FRACTURES AROUND ELBOW INCL SUPRACONDYLAR HUMERUS FRACTURE

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Elbow Fractures in Children

- Very common injuries (approximately 65% of pediatric trauma)

- Radiographic assessment - difficult for non-orthopaedists, because of the complexity and variability of the physeal anatomy and development

- Mechanism of injury
- h/o trouma
- Fall from height
- RTA
- Fall on outstretch hand

Elbow Fractures
Physical Examination

1]TENDER

2] Swelling

3] DEFORMITY

4] Complete vascular exam

- Doppler may be helpful to document vascular status

5]Neurologic exam is essential, as nerve injuries are common.

Elbow Fractures
Physical Examination

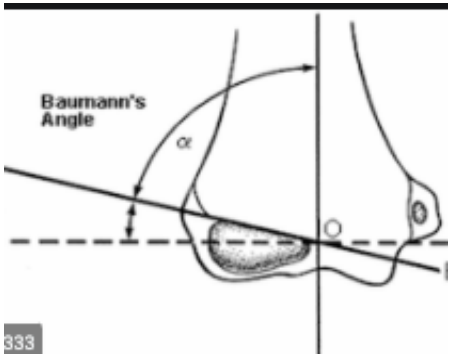
- Always palpate the arm and forearm for signs of compartment syndrome

- Thorough documentation of all findings is important
  - A simple record of "neurovascular status is intact" is unacceptable (and doesn't hold up in court…)
  - Individual assessment and recording of motor, sensory, and vascular function is essential

Elbow Fractures
Radiographs

- AP and Lateral views are important initial views
  - In trauma these views may be less than ideal, because it can be difficult to position the injured extremity
- Oblique views may be necessary
  - Especially for the evaluation of suspected lateral condyle fractures
- Comparison views frequently obtained by primary care or ER physicians
  - Although these are rarely used by orthopaedists

Elbow Fractures
Radiograph Anatomy/Landmarks



- Baumann's angle is formed by a line perpendicular to the axis of the humerus, and a line that goes through the physis of the capitellum
- There is a wide range of normal for this value - 61-82°
  - Can vary with rotation of the radiograph
- In this case, the medial impaction and varus position reduces Bauman's angle

Elbow Fractures
Radiograph Anatomy/Landmarks

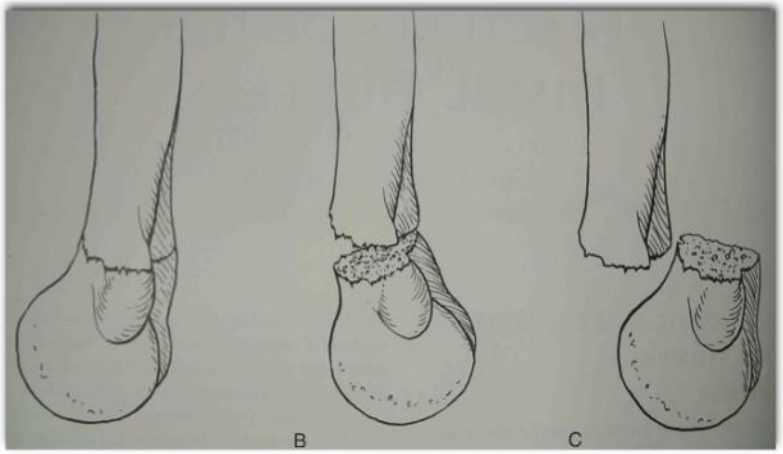
- The capitellum is angulated anteriorly about 30 degrees.
- The appearance of the distal humerus is similar to a hockey stick.

