

به نام خدا



TOPICS

- 1 - Entire Distal Humeral Physis Fractures**
- 2 - Medial Condyle(Trochlea) Fractures**
- 3- Osteonecrosis of trochlea**
- 4 - Lateral Epicondylar Apophysis Fractures**

These are categorized as:

TRASH lesions of the pediatric elbow.

**Waters PM, Beatty J, Kasser J.,
published an article entitled :**

**“TRASH” (The Radiographic Appearance Seemed Harmless)
lesions of the pediatric elbow.**

**Journal of Pediatric Orthopedics
March 2010; 30(Supplement 2):S77-S81**

“TRASH” describe:

**A group of osteochondral pediatric elbow injuries,
that may be overlooked on radiographs,
because of their unclear appearance,
if treated inappropriately,
may result in long-term adverse sequelae.**

TRASH lesions mostly occur in the very young children,
before secondary centers of ossification appearance.



C apitellum	1 yr.
R adial Head	3 yrs.
I nternal Epicondyle (medial)	5 yrs.
T rochlea	7 yrs.
O lecranon	9 yrs.
E xternal Epicondyle (lateral)	11 yrs.

Elbow TRASH Lesions

- **Distal humeral physeal fractures** before the capitellum ossifies (**1year**) .
- **Medial condylar fractures** before the trochlea ossifies (**7year**).
- **Osteochondral fractures** in children less than 10 years old that lead to joint incongruity.

**Stephanie Marie Holmes , Published
A “ Current Concept Review” article Entitled:**

“TRASH” Lesions of the Pediatric Lower Extremity.

**Journal of the Pediatric Orthopaedic Society of North America
(JPOSNA)**

November 2019 Volume 1, Number 1,

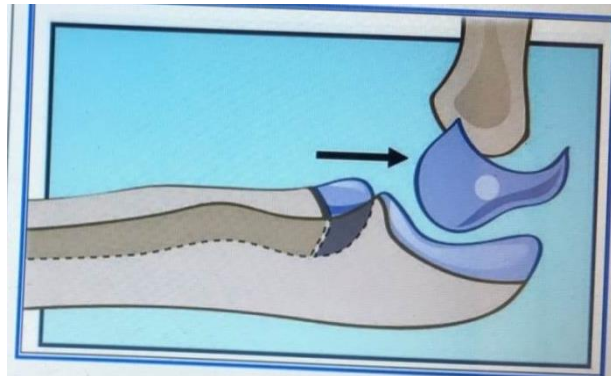
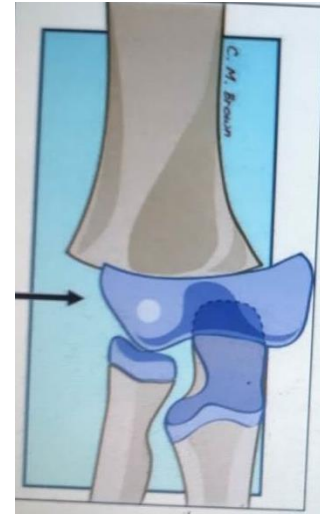
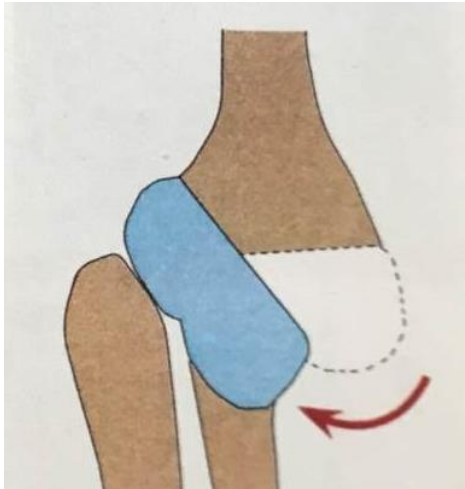
“TRASH” Lesions of the Pediatric Lower Extremity

- **Traumatic hip dislocations in the pediatric and adolescent can result in intraarticular pathology.**
- **Greater trochanteric avulsion fractures, may be complicated by avascular necrosis of the femoral head.**
- **Patellar sleeve fractures (patellar inferior pole osteochondral FX.), can result in significant sequelae.**
- **Proximal tibial metaphyseal fractures, even when nondisplaced, may result in posttraumatic genu valgum.**
- **Non- and minimally displaced Salter-Harris III and IV fractures of the medial malleolus can lead to premature physeal closure.**

کوه دماوند و لاله هایش



Fractures of the Entire Distal Humeral Physis



- **Most entire distal humeral physis fractures** occur before the age of 6 or 7 year and are most common under the age of 3.
- **Theoretically, the distal fragment can be displaced in any direction,** but most fractures reported have been displaced posteromedially .



**Posteromedial displacement
of the distal humeral physis**



Normal elbow

Mechanisms of Injury

A- Birth injuries, are the cause of many fractures of the entire distal humeral physis, **due to rotary or shear forces on the elbow.**

B - Child abuse, are probably more responsible for this injury in young children, **due to rotary or shear forces on the elbow.**

If child abuse is suspected, a bone scan and a skeletal survey are warranted, to look for metaphyseal corner fractures, rib fractures, or fractures at various stages of healing, and head trauma .

Signs and Symptoms

- **Swelling**
- **Irritability**
- **Instability**
- **Crepitus**
- **Limited range of motion**
- **Pseudoparalysis**

Distinguishing elbow dislocation, from the Entire Distal Humerus Physis Fx.

- Elbow dislocations are rare in the peak age for fractures of the entire distal humeral physis, because the cartilaginous physis is mechanically weaker than the bone ligament interface
- Elbow dislocations is mostly displaced posterolaterally and relationship between the proximal radius and lateral condylar epiphysis is disrupted.



Distal humeral physis FX



Elbow Dislocation

Distinguishing Supracondylar FX, from Entire Distal Humerus Physis FX.

- In young infants residual flexion contractures of the elbow, prevents the hyperextension injury that results in supracondylar elbow fractures .
- The key diagnostic point is the smooth outline of the distal metaphysis in fractures involving the total distal physis, and more irregular in supracondylar fractures.



