جامعة الملك سعود
King Saud University

PRINCIPLES OF FRACTURES (ADULTS)

OBJECTIVES

- Introduction.
- Basic science of fracture healing.
- Principles of evaluating patients with fractures.
- Principles of management.
- Common fractures in adults

introduction

- Fracture means literally broken bone.
- This can be described in different ways:
  - Extent
  - Location
  - Morphology
  - Mechanism
  - Associated soft tissue injuries

- Extent:
  - Complete: fracture extends 360° of bone circumference (all around)

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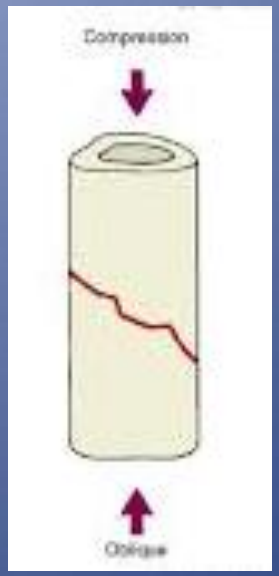
  - Incomplete: seen almost only in children:
    - Greensick
    - Buckle fracture

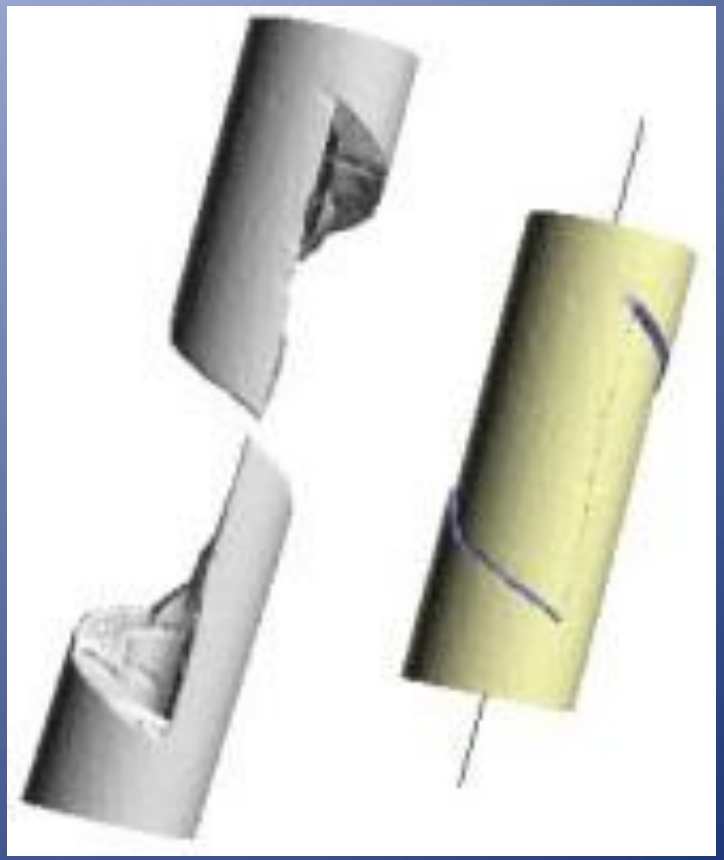
- Location:
  - Name of bone
  - Side
  - Diaphysis, metaphysis or epiphysis
  - Long bones (diaphysis): divide them in thirds (proximal, middle or distal third)
  - Metaphysis: intra-articular v.s extra-articular

- Morphology:
  - Transverse: loading mode resulting in fracture is tension

- Morphology:
  - Oblique: loading mode is compression.

