Bones 101: Introduction to Emergency Orthopedics

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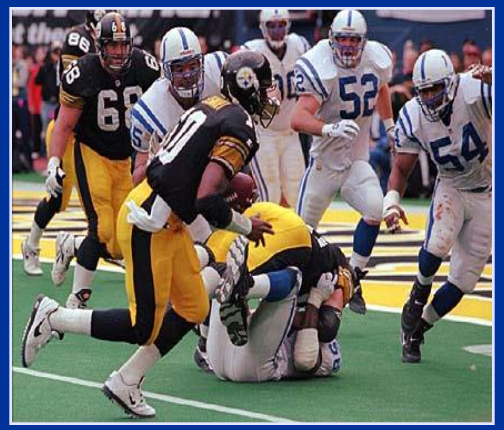
Intro to ortho: Overview

- General Terms & Principles
- Radiology
- Ottawa
- Salter-Harris Classification
- Splinting
- Complications
- Pain Control
- Follow-up

Ortho History

- Mechanism of injury
- Other injuries
- Tetanus status (if skin break)
- Handedness (for hand injuries)



Ortho Physical

- Inspection
  - Swelling/color/deformity
- ROM
  - Active/passive
- Palpation
  - Point of Max tenderness
  - Hematoma/crepitus
- Neurovascular Assessment
  - Motor: 0-5; peripheral nerve function

Motor Grade

- 0 = Nada
- 1 = Muscle fires (fasciculation); no movement
- 2 = Moves with gravity eliminated
- 3 = Moves against gravity
- 4 = Not full strength
- 5 = Full strength

Ortho Physical

- Sensation
  - 2-point
  - Pinprick
- Vascular
  - Cap refill
  - Pulses/skin temp

