# PEDIATRIC FOREARM FRACTURES TO CAST OR OPERATE?

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## OUTLINE

- Both bone forearm fractures
- Monteggia fractures

# **CLOSED OR SURGICAL TREATMENT?**

## BOTH BONE FOREARM FRACTURES



- One of the most common pediatric fractures
- Distal metaphysis > midshaft > physeal > proximal third
- Open fractures common
- Vast majority can be treated with closed reduction and cast

# CLOSED REDUCTION – 1<sup>ST</sup> STEP

- "Rule of thumb" for shaft fxs
  - Point the thumb toward fracture apex
  - Rotation may be the crucial reduction maneuver
- How to judge rotation?
  - Hard to tell!
  - Often underestimated
  - Cortical width
  - Radial tuberosity ~ radial styloid (AP view)
  - Ulnar styloid ~ coronoid (lateral view)





# IT'S ALL ABOUT THE CAST

#### Cast Index

- Pancakes, not burritos
- Goal <0.7
- Index >0.7= high rate of redisplacement





# UNIVALVE VS BIVALVE?

- Reduction in skin surface pressure of 70.8% for univalve, 85.1% for bivalve
- A good cast won't lose reduction with bivalving
- Cotton cast padding allows for the greatest change in pressure
  - Avoid gortex with reduction
- DO cut it!
  - 16% of children placed into a circumferential forearm cast following reduction of a displaced fracture require cast modification for complications associated with soft tissue swelling, supporting the notion that circumferential casts should be split after fracture reduction

J Bone Joint Surg Am. 2015 Mar 4;97(5):374-80. doi: 10.2106/JBJS.N.00579. The effectiveness of bivalving, cast spreading, and webril cutting to reduce cast pressure in a fiberglass short arm cast. J Pediatr Orthop. 2017 Jan;37(1):74-77. Effect of Casting Material on the Cast Pressure After Sequential Cast Splitting

Nietosvaara Y, Hasler C, Helenius I, Cundy P. Marked initial displacement predicts complications in physeal fractures of the distal radius: an analysis of fracture characteristics, primary treatment and complications in 109 patients. Acta Orthop. 2005; 76(6):873–877

#### CAST SAW BURNS

Splitting a cast is not without risk

- Iatrogenic cast saw abrasions and thermal burns occur with a frequency of 0.72% and are common sources of litigation
- Increased risk: dull blade, cutting in concavity (AC fossa), thin padding, thick cast
- In and out technique
- Cool with soaking wet webril

PEDIATRIC FOREARM FRACTURES: TOLERANCE

**HUGE remodeling potential** 

Distal remodeling much greater than diaphyseal (and proximal!)

Distal radius physis 75% of growth, distal ulna 80% of growth

| <10 Years Old                                       | >10 Years Old<br>(2+ years growth remaining)        |
|---|---|
| <ul> <li>Distal fracture: &lt;30 degrees</li> </ul> | <ul> <li>Distal fracture: &lt;20 degrees</li> </ul> |
| • Shaft fracture: <15-20 degrees                    | • Shaft fracture: <10 degrees                       |

• Bayonet <1cm

No bayonet (translation ok)

Plate/screws vs IM rod: dealer's choice (similar outcomes)

#### WHAT'S AT STAKE?

- <a>Pronation/supination</a>
- In general: more angulation → decreased ROM but NOT directly
- In general, amount of residual deformity is not well correlated with range of motion deficit
- Proximal radius angulation is likely worse than proximal ulnar angulation
- Age is truly the most important factor in remodeling

# GUSTILO-ANDERSON TYPE 1 OPEN FRACTURES

- Significant support in the literature for treating type 1 open fractures without surgery
- Early antibiotic administration, bedside irrigation, and fracture stabilization in the emergency department may be a safe and effective initial treatment
- Abx protocol varies give antibiotics, IV in hospital +/- oral as outpatient
- High level evidence is still lacking but this treatment does not seem to yield increased infection risk



#### FOREARM RE-FRACTURES

- Rate: up to 10%, usually midshaft
- Angulation matters:
  - Increased refracture rate with >15 degrees malunion
- Timing: usually first few months (vast majority within 6 months)
- Require longer immobilization: 72 days initial fracture vs 98 days refracture
- Wait for 4 cortices prior to return to activity
- Not an absolute indication for surgery in kids

#### MONTEGGIA FRACTURES

Any ulna fx needs elbow films



#### JUST DON'T MISS THEM (33% are missed!)





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# MONTEGGIA FRACTURES

Age 4-10

- Proximal/middle third ulna (even olecranon)
- Most common Bado 1 (then 3)
- Neuropathy of PIN (10%)
- Closed reduction (supination may be helpful)
- LOW THRESHHOLD for surgery if ANY concern for RC joint congruity
- Not certain?  $\rightarrow$  MRI or arthrogram



# CLOSED VS SURGICAL TREATMENT

- <u>2015: Ramski et al</u>
- Recommendation:
  - <u>Closed reduction for plastic/greenstick fractures</u>
  - Intramedullary fixation for transverse/short oblique fractures
  - Open reduction and plate fixation for long oblique/comminuted fractures
- Complete fractures treated non op had 33% failure
- Less rigorous treatment failed in 6/32 (19%) cases
- Versus 0 failures in 52 fractures treated operatively

#### BUT...

 Hart et al, JPO 2021: 14% with complete ulna fractures lost reduction and required surgical management – good results

 Foran et al, JPO 2017: 17% with complete ulna fractures lost reduction and required surgical management – good results

#### SURGICAL TECHNIQUE

- Closed vs open reduction of ulna fracture
  - Smooth Steinman pin
  - A little distraction is okay
  - Single poke hole +/- small ulnar incision at fx site



#### SURGICAL TECHNIQUE

- Radial head usually reduced and stable after ulna is anatomic
  - If unstable, may need to open radiocapitellar joint
  - Replace and/or repair annular ligament
  - RC joint pinning is worst case scenario

#### SURGICAL TECHNIQUE

• Arthrogram is helpful to evaluate radial head congruity with capitellum







#### POSTOPERATIVE MANAGEMENT

- Bivalved cast, less than 90, +/-slight supination
- Follow up in 1 week for cast overwrap and x-rays to check reduction
- Weekly x-rays x 3 weeks if nonop
- Immobilize x 6 weeks
  - I remove pin in clinic at 6 weeks
  - Steinman pin (as opposed to flexible nail) can be pulled in clinic











#### DOWNSIDES TO CLOSED TREATMENT

- Instability may necessitate casting in high flexion which can cause neurovascular complications! (Avoid casting over 90 degrees)
- Need for vigilant follow up. If lost to follow up, and displaces, this becomes a much more challenging problem
- High failure rate ~14-33%
- Surgical treatment after non-operative failure may be more complicated/invasive with less reliable outcomes, higher rate of annular ligament repair/reconstruction
- But... the upside is NO SURGERY

#### Comparison of treatment methods for pediatric Monteggia fracture

Met vs missed radial head dislocation Jin Peng He, MD<sup>a</sup>, Yun Hao, MD<sup>b</sup>, Jing Fan Shao, PhD<sup>a,\*</sup>