

ORTHOPEDICS

MUSCULOSKELETAL SYSTEM

ANATOMY

There are 206 bones in the body divided into four categories:

- ❖ **Long bones**- designed for weight bearing and movement
- ❖ **Short bones**- consist of cancellous bone covered by a layer of compact bone
- ❖ **Flat bones**-important sites of hematopoiesis and frequently protect vital organs.
- ❖ **Irregular bones**- have unique shapes related to their functions.

Three Types of Bone Cells:

- ❖ **Osteoblasts**- function in bone formation by secreting bone matrix
- ❖ **Osteocytes**- mature bone cells involved in bone maintenance, located in lacunae
- ❖ **Osteoclasts**- are multi nuclear cells involved in dissolving and resorbing bone

Parts of the Bone:

- ❖ **Osteon**- microscopic functioning unit of mature cortical bone
- ❖ **Periosteum**- dense, fibrous membrane covering the bone
- ❖ **Endosteum**- a thin, vascular membrane that covers the marrow cavity of long bones and the spaces in cancellous bone
- ❖ **Bone Marrow**- is a vascular tissue located in the medullary cavity of long bones and in flat bones
- ❖ **Epiphyses**- ends of the long bones
- ❖ **Cartilage**- tough, elastic, avascular tissue that covers the ends of long bones
- ❖ **Diaphysis**- shaft of the long bone

BONE FORMATION

Osteogenesis- bone formation begins long before birth.

Ossification- the process by which the bone matrix is formed, and hard mineral crystals composed of calcium and phosphorus are bound to the collagen fibers.

BONE MAINTENANCE

- ❖ **Remodeling**- primary process that occurs by early adulthood; maintains bone structure and function through simultaneous resorption and osteogenesis, and as a result, complete skeletal turn over occurs every 10 years.
- ❖ **Resorption**- removal or destruction of tissue, such as bone tissue

Factors:

- ❖ **Physical activity**- stimulate bone formation
- ❖ **Dietary intake of certain nutrients** (Calcium)
- ❖ **Several hormones** (calcitriol, PTH, calcitonin, thyroid hormone, cortisol, growth hormone and estrogen and testosterone.)

BONE HEALING

- ❖ Broken bones heal by a process referred to as union. Union takes place in a series of steps.

1. Hematoma formation

- Blood accumulates in the area of break or injury
- Extravascular blood converts from liquid to semisolid clots
- Active phagocytosis removes necrotic tissue and debris

2. Callus formation

- Fibrin cells form a network around the injured area
- The damaged periosteum is stimulated to generate osteoblasts, forming new bony substances referred to as osteoid.
- Minerals begin to accumulate in a network, forming a collagen callus

3. Calcification process

- Calcification begins and establishes support of the injury.
- Connective tissue proliferates across the site and is usually completely calcified within 6 weeks.

4. Remodeling process

- Excess cellular material is reabsorbed, and the bone resumes its preinjury strength and configuration
- This remodeling phase is enhanced by stress and exercise
- Complete remodeling can take 6 months

to 1 year to complete.

ARTICULAR SYSTEM

Joint- the junction of two or more bones

Three basic kinds of joints

- ❖ **Synarthrosis**
 - Immovable
 - (eg. skull sutures)
- ❖ **Amphiarthrosis**
 - Allow limited motion
 - (eg. vertebral joints and the symphysis pubis)
- ❖ **Diarthrosis**
 - Freely movable

Ball-and-socket joints

- Permit full freedom of movement.
- eg, the hip and the shoulder)

Hinge joints

- Permit bending in one direction only
- (eg, the elbow and the knee).

Saddle joints

- Allow movement in two planes at right angles to each other.
- The joint at the base of the thumb is a saddle, biaxial joint.

Pivot joints

- Characterized by the articulation between the radius and the ulna.
- They permit rotation for such activities as turning a doorknob.

✓ **Gliding joints**

- Allow for limited movement in all directions and are represented by the joints of the carpal bones in the wrist.

Synovium- membrane lining the capsule which secretes the lubricating and shock absorbing the synovial fluid into the joint capsule

Ligaments - fibrous connective tissue bands that bind the articulating bones together.

Bursa- sac filled with synovial fluid that cushions the movement of tendons, ligaments, and bones at a point of friction

Skeletal Muscle Contraction

- ❖ Each muscle cell (also referred to as a muscle fiber) contains myofibrils, which in turn are composed of a series of **sarcomeres**, the actual contractile units of skeletal muscle.
- ❖ Muscle cells contract in response to **electrical stimulation** delivered by an effector nerve cell at the motor end plate.
- ❖ Energy is consumed during muscle contraction and relaxation.
- ❖ The primary source of energy for the muscle cells is **adenosine triphosphate (ATP)**, which is generated through cellular oxidative metabolism.
- ❖ **Isometric contraction**, the length of the muscles remains constant but the force generated by the muscles is increased (pushing against an immovable wall).
- ❖ **Isotonic contraction** is characterized by shortening of the muscle with no increase in tension within the muscle; an example of this is flexing the forearm

Muscle Tone

- ❖ Relaxed muscles demonstrate a state of readiness to respond to contraction stimuli.
 - **Flaccid-** A muscle that is limp and without tone
 - **Spastic-** A muscle with greater-than normal tone.

Exercise, Disuse, and Repair

- ❖ Muscles need to be exercised to maintain function and strength
- ❖ **Hypertrophy**- results from an increase in the size of individual muscle fibers without an increase in their number
- ❖ **Atrophy**- decrease in the size of a muscle.
- ❖ The patient can decrease the effects of immobility by **isometric exercise** of the muscles of the immobilized part.
- ❖ **Quadriceps contraction exercises** (tightening the muscles of the thigh) and **gluteal setting exercises** (tightening of the muscles of the buttocks) help maintain the larger muscle groups that are important in ambulation

DIAGNOSTIC TESTS

1. X-ray Studies

- ❖ Determine bone density, texture, erosion, and changes in bone relationship

2. Computed Tomography

- ❖ Shows in detail a specific plane of involved bone, reveal tumors of the soft tissue or injuries to the ligaments or tendons.
- ❖ The patient must remain still during the procedure.

3. Magnetic Resonance Imaging

- ❖ Noninvasive imaging technique that uses magnetic fields, radiowaves, and computers to demonstrate abnormalities of soft tissues.
- ❖ Patient with any metal implants, clips, or pacemakers are not candidates for MRI. Intravenous contrast agents may be used. The patient must lie still and will hear a rhythmic knocking sound.
- ❖ Patients who experience claustrophobia may be unable to tolerate the confinement of closed MRI equipment without sedation.

4. Arthrography

- ❖ A radiopaque contrast agent or air is injected into the joint cavity to visualize irregular surfaces.
- ❖ After an arthrogram, a compression elastic bandage is applied as prescribed and the joint is usually rested for 12 hours.
- ❖ Assess contraindications to the study
 - Pregnancy
 - Claustrophobia
 - Inability to tolerate required positioning due to age and disability
 - Metal implants
- ❖ If contrast agents will be used for CT scan, MRI, or arthrography, the patient is assessed for possible allergies.

5. Bone densitometry

- ❖ used to estimate bone mineral density.
- ❖ Use of x-rays or ultrasound.

6. Bone scan

- ❖ Detect:
 - Metastatic and primary bone tumors
 - Osteomyelitis
 - Some fractures
 - Aseptic necrosis.
- ❖ A bone-seeking radioisotope is injected into the joint.
- ❖ The scan is performed 2 to 3 hours after the injection
- ❖ **Nursing Interventions:**
 - The nurse inquires about possible allergies to the radioisotope
 - Assess for any condition that would contraindicate performing the procedure (eg, pregnancy)
 - Encourage the patient to drink plenty of fluids to help distribute and eliminate the isotope
 - The patient is asked to empty the bladder before the procedure because a full bladder interferes with accurate scanning of the pelvic bones.
 - A sterile dressing is applied after aspiration.
 - There is a risk of infection after this procedure.

7. Electromyography

- ❖ Provides information about the electrical potential of the muscles and the nerves leading to them.
- ❖ The test is performed to evaluate muscle weakness, pain, and disability.
- ❖ Needle electrodes are inserted into selected muscles, and responses to electrical stimuli are recorded on an oscilloscope.
- ❖ Warm compresses may relieve residual discomfort after the study.

8. Biopsy

- ❖ Biopsy may be performed to determine the structure and composition of bone marrow, bone, muscle, or synovium to help diagnose specific diseases.
- ❖ The nurse monitors the biopsy site for edema, bleeding, pain, and infection. Ice is applied as prescribed to control bleeding and edema.
- ❖ Analgesic agents are administered as prescribed for comfort.

9. Arthroscopy

- ❖ Procedure that allows direct visualization of a joint to diagnose joint disorders.

Uses:

- Treatment of tears, defects, and disease processes.
- ❖ The procedure is performed in the operating room under sterile conditions; injection of a local anesthetic agent into the joint or general anesthesia is used
- ❖ **Complications:**
 - Infection
 - Hemarthrosis
 - Neurovascular compromise
 - Thrombophlebitis
 - Stiffness
 - Effusion
 - Adhesions
 - Delayed wound healing.
- ❖ **Nursing Interventions:**
 - After the arthroscopic procedure, the joint is wrapped with a compression dressing to control swelling.
 - Ice may be applied to control edema and enhance comfort.
 - Frequently, the joint is kept extended and elevated to reduce swelling.
 - It is important to monitor and document the neurovascular status.
 - Analgesic agents are administered as needed.
 - The patient is instructed about activities and exercises that may be performed.

