



Fractures

2022

Review of Readings

Definition of a fracture

Classifications

- Open, closed, spiral, comminuted, complete transverse, pathologic, stress, greenstick, avulsion

Clinical manifestations

- Signs and symptoms
- Relative specificity to injury

Clinical Manifestations

S/S of fractures vary according to:

- The location
- The bone involved
- The type of fx
- The amount of related soft tissue damage

Clinical Manifestations

Signs & Symptoms Include:

- Pain
- Edema
- Muscle Spasms
- Loss of Normal Function
- Obvious Deformity
- Excessive Motion at Site
- Crepitus
- Warmth Over the Injured Area
- Ecchymosis of Skin
- Loss of Sensation

Bone Healing Stages

1. Hematoma Formation

- Hematoma surrounds the ends of the fragments
- Begins within 24 hours

2. Cellular Proliferation Stage

- Fibrin meshwork formation – phagocytosis of necrotic tissue
- Hematomas changes to granulation tissue
- New bone formed
- Invasion of osteoblasts

Bone Healing Stages

3. Callus Formation

- Osteoclasts destroy old bone & new bone formed by osteoblasts
- Collagen strengthens
- Occurs 6-10 days after the injury

4. Ossification

- Formation of new bone \approx 3-10 weeks

Bone Healing Stages

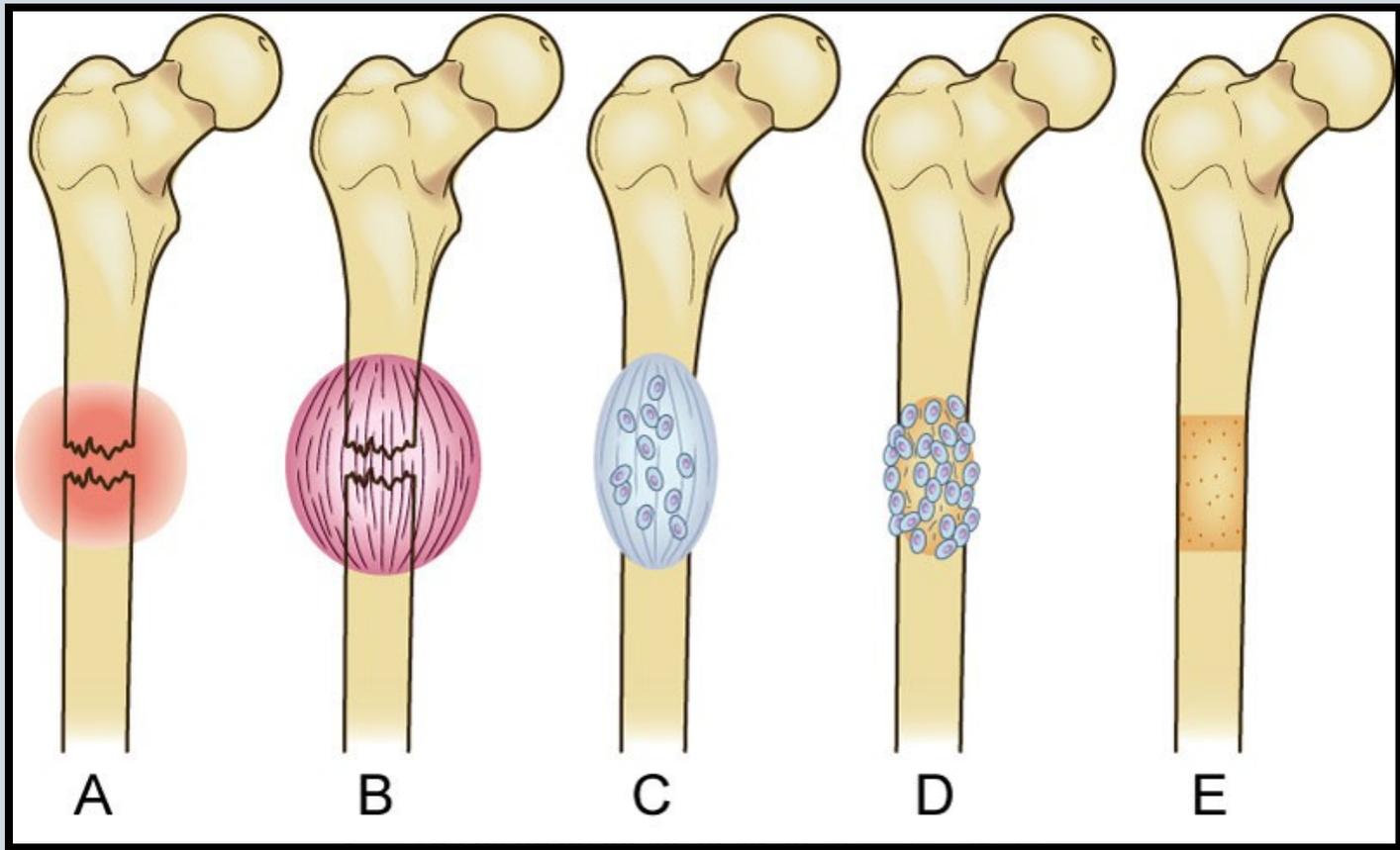
5. Consolidation

- ↓ distance between bone fragments until closed

6. Remodeling

- Excess cells reabsorbed & union complete

Stages of Bone Healing



Bone Healing

Factors That Enhance Bone Healing:

- Immobilization of fracture fragments
- Maximum bone fragment contact
- Sufficient blood supply
- Proper nutrition
- Exercise – weight-bearing for long bones
- Electric stimulation across fracture

Bone Healing

Factors That Inhibit Bone Healing:

- Excessive local trauma (edema)
- Bone loss
- Inadequate immobilization
- Space between bone fragments
- Infection
- Age
- Corticosteroids
- Denervation

Healing Time of Fractures

- Flat bone fractures (pelvis, scapula) heal rapidly.
- Epiphysis (cancellous bone) fractures heal more quickly than diaphysis (compact) fractures.
 - Femoral shaft fracture: 18 weeks
 - Pelvic fracture: 6 weeks
 - Proximal humerus fracture: 3-6 weeks
 - Scapula: 10 weeks

Collaborative Care

Overall Goals of Treatment

- Anatomic realignment of bone fragments (reduction)
 - “Setting the bones”
- Immobilization to maintain alignment (reduction) until healing occurs
- Restoration of normal function

Collaborative Care

Drug Therapy

- Muscle relaxant
- Tetanus toxoid or immunoglobulin
- Cephalosporin – bone penetrating mechanism



Immediate Fracture Management

- Immobilize the area by splinting
- Elevate the body part
- Apply cold packs or ice
- Assess for Δ in neurovascular status
- Assess for signs of shock
- Administer analgesics



Fracture Reduction

Closed Reduction

- Non-surgical, manual realignment
- Manual manipulation of the bones to their correct position
- Can do under local anesthetic, conscious sedation, or general anesthesia
- No incision
- Usually traction → reduction → cast

