Pediatric Musculoskeletal Disorders

Musculoskeletal System

I. Introduction

The musculoskeletal system is comprised of the bones, joints, muscles, ligaments, and tendons. Th e terms ligaments and tendons often are used interchangeably, but they actually are different structures in the body: ligaments are fi brous tissues that attach bones to other bones, while tendons are fibrous tissues that attach muscles to bones. Because of the magnitude of the system, a number of musculoskeletal problems are seen during childhood. First, because more accidents are seen in the children than in adults, many of those accidents result in broken bones and/or soft tissue injuries. In addition, there are a number of congenital pathologies as well as illnesses of older children that affect musculoskeletal structures.

II. Soft Tissue Injuries
The scope of soft tissue injuries is quite large and includes sprains, strains, dislocations, and contusions.

A. Incidence.

1. Soft tissue injuries are common in the pediatric population, especially in the teenage years.

B. Etiology.

1. Injuries from such events as falls, automobile accidents, and athletic pursuits.
2. Intentional injury (i.e., child abuse) by a parent or guardian may also result in a soft tissue injury.

C. Pathology: there are many types of soft tissue injuries, most commonly:

1. **Sprain:** a twisting of a joint that results in damage to the ligaments and/or blood vessels. The most common site of a sprain is the ankle. Signs and symptoms of inflammation are seen, i.e., edema, pain, heat, and redness, as well as ecchymosis (the escape of blood from blood vessels into subcutaneous tissue [i.e., bruising]).
2. **Strain:** the tearing or pulling of a muscle that also oft en includes damage to the tendon. The most common site of a strain is the back. Signs and symptoms of inflammation as well as ecchymosis are seen.
3. **Dislocations:** the bones of a joint are no longer in correct alignment. In other, more basic terms, the long bone is no longer positioned in the joint socket. Joint dislocations occur most frequently in the shoulder joint. Tendon strains often accompany dislocations. Signs and symptoms of inflammation are seen, and the range of motion of the dislocated joint is markedly affected.
4. **Contusions:** contusions are very serious bruises of a muscle. Signs and symptoms of inflammation are seen.

D. Diagnosis:
1. X-ray—Because it is impossible to determine whether a bone is broken or whether soft tissue damage has occurred, an x-ray should be performed.
2. CT scans, MRIs, ultrasounds, and, in rare cases, bone scans also may be performed.

E. Treatment.
1. **RICE:** i.e., rest, ice, compression, and elevation.
2. Safe dosages of NSAIDS are often prescribed to reduce swelling.
3. Physical therapy, if needed.
4. Surgery may be required, if the injury is severe.

F. Nursing considerations.
1. Injury/Pain/Knowledge Deficit.
a. Assess the injury utilizing the five Ps of extremity injury assessment.

b. If the injury appears severe (i.e., signs and symptoms of inflammation are present) and the child indicates a specific location of the pain, the child should be seen by a primary health-care provider who will be able to order an x-ray and make a definitive diagnosis.
c. If a soft tissue injury is diagnosed, educate the parents and child, if appropriate, regarding RICE and the safe dosage and method of NSAID administration.
d. Refer the child to a physical therapist:

- Educate the parents and child, if appropriate, regarding the need to restrict activities for the prescribed period of time. ii. Educate the parents and child, if appropriate, regarding any prescribed exercises.

III. Fractures
Fractured bones may be simple or open (compound) fractures. Simple fractures are fractures that are enclosed in intact skin, while compound fractures are broken bones that have punctured the skin.

A. Incidence.
1. Commonly seen in children, especially children in the school-age population.

B. Etiology.
1. Accidents and falls related to immature motor skills (e.g., playing on a rollerblade, playing on a playground, and skiing).
2. Motor accidents (e.g., accidents that occur while moving in a car, riding on a bicycle, walking as a pedestrian).
3. Accidents resulting from risk-taking behaviors (e.g., jumping from a high location, falling while climbing a tall tree).

C. Pathophysiology: there are a number of fractures commonly seen in children.
1. Signs and symptoms.

- Signs of inflammation, bruising or pallor, as well as limited range of motion (ROM).
    - A fracture should be suspected if a young child refuses to crawl or walk.

FRACTURE	CHARACTERISTICS		

Greenstick, or Incomplete, Fracture	Named after the kind of break seen when one attempts to break a healthy twig off from a tree. Commonly seen in children because their bones are soft and healthy		
Buckle, or Torus, Fracture	This is a type of incomplete fracture that is characterized by compression of one side of the bone, causing the other side to bulge. Commonly seen in young children because their bones are soft and healthy		
Epiphyseal Fracture	A fracture that affects the child's epiphyseal or growth plate.		
Spiral Fracture	Rarely seen as a result of an accident, spiral fractures are most often seen as a result of child abuse.		

D. Diagnosis.
1. X-ray, CT, MRI, ultrasound, and/or bone scan.

E. Treatment.
1. Casting (i.e., immobilizing the extremity within a rigid device).
a. Types include air casts, fiberglass casts, and plaster of Paris casts.
b. Before a cast is applied, the extremity is covered in a protective, cotton padding.
c. The primary practitioner exerts manual traction to the distal end of the limb and moves the limb into proper alignment before applying the cast (see following information).

2. Traction.
a. Traction usually is employed when the fractured bone cannot be moved into alignment manually.

- In a traction apparatus, a weight is suspended from the fractured limb.