10. Arthrocentesis

- ❖ (Joint aspiration) is carried out to obtain synovial fluid for purposes of examination or to relieve pain to effusion.
- ❖ Normally, synovial fluid is clear, pale, straw colored, and scanty in volume.
- ❖ Using aseptic technique, the physician inserts a needle into the joint and aspirates fluid

Nursing Interventions:

- Anti-inflammatory medications may be injected into the joint
- A sterile dressing is applied after aspiration.

PATIENT IN A CAST

Definition

- ❖ A rigid external immobilizing device that is molded to the contours of the body.
- ❖ **Mold-** used for splinting the affected part of the body wherein there is an infection, swelling and wound

Purposes

- ❖ Immobilize a reduced fracture
- ❖ Correct deformity
- ❖ Apply uniform pressure to underlying soft tissue
- ❖ Support and stabilize weakened joints

Types of Casts

❖ Casts in the Trunk Area

- **Collar Cast**
 - ✓ affectation of the cervical spine
- **Body Cast**
 - ✓ affectation of the lower thoracic and upper lumbar spine
- **Minerva Cast**
 - affectation of the cervical and the upper dorsal spine.
- **Rizzer's Jacket**
 - ✓ affectation of the thoraco-lumbar spine; for scoliosis
- **Shoulder spica cast**
 - ✓ affectation of the upper portion of the humerus and the shoulder joint
- **Sugar Tong**
 - ✓ compound affectation of the humerus with open wound, inflammation and swelling

❖ Casts in the Upper Extremities

- **Short arm circular cast**
 - ✓ affectation of the carpals and metacarpals
- **Short arm posterior mold**
 - ✓ affectation of the carpals and metacarpals with open wound, inflammation or swelling
- **Munster/ Fuenster Cast**
 - ✓ affectation of the radius-ulna with callus formation
- **Long arm circular cast**
 - ✓ affectation of the radius-ulna
- **Hanging cast**
 - ✓ affectation of the shaft of the humerus;
- **Functional Cast**
 - ✓ affectation of the shaft of the humerus with callus formation
- **Airplane cast**
 - ✓ affectation of the neck of humerus; recurrent shoulder dislocation
- **Thumb spica cast**
 - ✓ Affectation of the first metacarpal bone

❖ Casts in the Lower Extremities

- **Short leg circular cast**
 - ✓ affectation of tarsals and metatarsals
- **Short leg posterior mold**
 - ✓ affectation of tarsals and metatarsals with open wound, inflammation or swelling
- **Walking cast**
 - ✓ affectation of tarsals and metatarsals with callus formation
- **Long Leg Circular Cast**
 - ✓ affectation of tibia-fibula
- **Long leg Posterior mold**
 - ✓ affectation of tibia-fibula with open wound, inflammation and swelling
- **Patellar Tendon Bearing cast**
 - ✓ affectation of tibia-fibula with callus formation
- **Delvitt cast**
 - ✓ affectation of the distal third of tibia-fibula with callus formation
- **Cylinder cast**
 - ✓ affectation of the patella with open wound, inflammation or swelling
- **Ischial weight bearing cast**
 - affectation of the shaft of femur with callus formation
- **Basket cast**
 - for massive bone injury of the patella to facilitate wound dressing

- **Cast brace**

fracture of the distal third of femur and proximal third of tibia with callus formation

- **Single hip spica cast**
affectation of one hip and one femur
- **One and one half cast**
affectation of two hips and one femur
- **Double hip spica cast**
affectation of two hips and two femur
- **single hip spica mold**
affectation of one hip and one femur with open wound, inflammation or swelling
- **Pantalon case**
affectation of pelvis
- **Frog cast**
for congenital hip dysplasia
- **Internal rotator board**
for post hip surgery to maintain knee adduction
- **Night splint**
✓ for post poliomyelitis with contractures of hip and knee; applied at night only

Casting materials

❖ Fiberglass

- Made of an open-weave, no fabric impregnated with hardeners
- Water-activated polyurethane resin
- Lighter in weight
- Costly
- Stronger and more durable
- Water resistant
- Dries completely within 10 to 15 minutes
- Can bear weight within 30 minutes

❖ Plaster Cast

- Rolls of crinoline with powdered anhydrous calcium sulfate (gypsum crystals) mixed with water swells and forms into a hard cement
- Traditional
- Plaster of Paris
- Less costly
- Achieve a better mold not as durable and take longer to dry
- Requires 24 to 72 hours to dry completely

Materials/ Instruments in cast Application or Removal

- ❖ Stockinette
- ❖ Wadding sheet and gauze bandage
- ❖ Plaster of Paris/ fiberglass
- ❖ Trimming knife
- ❖ Cast spreader
- ❖ Stryker cast cutter
- ❖ Bandage scissors

Cast Techniques

❖ Windowing

- Putting a hole on a cast on the site of an open wound of the casted extremity.
- Purposes:

Visualization
Inspection

Dressing
Application of medications

❖ Bivalving

- Cutting the cast into two halves from the upper portion to the bottom part
- Purposes:

Relieving possible cast tightness

X-ray

Inspection of the casted extremity

❖ Reinforcing

- Reapplication of Plaster of Paris
- Purpose:
Regaining its strength in case of wetting the cast which resulted to its instability.

Nursing Management for Casts

- ❖ The nurse should prepare the patient for the sensation of increasing warmth so that the patient does not become alarmed.
- ❖ Promote cast drying
 - Do not cover
 - Leave exposed to circulating air.
- ❖ Handle damp plaster cast with palms of the hands
- ❖ Do not rest the cast on hard surfaces or sharp edges that can dent soft cast.
- ❖ Control swelling and pain
 - Elevate immobilized extremity to heart level
 - Apply intermittent ice bag if prescribed
 - Take analgesic agents as prescribed.
- ❖ Report pain uncontrolled by elevation and analgesics, may indicate compartment syndrome or pressure ulcer
- ❖ Avoid excessive use of injured extremity; observe prescribed weight-bearing limits
- ❖ Manage minor skin irritation
 - Pad rough edges with tape
 - Relieve itching
 - Blow cool air from hair dryer
 - Do not insert objects inside the cast.
- ❖ Check neurovascular status (8 P's)
- ❖ Report promptly to physician:
 - Uncontrolled swelling and pain
 - Cool, pale fingers or toes
 - Paresthesia
 - Paralysis
- Purulent drainage staining cast
- Signs of systemic infection
- Cast breaks

PATIENT IN SPLINTS AND BRACES

Splints

- ❖ May be used for conditions that do not require rigid immobilization
- ❖ Immobilize and support the body part in a functional position and must be well padded to prevent pressure, skin abrasion and skin breakdown.
- ❖ For short-term use

Examples Of Splints

Cock-up Splint- For wrist drop

Banjo Splint- For peripheral nerve injury

Oppenheimer- For radial nerve injury

Lively Finger Splint- For fracture of the finger

Arm sling- To support affected upper extremity

Braces

- ❖ Mechanical support for weakened muscles, joints and bones in rehabilitation

Purposes:

- Provide support
- Control movement
- Prevent additional injury.

- ❖ For longer use

Example of Braces

- ❖ **Collar Brace**

- For cervical spine affectation
- Shantz and Philadelphia

- ❖ **Four Poster Brace**

- For cervical spine and upper thoracic spine affectation

- ❖ **Somi Brace**

- Sterno- Occipito- Mandibular Immobilizer
- Forester Brace
- Cevico-thoraco-lumbar spine affectation

- ❖ **Knight Taylor Brace**

- Affectation of the upper thoracic spine

- ❖ **Chair Back Brace**

- For lumbo-sacral spine affectation

- ❖ **Jewette Brace**

- For dorso lumbar and upper lumbar spine affectation

- ❖ **Milwaukee Brace**

- For scoliosis
- Affectation of T9 and below

- ❖ **Yamamoto Brace**

- For scoliosis
- Affectation of T9 and above

- ❖ **Scottish Rite**

- For Coxa Plana or Legg Calve Perthes Disease

- ❖ **Long Leg Brace**

- For post poliomyelitis with residual paralysis

- ❖ **Short Leg Brace**

- For clubfoot

- ❖ **Dennis Browne Shoe**

- For congenital clubfoot (Talipes Equino-Varus)

Nurse Management

- Assess the neurovascular status before application
- Nurse gives information about the underlying pathologic condition and the purpose and expectations of the prescribed treatment regimen.
- Prepare the patient for the application of the cast, brace, or splint by describing the anticipated sights, sounds, and sensations
- Evaluate pain associated with the musculoskeletal condition

Alert: A patient's unrelieved pain must be immediately reported to the physician to avoid possible paralysis and necrosis.