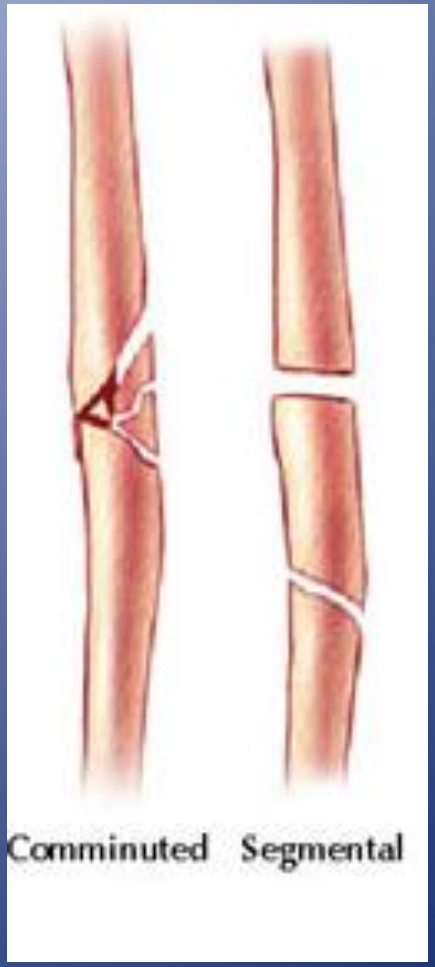


- Morphology:
  - Spiral: loading mode is torsion.



- Morphology:
  - Fracture with Butterfly fragment: loading mode is bending.
  - It also called a wedge fracture.

- Morphology:
  - Comminuted fracture: 3 or more fragments
  - Segmental fracture



- Mechanism:
  - High energy vs. low energy.
  - Multiple injuries vs. isolated injury.
  - Pathological fracture: normal load in presences of weakened bone (tumor, osteoporosis, infection)
  - Stress fracture: normal bone subjected to repeated load (military recruits).

- Associated soft tissue injuries:
  - Close fracture: skin integrity is maintained.
  - Open fracture: fracture is exposed to external environment .

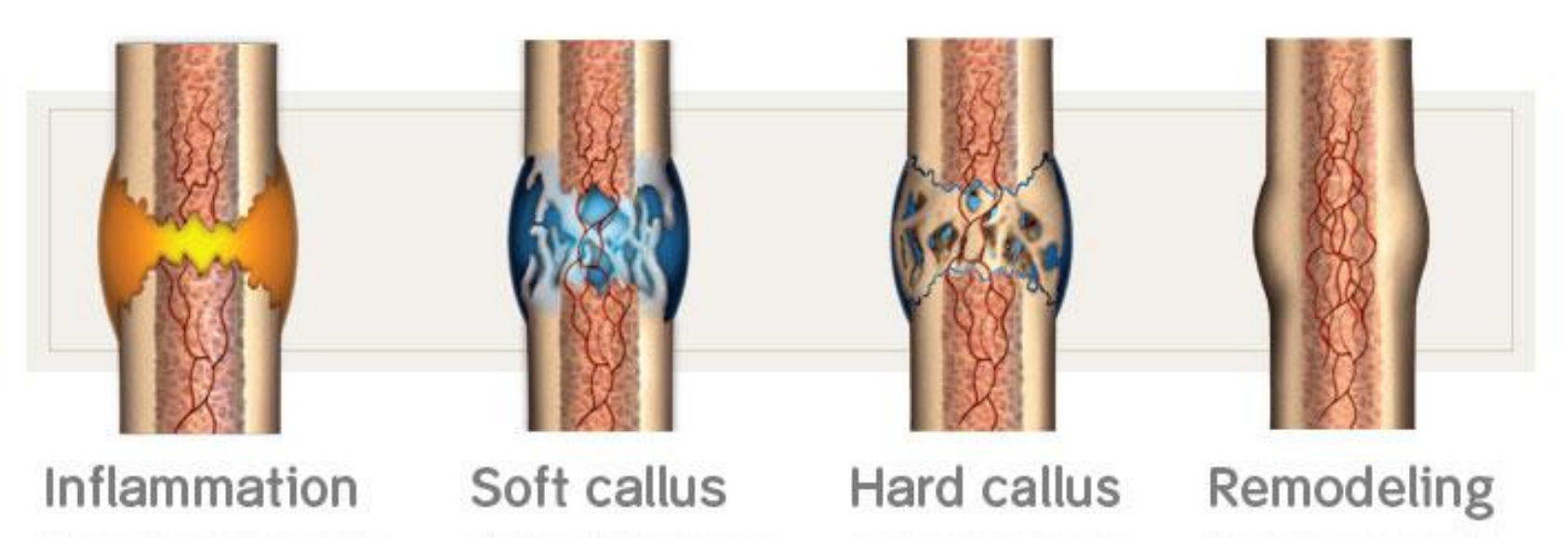
Any skin breach in proximity of a fracture is an open fracture until proven otherwise.