Supracondylar Humerus Fractures

- Most common fracture around the elbow in children
  - 60 percent of elbow fractures
- 95 percent are extension type injuries
  - Produces posterior angulation/displacement (extension) of the fragment
- Occurs from a fall on an outstretched hand
  - Ligamentous laxity and hyperextension of the elbow are important mechanical factors
- May be associated with a distal radius or forearm fractures

Supracondylar Humerus Fractures Classification[Gartland]

- Type 1
  - Non-displaced
- Type 2
  - Angulated/displaced fracture with intact posterior cortex
- Type 3
  - Complete displacement, with no contact between fragments



Type 1
Non-displaced

- Note the non- displaced fracture (Red Arrow)

Type 2
Angulated/displaced fracture with intact posterior cortex

Type 3
Complete displacement, with no contact between fragments

Supracondylar Humerus Fractures Associated Injuries

- Nerve injury incidence is high, between 7 and 16 %
  - Median, radial, and/or ulnar nerve

- Anterior interosseous nerve injury is most commonly injured nerve (traction injury rather than direct one)

- Carefully document pre-manipulation exam,
  - Post-manipulation neurologic deficits can alter decision making as in of nerve trapped between fracture fragments or injured by those may require surgical exploration and repair if torn

Supracondylar Humerus Fractures Associated Injuries

- Vascular injuries are rare, but distal pulses should always be assessed before and after reduction
- In the absence of a radial and/or ulnar pulse, the fingers may still be well-perfused, because of the excellent collateral circulation about the elbow
- Doppler device can be used for assessment

Supracondylar Humerus Fractures Associated Injuries

- Example - Type 3 supracondylar fracture
  - Absent ulnar and radial pulses
  - Fingers had capillary refill less than 2 seconds.
- The pink, pulseless extremity

Doppler revealed constriction of brachial artery

Supracondylar Humerus Fractures Treatment

- Type 1 Fractures
  - In most cases, these can be treated with immobilization [OBOVE ELBOW POP SLAB] for approximately 3 weeks, at 90 degrees of flexion
  - If there is significant swelling, do not flex to 90 degrees until the swelling subsides

Supracondylar Humerus Fractures Treatment

- Type 2 Fractures: Posterior Angulation

  REDUCTION + POP[A/E]

  K-WIRE FIXATION IF UNSTALE

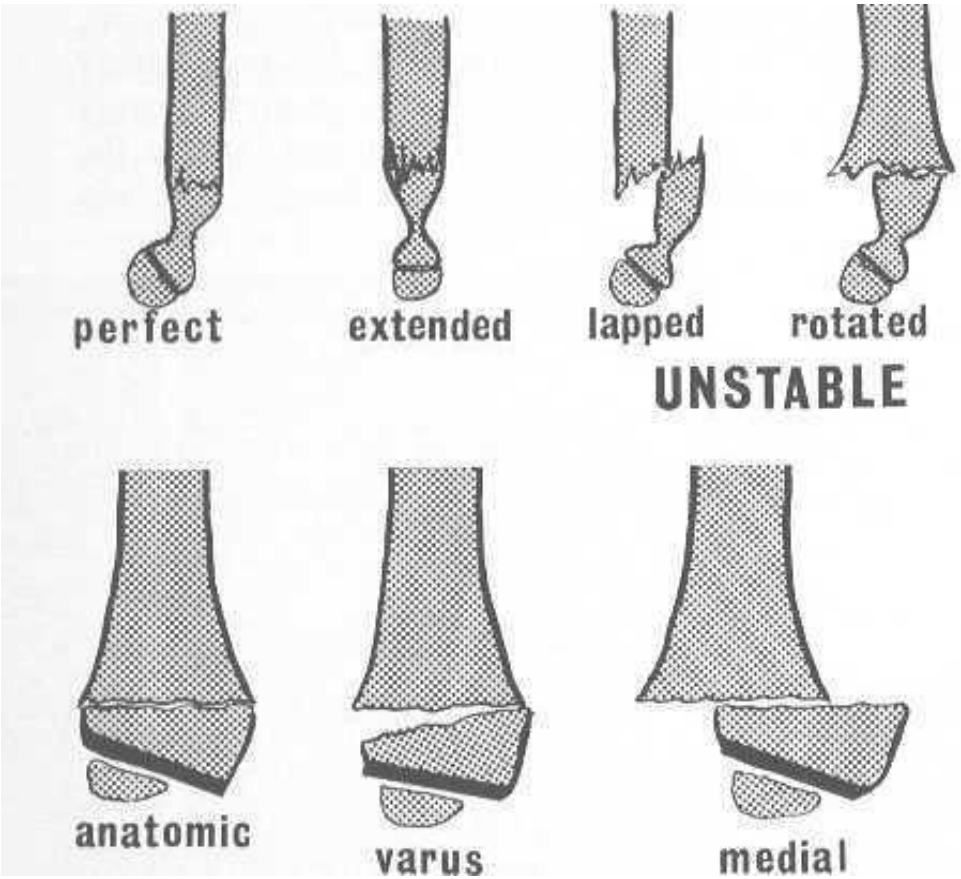
Supracondylar Humerus Fractures Treatment

