reduction and internal fixation of the fracture. Before surgery, what would be an important nursing intervention?  
1. Evaluate the quality of the pulses proximal to the temporary cast.  
2. Check the client’s feet to make sure they are not touching the end of the bed.  
3. Evaluate under the client for skin breakdown.  
4. Check the pin sites for inflammation and purulent drainage.

13. The nurse is caring for a client in the immediate postoperative period following a lumbar laminectomy. What nursing observations would cause the nurse the most concern?  
1. Complaints of pain when moving either leg.  
2. Pain radiating down the hip and thigh.  
4. Complaints of numbness and tingling in the client’s right foot.

14. What is the nursing management for a client in balanced suspension traction?  
1. Position client with his feet against the end of the bed to prevent foot drop.  
2. Remove the weights to allow the client to reposition himself.  
3. Adjust the weights every 8 hours to improve quality of circulation.  
4. Check the weights to make sure they are hanging freely in place.

15. A client is learning to use crutches. What is important for the nurse to teach the client?  
1. When going up stairs, advance the affected leg first.  
2. The axillary bar on the crutches should be firmly in the axillary area for full weight bearing.  
3. Always keep arms and elbows straight when walking.  
4. The axillary bar on the crutches should be two fingers width below the axillary area.

16. A woman is going to be taking alendronate (Fosamax) for treatment of her osteoporosis. The nurse is discussing with the woman how she should take the medication. What is very important to include in this discussion?  
1. The medication must be taken on an empty stomach, and no food must be eaten for at least 30 minutes after the medication is taken.  
2. The medication should be taken with a minimal amount of water, and the client should lie down after taking it.  
3. The client should take the medication every night at bedtime, and she should not suddenly stop taking it.  
4. Orthostatic hypotension may be a potential side affect, so she should stand up slowly and make sure she has her balance.

Answers and rationales to these questions are in the section at the end of the book titled Chapter Study Questions: Answers and Rationales.
Appendix 16-1   DIAGNOSTIC STUDIES

**Serum Diagnostics**

**Rheumatoid factor (RF):** Used to determine presence of autoantibodies (rheumatoid factor) found in clients with connective tissue disease; if antibody is present, it is suggestive of rheumatoid arthritis; the higher the antibody titer, the greater the degree of inflammation.

**Antinuclear antibody (ANA):** Identifies the presence of antibodies that destroy the nucleus of body tissue cells (i.e., those seen in connective tissue diseases); a positive test result is associated with systemic lupus erythematosus.

**Creatine kinase (CK):** Elevated levels found in muscular dystrophy and traumatic skeletal muscle injury.

**Invasive Diagnostics**

**Arthroscopy:** Involves the use of an arthroscope inserted into a joint for visualization of the joint structure; procedure is usually conducted in the operating room and performed with either local or general anesthesia; frequently used to diagnose structural abnormalities of the knee.

**Nursing Implications**
1. Perform preoperative nursing interventions, appropriate for the level of anesthesia to be used.
2. After procedure, wound is covered with a sterile dressing.
3. A compression bandage may be applied for 24 hours after the test.
4. Teach client symptoms of vascular compromise, mobility restrictions, and dressing change procedure.
5. Weight bearing may be limited, walking is permitted; however, excessive exercise should be avoided for a few days.
6. Teach the client signs of infection (increased temperature, local inflammation, and drainage at site).

**Arthrocentesis:** Incision of a joint capsule to obtain samples of synovial fluid; local anesthesia, and aseptic preparation is done before fluid aspiration. Synovial fluid is examined for infection and bleeding into the joint and to confirm specific types of arthritis.

**Nursing Implications**
1. Explain procedure to client.
2. May be done at bedside or in an examination room.
3. Compression dressing is usually applied, and joint is rested for several hours after test.
4. Observe dressing for leakage of blood or fluid.
5. Assess the puncture site for evidence of infection.

**Myelogram and CT scan:** Used to determine status of vertebral disk. See Appendix 15-1.

**Bone biopsy:** May be performed in client’s room or in a treatment room. Local anesthesia is used and a long needle is inserted into the bone, or a small incision is made to obtain bone tissue.