- The nurse monitors circulation, motion, and sensation of the affected extremity
- Normal findings include minimal edema, minimal discomfort, pink color, warm to touch, rapid capillary refill response, normal sensations, and ability to exercise fingers or toes

Eight "P"'s

- ❖ Pain
- ❖ Pallor
- ❖ Pulselessness
- ❖ Paresthesia
- ❖ Paralysis
- ❖ Poikilothermia (Cold extremity)
- ❖ Poor capillary refill
- ❖ Poor hair growth

Complication

- ❖ Compartment Syndrome
 - Occurs when there is increased tissue pressure within a limited space that compromises the circulation and the function of the tissue within the confined area
 - **Management:**
 - ✓ The cast must be bivalved (cut in half longitudinally) while maintaining alignment
 - ✓ Extremity must be elevated no higher than heart level to ensure arterial perfusion
 - ✓ A fasciotomy may be necessary to relieve the pressure within the muscle compartment.
- ❖ Pressure Ulcers
 - Main Pressure sites:
 - ✓ Heel
 - ✓ Malleoli
 - ✓ Dorsum of the foot
 - ✓ Head of the fibula
 - ✓ Anterior surface of the patella.
 - ✓ Medial epicondyle of the humerus
 - ✓ Ulnar styloid
 - Pain and tightness in the area.
 - A warm area on the cast or brace suggests underlying tissue erythema
 - The drainage may stain the cast 7 brace and emit an odor
 - Bivalve or cut an opening (window) in the cast.
- ❖ Disuse Syndrome
 - Muscle atrophy and loss of strength brought about by immobilization hum cast, brace and splint
- ❖ Tense or contract muscles (eg, isometric muscle contraction) without moving the part
- ❖ Muscle-setting exercises
 - Quadriceps-setting
 - Gluteal-setting exercises

NURSING MANAGEMENT FOR PATIENT'S WITH IMMOBILIZED EXTREMITIES

Upper:

- ❖ Frequent rest periods are necessary.
- ❖ To control swelling, the immobilized arm elevated.
- ❖ A **sling** may be used when the patient ambulates
- ❖ **Volkman's contracture**, a specific type of compartment syndrome. Contracture of the fingers and wrist occurs as the result a' obstructed arterial blood flow to the forearm and hand. Permanent damage develops.
- ❖ Neurovascular checks must be done frequently

Lower:

- ❖ The patient's leg must_ be supported on pillows to heart level to control swelling
- ❖ Ice packs should be applied as prescribed over the fracture site for 1 or 2 days.

- ❖ The patient is taught to elevate the immobilized leg when seated.
- ❖ The patient should also assume a recumbent position several times a day with the immobilized leg elevated to promote venous return and control swelling.
- ❖ Nerve function is assessed by observing the patient's ability to move the toes and by asking about the sensations in the foot.

Alert: Injury to the peroneal nerve as a result of pressure is a cause of footdrop (the inability to maintain the foot in a normally flexed position). Consequently, the patient drags the foot when ambulating.

NURSING MANAGEMENT FOR PATIENT WITH SPICA BODY CAST

- ❖ Assisting with skin care and hygiene,
- ❖ The nurse turns the patient as a unit toward the uninjured side every 2 hours to relieve pressure and to allow the cast to dry.
- ❖ The nurse turns the patient to a prone position, twice daily if tolerated, to provide postural drainage of the bronchial tree and to relieve pressure on the back.
- ❖ The nurse inspects the skin around the edges of the cast frequently for signs of irritation.
- ❖ The perineal opening must be large enough for hygienic care. Monitoring for **cast syndrome**
 - **Psychological component** is similar to a claustrophobic reaction.
 - Physiologic cast syndrome responses (eg, superior mesenteric artery syndrome) are associated with immobility in a body cast. Ileus may occur.
 - **Management:**
 - ✓ Decompression (nasogastric intubation connected to suction)
 - ✓ Intravenous (IV) fluid therapy until gastrointestinal motility is restored
 - ✓ The abdominal window must be enlarged if the abdomen restricts.

Alert: The nurse monitors the patient in a large body cast for potential cast syndrome, noting bowel sounds every 4 to 8 hours, and reports distention, nausea, and vomiting to the physician.

THE PATIENT WITH AN EXTERNAL FIXATOR

External fixators

- ❖ Used to manage open fractures with soft tissue damage.
- ❖ Provides stable support for severe comminuted (crushed or splintered) fractures while permitting active treatment of damaged soft tissues
- ❖ The fracture is reduced, aligned, and immobilized by a series of pins inserted in the bone.
- ❖ Pin position is maintained through attachment to a portable frame

Nursing Management:

- ❖ After the external fixator is applied, the extremity is elevated to reduce swelling.
- ❖ If there are sharp points on the fixator or pins, they are covered with caps to prevent device-induced injuries.
- ❖ Monitor the neurovascular status of the extremity every 2 to 4 hours
- ❖ Assess each pin site for redness, drainage, tenderness, pain, and cleaning each pin site separately one or two times a day with cotton-tipped applicators soaked in chlorhexidine solution.
- ❖ If signs of infection are present or if the pins or clamps seem loose, the nurse notifies the physician.
- ❖ The nurse encourages isometric and active exercises as tolerated

Alert: The nurse never adjusts the clamps on the external fixator frame. It is the physician's responsibility to do so.

THE PATIENT IN TRACTION

- ❖ **Traction** is the application of a pulling force to a part of the body.
- ❖ **Purposes:**
 - Minimize muscle spasms
 - To reduce, align, and immobilize fractures
 - To reduce deformity
 - To increase space between opposing surfaces
- ❖ **Principles:**
 - Traction must be continuous to be effective in reducing and immobilizing fractures.

- Skeletal traction is never interrupted.
- Weights are not removed unless intermittent traction is prescribed.
- Any factor that might reduce the effective pull or alter its resultant line of pull must be eliminated:
- The patient must be in **good body alignment** in the center of the bed when traction is applied.
- Ropes must be **unobstructed**.
- Weights must **hang freely** and should not rest on the bed or floor.
- Knots in the rope or the footplate must not touch the pulley or the foot of the bed.

TYPES OF TRACTION

- ❖ **Skin Traction**- traction applied to the skin, non-invasive
- ❖ **Skeletal traction**- traction applied directly to the bony skeleton, invasive
- ❖ **Manual traction**- traction applied with the hands, temporary traction that may be used when applying a cast, giving skin care under a Buck's extension foam boot, or adjusting the traction apparatus.

SKIN TRACTION

- ❖ Used to control muscle spasm and to immobilize an area before surgery.
- ❖ Pulling force is applied to the skin, transmitted to the muscle, then to the bones.
- ❖ The amount of weight applied must not exceed the tolerance of the skin.

ADHESIVE SKIN TRACTION

- ❖ Use of adhesive tape, elastic bandage, wooden spreader and wadding sheet

1. Dunlop Traction

- Affection of Supracondylar of the humerus

2. Zero Degrees Traction

- Affection of the surgical neck of the humerus and the shoulder joint

3. Buck's Extension Traction

- Is skin traction to the lower leg
- Affection of the hip and the femur

Nursing Interventions:

- ❖ Avoid wrinkling and slipping of the traction bandage and to maintain countertraction.
- ❖ Proper positioning must be maintained to keep the leg in a neutral position.

Skin Breakdown

- ❖ Removes the foam boots to inspect the skin, the ankle, and the Achilles tendon three times a day.
- ❖ Provides back care at least every 2 hours to prevent pressure ulcers. The patient who must remain in a supine position is at increased risk for development of a pressure ulcer.
- ❖ Uses special mattress overlays (eg, air-filled, high density foam) to prevent pressure ulcers.

Nerve Damage

- ❖ The nurse should immediately investigate any complaint of a burning sensation under the traction bandage or boot.

Circulatory Impairment

- ❖ Nurse assesses the foot within 15 to 30 minutes and then every 1 to 2 hours.
- ❖ Circulatory assessment consists of the following:
 - Peripheral pulses
 - Color
 - Capillary refill
 - Temperature of the fingers or toes

4. Bryant Traction

- The Affection of the hip and femur for children below 3 yrs. Old

5. Boot Cast Traction

- For post poliomyelitis with residual paralysis of the hip and knee

NON-ADHESIVE SKIN TRACTION

- ❖ Use of canvas, slings, leathers, straps with buckles, laces and ribbons

1. Head Halter Traction

- For cervical spine affection

2. Pelvic Girdle Traction

- For Lumbo-sacral spine affection
- For Herniated Nucleus Pulposus

3. Cotrel Traction

- For Scoliosis
- A combination of head halter and pelvic girdle Traction

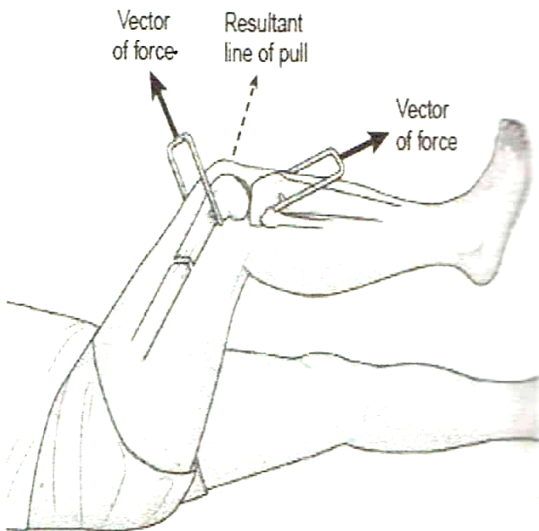
4. Hammock Suspension Traction

- For affection of the pelvis
- For Malgained Fracture (double fractures of the pelvic ring causing instability of the pelvis)

5. Bohler Braun Splint

- Supports the lower leg
- For fracture of Proximal 3rd and Middle 3rd of tibia-fibula.

SKELETAL TRACTION



- ❖ Skeletal traction is applied directly to the bone by use of a metal pin or wire that is inserted through the bone distal to the fracture, avoiding nerves, blood vessels, muscles, tendons, and joints.
- ❖ Skeletal traction frequently uses 7 to 12 kg (15 to 25 lb) to achieve the therapeutic effect
- ❖ Supports the affected extremity off the bed and allows for some patient movement without disruption of the line of pull.