- Th e weight that exerts the traction fatigues the muscles surrounding the bone and pulls the distal end of the bone until it is in direct alignment with the proximal portion of the bone.
- For traction to work, there must be a force or weight that is exerted in the opposite direction from the weight of the traction.
    - The child's body weight usually acts as the counterweight.
    - Additional weights may need to be added if the child is very small.

b. Types of traction

- Manual traction is achieved when an individual pulls on the end of the bone during the casting procedure.
- **Skin traction** (see image below) is achieved when the force is applied to an ace bandage, or other material, that has been placed on the skin surrounding the break.

    - Most common traction used on young children.
    - Not appropriate when the child has sustained an open fracture.
    - Th e most serious complications related to skin tractions are impaired skin integrity and neurovascular damage.
- **Skeletal traction:** instead of the traction being exerted onto the skin, in skeletal traction a pin is inserted through the skin and the bone so that the traction can be applied directly to the bone.

    - Can usually be tolerated for longer periods of time than skin traction.
    - The most serious complication is osteomyelitis, a bone infection.

3. **External fixation devices (EFD):** these devices act in a similar fashion to skeletal traction, but the child is not immobilized (i.e., the bone is maintained in alignment exclusively because of the action of the device). No weight is required. Osteomyelitis is a complication of EFD.

F. Nursing considerations.
1. Injury/Pain/Knowledge Deficit following the initial injury.
a. Assess the injury utilizing the five Ps of extremity injury assessment.
b. If the injury appears severe (i.e., signs and symptoms of inflammation are present) and/or the child indicates a specific location of the pain, the child should be seen by a primary health-care provider who will be able to make a definitive diagnosis.
c. Educate the parents and child, if appropriate, regarding RICE and the safe dosage and method of NSAID administration.
d. Refer the child to a physical therapist:

- Educate the parents and child, if appropriate, regarding the need to restrict activities for the prescribed period of time.
- Educate the parents and child, if appropriate, regarding any prescribed.

2. Pain/Risk for Injury resulting from the treatment method.

a. Assess neurovascular status every 2 hr for the first 48 hr.

- Must be especially vigilant if the patient is a young child because of the child's rapid growth.
    - Th e child's limb can become dangerously constricted during periods of rapid growth.
- Assess the status of the injured limb in relation to that of the uninjured limb, that is:
    - Compare the temperature, capillary refill, pulses, and movement as well as the sensation and edema of the affected extremity distal to the injury with that of the unaffected extremity.
    - If the assessments reflect diminished neurovascular status in the affected extremity, immediately report the finding to the primary health-care provider.

b. Elevate the extremity above the heart, and apply ice to reduce swelling.
c. Monitor for signs of fat embolism and compartment syndrome.

- Common symptoms of fat emboli: shortness of breath and other signs of respiratory distress, change in sensorium, and petechiae.
- Common symptoms of compartment syndrome: a persistent ache deep in the bone and/or a pain level that is markedly higher than expected from the injury.

d. Administer safe dosages of analgesics, as prescribed.

- If moderate to severe pain, narcotics should be administered.
- For mild pain, the administration of NSAIDS is usually appropriate.
- If the child is discharged, educate the parents and child, if appropriate, regarding the safe administration of the analgesics.

e. Provide non-pharmacological pain interventions, as needed.
f. Apply restraints, as ordered.

- Jacket restraints may be needed when young children are on bedrest with casts or traction.
- Communicate to the child that the restraint is not meant as disciplinary action but rather is important in order to get him or her better.

g. If limb is casted:

- Assist the child to reposition every 2 hr.
- If plaster of Paris cast:
    - The cast should be held by the palms of the hands rather than the tips of fingers to minimize the potential for pressure points.

h. If child is in traction:

- Maintain weight alignment per order and maintain countertraction.
    - It is especially important to prevent the weight from swinging and/or the weight becoming attached to the frame of the child's bed when transporting the child to and from radiology, the playroom, and/or any other location.

i. If the child is discharged home, educate the parents and child, if appropriate, regarding all facets of the child's care.

3. Risk for Infection.
a. From pin insertion in skeletal traction or EFD.

- Monitor insertion site carefully for REEDA (redness, edema, ecchymosis, discharge, and approximation).
    - If any signs appear, report immediately.
- Monitor the child's temperature, pulse, and respiratory rate for elevations.
- Monitor the child's laboratory results for an increase in the white blood cell (WBC) count.
- Administer safe dosages of antibiotics, if prescribed.

b. From casting.

- If a plaster of Paris cast:

(1) Allow the cast to dry slowly. (a) A fan may be used, but heat from a hair dryer or other source is contraindicated.
(b) When a cast dries too rapidly, the outer portion of the cast dries quickly while the cast closest to the skin remains wet. The wet skin can become macerated and infected.

- Assess entire cast for warm areas and/or signs of discharge, which may indicate infected areas.
    - Compound fractures are especially high risk for infection.
- Monitor for rise in vital signs and/or WBC count.
- Administer safe dosages of antibiotics, as prescribed.

4. Risk for Impaired Breathing Patterns/Impaired Gas Exchange resulting from bedrest.

- Monitor respiratory rate.
- Monitor lung sounds.
- Encourage deep breathing and coughing and/ or incentive spirometry every 2 hr.

5. Risk for Impaired Skin Integrity related to the injury, treatment, and/or bedrest.

- Assess the skin for signs of breakdown.
- If on bedrest, place the child on a soft surface (e.g., lambskin).
- Gently cleanse, dry, and massage the skin, especially areas in communication with the surface of the bed.
- If the child has yet to be toilet trained, change diapers frequently.
- Reposition the child every 2 hr, if appropriate.

