Physiology of the Musculoskeletal and Connective Tissue

Skeletal System
A. Bone structure.
1. Periosteum: dense fibrous membrane covering the bone; periosteal vessels supply bone tissue.
2. Epiphysis: the widened area found at the end of a long bone.
3. Epiphyseal plate (growth zone): a cartilage area in children, which provides for longitudinal growth of the bone.
4. Articular cartilage: provides a smooth surface over the end of the bone to facilitate joint movement.
5. Red bone marrow: hemopoietic tissue located in the central bone cavities.
B. Bone maintenance and healing.
1. Regulatory factors determining both formation and resorption.
   a. Weight-bearing stress stimulates local bone resorption and formation; in states of immobility in which weight bearing is prevented, calcium is lost from the bone.
   b. Vitamin D promotes absorption of calcium from the gastrointestinal tract and accelerates mobilization of calcium from the bone to increase or maintain serum calcium levels.
   c. Parathyroid hormone regulates the concentration of calcium in the serum partially by promoting the transfer of calcium from the bone.
   d. Calcitonin and amino biphosphates (e.g., alendronate [Fosamax], ibandronate [Boniva]) increase the production of bone cells.
2. Bone healing.
   a. When a bone is damaged or injured, a hematoma precedes new tissue formation in the production of new bone substance.
   b. A callus is formed as minerals are deposited to organize a network for the new bone.
   c. The callus forms the initial clinical union of the bone and provides enough stability to prevent movement when bones are gently stressed.
   d. Continued bone healing provides for gradual return of the injured bone to its preinjury shape and structural strength; this is frequently referred to as remodeling of the bone.

Alert: Identify pathophysiology related to an acute or chronic condition (e.g., signs and symptoms).

Connective Tissue: Joints and Cartilage
A. Joints.
1. The action of joints permits bones to change position and facilitate body movement.
2. The diarthrodial (synovial) joint is the most common type of joint in the body.
   a. Cartilage (hyaline) covers the end of the bone.
   b. A fibrous capsule of connective tissue joins the two bones together.
      (1) Synovium (synovial membrane) lines the capsule.
      (2) Synovial fluid is secreted by the synovium and serves to decrease friction by lubricating the joint.
B. Articular cartilage is rigid, connective, avascular tissue that covers the end of each bone; nourished by capillaries in adjacent connective tissue; damaged cartilage heals slowly because of lack of direct blood supply.
C. Ligaments and tendons are tough fibrous connective tissues that provide stability while continuing to permit movement.
   1. Tendons attach muscles to the bone.
   2. Ligaments attach bones to joints.

Skeletal Muscle
A. Lower motor neurons control the activity of the skeletal muscles.
B. Energy is consumed when skeletal muscles contract in response to a stimulus.
   1. Lactic acid, a by-product of muscle metabolism, accumulates if the amount of oxygen available to the cell is not sufficient.
   2. Muscle fatigue results from:
      a. Increased work of the muscle, with inadequate oxygen supply.
      b. Depletion of glycogen and energy stores.
C. Muscle contraction.
   1. Isometric: the length of the muscle remains constant; the force generated by the muscle increases—for
example, when one pushes against an immovable object.
2. Isotonic: shortening of the muscle but with no increase in muscle tension.
3. Normal activity is a combination of both types of muscle contraction.
4. 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:** Know the terms used in referring to movement of joints.

5. Hypertrophy will occur if muscle is exercised repeatedly.
6. Atrophy will occur with muscle disuse.

**System Assessment**

A. History.
   1. History of musculoskeletal injuries, musculoskeletal surgeries, neuromuscular disabilities, inflammatory and metabolic conditions directly or indirectly affecting the musculoskeletal system.
   2. Familial predisposition to orthopedic problems.
   3. Level of normal activity, occupation, exercise, recreation.
   4. Existence of other chronic health problems.

B. Physical assessment.
   1. Initial inspection for gross deformities, asymmetry, and edema.
   2. Nutritional status: appropriateness of client’s weight and body frame; 24-hour diet recall, dietary supplements.
      a. Movement: active and passive; examine active movement first; compare movement and range of motion (ROM) on one side of the body with movement and ROM on the opposite side.
      b. Inflammation and tenderness: with or without movement.
      c. Presence of joint deformities and dislocations.
      d. Palpate joints for crepitus.
   4. Evaluate limb length and circumference if hypertrophy or inconsistency in bone length is evident.
   5. Evaluate client’s spinal alignment, posture, and gait.
   6. Evaluate skeletal muscle.
      a. Muscle strength bilaterally.
      b. Coordination of movement.
      c. Presence of atrophy or hypertrophy.
      d. Presence of involuntary muscle movement.
   7. Assess peripheral pulses and peripheral circulation.
   8. Assess for presence and characteristics of pain.
      a. Specific type of pain and exact location.
      b. Identify precipitating and/or alleviating factors (most musculoskeletal pain is relieved by rest).
      c. Ask about back pain and/or injury.

**Box 21-1  BODY MECHANICS**

The wider the base of support, the greater the stability. Position feet wide apart.
The lower the center of gravity, the greater the stability. Flex the knees; let the strong muscles of the legs do the work. Position close to client.
Face the client; keep back, pelvis, and knees aligned; avoid twisting.
Balance activity between arms and legs.
Avoid bending to lift; this decreases strain on the back.
Encourage client to assist.
Pivoting, turning, rolling, and leverage require less work.
Person with heaviest load should coordinate team efforts.
Obtain assistance or a lift with heavy or difficult transfers or moves.
Teach client proper body mechanics.

**Alert** Use ergonomic principles when providing care (assistive devices, proper lifting).

**Box 21-2  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 musculoskeletal system alter posture and gait.
- Degenerative changes in cartilage and ligaments result in joint stiffness and pain.
- Range of motion of extremities decreases; older adult may need increased assistance with activities of daily living.
- Slowed movement and decreased muscle strength lead to decreased response time.
- Loss of height from disk compression, posture changes, kyphosis.

10. Body mechanics (Box 21-1, Appendix 3-1).
11. Changes in the older adult (Box 21-2).

**Alert** Perform a focused assessment and reassessment for changes in client condition. Recognize signs and symptoms of complications and intervene appropriately.

**DISORDERS OF MUSCULOSKELETAL AND CONNECTIVE TISSUE**

**Congenital Hip Dysplasia**

Congenital hip dysplasia is a malformation of the hip that occurs as a result of imperfect development of the femoral head, the acetabulum, or both. The structures that support the hip joint and hold the joint together are too loose, or the joint cavity is too shallow.
Assessment

A. Risk factors/etiology.
   1. Frequently associated with other congenital deformities.
   2. Prenatal factors.
      a. Maternal hormone secretion.
      b. Intrauterine posture, especially frank breech position.
B. Clinical manifestations (newborn).
   1. Ortolani sign: infant supine, knees flexed, hips fully abducted; a click is heard or felt as the hip is reduced by abduction.
   2. Asymmetrical gluteal and thigh folds.
   3. Shortening of the leg on the affected side; one knee is lower than the other (Galeazzi sign).
C. Diagnostics (see Appendix 21-1).

Treatment

A. Treatment is initiated as soon as condition is identified.
B. For the newborn, the dislocated hip is securely held in a full abduction position. This keeps the femur in the acetabulum and stabilizes the area.
   1. Abduction devices.
      a. Pavlik harness: a fabric strap harness that is secured around the infant’s shoulders and chest and is connected to straps around the lower leg. The harness maintains the legs in a flexed, abducted position at the hip. The harness may be removed for bathing, but the infant will wear it full time until the hip is stable.
      b. Hip spica cast: most often used when adduction contracture is present. After the removal of the cast, a protective abduction brace is fitted.
   2. Closed reduction: performed in older children, 6 to 18 months old.
   3. Open reduction: performed if hip is not reducible with traction or closed reduction.
C. Successful reduction becomes increasingly difficult after the age of 4 years.

Nursing Interventions

Goal: To identify hip dysplasia in the newborn before discharge.

Goal: To assist parents to understand mechanism to maintain reduction.
A. Pavlik brace: teach parents proper application of brace; undershirts should be worn beneath the brace; check skin under brace for irritation or pressure areas; no oils or lotions should be applied to skin that will be under brace.
B. Teach parents cast care if hip spica cast is applied.