**Nursing Implications**
1. Plan for analgesic to be administered before procedure.
2. If an incision was made, maintain a pressure dressing over the site.
3. Extremity is elevated to decrease edema and may be immobilized for about 12 to 24 hours.
4. Assess the puncture site or incision for evidence of infection.

**Electromyelogram (EMG):** Evaluates the electric potential of the muscle with muscle contraction. Small needles are inserted into the muscle and recording of electrical activity is performed.

**Nursing Implications**
1. Explain to client that there is discomfort with procedure.
2. No stimulants (caffeine) or sedatives 24 hours before the procedure.

**Noninvasive Diagnostics**

**X-ray films:** The most common diagnostic procedure to determine musculoskeletal problems.
1. Identify musculoskeletal problems.
2. Determine progress of disease or condition.

**Bone scan:** Radios isotopes may be injected intravenously, and bone is scanned to determine where the isotopes are “taken up.” May be used to determine presence of malignancies, arthritis, and osteoporosis. No special precautions before or after test; need to encourage fluid intake to increase excretion of dye.

**Computerized axial tomography (CAT scan):** See Appendix 15-1.

**Magnetic resonance imaging (MRI):** See Appendix 15-1.
### Appendix 16-2  MEDICATIONS

<table>
<thead>
<tr>
<th>Medications</th>
<th>Side Effects</th>
<th>Nursing Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANTIGOUT AGENTS:</strong> Decrease the plasma uric acid levels either by inhibiting the synthesis of uric acid or increasing the excretion of uric acid.</td>
<td></td>
<td>1. Take medication at earliest indication of impending gout attack.</td>
</tr>
<tr>
<td>Colchicine: PO</td>
<td>Nausea, vomiting, diarrhea</td>
<td>2. Take medication with food.</td>
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<tr>
<td></td>
<td>Toxic effects: bone marrow depression</td>
<td>3. Encourage high fluid intake to promote uric acid excretion.</td>
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<td></td>
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<td>4. In acute attack, administer 1 tablet every hour until symptoms subside, until GI problems occur, or until a total of 8 mg has been taken.</td>
</tr>
<tr>
<td>Allopurinol <em>(Zyloprim)</em>: PO</td>
<td>Rash, GI distress, fever, headache</td>
<td>1. Administer with food to decrease gastric upset.</td>
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<tr>
<td></td>
<td></td>
<td>2. Discontinue medication if rash occurs.</td>
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<td></td>
<td></td>
<td>3. Use with caution in clients with renal insufficiency.</td>
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<td></td>
<td></td>
<td>4. May be used to decrease serum uric acid levels in clients receiving chemotherapy.</td>
</tr>
<tr>
<td>Probenecid <em>(Benemid)</em>: PO</td>
<td>GI disturbances, headache, skin rash, fever</td>
<td>1. Urate tophi deposits should decrease in size with therapy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Give with food.</td>
</tr>
<tr>
<td><strong>SKELETAL MUSCLE RELAXANTS:</strong> Relax skeletal muscle by depressing synaptic pathways in the spinal cord.</td>
<td></td>
<td>1. Used to treat muscle spasms.</td>
</tr>
<tr>
<td>Methocarbamol <em>(Robaxin)</em>: PO, IM, IV</td>
<td>Drowsiness, dizziness, GI upset, rash, blurred vision</td>
<td>2. Caution clients to avoid activities that require mental alertness for safety (driving, using power tools, etc.).</td>
</tr>
<tr>
<td>Cyclobenzaprine <em>(Flexeril)</em>: PO</td>
<td>Drowsiness, dizziness, headache, GI upset, orthostatic hypotension</td>
<td>3. Advise client to avoid CNS depressants (e.g., alcohol, opioids, antihistamines).</td>
</tr>
<tr>
<td>Carisoprodol <em>(Soma)</em>: PO</td>
<td></td>
<td>4. Administer with meals to decrease GI distress.</td>
</tr>
<tr>
<td>Baclofen <em>(Lioresal)</em>: PO</td>
<td>Drowsiness, weakness, fatigue, confusion</td>
<td>1. Teach clients symptoms to report any yellowing skin or eyes, it may indicate a problem with liver function.</td>
</tr>
<tr>
<td>Dantrolene <em>(Dantrium)</em>: PO, IV</td>
<td>Hepatotoxicity, muscle weakness, drowsiness</td>
<td>2. Acts directly to relax skeletal muscle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Monitor levels of serum calcium.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Treatment of established postmenopausal osteoporosis.</td>
</tr>
<tr>
<td>Calcitonin-salmon <em>(Calcimar, Miacalcin)</em>: subQ, IM, nasal spray</td>
<td>GI upset, local inflammation at injection site, flushing</td>
<td>1. Have client swallow tablet whole; it should not be chewed.</td>
</tr>
<tr>
<td>Bisphosphonates—alendronate <em>(Fosamax)</em>, ibandronate, <em>(Boniva)</em>: PO, nasal spray</td>
<td>Esophagitis, GI flushing, rash, musculoskeletal pain, fever, chills, jaw pain</td>
<td>2. Take in morning on an empty stomach with large glass of water (6 to 8 oz) and wait at least 30 minutes before eating or lying down.</td>
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<td>3. Encourage client to take supplemental vitamin D.</td>
</tr>
<tr>
<td>CORTICOSTEROIDS: See Appendix 5-7.</td>
<td></td>
<td>4. Used for prevention and treatment of postmenopausal osteoporosis.</td>
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*Continued*
### MEDICATIONS—cont’d.