Limb Deformity

- Valgus = away from midline
- Varus = towards the midline

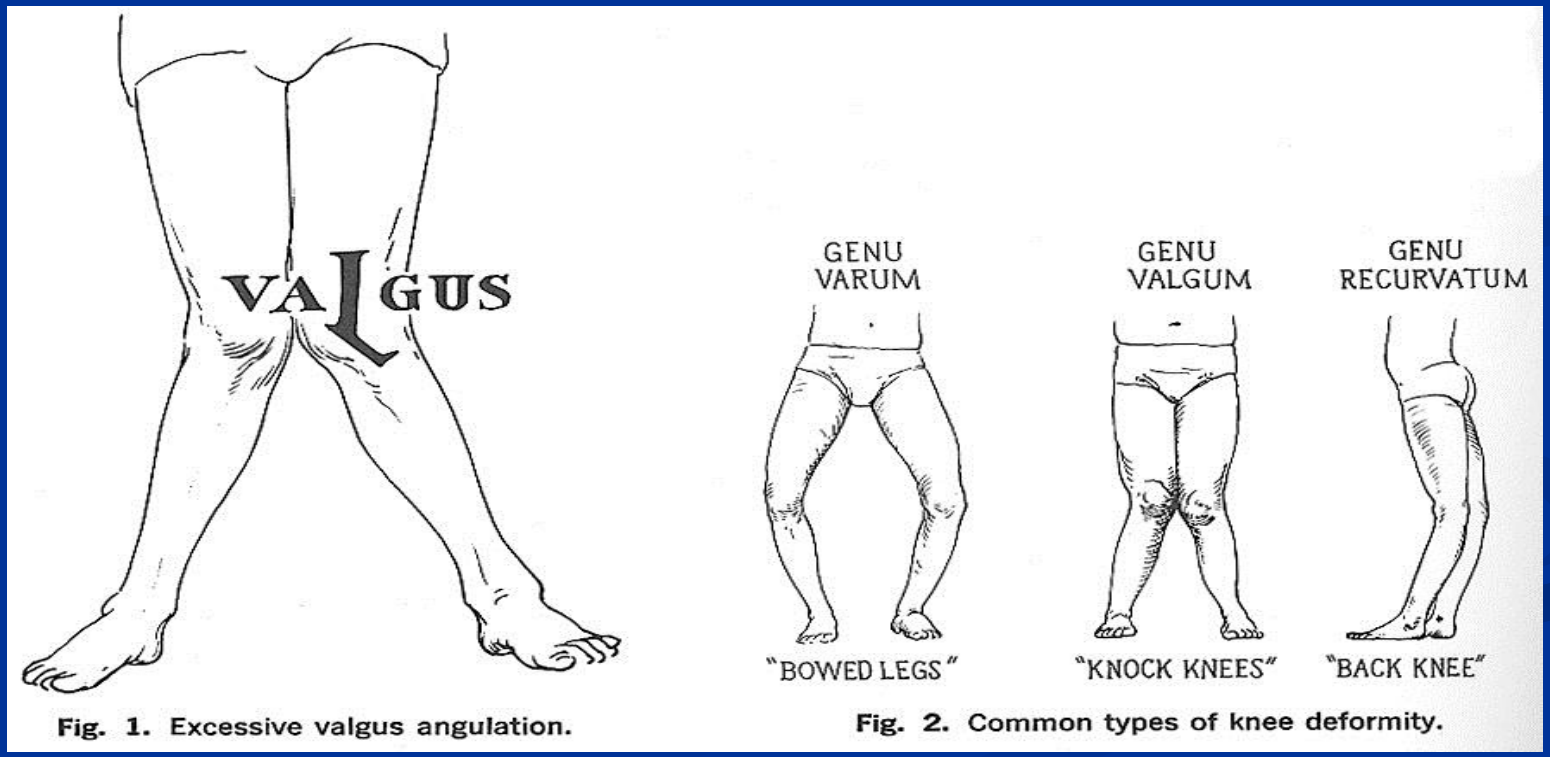


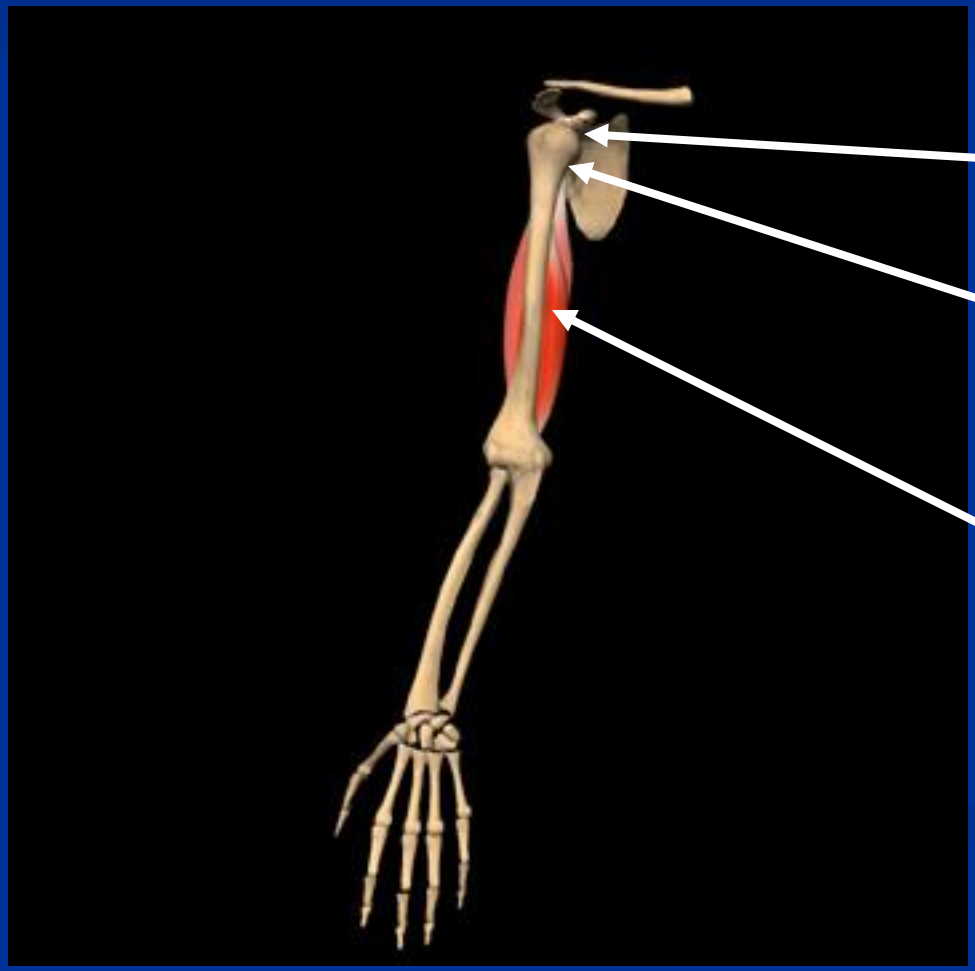
Fig. 1. Excessive valgus angulation.