- Type 3 Fractures
  - These fractures have a high risk of neurologic and/or vascular compromise
  - Can be associated with a significant amount of swelling
  - Current treatment protocols use percutaneous pin or k wire fixation in almost all cases
  - In rare cases, open reduction may be necessary
    - Especially in cases of vascular disruption and in those with failed closed reduction

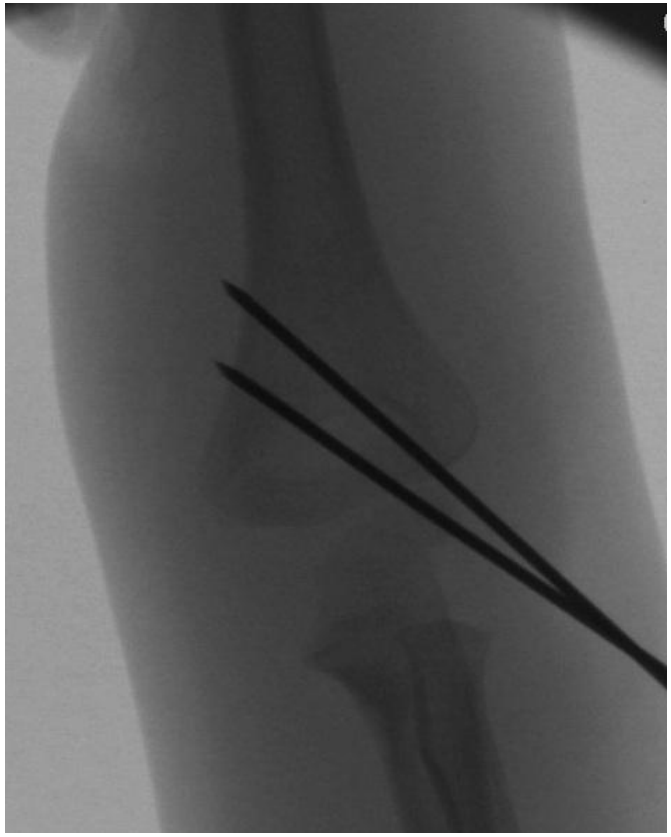
Type 3
Supracondylar Fracture

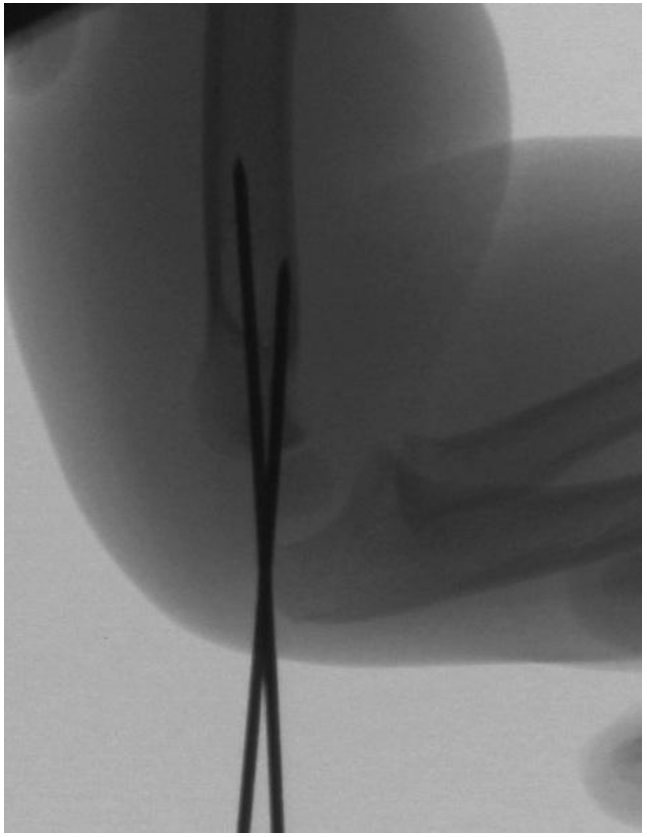
Adequate Reduction?