6. Risk for Constipation resulting from bedrest and/or narcotic ingestion.

- Monitor bowel sounds and stooling patterns.
- Provide a diet that is high in fluids, fresh fruits, vegetables, and whole grains.
- Administer stool softeners, as prescribed and as needed.

7. Risk for Impaired Physical Mobility resulting from injury and/or bedrest.

- Encourage active ROM exercises of unaffected limbs.
- Assist with passive ROM exercises of joints distal to the injury on the affected extremity, if permitted.
- Provide and encourage participation in age-appropriate activities that encourage appropriate movement.

8. Powerlessness/Risk for Ineffective Coping/Risk for Altered Growth and Development/Anger.

- Provide the child and parents opportunities to verbalize anger and frustration.
- Explain all interventions in age-appropriate language.
- Provide opportunities for therapeutic play.

NCLEX!!! The child should be moved to the playroom for play as often as possible, but if in traction, weight alignment must be maintained. Many play activities can be used to dispel the anger children may feel from long-term confinement. For example, throwing bean bags at a target and hammering pegs into holes in a thick board are therapeutic actions that can help children to release their anger in socially acceptable ways.

- Allow regression early in the hospitalization, but foster growth, as appropriate, if hospitalized for an extended period of time. For example, set limits, allow appropriate decision making, and allow personal food and clothing choices.
- Encourage the child to complete schoolwork provided by tutors and home school teachers, as appropriate.
- Provide toys and activities that are compatible with the child's therapy and that promote fine and gross motor development.

IV. Clubfoot

A. Incidence.
1. Clubfoot affects boys more frequently than girls.
2. Defect often accompanies other defects (e.g., spina bifida).
3. Clubfoot may be unilateral or bilateral.

B. Etiology.
1. There is increased incidence in some families, but no genetic markers have been identified.
2. Some cases of clubfoot appear to result from fetal malposition while in utero and/or intrauterine restriction resulting from oligohydramnios.

C. Pathophysiology.
1. Over 90% of cases of clubfoot are classified as talipes equinovarus, a foot that is plantar flexed and pointed inward. Th e remaining 10% are classified as:
a. Talipes equinovalgus: plantar flexed and pointed outward.
b. Talipes calcaneovarus: dorsiflexed and pointed inward.

c. Talipes calcaneovalgus: dorsiflexed and pointed outward.

2. Although many neonates' feet appear malaligned, clubfoot is only diagnosed when the feet resist being moved into proper alignment.

D. Diagnosis.
1. Clinical picture, i.e., the inability to move the neonate's foot into correct alignment is suggestive.
2. Definitive diagnosis is determined by x-ray and/ or ultrasound.

E. Treatment.
1. Serial casting.
a. Every 1 to 2 weeks beginning shortly after birth, casts are applied to the affected foot, incrementally moving the foot into proper alignment.

- Casts must be removed and reapplied frequently because of the rapid growth of the neonate.
- Th e goal of the serial casts is to stretch ligaments and tendons on the inner aspect of the foot.

b. Bracing often follows casting.
2. Surgery may be needed if correction is not achieved through casting.
3. Physical therapy may be prescribed.

F. Nursing considerations.
1. Risk for Injury/Pain related to cast compression.
a. Educate the parents regarding the importance of monitoring the child who has been casted for signs of neurovascular compromise.
b. Educate the parents regarding age-appropriate pain assessment.
c. Administer a safe dosage of an appropriate analgesic, as needed.

After casts are applied, babies with club feet will be discharged home. It is critically important for the nurse to educate the parents regarding assessing the child for neurovascular compromise at least once each day and immediately to report any deviations from normal.
Because babies grow so rapidly during the first weeks of life, the cast can become too tight very quickly. The parents must assess for the:
• Presence of pain, which is usually exhibited in neonates as crying.
• Presence of pedal pulses bilaterally.
• Color of the feet, which should be pink bilaterally.
• Spontaneous movements of both feet.
• Temperature of both feet. Although babies' feet are often cool to the touch, the temperature of both feet should be the same.
• Presence of edema.
• Capillary refill.

d. If surgery is performed, monitor surgical site for REEDA, and report abnormal findings.

2. Knowledge Deficit/Risk for Ineffective Coping of parents.

a. Provide parents the opportunity to verbalize grief, anger, and frustration over birthing a child with a physical defect.
b. Carefully explain to the parents the rationale for each treatment method.

V. Developmental Dysplasia of the Hip
A. Incidence.
1. Developmental dysplasia of the hip (DDH) is seen seven times more frequently in girls than in boys.
2. Higher incidence in breech babies.
3. Frequently seen in conjunction with other defects (e.g., spina bifida).

B. Etiology.
1. There is increased incidence in families, but no genetic evidence has been found.
2. Most commonly associated with fetal positioning and in conjunction with other defects.

C. Pathophysiology.
1. Instability of the hip joint secondary to a laxity of the ligaments of the hip.
2. The severity of the defect—subluxation to complete dislocation—is dependent on the extent of the dysplasia.
3. Signs and symptoms.
a. Positive Ortolani's sign.

To prevent injury, Ortolani's test should only be performed by a trained practitioner.
• The baby is placed on his or her back.
• The knees and hips are bent at right angles.
• The practitioner places his or her index fingers at the level of the trochanter and remaining fingers along the outside of the legs.
• The thumbs are placed on the inner aspects of the thighs.
• The practitioner internally and externally rotates the legs.
• If instability is felt, DDH is suspected.

b. Positive Barlow's sign.