Fig. 2. Common types of knee deformity.

Nomenclature

- Subluxation: **partial** loss of the nl anatomic relationship between joint surfaces
- Dislocation: **complete** loss of the normal anatomic relationship between joint surfaces (Note: Fractures don't dislocate, they displace)

Nomenclature

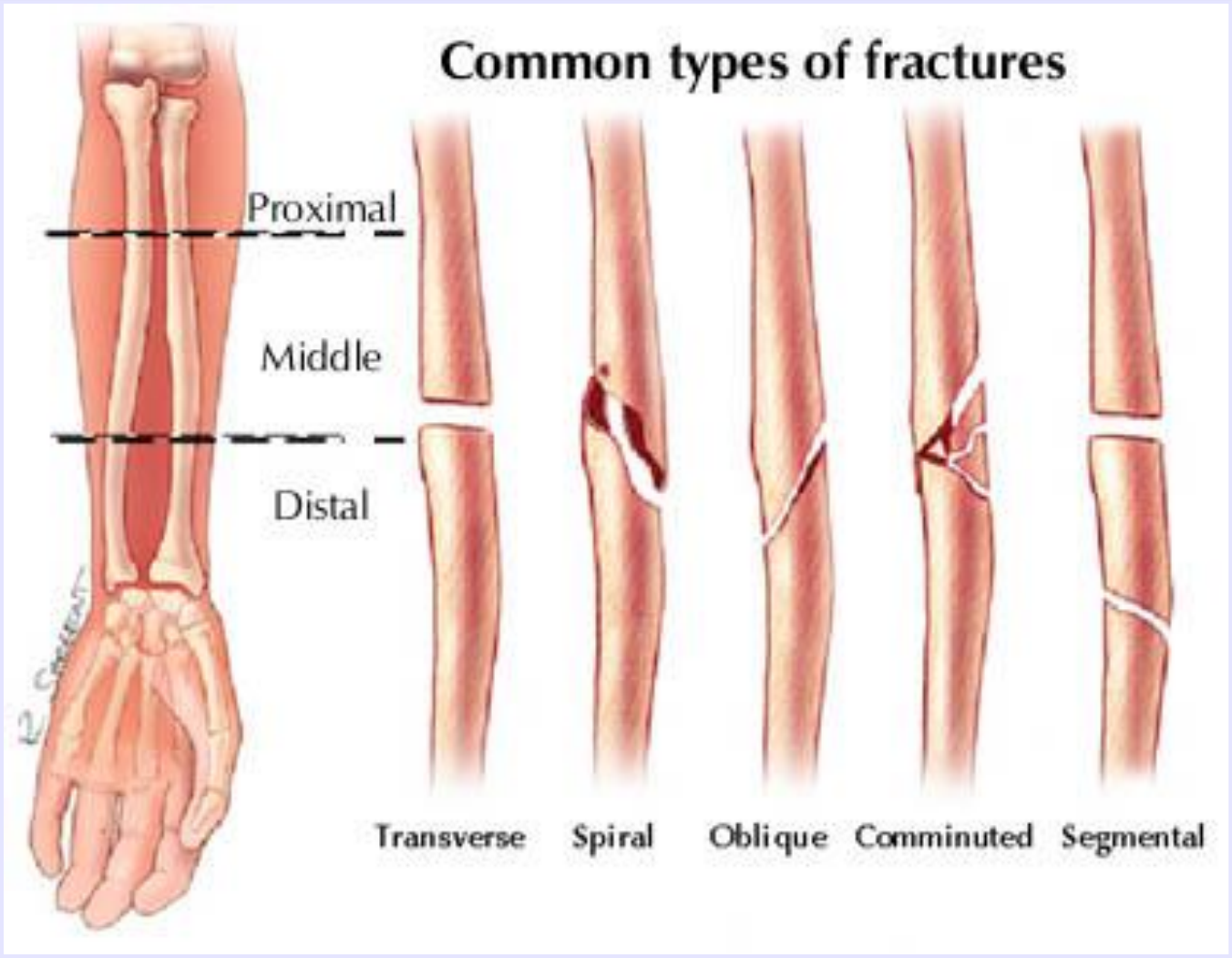


Epiphysis

Metaphysis

Diaphysis

Nomenclature



Nomenclature

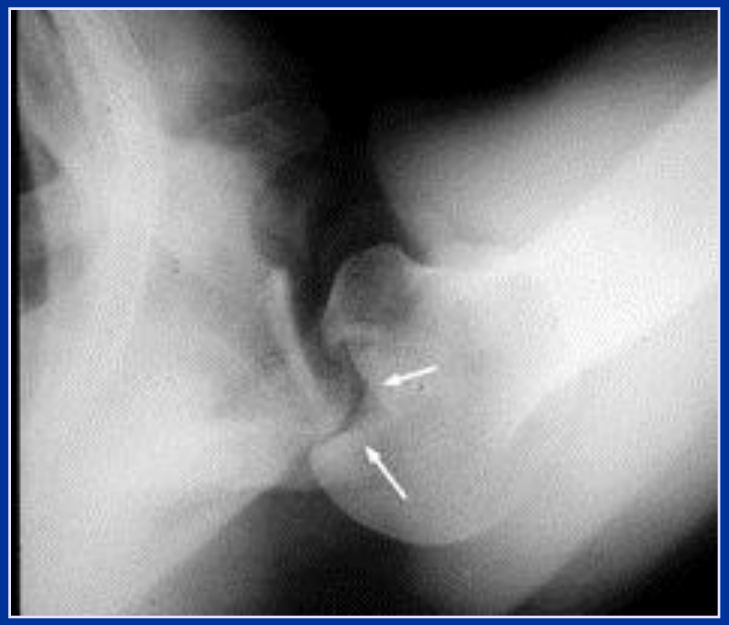
