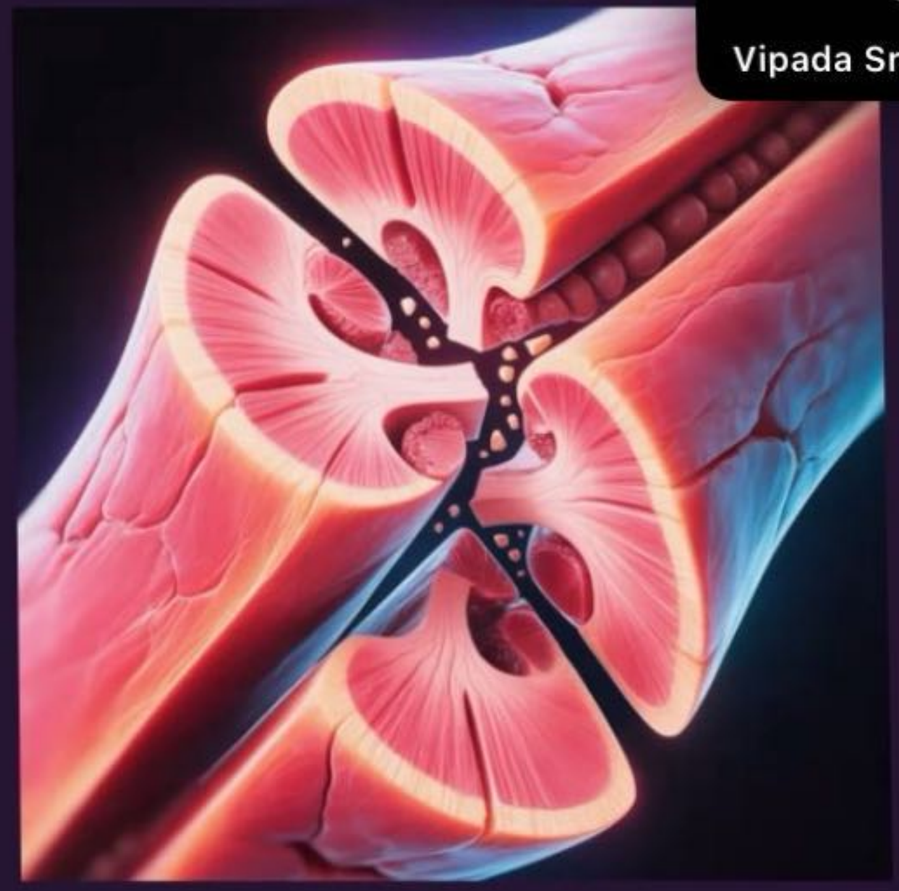
What is a Fracture?

Definition

A fracture is a break or discontinuity in bone tissue caused by external force exceeding the bone's strength, or from pathological conditions that weaken the bone. Fractures may affect surrounding tissues including muscles, blood vessels, nerves, and skin.

Common Causes

- Traumatic injuries from falls, collisions, or sports activities
- Repetitive stress leading to stress fractures
- Osteoporosis making bones fragile and prone to breaking
- Nutritional deficiencies, especially calcium and vitamin D
- Advanced age and muscle deterioration



Classification of Fractures

Closed vs. Open Fractures

Closed (Simple): Skin remains intact; no external wound. Lower infection risk.

Open (Compound): Bone fragments penetrate the skin; high infection risk requiring immediate intervention.

Complete vs. Incomplete

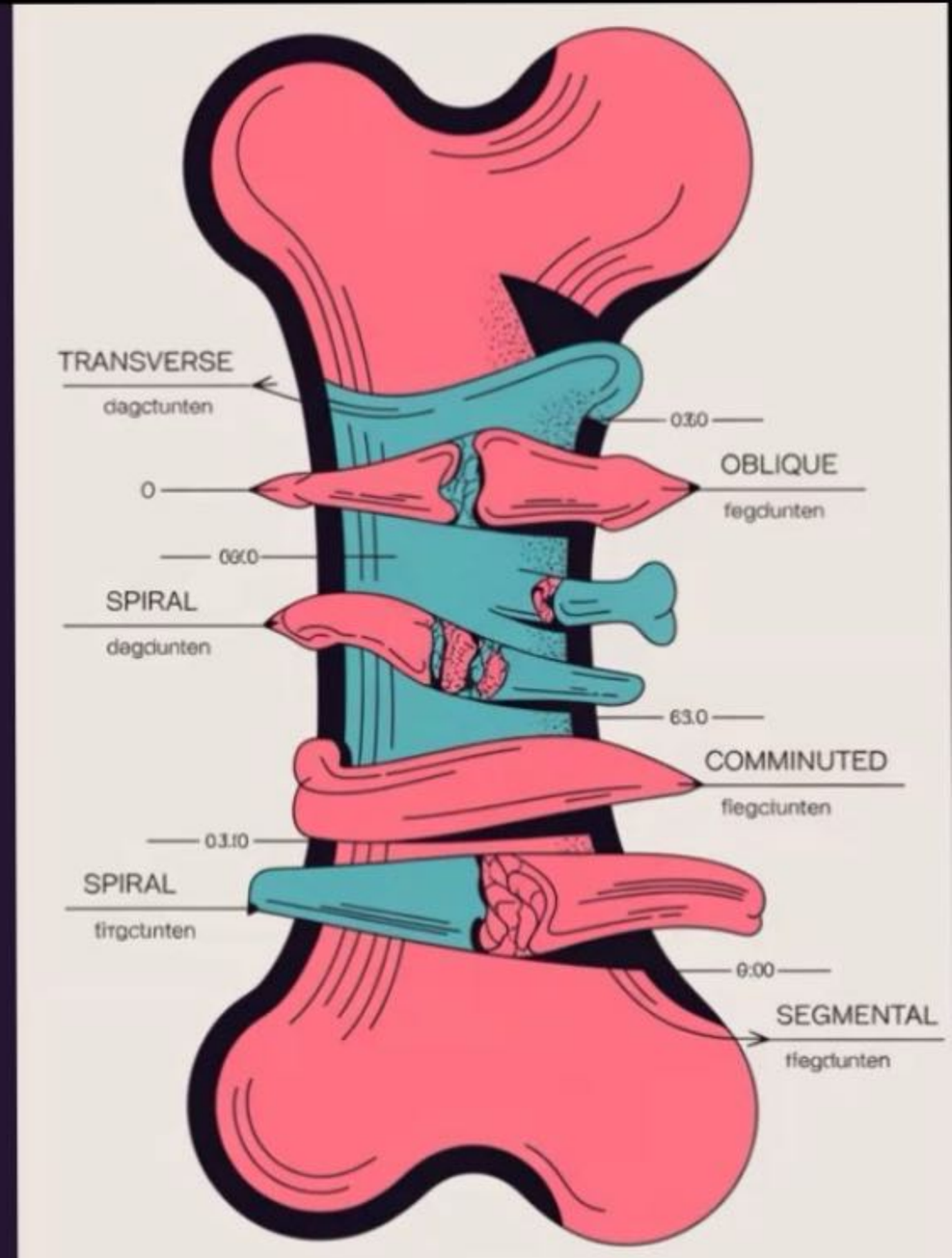
Complete: Bone is broken into two or more separate pieces.