Distal Humerus Physis FX

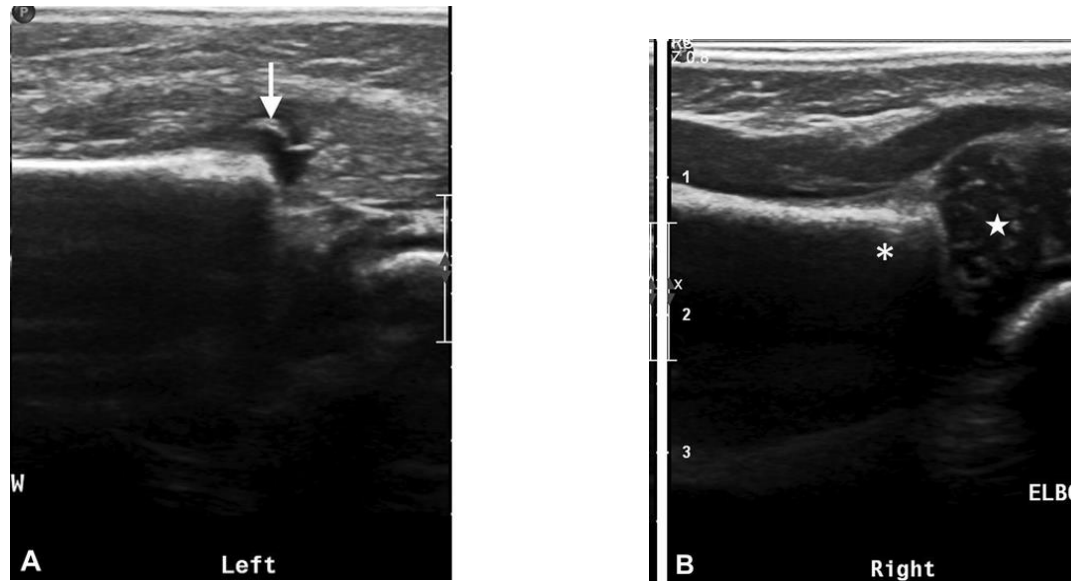


Supracondylar FX

Diagnostic Imaging

- The recognition of the entire Distal Humerus Physis FX, according to radiographic appearance is the major problem.
- Radiographs of the entire extremity not centered on the elbow may lead to a missed diagnosis.
- A recent ultrasound study showed that 56% may be missed on plain radiographs.
- Radiographic diagnosis of distal humeral physis FX, in an infant can be difficult, If the ossification center of the lateral condyle is not visible.
- In neonates and infants in whom ossification has not begun, Ultrasonography / Arthrography or MRI can be used to identify the displaced epiphysis of the humerus .

Ultrasound



A

B

Sonography of left (abnormal) and right elbow (normal) of a two-day-old neonate

(A) demonstrates, Salter-Harris I distal humerus fracture with abrupt step-off at the distal humerus physis (arrow).

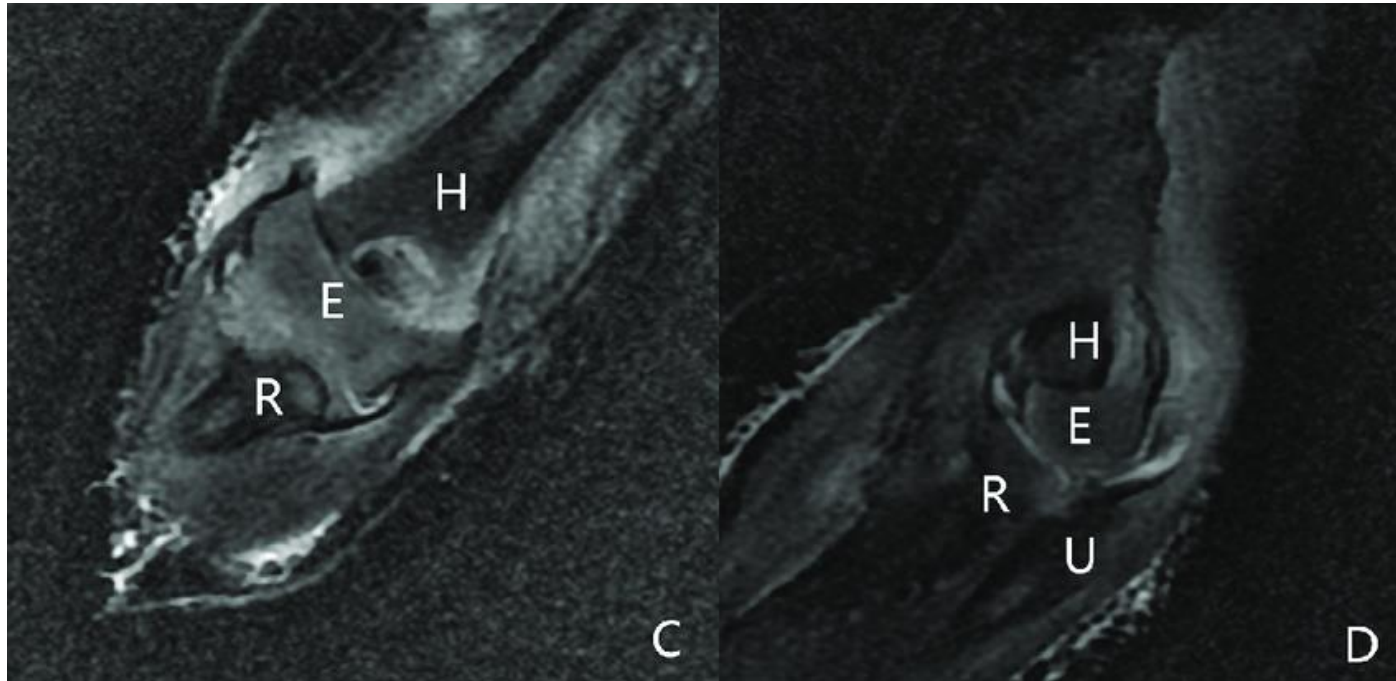
(B) Right demonstrates a normal physal junction between the distal humerus metaphyseal bone (asterisks) and the unossified cartilage of the distal humerus epiphysis (star).

Arthrogram



Arthrogram reveals medial displacement of
distal physis of humerus (**red arrow**)

MRI



Coronal (c), Sagittal (d) MRI views of the injured elbow

(**H**, humeral distal metaphysis; **E**, humeral distal epiphysis;
R, radius proximal metaphysis; **U**, ulnar proximal metaphysis).

Classification according to the degree of ossification of the lateral condylar epiphysis (DeLee et al.)

Group A fractures - Usually Salter- Harris type I physeal injuries , occur in infants up to 12 months of age, before the secondary ossification center of the lateral condylar epiphysis appears.



A small infant who had a swollen left elbow after a difficult delivery.

The medial and posterior displacement of the proximal radius and ulna are seen.

Secondary ossification center of the lateral condylar epiphysis not appeared.

Group B fractures - occur most often in children of 12 months to 3 years of age in whom there is definite ossification of the lateral condylar epiphysis.

There may be a small flake of metaphyseal bone (Salter-Harris II fracture),
this essentially behaves as a type I Salter- Harris physeal injury.