1. Kirschner's wire holder

- Affection of the radius ulna
- Thinner than the Steinmann's pin

2. Steinmann's pin holder

- Affection of the humerus, femur, tibia, fibula

3. Crutchfield tong

- Affection of the upper dorsal cervical Spine

- Inserted at the parietal area

4. Balanced suspension traction

- Affection of the hips and or femur

5. Overhead traction

- Supracondylar Fracture of the humerus

6. Ninety-ninety degrees Traction

- Subtrochanteric and 3rd fracture of femur

7. Halo-pelvic traction

- For C-type Scoliosis

8. Halo-femoral traction

- For S-type Scoliosis

9. Stove-in Traction

- For massive rib fracture

❖ Nursing Interventions:

- Maintain alignment of the patient's body in traction
- Avoid foot drop (plantar flexion), inward rotation (inversion), and outward rotation (eversion)
- Protect the elbows and heels and inspect them for pressure ulcers.
- Assess neurovascular status at least every hour for the first 4 hours.
- The nurse encourages the patient to do active flexion—extension ankle exercises and isometric contraction of the calf muscles (calf-pumping exercises) 10 times an hour while awake to decrease venous stasis.
- Anti-embolism stockings, compression devices, and anticoagulant therapy may be prescribed to help prevent thrombus formation
- Pin site care is performed initially one or two times a day.
- Chlorhexidine solution is recommended as the most effective cleansing solution; however, water and saline are alternate choice.
- The nurse must inspect the pin sites every 8 hours for reaction and infection
- Patients permitted to take showers within 5 to 10 days of pin insertion are encouraged to leave the pins exposed to water flow.

Alert: The nurse must never remove weights from skeletal traction unless a life-threatening situation occurs. Removal of the weights completely defeats their purpose and may result in injury to the patient.

❖ Complications:

1. Atelectasis and Pneumonia

- The nurse auscultates the patient's lungs every 4 to 8 hours
- To assess respiratory status:
 - ✓ Teach the patient deep breathing and coughing exercises to aid in fully expanding the lungs and clearing pulmonary secretions

2. Constipation and Anorexia

- Diet:
 - high in fiber and fluids may help stimulate gastric motility
- Therapeutic measures may include stool softeners, laxatives, suppositories, and enemas.
- To improve the patient's appetite, the patient's food preferences are included, as appropriate, within the prescribed therapeutic diet

3. Urinary Stasis and Infection.

- The patient is encouraged to drink fluids to prevent dehydration and associated hemoconcentration, which contribute to stasis.

4. Venous Thromboembolism

- The nurse monitors the patient for signs of DVT, including unilateral calf tenderness, warmth, redness, and swelling (increased calf circumference).

BALANCED SKELETAL TRACTION

- ❖ Equipment
 - Ropes

- ✓ Thigh (short)
- ✓ Traction (long)
- ✓ Suspension (longest)
- Foot board/foot pedal
 - ✓ For foot support
 - ✓ Avoid foot drop
- **Paper clips/Safety Pins**
- **Slings**
 - ✓ Wider and longer for thigh part
 - ✓ Shorter for leg part
- **Splints/Attachments**
 - ✓ Pearson Attachment
 - ✓ Rest Splint
 - ✓ Thomas Splint (with half ring)
- **Weight Bags (2)**
 - ✓ Traction - 10% of the patient's body weight
 - ✓ Suspension - 50% or 1/2 of the traction bag
- ❖ **Checking the efficiency of traction**
 - Flex the unaffected leg
 - Hold-on the overhead trapeze
 - Swing the affected leg
 - ✓ Forward and backward
 - ✓ Side by side (right and left)
- ❖ **Principles:**
 - Avoidance of friction
 - ✓ Ropes run freely along the groove of the pulley
 - ✓ Knots away from the pulley
 - Continuous traction
 - Observe wear and tear on the bags and ropes
 - Weight bags hanging freely
 - Line of pull in line with deformity
 - ✓ 1ST pulley in line with the inguinal/groin area
 - ✓ 2ND pulley in line with the knee
 - ✓ 3rd pulley in line with the 1ST and 2nd pulley
 - Opposite pull or Countertraction
 - ✓ Patient's weight
 - Supine/ Dorsal Recumbent position
- ❖ **Nursing Interventions:**
 - General hygiene and comfort
 - Sponging of affected leg
 - Conditioning exercises
 - ✓ Deep and Coughing exercises
 - ✓ Dorsiflexion and plantar flexion of toes to prevent foot drop
 - ✓ Active ROM to unaffected extremity
 - ✓ Static quadriceps to affected extremity
 - ✓ Alternate contraction and relaxation
 - Prevention of complications
 - ✓ Hypostatic Pneumonia
 - Deep breathing
 - Keep back dry
 - Frequent turning/ repositioning
 - ✓ **Bed sore/Decubitus ulcer**
 - Linen free from wrinkles and crumbs
 - Keep back dry

- Lift buttocks (use of overhead trapeze)
- Frequent turning/repositioning
- Massage
- ✓ **Joint contractures and muscle atrophy**
- ✓ **Constipation / UTI**
 - Increase fluid and roughage diet
 - Exercise
 - Bedpan at regular interval
 - Repositioning
- ✓ **Infection/ neurovascular status of affected extremity**
 - Aseptic technique
 - Sterile dressing
- ✓ **Provide diversional activities**
- ✓ **Meet nutritional needs**
- Vit. C, Calcium and Protein
- ✓ **Pertinent inspection and observation of the patient**
- Attend to any complaint

THE PATIENT UNDERGOING ORTHOPEDIC SURGERY

- ❖ Patients with severe joint pain and disability may undergo joint replacement.
- ❖ **Nursing Management:**
 - **Preventing Infection**
 - ✓ Preoperative skin preparation frequently begins 1 or 2 before the surgery.
 - ✓ Prophylactic antibiotic 60 minutes prior to incision are effective in preventing postoperative infection
 - ✓ Culture of the joint during surgery may be important in identifying and treating subsequent infections.
 - ✓ Persistent infection at the site of the prosthesis usually requires removal of the implant and joint revision.
 - **Promoting Ambulation**
 - ✓ Assist the patient in achieving the goal of independent ambulation.
 - ✓ The nurse encourages transferring to a chair several times a day for short periods and walking for progressively greater distance.

TOTAL HIP REPLACEMENT

- ❖ Replacement of a severely with an:
 - **Artificial joint**
 - **Osteoarthritis**
 - **Rheumatoid arthritis**
 - **Femoral neck fractures**
 - **Failed prosthesis**
 - **Osteotomy**
 - **Legg-Calve-Perthes**
- ❖ **Nursing Management:**
 - **Preventing Dislocation of Prosthesis**
 - ✓ Maintenance of the femoral head component in the acetabular cup
 - ✓ Positioning the leg in **abduction**, which helps prevent dislocation of the prosthesis.
 - ✓ The use of an **abduction** splint, a wedge pillow or two or three pillows between the legs keeps the hip in abduction.
 - ✓ The patient's hip is **never flexed more than 90 degrees**.
 - ✓ **High-seat (orthopedic) chairs**, semi-reclining wheelchairs, and raised toilet seats are used to minimize hip joint flexion
 - ✓ The patient should not cross his or her legs.
 - ✓ The patient should not bend at the waist to put on shoes and socks.
 - ✓ If a prosthesis becomes dislocated, the nurse (or the patient, if at home) immediately notifies the surgeon.

• **Monitoring Wound Drainage**

- ✓ Drainage of **200 to 500 mL** in the first hours is expected
- ✓ The nurse promptly notifies the physician of any drainage volumes greater than anticipated.

• **Preventing Deep Vein Thrombosis**

- ✓ Anti-embolism stockings
- ✓ Signs of DVT include calf pain, swelling, and tenderness.
- ✓ Medications:
 - Fondaparinux (Arixtra)
 - Low-molecular-weight heparin (eg, enoxaparin [Lovenox], dalteparin [Fragmin])

• **Preventing Infection**

- ✓ Potential sources of infection are avoided.
- ✓ Prophylactic antibiotics are prescribed if the patient needs any future surgical or invasive procedures
- ✓ Severe infections may require surgical debridement or removal of the prosthesis
- ✓ If an infection occurs, antibiotics are prescribed.

TOTAL KNEE REPLACEMENT

- ❖ considered for patients who have severe pain and functional disabilities related to destruction of joint surfaces by osteoarthritis or rheumatoid arthritis.
- ❖ Nursing Management:
 - ❖ The knee is dressed with a compression bandage.
 - ❖ Ice may be applied to control edema and bleeding.
 - ❖ The nurse assesses the neurovascular status of the leg.
 - ❖ It is important to encourage active flexion of the foot every hour when the patient is awake.
 - ❖ Preventing complications
 - ❖ A wound suction drain removes fluid accumulating in the joint
 - ❖ If extensive bleeding is anticipated, an autotransfusion can be used.
 - ❖ Use of a continuous passive motion

(CPM) device which increases circulation and range of motion of the knee joint is recommended.