QUESTIONS ?

FRACTURE HEALING

Natural Bone Healing

- Indirect bone healing (endochondral ossification) occurs in nature with untreated fracture.
- It is called indirect because of formation of cartilage at intermediate stage.
- It runs in 4 stages:
  - Hematoma formation
  - Soft callus formation
  - Hard Callus formation
  - Remodeling


Inflammation
Soft callus
Hard callus
Remodeling

PRINCIPLES OF EVALUATION

Diagnosis: History

- Patients complain of pain and inability to use the limb (if they are conscious and able to communicate)

- What information can help you make the diagnosis?

Diagnosis: History

- **Onset**:
  - When and how did the symptoms begin?
  - Specific traumatic incident vs. gradual onset?

- **If there was a specific trauma, the details of the event are essential information:**
  - **Mechanism of injury**?
  - Circumstances of the event? Work-related?
  - Severity of symptoms at the time of injury and progression after?

Diagnosis: Physical exam

- **Inspection**
  - Swelling
  - Ecchymosis
  - Deformity
  - If fracture is open:
    - Bleeding
    - Protruding bone

Diagnosis: Physical exam

- **Palpation**
  - Bony tenderness

Diagnosis: Physical exam

- If a fracture is suspected what should we rule out?
  - Neurovascular injury (N/V exam)
  - Compartment syndrome
  - Associated MSK injuries (examine joint above and below at minimum)

Diagnosis: Imaging

- X-rays are 2D: get minimum two orthogonal views!
- Include joint above and below injury

Diagnosis: Imaging

- NB: Fractures hurt, immobilization helps.
- Immobilizing a patient in a backslab is the most effective way to relieve pain from a fracture and may be done BEFORE getting x-rays

Diagnosis: Imaging

- Fractures may be obvious on x-ray
- Undisplaced or stress fractures are sometimes not immediately apparent

- Secondary signs of fracture on x-ray:
  - Soft tissue swelling
  - Fat pad signs
  - Periosteal reaction
  - Joint effusion
  - Cortical buckle

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How to describe a fracture

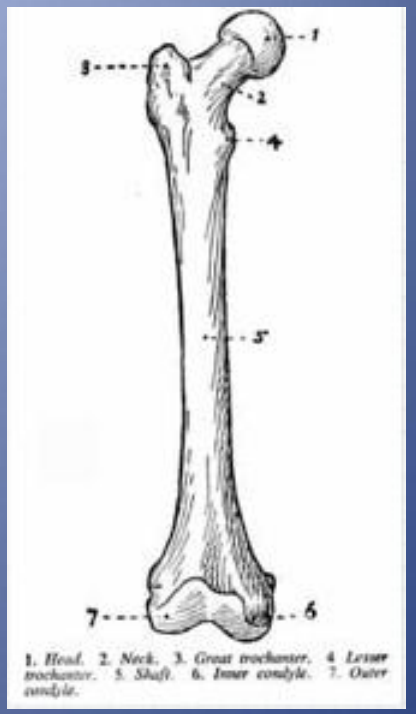
- Clinical parameters
- Radiographic parameters

Clinical Parameters

- Open vs. closed
  - ANY break in the skin in proximity to the fracture site is OPEN until proven otherwise
- Neurovascular status
- Presence of clinical deformity