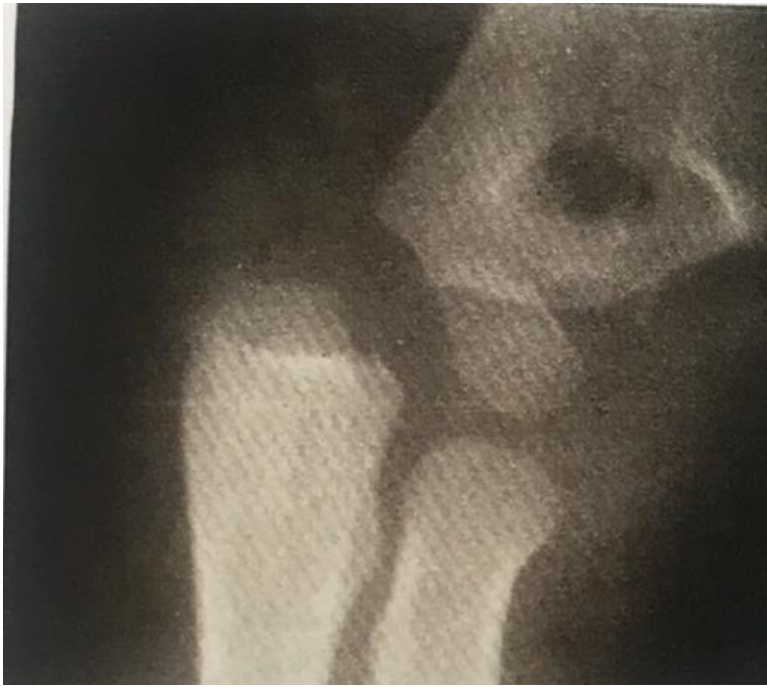


Posteromedial displacement of the distal fragment (arrows).

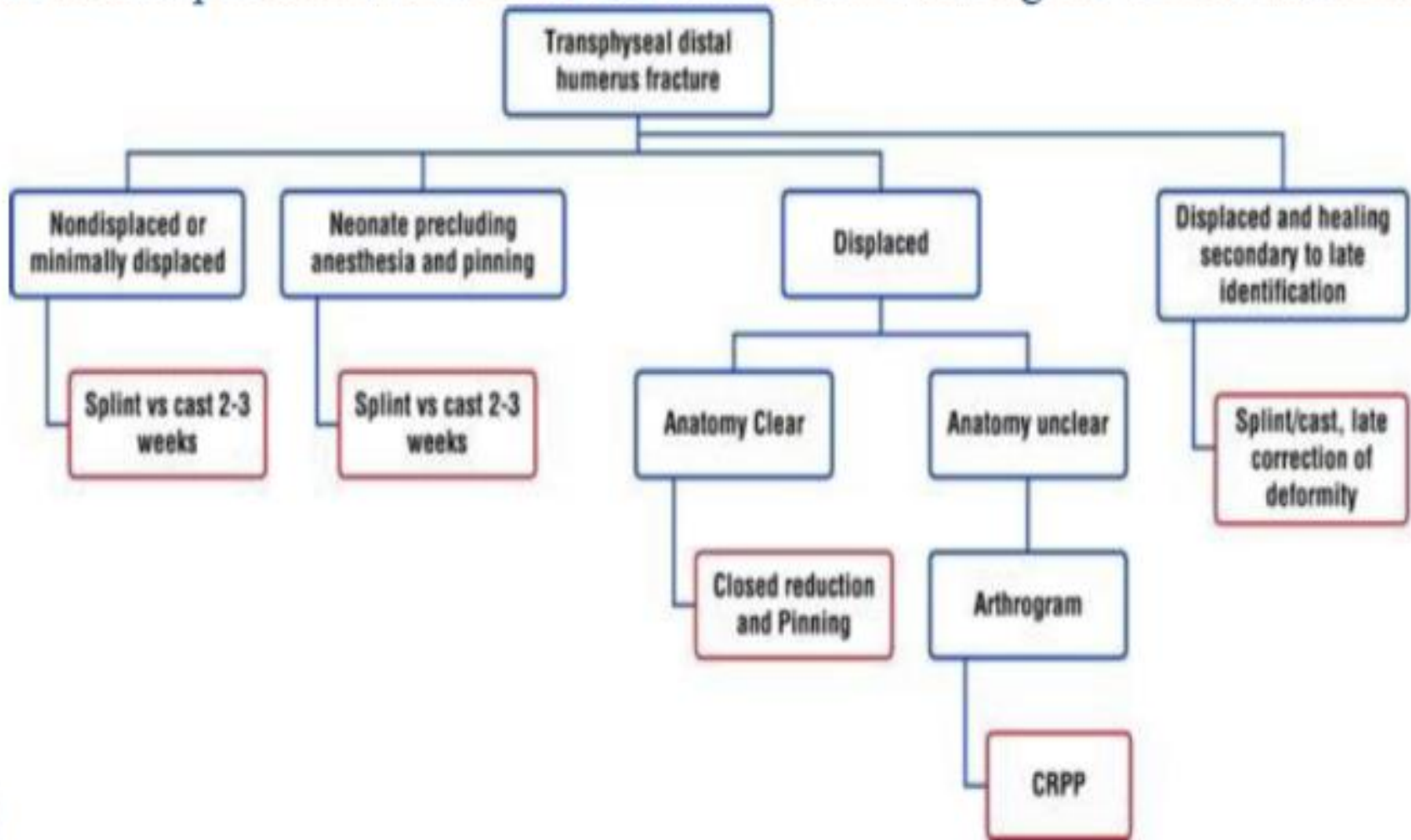
The relationship between the ossification center of the lateral condyle
and the proximal radius has been maintained.

Group C fractures - occur in children, from 3 to 7 years of age and result in a large metaphyseal fragment (**Salter Harris type II FX.**).

- **The location of metaphyseal fragment is most commonly lateral,** but can be medial or posterior.



Treatment Algorithm



Complications

- **Malunion (cubitus varus)** with Lower incidence or severity than untreated supracondylar fractures.
- **Neurovascular injuries** (rare).
- **Osteonecrosis** (rare).
- **Nonunion.** (only one case has been reported).

K Mizuno, K Hirohata, D Kashiwagi

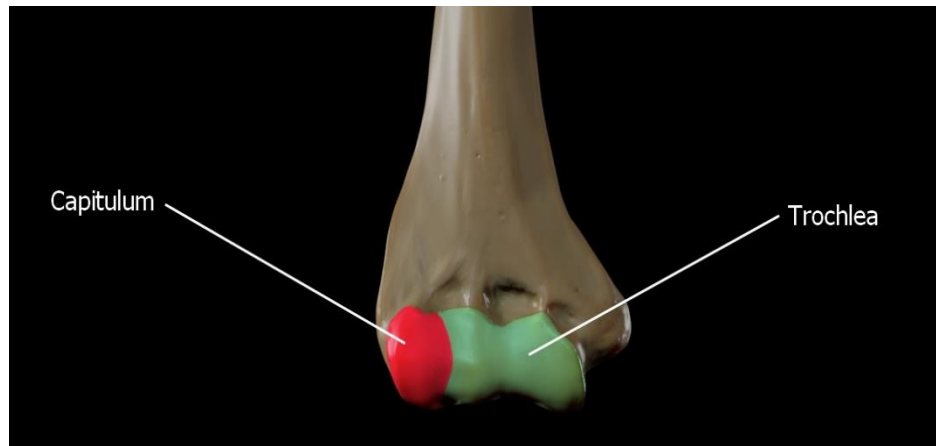
Fracture-separation of the distal humeral epiphysis in young children.