Incomplete: Partial break; bone remains partially intact (e.g., greenstick fractures in children).

Displacement

Displaced: Bone fragments are misaligned and separated.

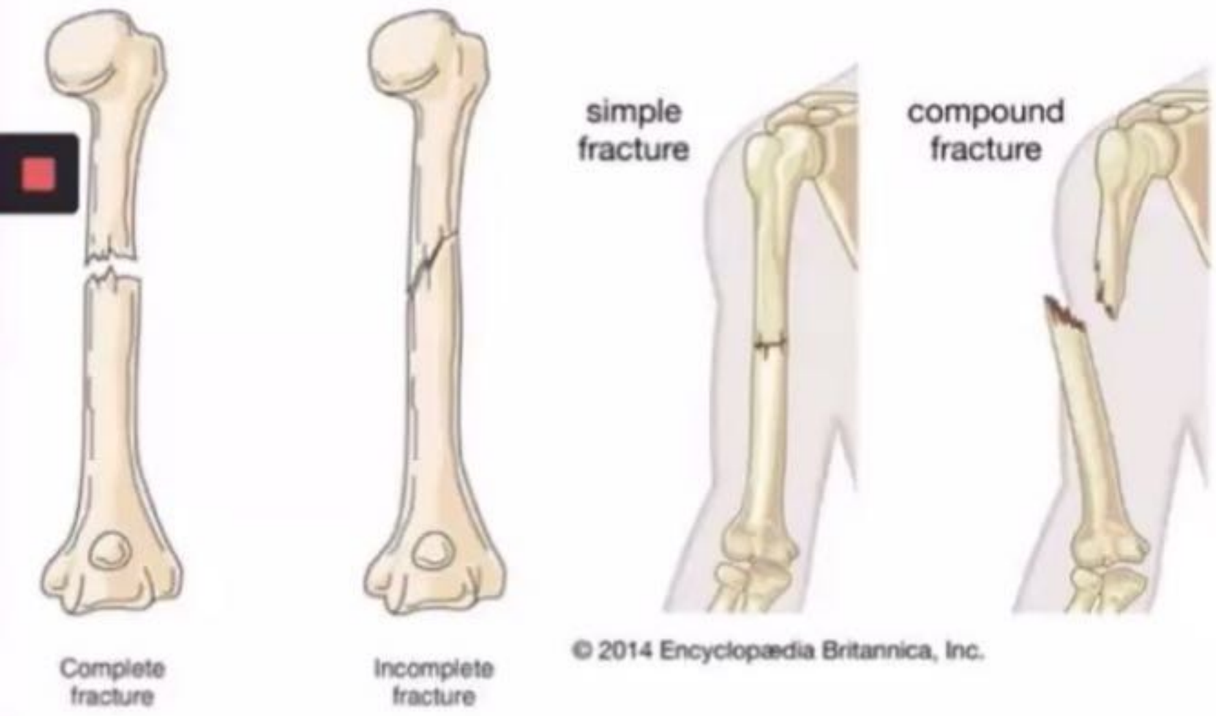
Non-displaced: Bone fragments maintain anatomical alignment.



Fractures bone

Musculoskeletal Injury

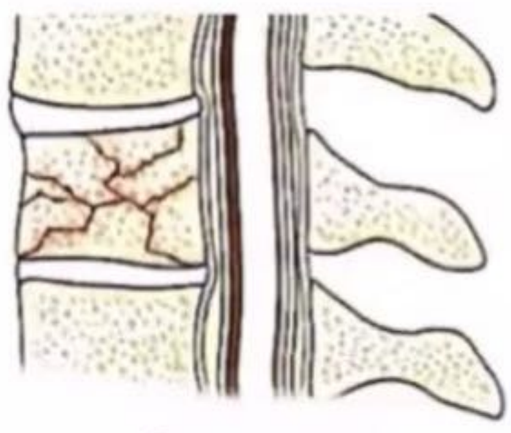
Type of Fractures bone



specific type of fracture

Pathologic
A fracture that occurs through an area of diseased bone (e.g., osteoporosis, bone cyst, Paget disease, bony metastasis, tumor), can occur without trauma or fall

Stress
A fracture that results from repeated loading of bone and muscle



Compression
A fracture in which bone has been compressed (seen in vertebral fractures)

Specific Fracture Types

Comminuted

Bone is splintered or crushed into three or more fragments. Common in high-impact trauma; requires complex management.

Impacted

One bone fragment is driven into another, causing compression. Often seen in vertebral fractures or hip fractures in elderly patients.