AMPUTATION

- ❖ The removal of a body part, often an extremity.
- ❖ Causes:
 - Peripheral Vascular Disease (Diabetes Mellitus)
 - Fulminating gas gangrene
 - Crushing injuries
 - Burns
 - Frostbite
 - Electrical Burns
 - Ballistic injuries
 - Congenital deformities
 - Chronic osteomyelitis
 - Malignant tumor
- ❖ Purposes:
 - Relieve symptoms
 - Save or improve the patient's quality of life
- ❖ **Levels of Amputation**
 - Most distal point that will heal successfully.
 - Factors:
 - ✓ Circulatory adequacy
 - ✓ Type of prosthesis
 - ✓ Function of the part
 - ✓ Muscle balance
 - Objectives:
 - ✓ Conserve as much extremity length as needed to preserve function
 - ✓ Achieve a good prosthetic fit
- **Upper extremities**

- ✓ Above Elbow (AE)
- ✓ Below Elbow (BE)

- **Lower extremities**

- ✓ Above knee (AK)
- ✓ Knee disarticulation
- ✓ Below Knee (BK)
- ✓ Syme (modified ankle disarticulation amputation)

- **Complications**

- ✓ **Hemorrhage**- severed blood vessels
- ✓ **Infection**- risk with all surgical procedures
- ✓ **Skin breakdown**-due to prosthesis
- ✓ **Phantom Limb Pain**- caused by the severing of peripheral nerves.
- ✓ **Joint Contracture**- caused by positioning and a protective flexion withdrawal pattern associated with pain and muscle imbalance.

❖ **Nursing Interventions**

- **Relieving Pain**

- ✓ Surgical pain can be effectively controlled with opioid analgesics
- ✓ Placing a light sandbag on the residual limb to counteract the muscle spasm.

- **Minimizing Altered Sensory**

Perceptions

Phantom Limb pain- unusual sensations, such as numbness, tingling or muscle cramps, feeling that the extremity is present, crushed, cramped or twisted in an abnormal position.

Acknowledge these feelings as real

Encourage the patient to verbalize when in pain

Keep the patient active

Early intensive rehabilitation, residual limb desensitization with kneading massage

Distraction techniques

Local anesthetics

Beta-blockers to relieve burning discomfort

Anti-depressant to improve mood and coping ability

Promoting Wound Healing

- ✓ Wrap the residual limb with an elastic compression bandage to prevent edema

Enhancing Body Image

- ✓ Encourage the patient to look at, feel and care for the residual limb

Helping the Patient to Resolve Grieving

- ✓ Encourage the patients to express and share their feelings and work through the grief process.

Promoting Independent Self-care

Helping the Patient to Achieve Physical Mobility

- ✓ Proper positioning
- ✓ Abduction, external rotation and flexion of the lower extremity are avoided.
- ✓ The residual limb is placed in extended position or elevate for brief period of time
- ✓ To prevent flexion contracture of the hip:
 - The residual limb should not be placed on a pillow
 - Turn side to side Assume prone position
- ✓ To prevent abduction deformity:
 - The legs should be closed together
- ✓ Use assistive devices when performing self-care
- ✓ Postoperative Range of Motion exercises are done early to prevent contractures
- ✓ Environmental barriers are identified to promote safety
- ✓ A well-fitting shoe with a non-skid sole should be worn
- ✓ The patient with an upper extremity amputation may wear a cotton T-shirt to prevent contact between the skin and shoulder harness and to promote reabsorption of perspiration
- ✓ The residual limb must be shaped into a conical form to permit accurate fit, maximum comfort, and function of the prosthetic device
- ✓ Adjustment of the prosthetic sockets occur during the first 6 months to 1 year after surgery

• **Monitoring and Managing Potential Complications**

✓ **Massive hemorrhage**

- A large tourniquet should be in plain sight at the patients bedside
- Notifies the surgeon in the event of excessive bleeding

✓ **Infection**

- Antibiotic as prescribed
- Careful skin hygiene
- The healed residual limb is washed and dried gently at least twice daily
- Monitor the drainage. Mark the stain on the bandage to know if there is increasing drainage which suggests infection

PROVIDING RANGE OF MOTION EXERCISES

❖ **Active Range of Motion Exercises**

- Isotonic exercises in which the clients move each joint in the body through its complete range of movement, maximally stretching all muscle groups within each plane over the joint.
- **Guidelines:**
 - ✓ Perform each ROM exercise as taught to the point of slight resistance, but not beyond, and never to the point of discomfort.
 - ✓ Perform the movements systematically, using the same sequence during each session
 - ✓ Perform each exercise three times
 - ✓ Perform each series of exercises twice daily

❖ **Passive Range of Motion Exercises**

- Another person moves each of the client's joints through its complete range of movement, maximally stretching all muscle groups within each piece over each joint
- **Guidelines:**
 - ✓ Support the client's limb above and below the joints as needed to prevent muscle strain or injury done by cupping joints in the palm of hand or cradling limbs along your forearm
 - ✓ Avoid moving or forcing a body part beyond the existing range of motion
 - ✓ If muscle spasticity occurs, stop temporarily but continue to apply slow, gentle pressure on the part until the muscle relaxes, then proceed with the motion.

❖ **Active-assistive Range of Motion Exercises**

- The client uses a stronger, opposite arm or leg to move each of the joints of a limb incapable of active motion.
- This activity increases active movement on the strong side of the client's body and maintains joint flexibility on the weak side
- Clients who require passive ROM exercises after a disability should have a goal of progressing to active-assistive ROM exercises and, finally, to active ROM exercises.

ASSISTIVE DEVICES

CANES

❖ **Two Types:**

- **Standard cane**- straight-legged cane
- **Quadcane**- has four feet and provides the most support

❖ **Principles:**

- Hold the cane with the hand on the stronger side of the body to provide maximum support and appropriate body alignment when walking
- Position the tip of a standard cane (and the nearest tip of other canes) about 15 cm (6 inches) to the side and 15cm (6

inches) in front of the near foot, so that the elbow is slightly flexed

- Move the cane and weak leg, weight is borne by the stronger leg
- Move the stronger leg, weight is borne by the cane and the weak leg

CRUTCHES

❖ **Kinds of Crutches:**

- **Underarm or Axillary crutch**
- **Lofstrand crutch**- extends only to the forearm

❖ **Principles:**

- The weight should be borne by the arms rather than the axillae (armpits).
- Continual pressure on the axillae can injure the radial nerve and eventually cause crutch palsy (weakness of the muscles of the forearm, wrist and hand)
- Maintain an erect posture as much as possible to prevent strain on muscles

❖ **Measuring Clients for crutches**

• **Method 1:**

- ✓ Client lies supine position
- ✓ Nurse measures from the anterior fold of the axilla to the heel of the foot
- ✓ Add 2.5 cm (1 in)

• **Method 2:**

- ✓ Client stands erect and positions the crutch with elbow flexion angle of 30 degrees
- ✓ Nurse makes sure the shoulder rest on crutch is at least 3 fingers widths, that is, 2.5 to 5 cm (1 to 2 in) below the axilla.

❖ **Crutch Gaits**

• **Crutch stance**

✓ **Tripod (triangle position)**

- Crutches are placed about 15 cm (6 in) in front of the feet and out laterally about 15 cm (6 in)

• **Four-point gait**

- ✓ Most elementary
- ✓ Safest gait
- ✓ Provides at least three points of support at all times
- ✓ Used when walking in crowds
- ✓ Needs to bear weight on both legs.
 1. Move the right crutch ahead a suitable distance
 2. Move the left front foot forward
 3. Move the left crutch forward
 4. Move the right foot forward

• **Three-point gait**

- ✓ The two crutches and the unaffected leg bear weight alternately
 1. Move both crutches and the weaker leg forward
 2. Move the stronger leg forward

• **Two-point alternate gait**

- ✓ Faster than the four-point gait
- ✓ Require more balance because only two points support the body at one time
- ✓ Requires least partial weight bearing on each foot
 1. Move the left crutch and the right foot forward
 2. Move the right crutch and the left foot ahead together.

• **Swing-To Gait**

- ✓ Used by clients with paralysis of the legs and hips
- ✓ Prolonged use of this gait results in atrophy of the unused muscles. The swing-to gait is the easier of these two gaits.
 1. Move both crutches ahead Together
 2. Lift body weight by the arms and swing to the crutches

• **Swing-Through Gait**

- ✓ Requires considerable skill, strength and coordination

1. Move both crutches forward together
 2. Lift body weight by the arms and swing through and beyond the crutch
- **Going up stairs**
 - ✓ Transfer the body weight to the crutches and move the unaffected leg onto the step
 - ✓ Transfer the body weight to the unaffected leg on the step and move the crutches and affected leg up to the step
 - ✓ The affected leg is always supported by the crutches.
 - **Going down Stairs**
 - ✓ Shift the body weight to the unaffected leg, and move the crutches and affected leg down onto the next step
 - ✓ Transfer the body weight to the crutches, and move the unaffected leg to that step
 - ✓ The affected leg is always supported by the crutches

LOW BACK PAIN

CAUSE

- Acute lumbosacral strain
- Unstable lumbosacral ligaments
- Weak back muscles
- Osteoarthritis of the spine
- Spinal stenosis
- Intervertebral disk problems unequal Leg length and obesity

CLINICAL MANIFESTATIONS

- Pain radiating to the legs (radiculopathy) or (sciatica) - presence of this signifies nerve involvement
- Leg motor strength, and sensory perception maybe affected.
- Increased muscle tone of the back postural muscles
- Loss of the normal lumbar curve and possible spinal deformity.