Bone Joint Surg Am. 1979 Jun;61(4):570-3.

منظره بهاری پل ورسک



Medial Condyle(Trochlear) Fractures

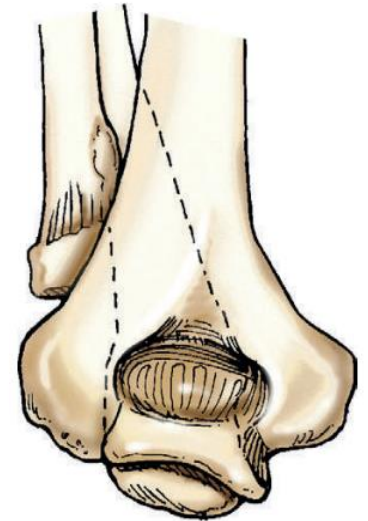
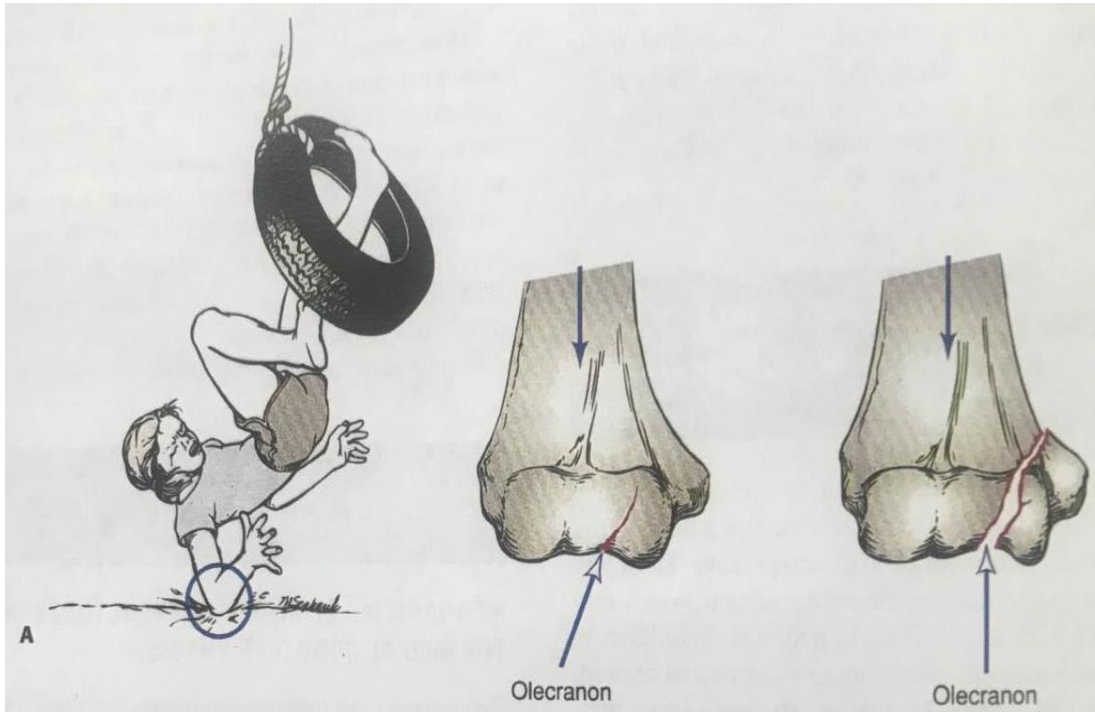


- Fractures of the medial condyle can be thought of as the mirror image of lateral condyle fractures.
- Rare in skeletally immature children, accounting for less than 1% of fractures involving the distal humerus.
- Is an avulsion fracture that can occur as early as 6 months of age before any ossification of the distal humerus has appeared.
- If missed and not treated appropriately, result in poor outcome

Mechanisms of Fractures

A - Falling directly on the point of the flexed elbow.

A direct force applied to the posterior aspect of the elbow causes the sharp articular margin of the olecranon to wedge the medial condyle from the distal humerus .



**B: Falling on the Outstretched Arm with
the Elbow Extended and the Wrist Dorsiflexed**

**Causes the medial condyle to be avulsed by both
ligamentous and muscular forces.**

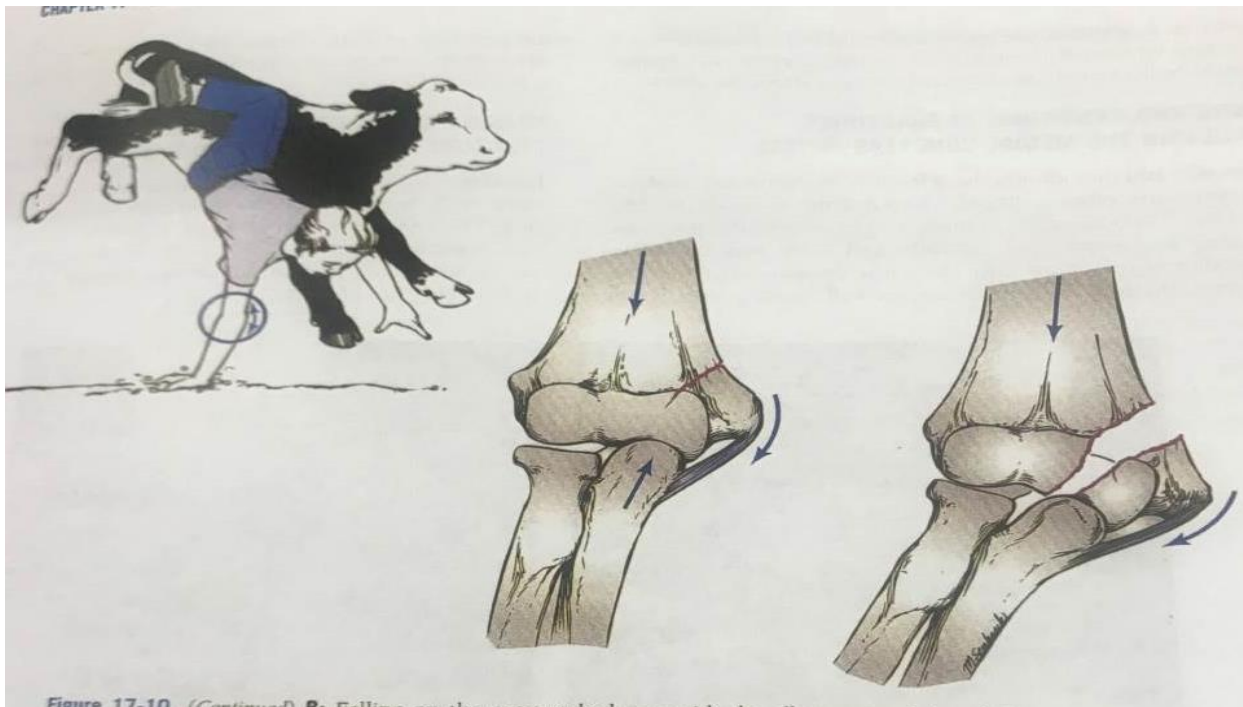
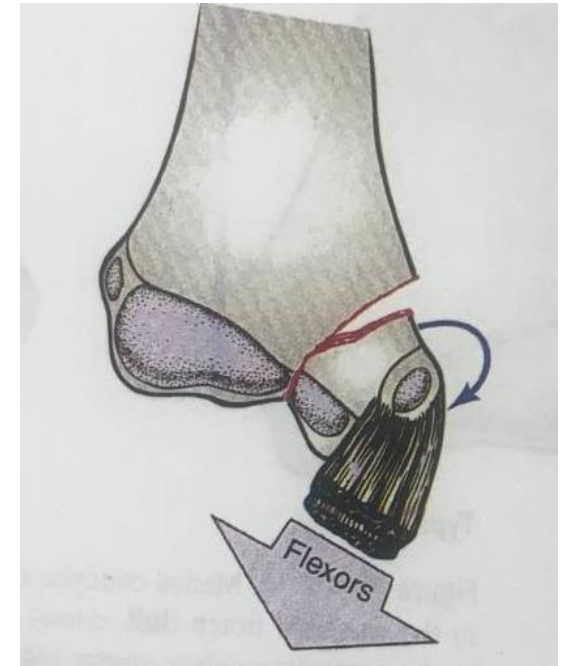