Fracture Reduction

Open Reduction

- *Correction of bone alignment through a surgical incision*
- May use internal fixation
- Potential for infection
- Early mobilization

ORIF:

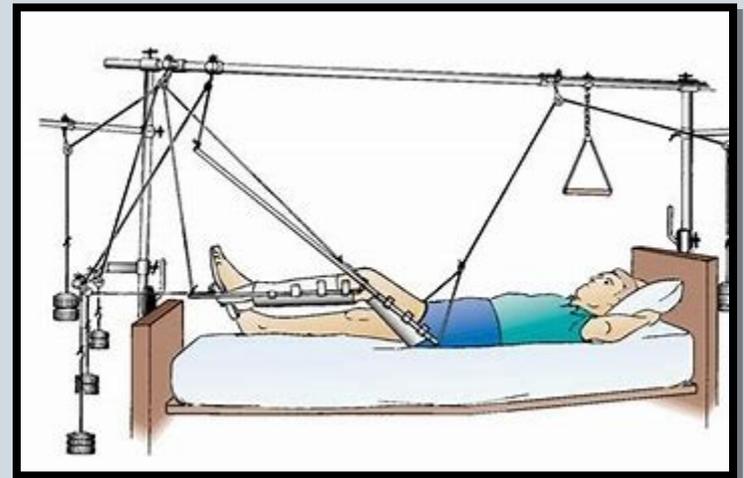
- **Open Reduction, Internal Fixation**

Fracture Redu



Traction

- Skin traction → short term
- Skeletal traction → longer time period



Fracture Immobilization

Casts

- Temporary circumferential immobilization device
- Common treatment following closed reduction
- Types:
 - Short / long arm casts
 - Short / long leg casts
 - Body jacket cast
 - Walking Cast
 - Hip spica cast

Fracture Immobilization

- °Types
- °Materials used
 - °Plaster vs. fiberglass



Fracture Immobilization

Casts

- Cast Application
 - Clean skin & assess for lacerations or lesions – dry completely
 - Wrap area with cotton padding or stockinette
 - Plaster rolls submersed in warm water until no bubbling occurs
 - Plaster or fiberglass applied
 - After application, place on pillow & reposition q 2-3°
 - Allow to air dry

Fracture Immobilization

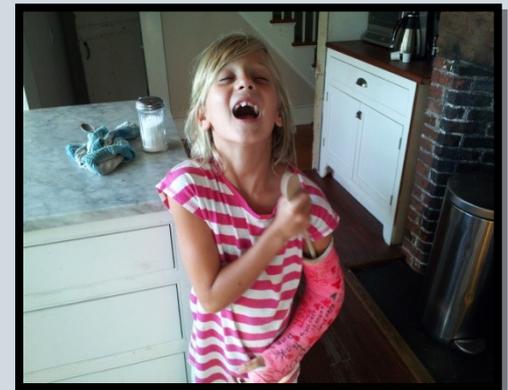
Casts

- Cast Application Cont'd...
- Handle a damp cast with palms of hands, do not touch with fingertips
- Once cast is dry, finish the edges to prevent skin irritation
- Trim and smooth edges

Fracture Immobilization

Casts

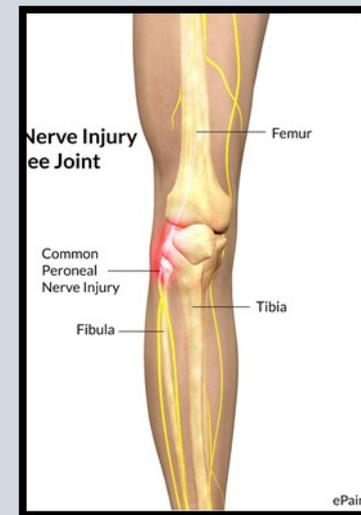
- Cast Care:
- Skin care – maintain good skin integrity – prevent breakdown!
 - Inspect skin at edges of cast & underlying the cast for redness or irritation
 - Don't use powders
 - No lotions
 - No scratching in the cast



Fracture Immobilization

Casts

- Risk for Neurovascular Compromise
- Need a baseline – do bilateral assessment before cast application
- Be aware of nerves and vessels in the casted area (peroneal, ulnar)
- Teach S/S of Compartment Syndrome



Fracture Immobilization

Casts

- Drainage on the Cast:
 - May have with an open wound or surgery prior to cast application
 - Wet plaster – drainage is absorbed & spreads rapidly
 - Amount you see is not equal to amount draining
 - 24-72° after trauma - ↑ risk for drainage
 - Concerned if bright red drainage on cast

Fracture Immobilization

Casts

- Edema of the extremity:
 - raise leg, raise foot of bed
- Pressure areas under cast
 - ↑ pain
- Infection under the cast – ✓ for odor, temp, pain, burning, drainage

Fracture Immobilization

Casts

- Maintain a clean, dry cast
- Mobility
 - Full ROM of all other joints
 - Isometric or muscle setting exercises
 - No joint movement, tighten muscle & relax
 - Prevent venous stasis & atrophy
 - Wt.-bear with MD order

Fracture Immobilization

Casts

- Windowing = cut in dry cast to inspect the skin, wound, or remove drains
- Bivalving = splint along both sides



Fracture Immobilization

Casts

- Cast removal: electric cast saw
 - Not painful
 - Very noisy, can be frightening
 - Skin is often sensitive – covered with yellow/brown scales or crusts of dead skin
 - Muscle may be flabby/weak
 - Altered balance after the extra weight from the cast is removed
 - Gently soak & wash the skin
 - Pat dry
 - Mineral oil to remove dried skin



A patient has a long-arm plaster cast applied for immobilization of a fractured left radius. Until the cast has completely dried, the nurse should