To prevent injury, the Barlow's test should only be performed by a trained practitioner.
• The baby is placed on his or her back.
• The hips are bent and legs abducted.
• The practitioner places his or her index fingers at the level of the trochanter and remaining fingers along the outside of the legs.
• The thumbs are placed on the inner aspects of the thighs.
• The practitioner pushes the legs posteriorly, and DDH is suspected if a slippage of the hip is felt.

c. Limited abduction of one or both legs.
d. Asymmetry of skin folds on the anterior and posterior surfaces of the thigh.
e. Asymmetry of femur lengths.

D. Diagnosis.
1. Clinical findings are suggestive, and assessments should be performed at each well-baby visit.

a. Ortolani's test.
b. Barlow's test.
2. Definitive diagnosis is determined by x-ray and/ or ultrasound.

E. Treatment.
1. To prevent permanent damage, it is important that treatment be instituted before the child starts to creep and crawl.
2. Pavlik harness: if the child is less than 6 months of age, the Pavlik harness is the classic treatment.

a. Goals of the harness:

- Keep the legs abducted.
- Keep the trochanter positioned in the acetabulum.
- Enable the hip ligaments to mature and strengthen.

3. If the child is older than 6 months or if the Pavlik was not effective:
a. Invasive procedures may be performed (e.g., traction; surgery; spica casting, in which the trunk as well as one or more limbs is enclosed in a cast).

1.**F. Nursing considerations.**

If Pavlik:
a. Risk for Ineffective Coping/Knowledge Deficit/ Risk for Impaired Skin Integrity.

- Provide the parents the opportunity to verbalize grief, anger, and frustration regarding birthing a child with a defect and/or the necessary therapy.
- Carefully explain the pathophysiology of DDH and rationale for the harness.
- Educate the parents regarding the proper use of the harness.
- Educate the parents to assess the skin under the harness daily for signs of skin breakdown.
- Because car seats adduct the legs, parents should be advised to avoid long trips in the car.

Parent Education for Use of the Pavlik Harness
• The harness must be worn 23 to 24 hr per day, as prescribed. • If the primary health-care provider states that the harness may be removed, the parents must be taught how to reapply it correctly. • The parents must be advised to return to the primary healthcare provider on a regular basis to have the length of the straps adjusted to accommodate the baby's rapid growth. • The harness will keep the baby's hips bent and abducted, but the baby should show no signs of discomfort. • To maintain proper positioning, the diaper must be put on under the harness and all outer clothing must fi t loosely over the lower extremities. • To protect the skin, a tee shirt should be worn by the baby under the harness. • To prevent pressure points from developing, the parents should be advised to check for wrinkles

in the shirt.

2. If spica cast:
a. See “Casting.”
b. Risk for Impaired Skin Integrity.

- Advise the parents to use disposable diapers and sanitary pads to prevent urine and feces from soiling the cast.

c. Risk for Injury.

- Advise the parents to monitor for signs of neurovascular compromise (see earlier).
- Advise the parents to support all extremities with pillows and/or blankets.
- Advise the parents to perform safe position changes throughout the day.
- Advise the parents to exercise care in carrying and traveling with the child.
- Advise the parents never to leave the child unattended.
    - Even children who have been casted may learn to move independently.

d. Risk for Impaired Breathing Patterns/Risk for Impaired Gas Exchange.

- Educate the parents to monitor the child’s respiratory eff ort and breathing patterns each day and to report any deviations from normal.

e. Risk for Altered Growth and Development.

- Provide toys and activities that are compatible with the child’s therapy and that promote fine and gross motor development.

VI. Legg-Calve-Perthes
A. Incidence.
1. Legg-Calve-Perthes (LCP) can be seen in children from toddlerhood through the end of the school-age period but is most commonly seen in children aged 4 to 8 years of age.
2. It is most commonly seen in boys and in Caucasian children.

B. Etiology.
1. The etiology of LCP is unknown.

C. Pathophysiology.
1. A temporary drop in the blood supply to the head of the femur and, in some circumstances, to the acetabulum as well, resulting in an aseptic necrosis of the bones.
2. Eventually, the blood supply returns to normal and the bone regenerates, but the ischemia may last for months or years.
3. The resultant bone may be normal or may be markedly deformed.
4. Signs and symptoms:
a. Pain
b. Limp that increases as the child’s activity level increases.

D. Diagnosis.
1. Clinical picture is suspicious.
2. Definitive diagnosis is made with x-ray, bone scan, and/or MRI.
3. Early diagnosis is essential in order to prevent permanent damage.

E. Treatment.
1. Anti-inflammatory medications and non-weight bearing.
a. Non-weight bearing may be achieved with crutch walking.
b. If pain is severe, bedrest may be needed.
2. Casting and/or surgical intervention may be necessary.

F. Nursing considerations.
1. Risk for Ineffective Coping/Pain/Knowledge Deficit/Risk for Altered Growth and Development.

- Provide the parents and children, if appropriate, the opportunity to verbalize anger and frustration with the diagnosis and treatment plan.
- Carefully explain the pathophysiology of the disease and the rationale for therapy.
- Advise the parents to provide the child with age-appropriate activities to maintain and promote fine and gross motor development.
- Advise the child and parents that the child is able to and should go to school but must refrain from engaging in activities that will interfere with the treatment.
- Emphasize the importance of non-weight bearing to prevent further injury to the joint.
    - If prescribed, reinforce education by the physical therapist (PT), or, if PT is unavailable, educate the child regarding safe crutch walking.
- Educate the parents and child, if appropriate, regarding the safe administration of antiinflammatory medications.
- Educate parents and child, if appropriate, regarding the safe administration of analgesics and regarding appropriate nonpharmacological pain interventions, as needed.