Location

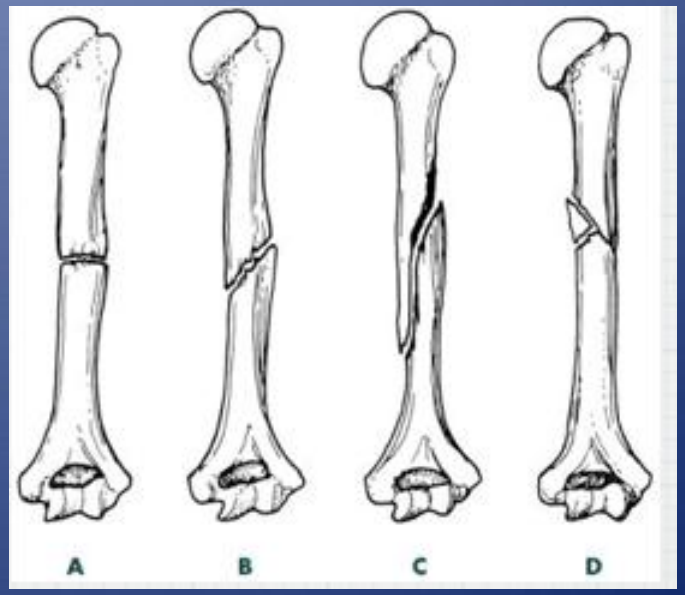
- Which bone?
- Which part of the bone?
  - Epiphysis -intraarticular?
  - Metaphysis
  - Diaphysis -divide into 1/3s
- Use anatomic landmarks when possible
  - e.g. medial malleolus, ulnar styloid, etc



1. Head. 2. Neck. 3. Great trochanter. 4. Lesser trochanter. 5. Shaft. 6. Inner condyle. 7. Outer condyle.

Pattern

- Simple vs. comminuted
- Complete vs. incomplete
- Orientation of fracture line
  - Transverse
  - Oblique
  - Spiral



Displacement

- Displacement is the opposite of apposition
- Position of distal fragment relative to proximal
- Expressed as a percentage

Angulation

- Deviation from normal alignment
- Direction of angulation defined by apex of
- Expressed in degrees

Fracture description: Summary

- Clinical parameters
  - Open vs. Closed
  - Neurovascular status
  - Clinical deformity
- Radiographic parameters
  - Location
  - Pattern
  - Displacement
  - Angulation
  - Shortening

Treatment Principles

1. Reduction if necessary.
2. Immobilization (definitive or temporary).
3. Definitive treatment
4. Rehabilitation.

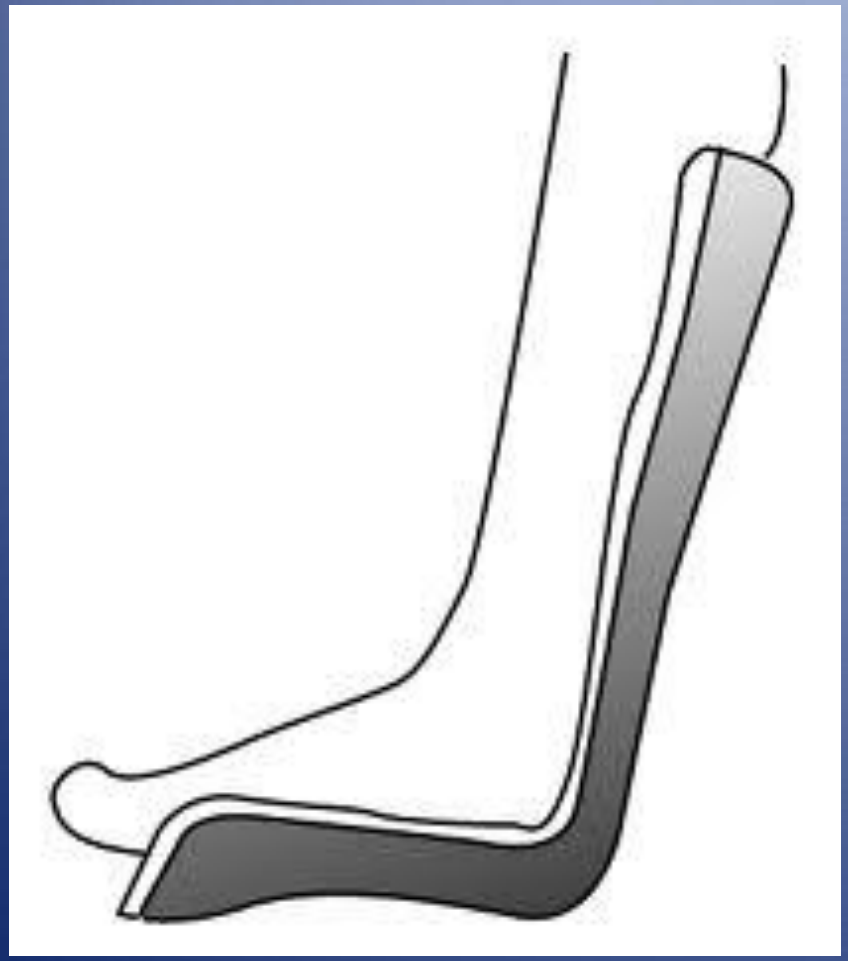
Initial (Reduction)