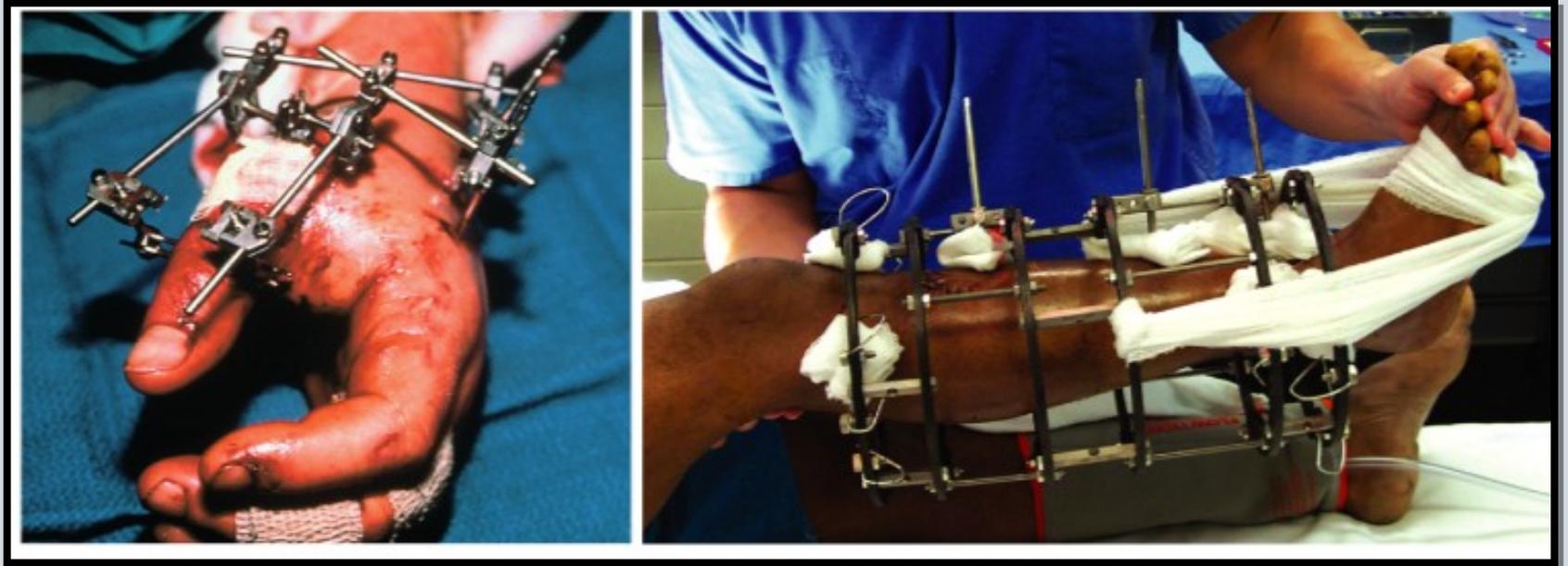
- A Keep the left arm in dependent position.
- B Avoid handling the cast using fingertips
- C Place gauze around the cast edge to pad any roughness
- D Cover the cast with a small blanket to absorb the dampness

Fracture Immobilization

External Fixation

- Metallic devices composed of pins that are inserted into the bone & attached to external rods
- Used to compress fx fragments & immobilize reduced fx's when a cast and traction are not appropriate
- Hold fragments in place
- Used to treat fx's with associated soft tissue trauma

External fixation for a wrist and a tibia-fibula fracture



Halo Vest

Ted Beneke – “Breaking Bad”



Fracture Immobilization

External Fixation

- Assess for S/S infection
 - Sterile drgs may be placed over entry & exit sites of pins or may be left uncovered to observe
- Pin Site Care
 - Attached directly to the bones
 - Depends on MD preference
 - Keep skin areas around pin sites clean & dry
 - Directly remove the exudate with water, rinse with sterile NS, dry with sterile gauze, may use antibiotic ointment

Fracture Immobilization

External Fixation

- Pt with an external fixator on the lower leg can be OOB in a wheelchair or even ambulate without wt. Bearing on the affected limb
- Nursing care is the same as pt in cast or skeletal traction, except that these pts are mobile earlier



Fracture Immobilization

Internal Fixation

- ° Pins, plates, intramedullary rods, & screws
- ° Surgically inserted at the time of realignment



Fracture Immobilization

Traction

- Application of a pulling force to an injured part of the body while counter-traction pulls in the opposite direction
- Purpose of Traction:
 - Prevent or reduce muscle spasms
 - Immobilization
 - Reduction
 - Treat a pathologic condition or correct deformities

Fracture Immobilization

Traction

Terms to Know:

◦ Counter-traction

- Force that counteracts the pull of traction
- Pulls in the opposite direction
- Prevents the pt from sliding OOB

◦ Suspension

- Use of traction equipment to suspend a body part

Fracture Immobilization

Traction

Terms to Know:

- Balanced Suspension
 - Weights used to suspend the part correctly & continuously
 - Often used with traction to allow pt to move in bed

Fracture Immobilization

Traction

Three Types of Traction

1. Manual = hands are used to exert a pulling force on the bone that is to be realigned
 - Used for stable fx's or dislocations prior to splinting or casting or tx application

Fracture Immobilization

Traction

2. Skin Traction = strips of tape or special traction strips are applied directly to the skin
 - Pull of the weights is transmitted indirectly to the involved bone
 - Used for fx's which require only a moderate amount of pulling force for a relatively short period of time
 - Need careful skin assessment

Fracture Immobilization

Traction

- Types of Skin Traction:
 - Buck's & Hare Traction
 - Russell's traction
 - Cervical traction
 - Pelvic traction

Fracture Immobilization

Skin Traction

- **Buck's** = simplest form of skin traction
 - Straight pull on the affected extremity
 - Used to relieve muscle spasms & immobilize a limb temporarily
 - Temporary immobilization of fx hips, or femurs prior to OR
 - Buck's boot used mostly
 - *Counter-traction maintained by keeping HOB flat*

Buck's traction with a hook-and-loop fastener (Velcro) boot



Skin Traction

Hare Traction → fractured femur



Fracture Immobilization



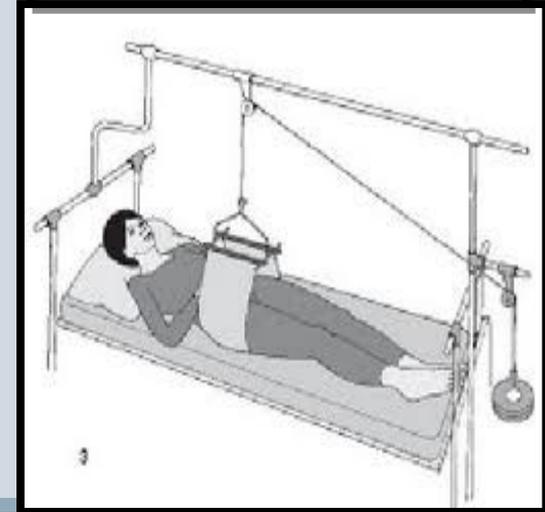
Skin Traction

- **Cervical** = head holter used to apply tx to cervical spine
- Used for relief of neck pain, whiplash, dislocations, and minor cervical fx's
- Assess skin on chin & under holter

Fracture Immobilization

Skin Traction

- **Pelvic** = disposable belt with straps that attach to cords & weights to exert pull on the lower back
- Used for pain relief from muscle spasms and minor fx's of the lower spine