How to Use Crutches

1. Standing with the unaffected foot on the floor:

- The elbows should be slightly bent.
- The hands should grip the hand supports.
- When moving, the axilla should be placed over the underarm supports but not touching the underarm supports.

2. While continuing to stand on the unaffected foot:

- The crutches should be moved forward slightly.
- While continuing to keep a space between the underarm supports and the axilla, the patient should push down on the hand grips.

3. Last, the body should swing to meet the placement of the crutches.

VII. Slipped Capital Femoral Epiphysis

A. Incidence.
1. Slipped capital femoral epiphysis (SCFE) is seen in children during the pubertal growth spurt.
2. Most commonly seen in males and obese children.

B. Etiology.
1. Th e cause of SCFE is unknown; however, obesity is presumed to be a significant risk factor, if not a cause; the vast majority of children who develop the problem are in the top 10th percentile for weight.
2. SCFE is also associated with other diseases (e.g., endocrine disorders), and, because of its proximity to the adolescent growth spurt, hormonal changes likely factor into its development.
3. There is increased incidence in some families, although a direct genetic link has not been identified.

C. Pathophysiology.
1. Th e head of the femur separates from the rest of the femur at the site of the growth, or epiphyseal, plate.
2. Blood supply to the femoral head is disrupted and frequently results in necrosis of the bone.

3. Signs and symptoms.
a. Hip tenderness or pain.
b. Decreased hip flexion.
c. Limp.
d. Increased pain when the toes are turned inward.

D. Diagnosis.
1. The clinical picture of an obese preteen with a painful limp is highly suggestive.
2. Definitive diagnosis is made by x-ray.

E. Treatment.
1. Surgery usually is performed as soon as the diagnosis is made.

a. Th e sooner interventions are instituted, the less likely the child will experience permanent damage.
b. Traction often is instituted following surgery.
2. Immobility of the joint, including bedrest and/or crutch walking, both before and following surgery is usually prescribed.

Nursing Video: Slipped Capital Femoral Epiphysis

F. Nursing considerations.
1. Pain/Deficient Knowledge.
a. Carefully explain the pathophysiology of the disease and rationale for therapy.
b. If prescribed, reinforce education by the physical therapist (PT), or, if PT is unavailable, educate the child regarding safe crutch walking.
c. Administer safe dosages of analgesics, as prescribed.

- If moderate to severe pain, narcotics should be administered.

    - Patient-controlled analgesia is an excellent mode of medication administration for this age patient.
  - For mild pain, NSAIDS should be administered.
  - When the child is discharged, educate the parents and child, if appropriate, regarding the safe administration of analgesics.

d. Provide nonpharmacological pain interventions, as needed.

2. Risk for Ineffective Coping/Risk for Altered Growth and Development.
a. Provide the parents and child the opportunity to verbalize anger and frustration with the diagnosis and treatment plan.
b. Strongly encourage the child to continue close relationships with friends and to invite friends to visit when in the hospital or confined to the home.
c. Advise the child and parents that the child is able to and should keep up with schoolwork.

3. Readiness for Enhanced Self-Health Maintenance.
a. Encourage the primary health-care provider to refer the child and family for nutrition counseling.
b. Support the education provided during nutrition counseling.
c. Provide positive reinforcement for dietary changes made.
d. Following convalescence, strongly encourage the child to begin a wellness exercise program.

VIII. Scoliosis
A. Incidence.
1. Although scoliosis is seen in other children, including neonates, by far the highest incidence of the disease is seen in adolescent girls during their pubertal growth spurt.

B. Etiology.
1. In the vast majority of cases, there is no apparent cause.
2. Th ere is a rare autosomal dominant form of the disease.
a. A genetic test is available for the small, at-risk population.
3. Scoliosis is also seen in conjunction with other diseases (e.g., cerebral palsy, muscular dystrophy).
4. It is believed that scoliosis is neither caused by nor worsened by carrying heavy backpacks and/or by engaging in sports.

C. Pathophysiology.

1. Scoliosis is characterized by a lateral curvature and rotation of the spine, defi ned in terms of degrees of curvature.
a. A deviation of greater than 10 degrees is diagnostic.
2. Th e rotation of the spine is related to weakness in muscles and ligaments on the opposite side of the body.
3. Signs and symptoms.
a. Uneven posture with:

  - One scapula protruding farther than the other.
  - Uneven shoulder and waist heights.
  - Hip and rib asymmetry.
  - In severe cases, respiratory and cardiac compromise because of thoracic compression.

D. Diagnosis.
1. Clinical picture is suggestive.
i. Deviation and asymmetries are seen when the child bends at the waist and allows his or her arms to fall freely ii. Scoliometer is a device placed on the back of the child as he or she bends from the waist to measure the curvature of the spine.
2. Definitive diagnosis is made by x-ray.

E. Treatment.
1. Mode of treatment is dependent on many factors, including the extent of the deviation and the age of the child.
2. Bracing usually is the treatment of choice for relatively minor deviations.

- It is important to realize that bracing is not curative; braces merely help to prevent any further deviation.
- It is not uncommon for children to refuse to wear the braces. Therefore, to promote compliance:
    - Most braces currently used are small enough to hide under one's clothing.
    - Some braces are designed only to be worn while sleeping.

