Distal Humeral Transphyseal Fractures in Young Children

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Learning objectives

1. To recognise transphyseal fractures of the distal humerus of young children (< 3 yrs)

2. To emphasize that transphyseal fractures should always be considered in young children presenting with mal-alignment about the elbow, as dislocation is uncommon in this age group
3. To demonstrate the role of different imaging modalities used to evaluate transphyseal fractures of the distal humerus and distinguish these from lateral condylar fractures
Patterns of elbow injuries in children under 3 years differ from older children
  • Transphyseal injuries of the distal humerus occur frequently in the younger age group
  • The more commonly recognized supracondylar and lateral condylar fractures usually occur in older children
  • Transphyseal fractures are often misdiagnosed as elbow dislocation or lateral condylar fractures
Background

- Anatomic differences in the young elbow combined with different mechanical forces account for the different fracture patterns.
- Transphyseal fracture results from rotatory forces such as occur in birth trauma, non-accidental injury or fall from a height.
- Orthopaedic management of transphyseal fractures differs from lateral condylar fractures making radiographic recognition important.
Transphyseal fracture of the distal humerus

- Transphyseal fractures involve the entire distal humeral physis
- The non-ossified epiphysis, radius and ulna are displaced posteromedially relative to the distal humerus
- Radiographic diagnosis can be difficult because the capitellum is not ossified and good AP and lateral positioning is hard to achieve at this young age
- Diagnosis is established by recognizing the posteromedial displacement of the radius and ulna
- Elbow dislocation does not occur in this age group
AP radiographs show the radius, ulna and radiolucent distal epiphysis displaced medially in relation to the distal humerus.

Transphyseal fracture of the distal humerus

• These physeal injuries may be either Salter I or II fractures

• Infants to 12 months with no capitellar ossification have no metaphyseal bony fragment (Salter I)

• 12 months to 3 years with capitellar ossification may have a small metaphyseal fragment (Salter I or II)
Salter I fracture

Newborn not using left arm following traumatic delivery

AP and lateral radiographs demonstrate typical posteromedial displacement of radius and ulna in relation to the humerus.
Follow up radiographs in the same patient showing periosteal reaction of the distal humerus and persistent medial displacement of the radius and ulna in relation to the distal humerus.
Another child with Salter I injury showing posteromedial displacement of the radius and ulna and small capitellar ossification (arrow). The patient is being investigated for non-accidental injury, which should be considered in patients with a transphyseal fracture.
Salter II fracture

2 year old boy who fell on arm

AP and lateral radiographs show posterior displacement of the radius and ulna and a medially displaced metaphyseal fragment (arrow). The obliquity of these films contributed to misinterpretation of this fracture as a lateral condylar fracture, which typically has lateral displacement of the metaphyseal fragment.
The patient underwent closed reduction and percutaneous pinning (left). Follow up radiographs show persistent medial displacement of the capitellum, radius and ulna with periosteal reaction along the medial supracondylar ridge.
AP radiograph shows typical medial displacement of the radius, ulna and capitellum and the lateral view shows a mildly displaced metaphyseal fragment. AP radiograph following intra-operative arthrogram, closed reduction and lateral percutaneous pin fixation shows anatomic alignment of the distal humeral epiphysis which is completely surrounded by contrast.
Lateral condylar fractures are Salter IV fractures involving the metaphysis and extending through the epiphysis.

Transphyseal versus lateral condylar fracture

• Both Salter II transphyseal fracture and lateral condylar fracture have a lateral metaphyseal fragment
• The two can be distinguished by the direction of displacement of the metaphyseal fragment
• In transphyseal fractures the fragment and entire epiphysis are displaced medially
• In lateral condylar fractures the fragment is displaced laterally
If radiographs are inconclusive, intra-operative arthrograms or MRI are useful in distinguishing transphyseal fracture from lateral condylar fracture. These intra-operative arthrograms demonstrate contrast outlining the entire epiphysis in a transphyseal fracture (right) while it opacifies the epiphyseal fracture line in a lateral condylar fracture (left).
Lateral condylar fracture

MRI allows direct visualization of the fracture through the cartilagenous epiphysis (arrow) and distinction from a transphyseal fracture. (Image from coronal 3D gradient echo sequence).
Discussion

- The importance of pre-operative recognition of transphyseal fractures is that management differs from lateral condylar fractures.
- Transphyseal fractures do not require open reduction but if unstable may require percutaneous fixation.
- Displaced lateral condylar fractures may require open reduction and pinning.
Discussion

• If radiographs show typical posteromedial displacement of the radius and ulna in a transphyseal fracture, no further pre-operative imaging is required.

• If radiographs are confusing, MRI or intra-operative arthrography are useful for determining the type of fracture.

• Ultrasound, while able to image cartilage, is difficult in the young child with a painful elbow.

• CT has no role in the evaluation of the unossified elbow.
• Always consider transphyseal injury in the child under the age of three with elbow malalignment as dislocation rarely occurs in this age group
• In transphyseal fractures, the distal humeral epiphysis, radius and ulna are displaced posteromedially
• In lateral condylar fractures the condylar fragment is displaced laterally
References


Thank you