- Transverse/spiral/comminuted

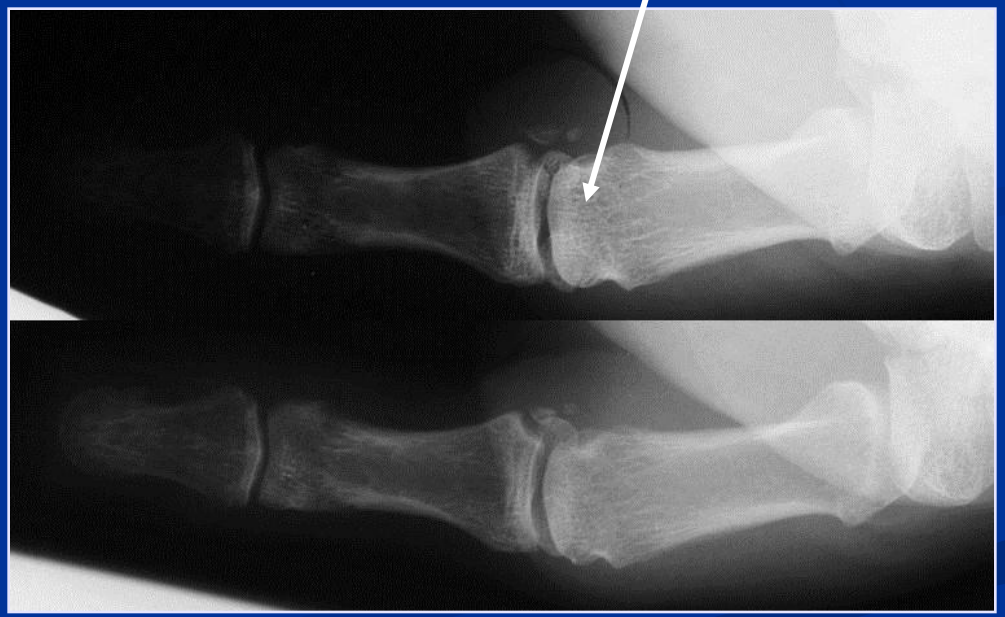
Nomenclature

- Open vs. Closed

Nomenclature

- Impacted/avulsed





Nomenclature

- Complete/incomplete

Nomenclature

- Buckle (Torus)/bowing fracture

Fracture description

Angulation

Shortening

Displacement/ apposition

Radiology

- A minimum of 2 views at right angles to each other are necessary to evaluate a bone or joint.
- Many specialized views (Joint specific)