MEDICAL MANAGEMENT

- Priority is pain management
- Most back pain is self-limiting and resolves within 4 weeks with analgesics and rest
- Tylenol and non-steroidal anti-inflammatory drugs (NSAIDs) (eg., ibuprofen)
- Muscle relaxants
- TCA (eg., amitriptyline [Elavil]) are effective in relieving chronic back pain
- Opioids (eg., Morphine, tramadol and benzodiazepines)

NONPHARMACOLOGIC INTERVENTIONS

- Application of superficial heat
- Chiropractic therapy-spinal manipulation).
- Acupuncture, massage and yoga are all effective non pharmacologic interventions for Chronic Back pain not Acute back pain

NURSING INTERVENTIONS

- Avoid twisting, Bending, lifting, and reaching all of which put on stress on the back
- Change positions frequently
- Sitting should be limited to 20 to 50 mins
- Bed rest for 2 days max of 4 days if pain is severe
- Proper body mechanics
- Major goal is pain relief
- Improved physical mobility and weight, reduction
- A bed board is recommended for use instead of a soft mattress
- **Avoid prone position**

BURSITIS AND TENDINITIS

- ❖ Bursae are fluid filled sacs that prevent friction between joints structures during joint activity.
- ❖ Inflammation causes proliferation of synovial membrane and pannus formation, which restricts joint movement
- ❖ Inflammatory conditions that commonly affect the shoulders

TREATMENT

- Arthroscopic synovectomy may be considered if shoulder and weakness persist

NURSING MANAGEMENT

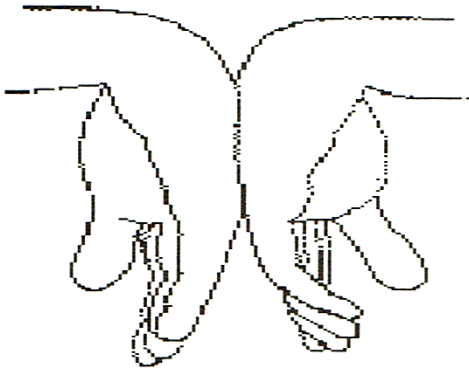
- Rest of the extremity
- Intermittent ice and heat application
- NSAID's to control the pain

CARPAL TUNNEL SYNDROME

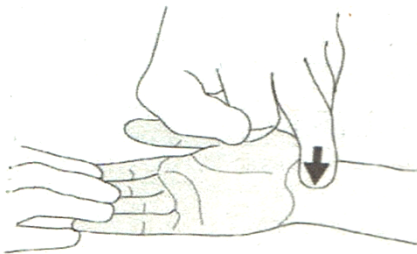
- ❖ Entrapment Neuropathy that occurs when the **median nerve at the wrist is compressed** by a thickened flexor tendon sheath, skeletal encroachment, edema or soft tissue mass
- ❖ Common to women between 30 to 60 years of age
- ❖ Caused by repetitive hand and wrist movement
- ❖ Hands are repeatedly exposed to cold temperatures, vibration or extreme direct pressure

ASSESSMENT

Pain along the median nerve



Phalen's Test Place the backs of both of your hands together and hold the wrists in forced flexion for a full minute. (Stop at once if sharp pain occurs) . If this produces numbness or "pins and needles" along the thumb side half of the hand, you most likely have Median nerve entrapment (Carpal Tunnel Syndrome)



Tinel's sign may be elicited in patients with carpal tunnel syndrome by percussing lightly over the median nerve, located on the inner aspect of the wrist. If the patient reports tingling, numbness, and pain, the test for Tinel's sign is considered positive

TREATMENT

- Intra-articular injections of corticosteroids and oral corticosteroids
- Application of wrist splints to prevent hyperextension and flexion of the wrist
- Traditional open nerve release or endoscopic laser surgery are the two most common surgical management options

NURSING MANAGEMENT

- The patient may need assistance with personal care and ADLs. Full recovery of motor and sensory function after either type of nerve release surgery may take several weeks or months.

GANGLION

- ❖ Collection of gelatinous material usually on the dorsum of the wrist.
- ❖ The ganglion is locally tender and may cause aching pain.

TREATMENT

- Aspiration and corticosteroid injection or surgical excision after treatment, a compression dressing and immobilization splint are used.

DUPUYTREN'S DISEASE

- ❖ Slowly progressive contracture of the palmar fascia

ASSESSMENT

- Flexion of the fourth and fifth finger and frequently the middle finger.
- It renders the fingers more or less useless
- Hereditary
- Common in men older than 50 yrs
- Dull-aching discomfort, morning numbness, cramping, and stiffness in the affected fingers

TREATMENT

- Intranodular injections of corticosteroids (eg, triamcinolone) may prevent contractures
- With contracture development, palmar and digital fasciectomy are performed to improve function.

OSTEOPOROSIS

- ❖ (Porous bones) it is a disease of bones that leads to increased risk of fracture. Bone mineral density is reduced. Bone micro architecture deteriorates

RISK FACTORS

- Caucasian or Asian
- Female
- Post menopause
- Advanced age
- Decreased calcitonin
- High phosphate
- Intake of carbonated beverages
- Sedentary lifestyle
- Lack of weight-bearing exercise
 - Medications eg:
 - ✓ Corticosteroids
 - ✓ Anti-seizure medications
 - ✓ Heparin
 - ✓ Thyroid hormone

"these medications affect calcium absorption and metabolism"

TYPES

- ❖ Primary osteoporosis occurs in women after menopause (usually between the ages of 45 and 55 years) Failure to develop optimal peak bone mass during childhood, adolescence and young adulthood contributes to the development of osteoporosis.
- ❖ Secondary osteoporosis Is a result of medications or other conditions and diseases that affect bone metabolism
 - **Diseases:** celiac disease., hypogonadism
 - **Medications:** corticosteroids, antiseizure medications

The degree of osteoporosis is related to the duration of medication therapy.

Patients who have had **bariatric surgery** are at increased risk for osteoporosis as the duodenum is bypassed, which is the primary site for absorption of calcium as are patients who have **gastrointestinal diseases** that cause malabsorption (eg, celiac disease).

ASSESSMENT

- Loss of height
- Respiratory dysfunction
- Increased risk of subsequent fractures,

especially hip fractures

- Colles fractures of the wrist.
- Development of kyphosis (ie, "dowagers hump")

DIAGNOSIS

- Osteoporosis may be undetectable on routine x-rays until there has been 25% to 40% demineralization, resulting in radiolucency of the bones Osteoporosis is diagnosed by **dual-energy x-ray absorptiometry (DXA)**

TREATMENT

- Elderly need to consume approximately **1200 mg** of daily calcium and **vitamin D** it adequate to maintain bone remodeling and body functions.
- Percutaneous vertebroplasty or kyphoplasty (injection of polymethylmethacrylate **bone cement** into the fractured vertebra, followed by inflation of a pressurized balloon to restore the shape of the affected vertebra
- Regular **weight-bearing exercise** promotes bone formation.
- From 20 to 30 minutes of aerobic exercise (eg, walking), 3 days or more a week, is Recommended

PHARMACOLOGIC THERAPY

- **Calcitonin** (miacalcin) directly inhibits osteoclasts, thereby reducing bone loss and increasing bone mass density.
 - ✓ Calcitonin is administered by nasal spray or by subcutaneous or intramuscular injection. It should not be prescribed for patients with seafood allergies
- **Teriparatide** (Forteo) is subcutaneously administered anabolic agent that is administered once daily. As a recombinant it stimulates osteoblasts to build bone matrix and facilitates overall calcium absorption
- **Bisphosphonates** that include daily or weekly oral preparations of alendronate (Fosamax) or risedronate (Actonel),

NURSING INTERVENTIONS

Assess risk for and prevent injury in client's personal environment.

- Assist client to identify and correct hazards in his or her environment.
- Position household items and furniture for an unobstructed walkway
- Use side rails to prevent falls
- Instruct in use of assistive devices such as a cane or walker
- Instruct the client in the use of good body mechanics.
- Instruct the client in exercises to strengthen abdominal and back muscles to improve posture and provide support for the spine.
- Instruct the client to avoid activities that can cause vertebral compression.
- Instruct the client to eat a diet high in protein, calcium, vitamins C and D, and iron.
- Instruct the client to avoid alcohol and coffee.
- Administer calcium, vitamin D, and phosphorus as prescribed for bone metabolism.
- Administer calcitonin as prescribed to inhibit bone loss.
- Administer estrogen or androgens to decrease the rate of bone resorption as prescribed.

OSTEOMALACIA

- ❖ Metabolic bone disease characterized by inadequate mineralization of bone softening and weakening of the skeleton

ASSESSMENT

- Pain, tenderness to touch, bowing of the bones, and pathologic fractures
- Skeletal deformities (spinal kyphosis)
- Bowed legs give patients an unusual appearance and a waddling or limping gait.

PATHOPHYSIOLOGY

The primary defect in osteomalacia is a **deficiency of activated vitamin D** (calcitriol), which promotes calcium absorption from the gastrointestinal tract and facilitates mineralization of bone. Without adequate vitamin D, calcium and phosphate are not moved to calcification sites in bones.

