Pediatric Fractures & Case Study

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Overview

• Unique pediatric traits in fractures
  – Salter-Harris classification in physeal fractures
• Wrist injuries
• Elbow fractures
• Ankle fractures
• SCFE
Unique Pediatric Traits

• Salter-Harris classification system
  – They involve the physis and occur in about 15% of long bone fractures

• Only 2% of physeal fractures result in significant functional disturbances

• Labelled 1 thru 5
Salter-Harris Classification

- **Salter-Harris 1 injuries**
  - Occur completely thru the physis
  - May or may not be displaced depending on energy
  - Tend to heal quite readily
Salter-Harris Classification

- **Salter-Harris 2 injuries**
  - Occurs across the physis with exit thru the metaphysis
  - May or may not be displaced depending on energy
  - Very common version of S-H fractures
  - Tend to heal quite readily
Salter-Harris Classification

• **Salter-Harris 3 injuries**
  - Occurs across the physis with exit through the epiphysis
  - May or may not be displaced depending on energy
  - Outcomes vary with joint reduction
Salter-Harris Classification

• Salter-Harris 4 injuries
  – Crosses the metaphysis & epiphysis
  – Through the physeal plate and intra-articular
  – Least common
  – Results depend on joint reduction
Salter-Harris Classification

• Salter-Harris 5 injuries
  Through the physeal plate
  – Difficult to diagnose
  – Usually discovered retroactively
  – Premature physeal closure can be seen
Salter-Harris Classification

- Salter-Harris injuries: SALTR
  - Type 1=S: slipped
  - Type 2=A: above
  - Type 3=L: lower
  - Type 4=T: through (everything)
  - Type 5=R: rammed
Wrist & Forearm Fractures

- Torus fractures
  - A bend is produced on one side
Wrist & Forearm Fractures

- Torus fractures
  - Typically from a fall; pediatric bones (thicker periosteum) allows this to occur
  - Heals in a cast, 3-6 weeks
  - When the cast is removed, the wrist stiffness will go away in 10-14d
  - PT is not needed
  - Parents are urged to avoid playground structures for 3-4 weeks after
Wrist & Forearm Fractures

- Greenstick fractures
  - An incomplete fracture pattern
Wrist & Forearm Fractures

- Greenstick fractures
  - Reductions are sometimes required
  - Treatment is similar to torus fractures
  - Again PT is not needed
  - Keeping children away from playground structures is like keeping Baloo the bear away from honey!
Wrist & Forearm Fractures

- Galeazzi fractures
  - A fracture-dislocation pattern of isolated distal 1/3 radius fracture with distal radio-ulnar joint (DRUJ) disruption
Wrist & Forearm Fractures

• **Galeazzi fractures**
  – This injury disrupts the forearm axis
  – It is known as a “fracture of necessity”
  – It is thought to be caused by a fall on a hyperpronated forearm
  – The overpull of the brachioradialis & pronator quadratus are the deforming forces…92% malunion rates are expected
  – Requires surgical intervention
Wrist & Forearm Fractures

• Monteggia fractures
  – A fracture-dislocation pattern of the proximal ulnar shaft & radial head dislocation
Wrist & Forearm Fractures

• Monteggia fractures
  – For diagnosis, it’s important to obtain quality elbow films
  – Remember that the radial head appearance is age-dependant
  – Reduction is critical
  – Surgery is usually necessary
Elbow Fractures

• Supracondylar elbow fractures
  – These fractures occur through the thin part of distal humerus (through the olecranon fossa) & above the physis
  – Makes up 41% of all pediatrics elbow fractures
Elbow Fractures

• Supracondylar elbow fractures
  – Peak age 4-6
  – These are falls on a hyperextended elbow
  – It is important to check a neuro exam & radial pulse
  – Splint the injury as is
  – Referral to ortho for follow up
Elbow Fractures

• Type I SCH fractures
Elbow Fractures

- Type II SCH fractures
Elbow Fractures

• Type III SCH fractures
Elbow Fractures

- Medial epicondyle fractures
  - The injury mechanism is typically a large valgus stress
  - About ½ are associated with posterior elbow dislocation
  - 14% of all peds elbow fractures
Elbow Fractures