Spiral

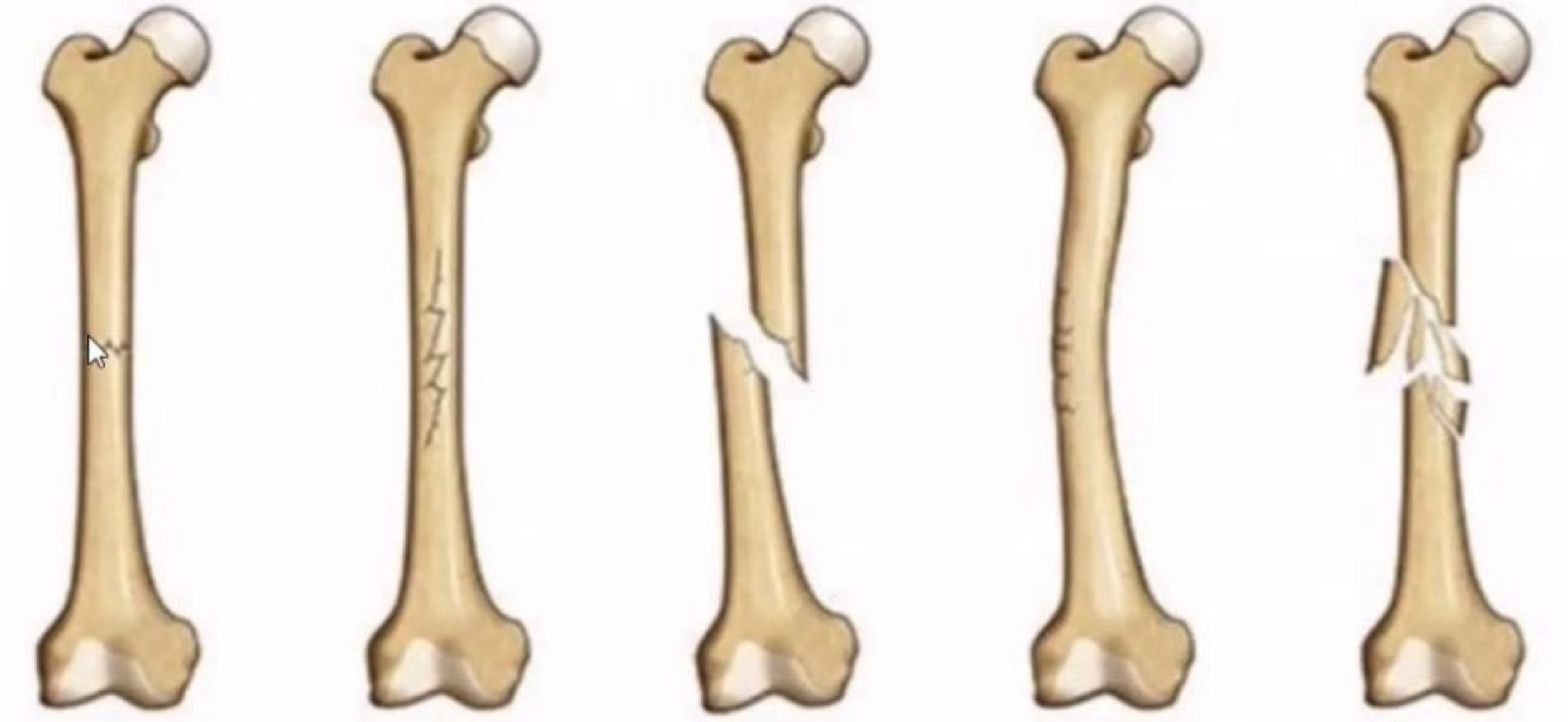
Results from twisting force; fracture line spirals around the bone shaft. Common in sports injuries and abuse cases.

Pathological

Occurs through diseased or weakened bone (osteoporosis, cancer, infection) with minimal trauma.

Stress Fracture

Hairline crack from repeated stress or overuse. Common in athletes and military recruits; diagnosed via MRI or bone scan.



Transverse

Stress

Oblique, Displaced

Greenstick

Comminuted

Scenario: Concept & Classification

A 72-year-old woman with osteoporosis falls in the bathroom and presents with severe right hip pain, leg shortening, and external rotation. X-ray shows a **displaced comminuted fracture** of the femoral neck.

1. Which definition best describes a fracture?

A. A joint dislocation
B. A ligament rupture
C. A muscle tear caused by overstretching
D. A break in bone continuity caused by external or internal factors

Pathophysiology of Bone Healing

Understanding the biological process of fracture healing enables nurses to provide phase-appropriate care, anticipate complications, and educate patients about realistic recovery timelines. Bone healing is a complex, sequential process that typically takes 6–12 weeks but varies based on fracture type, location, patient age, and comorbidities.

Inflammatory Phase (Days 1-5)

Hematoma forms at fracture site. Inflammatory cells arrive to remove debris. Pain, swelling, and heat are prominent. **Nursing focus:** pain management, immobilization, and edema control.

1

Reparative Phase (Weeks 2-6)

2

Soft callus forms as fibroblasts and osteoblasts produce collagen and cartilage. Gradually hardens into bony callus. **Nursing focus:** nutrition support (protein, calcium, vitamin D), prevent displacement.

Remodeling Phase (Months 3-12+)

Excess bone is resorbed; bone is reshaped along lines of stress. Strength gradually returns to normal. **Nursing focus:** gradual mobilization, rehabilitation exercises, and patient education.

3

Clinical Manifestations of Fractures

Key Signs and Symptoms

- **Pain:** Severe, localized, worsens with movement or weight-bearing
- **Swelling and bruising:** Due to bleeding into surrounding tissues
- **Deformity:** Abnormal shape, angulation, or shortening of limb
- **Loss of function:** Inability to move or bear weight on affected area
- **Crepitus:** Grating sensation from bone fragments rubbing together
- **Abnormal mobility:** Movement where it shouldn't occur

Nursing Alert: Always perform neurovascular assessment (5 P's: Pain, Pallor, Pulselessness, Paresthesia, Paralysis) to detect complications like compartment syndrome.