Alert: Apply, maintain and or remove orthopedic devices (tractions, braces, splints, casts).

Goal: To facilitate developmental progress.
A. Provide appropriate stimuli and activity for developmental level.

B. Encourage parents to hold and cuddle child.
C. Maintain normal home routine.

Clubfoot (Talipes Equinovarus)

Clubfoot is a deformity of the foot in which adduction, plantar flexion, and inversion of the foot occur in varying degrees of severity. The unilateral form occurs more commonly than the bilateral form.

Assessment

A. Risk factors/etiology (inconclusive).
   1. Intrauterine compression.
   2. Decreased growth of distal tibia.
B. Assessment.
   1. Condition is apparent at birth.
   2. In true clubfoot, there is severe limitation of ROM.
C. Diagnostics: clinical manifestations.

Treatment

Treatment is begun immediately and most often requires three stages for correction.
A. Correction of deformity: casts are applied in series for gradual stretching and straightening; massage accompanied by special bandaging may also be used.
B. Maintenance of correction: orthopedic shoes.
C. Follow-up observations to prevent recurrence of the deformity.

Nursing Interventions

Goal: To assist parents to understand mechanism of treatment to achieve correction.
A. Appropriate care of cast or brace at home.
B. Follow-up care and importance of frequent cast changes.

Goal: To facilitate developmental progress and adapt nurturing activities to meet infant’s and parents’ needs (same as for congenital hip dysplasia).

Herniated Lumbar 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 pulposus) herniates inward toward the spinal column, causing compression or tension on the spinal nerve root. The problem most often occurs in the lumbar-sacral area.

Assessment

A. Risk factors/etiology.
   1. Degenerative disk disease.
   2. Obesity.
   3. Injury or stress to the lower back.
B. Clinical manifestations (lumbar disk).
   1. Low back pain, commonly radiating down one buttock and posterior thigh.
2. Coughing, straining, sneezing, bending, twisting, and lifting exacerbate the pain.
3. Lying supine and raising the leg in an extended position will precipitate the pain.
C. Diagnostics (see Appendix 21-1).

**Treatment**

A. Conservative.
   1. Analgesics, muscle relaxants.
   2. Weight reduction, if appropriate.
   3. Ice may be used for first 48 hours after injury; then moist heat is a better analgesic.
   4. Activity modification, good body mechanics, back brace.
   5. Ultrasound therapy and massage.
B. Surgical.
   1. Laminectomy: removal of the herniated portion of the disk.
   2. Microlaminectomy (diskectomy): removal of the herniated disk with use of a microscope (less trauma in the disk area, improved hemostasis, minimal nerve root involvement).
C. Alternative: acupressure or acupuncture.

**Nursing Interventions**

**Goal:** To relieve pain by means of conservative measures and prevent recurrence of problem.
A. Decrease muscle spasm/pain with analgesics, muscle relaxants, decreased activity, and cold or heat applications.
B. Begin ambulation slowly and avoid having client bend, stoop, twist, sit, or lift.
C. Instruct the client and family regarding the principles of appropriate body mechanics.
D. The client will need a firm mattress; sleeping in the prone position, especially with a pillow, should be avoided.
E. Instruct the client and family regarding lower back exercises.
F. Encourage correct posture; instruct client to avoid prolonged standing.
G. Client should sit in straight-backed chairs.
H. Semireclining position with forward flexion of lumbar spine (recliner) may be position of comfort.

**Goal:** To prepare client for laminectomy.
A. Perform preoperative nursing interventions, including education as appropriate.
B. Have client practice logrolling.
C. Have client practice voiding from supine position.
D. Discuss with client postoperative pain and anticipated methods to decrease pain.
E. Evaluate bowel and bladder function.
F. Identify specific characteristics of pain to be included in database for comparison with pain after surgery.
G. Establish a baseline neurologic assessment for postoperative reference.

**Goal:** To maintain spinal alignment after laminectomy.
A. Keep the bed in flat position.
B. Logroll client when turning.
C. Keep pillows between the legs when client is positioned on the side.
D. The client who has had microdisk surgery will have fewer limitations on mobility. Often, the client may assume a position of comfort.
E. Assist with application of back brace if ordered.

**Goal:** To maintain homeostasis and assess for complications after laminectomy.
A. Evaluate incision area for possible leakage of spinal fluid and bleeding – notify health care provider of clear fluid leaking from incisional area.
B. Analgesics may be given via a patient-controlled analgesia pump or epidural catheter.
C. Assess pain and determine whether there is any pain radiation.

**ALERT** Assess client’s need for pain management and intervene as needed using non-pharmacologic comfort measures. Use pharmacological pain measures for pain management as needed.

D. Perform neurovascular checks of extremities.
E. Normal bladder function returns in 24 to 48 hours; assess current status of voiding.

**NURSING PRIORITY** The client who has undergone laminectomy frequently experiences difficulty voiding; this may be due to edema in the area of surgery that interferes with normal bladder sensation.

F. Ambulate as soon as indicated (frequently on first postoperative day if no fusion was done).
G. If fusion was performed, may need to apply body brace before ambulation.
H. The client who has undergone microlaminectomy experiences less pain, is frequently out of bed on the day of surgery, and has fewer complications.
I. Paralytic ileus and constipation are common complications; assess for decreased bowel sounds and abdominal distention.

**ALERT** Identify factors that interfere with elimination.

**Scoliosis**

Scoliosis is a lateral curvature of the spine. If it is allowed to progress without treatment, it will severely affect the shape of the thoracic cavity and impair ventilation.
A. Idiopathic (predominant type) occurs primarily in adolescent girls.
B. Most noticeable at beginning of growth spurt, around 10 years of age.

**Assessment**

A. Clinical manifestations.
   1. Uneven hips and shoulders.
   2. Visible curvature of the spinal column; head and hips are not in alignment.
3. When child bends forward from the waist, there is visible asymmetry of the shoulders. The ribs and shoulder are more prominent on one side.
4. Waist line is uneven; one hip is more prominent.

B. Diagnostics.
1. Clinical manifestations.
2. X-ray film.

Treatment
A. Observation and monitoring for curvature less than 25 degrees.
B. Brace if curvature shows progression (used for curvatures of 25 to 40 degrees).
1. Milwaukee brace for high thoracic curvatures.
2. Boston brace (underarm orthosis) for thoracic-lumbar curves.
C. Surgery (used for curvatures of more than 40 degrees): spinal fusion and placement of a rod to prevent destruction 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 school to identify condition.

ALERT: Perform targeted screening (scoliosis, vision and hearing).

B. Assist client and parents to properly use braces.
   1. Make sure 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.

Goal: To support normal growth and development and assist the child to develop a positive self-image.
A. Continue to encourage peer socialization.
B. Encourage independence.
C. Encourage child to participate in and be independent in scheduling of activities and other aspects of care.
D. Emphasize positive long-term outcome.

Goal: To maintain spinal alignment after surgical correction (see Care of Client After Laminectomy and Fusion).

Goal: To maintain homeostasis and assess for complications after surgical correction (see Care of Client After Laminectomy and Fusion).

Fractures
A. A fracture is a disruption or break in the continuity of the bone, which occurs most often as the result of a traumatic injury.

B. Characteristics of bones in children affecting fractures and fracture healing.
1. Presence of epiphyseal plate; if the epiphyseal plate is damaged in the fracture, this may affect the growth of the long bone.
2. Periosteum is thicker and stronger and has an increased blood supply; therefore healing is more rapid.
3. Bones are more porous and allow for greater flexibility.

C. Pathologic fractures occur as a result of a disease process.
D. Classification of fractures (Figure 21-1).

1. Type.
   a. Complete: fracture line extends through the entire bone; the periosteum is disrupted on both sides of the bone.
   b. Incomplete: fracture line extends only partially through the bone (greenstick, hairline-type fractures).
   c. Comminuted: fracture with multiple bone fragments; more common in adults.
   d. Greenstick: an incomplete fracture with bending and splintering of the bone; more common in children.
   e. Impacted: complete fracture in which bone fragments are driven into each other.