• Medial epicondyle fractures
  – Peak age 9-14
  – Non-operative results are good
  – Even displaced fractures heal with fibrous union & good outcomes
  – Surgery is reserved for >5mm displacement, ulnar nerve deficit, or when the fragment becomes trapped intra-articularly
Elbow Fractures

- Lateral condyle fractures
  - Highly missed diagnosis
  - Remember, these generally represent a S-H 4 fracture pattern
  - Use 4V elbow radiographs (important to check the obliques)
  - 17% of all peds elbow fractures
Elbow Fractures

- Lateral condyle fractures
  - Peak age 4-9
  - 2mm displacement requires ORIF
  - There is an increased risk for lateral overgrowth
  - Growth arrest
  - Cubitus varus deformity or tardy ulnar nerve palsy (late)
Ankle Fractures

• Ankle fractures
  – Peak age 8+
  – Treatment doesn’t differ from adult fractures for mortise alignment & displacement in non-physeal injuries
  – Mechanism is typically axial loading or rotation about a fixed foot

• SH 1 & 2
  – Very rarely serious
  – Cast treatment
Ankle Fractures

• SH 3: Tillaux fracture
  – Represents an anterior tibiofibular avulsion
  – Higher risk for growth plate disturbance
  – Requires an anatomic reduction
  – K wire or screw fixation
Ankle Fractures

• SH 4: Triplane fracture
  – Higher energy torsional fracture
  – Higher risk for growth plate disturbance
  – Requires an anatomic reduction
  – K wire or screw fixation
Slipped Capital Femoral Epiphysis

- SCFE
  - Peak age 11-15
  - Approx 1-10,000 live births
  - A unique disorder to adolescent hips, most often developing during periods of accelerated growth, shortly after puberty
  - Fractures occur through the hypertrophic zone of the physis
Slipped Capital Femoral Epiphysis

- SCFE
  - Slips are acute or subacute (stable or unstable)
  - 20+% are missed at the first presentation to a medical facility
  - Good long term outcomes if caught early
  - At least 1 in 5 are eventually bilateral
Slipped Capital Femoral Epiphysis

• Other risk factors
  – Endocrine disorders (inc Type I Diabetes)
  – Renal disease
  – Cancer treatments
  – Corticosteroid use

• Diagnosis
  – 2-3x more common in high BMI males
  – Pain in the hip or knee
  – Waddling gait
  – Restricted IR on exam
Slipped Capital Femoral Epiphysis

• Diagnosis via radiographs
  – Klein’s line noted on the frog leg lateral view

• Repair with single screw fixation
  – Crutch walking
  – Sports restrictions
  – Close radiographic follow-up for 3-4 mos until physeal closure
Case Study

• C.H., a 12 y/o M.S. boy
  – Limping
  – Diagnosis via radiographs
  – Urgent screw fixation, 2003
  – C.H.’s gym teacher required a note
  – Healing & eventual opposite hip ORIF 2005

• Local High School
  – 6’3” 284lb offensive lineman, sev state championships & second team all-state
  – state wrestling runner-up, heavyweight
Case Study

• HWR
• UW-
  – 270lb OLB, played in the Rose Bowl
  – Engineering, post-grad honors
  – Lost 60lbs
  – Married
Conclusion

• Remember SALTR
  – Five types of Salter-Harris fractures

• Torus & greenstick wrist fractures
  – Unique to peds
  – Heal similarly

• Galeazzi & Monteggia
  – Require urgent ortho referral

• SCH elbow fractures
  – Type I-III
  – Usually splint as is and consult ortho
Conclusion

• **Medial epicondyle fractures**
  – Are elbow dislocation variants
  – Check the ulnar nerve

• **Lateral condyle fractures**
  – Can be missed easily
  – Often described on the phone to me as “something just not right”

• **Ankle Fractures**
  – SH 1&2 are low energy & stable
  – Special consideration for SH 3&4
Conclusion

- SCFE
  - Higher BMI males with insidious onset hip pain
  - Waddling limp
  - May present as knee pain
  - Good results are expected with early diagnosis & treatment