Medical Management: Assessment and Diagnosis

Clinical Assessment

Comprehensive history including mechanism of injury, time of occurrence, and associated symptoms. Physical examination assessing deformity, range of motion, neurovascular status, and associated injuries.

Radiographic Imaging

X-ray: Primary diagnostic tool showing bone alignment and fracture pattern. Minimum two views (anteroposterior and lateral) required for accurate assessment.

Advanced Imaging

CT Scan: Detailed views of complex fractures, especially in spine, pelvis, and joints. **MRI:** Evaluates soft tissue damage, ligament injuries, and occult fractures not visible on X-ray.

Laboratory Tests

Complete blood count (monitor for bleeding, infection), coagulation studies (pre-operative), calcium and vitamin D levels (assess bone health), creatine kinase (compartment syndrome).

Principles of Fracture Treatment

Reduction

Realignment of bone fragments to anatomical position. Essential for proper healing and restoration of function.

Immobilization

Maintaining bone alignment using casts, splints, traction, or fixation devices. Prevents displacement during healing.

Rehabilitation

Progressive restoration of function through exercises, physical therapy, and gradual return to activities.

Types of Fracture Reduction

Closed Reduction

Non-surgical realignment of bone fragments through manual manipulation under anesthesia. The physician applies traction and manipulation to restore anatomical position, confirmed by X-ray imaging.

Indications:

- Simple, non-displaced or minimally displaced fractures
- Stable fracture patterns
- Patient factors favor conservative management

Advantages:

- No surgical incision required
- Lower infection risk
- Shorter hospital stay
- Reduced cost

Open Reduction

Surgical procedure requiring incision to directly visualize and align bone fragments. Often combined with internal fixation using plates, screws, pins, or rods (ORIF: Open Reduction Internal Fixation).

Indications:

- Severely displaced or comminuted fractures
- Intra-articular fractures affecting joints
- Open fractures requiring debridement
- Failed closed reduction
- Neurovascular compromise

Considerations:

- Requires general or regional anesthesia
- Higher infection risk
- Longer recovery time
- May provide more stable fixation

Immobilization Methods

Casts

Rigid circumferential device made of plaster or fiberglass. Provides maximum immobilization for stable fractures. Requires careful monitoring for circulation, sensation, and swelling. Patient education on cast care is essential.

Splints

Non-circumferential, removable devices for temporary immobilization. Allow for swelling and provide easier access for wound care. Used for initial stabilization, unstable fractures with swelling, or post-operative support.

Traction

Application of pulling force to align and immobilize fractures. **Skin traction:** Force applied via straps (Buck's, Russell's). **Skeletal traction:** Pins inserted through bone for heavier weight and longer duration.

External Fixation

Metal frame attached to bone via percutaneous pins or wires. Used for severe open fractures, infected fractures, or when internal fixation is not feasible. Allows wound access while maintaining alignment.