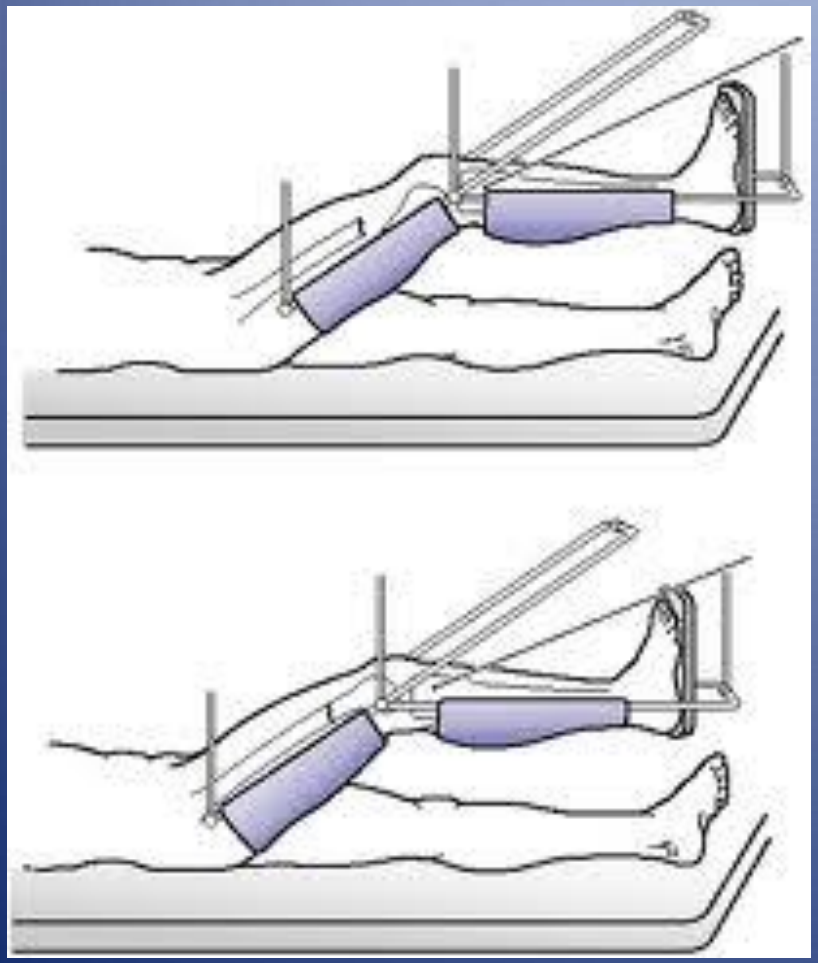
- IF fracture is displaced.
- Meant to re-align fracture fragments.
- To minimize soft tissue injury.
- Can be consider definitive if fragments' position is accepted.
- Should be followed by immobilization.

Initial (Immobilization)

- To hold reduction in position.
- To provide support to broken limb
- To prevent further damage.
- **Control the Pain**