2. Classified according to location on the bone: proximal, middle, or distal.
   a. Stable: a portion of the periosteum usually remains intact; frequently transverse, spiral, or greenstick fractures.
   b. Unstable: bones are displaced at the time of injury, with poor approximation; frequently comminuted or impacted.
4. Simple, closed fracture: does not produce a break in the skin.
5. Complex, open, or compound fracture: involves an open wound through which the bone has protruded.

**NURSING PRIORITY** Age, displacement of the fracture, the site of the fracture, nutritional level, medications, and blood supply to the area of injury are factors influencing time required for fracture healing to become complete. Be familiar with the terms used to describe fractures.

**Assessment**
A. Risk factors/etiology.
   1. Pathologic fracture.
      a. Osteoporosis.
      b. Tumors (multiple myeloma, osteogenic sarcoma).
      c. Metabolic diseases (e.g., thyroid disorders).
   2. Trauma.
B. Clinical manifestations.
   1. Edema, swelling of soft tissue around the injured site.
   2. Pain; immediate, severe.
   3. Abnormal positioning of extremity; deformity.
   4. Loss of normal function.
   5. False movement: movement occurs at the fracture site; bone should not move except at joints.
   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.
C. Diagnostics (see Appendix 21-1).

**Treatment**
A. Immediate immobilization of suspected fracture area.
B. Fracture reduction.
   1. Closed reduction: nonsurgical, manual realignment of the bones; then injured extremity is usually placed in a cast for continued immobilization until healing occurs.
   2. Open reduction and internal fixation (ORIF): surgical correction of alignment.
C. Traction (Figure 21-2).
   1. Purposes.
      a. Immobilization of fractures until surgical correction is done; immobilization or alignment of fracture until sufficient healing occurs to permit casting.
      b. Decrease, prevent, or correct bone or joint deformities associated with muscle diseases and bone injury.
      c. Prevent or reduce muscle spasm.

![Figure 21-2](Image)  

   2. Types.
      a. Skeletal: wire or metal pin is inserted into or through the bone.
      b. Skin: force of pull is applied directly to the skin and indirectly to the bone.
D. Cast application to maintain immobility of affected area.
   1. Cast applied to immobilize joints above and below the injured area.
   2. Short or long arm or leg cast.
E. Fixation devices.
   1. External fixation: application of a rigid external device consisting of pins placed through the bone and held in place by a metal frame; requires meticulous care of pin insertion sites (Figure 21-3).
   2. Internal fixation: done through an open incision; hardware (pins, plates, rods, screws) is placed in the bone.
   3. Both methods may be used to treat a fracture.

**Complications**
A. Improper healing: delayed union, nonunion, or angulation (bone heals at a distorted angle).
B. Infection: especially in injuries resulting in an open fracture and soft tissue injury.
C. Decreased neurovascular status resulting from pressure of cast and edema formation.
   1. Decreased pulses distal to injury.
   2. Pain unrelieved by analgesics.
   3. Edema, pallor.
   4. Decreased sensory and motor function.

D. Compartment syndrome: muscle, nerves, and vessels are restricted within a confined space (myofascial compartment) within an extremity (Figure 21-4).
   1. Etiology.
      a. Decreased compartment size from cast, splints, tight bandages, tight surgical closure.
      b. Increase in compartment contents caused by hemorrhage and/or edema.
   2. Clinical manifestations of compartment syndrome.
      a. Muscle ischemia occurs as a result of compression of structures in the compartment.
      b. Arterial compression may not occur; pulses may still be present.

**ALERT** Manage a client with alteration in hemodynamics, tissue perfusion and hemostasis (cerebral, cardiac, peripheral). Recognize signs and symptoms of complications.

   c. May cause permanent damage if not relieved immediately.
   d. Clients complain of excessive pain unrelieved by analgesics.
   e. Occurrence of complication may be decreased by elevation of the extremity and application of ice packs after initial injury.
   f. 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.

   g. Volkmann’s ischemic contracture: compartment syndrome in the arms that compromises circulation; occurs most often as a result of short arm cast used to immobilize a fracture of the humerus.
   h. Can result in permanent damage in a short time (6-8 hours).
      i. Paresthesia is frequently the first sign; pulselessness is a late sign.

E. Venous stasis and thrombus formation are related to immobility.

F. Fat embolism.
   1. Associated with fractures or surgery of long bones (especially the femur); primarily occurs in adults.
   2. Clinical manifestations generally occur within 12 to 48 hours of injury.
   3. Fat embolism produces symptoms of acute respiratory distress and hypoxia.

G. Blisters may be associated with twisting-type fractures or compartmental syndrome.

**Nursing Interventions**

**Goal:** To immobilize a fractured extremity and to provide emergency care before transporting victim.

A. Evaluate circulation distal to injury.

**NURSING PRIORITY:** Identify orthopedic situations that can cause compromised circulation and neurologic damage; intervene and obtain assistance.

B. If pulses are not present or if the extremity must be realigned to apply splint for transfer, apply just enough traction to support and immobilize the fractured extremity in a position of proper alignment. Once the traction...
is initiated, do not release it until the extremity has been properly splinted.
C. Splint and immobilize extremity before transfer.

**NURSING PRIORITY** Do not apply traction to compound fractures; traction may cause more damage to tissue and vessels.

D. Elevate the affected extremity, if possible, to decrease edema.

**Goal:** To identify complications early, perform frequent peripheral nerve and vascular assessments distal to the area of injury or cast.

A. Impaired blood flow.
1. Pulselessness; skin pale and cool to touch.
2. Pain, swelling, edema distal to injury or cast.
3. Capillary refill greater than 3 seconds.

B. Nerve damage from excessive pressure.
1. Paresthesia, numbness distal to injury or cast.
2. Motor paralysis of previously functioning muscles.
3. Feeling of deep pain and pressure.

C. Infection: may occur within the cast.
1. Unpleasant odor, drainage (foul, purulent).
2. Generalized body temperature elevation.
3. Increased warmth over cast, “hot spot.”

**ALERT** Monitor wound for signs and symptoms of infection; identify adverse response to therapy.

D. Compartment syndrome.
1. Significant increase in pain, not responsive to analgesics.
2. Loss of movement and sensation distal to cast.
3. Skin is pale, cool to touch.
4. Edema distal to injury or cast.
5. Pulses may be present initially.

E. Notify physician immediately if any complications of compartment syndrome or compromised circulation are present.

**ALERT** Manage care for a client with alteration in tissue perfusion (peripheral circulation). Recognize signs and symptoms of complications and intervene appropriately.

**Goal:** To maintain immobilization by means of a cast.

A. Plaster cast: allow cast to dry adequately before moving the client or handling the cast.
1. Encourage drying of cast by using fans and maintaining adequate circulation.
2. Avoid handling wet cast to prevent indentations in the cast, which may precipitate pressure areas inside the cast; support cast on pillows.
3. Reposition client every 2 hours to increase drying on all cast surfaces.
4. “Petaling” a cast is done to cover the rough edges and prevent crumbling of a plaster cast; edges are covered with small strips of waterproof adhesive.

B. Synthetic casts (fiberglass, polyester cotton knit) are lighter and require a minimal amount of drying time.
1. Frequently used for upper body cast.
2. Preferable for infants and children.
3. Cast does not crumble around the edges and does not soil as easily.
4. Cast dries rapidly if it gets damp, and it does not disintegrate in water; some synthetic casts can be immersed for bathing.

C. Continue to assess for compromised circulation and compartment syndrome.

D. Body jacket cast and hip spica cast.
1. Evaluate for abdominal discomfort caused by cast compression of mesenteric artery against duodenum.
2. Relief of abdominal pressure can be achieved by means of nasogastric tube and suction or cast removal and reapplication.
3. Evaluate for pressure areas over iliac crest.

E. Elevate casted extremity, especially during the first 24 hours after application.

F. Apply ice packs over the area of injury (keeping cast dry) during the first 24 hours.

G. Encourage movement and exercise of unaffected joints.

**Goal:** To maintain immobilization via traction (see Figure 21-2).

A. Assume that traction is continuous unless the doctor orders otherwise.

B. Carefully assess for skin breakdown, especially under the client.

C. Do not change or remove traction weight 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 countertraction to be effective.
1. Do not let the client’s feet touch the end of the bed; this will cause the countertraction to be lost.
2. Do not allow the traction weights to rest on anything at the end of the bed; this negates the pull of the traction.