TABLE 2-3

ABC'S Approach to Interpreting Skeletal Radiographs

Adequacy	All views are included Positioning and penetration (exposure) are correct
Alignment	Anatomic relationships between all bones are normal
Bones	Look for fracture lines or distortion of cortex and trabeculae Supplementary views may be needed to detect nondisplaced fractures Pseudofractures can mimic a fracture: Accessory ossicles, growth plates, nutrient artery foramina, and Mach bands
Cartilage	Joints should be of normal width and have uniform spacing Fracture fragments may be seen within joint space
Soft tissues	Soft tissue swelling, joint effusions, and distortion of fat planes may be easier to see than the fracture itself

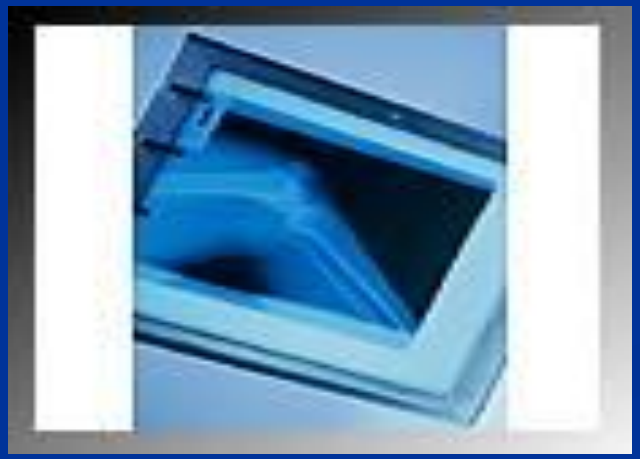
Just where is Ottawa and why should I care (And what does it have to do with Orthopedics?)

Ottawa Criteria

- Decision rules for determining who needs a knee/Ankle x-ray.
- Ian G. Stiell et. al. 1995
- Designed to reduce cost while **not** missing clinically significant bony injuries
- Shooting for sensitivity of 1.0 (want to miss no fractures, ok to xray some normal joints)

Ottawa Knee Rules

- Age 18-55
- Able to weight-bear > 4 steps
- Able to flex to 90^{o}
- No fibular head tenderness
- No isolated patellar tenderness



Ottawa Knee Rules

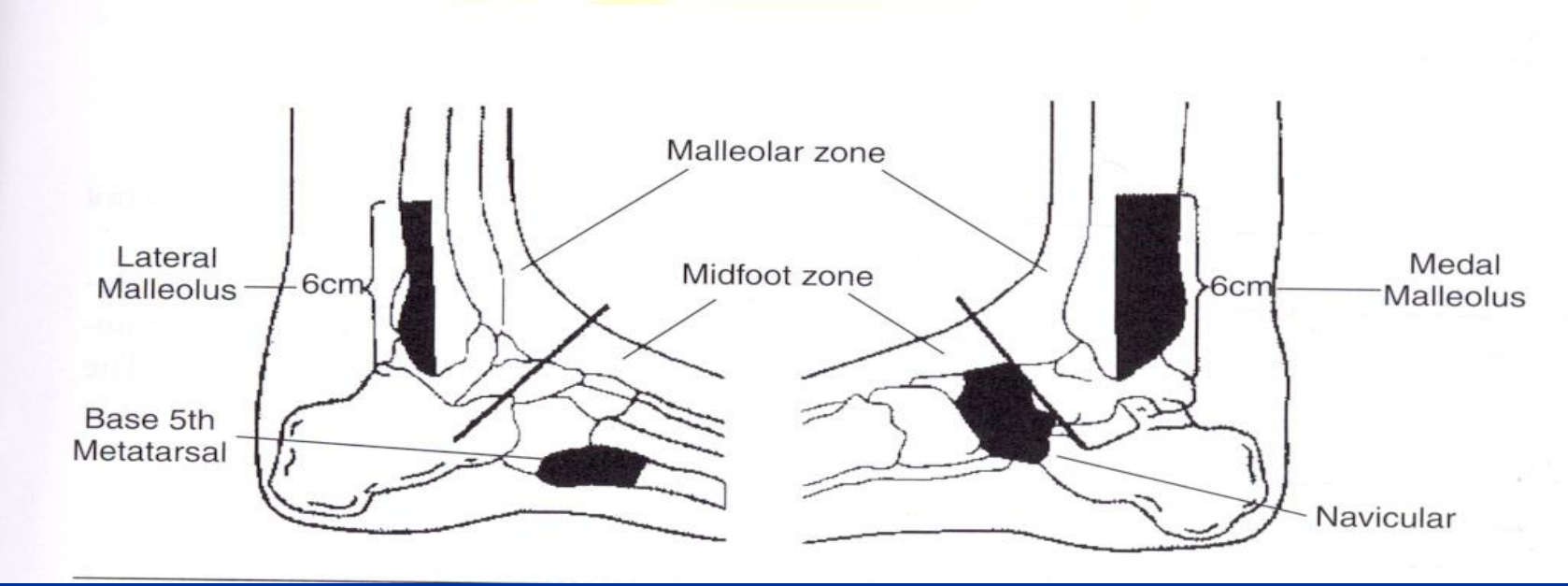
- 1,047 patients (68 fractures)
- Sensitivity = 1.0
- Specificity of .54
- Rule would have reduced x-rays by 28%