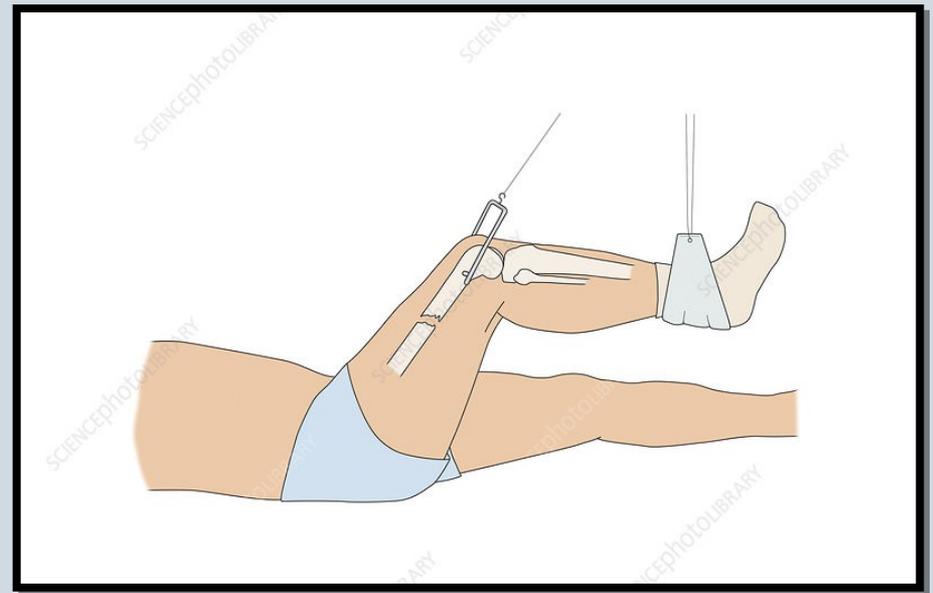
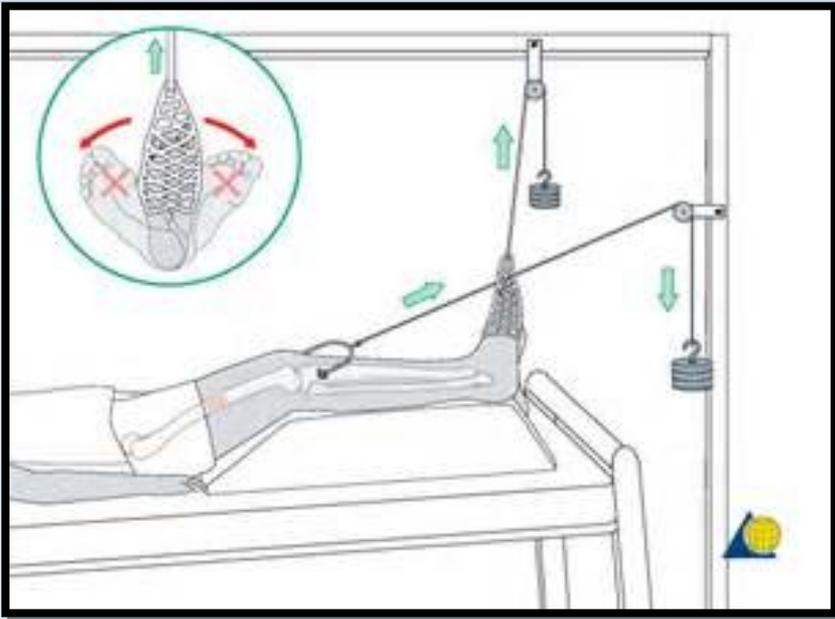


Fracture Immobilization

Traction

3. Skeletal Traction = traction force is applied directly to the bone using pins, wires, or screws
 - Use tongs for cervical tx, applied directly to the skull
 - Used for fx's requiring ↑ pulling force, over extended periods of time
 - Used for fx's of the tibia, femur, humerus, cervical spine, & unstable fx's
 - You do not remove the weights!

Skeletal Traction



Fracture Immobilization

Traction

- 8 General Principles of Traction: **
- Do not re-use the traction cord
- Assess area -skin tx can not be applied over a wound
- Avoid pressure over bony prominences
- Keep weights *hanging free*
- Don't add/remove weight without MD order
- Don't allow weights to hang over a patient
- Make sure ropes are in the pulleys & knots are free from pulleys
- Keep bed linens from interfering with tx

Fracture Immobilization

Traction

- Nursing Care
 - **Assessment:** skin, N/V, pain, activity, nutrition, elimination
 - **Planning:** set goals with pt
 - NV Compromise
 - Anxiety?
 - Pain
 - Impaired Physical Mobility
 - Immobility Complications
 - Knowledge Deficit
 - Self-Care Deficit

Immobilization: Traction

- Nursing Care
 - **Implementation:**
 - Position
 - Make sure counter-traction is in place
 - Avoid friction
 - Make sure traction is continuous
 - Maintain correct line of pull
 - Prevent venous stasis
 - Maintain neuro-vascular status
 - Skin care!
 - Isometric & isotonic exercises
 - Promote ADL's

Secondary Management for Compound Fractures

- Surgical Debridement
- Tetanus toxoid
- Wound culture
- Wound packing



Secondary Management for Compound Fractures

- IV antibiotics
- Assess for S/S of infection
- Reduction of a fracture
- Immobilization of a fracture
- Treat any complications

Fracture Diagnosis

- History
- Physical Exam
 - Signs & symptoms of Fracture
- X-ray



Nursing Assessment

- Brief history of the accident
- Mechanism of injury
- Special emphasis focused on the region distal to the injury site

Neurovascular Assessment

Color

Temperature

Capillary refill

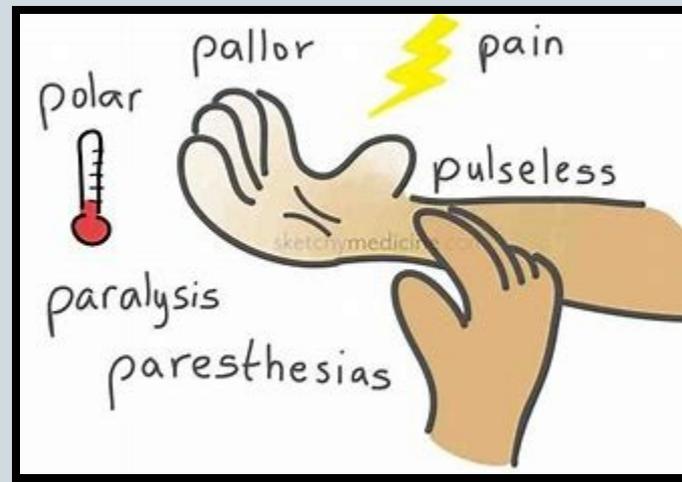
Peripheral pulses

Edema

Sensation

Motor function

Pain



Nursing Diagnosis

R/F Peripheral
Neurovascular
Dysfunction

Acute Pain

R/F Infection

R/F Injury

Anxiety

R/F Impaired Skin
Integrity

Impaired Physical
Mobility

Ineffective Therapeutic
Regimen Management

Self Care Deficit

Deficient Knowledge

Nursing Management

Planning: Overall Goals

- Physiologic healing with no associated complications
- Pain relief
- Achieve maximal rehabilitation potential

Nursing Management

Implementation:

- Acute Intervention
 - **Pre-operative Management**
 - Skin preparation
 - Assess last oral intake
 - Monitor VS, need baseline NV assessment
 - Obtain consent
 - Administer prescribed meds
 - Explain all post-op treatments
 - Pain relief



Nursing Management

Implementation:

- Acute Intervention
 - Post-Operative Management
 - Monitor VS – maintain patent airway!!
 - Frequent NV assessments – assess cast & skin too
 - Pain relief – analgesics, cold compresses, elevation
 - Encourage participation in ADL's
 - Maintain mobility and muscle tone



Nursing Management

Implementation:

- Acute Intervention
- Post-Operative Management Cont'd..
 - Teach care of devices –pin care
 - Prevent skin breakdown
 - Ambulation – usually started in mobility training when able to sit in bed & dangle feet over the side
 - Assistive devices
 - Counseling and referrals

Nursing Management

Implementation:

- Acute Intervention
 - **Other measures:**
 - Activity
 - Maintain ↑ fluid intake
 - Diet high in bulk

Nursing Management

Implementation:

- Ambulatory & Home Care
 - **Cast care:**
 - Frequent NV assessments
 - Teach signs of complications
 - ↑ extremity above level of heart
 - Exercise joints above & below cast

Nursing Management

Implementation:

- Ambulatory & Home Care
 - **Psychosocial Problems:**
 - Assist pt to adjust to any problems caused by the injury
 - Address complaints of extreme pain, unrelieved by elevation, analgesics, or repositioning
 - Assess any complaints of heightened or ↓ sensation/parasthesia distal to the injury, or due to an external fixation device

Nursing Management

Evaluation:

- Expected Outcomes
 - Normal NV assessment
 - Tolerable or no pain
 - No evidence of infection
 - No evidence of skin breakdown
 - Crutches used correctly
 - Minimal loss of muscle bulk of affected extremity

A patient with a right lower leg fracture will be discharged home with an external fixation device in place.

"You will need to check and clean the pin insertion sites daily."

"The external fixator can be removed for your bath or shower."

"You will need to remain on bed rest until bone healing is complete."

"Prophylactic antibiotics are used until the external fixator is removed."

Fractures of Specific Bones

Hip Fractures

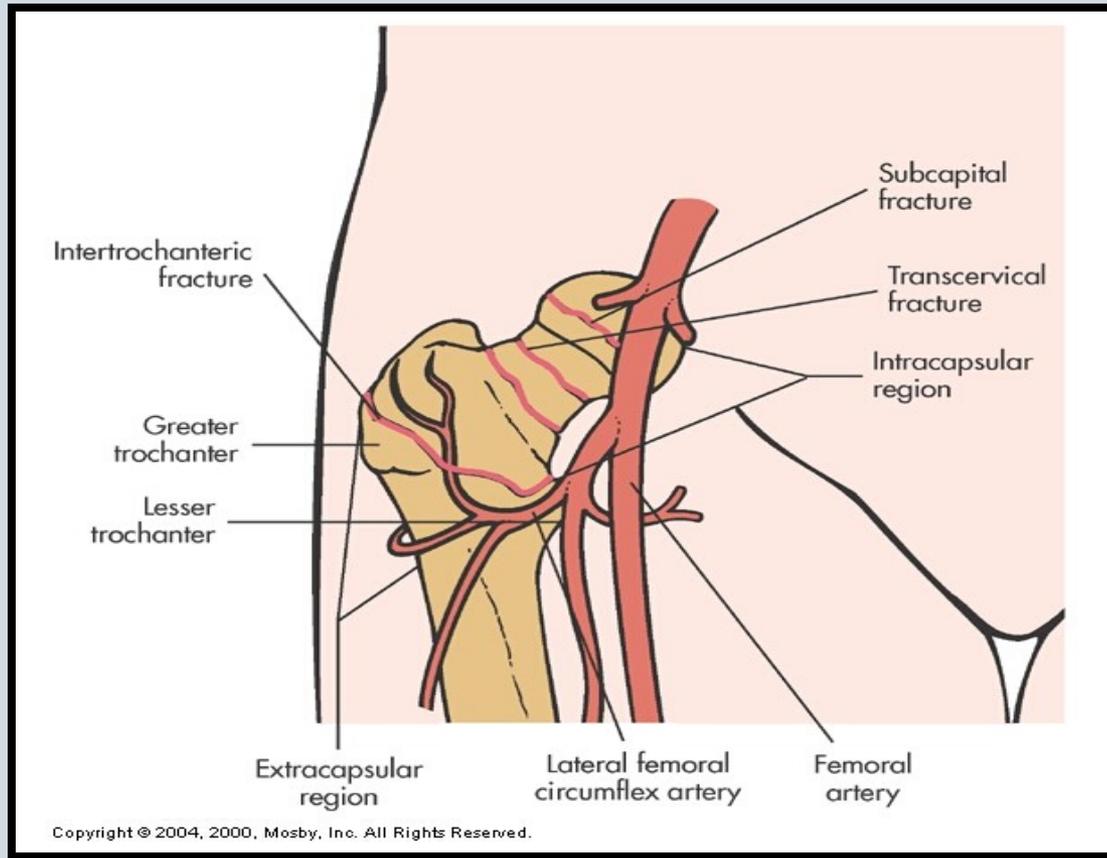
Most common fx seen in the hospital

Occurs more frequently in women than men due to osteoporosis & an ↑ life expectancy

****2 Categories****

- Intracapsular = occurs within the hip joint & capsule
- Extracapsular = inter-trochanteric fx

Hip Fractures



Hip Fractures

S/S of a Hip Fx:

- Severe pain at the fx site
- Inability to move the leg voluntarily
- External rotation of the leg
- Shortening of the leg

Diagnosis:

- X-Ray plus the S/S

Hip Fractures

Nursing Diagnosis:

- Pain
- Impaired Physical Mobility
- High Risk Peripheral NV Compromise
- Anxiety
- HR for Thrombophlebitis, Impaired Skin Integrity, Respiratory Complications, GI Function, GU Function
- Knowledge Deficit
- Impaired Home Maintenance

Hip Fractures

Medical Management

- Bucks traction can be applied prior to surgery.
- Choice of fixation device depends on the location of the fx, potential of avascular necrosis, & surgeon's preference

Hip Fractures

- Open Reduction Internal Fixation (ORIF)
 - Extracapsular fx's (intertrochanteric)
- Use of intramedullary rod, pins, and screws to stabilize & reduce the fx.
- Advantage = early ambulation.
- Risk hip dislocation & subluxation post-op
- Hip precautions: avoid hip adduction & rotation

Hip Fractures

Medical Management:

- Prosthetic Implant (Hip replacement) – to replace the femoral head & neck
- Used for Intracapsular fx's
- Implies some position restrictions for up to 2 months
- Partial wt. bearing restrictions for up to 2 months
- Same hip precautions post-op (avoid adduction & rotation)

Hip Fractures

Medical Management:

Closed reduction, Buck's traction, and pain management only if pt's general medical condition precludes surgery (Not candidate for Sx)

Nursing Management:

- Same interventions as with all other fractures
- Assess NV status – frequent VS immediately post-op!
- ✓ dressing & drains frequently.