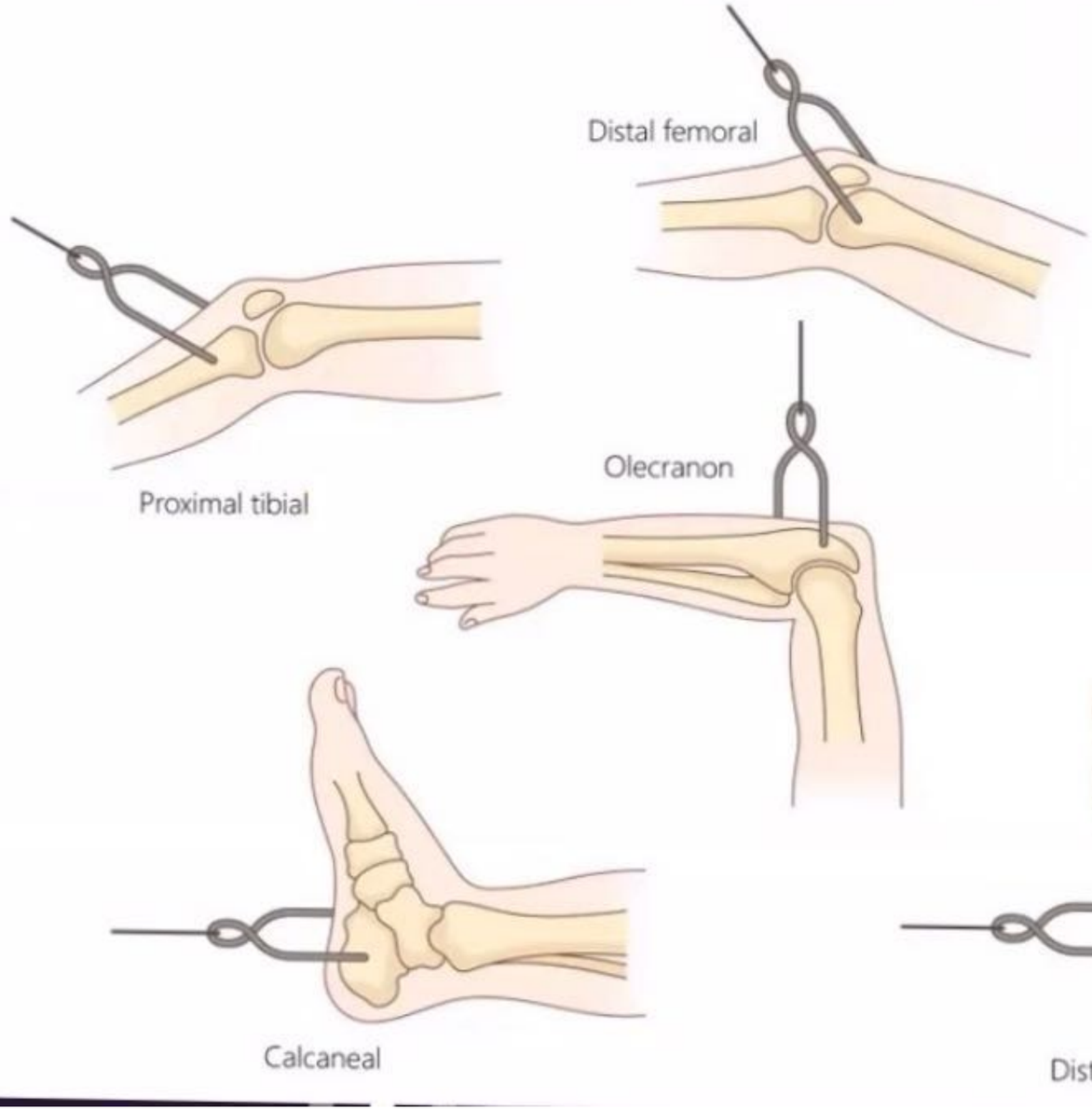
Internal Fixation

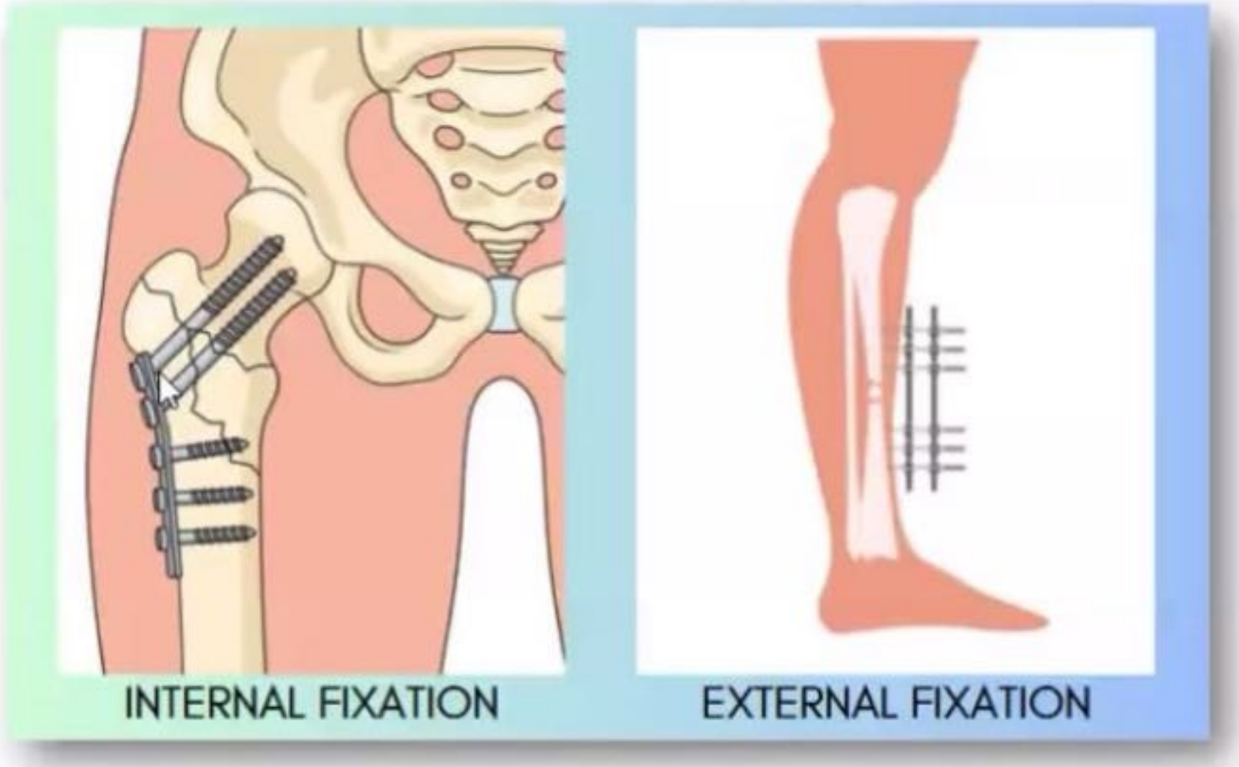
Surgical implantation of hardware (plates, screws, rods, pins) to stabilize fractures internally. Provides rigid fixation allowing early mobilization. Requires surgical incision with associated infection risks.