3. Exercises oft en are employed in conjunction with bracing, but exercises alone are not effective.
4. In severe cases and when bracing fails to prevent further injury, surgery is performed.

- Most frequently, one or more rods are inserted adjacent to and wired to the spine.
- Bone graft s from the child's hip or other site are used to fuse and/or stabilize the vertebrae.
- Renal and/or neurological damage, as well as extensive blood loss, are possible complications from the surgery.
- Following surgery, the child will usually be required to wear a brace until the site is fully healed.

F. Nursing considerations.
1. If bracing:
a. Risk for Impaired Skin Integrity.

- The child's skin should be thoroughly dried before donning the brace.
- The child should wear a cotton tee shirt under the brace.
    - Care should be taken to eliminate all wrinkles in the shirt.
- The skin should be assessed daily for signs of breakdown.
- The use of lotions and powders on the skin under the brace should be avoided.

b. Risk for Ineffective Coping/Deficient Knowledge/Anger/Risk for Disturbed Body Image.

- Carefully explain to the parents and child the pathophysiology of the disease and the rationale for therapy.
- Educate the parents and child regarding the importance of wearing the brace to prevent further deviation.
- Allow the parents and child to express anger and frustration over the need to wear a brace and, if required, the need to refrain from normal physical activities.

- Educate the parents and child regarding how to put on the brace in order to prevent complications.
- Consider introducing the child to a child of the same age and gender who is compliant with the therapy.
- Provide the child with consistent encouragement and positive reinforcement when complying with therapy.
- Introduce the child and family to relevant community organizations (e.g., National Scoliosis Foundation).

2. If surgery:
a. Risk for Anxiety/Fear/Anger/Defi cient Knowledge.

- Allow the child and parents to express their anxieties, fears, and anger regarding the need for surgery.
- Provide the child and parents with comprehensive education regarding the surgical procedures as well as preoperative and postoperative care.
- Parents should be advised that the child may regress during the surgical period, for example:
    - Th e child may wish to hold a favorite toy or other possession from when he or she was younger while in the hospital.
    - Th e child will likely request his or her parents to stay with him or her immediately pre- and postsurgery and throughout the remainder of the hospitalization.

b. Risk for Impaired Mobility/Risk for Injury.

- Immediately following surgery, log rolling should be performed when changing the child's position to prevent injury to the surgical site.
- Provide needed assistance for the application of the postoperative brace and educate the parents to do the same.
- Assist with physical therapy interventions, as prescribed.
- Carefully monitor for postoperative complications and report any adverse findings.
    - Because the spinal column is manipulated during surgery, thorough neurological assessments must be performed.
    - Assess lung fields and encourage use of the incentive spirometer.
    - Assess bowel sounds and monitor for return of bowel movements.

c. Risk for Deficient Fluid Volume because surgical blood loss may be excessive.

- Monitor vital signs and report to the healthcare provider evidence of tachycardia and/or hypotension.
- Maintain strict intake and output (I&O).
- Monitor laboratory values (e.g., hematocrit and hemoglobin, electrolytes, renal function tests) and report significant changes.
- Employing protocols, administer IV therapy and/or blood replacement products, as prescribed.

d. Pain.

- Assess pain using an age-appropriate pain rating scale.

- Administer safe dosages of analgesics utilizing appropriate technique, as prescribed.
    - Narcotic analgesics are essential during the immediate postoperative period.
    - Patient-controlled analgesia is an excellent mode of medication administration for teenage patients.
- Prior to discharge, educate the parents and child, if appropriate, regarding the safe administration of analgesics.
- Provide nonpharmacological pain interventions, as needed.
- Assess the response to pain intervention methods and intervene, as needed.

IX. Muscular Dystrophies
There are a number of progressively debilitating hereditary diseases that adversely affect muscular function and result in impaired, or a total loss of, mobility. The most severe and most common form, Duchenne muscular dystrophy (DMD), is presented as an exemplar in this chapter.

A. Incidence.
1. Approximately 1 of every 3,500 males is diagnosed with DMD.

B. Etiology: all muscular dystrophies have a genetic etiology. Some are X-linked, others are autosomal dominant, and others are autosomal recessive.
1. Classically, DMD is a single gene, X-linked recessive disease.
2. Many cases of DMD, however, are found to be caused by spontaneous genetic mutations.

C. Pathophysiology.
1. Children with DMD have a genetic defect that results in the inability to produce the protein, dystrophin, which is essential for maintaining the health and well-being of
muscle tissue.
2. Slowly over time, the cells of the muscles of the body are replaced by fat cells.
3. Initially, the long muscles of the legs and the muscles in the pelvic area are affected, but eventually all muscle is replaced by fat, including the muscles of the respiratory and cardiac systems.
4. Characteristically, the fatal illness ends in death from respiratory infection or cardiac failure when the men reach their late teens or early twenties.
5. Signs and symptoms.

- Th e growth and development of children with DMD usually are within normal limits for the first few years of life.
- At approximately age 3, gross motor development stalls and begins to decline (i.e., the child never is able to ride a tricycle and starts to have difficulty running and climbing stairs).
- Slowly over time, gross motor skills become more and more difficult, and the child develops:
    - Lordosis (concave curvature of the back, commonly called sway back).
    - Waddling gait.
    - Gower’s sign, characterized by the need to push oneself to the standing position by holding onto furniture or using one’s hands to “walk up” the body.
        - Usually seen during the school-age period.
    - By the time the children become teenagers, they usually are wheelchair bound.