Figure 17-10. (Continued) B: Falling on the outstretched arm with the elbow extended and the wrist dorsiflexed.

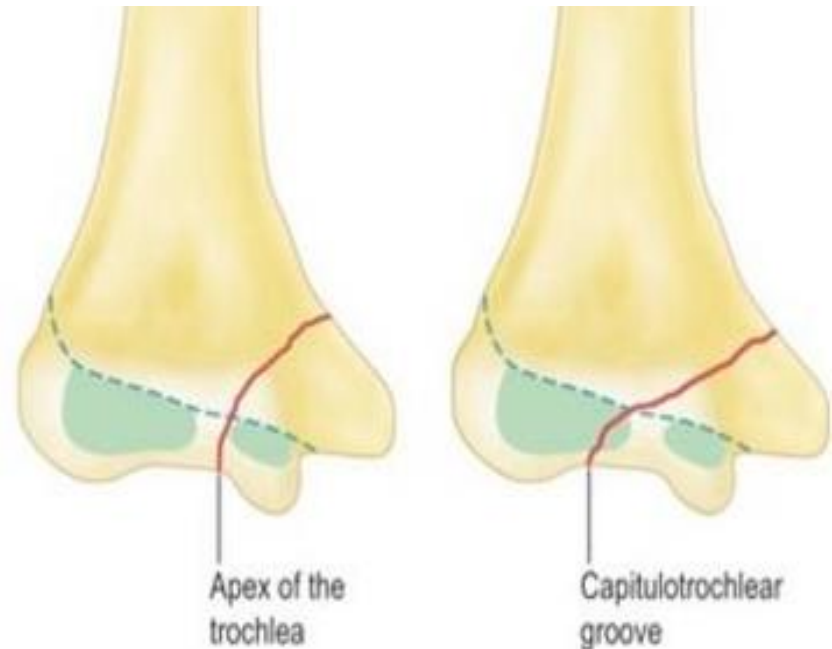
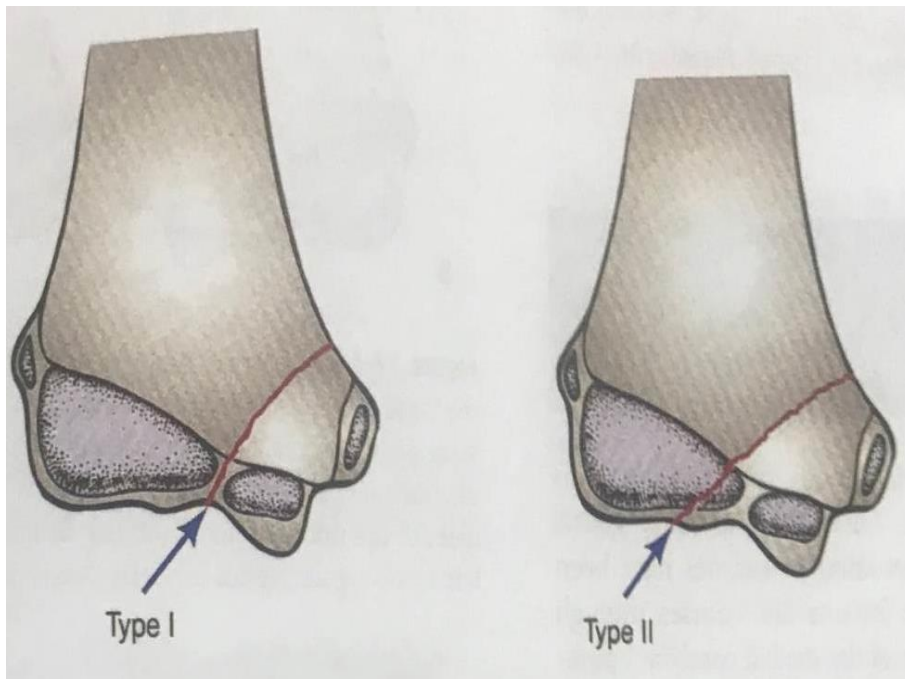


Milch Classification

According to Location of the Fracture Line

Type I - the fracture line traverses the apex of the trochlea.