CAUSES

- Malabsorption syndrome or from excessive loss of calcium from the body.
- Gastrointestinal disorders
 - ✓ Celiac disease

- ✓ Chronic biliary tract obstruction,
- ✓ Chronic pancreatitis
- ✓ Small bowel resection
- ✓ Liver and kidney diseases

- Severe renal insufficiency results in acidosis. The body uses available calcium to combat the acidosis, and Parathyroid hormone stimulates the release of skeletal calcium in an attempt to reestablish a physiologic pH
- Hyperparathyroidism leads to skeletal Decalcification
- Prolonged use of anti-seizure medication (eg, phenytoin [Dilantin], phenobarbital) poses a risk of osteomalacia
- Insufficient vitamin D (dietary, sunlight). malnutrition (deficiency in vitamin D often associated with poor intake of calcium

ASSESSMENT AND DIAGNOSTIC FINDINGS

- On x-ray studies, generalized demineralization of bone is evident.
- **Laboratory studies show low serum calcium and phosphorus levels**
- moderately elevated alkaline phosphatase concentration
- Bone biopsy demonstrates an increased amount of osteoid, a demineralized, cartilaginous bone matrix that is sometimes referred to as "prebone."

MEDICAL MANAGEMENT

- If osteomalacia is caused by malabsorption, increased doses of vitamin D, along with supplemental calcium
- **Nursing alert**
High doses of vitamin D are toxic and increase the risk for hypercalcemia,
- Exposure to sunlight may be recommended; ultraviolet radiation transforms a cholesterol substance (7-dehydrocholesterol) present in the skin into vitamin D
- Some persistent orthopedic deformities may need to be treated with braces or surgery (eg, osteotomy may be performed to correct long bone deformity)

PAGET'S DISEASE

- ❖ Paget's disease (osteitis deformans) is a disorder of localized rapid bone turnover, most commonly affecting the **skull, femur, tibia, pelvic bones, and vertebrae**

ASSESSMENT

- Skeletal deformities
- **Bowing of the femur**
- **Enlargement of the skull**
- **Deformity of pelvic bones**
- **Occurrence of cortical thickening of the long bones**
- Patient may report that a hat no longer fits
- Patient may report that a hat no longer fits
- This give the face a small, triangular appearance
- Most patient with skull involvement have **impaired hearing** from cranial nerve compression and dysfunction.
- Femurs and tibia tend to bow, producing a **waddling gait**.
- **Spine is bent** forward and is rigid
- Pain, tenderness, and **warmth over the bones may be noted**. The temperature of the skin overlying the affected bone increases because of increased bone vascular

PATHOPHYSIOLOGY

- In Paget's disease, there is primary proliferation of osteoclasts, which induce bone resorption in population older than 50 years. As bone turnover continues, a classic **mosaic (disorganized) pattern of bone develops**. Because the diseased bone is highly vascularized and structurally weak, pathologic fractures develop

ASSESSMENT AND DIAGNOSTIC FINDINGS

- Elevated serum alkaline phosphatase
- Normal blood calcium levels
- **X-rays** confirm the diagnosis of Paget's disease
- local areas of demineralization and bone overgrowth produce characteristic **mosaic patterns** and irregularities

MEDICAL MANAGEMENT

- Pain usually responds to NSAIDs
- Gait problems from bowing of the legs are managed with walking aids, shoe lifts, and physical therapy

PHARMACOLOGIC THERAPY

- **Anti-osteoclastic** therapy medications reduce bone turnover
- **Calcitonin** retards bone resorption by decreasing the number and availability of osteoclasts.

- ✓ Side effect includes flushing of the face and nausea
- ✓ The effect of calcitonin therapy is evident in 3 to 6 months through reduction of bone loss and pain.
- **Plicamycin** (Mithracin), cytotoxic antibiotic This medication has dramatic effects on pain reduction and on serum calcium, alkaline phosphate, level
 - ✓ Administered by IV infusion diet with adequate calcium and vitamin

OSTEOMYELITIS

- ❖ Infection of the bone that result in inflammation, necrosis, and formation of new bone

CLASSIFICATION:

- **Hematogenous osteomyelitis** (ie. Due to bloodborne spread of infection)
- **Contiguous-focus osteomyelitis**, from contamination from bone surgery, open fracture, or traumatic injury (eg. Gunshot wound)
- **Osteomyelitis with vascular insufficiency**, seen most commonly among patients with diabetes and peripheral vascular disease,
 - ✓ Most commonly affecting the feet

RISK FACTORS

- Poor nourished
- Elderly
- Obese client
- Impaired immune systems
- Chronic illness (eg, diabetes, rheumatoid arthritis)
- Those receiving long-term corticosteroid

FACTS

- Bone infection are more difficult to eradicate than soft tissue infections because the **infected bone is mostly avascular** not accessible to the body's natural immune response
- It is also said that it has decreased penetration by antibiotics

CAUSATIVE ORGANISM

- **Staphylococcus aureus.** (most common)
- **Other organism**
 - ✓ Streptococci
 - ✓ Enterococci
 - ✓ Pseudomonas

CLINICAL MANIFESTATION

- In bloodborne infection, the onset is usually sudden, occurring often with the clinical and laboratory manifestation of sepsis (eg, chills, high fever, rapid pulse, general malaise).
- Pulsating pain that intensifies with movement as a result of the pressure of the collecting purulent material
- Non healing ulcer that overlies the infection bone with a connecting sinus that will intermittently and spontaneously drain pus

ASSESSMENT AND DIAGNOSTIC FINDINGS

- **Blood studies** reveal leukocytosis and an elevated ESR.
- **X-ray** findings demonstrate soft tissue edema
- In about 2 to 3 weeks, areas of periosteal elevation and bone necrosis are evident
- **Radioisotope bone scans** particularly the isotope-labeled white blood cell (WBC) scan, and magnetic resonance imaging (MRI) help with early definitive diagnosis

MEDICAL MANAGEMENT

- The area affected with osteomyelitis. is immobilized to decrease discomfort and to prevent pathologic fracture of the weakened bone

PHARMACOLOGIC THERAPY

- IV antibiotic therapy begins, based on the assumption that infection results from a staphylococcal organism that is sensitive to a penicillin or cephalosporin.
- The aims is to control the infection before the blood supply to the area diminishes as a result of thrombosis
- IV antibiotic therapy continues for 3 to 6 weeks

SURGICAL MANAGEMENT

- If the infection is chronic and does not respond to antibiotic therapy, **surgical debridement** is indicated

- The infected bone is surgically exposed, the purulent and necrotic material is removed, and the area is irrigated with sterile saline solution.
- **Antibiotic-impregnated beads** may be placed in the wound for direct application of antibiotics for 2 to 4 weeks
- All dead, infected bone and cartilage must be removed before permanent healing can occur.

NURSING INTERVENTION

- Management of osteomyelitis include the following:
 - ✓ Affected part may be immobilized with a splint to decrease pain and muscle spasm
 - ✓ Wound care
 - ✓ I.V antibiotic therapy
 - ✓ Monitor the patient for response to the treatment, signs and symptoms of super infections
 - ✓ Monitoring for adverse drug reaction

RHEUMATOID ARTHRITIS

- ❖ Is a systemic inflammatory disease which manifests itself in multiple joints of the body.
- ❖ The inflammatory process primarily affects the lining of the joints (synovial membrane), but can also affect other organs.
- ❖ The inflamed synovium leads to erosions of the cartilage and bone and sometimes joint deformity.
- ❖ Pain, swelling, and redness are common joint manifestations

CAUSE

- RA is believed to be the result of a faulty immune response. RA can begin at any age and is associated with fatigue and prolonged stiffness after rest.
- There is no cure for RA
- In RA, the autoimmune reaction primarily occurs in the synovial tissue.
- Phagocytosis produces enzymes within the joint. The enzymes break down collagen, causing edema, proliferation of the synovial membrane, and ultimately pannus formation

ASSESSMENT

- Bilateral and symmetric stiffness, tenderness, swelling, and temperature changes in the joints
- X-rays show bony erosions and narrowed joint spaces
- Arthrocentesis shows synovial fluid that is cloudy, milky, or dark yellow and contains numerous inflammatory components, such as leukocytes and complement

TREATMENT

- Corticosteroids
- Non-steroidal anti-inflammatory drugs (NSAIDs) then slowly progressed for fewer people to non-biologic disease-modifying antirheumatic drugs (DMARDs) and finally progressed for even fewer people to biologic DMARDs if people had not responded to the previous drugs.
- Today, a much more aggressive treatment approach is advocated for people with RA, with prescription of non-biologic DMARDs within three months of diagnosis

NURSING MANAGEMENT

- Enable the patient to maintain as much independence as possible,
- Take medications accurately
- Use adaptive devices correctly.
 - ✓ Teaching focuses on the disorder itself, the possible changes related to the disorder, the therapeutic regimen prescribed to treat it, the potential side effects of medications, strategies to maintain independence and function, and patient safety in the home

OSTEOARTHRITIS

- ❖ **Degeneration of cartilage** and its underlying bone within a joint as well as bony overgrowth.
- ❖ The breakdown of these tissues eventually leads to pain and joint stiffness
- ❖ "wear and tear" related to aging
 - The joint most commonly affected are the knees, hips, and those in the hands and spine.
 - The specific causes of are believed to be a result of both mechanical and molecular events in the affected joint.
 - Disease onset is gradual and usually begins after the age of 40.
 - There is current **no cure for OA**.
 - **Treatment for OA focus on relieving symptoms and improving functions** and can include a combination of patient education, physical therapy, weight control, and use of medications.
 - also known as **degenerative joint** disease
 - **Most common** form of arthritis.