Hip Fractures

Nursing Management

- Special restrictions (Hip Precautions):
- No hip flexion beyond 90° for 10 days-2 months
- No adduction of the affected leg beyond midline for 2 months
- No hyperextension
- No Internal rotation

Hip Fractures

Nursing Management

- **Special restrictions:**
 - These positions are avoided with an abduction splint & pillows between the legs
 - Carefully monitor pt's position during transfer – get pt OOB on their operative side
 - Sling back chair for transfer to PT
 - Avoid elevation of the leg above hip level

Hip Fractures

Nursing Management

- Post-op anti-coagulant therapy
 - Monitor PT or PTT times & administer the appropriate med & dose
- Maintain Anti-embolism stockings or EPC's
- Coughing and Deep Breathing
- Encourage leg exercises with the unaffected leg & foot pumps with the affected leg
- Maintain skin integrity – turning & meticulous skin care

Hip Fractures

Nursing Management

- Administer pain meds prior to PT
- Teach the use of overhead trapeze
- Monitor bowel elimination & UO
- Ambulate when permitted & with assistance
- Maintain a sterile drsg & use aseptic technique when changing it

Hip Fractures

Nursing Management

- Drains are placed in the wound to prevent formation of hematomas
 - Need constant suction applied
 - Note amount & type of drainage
- Do not turn on the affected hip
- Raised toilet seat
- Lifelong need for abx prophylaxis to protect the prosthesis from bacteremic infection

Colles Fracture

- Fracture of distal radius
- Fall on an outstretched hand

Wrist appear deformed , see a hump when viewed from the side

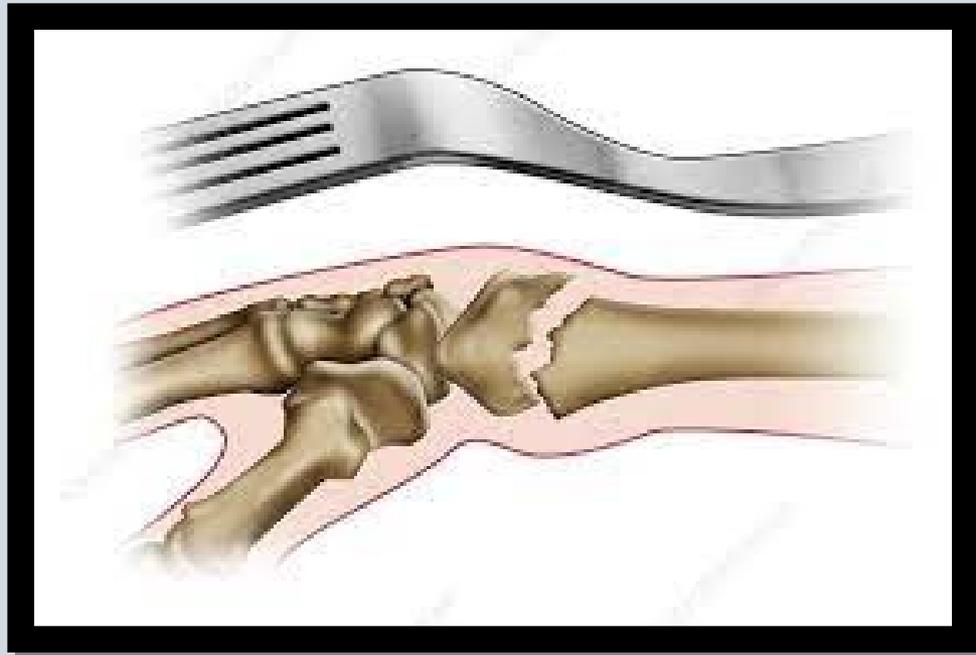
Major complication is vascular insufficiency from the edema

- Need to ↓ edema & and do frequent NV assessments

Takes 6-8 weeks to heal for an adult

Splint or cast, may need pinning if displaced

Colles Fracture



Facial Fractures

NURSING MANAGEMENT

Check for loose teeth

Do not insert an NG tube

Maintain a patent airway!!

Oral hygiene q2°

Wire cutters available

No straws or nose blowing

Soft toothbrush & rinsing

Monitor for infection & pain

Complications with Fractures

Complications of Fractures

1. Compartment Syndrome

- Condition in which elevated intra-compartmental pressure within a confined myofascial compartment compromises the NV function of tissues within that space
- Causes capillary perfusion to be ↓ below a level necessary for tissue viability

Compartment Syndrome

Arm Compartments:

- Deltoid
- Upper Arm
- Forearm – One of the most common!
- Hand

Leg Compartments:

- Buttock
- Thigh
- Lower leg
- Foot

Compartment Syndrome

2 Basic Etiologies:

- ↓ **Compartment Size**
 - Restrictive drsgs
 - Splints
 - Casts
- ↑ **Compartment Content / Volume**
 - Bleeding
 - Edema

Compartment Syndrome:

Pathophysiology

Decreased Venous Emptying



Increased Capillary Permeability



Edema



Venous Obstruction & Increased Intra-compartmental Pressure



Venous-Arterial Compression



Arterial Occlusion



Tissue Death

Compartment Syndrome

Prognosis

- Functional changes of muscle in 4°
- Functional loss of nerves in as little as 4°
- As time of ischemia ↑, damage is increasingly irreversible
- Within 4-6° after onset, may have irreversible damage
- Contractures can develop after 12° of ischemia, extremity may be useless in 24-48°

Compartment Syndrome

Clinical Manifestations



Compartment Syndrome

S/S:

- Early detection is **essential** to prevent permanent deficits!!
- Pain
 - Most distinctive & usually the earliest sign!
 - Out of proportion to magnitude of injury
 - Unrelieved by narcotics or elevation
 - Pain with passive stretch
 - Absence of pain does not rule out CS

Compartment Syndrome

S/S:

- Parasthesia getting progressively worse
- Pressure
 - Tense on palpation
 - Direct measurement
- Paresis progressing to paralysis of the affected limb
- Pulses, Cap Refill, Color, Temperature are all unreliable indicators
 - Generally not ↓ until late since circulation to the skin may not be compromised

Compartment Syndrome

Clinical Manifestations

- Myoglobinuria – dark reddish-brown urine
- Injured muscle releases myoglobin into circulation = Myoglobinuric Renal Failure



Compartment Syndrome

Prevention

- Elevate & ice application
- Document NV assessments frequently
- Teach the patient S/S to look for
- This is a medical emergency!!
 - Call the MD!