Ottawa Ankle Rules

- Stiell et al.
- Age 18-55
- Acute (<10 days) injury
- Initial evaluation
- Not pregnant

Ottawa Ankle Rules

- No bony tenderness POSTERIOR edge of distal 6 cm of fibula or tibia
- No tenderness in midfoot (base 5th MT, Navicular)
- Able to bear weight 4 steps in ED



Ottawa Ankle Rules

- Sensitivity of 1.0
- Reported equivalent patient satisfaction
- Saves a lot of money.

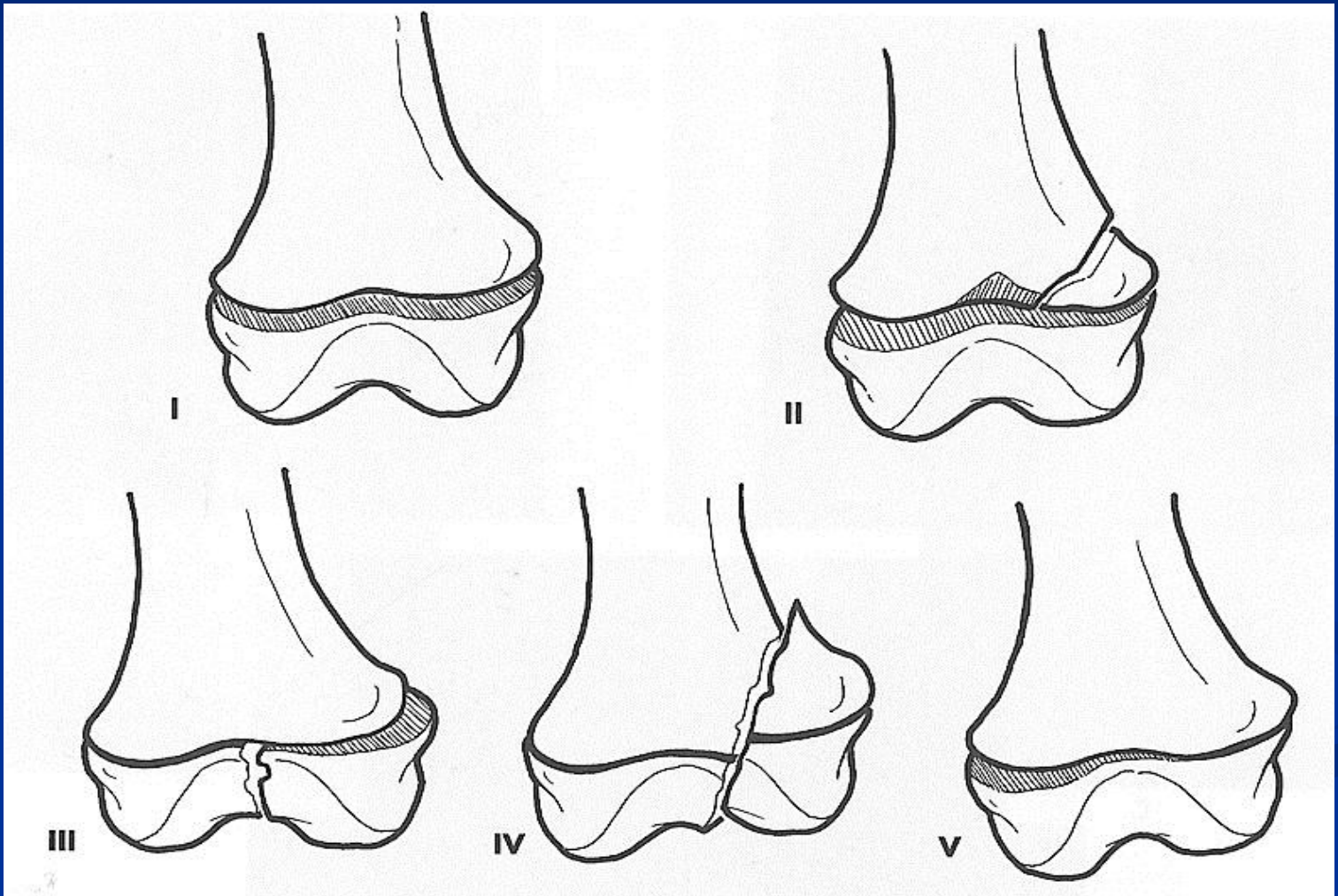
A word on kids…

- Tendons are stronger than bones.
- They can't always tell you exactly where it hurts.
- Missed fractures in kids cost a lot.

Growth Plate Injuries
(aka Salter-Harris classification)

- Epidemiology:
  - 15-30% of all skeletal injuries in children
  - Occurs most commonly after age 10, with a median age of 13 years. Males >> females
  - Distal radius most common (30-60% of cases)
  - Most common April-September
  - Most commonly mis-diagnosed as "sprain"

Salter-Harris classification




I


IV
ME


III
E


II
M

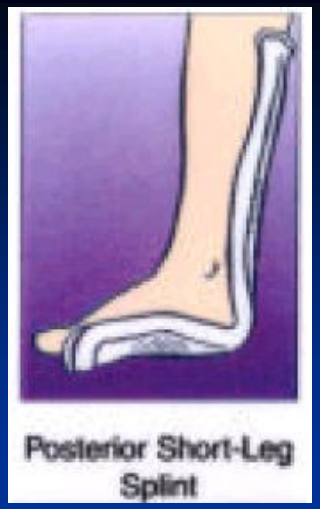

V

"Can I have something for pain?"

- Sprains hurt too! (Don't let the x-ray determine if the patient has pain)
- Anticipate duration of pain
- NSAID and narcotics for most
- "R-I-C-E"

Splinting
(not casting)

- Adequate for the job
  - The right splint
  - The right material
  - The right size
- Well-padded
- Comfortable