F. Carefully assess the pin sites in clients with skeletal traction. Osteomyelitis is a serious complication of skeletal traction.

**ALERT** Recognize client with a condition that increases risk for insufficient vascular perfusion; monitor effective functioning of therapeutic device; prevent complications of immobility. The majority of clients with fractures will experience some level of immobility.

**PRIORITY** Teach client: DO NOT get plaster cast wet, remove any type of padding, insert any objects inside cast, bear weight on new cast for 48 hours (if weight-bearing type), or cover cast with plastic for long periods of time.
Goal: To prevent complications of immobility (see Chapter 3).
Goal: To prevent complications from external or internal fixation.
A. Inspect exposed skin and pin sites for infection.
B. Cleanse around pin sites.
C. Perform wound care on incisional area or area of trauma.
D. Observe carefully for development of an infection.
E. Evaluate for circulatory and neurosensory impairment.

Home Care
A. Teach client what not to do.
1. Do not bear weight on the affected extremity until instructed to do so.
2. Do not allow the cast to get wet (discuss alternatives to tub baths).
3. Do not insert any objects into the cast or remove any padding.
4. Do not move or manipulate pins on an external fixator device.
B. Client should report symptoms associated with swelling or an increase in pain, especially pain unrelieved by analgesics.
C. Assess pin sites for evidence of infection.

Specific Fractures
A. Colles’ fracture.
1. Fracture of the distal radius.
2. Primary complication is compartment syndrome.
B. Fractured pelvis.
1. Frequently occurs in older adults and is associated with falls.
2. May cause serious intra-abdominal injuries (hemorrhage) and urinary tract injury.
3. Bed rest is prescribed for clients with stable fractures.
4. Combination of traction, casting, and surgical intervention may be used for the client with a complex fracture.
5. Turn client only on specific orders.
C. Fractured hip: may be repaired by fixed or sliding nail plates, replacement prostheses, or hip joint replacement.
1. Common in women older than 65 years because of loss of postural stability and loss of bone mass.
2. Types of fractures.
   a. Intracapsular fracture (femoral neck): more difficult to heal; associated with osteoporosis; more likely to be associated with avascular necrosis due to interruption of blood supply.
   b. Extracapsular fracture: occurs outside joint capsule; usually caused by severe direct trauma or a fall.
3. 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.

4. Treatment.
   a. Initially, Buck’s traction to immobilize fracture and decrease muscle spasms (see Figure 21-2).
   b. Surgical repair as soon as client’s condition allows (permits earlier mobility and prevents complications of immobility).
5. Nursing interventions after surgery (Box 21-3).
   a. Circulatory and neurologic checks (Box 21-3).
   b. Position to prevent flexion, adduction, and internal rotation, which cause dislocation of the prosthesis.

**ALERT:** Position client to prevent complications.

(1) Do not adduct the affected leg past the neutral position.
(2) Maintain the affected leg in an abducted position with an A-frame pillow or pillows between the legs.
(3) Avoid flexion of the hip of more than 90 degrees.
(4) Prevent internal or external rotation by using sandbags, pillows, and trochanter rolls at the thigh.
(5) Extreme external rotation accompanied by severe pain is indicative of hip prosthesis displacement.

C. Check physician’s order regarding positioning and turning.
D. Evaluate blood loss.
(1) Check under the operative site for hemorrhage.
(2) Measure the diameter of both thighs to evaluate the presence of internal bleeding in the affected extremity.

**NURSING PRIORITY:** The client is especially prone to complications of immobility (thromboembolism following hip fracture); use nursing interventions to minimize complications.

**Box 21-3 OLDER ADULT CARE FOCUS**

**Musculoskeletal Nursing Implications**

- Older adults have difficulty maintaining immobility after fractures; therefore fractures are frequently repaired with surgical intervention (ORIF).
- Older adults heal more slowly, so use of 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 in older adults.
- Encourage older adults to use assistive devices such as canes and walkers.
D. Total hip replacement.
1. Hip replacement may be done because of a pathologic fracture or a disease process such as arthritis.
2. Preoperative care.
   a. Encourage client to practice using either crutches or a walker, whichever is anticipated to be used after surgery.
   b. Encourage client to practice moving from bed to a chair in the manner that will be necessary after surgery.
   c. Help the client begin practicing the postoperative exercises so that he or she will understand and be able to do them correctly after surgery.
   d. Client should discontinue use of NSAIDs and/or aspirin about a week before surgery.
3. Postoperative care.
   a. Position supine with head slightly elevated, maintain abduction of affected leg.
   b. Quadriceps exercises.
   c. Neurologic and circulation checks.
   d. Client is mobilized on first or second postoperative day to prevent complications of immobility; may use antiembolism stockings and/or sequential compression pumps on lower extremity to prevent venous stasis.
   e. Low-molecular-weight heparin (see Appendix 16-3) may be given to prevent thrombophlebitis.
   f. Keep client’s heels off the bed to prevent skin breakdown.
   g. Legs should not be crossed.
   h. Observe for signs of possible hip dislocation.
      (1) Increased hip pain.
      (2) Shortening of affected leg.
      (3) External leg rotation.
      (4) If these symptoms are observed, contact the surgeon immediately.
E. Femoral shaft fracture.
2. Treatment.
   a. Immobility is achieved by means of a spica cast in older children.
   b. 90°-90° traction (see Figure 21-2): balanced skeletal traction for fractured femur.
   c. Older child and adult.
      (1) Internal fixation (adults).
      (2) Balanced skeletal traction for 8 to 12 weeks.
      (3) Immobilization by application of a hip spica cast alone or after balanced skeletal traction.
F. Rib fractures.
1. Usually heal in 3 to 6 weeks with no residual impairment.
2. Painful respirations cause client’s breathing to be more shallow and coughing to be restrained; this precipitates buildup of secretions and decreased ventilation, leading to atelectasis.
3. Chest taping or strapping is not usually done because it decreases thoracic excursion.
4. Multiple rib fractures may precipitate the development of a pneumothorax or a tension pneumothorax (see Chapter 15).
G. Mandible fracture.
1. Wiring of jaws (intermaxillary fixation) is treatment.
2. Postoperative problems: airway obstruction and aspiration of vomitus.
3. Wire cutters at bedside in case of emergency (cardiac or respiratory arrest).
   a. Suction client if vomiting.
   b. Cutting wires may complicate problem.
4. Tracheostomy set at bedside.
5. Oral hygiene and use of pad/pencil or picture board to communicate post-op.
6. Discharge teaching: oral care, techniques for handling secretions, diet (problems with constipation and flatus due to low-bulk, high-carbohydrate liquid supplements), how and when to use wire cutters.

**Osteoporosis**

Osteoporosis is a metabolic bone disease that involves an imbalance between new bone formation and bone resorption.

A. Primary osteoporosis is the most common type; occurs most often in women after menopause because low levels of estrogen are associated with an increase in bone resorption.
B. Bone loss occurs predominantly in the vertebral bodies of the spine, the femoral neck in the hip, and the distal radius of the arm. Bone mass declines, leaving the bones brittle and weak.

**Assessment**

A. Risk factors/etiology.
   1. Age/ethnicity: incidence increases in white and Asian women after the age of 50 years.
   2. Estrogen deficit: early menopause, estrogen-blocking medications such as tamoxifen or aromasin.
   3. Low peak bone mass: the maximum amount of bone a person achieves is peak bone mass achieved before age 20.
   4. Alcohol intake, sedentary lifestyle.
   5. Endocrine disorders of the thyroid and parathyroid glands.
   6. Nutritional deficits: insufficient intake of dietary calcium and/or vitamin D.
   7. Cigarette smoking, long-term use of corticosteroids.
B. Clinical manifestations (Figure 21-5).
   1. May be asymptomatic until x-ray films demonstrate skeletal weakening. Bone loss of 25% to 40% must
occur before osteoporosis can be identified on standard x-ray films.

2. Spinal deformity and “dowager’s hump.”
   a. Results from repeated pathologic, spinal vertebral fractures.
   b. Gradual loss of height.
   c. Increase in spinal curvature (kyphosis).

3. Spinal 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, decrease in abdominal capacity, and decrease in exercise tolerance.