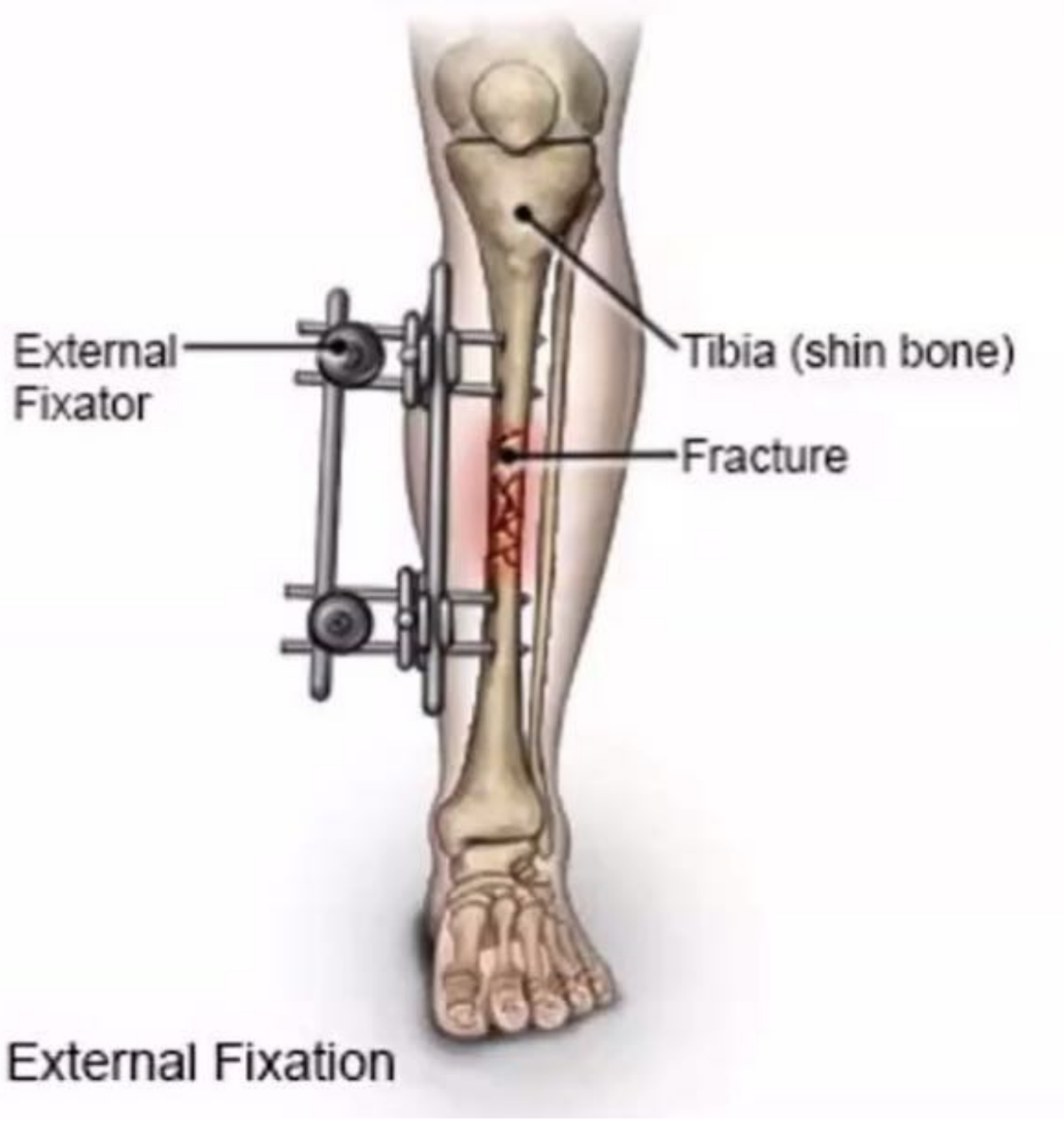
casts

splint

Skeletal Traction Sites







now

Which statement is TRUE about open reduction (ORIF)?

A. It has lower infection risk than closed reduction

B. It requires surgical exposure of the fracture site

C. It is used only for stable fractures

D. It does not require anesthesia

Pain Management Strategies

Assessment

Monitor pain using 0-10 pain scale every 4 hours or more frequently as needed. Document location, quality, and factors that worsen or relieve pain.

Pharmacological

Administer analgesics as prescribed: Paracetamol for mild pain, NSAIDs for inflammation, Opioids for severe pain. Follow pain ladder approach.

Non-Pharmacological

Apply ice packs during first 24-48 hours to reduce swelling. Elevate affected limb above heart level. Use relaxation techniques and distraction methods.

Positioning

Reposition patient regularly for comfort while maintaining proper alignment. Use pillows and support devices to reduce pressure on fracture site.

Potential Complications

Compartment Syndrome

Increased pressure within muscle compartment compromising blood flow. Requires immediate fasciotomy to prevent tissue death.

Fat Embolism

Fat globules enter bloodstream, potentially causing respiratory distress and altered mental status. Monitor for dyspnea and confusion.

Infection

Especially in open fractures. Can progress to osteomyelitis requiring prolonged antibiotic therapy and possible surgical debridement.

DVT/PE

Deep vein thrombosis and pulmonary embolism from immobility. Prevent with early mobilization, compression devices, and anticoagulants.

Delayed/Non-union

Failure of bone to heal properly within expected timeframe. May require bone grafting or electrical stimulation.

Recognizing Critical Complications

Compartment Syndrome

5 Ps: Pain (out of proportion), Pressure (tense compartment), Pallor (pale), Paresthesia (numbness), Pulselessness (late sign). Requires emergency fasciotomy. Most common after casting or crush injuries.

Infection

Signs include fever, increased pain, redness, warmth, drainage, foul odor. Open fractures at highest risk. Requires cultures, antibiotics, possible surgical debridement.

DVT and PE

Prevention: Early mobilization, compression devices, adequate hydration, anticoagulants as prescribed. DVT signs: calf pain, swelling, warmth. PE signs: sudden dyspnea, chest pain, tachycardia.