Splinting

Always:

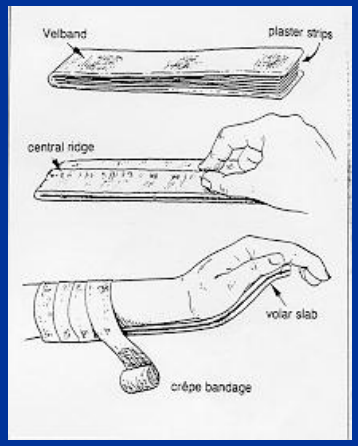
Extend Padding Beyond Splint

Splint Thickness:

- Upper Extremity 8-10 Layers
- Lower Extremity 12-15 Layers

Molding/Holding:

- Always Use Pads of Hand to Mold and Hold
- Plaster Sets in 5-8 Minutes
- Dry in 30-90 Minutes
- Ace Wraps Hold Splint… Not for Compression



Fracture complications

- Open fracture
- Compartment syndrome
- Neurovascular injury
- Splinting errors
- Unrecognized implications

Follow-up

- Everybody needs it!
- Appropriate caregiver. (NOT all injuries need to follow-up with ortho) Conversely, don't send complex fractures to primary care provider.
- When in doubt, splint and follow-up (especially kids)
- Give clear, **time-sensitive** instructions to return for problems.

Ortho Pitfalls

- X-rays not obtained
- Correct views not obtained
- Inadequate films accepted
- Failure to consider > 1 injury
- Failure to consider occult fractures

Failure to diagnose complications:

- Neurovascular injury
- Compartment syndrome
- Retained foreign body
- Systemic Complications
  - Fat emboli
  - Rhabdo

Treatment errors:

- Failure to keep pt NPO.
- Failure to immobilize
- Incorrect/Incomplete splinting
- Casting complications
- Non-weightbearing/elevation

Failure to communicate:

- Poor discharge instructions
- Inadequate follow-up

QUESTIONS/COMMENTS