6. Hip fractures and vertebral collapse are the most debilitating problems.

C. Diagnostics (see Appendix 21-1).

1. Serum laboratory values of calcium, vitamin D, phosphorus, and alkaline phosphatase may be normal or low.

2. Computed tomography or bone density scan (DEXA) can be performed to evaluate bone loss.
   a. Bone mineral density (BMD): 2.5 standard deviations below mean of young adults is classified as osteoporosis.
   b. Osteopenia: T-score = 1.0 to 2.5, but not at level of osteoporosis.

Treatment

A. Dietary: increased intake of protein, calcium, and vitamin D.

B. Medications.

1. Calcium supplements: daily intake of calcium should be approximately 1000 mg for men and 1500 mg for postmenopausal women.

2. Vitamin D supplements to enhance utilization of calcium; spending 20 minutes daily in the sun will provide adequate vitamin D.

3. Medications to facilitate increased bone density (see Appendix 21-2).

C. Exercise: activities that put moderate stress on bones by working them against gravity (walking, racquet sports, jogging).

1. Swimming and yoga may not be as beneficial because of decreased stress on bone mass.

2. Walking for 30 minutes 3–5 times a week is most effective exercise in preventing osteoporosis.

3. Weight bearing exercise decreases the development of osteoporosis and possibly increases new bone formation.

D. Compression fractures of the vertebrae usually heal without surgical intervention.

Complications

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

Nursing Interventions

Goal: To decrease pain and promote activities to diminish progression of disease.

A. Pain relief.

1. Bed rest initially, firm mattress.

2. Narcotic analgesics initially, followed by nonsteroidal antiinflammatory drugs (NSAIDs).

B. Assess bowel and bladder function; client will be prone to constipation and paralytic ileus if vertebrae are involved.

C. Regular daily exercise; encourage outdoor exercises (increases utilization of vitamin D).

D. Increased calcium intake and estrogen therapy.

Home Care

A. Decrease falls and injury by maintaining safe home environment (Box 21-4).

Box 21-4 OLDER ADULT CARE FOCUS

Protecting Joints

• If pain lasts longer than 1 hour after exercise, change the exercises that involve that joint.

• Plan activity and work that conserve energy; do important tasks first.

• Alternate activities; do not do 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 largest 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 should carry purses on their shoulders rather than in their hands.

• Painful, acutely swollen inflamed joints should not be exercised beyond basic range of motion.

• Regular exercise can be done even when joints are slightly painful and stiff; swimming and bike riding maintain mobility without weight-bearing.

• Expect changes in mental status after surgery.

• There may be a role change in the family due to the client’s decreased mobility.
B. The client should understand the need to continue taking medications, even if they do not make the client feel better. It is important for the client to understand that the calcium and vitamin D supplements are necessary to prevent further bone loss.

C. Do not exercise if pain occurs.

D. Avoid heavy lifting, stooping, and bending. Review and demonstrate good body mechanics with the client.

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**Osteomyelitis**

Osteomyelitis is an infection of the bone, bone marrow, and surrounding soft tissue.

A. The most common causative organism is *Staphylococcus aureus.*

B. Inflammatory response occurs initially, with increased vascularization and edema.

C. Even though the healing process occurs, the dead bone tissue frequently forms a sequestrum, which continues to retain viable bacteria; this tissue may produce recurrent abscesses for years.

D. Classified according to acute or chronic status.

1. Acute: sudden onset; may heal in 2 to 3 weeks or progress to chronic status.
2. Chronic: a continuous, persistent problem or exacerbation of previous problem.

**Assessment**

A. Risk factors/etiology.

1. Indirect entry of organism: hematogenous.
   - b. Injury and infection of adjacent soft tissue in distal femur, proximal tibia, humerus, and radius.

2. Direct injury: can occur at any age.
   - a. Trauma.
   - b. Surgical procedures.

B. Clinical manifestations.

1. Acute.
   - a. Tenderness, swelling, and warmth in affected area.
   - b. Drainage from infected site.
   - c. Systemic symptoms: fever, chills, nausea, night sweats.
   - d. Constant pain in affected area; worsens with activity.
   - e. Circulatory impairment.

2. Chronic (present longer than 1 month; failed to respond to initial course of antibiotic therapy).
   - a. Drainage from wound or sinus tract.
   - b. Recurrent episodes of bone pain.
   - c. Diminished systemic signs: low-grade fever; local signs of infection more common.
   - d. Remission and exacerbation of problem.

C. Diagnostics (see Appendix 21-1).

1. Wound and/or blood culture.

**Treatment**

A. Intensive intravenous (IV) antibiotics; oral antibiotic therapy for 6 to 8 weeks.

B. Immobilization of affected area.

C. Surgical debridement may be necessary.

D. Hyperbaric oxygen therapy to stimulate circulation and healing.

**Nursing Interventions**

**Goal:** To decrease pain, promote comfort, and decrease spread of infection.

A. Administer IV piggyback antibiotics; frequently assess status of IV site.

B. Maintain correct body alignment.

1. Move affected extremity gently and with support.
2. Prevent contractures, especially of affected extremity.

C. If there is an open wound, maintain wound (contact) precautions (see Chapter 6).

D. Client is usually discharged with prescription for antibiotics and should keep all follow-up care appointments.

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**Osteogenic Sarcoma**

A. Osteogenic sarcoma (osteosarcoma) is the most common primary bone cancer; it advances very rapidly with metastasis to the lungs via the blood (see Chapter 8).

B. Most commonly affects the long bones, often the distal end of the femur, proximal tibia, or proximal humerus.

**Assessment**

A. Risk factors/etiology.

1. Peak incidence between 10 and 25 years of age.

2. Increased incidence in males during adolescence.

B. Clinical manifestations.

1. Localized pain, swelling at site of tumor usually around knee.

2. Client may limp and be unable to function at full capacity.

C. Diagnostics (see Appendix 21-1).

1. Computed tomography scan to determine the extent of the lesion.

2. Radioisotope scans to evaluate for metastasis.

3. Lung evaluation to determine whether metastatic sites are present.

4. Results of serum laboratory studies are inconclusive; client usually has an increase in the serum alkaline phosphatase level.

5. X-ray film will reveal the tumor location and assist in determining an appropriate biopsy site.

**Treatment**

A. Amputation of extremity and/or extensive surgical resection of bone and surrounding tissue. Limb salvage procedure more often done, if there is a clear margin around tumor site.

B. Chemotherapy; radiation therapy.
Nursing Interventions

Goal: To maintain homeostasis and prevent complications after surgery.
A. An extensive pressure dressing with wound drains/suction may be applied.
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 21-3).
Goal: To assist the client/child and family to cope with the diagnosis and build basis for rehabilitation.
A. Provide honest, straightforward information to child/parent regarding the situation.
B. Allow the family and client an opportunity to express their concerns and fears; surgery is extensive and may affect body image (see Chapter 9).
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 child and the family to cope with the side effects of chemotherapy and radiation (see Chapter 8).

Amputations

Removal of part of an extremity at various anatomic locations.

Assessment
A. Indications for amputation.
   1. Peripheral vascular disease, especially vascular disease of lower extremities.
   2. Severe trauma, congenital disorders.
   3. Acute or widespread infections (e.g., gas gangrene).
B. Diagnostic tests: dependent on underlying problem.

Nursing Interventions

Goal: To prevent further loss of circulation to the extremity, promote psychologic stability, promote comfort, promote optimum level of mobility.
A. Monitor circulation before surgery.
B. Provide preoperative care regarding upper extremity exercises to promote arm strength for postoperative activities of crutch walking and gait training.

Goal: To manage pain control and residual limb wound care postoperatively.
A. Residual limb may be elevated immediate post-op; after that time, clients should avoid sitting in a chair for more than 1 hour with hips flexed or having pillow under the residual limb to prevent flexion contractions. Flexion contracture hinders use of prosthesis.
B. Client should lie on their abdomen for 30 minutes 3 to 4 times/day and position the hip in extension while prone.
C. Discuss the phenomenon of phantom limb sensation.
D. Administer analgesics; phantom limb pain is very real to the client.
E. Evaluate residual limb for bleeding and healing.
F. A rigid compression dressing (plaster molded over dressing) may be applied to prevent injury and to decrease swelling. Controlling the edema will enhance healing and promote comfort. Changes of the rigid dressing are necessary; as the residual limb heals, it also shrinks. The compression dressing may be changed three or four times before a permanent prosthesis is fitted. The compression dressing may be formed so that it can attach to a prosthesis.
G. If the client is not fitted with a rigid compression dressing, the residual limb will be shaped with a compression bandage. Ace bandage elastic wrapping is often used for compression of this type. It should be worn at all times except during physical therapy and bathing.
Goal: To assist the client to understand measures for residual limb care after the wound has healed.
A. Continually assess for skin breakdown; visually inspect the residual limb for redness, abrasions, or blistering.
B. The residual limb should be washed daily, carefully rinsed, and dried; residual soap and moisture contribute to skin breakdown.
C. Do not apply anything to the residual limb (alcohol increases skin dryness and cracking; lotions keep skin soft and hinder use of prosthesis).