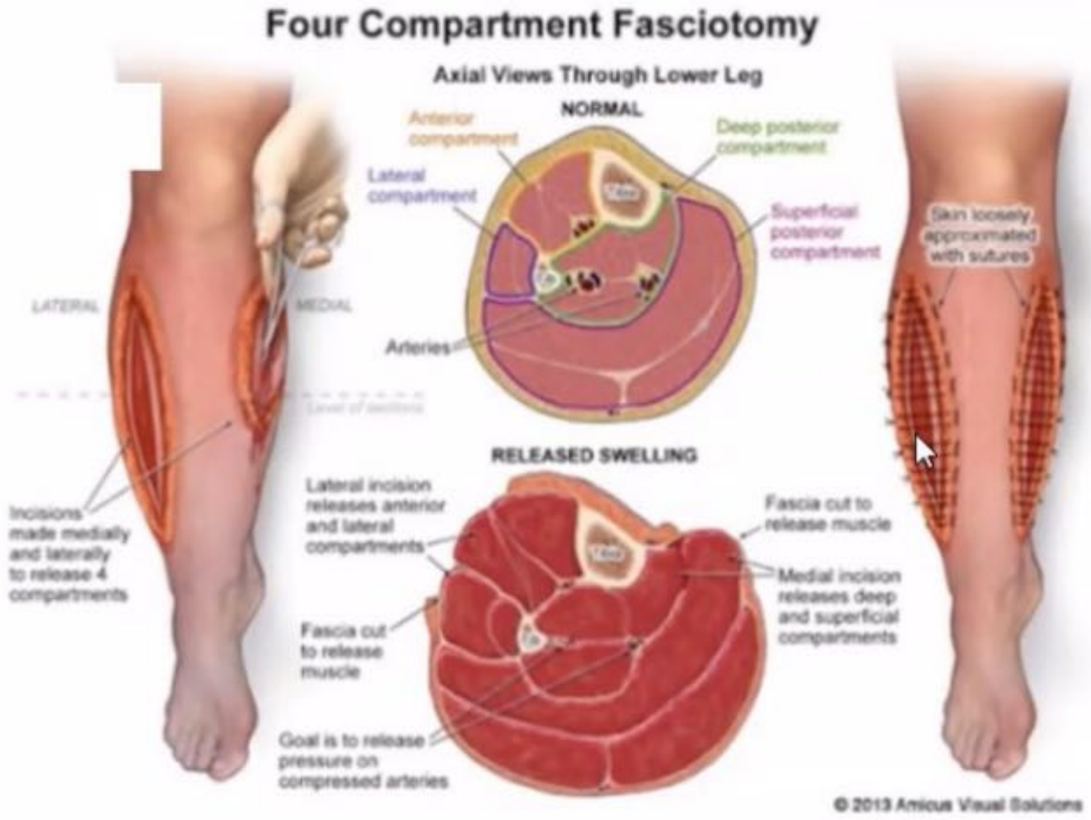
Pressure Sores

Prevention: Reposition every 2 hours, use pressure-relieving devices, keep skin clean and dry, massage bony prominences, use specialized mattresses for immobile patients.

Compartment syndrome

Musculoskeletal Injury

Acute serious complications in musculoskeletal trauma



10-20 mmHg

Internal cause

- ❑ Blood accumulation
- ❑ tissue edema
- ❑ fluid infiltration

External cause

- ➢ constricting dressing
- ➢ decrease size of compartment

most common at

- ✓ thigh
- ✓ lower leg
- ✓ foot
- ✓ gluteal
- ✓ forearm
- ✓ hand

Compartment syndrome

Musculoskeletal Injury

Acute serious complications in musculoskeletal trauma

injury

↓

inflammatory response

↓

sympathetic nerve ↓

histamine, complement proteins)

kinins, prostaglandin

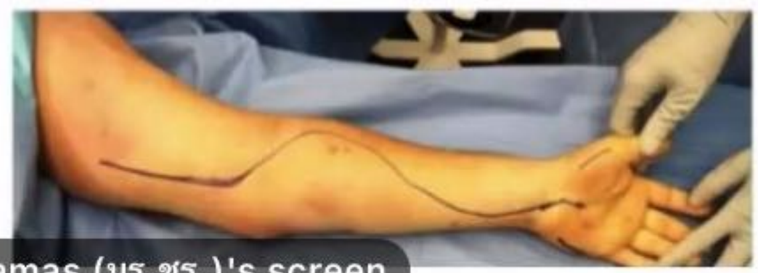
↓

vasodilatation

↓

permeability

edema, redness, pain, poor tissue perfusion



- absolute compartmental pressure, ACP > 30 mmHg
- perfusion pressure <20 mmHg

"7Ps"

- Pain – sudden and severe
- Pallor – commonly mottled
- Pulselessness – loss of peripheral pulses
- Paraesthesia – decrease in sensation or loss of sensation
- Paralysis – failure of dorsiflexion
- Poikilothermia – coolness of the affected limb
- Puffiness -- swelling

fibrosis → contracture

Volkman's ischemia contracture"

Musculoskeletal Injury

Acute serious complications in musculoskeletal trauma

Infection

An open fracture is a soft-tissue injury which also involves the bone

Nursing Care in Hospital: Initial Assessment

ABCDE Approach

Systematic primary survey ensures life-threatening conditions are identified and managed first, particularly in trauma patients with multiple injuries.

- **Airway:** Ensure patency and cervical spine protection
- **Breathing:** Assess respiratory rate, effort, oxygen saturation
- **Circulation:** Check pulses, blood pressure, signs of shock or bleeding
- **Disability:** Neurological assessment using Glasgow Coma Scale
- **Exposure:** Remove clothing to assess injuries while preventing hypothermia

Neurovascular Assessment: The 5 P's

Perform baseline assessment and repeat regularly (every 1–2 hours initially, then every 4 hours). Document findings meticulously and report changes immediately.

1. **Pain:** Intensity, location, quality, response to analgesia
2. **Pallor:** Color of extremity compared to unaffected side
3. **Pulselessness:** Compare distal pulses bilaterally using Doppler if needed
4. **Paresthesia:** Numbness, tingling, or altered sensation
5. **Paralysis:** Ability to move digits and perform against resistance

Critical Thinking: Late signs indicate advanced compromise. Early detection prevents permanent damage.

Cast Care: Essential Nursing Interventions

During Cast Drying (24-48 hours)

- Handle cast with palms only (fingertips can create pressure points)
- **Elevate casted extremity above heart level to reduce swelling**
- Allow cast to air-dry completely; avoid using fans or heat
- Turn patient regularly to ensure even drying for body casts

Ongoing Circulation Monitoring

- Perform neurovascular checks every 1–2 hours initially
- Assess for tightness: patient should fit one finger under cast edges
- Check capillary refill time (should be less than 3 seconds)
- Report persistent numbness, tingling, or severe pain immediately

Patient Education for Home Care

- Keep cast dry; use plastic bag for bathing
- Never insert objects inside cast to scratch (causes skin breakdown)
- Elevate casted limb when sitting or lying down
- Perform exercises for uncasted joints to prevent stiffness
- Report foul odor, drainage, increased pain, or loosening

Traction Care and Pin Site Management

Traction Principles

Traction applies a pulling force to maintain bone alignment, reduce muscle spasm, and immobilize fractures during healing. Requires meticulous nursing care to prevent complications.

Key Nursing Responsibilities:

- Maintain proper body alignment and counterbalance
- Ensure weights hang freely without touching floor or bed
- Never remove or adjust weights without physician order
- Check ropes for fraying and pulleys for smooth operation
- Assess neurovascular status every 2–4 hours
- Monitor for complications: nerve damage, pressure ulcers, infection

Pin Site Care (Skeletal Traction)

Pin sites are portals for infection. Evidence-based care prevents osteomyelitis and pin loosening.