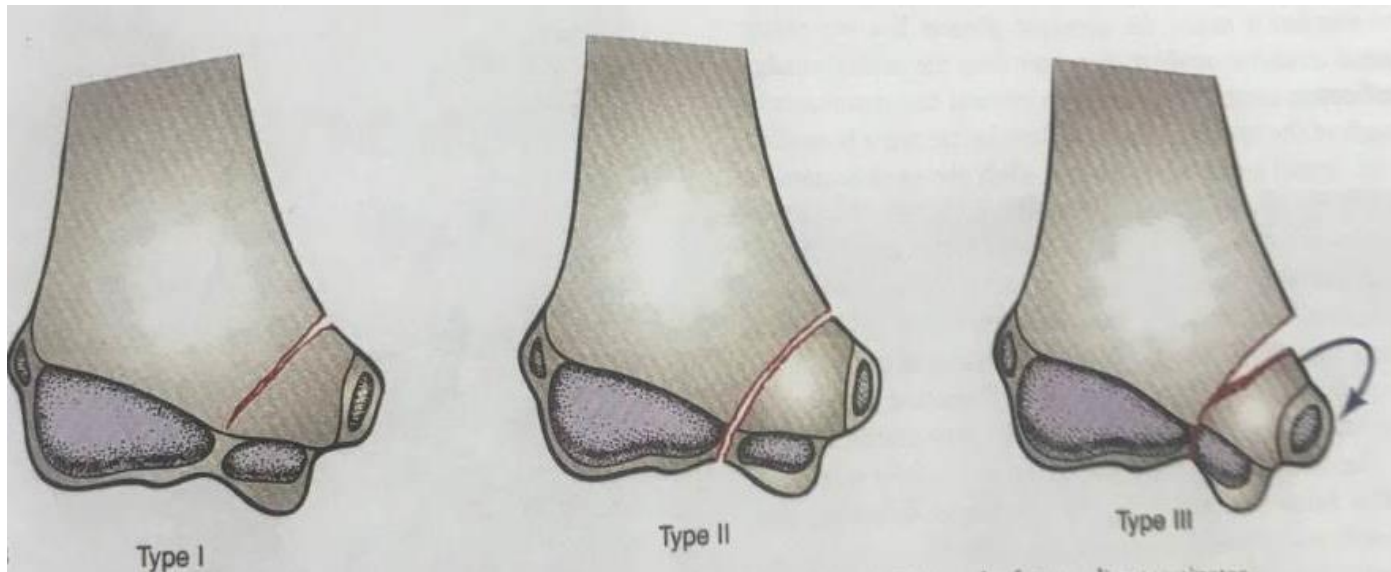
Type II - the fracture line traverses more laterally through the capitulotrochlear groove.



Kilfoyle Classification

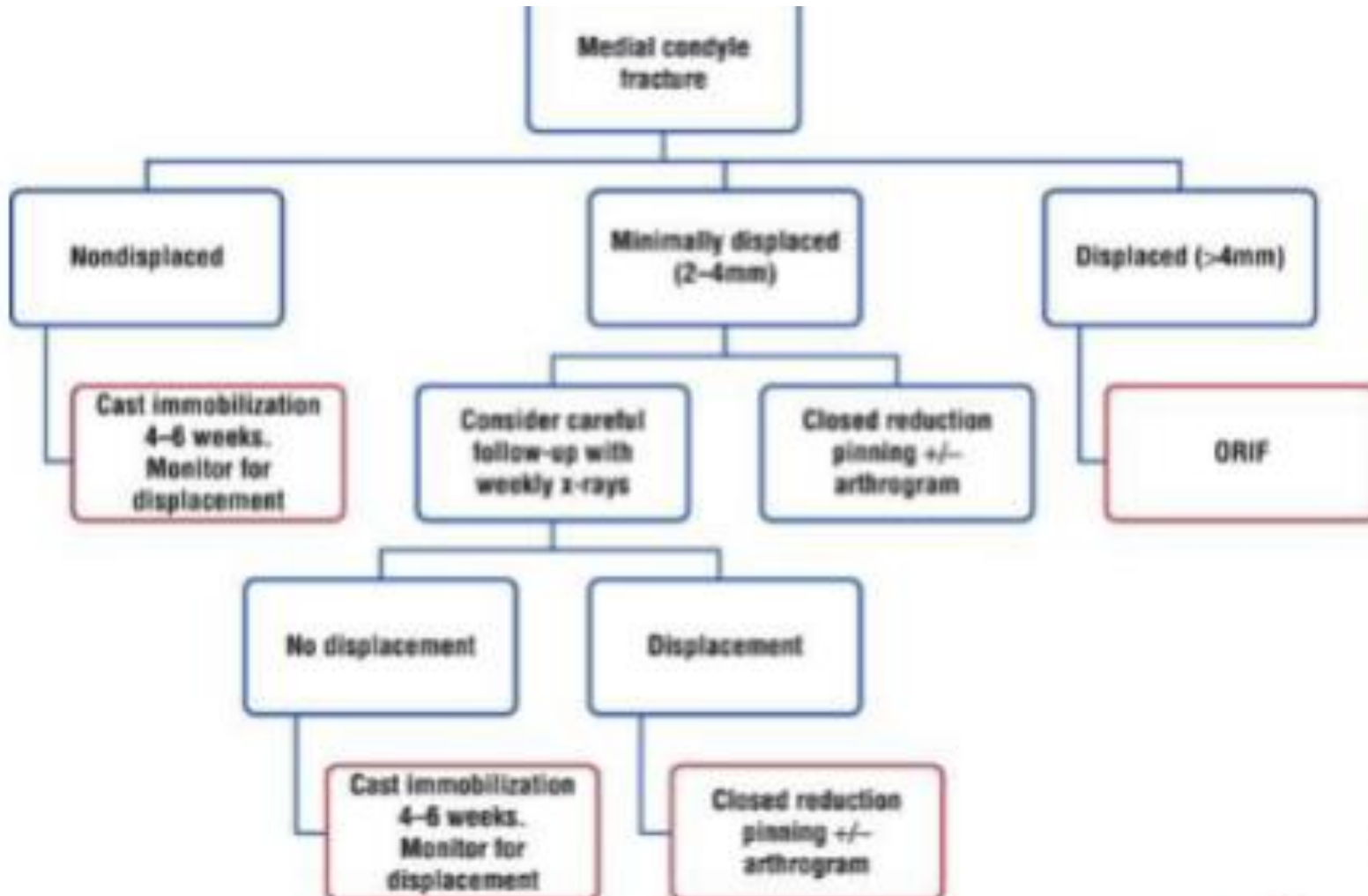
According to the Degrees of Displacement

- **Type I** - An incomplete fracture that does not violate the joint.
- **Type II** - Fracture line enters the joint, but has less than 2 mm displacement.
- **Type III** - Fracture line Enters the joint and results in malangulation, malrotation, and articular displacement.



Kilfoyle Classification

Treatment Algorithm



Complication

The major complication is failure to make the proper diagnosis especially in younger children, in whom a medial condylar fracture can be confused with a displaced fracture of the medial epicondyle.



A



B



C

A: Initial film of a 6-year-old who was originally diagnosed as having a displaced fracture of the medial epicondyle (arrows).

B: Normal side for comparison.

C: Three months later, the patient continued to have a painful elbow, and there was ossification of the metaphysis (arrow) adjacent to the epicondyle.



A: Initial film in a 7-year-old girl who was suspected of having only a fracture of the medial epicondyle. there was a significant metaphyseal fragment with moderate displacement,(arrow).

B: An arthrogram revealed medial condylar physis fracture(arrow) .