Home Care
A. Client should put the prosthesis on when he or she gets up and should wear it all day. The residual limb tends to swell if the prosthesis is not applied. The more the client wears the prosthesis; the less swelling will be experienced.
B. Using a lower limb prosthesis requires 40% to 60% more energy for walking.
C. Referral to community health nurse for instruction ambulation, transfer techniques, prone positioning, and proper residual limb care.

Rheumatoid Arthritis

Rheumatoid arthritis is a chronic, systemic autoimmune disease that affects all areas of the body; inflammatory responses occur in all connective tissue. Early symptoms include inflammation of the synovial joints.
A. Joint involvement progresses in stages; if disease is diagnosed early, permanent joint deterioration may be prevented.
   1. The synovium becomes thickened and inflamed, and fluid accumulates in the joint space; this causes a pannus to form.
   2. The pannus tissue erodes the cartilage and destroys the joint.
B. Exacerbations and remissions occur; condition tends to be progressive with each exacerbation.
C. Condition is a problem of the connective tissue; inflammatory response may occur in organs throughout the body (heart, lungs, blood vessels, muscles).

Assessment
A. Risk factors/etiology.
   1. Gender: significantly increased incidence in women.
   2. May occur at any age including childhood; peak incidence occurs between 20 and 45 years of age.
B. Clinical manifestations.
   1. Symmetrical joint involvement (hands and feet).
      a. Warm, tender, red, painful joints; primarily affects small joints, wrists, elbows, shoulders.
      b. Decrease in ROM.
      c. Decrease in strength.
      d. Stiffness and pain are worse in the morning and decrease during the day with moderate activity.
   2. Subcutaneous nodules over bony prominences.
      a. Nodules are painless; frequently occur on the elbows.
      b. May be present for weeks to months.
   3. Systemic effects.
      a. Vasculitis.
      b. Pulmonary fibrosis.
      c. Pericarditis.
      d. Sjögren’s syndrome (dry eyes, etc.).
   4. Chronic deformities develop, most often in the hands.
   5. Exacerbation of symptoms may be associated with physical or emotional stress.
C. Diagnostics (see Appendix 21-1).

Treatment
A. Disease-modifying antirheumatic drugs (DMARDs) (see Appendix 21-2).
B. NSAIDs.
   1. Salicylate (aspirin).
   2. Ibuprofen, naproxen.
C. Corticosteroids (see Appendix 6-7).
D. Methotrexate (see Appendix 8-1).
E. Heat and/or cold applications.
F. Assistive devices to preserve joints and prevent deformity.
G. Physical and rehabilitative therapy.
H. Surgery: joint replacements.

Complications
A. Musculoskeletal.
   1. Severe joint deformity, flexion contracture.
   2. Diffuse skeletal demineralization.
B. Systemic involvement.

Nursing Interventions
Goal: To relieve pain and preserve joint mobility and muscle strength (see Box 21-4).
A. Use warm compresses to promote relaxation and to decrease stiffness; use cold compresses to decrease inflammation.
B. If heat increases pain, cold compresses may be beneficial during an acute episode.
C. Acutely inflamed joints should be immobilized in a device that maintains a functional position.
D. Position client to maintain correct body alignment and prevent contractures, especially flexion contractures.

ALERT Assess client for complications of immobility, intervene appropriately when providing care.

E. Immobility can increase the pain; ROM exercises and weight bearing may help decrease pain.
F. Antiinflammatory medications should be taken before activity and with meals or food to decrease gastric upset.
G. If client is taking steroids, he or she should wear a medical identification tag.

Goal: To assist client to prevent joint deformity, preserve joint function, and reduce inflammation and pain.
A. Regularly scheduled rest periods (excessive fatigue is a problem); balance activities with rest.
B. Protect joints (Box 21-4).
   1. Maintain functional joint alignment; avoid positions that precipitate joint contraction (sitting too long with knees bent).
   2. Warm moist or cold compresses to relieve pain and muscle spasms.
   3. Acutely inflamed joints may be splinted; splint should be removed periodically and gentle ROM exercises performed.
   4. Use large muscle groups; avoid repetitive movement of smaller joints.
C. Demonstrate ability to carry out individual exercise program.
D. Identify medications that are effective in relieving pain.
E. Chronic pain may lead to feelings of powerlessness and make the client more susceptible to false advertising regarding claims of cure and relief of chronic pain.
F. Encourage client to be independent in activities of daily living (ADLs) as long as possible.

Home Care
A. Encourage client to ventilate feelings regarding chronic progression of the disease state.
B. Evaluate family support system; help family to identify measures to assist client.
C. Modify home routine to decrease stress on joints: ADLs, dressing, etc.
D. Identify measures to assist client to maintain self-esteem:
   What activities can client continue to participate in?
   Focus on what client can do.
E. Assist client to set realistic goals.
F. Identify available community resources.

ALERT Determine client’s ability to perform self-care; assist family to manage care of client with long-term care needs.

Osteoarthritis (Degenerative Joint Disease)
Osteoarthritis is a progressive, nonsystemic, noninflammatory disease that causes a progressive degeneration of synovial joints of weight-bearing long bones.
A. Primarily associated with aging; may also be caused by musculoskeletal injury or conditions that cause repetitive damage to joints.
B. The cartilage at the ends of the long bones deteriorates and leaves the ends of the bones rubbing together; this produces a painful, swollen joint.

Assessment
A. Etiology/predisposing factors.
   1. Excessive use of a specific joint: knees in athletes, feet in dancers, etc.
   2. The hips are more commonly affected in men; in women, the hands are more commonly affected.
   3. Obesity: joints that carry excess weight are more likely to degenerate earlier.
   4. Frequently observed in older adults.
B. Clinical manifestations.
   1. Joints involved.
      a. Primarily involves weight-bearing joints; occurs as a result of mechanical stress.
      b. May also involve joints in the fingers and the vertebral column.
   2. Symptoms occurring in the joint.
      a. Pain, swelling, tenderness.
      b. Crepitation: a grating sound or feeling with movement.
      c. Instability, stiffness, and immobility.
   3. Pain occurs on motion and with weight bearing.
   4. Pain increases in severity with activity.
   5. Heberden's nodes: bony nodules on the distal finger joints.
C. Diagnostics (see Appendix 21-1).
   1. No specific lab test to confirm; diagnosis is made primarily on the basis of symptoms and history.

Treatment
A. Medications for pain relief: salicylates (aspirin), acetaminophen (TYlenol), NSAIDs (ibuprofen [Motrin]); COX-2 inhibitors (Celebrex).
   1. Intraarticular injection of corticosteroids, methotrexate, disease-modifying antirheumatic drugs, and gold compounds.
B. Activity balanced with adequate rest.
C. Weight reduction, if appropriate.
D. Physical therapy and exercise.
E. Surgical intervention with joint replacement.

Nursing Interventions
Goal: To relieve pain, prevent further stress on the joint, and maintain function.
A. Acutely inflamed joint should be immobilized with splint or brace.
B. Plan ADLs to prevent stress on involved joints and provide adequate rest periods.
C. Heat compresses can be used for relief of pain; cold compresses may be used if joint is inflamed.
D. It is very important to maintain regular exercise program; decrease activity in acutely inflamed, painful joints.

NURSING PRIORITY More than 4000 mg daily of acetaminophen increase client risk for liver damage.

Goal: To help client understand measures to maintain health (see Box 21-4).
A. Identify activities requiring increased stress on involved joints.
B. Maintain regular exercise program (e.g., walking, swimming) to promote muscle strength and joint mobility.
C. Encourage independence in ADLs.
Goal: To maintain psychologic equilibrium and promote positive self-esteem.