<table>
<thead>
<tr>
<th><strong>Medications</strong></th>
<th><strong>Side Effects</strong></th>
<th><strong>Nursing Implications</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DISEASE-MODIFYING ANTIRHEUMATIC DRUGS (DMARDs):</strong> Anti-metabolite, anti-rheumatic, and anti-malarial drugs that act to decrease inflammation.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Methotrexate *(Rheumatrex): PO* | **Toxic effects:** hepatotoxicity, bone marrow depression Nausea, vomiting, stomatitis | 1. Caution women of childbearing age to avoid pregnancy.  
3. Avoid alcohol during therapy.  
4. Administer with food. |
| Hydroxychloroquine *(Plaquenil): PO* | **Toxic effects:** retinopathy, skeletal muscle myopathy or neuropathy Headache, anorexia, dizziness | 1. Recommend eye exams every 3 months.  
2. Not recommended for children.  
3. Therapeutic effect may not be evident for 3 to 6 months. |
| Leflunomide *(Arava): PO* | **Toxic effects:** hepatotoxicity, diarrhea, teratogenesis | 1. Not recommended for women who may become pregnant.  
2. May slow the progression of joint damage caused by rheumatoid arthritis and improves physical function. |
| **BIOLOGICAL THERAPY:** Agents that bind TNF to decrease inflammatory and immune responses; used in cases of severe arthritis. |
| Etanercept *(Enbrel): subQ* | Increased risk for infections, injection site reactions, heart failure, headache, nausea, dizziness | 1. Use cautiously in clients with heart disease.  
2. Rotate injection sites at least 1 inch apart.  
3. Advise clients that injection site reaction generally decreases with continued therapy.  
4. Do not administer to clients with chronic or localized infections.  
5. Have client report signs of infection, bruising, or bleeding. |
| Infliximab *(Remicade): IV* | Increased risk for opportunistic infections, abdominal pain, nausea/vomiting, headache, rash, injection site reactions | 1. Avoid in clients with heart disease.  
2. Assess clients for infections; administer TB skin test and chest x-ray before starting medication.  
3. Rotate injection sites at least 1 inch apart.  
4. Perform periodic CBCs to monitor for blood dyscrasias. |

**NONSTEROIDAL ANTIINFLAMMATORY MEDICATIONS (NSAIDS):** See Appendix 5-8.

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*CBC,* Complete blood count; *CHF,* congestive heart failure; *CNS,* central nervous system; *GI,* gastrointestinal; *IV,* intravenous; *PO,* by mouth (orally); *subQ,* subcutaneous; *TNF,* tumor necrosis factor.
Appendix 16-3  AMPUTATIONS

Removal of all or part of an extremity. The precipitating problem determines if the amputation is an elective or an emergency procedure.