Positive Fat Pad Sign

Indicates that in contrast to medial condyle fracture,

the injury has entered the elbow joint and a fracture of the medial condyle is likely.



**In a child younger than 8 to 10 years of age,
with significant medial elbow ecchymosis,**

If on radiographic image

**the true location of the fracture line is questionable ,
arthrography , MRI and Computed tomography
particularly 3-D of the elbow should be performed.**

Complications

- **Both cubitus varus and valgus deformities** have been reported in patients whose fractures united **uneventfully**.
- **Cubitus varus appears to result** from decreased growth of the trochlea, possibly caused by a vascular insult.
- **The valgus deformity may be caused** by secondary stimulation or overgrowth of the medial condylar fragment.
- **Osteonecrosis (Rare)**. Will be described separately.



As with fractures of the lateral condylar physis,
union may be slow and may result in nonunion.

کتابخانه مرکزی دانشگاه علوم پزشکی بابل



OSTEONECROSIS OF THE TROCHLEA



Etiology

- Displaced or minimally displaced supracondylar humerus fractures,
- Lateral condylar fractures,
- Physeal separations,
- Medial condylar fractures,
- Initial or iatrogenic vascular damage from excessive soft tissue stripping .

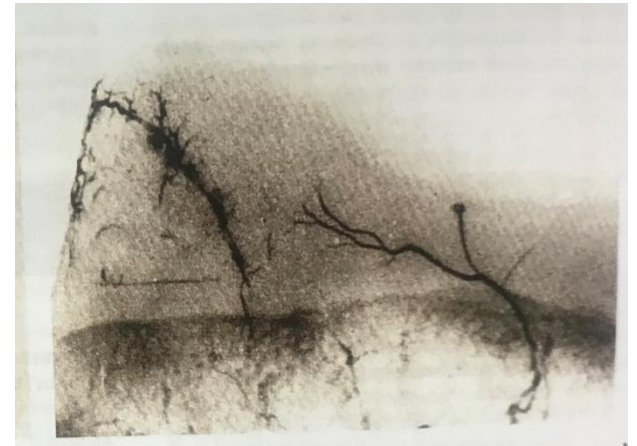
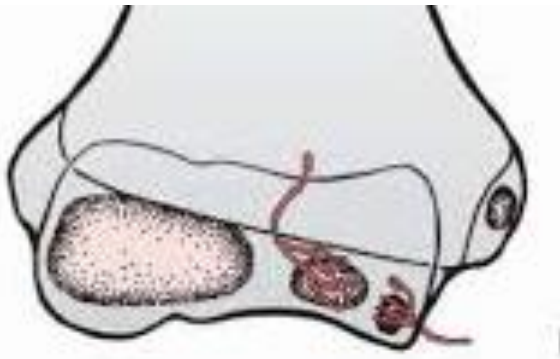
Signs and Symptom

May take 8 years post trauma, until complain begin, and include:

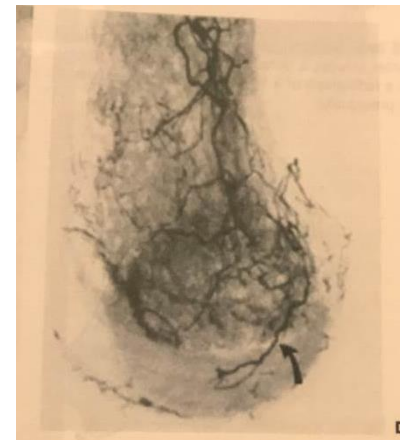
- Pain and Loss of Motion secondary to joint incongruity .
 - Locking, related to loose body formation .
 - Late-onset ulnar neuropathy, thought to be due to a multiplicity of factors.
 - Joint instability.

Intraosseous vasculature of trochlea

- Only two small vessels supply the medial crista of the trochlea.
- no anastomoses are seen between these medial and lateral vessels



- The vessels penetrate the physis posteriorly to enter the epiphyseal cartila





**Two separate ossification centers (arrows)
of the medial crista in a 12-year-old boy is seen.
The area supplied by the lateral vessel.**

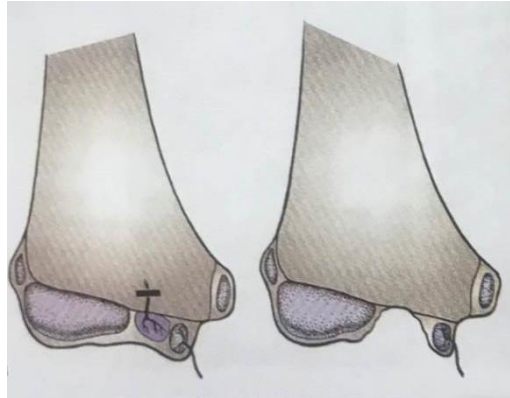
For prevention of osteonecrosis avoid dissection of posterior surface of the condylar fragment and the medial aspect of the medial crista of the trochlea.

Because these are the blood supply sources to the ossific nuclei of the trochlea.

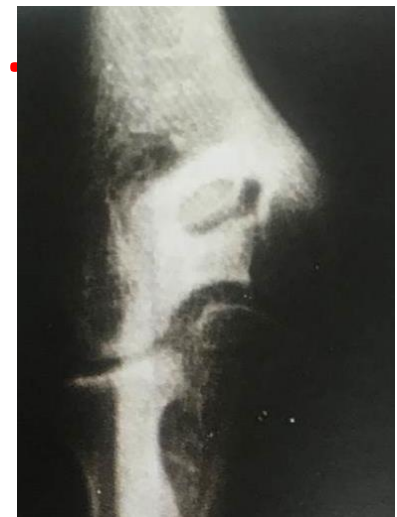
Vascular insult may occur at the time of initial injury.

Type A: Central Defect/ Fishtail deformity

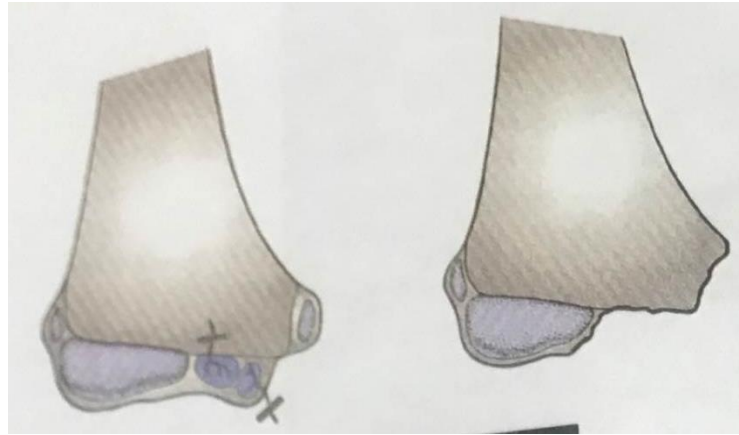
- Loss of blood supply from lateral vessels results in osteonecrosis of lateral ossification center and creation of a defect in the apex of the trochlear groove .



