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
Nomenclature

- **Subluxation**: partial loss of the normal anatomic relationship between joint surfaces

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

Diaphysis

Epiphysis

Metaphysis

Diaphysis
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
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°
- 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
“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