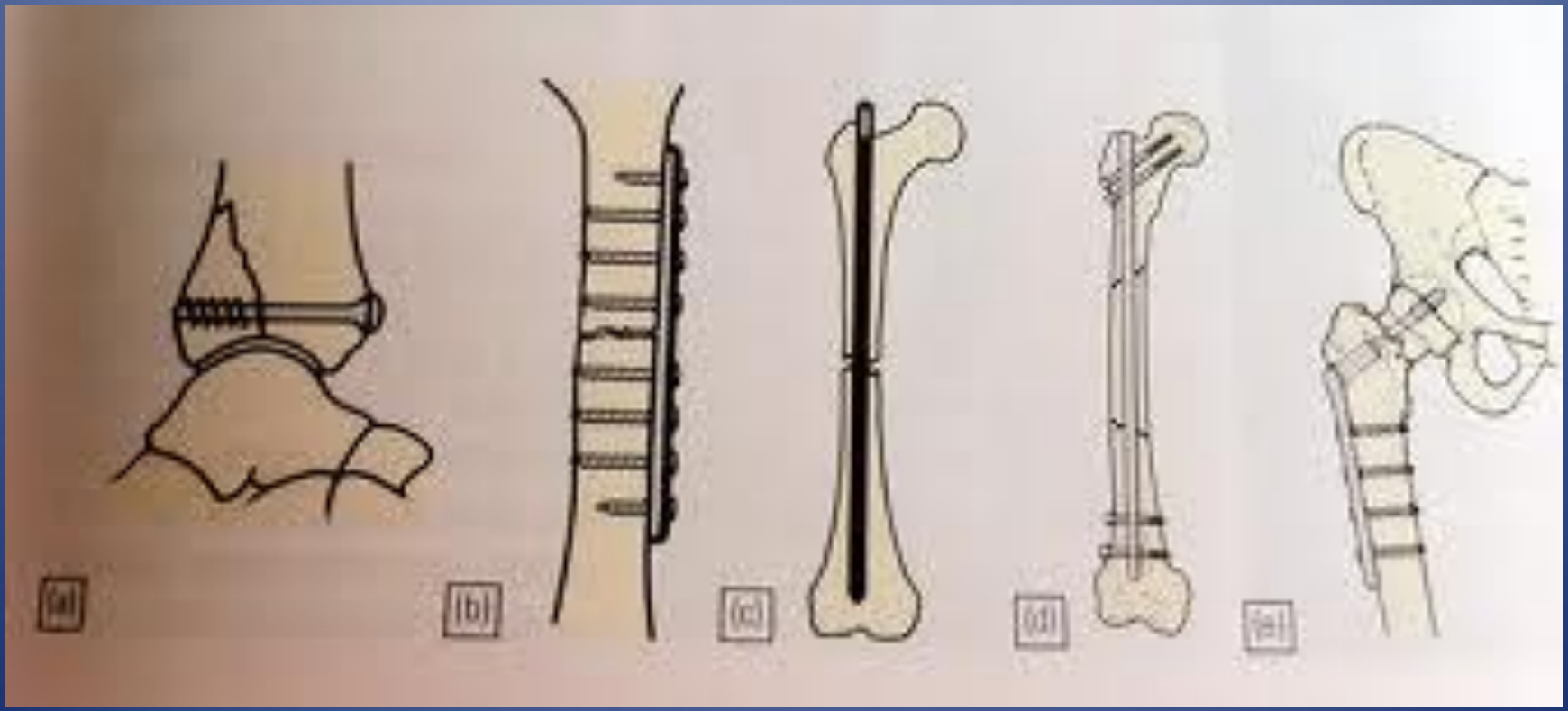
Initial (Immobilization)





Definitive

- If satisfactory reduction can not be achieved or held at initial stage.
- Reduction can be attempted close or open (surgery)
- Immobilization can be achieved with:
  - Plate and screws.
  - IM nail
  - EX-fix



Treatment: Principles

- Rehabilitation
  - Motion as early as possible without jeopardizing maintenance of reduction.
  - Wt bearing restriction for short period.
  - Move unaffected areas immediately

Treatment: Principles

- Reduce (if necessary)
  - to maximize healing potential
  - to insure good function after healing
- Immobilize
  - to relieve pain
  - to prevent motion that may interfere with union
  - to prevent displacement or angulation of fracture
- Rehabilitate
  - to insure return to function

Multiple Trauma

- Multi-disciplinary approach.
- Run by Trauma Team Leader (TTL) at ER. Orthopedic is part of the team.
- Follow trauma Protocol as per your institution.
- Treatment is prioritized toward life threatening conditions then to limb threatening conditions.

Take home points

- Fractures hurt –immobilization relieves pain.
- R/o open fracture, Compartment syndrome and N/V injuries.
- Principles of fracture treatment:
  - Reduce (if necessary)
  - Immobilize
  - Rehabilitate

QUESTIONS?

THANKS