Pediatric Elbow Trauma

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No relevant disclosures
Elbow Fractures

• 86% of elbow fractures are in distal humerus
  - 80% supracondylar
  - 17% lateral condyle
  - 12% medial epicondyle
Pediatric Elbow Fractures

- Supracondylar humerus fractures
- Lateral humeral condyle fractures
- Medial epicondyle fractures
- Radial neck fractures
- Olecranon fractures
- Monteggia fractures
- Nursemaid’s elbow
A good preoperative exam

How important is it?
Patient Evaluation in ED

- Distal perfusion: pulses/doppler signal?
- Skin – soft tissues: brachialis sign, open?
- Neurological function
- NPO status
- Other injuries?
Neurologic Exam

• Extend fingers/thumb (Radial N)

• Make O with thumb and index finger (Median N)

• Spread fingers (Ulnar N)
Anterior Interosseous Nerve Deficit

OK

NOT OK
Radiographic Assessment
Fat Pad Sign

- 50% will have a fracture
Fat Pad Sign

- Usually cast children with + fat pad sign for 3 wks
Elbow Fractures in Children:
Radiograph Anatomy/Landmarks

• Baumann’s angle: a line parallel to the axis of the humerus and a line through the physis of the capitellum
• Wide range of normal and can vary with rotation of arm (64-81)
• In this case, the medial impaction and varus position increases Baumann’s angle
• Note that some refer to the complement as Baumann’s angle
Elbow Fractures in Children: Radiograph Anatomy/Landmarks

- Anterior Humeral Line - should pass through middle of capitellum. If it does not then posterior displacement/angulation
Elbow Fractures in Children: Radiograph Anatomy/Landmarks

- Distal humerus angulated anteriorly about 30 degrees.
- Implications for pinning
Type I: non-displaced

- Note the non-displaced fracture anteriorly
  - (Red Arrow)

- Note the posterior fat pad
  - (Yellow Arrows)
Type II: Angulated with intact posterior cortex
Type III: Complete displacement, with no contact between fragments
Type IV: Completely unstable
Treatment

• Type I: cast
• Types II and III (and IV)
  – Closed Reduction and Pinning
  – Cast / Pins 3 weeks
When to fix?

How long is it safe to wait?
When to fix?

• Type II can be sent home from the ED and fixed electively in the next few days

• Type III needs to be fixed within 24 hours preferably

• Which ones need to get fixed emergently?
6 year old, AIN out, good pulses and sensation
Brachialis sign
CRPP next am, stable exam postop
Supracondylar Fractures

Catastrophes

- Neurovascular injury
- Large open
- Compartment syndrome
Emergent

• Open
• Poorly perfused hand
What is the role of “partial reduction” or temporizing reduction in the ED?

How do you do it – ? conscious sedation
What is an acceptable closed reduction?
Adequate reduction?

- No varus/valgus
- Anterior hum line
- Minimal rotation
- Translation OK

From M. Rang, Children’s Fractures
Acceptable Reduction?

- <10 degree difference in Baumann’s angle
- <15 degrees decrease in carrying angle
CRPP

- Examine other elbow first
- carrying angle, ROM
- supine, sheet around axilla
- plexiglass arm board
Closed Reduction: One Technique

- Longitudinal traction
- Correct medial-lateral displacement, rotation
- Push olecranon forward
- Flex elbow & pronate forearm
Reduction

From Mercer Rang’s Children’s Fractures
Push olecranon anterior
Are there tricks/tips for closed reduction method?
Severely Displaced

- Skin dimple
- Hyperextension/rotation
- “milk” brachialis first
- Don’t flex elbow until olecranon pushed anterior to epicondyles
“Milking Maneuver”

From Archibeck et al. JPO 1997
Milking Maneuver

From Archibek et al. JPO 1997
6 yo fall off of jungle gym
Very unstable fracture / soft tissue hinges disrupted
Injury films - extension type III, impaled through brachialis
After milking maneuver, longitudinal traction
After flexion reduction maneuver.
Postoperative care

• How do you take care of pins postoperatively?
Avoiding Complications: Pin Tract Infections
Avoiding Complications: Pin Tract Infections
How do you immobilize the upper extremity after CRPP?

- Splint
- Cast
- Material?
- Position of elbow?

From John Charnley,
The Closed Treatment of Fractures
CHLA
Pin care – Padding- Cast technique
Post-pinning Management

- Pins out of the skin, bend 90 deg and cut long
- Sterile felt and cast padding
- Flex until antecubital skin touches, then extend 10 deg
- Fiberglass LAC, split & spread
- Monitor overnight
Cubitus Varus - causes

- Failure to recognize varus
- Malreduction - primarily coronal plane, also extension / IR
- Loss of fixation
- Avascular necrosis
- Overgrowth
Pre and Post Osteotomy
Pre and Post Osteotomy
Ipsilateral SCH and Distal Radius fractures

- Increased risk for?
What type supracondylar is this?
Trick Question!
Lateral Condyle Fractures

- Diagnosis
- Often subtle
Lateral Condyle

- Less than 2 mm or only visible on one image then try non-op
- 2-4mm then closed reduction with perc pin or screw fixation and arthrogram
- Greater than 4mm typically needs open reduction
Lateral Condyle
Lateral Condyle
Medial Epicondyle Fractures

- Often associated with Elbow dislocation
Medial Epicondyle Fracture

- Think dislocation
- Literature supports conservative treatment for many
- Reduction and fixation in overhead athlete/gymnast
Incarcerated Medial Epicondyle
Olecranon
Bilateral Olecranon Fractures

• This should raise a red flag in your head

• Maybe associated with blue sclera

• Osteogenesis Imperfecta!
Tension Band
Radial Neck
• 5 yo M
• Fall onto outstretched arm 3/29
• 4/17 .... Almost 3 weeks post injury
• Exam shows almost full flex/ex
• Severely limited supination
• Prompts MRI and referral
MRI
- Open reduction
- K-Wire across fracture
Radial Head & Neck Fx’s

- Observe I
- > 30° consider closed versus percutaneous reduction
BC

- Joystick
Forearm Fractures
Monteggia Fx
Monteggia Fractures

- Dislocated Radial Head
- Ulna fracture
- Remember to examine elbow & wrist of forearm fx’s
Monteggia Fracture

- High index of suspicion
- “Isolated” radial head dislocation — usually has plastic deformation of ulna
Nursemaid’s elbow

• Caused by pulling in a child’s arm but can be a gentle twist

• Usually 1 - 4 year old children
Nursemaid Elbow
Nursemaid Elbow
Nursemaid’s elbow

• Subluxation of radial head (normal radiographs)

• Reduce by supinating forearm and flexing elbow
Closing remarks

• Be wary of the pediatric elbow
• Un-ossified structures can try to trick you
• Let mechanism, swelling, and pain increase your level of concern as needed
• Use the contralateral elbow for exam (and even radiographs) to help you if needed!
Thank You