Juvenile Idiopathic Arthritis (Juvenile Rheumatoid Arthritis)
Juvenile idiopathic arthritis (JIA) is a new name for chronic childhood arthritis, previously called juvenile rheumatoid arthritis (JRA). It is characterized as a chronic inflammatory problem of connective tissue; it involves the synovial joints.
A. Synovium becomes thick and edematous; granulation tissue turns to scar tissue, and the joint is destroyed.
B. Reason for name change to JIA is due to the minimally applicable reference of “rheumatoid” in childhood arthritis, which is relevant only in a small number of affected children.

Assessment
A. Risk factors/etiology.
   1. Possibly autoimmune in origin.
   2. Peak onset between 1 and 3 years and 8 and 10 years of age.
B. Clinical manifestations.
   1. Morning stiffness.
   2. May have multiple joint involvement, both large and small joints.
   3. Joints may be tender and painful to touch or may be relatively free of pain.
   4. Fever, rash, and development of uveitis (inflammation of the iris and ciliary body of the eye).
C. Diagnostics: diagnosis is made by exclusion of other diseases; presence of antinuclear antibodies.

**Treatment**

A. Medications.
   1. NSAIDs, methotrexate.
   2. Tumor necrosis factor inhibitors.
   3. Corticosteroids in severe cases.
B. Physical therapy.
C. Moist heat is used to reduce stiffness and relieve pain.
D. Exercise, especially water exercises.

**Complications**

Complications include severe hip disease and loss of vision from iridocyclitis.

**Nursing Interventions**

Child is usually cared for at home except during severe exacerbations.

**Goal:** To decrease pain and promote joint mobility.
A. Moist heat to relieve joint stiffness and pain.
B. Therapeutic exercises incorporated into play activities.
C. Maintain good body alignment when child is at rest; prevent flexion contractures of affected joints.
D. Avoid overexercising painful joints.

**Goal:** To help child maintain normal growth and development patterns and to promote self-esteem.
A. Well-balanced diet without excessive weight gain.
B. Schedule regular exercise program appropriate to developmental level.
C. Encourage independence; allow child to participate in planning care.
D. Encourage school attendance and socialization with peers.

**Gout**

Gout is an arthritic condition resulting from a defect in the metabolism of uric acid (hyperuricemia).
A. Uric acid is the end product of purine metabolism.
B. Hyperuricemia may also occur in individuals receiving chemotherapy (secondary gout).

**Assessment**

A. Risk factors/etiology.
   1. Increased incidence in middle-aged men and with diets high in purine-rich food.
   2. Obesity, hypertension, diuretic use, excessive alcohol consumption.
B. Clinical manifestations.
   1. Intense pain and inflammation of one or more small joints, especially those in the large toe.
   2. Characterized by remissions and exacerbations of acute joint pain.
   3. Onset is generally rapid with swollen, inflamed, painful joints.
   4. Presence of tophi or uric acid crystals in the area around the large toe and the outer ear.
   5. Tophi may be present in subcutaneous tissue.
C. Diagnostics: persistent hyperuricemia: level greater than 6 mg/dL.

**Treatment**

A. Medications.
   1. Antigout (see Appendix 21-2).
   2. NSAIDs for pain and also to assist in preventing attacks.
B. Decrease amount of purine in diet (see Chapter 2).

**Complications**

A. Uric acid kidney stones.
B. Secondary osteoarthritis.

**Nursing Interventions**

**Goal:** To prevent acute attack, promote comfort, and maintain joint mobility.
A. Medications should be given early in the attack to decrease the severity of the attack.
B. Protect affected joint: immobilize, no weight bearing.
C. Cold packs may decrease pain.
D. Decreased amount of purine in diet.
E. Encourage high fluid intake to increase excretion of uric acid and to prevent the development of uric acid stones.
F. Assist client to identify activities and aspects of lifestyle that precipitate attacks.
   1. Dietary habits (decrease purine intake).
   2. Decrease alcohol consumption.
**Appendix 21-1  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):** Measures 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.

**Complement:** Essential body protein to measure immune and inflammatory reactions; usually depleted in rheumatoid arthritis.

**Alkaline phosphatase:** Enzyme produced by osteoblasts; elevated levels found in osteoporosis, healing fractures, bone cancer, osteomalacia.

**Aldolase:** Elevated levels in muscular dystrophy.

**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; preferably, procedure is conducted in the operating room with strict asepsis and performed with either local or general anesthesia; frequently used to diagnose structural abnormalities of the knee.

**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 20-1.

**Bone biopsy:** May be performed in client's room or in a treatment room. After satisfactory local anesthesia is achieved, 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:** Radioisotopes 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 20-1.

**Magnetic resonance imaging (MRI):** See Appendix 20-1.
### Appendix 21-2 MEDICATIONS

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<tr>
<th>MEDICATIONS</th>
<th>SIDE EFFECTS</th>
<th>NURSING IMPLICATIONS</th>
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<tr>
<td><strong>Antigout Agents</strong></td>
<td>Decrease the plasma uric acid levels either by inhibiting the synthesis of uric acid or increasing the excretion of uric acid.</td>
<td></td>
</tr>
<tr>
<td>Colchicine: PO</td>
<td>Nausea, vomiting, diarrhea Toxic effects: bone marrow depression</td>
<td>1. Take medication at earliest indication of impending gout attack.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Take medication with food.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Promote high fluid intake to promote uric acid excretion.</td>
</tr>
<tr>
<td></td>
<td></td>
<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 (Zyloprim): PO</td>
<td>Rash, GI distress, fever, headache</td>
<td>1. Administer with food to decrease gastric upset.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Discontinue medication if rash occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Use with caution in clients with renal insufficiency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. May be used to decrease serum uric acid levels in clients receiving chemotheraphy.</td>
</tr>
<tr>
<td>Probenecid (Benemid): 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>
</tbody>
</table>

### Skeletal Muscle Relaxants Relax skeletal muscle by depressing synaptic pathways in the spinal cord.

<table>
<thead>
<tr>
<th>MEDICATIONS</th>
<th>SIDE EFFECTS</th>
<th>NURSING IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methocarbamol (Robaxin): PO, IM, IV</td>
<td>Drowsiness, dizziness, GI upset, rash, blurred vision Drowsiness, dizziness, headache, GI upset, orthostatic hypotension Drowsiness, weakness, fatigue, confusion</td>
<td>1. Used for muscle spasms associated with MS and spinal cord injury.</td>
</tr>
<tr>
<td>Cyclobenzaprine (Flexeril): PO</td>
<td></td>
<td>2. Caution clients to avoid activities that require mental alertness for safety (driving, using power tools, etc.).</td>
</tr>
<tr>
<td>Carisoprodol (Soma): PO</td>
<td></td>
<td>3. Evaluate client for postural hypotension.</td>
</tr>
<tr>
<td>Baclofen (Lioresal): PO</td>
<td></td>
<td>4. Advise client to avoid CNS depressants (e.g., alcohol, opioids, antihistamines).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Administer with meals to decrease GI distress.</td>
</tr>
<tr>
<td>Dantrolene (Dantrium): PO, IV</td>
<td>Hepatotoxicity, muscle weakness, drowsiness</td>
<td>1. Teach clients symptoms of liver dysfunction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Acts directly to relax skeletal muscle.</td>
</tr>
</tbody>
</table>

### Calcium Medications Hormones that enhance bone density by preventing the reabsorption of calcium in bone and kidneys.