D. Diagnosis.

1. Suggestive from clinical picture, that is:

- Normal growth and development from birth through toddlerhood.
- Slow regression of motor function after age 3.
- Gower's sign beginning at approximately age 7.
- Elevated serum creatine kinase levels, indicating that muscle cells have been damaged.

2. Definitive diagnosis.

- Muscle biopsy showing fat infiltrates in the muscle tissue.
- DNA analysis.

E. Treatment.
1. There is no cure for DMD; the goal of the treatment for DMD is to maintain ambulatory and vital organ function for as long as possible.

- Preventing obesity and preventing the development of contractures help the children to prolong their mobility.
- When needed, additional interventions are instituted, including bracing, PT, and crutch walking.
- Those who engage in vigorous exercise programs have been shown to prolong their mobility longer than those who live a more sedentary lifestyle.

2. Corticosteroids have been administered and have slowed the progression of the illness in some cases.
3. Prophylactic antibiotics, respiratory physical therapy, and aggressive intervention for all upper respiratory infections and symptoms related to cardiac failure help to maintain function of the vital organs.

F. Nursing considerations.
1. Knowledge Deficit.

- Provide the parents and child, when appropriate, with comprehensive education regarding the etiology and pathophysiology of the disease.
- Refer the family to a genetic counselor for comprehensive, familial genetic analysis.

2. Risk for Impaired Coping/Anxiety/Fear/Anger/ Grieving.

- Allow the parents and child to express concerns, anxiety, and fears regarding the Gower's sign. diagnosis, including the knowledge and fear of eventual death.
- Allow the teen to express anger at his or her physical restrictions and increasing dependency related to the progression of disease.
- Encourage the family to join supportive community organizations (e.g., Muscular Dystrophy Association).
- Be prepared to assist the child and family with grief work.

3. Impaired Physical Mobility/Risk for Impaired Skin Integrity.

- Reinforce education by the physical therapist (PT), or, if PT is unavailable, educate the

child and family regarding safe crutch walking and/ or wheelchair use.
- Assist the child to maintain activity levels as long as possible by incorporating a structured exercise routine into the daily plan of care.
- If wheelchair bound, educate the parents and child to monitor for signs of skin breakdown.
- Because maintaining optimal body weight enables affected children to maintain ambulation longer, refer the family to a registered dietitian and reinforce nutrition counseling.

4. Risk for Infection/Risk for Impaired Gas Exchange/Risk for Impaired Breathing Patterns as the child's muscular function deteriorates.

- Educate the parents to perform daily respiratory PT.
- Educate the parents to assess the child's respiratory function daily.
- Educate the parents to protect the child from others with active infection.
- Educate the parents immediately to seek medical care whenever the child exhibits signs of respiratory infection.
- Educate the parents and child regarding signs and symptoms of congestive heart failure and immediately to seek medical care if signs and symptoms appear.

5. Risk for Injury/Impaired Urinary and Bowel Elimination.

- Educate the parents and child to monitor daily I&O.
- Educate the parents regarding the child's DMV needs.
- Encourage the parents to provide the child with a high-fi ber diet.
- Administer stool softeners/laxatives, as needed.

X. Osteomyelitis
A. Incidence.
1. Osteomyelitis most frequently affects children in the late toddler and preschool period.
2. Boys are more frequently affected than are girls.

B. Etiology.
1. Bacterial invasion into the bone occurs either indirectly via the vascular system or directly as a result of a break in the skin.
2. The most common pathogen is Staphylococcus aureus. Other responsible bacteria are Escherichia coli, Haemophilus influenzae, and Streptococcus pyogenes. In addition, pathogens found in the soil (e.g., Pseudomonas aeruginosa) also are seen.

C. Pathophysiology.
1. Either via the vascular tree or directly via a break in the skin, bacteria enter the bone, most commonly the epiphyseal plate.
2. Pus develops in the area but, because the pus is unable to be evacuated from the site, abscesses often develop.
3. Over time, the blood supply to the area is adversely affected.
4. If unsuccessfully treated, an acute or subacute form of the disease can result in a chronic disease.
5. Signs and symptoms.

- In infants and young toddlers: nonspecific signs and symptoms:
    - Elevated temperature, irritability, poor feeding, and lethargy.

- b. Older children exhibit more specific symptoms.
    - Signs of inflammation (e.g., redness, warmth, swelling, pain) over the site of the infection.
    - Limping, if the child is ambulatory.
    - Children sometimes complain of pain in a nearby joint, even though the joint is unlikely the site of the infection.

D. Diagnosis.
1. The clinical picture is suggestive, including the characteristic signs and symptoms plus:

- Laboratory evidence, including elevated WBC count, elevated erythrocyte sedimentation rate (ESR), and/or positive blood cultures.

2. Definitive diagnosis is made from:

- X-ray, MRI, CT scans, and/or bone scans.
- Culture and sensitivity of the aspirate from the bone.

E. Treatment.
1. High-dose, IV antibiotics, including aminoglycosides, which must often be administered for 6 weeks or more.
2. Surgery is often required when:

- An abscess is present and/or the infection is not treated effectively by the antibiotics.
- Bone necrosis has occurred.

