Pediatric Hip Fractures

Shiraz Younas, MD
Assistant Professor
Pediatric Orthopaedics

Pediatric Hip Fractures

• Less than 1% of all pediatric fractures

• 80-90% are a result of high energy trauma

• 10% due to moderate trauma or pathologic lesions

Pediatric Hip: Development

• Single physis at birth

• Develops two separate centers of ossification

• Ossific nucleus of femoral head forms between 4-6 months

• Ossific nucleus of greater trochanter forms at about 4 years of age
Pediatric Hip: Development

• Femoral neck shaft angle
  – 135 degrees at birth
  – 145 degrees by 1-3 years of age
  – Gradually matures to 130 degrees at skeletal maturity

• Femoral anteverision
  – 30 degrees at birth
  – Matures to about 10 degrees at skeletal maturity

Implications of injuries across the proximal femoral physis

• Abnormal neck shaft angle

• Abnormal femoral neck version

• Decreased articulo-trochanteric distance

• Mild limb length discrepancy
Pediatric Hip: Anatomy

- Lateral circumflex
  - Supplies the anterior portion of the femoral epiphysis and physis till 5-6 months of age
  - Contribution to femoral head blood supply diminishes by 3 years of age
- Medial Circumflex
  - Major blood supply to proximal femur
  - The entire blood supply to the proximal femoral epiphysis comes from the lateral epiphyseal branches of the medial circumflex by 3 years of age
- 20% blood supply to femoral head by artery of ligamentum teres after 8 years of age

Pediatric Hip Fractures

- 85-90% are caused by high energy
- Associated major injuries seen in 30 percent of pediatric patients with hip fractures
- Intraabdominal and intrapelvic injuries most common
- Hip dislocations, pelvic fractures and femoral fractures most common associated skeletal injuries
- <10% caused by pathologic lesions
- Non-accidental trauma rare cause of hip fractures in children less than 12 months of age

Pediatric Hip Fractures: Delbet’s Classification

- Type I: Trans-physeal
  - <10% of hip fractures
  - Most in children less than 2 or between 5 and 10 years of age
  - Diagnosed late in newborns and infants
  - Can result from child abuse
Pediatric Hip fractures: Delbet's Classification

- **Type I:**
  - Usually a result of severe trauma
  - 50% associated with femoral head dislocation
  - Associated injuries in over 60% of patients
  - Pelvic fractures most common associated orthopaedic injury
  - High rate of AVN

- **Type II:** Transcervical
  - Most common pediatric hip fracture (40-50%)
  - Result from severe trauma
  - 70-80% displaced at initial presentation
  - Initial displacement at time of injury best predictor of AVN
  - Higher complication rate than type III and IV
  - AVN reported up to 50% although thought to be less with more aggressive management
Pediatric Hip fractures: Delbet's Classification

- Type III: Cervicotrochanteric
  - 25-30% of hip fractures
  - 20-25% AVN rate
  - AVN rate directly related to amount of displacement at time of injury
Pediatric Hip fractures: Delbet's Classification

• Type IV: peritrochanteric or intertrochanteric
  – 6-15% of pediatric hip fractures
  – AVN in less than 10%
  – Most favorable outcomes

Delbet Type IV

Pediatric Hip Fractures: Missed Injuries

• Pain from hip fractures may obscure associated injuries.
• Concomitant injuries, especially head injuries can lead to delay in diagnosis (up to 20% of hip fractures)
• Often missed in newborns and infants
• Stress fractures may be ignored as hip/groin sprains
Pediatric Hip Fractures:
Treatment Type I Fractures
• 35% loss of reduction rate with cast immobilization alone
• Rigid internal fixation for acute presentation with cast immobilization
• Gentle reduction maneuvers: Flexion, slight abduction and internal rotation under fluoroscopy

Pediatric Hip Fractures:
Treatment Type I Fractures
• If femoral head is not in acetabulum, one attempt at closed reduction followed by open reduction
• Smooth pins in children less than 4, 4.0 mm cannulated screws in 4-7 year range, and larger cannulated screws in older children
• Pin/screw placement through lateral incision. Avoid threads across the physis.

Pediatric Hip Fractures:
Treatment Type II fractures
• Stable internal fixation for all fractures
• Complications a lot more common with closed treatment
• Gentle closed reduction attempted under fluoroscopy
• Open reduction through anterior or anterolateral approach
Pediatric Hip Fractures: Treatment Type II fractures

- Threaded steinman pins in younger child
- Cannulated screws in older
- Keep fixation distal to physis if possible
- At least two screws in older patients
- Needle hip decompression recommended
- One and a half hip spica cast till good healing

Pediatric Hip Fractures: Treatment Type III fractures

- Abduction casting for nondisplaced fractures in children less than 6
- Internal fixation for all type III fractures in children greater than 6 years, displaced fractures in children less than 6.
- Augment cannulated screws with casting
- Avoid Physis

Pediatric Hip Fractures: Treatment Type IV fractures

- Cast immobilization for nondisplaced fractures in younger patients
- Internal fixation for all displaced fractures and nondisplaced fractures in children over 6.
- More favorable outcomes
Pediatric Hip Fractures: Complications

• AVN:
  – Type I: 100% vs 38%
  – Type II: 50% vs 28%
  – Type III: 25% vs 18%
  – Type IV: 15% vs 5%
• Results from disruption of femoral head blood supply and tamponade from hemarthrosis
• Type I/II fractures, older age, initial displacement are risk factors.
• Time to treatment, needle decompression

Pediatric Hip Fractures: Complications

• Coxa Vara
  – 10-32% of cases
  – Malreduction
  – Delayed union or nonunion
  – Premature proximal femoral physeal closure with greater troch overgrowth
  – Casting alone especially in older patients risk factor
  – Less likely with rigid internal fixation

Pediatric Hip Fractures: Complications

• Nonunion
  – 6.5-12.5%
  – Higher rates with casting alone
  – Poor reduction
  – Distraction at fracture site
  – Fracture orientation (higher pavuwell's angle)
  – Can result in coxa vara or AVN
Pediatric Hip Fractures: Complications

- Premature Physeal Closure
  - 10-62%
  - AVN most common cause
  - Crossing the physis with hardware risk factor (62% vs 12%)

Delbet Type I

Presentation

- 7 month old child presents with one day history of refusal to move left leg
Closed reduction and casting

3 months

10 months
One year

7/22/14 (2yr followup) & 8/5/15 (3 yr followup)

Delbet type II
Initial presentation

- 7 year old male involved in auto vs pedestrian accident
- Right hip pain with movement

Initial Films

- X-ray images showing possible injuries to the hip area.

Initial Films

- CT scans of the hip region, indicating potential fractures or dislocations.
ORIF

10 month follow-up

19 months postop
Delbet type III

Initial Presentation

• 3 yr old male involved in autopedestrian accident
• Brought in with shortened externally rotated right lower extremity, blood at urethral meatus

Initial Films
Associated injuries

ORIF

Spica cast for pelvic injuries
3 month followup

Delbet type IV

Initial presentation

- 8 year old rode his bike into a metal post
- Developed acute right hip pain
Conclusion

- Pediatric Hip fractures are rare
- High suspicion in infants and patients with concomitant injuries leads to less missed injuries
- Aggressive early treatment may result in a lower complication rate than historically quoted

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Thank You!