Recommended Protocol:

1. Cleanse pin sites daily (or per facility protocol) using sterile technique
2. Use sterile normal saline or prescribed antiseptic solution
3. Remove crusts gently; some drainage initially is normal
4. Apply sterile gauze if drainage present; leave open if dry
5. Assess for signs of infection: redness, swelling, purulent drainage, foul odor, loosening
6. Report increased pain, fever, or pin instability immediately

Monitoring and Preventing Complications

Compartment Syndrome Incidence

Occurs in approximately 10% of tibial fractures. Requires emergency fasciotomy within 6–8 hours to prevent permanent damage.

DVT Risk in Immobilized Patients

Up to 40% of orthopedic patients develop DVT without prophylaxis. Early mobilization and anticoagulation reduce risk significantly.

Fat Embolism Syndrome

Affects 1–2% of patients with long bone fractures. Monitor for respiratory distress, confusion, and petechial rash 24–72 hours post-injury.

As nurses, our vigilant monitoring, early recognition of warning signs, and prompt intervention are essential to preventing these potentially devastating complications. Systematic assessment, thorough documentation, and effective communication with the healthcare team protect patient safety and optimize outcomes.

Rehabilitation After Fracture: Goals and Principles

Rehabilitation begins immediately after fracture stabilization and continues throughout the healing process. The ultimate goal is to restore maximum function, independence, and quality of life. Evidence-based rehabilitation reduces complications such as joint stiffness, muscle atrophy, chronic pain, and permanent disability.

Restore Range of Motion

Prevent joint contractures and maintain flexibility through passive, active-assistive, and active exercises as healing progresses.

Promote Safe Mobilization

Gradual weight-bearing progression using assistive devices. Teach proper crutch walking, walker use, and transfer techniques to prevent falls.

Rebuild Muscle Strength

Progressive resistance exercises counteract atrophy from immobilization. Begin with isometric exercises, advance to isotonic and functional movements.

Achieve Functional Independence

Focus on activities of daily living (ADLs), work tasks, and recreational activities. Adaptive equipment and home modifications support success.

Therapeutic Exercise Types

Range of Motion (ROM)

Begin with passive ROM where therapist moves the joint, progress to active-assisted, then active ROM. Perform exercises 10-15 repetitions, 2-3 times daily.

Strengthening

Start with isometric exercises (muscle contraction without joint movement), advance to isotonic exercises with resistance. Gradually increase repetitions and resistance.

Weight-Bearing

Progress from non-weight-bearing to partial, then full weight-bearing as directed. Use parallel bars initially, advance to walker, crutches, then cane.

Functional Training

Practice activities of daily living (ADLs) including walking, climbing stairs, reaching, and lifting. Simulate work or sport-specific movements as appropriate.

The Nurse's Role Across the Care Continuum

Acute Care Setting

Assessment and Monitoring

- Comprehensive initial and ongoing neurovascular assessments
- Pain assessment using validated tools; evaluate intervention effectiveness
- Monitor for complications (compartment syndrome, DVT, infection, fat embolism)
- Document findings thoroughly and report changes promptly

Direct Patient Care

- Administer medications (analgesics, antibiotics, anticoagulants)
- Perform wound care and dressing changes using sterile technique
- Provide cast, splint, and traction care
- Assist with repositioning, transfers, and mobility
- Ensure proper body alignment and immobilization

Rehabilitation Setting

Education and Empowerment

- Teach proper use of assistive devices (crutches, walker, cane)
- Demonstrate exercises and reinforce physical therapy instructions
- Educate about medications, nutrition, and bone health
- Provide written instructions and resources for home care

Coordination and Advocacy

- Collaborate with multidisciplinary team (physicians, physical therapists, occupational therapists, social workers)
- Coordinate discharge planning and home health referrals
- Advocate for patient needs and preferences
- Provide psychosocial support and encourage active participation
- Assess home environment for safety hazards and recommend modifications

Patient Education: Keys to Successful Recovery

Nutrition for Bone Healing

Emphasize adequate protein (1.2–1.5 g/kg/day), calcium (1000–1200 mg/day), vitamin D (600–800 IU/day), and hydration. Educate about dietary sources and supplementation when indicated.

Medication Adherence

Review pain medications, antibiotics, anticoagulants, and supplements. Discuss timing, side effects, and importance of completing prescribed courses. Encourage questions and address concerns.

Warning Signs to Report

Teach patients to recognize and immediately report: increased pain unrelieved by medication, numbness or tingling, color changes, swelling, fever, foul odor, cast problems, and breathing difficulties.

Home Safety and Fall Prevention

Assess home for hazards: remove throw rugs, ensure adequate lighting, install grab bars in bathroom, clear walkways. Discuss proper footwear and avoiding risky activities during recovery.

Follow-Up Care

Stress importance of keeping all appointments for X-rays, cast changes, physical therapy, and provider visits. Provide written schedule and contact information for questions or concerns.

Summary and Key Takeaways

Comprehensive Assessment is Foundational

Systematic neurovascular assessment, pain evaluation, and complication monitoring form the basis of safe, effective orthopedic nursing care across all settings.

Evidence-Based Interventions Prevent Complications

Proactive measures including proper immobilization care, DVT prophylaxis, infection prevention, and early mobilization significantly reduce morbidity and improve patient outcomes.

Rehabilitation Begins at Admission

Early planning for functional restoration, patient education, and discharge preparation ensures continuity of care and supports successful recovery and return to independence.

Nurses are Essential Care Coordinators

Effective collaboration with the multidisciplinary team, patient advocacy, and holistic care addressing physical, psychological, and social needs optimize healing and quality of life.

Patient Education Empowers Recovery

Comprehensive teaching about self-care, warning signs, medication management, nutrition, and home safety enables patients to actively participate in their recovery and prevent complications.

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