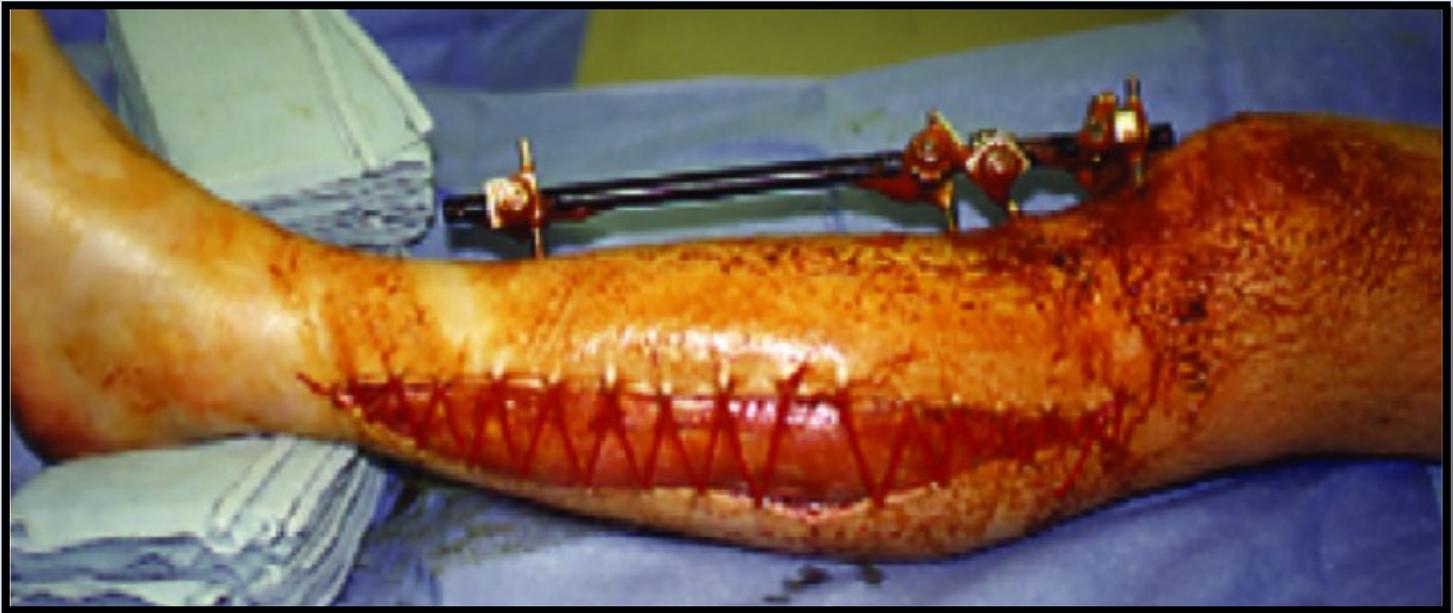
Compartment Syndrome

Treatment

- Remove constrictive dressing, bivalve cast
- Elevation, but not $>$ heart level
- Fasciotomy if S/S don't decrease or pressure remains consistently high

Compartment Syndrome

Fasciotomy

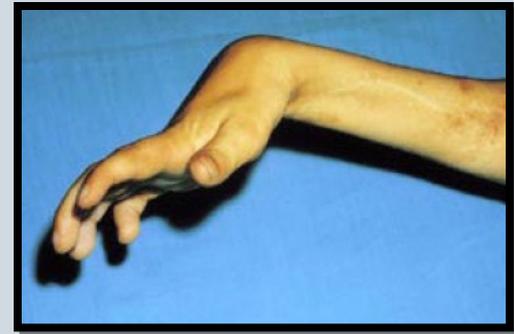


Compartment Syndrome

Complications:

- Infection- tissue necrosis
- Renal Failure – excessive myoglobin
- Hyperkalemia-damaged muscles release K
- Metabolic Acidosis-lactic acid released by necrotic tissue
- Volkman's Contracture-stiff

Claw-like deformity of hand and arm



Complications of Fractures

Crush Syndrome

- Result of prolonged, continuous pressure on large muscles
- Muscle tissue disintegrates
- After pressure is released & circulation restored myoglobin, K⁺, and Phos leak into circulation
- Rhabdomyolysis = myoglobin released from skeletal muscle into the bloodstream.
 - Acute tubular necrosis / renal failure

Complications of Fractures

Artery Damage

- Fractures may cause artery damage → lacerated, contusion, or spasms
- Emergency Treatment:
 - Splint
 - Reduce fx
 - Surgery if needed to ligate the artery

Complications of Fractures

Peripheral Nerve Damage

- Can occur at the time of injury or after treatment
- Prevent by keeping the injured extremities well aligned
- Keep pressure off peripheral nerves - ↓ edema!

Complications of Fractures

Fat Embolism Syndrome (FES)

- Characterized by the presence of fat globules in tissues & organs after a traumatic skeletal injury

Fat Embolism Syndrome (FES)

Predisposing factors:

- Fractures!
 - Especially of long bones , ribs, tibia, pelvis, multiple fx's, and crush injuries
 - Occasionally seen with TJR
- Other
 - Burns, pancreatitis, diabetes, alcoholism, osteomyelitis, sickle cell crisis, some poisonings, sepsis, neoplasm, possible genetic predisposition

Fat Embolism Syndrome (FES)

Tissues Most Often Affected:

- *Lungs
- Brain
- Heart
- Kidneys
- Skin



Fat Embolism Syndrome (FES)

Pathophysiology

- Mechanical theory- Direct release of fat globulins from the yellow bone marrow of injured bones.
- Most lodge in the capillaries of the lungs
- Clog blood vessels that supply major organs

Complications

- Pulmonary, coronary, & cerebral occlusions
- Pulmonary edema, ARDS, DIC

Fat Embolism Syndrome (FES)

Clinical Manifestations

- Usually occur 12-72° after the injury
- Mental status change is usually 1st sign*
- Interstitial Pneumonitis
 - Produces S/S of ARDS → chest pain, tachypnea, cyanosis, ↓ PaO₂, dyspnea, apprehension, tachycardia
- Fever > 101 (Could also be early sign)

Fat Embolism Syndrome (FES)

Clinical Manifestations

- Petechia
 - Late but classic sign!
 - Tiny, red, flat spots located on neck, chest, axilla
 - Result of intravascular thrombosis caused by ↓ oxygen
- Rapid & acute course
- Feeling of impending disaster
- May become comatose in a short time



Fat Embolism Syndrome (FES)

Diagnostic Studies

- **ABG's** → hypoxia, early resp. alkalosis, late resp. acidosis
- **CXR** → “snowstorm effect” , pulmonary consolidation, poor prognosis
- **Fat in Urine & Sputum** (Occasional)
- ↑ serum lipase & sed rate
- ↓ Hgb, Hct, RBC, Plt, Ca⁺, Albumin

Fat Embolism Syndrome (FES)

Prevention

- May ↓ incidence by immediate immobilization, minimal manipulation, and adequate support when turning & positioning
- Assess LOC frequently in high risk pts
- Steroids in high risk pts → investigating

Fat Embolism Syndrome (FES)

Treatment

- Most important is Prevention!
 - Immobilize long bone fractures!
- Symptom Management
- Fluid resuscitation
- O₂ - high concentration
- High Fowler's position
- Reposition as little as possible

Fat Embolism Syndrome (FES)

Treatment

- Steroids for lung inflammation & cerebral edema
- Dextran to improve pulmonary & capillary flow
→ desludging effect
 - ↓ RBC aggregation
- Heparin for the lipolytic effect → helps break down the fat
 - May cause hemorrhage at the fx site
- Analgesics prn

Fat Embolism Syndrome (FES)

Prognosis

- Good if identified & treated early before full blown FES
- If identified late or left untreated, mortality can be as high as 80%

Complications of Fractures

Venous Thrombosis

- Most common complication following trauma of the lower extremity in adults!
- Most common fatal complication of orthopedic surgery
- Veins in the lower extremities & pelvis are highly susceptible to thrombus formation after a fracture
 - Especially a hip fracture!