- Typical fishtail deformity following an undisplaced distal supracondylar fracture , with no angular deformities .



Type B : Total osteonecrosis of the trochlea



Loss of blood supply from both the medial and lateral vessels results in osteonecrosis of the entire medial crista .



Type II physeal fracture of the entire distal humeral physis resulted in osteonecrosis of the entire trochlea and cubitus varus deformity .

Treatment

- Treatment is aimed at only the sequelae of the osteonecrosis of the trochlea.
- Supracondylar osteotomy with ulnar nerve transposition for varus deformity.
- Arthroscopic debridement, transiently improve symptoms .
- Phseal closure, if growth remain in the medial or lateral physis.

برج دیدبانی بابل

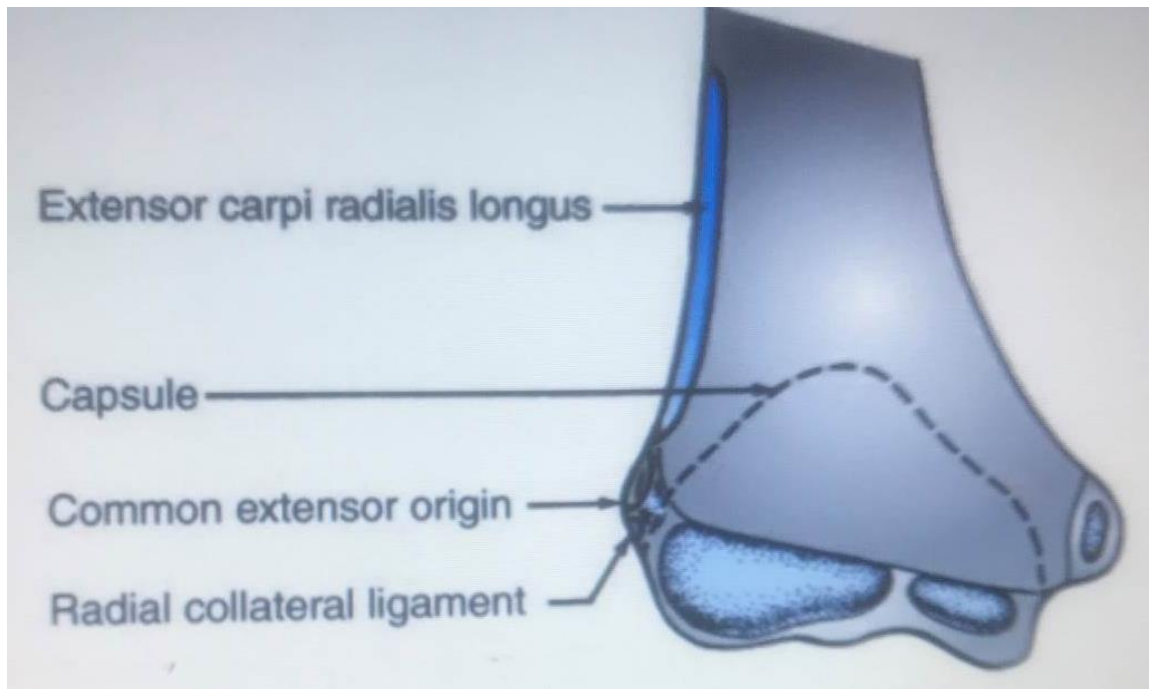


Lateral Epicondylar Apophysis Fractures



- The lateral epicondyle is **the last center of ossification to appear (11 Year) and fracture rarely.**
- In children, it is believed that avulsion forces from forearm extensor muscles can be **responsible for some of these injuries.**
- In adults, the most common etiology is **a direct blow to the lateral side of the elbow.**

- If the proximal part of the fracture line lays **between** the origin of the common extensors **and the** extensor carpi radialis longus, **there is usually little displacement.**
- If the fracture lines enter the area of origin of the extensor carpi radialis longus, **considerable displacement can occur.**



Diagnosis

- **History and clinical exam.**
- **Comparing radiographs of the contralateral elbow can be used to aid in diagnosis.**
- **The key to determining true separation is looking beyond the osseous tissues for the presence of associated soft tissue swelling.**

Soft tissue swelling

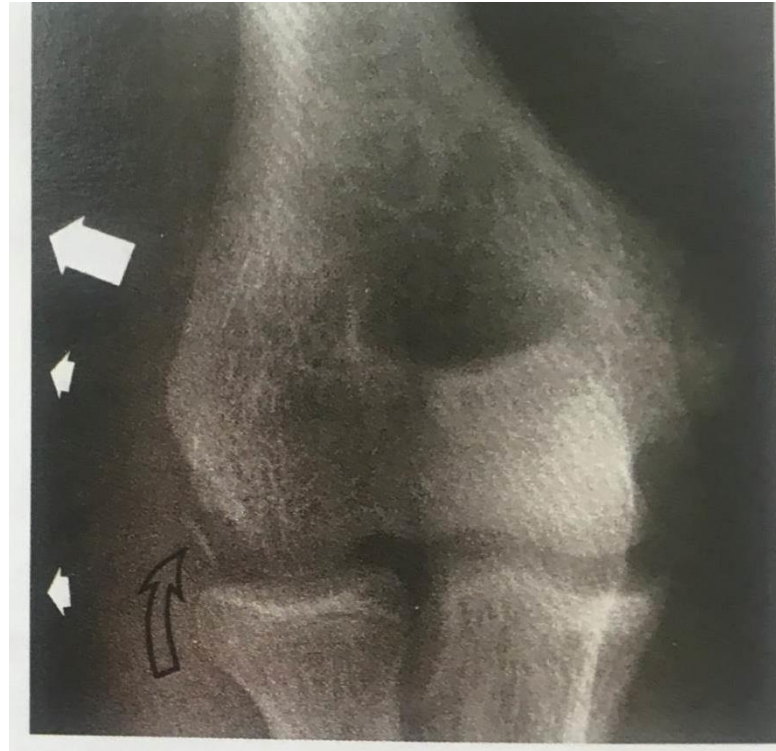


Soft tissue swelling around the lateral epicondylar apophysis (arrows).

suggests an undisplaced fracture involving the apophysis.

The fragmentation of the apophysis is caused by irregular ossification.

Soft tissue swelling



**A small avulsion of the lateral epicondyle (open arrow)
in an adolescent who is almost skeletally mature.**

There was considerable soft tissue swelling in this area (solid arrows).

Treatment

- Unless the fragment is incarcerated within the joint, treatment is simple immobilization for comfort .
- Nonunion of the fragment can occur that represent chronic posterolateral instability .
- Those patients who are symptomatic, have functional limitations, will require open repair.



با تشکر از توجه
شما عزیزان