<table>
<thead>
<tr>
<th>MEDICATIONS</th>
<th>SIDE EFFECTS</th>
<th>NURSING IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcitonin-salmon (Calciomar, Miacalcin): subQ, IM, nasal spray</td>
<td>GI upset, local inflammation at injection site, flushing</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>Bisphosphonates—alendronate (Fosamax), ibandronate, (Boniva): PO, nasal spray</td>
<td>Esophagitis, GI flushing, rash, musculoskeletal pain, fever, chills, jaw pain</td>
<td>1. Have client swallow tablet whole; it should not be chewed.</td>
</tr>
<tr>
<td></td>
<td></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>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Make sure client has adequate intake of vitamin D.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Used for prevention and treatment of postmenopausal osteoporosis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Client should report any signs or symptoms of gastric reflux or pain.</td>
</tr>
</tbody>
</table>
## MEDICATIONS—cont’d

### Nonsteroidal Antiinflammatory Medications (NSAIDs)
See Appendix 3-3.

### Disease-Modifying Antirheumatic Drugs (DMARDs)
Antimetabolite, antirheumatic, and antimalarial drugs that act to decrease inflammation.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Toxic effects</th>
<th>Nursing Implications</th>
</tr>
</thead>
</table>
| **Methotrexate (Rheumatrex)** | 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)** | 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 take 3 to 6 months. |
| **Leflunomide (Arava)** | 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.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Increased risk for infections, injection site reactions, heart failure, headache, nausea, dizziness</th>
<th>Nursing Implications</th>
</tr>
</thead>
</table>
| **Etanercept (Enbrel): subQ** |                                                                                                   | 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** |                                                                                                   | 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. |
| **Adalimumab (Humira): subQ** |                                                                                                   | 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. |

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 21-3  ASSISTIVE DEVICES FOR IMOBILITY**

**Crutches**

**Measuring a Client (Figure 21-6)**

- Measurement may be taken with client supine or standing.
- 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 to 6 inches to the side and 4 to 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.

**Four-Point Alternate Gait**

- The four-point alternate gait is used by clients who can bear partial weight on both feet—for example, clients with arthritis or cerebral palsy. It is a particularly safe gait, in that there are three points of support on the floor at all times.
- This gait provides a normal walking pattern and makes some use of the muscles of the lower extremities.

**Three-Point Alternate Gait**

- For the three-point alternate gait, 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: Crutches and affected leg move down first, body weight is transferred to the crutches, and the unaffected leg is moved down.

**ALERT**  Assess client’s use of assistive devices; evaluate correct use; assist client to ambulate with an assistive device.

**Canes**

- The cane is used on the side opposite the affected leg.
- The cane and the affected leg move together.

**Walkers**

- Lift the walker and place it approximately 2 feet in front.
- Gain balance before moving walker forward again; balance provides stability and equal weight bearing.
* Removal of part of a body, usually an extremity at various anatomic locations.

**Indications for Amputation**
1. Peripheral vascular disease, especially vascular disease of lower extremities.
2. Severe trauma.
3. Acute chronic infection.

**Nursing Implications**
1. Prevent further loss of circulation to the extremity.
2. Promote psychologic stability.
3. Promote comfort.
4. Promote optimum level of mobility.

**Postoperative Care**

**ALERT** Identify and prevent complications of immobility; use positioning to prevent contractures; provide support for client with unexpected alteration in body image; assist client to ambulate and move with assistive devices; promote wound healing; assist client with use of prosthesis.

**Residual Limb Wound Care**
1. The residual limb may be elevated for approximately 24 to 48 hours; after that time, keep the joint immediately above the residual limb in an extended position. Flexion contracture hinders use of prosthesis.
2. Recognize the difference between phantom limb pain (PLP) and residual limb pain (RLP). Opioid analgesics are not as effective for PLP as for RLP.
3. Phantom limb pain is very real to the client. Handle residual limb carefully when assessing site or changing dressing.
4. Evaluate residual limb for bleeding and healing.
5. A rigid compression dressing may be applied to prevent injury and to decrease swelling. Controlling the edema will enhance healing and promote comfort. Changes of the rigid dressing are necessary; as the residual limb heals, it also shrinks. Jobst air splint, a plastic inflatable device, is used and inflated to 20 mm Hg for 22 of every 24 hours.
6. If the client is not fitted with a rigid compression dressing, the residual limb will be shaped with a compression bandage. Ace bandage elastic wrapping is often used for compression of this type.
7. Discourage a semi-Fowler’s position in the client with above-the-knee amputation; this position encourages flexion contraction at the hip.

**Residual Limb Care after Wound Has Healed**
1. Continually assess for skin breakdown; visually inspect the residual limb for redness, abrasions, or blistering.
2. The residual limb should be washed daily, carefully rinsed, and dried. Soap and moisture contribute to skin breakdown.
3. Do not apply anything to the residual limb (alcohol increases skin dryness and cracking; lotions keep skin soft and hinder use of prosthesis).
4. Client should put the prosthesis on when he or she gets up and should wear it all day. The residual limb tends to swell if the prosthesis is not applied. The more the client wears the prosthesis, the less swelling will be experienced.
Study Questions  Musculoskeletal System

1. After a lumbar laminectomy, a client continues to complain of the same low back pain that he had before surgery. The nurse knows that this finding is caused by what problem?
   1. Failure of the surgeon to remove the client’s herniated disk
   2. Swelling in the operative area that compresses adjacent structures
   3. Twisting of the client’s spine when he turns from side to side
   4. Limitation of movement resulting from spinal fusion

2. The nurse is assessing a client who had a fractured femur repaired with an external fixator device. Which assessment findings would cause the nurse concern regarding the development of compartmental syndrome? Select all that apply.
   ____ 1 Decrease in pulse rate in affected leg
   ____ 2 Paresthesia distal to area of injury
   ____ 3 Toes on affected leg cool to touch and edematous
   ____ 4 Complaints that pins are hurting
   ____ 5 Complaints of leg pain unrelieved by analgesics or repositioning
   ____ 6 Client angry and calling loudly to the nurse every 10 minutes

3. In taking the health history of a client with severe painful osteoarthritis, the nurse would expect the client to report which of the following?
   1. A gradual onset of the disease, with involvement of weight-bearing joints
   2. A sudden onset of the disease, with involvement of all joints
   3. No complaints of morning stiffness
   4. Joint pain that is not affected by exercise

4. A client has a fractured hip and is currently in Buck’s traction before surgery. How is the counterattraction in Buck’s traction achieved?
   1. By applying a 10-pound counterweight at the knee
   2. By placing shock blocks under the head of the bed
   3. By elevating the knee gatch and elevating the head of the bed about 30 degrees
   4. By elevating the foot of the bed frame and allowing the weights to hang freely

5. The postoperative nursing care plan for a client who has had a right leg amputation includes:
   1. Applying ice packs to the residual limb for 72 hours
   2. Having the client lie on his or her abdomen for 30 minutes 3-4 times/day
   3. Wrapping the residual limb with Ace bandages from proximal to distal ends
   4. Managing client’s pain with antiinflammatory medications

6. A client has a long leg plaster cast applied. What nursing actions are implemented while the cast is still wet?
   1. Use only the fingertips when moving the cast.
   2. Keep the client and cast covered with blankets.
   3. Support the cast on plastic-covered pillows.
   4. Place a heat lamp directly over the cast.

7. A client is being treated with Buck’s traction. What are important nursing interventions for this client?
   1. Remove the traction boot every 6 hours to provide skin care.
   2. Check and clean the pin sites at least three times daily.
   3. Check the area around the pin where the traction is applied.
   4. Verify that weights are in the amounts ordered and are hanging freely.

8. For a client with severe painful osteoarthritis, a regimen of heat, massage, and exercise will:
   1. Help relax muscles and relieve pain and stiffness.
   2. Restore range of motion previously lost.
   3. Prevent the inflammatory process.
   4. Help the client cope with pain effectively.

9. A client is confined to bed with a fracture of the left femur. He begins receiving subcutaneous heparin injections. What is the purpose of this medication?
   1. To prevent thrombophlebitis and pulmonary emboli associated with immobility
   2. To promote vascular perfusion by preventing formation of microemboli in the left leg
   3. To prevent venous stasis, which promotes vascular complications associated with immobility
   4. To decrease the incidence of fat emboli associated with long bone fractures

10. What is important assessment information to obtain from a client with a fractured hip?
    1. Circulation and sensation distal to the fracture
    2. Amount of swelling around the fracture site
    3. Degree of bone healing that has occurred
    4. Amount of pain that the fracture and healing are causing

11. What evaluation is important in the preoperative nursing assessment of a client with a severely herniated lumbar disk?
    1. Movement and sensation in the lower extremities
    2. Leg pain that radiates to both lower extremities
    3. Reflexes in the upper extremities
    4. Pupillary reaction to light

Answers and rationales to these questions are in the section at the end of the book titled Chapter Study Questions: Answers and Rationales.