Venous Thrombosis

Precipitating Factors

- Vein trauma
- Venous stasis caused by incorrectly applied casts or traction
- Local pressure on a vein
- Immobility
- Hypercoagulability
- Dehydration



Venous Thrombosis

Clinical Manifestations

- Begin 24-48° after the injury, but not apparent for 7-10 days
- Only 40-50% have clear S/S
- 1st indication may be a PE with sudden onset
- Inflammation to the LE & fever
- Homan's sign is not specific

Venous Thrombosis

Prevention Interventions

- Active & passive exercises as appropriate
- Early ambulation
- Elevation of lower extremities
- Elastic stockings or EPC's
- Adequate hydration
- Cough & Deep Breath
- Anticoagulants
- Dextran (Plasma volume Expander) used to tx hypovolemia



Complications of Fractures

Shock

- Average adult blood volume = 4-5L or 70-75ml/kg
- Bones are very vascular
 - Esp the Femur
 - Longest & strongest bone in the body
 - Can bend 2in. prior to fx
 - Usually has a lot of soft tissue damage
- Check expanding thigh & S/S Shock
- 1st Sign = Δ in LOC!



Shock

Pelvis also has a rich blood supply

- Check urine output
- Can have a massive hidden bleed
- *** Remember...1st sign is probably a Δ in mental status!



Complications of Fractures

Infections

- Open fractures & soft tissue injuries have an ↑ incidence
 - Open fractures require aggressive surgical debridement
 - Post-op antibiotics for 3-7 days
- Need to be immunized if there is an open wound = Tetanus**
- Osteomyelitis can become chronic
- Gas Gangrene (life threatening)

Complications of Fractures

Avascular Necrosis

- Bone loses its blood supply & dies
- Etiology:
 - Fractures – esp. femur head & neck, carpals, scaphoid & talus
 - Dislocations
 - Prolonged high dose steroids
 - Chronic renal disease
 - Sickle cell anemia

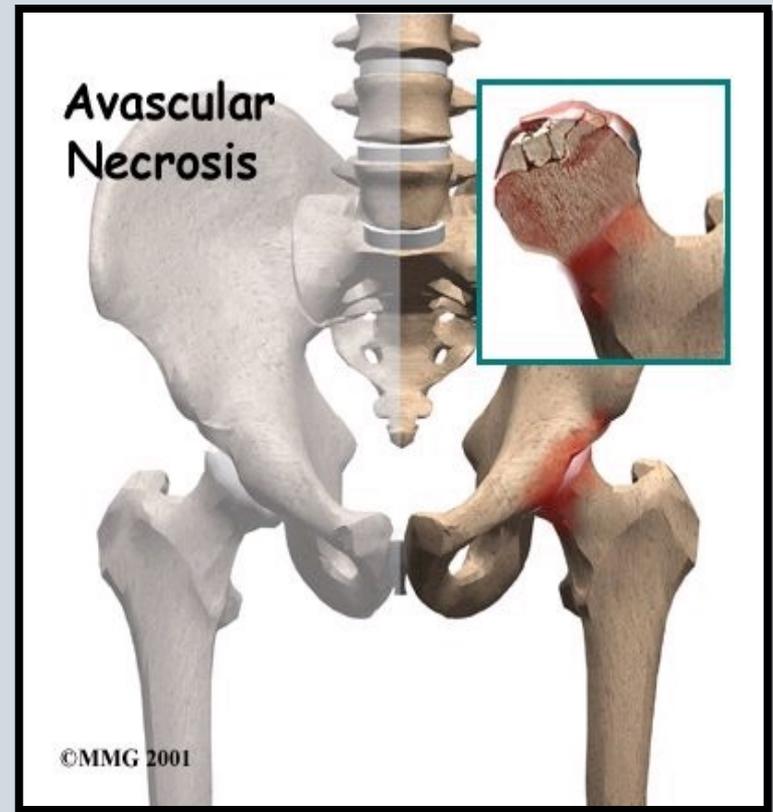
Avascular Necrosis

S & S

- ↓ Rom & pain

Treatment

- May require OR



Complications of Fractures

Kidney Stones

- High risk for renal stones due to bone destruction
- ↑ serum calcium
- Prevent by ↑ fluids

Complications of Fractures

Complications of Bone Union

Delayed Union

- Fracture healing progressing more slowly than expected; healing eventually occurs
- Taken > 6 months
- ****Causes** = inadequate immobilization, infection, multiple bone fragments

Complications of Fractures

Treatment of Delayed Union

- Electrical Bone Stimulation
 - Stimulates bone growth
 - Electrode surgically implanted into fx site
 - Implant the entire device
 - Or external electrodes over skin or cast

Complications of Fractures

Complications of Bone Union

Nonunion

- Complete failure of healing to take place
- May have motion at the site of fx due to pseudoarthrosis

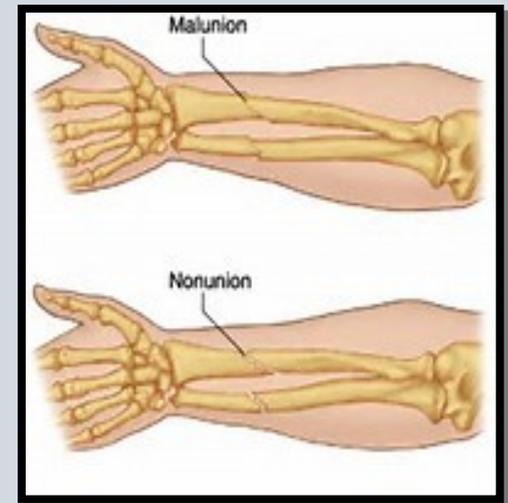
Treatment = ORIF, bone graft

Complications of Fractures

Complications of Bone Union

Malunion

- Fracture heals in expected time but in unsatisfactory position, which may result in deformity or dysfunction
- If ↓ function, may re-fracture and ORIF



Complications of Fractures