Preventive measure can slow the progress if undertaken early enough:

- Weight reduction
- Joint rest
- Avoidance of joint overuse,
- Orthotic devices (eg, splints, braces to support inflamed joints,
- Isometric and posture exercise, and aerobic exercise

PHARMACOLOGIC THERAPY

- Initial analgesic therapy is acetaminophen
- NSAIDs
- Cox-2 enzyme blockers.
- Intra-articular corticosteroids

NURSING MANAGEMENT

- Pain management and optimal function ability are major goals of nursing intervention Weight loss and exercise are important approaches to pain and disability improvement
- Referral for physical therapy or to an exercise program for people with similar problems can be very helpful. Canes or other assistive device for ambulation should be considered
- Exercise such as walking should be begun in moderation and increased gradually

GOUT

- ❖ Genetic defect of purine metabolism that result in hyperuricemia
- ❖ Is a rheumatic disease resulting from deposition of uric acid crystals (monosodium urate) in tissue and fluids within the body.
- ❖ This process is caused by an overproduction or under excretion of uric acid.

ASSESSMENT

- Acute onset of excruciating pain in joint due to accumulation of uric acid within the joint
- Redness due to inflammation around the joint
- Nephrolithiasis (kidney stone) due to uric acid deposits in the kidney
- Uric and crystal accumulate in joints, most commonly the big toe (podagra)

DIAGNOSTIC FINDINGS

- The gold standards for diagnosing gout is aspiration and microscopic analysis for urate crystals in joint fluid or a tophi
- Elevated erythrocyte sedimentation rate (ESR)
- Elevated serum uric acid level

TREATMENT

- **Acute** treatment is managed with colchicine and nonsteroidal anti-inflammatory
- **Chronic gout** is treated with allopurinol or an uricosuric agent to reduce the amount of uric acid in the system
- Diet and lifestyle (weight loss, avoiding alcohol, reducing dietary purine intake) Modifications may help prevent future attacks.
- Immobilize the joint for comfort.

NURSING INTERVENTION

- Have the patient drink 3 liters of fluid per day to avoid crystallization of uric in the kidneys. Increased fluids help flush the uric acid through the kidney
- Assist with positioning for comfort
- Avoid touching inflamed joint unnecessarily
- Explain to patient which foods are high-purine proteins:
 - ✓ Turkey
 - ✓ Organ meats
 - ✓ sardines
 - ✓ smelts
 - ✓ mackerel
 - ✓ anchovies
 - ✓ herring
 - ✓ bacon
- Avoid alcohol, which inhibits renal excretion of uric acid.

SCOLIOSIS

- ❖ Scoliosis is a progressive condition causing the spine to curve or twist into a "C" or "S" shape.

Dextroscoliosis is a scoliosis with the convexity on the right side.

Levoscoliosis is a scoliosis with the convexity on the left side.

Rotoscoliosis: Pronounced rotation of the vertebrae

Cause is unknown or idiopathic. Contrary to common belief, scoliosis does not come from slouching, sitting in awkward positions, or sleeping on an old mattress

ASSESSMENT

- Uneven hip and shoulder levels
- Uneven musculature on one side of the spine
- Asymmetric rib cage
- Visible curvature of the spine
- Uneven pelvis

TREATMENTS

- Up to 20-degree curvature: Exercise to enhance muscle tone and posture.
- Between 20 and 40 degree curvature: Apply a brace to maintain curvature.
- Greater than 40 degree curvature: Spinal fusion surgery.
 - ✓ **Bracing** - for example the Milwaukee brace, bracing is done when the patient has bone growth remaining, and is generally implemented in order to hold the curve and prevent it from progressing to the point where surgery is necessary.

NURSING INTERVENTION

If spinal fusion surgery is performed:

- Use log rolling to reposition the child every 2 hours to inhibit development of pressure sores and to adequately inflate lungs.
- Monitor vital signs following surgery.
- Apply antiembolism stockings while the patient is on bed rest.
- Remove the antiembolism stocking for 1 hour three times a day.

LEGG-CALVE-PERTHES DISEASE

- ❖ This disease is characterized by necrosis of the femoral head that occurs in children between 2 and 12 years of age caused by a decreased blood supply to the femoral head
- ❖ This disease is **self-limiting**, and the child will fully recover after the disease has run its course

THREE STAGES OF LEGG-CALVE-PERTHES DISEASE:

1. **Avascular:** Blood supply to the head of the femur is interrupted within 1 year.
2. **Revascularization:** Creeping substitution occurs where connective and vascular tissue enter the necrotic bone causing live noncalcified bone to replace the necrotic tissue.
3. **Healing:** The bone ossifies over 3 years.

ASSESSMENT

- Pain in the groin
- Pain in the anterior thigh

DIAGNOSIS

Radiograph: Shows decreased bone mass, ossification centers, and possibly subchondral fracture

TREATMENT

- Legg-Calve-Perthes disease is self-limiting.
- Physical therapy to restore range of motion.
- Administer analgesic to reduce pain.

NURSING INTERVENTION

- Perform range-of-motion activities to maintain normal motion of the joint.
- Teach the patient how to use crutches.
- Explain to the parents and the patient that the disease is self-limiting and that the patient will fully recover once the disease has run its course.

FRACTURES

- ❖ A break in the continuity of the bone as a result of trauma, twisting, or bone decalcification
- ❖ Fractures occur when the bone is subjected to stress greater than it can absorb. Fractures may be caused by direct blows, crushing forces, sudden twisting motions, and extreme muscle contractions.

TYPES

- A complete fracture involves a break across the entire cross section of the bone and is frequently displaced (removed from its normal position).
- An incomplete fracture (eg, greenstick fracture) involves a break through only part of the cross-section of the bone.
- A comminuted fracture is one that produces several bone fragments. A closed fracture (simple fracture) is one that does not cause a break in the skin.
- An open fracture (compound, or complex, fracture) is one in which the skin or mucous membrane wound extends to the fractured bone.

ASSESSMENT

The clinical signs and symptoms of a fracture include acute pain, loss of function, deformity, shortening of the extremity, localized edema and ecchymosis

EMERGENCY MANAGEMENT

- Immediately after injury, if a fracture is suspected, it is important to immobilize the body part before the patient is moved. Adequate splinting is essential. Joints proximal and distal to the fracture must be immobilized to prevent movement of fracture fragments

Reduction:

- ✓ Restoring the bone to proper alignment

Closed reduction:

- ✓ Accomplished by manual alignment of the fragments, followed by immobilization

Open reduction:

- ✓ Surgical insertion of internal fixation devices, such as rods, wires, or pins, that help maintain alignment while healing occurs

BONE TUMORS

- ❖ Neoplasm of the musculoskeletal system

TYPES

BENIGN BONE TUMORS

- Benign tumors of the bone and soft tissue are more common than malignant primary bone tumors
- Slow growing
- Well circumscribed
- Encapsulated
- **Osteochondroma** is the most common benign bone tumor.
- It usually occurs as a large projection of bone at the end of long bones (at the knee or shoulder)

MALIGNANT BONE TUMORS

- Rare and arise from connective and supportive tissue cells (sarcomas) or bone marrow elements
- Osteosarcoma (ie, osteogenic sarcoma) is the most common and most often fatal primary malignant bone tumor.
- Prognosis depends on whether the tumor has metastasized to the lungs
- Appears most frequently in children, adolescents and young adults (in bones that grow rapidly)
- Most common sites are the distal femur, the proximal tibia, and the proximal humerus

METASTATIC BONE DISEASE

- Metastatic bone disease (secondary bone tumor) is more common than primary bone tumors
- Tumors arising from tissues elsewhere in the body that may invade the bone
- The most common primary sites of tumors that metastasize to bone are the kidney, prostate, lung, breast, ovary, and thyroid
- Most frequently attack the skull, spine, pelvis, femur, and humerus

CLINICAL MANIFESTATION OF PATIENTS WITH BONE TUMORS

- Have pain that ranges from mild an: occasional to constant and severe
- Varying degrees of disability Weight loss malaise, and fever may be present

ASSESSMENT AND DIAGNOSTIC FINDINGS

- Serum alkaline phosphatase levels are frequently elevated in osteogenic sarcoma
- Serum acid phosphatase in metastatic carcinoma of the prostate
- Hypercalcemia is present with bone metastases from breast, lung, or kidney cancer.
- A surgical biopsy is performed for histologic identification

MANAGEMENT FOR PRIMARY BONE TUMORS

- The goal of primary bone tumor treatment is to destroy or remove the tumor through:
 - ✓ Surgical excision
 - ✓ Radiation therapy
 - ✓ Chemotherapy
- Chemotherapy is started before and continued after surgery in an effort to eradicate micro metastatic lesions
- Chemotherapy may be delivered intra-arterially for patients with osteosarcoma

MANAGEMENT FOR SECONDARY BONE TUMORS

- The treatment of metastatic bone cancer es palliative
- Goal is to relieve the patient's pain and discomfort while promoting life.
- Patients with metastatic disease are at higher risk than other patients for postoperative pulmonary congestion
- Hypercalcemia results from breakdown of bone
- Treatment includes hydration with IV administration of normal saline solution; diuresis; mobilization; and medication such as bisphosphonates, (e.g. pamidronate [Aredia]) and calcitonin.

NURSING TREATMENT

- The nurse prepares the patient and gives support during painful procedures
- Prescribe IV or epidural analgesic medications are used during the early postoperative period
- Affected extremities should be support and handled gently.
- Prophylactic antibiotics and strict aspect dressing techniques are used to diminish the occurrence of osteomyelitis and wound infections
- The symptoms of hypercalcemia must be recognized and treatment initiated promptly