F. Nursing considerations.
1. Knowledge Deficit/Risk for Impaired Coping/ Anxiety/Fear/Anger.

- An excellent nursing history must be conducted in an attempt to determine how the bacteria entered the child’s body.
- Once a correct diagnosis is made, educate the parents and child, if appropriate, regarding the etiology and pathophysiology of the disease.
- Allow the parents and child, if appropriate, to express concerns, anxiety, and fears regarding the disease and treatment plan.
- Allow the child to express, in his or her own way, anger at the requisite physical restrictions.

2. Pain.

- Assess pain using an age-appropriate pain rating scale.
- Administer safe dosages of analgesics utilizing appropriate technique, as prescribed.
- Prior to discharge, educate the parents and child, if appropriate, regarding the safe administration of analgesics.
- Provide nonpharmacological pain interventions, as needed.

3. Risk for Injury that may develop from prolonged use of antibiotics.

- Administer safe dosages of antibiotics using the five rights of medication administration.
- Monitor the IV site for signs and symptoms of phlebitis and/or infiltration of the IV.

- Recommend to the primary health-care provider that a peripherally inserted central catheter (PICC) or other central line be inserted to preclude the child from having multiple IV insertions.
    - If a PICC line is in place, the child must be monitored carefully for complications, including air emboli, infection, phlebitis, and thrombi.
- Carefully monitor the child for signs and symptoms of side effects to the antibiotics (e.g., diarrhea, ototoxicity, nephrotoxicity, rash, respiratory complications, adverse laboratory values).
- Use necessary restraint systems in order to prevent the child from removing the IV catheter (e.g., arm board, elbow restraints).

4. Infection.

- If wound care is needed, maintain standard precautions during dressing changes.
    - f the hospitalized child is young and unreliable, or if the infection is caused by a resistant organism, consider placing the child in a private room on contact isolation.

5. Imbalanced Nutrition: Less than Body Requirements/Risk for Altered Growth and Development.

- Encourage the parents to provide the child with a high-protein, high-calorie diet to promote resolution of the infection.
- Encourage the parents to offer the child small, frequent servings of foods that are favored by the child.
- Encourage the parents to provide the child with age-appropriate activities that are consistent with the treatment plan.
- To prevent complications, if the child is required to remain immobile, monitor respiratory and bowel function and perform prescribed active and passive ROM exercises.

XI. Osteogenesis Imperfecta

Osteogenesis imperfecta is a genetic bone disease characterized by bones fracturing easily without any obvious cause. There are four classifications of osteogenesis imperfecta:

- Type I (most common): Bones fracture easily before puberty.
- Type II (most severe): Severe bone deformity and numerous fractures resulting in respiratory problems at or shortly after birth resulting in death.
- Type III: Fractures present at birth and may have healed.
- Type IV: Fractures are greater than type I and occur before puberty.

A. Signs and Symptoms

- Easy bruising
- Hyperextensible ligaments
- Epistaxis
- Blue sclera
- Fractures occurring for no obvious reason
- Short statue in all but type I

B. Test Results
Radiograph: Shows fractures or healed fractures

C. Treatments
No known cure
Physical therapy to strengthen muscles and prevent osteoporosis

D. Nursing Interventions
Handle patients gently to prevent fractures and bruising.
Teach the parents how to care for the patient.

The sternocleidomastoid muscle is damaged from intrauterine malposition of the fetus in or from birth trauma resulting in unusual contraction of the sternocleidomastoid muscle causing the head to bend toward the affected muscle. Torticollis can also occur from trauma not related to birth.

A. Signs and Symptoms

- Neck is flexed toward the affected sternocleidomastoid muscle.

B. Test Results

- Decreased range of motion of the head to the unaffected sternocleidomastoid muscle

C. Treatments

- Low-impact neck stretching exercise to strengthen the neck.
- Apply heat to encourage healing.
- Frequent shiatsu massages to relieve tension caused by the contracting muscle.

D. Nursing Interventions

- Provide support to the patient’s neck and head.
- Teach the parents how to care for the patient.

XV. Osgood-Schlatter Disease

Osgood-Schlatter disease, also called osteochondrosis, is a painful, incomplete separation of the epiphysis of the tibial tubercle from the tibial shaft. This is a common cause of
knee pain in adolescents. It’s most common in active adolescent boys, but may also be seen in girls ages 10 to 11.

A. Causes

1. Trauma before complete fusion of the epiphysis to the main bone
2. Locally decreased blood supply

3. Genetic factors

B. Assessment

1. Aching and pain over tibial tubercle
2. Swelling
3. Tenderness

C. Diagnostic Procedures

1. X-rays show epiphyseal separation and soft tissue swelling in first 6 months after onset; eventually show bone fragmentation.
2. Bone scan may show increased uptake in area of tibial tuberosity.

D. Nursing Diagnoses

1. Impaired physical mobility
2. Chronic pain
3. Delayed growth and development

E. Treatment

1. Conservative: designed to decrease stress to affected knee
2. Avoiding strenuous exercise for the affected knee
3. Ice application after exercise
4. Rest and quadriceps strengthening and hamstring and quadriceps stretching exercises
5. Surgery to reposition epiphysis (if conservative methods fail
6. **Drug therapy**
   • Analgesics: acetaminophen (Tylenol), ibuprofen (Motrin)

F. Nursing Interventions

1. Monitor the child for circulatory or neurologic changes in the leg, which could indicate neurovascular compromise.
2. Assess the child for limitations in movement and reposition as needed to maintain skin integrity.
3. Provide emotional support to the child and family.
4. Teaching topics:
   • Explanation of the disorder and treatment plan
   • Medication use and possible adverse effects
   • Following up with physician and therapy appointments
   • Importance of socialization