POSTOPERATIVE CARE

Residual limb wound care
1. The residual limb may be elevated for approximately 24 hours; after that time, keep the joint immediately above the limb in an extended position. Flexion contracture hinders the use of a prosthesis.
2. Discuss the phenomenon of phantom limb pain; it does not help for the nurse to point out to the client that the extremity is gone.
3. Administer analgesics; assist the client to differentiate between incisional pain in residual limb and phantom limb pain; phantom limb pain is very real to the client.
4. The residual limb may be elevated for a short time postoperatively to decrease edema; the skin flap should be pink and the area should be warm with minimum drainage.
5. A rigid compression dressing (plaster molded over the wound dressing) may be applied to prevent injury and to decrease swelling. Controlling the edema will enhance healing and promote comfort.
6. If the client is not fitted with a rigid compression dressing, the residual limb will be shaped with a compression bandage.
7. Compression wrapping with elastic bandage should be applied in a distal to proximal direction. To protect circulation a figure 8 wrapping should be used with decreasing pressure while wrapping from the distal to the proximal area.
8. For client with above the knee (AKA), or below the knee amputations (BKA), encourage range of motion exercises, especially to the knee and the hip. Discourage prolonged time in semi-Fowler’s position in the client with above-the-knee amputation; this position encourages flexion contraction at the hip.
9. For clients with a AKA, encourage resting in a prone position for 30 minutes every 3-4 hours.

Residual limb care after wound has healed
1. Continually assess for skin breakdown; visually inspect the residual limb daily.
2. The residual limb should be washed, carefully rinsed, and dried daily. Soap and moisture contribute to skin breakdown.
3. Do not apply anything to the residual limb (alcohol increases skin dryness and skin cracking; lotions keep skin soft and hinder prosthetic use).
4. Client should put the prosthesis on when he/she gets up and it should be worn all day. The residual limb tends to become edematous if the prosthesis is not applied. The more the client wears the prosthesis; the less edema will occur.

TEST ALERT: Provide support to client with changes in body image. Maintain correct body alignment of client. Monitor client mobility, gait, and strength.

✔ NURSING PRIORITY: Be familiar with the nursing management of a client with an amputated extremity, especially regarding positioning to prevent contractures.
**Appendix 16-4  ASSISTIVE DEVICES FOR IMMOBILITY**

**Crutches**

**Measuring a Client (Figure 16-6)**

- **Supine** - measure the distance from the client’s axilla to a point 6 inches lateral to the heel.
- **Standing** – measure the distance from the client’s axilla to a point 4 - 6 inches to the side and 4-6 inches in front of the foot.
- Adjust hand bars so that client’s elbows are flexed approximately 30 degrees.
- If client was measured while supine, assist client to stand with crutches. Check the distance between client’s axilla and arm pieces. You should be able to put two of your fingers between client’s axilla and the crutch bar.

**Three-Point Alternate Crutch Gait**

- Most common gait for clients with musculoskeletal injuries.
- The client must be able to bear the total body weight on one foot; the affected foot or leg is either partially or totally non-weight-bearing.
- In this gait both crutches are moved forward together with the affected leg while the weight is being borne by the client’s hands on the crutches. The unaffected leg is then advanced forward.

**Crutch Walking**

- **Up stairs:** Unaffected leg moves up first, followed by the crutches and the affected leg.
- **Down stairs:** While bearing weight on unaffected leg, crutches are moved to lower stair and client transfers weight to crutches and moves affected leg first, body weight is transferred to the crutches, and the unaffected leg is moved down.

**Canes**

- The cane is used on the side opposite the affected leg and the elbow should be flexed no more than 30°.
- The cane and the affected leg move together.
- The top of the cane should be parallel to the greater trochanter of the femur.

**Walkers**

- Lift the walker and place it approximately 12-18 inches in front; make sure all 4 feet of walker are resting on the floor. While resting on walker, step forward with weaker leg first, take alternating small steps toward walker.
- Gain balance before moving walker forward again; balance provides stability and equal weight bearing.