- No varus/valgus malalignment
- Anterior humeral line should be intact
- Minimal rotation
- Mild translation is acceptable

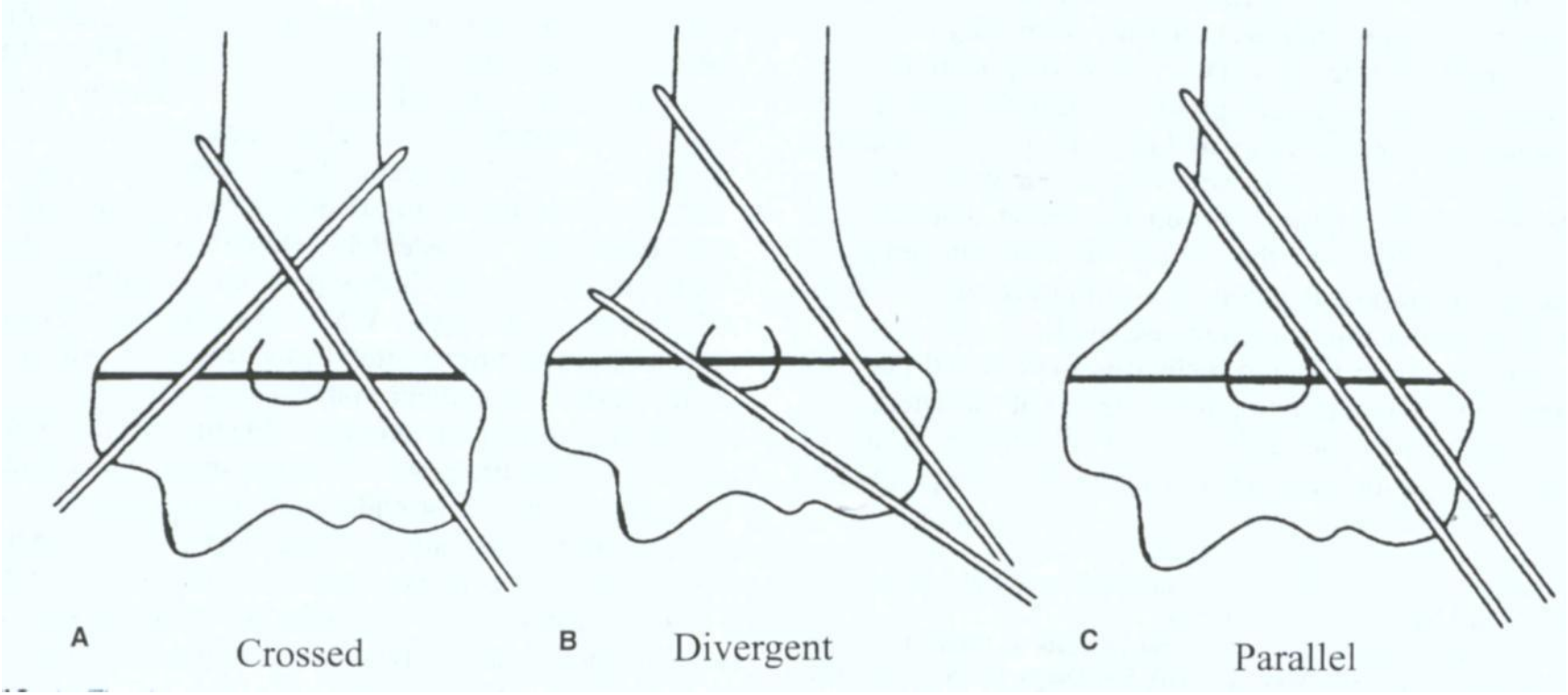


Lateral Pin Placement

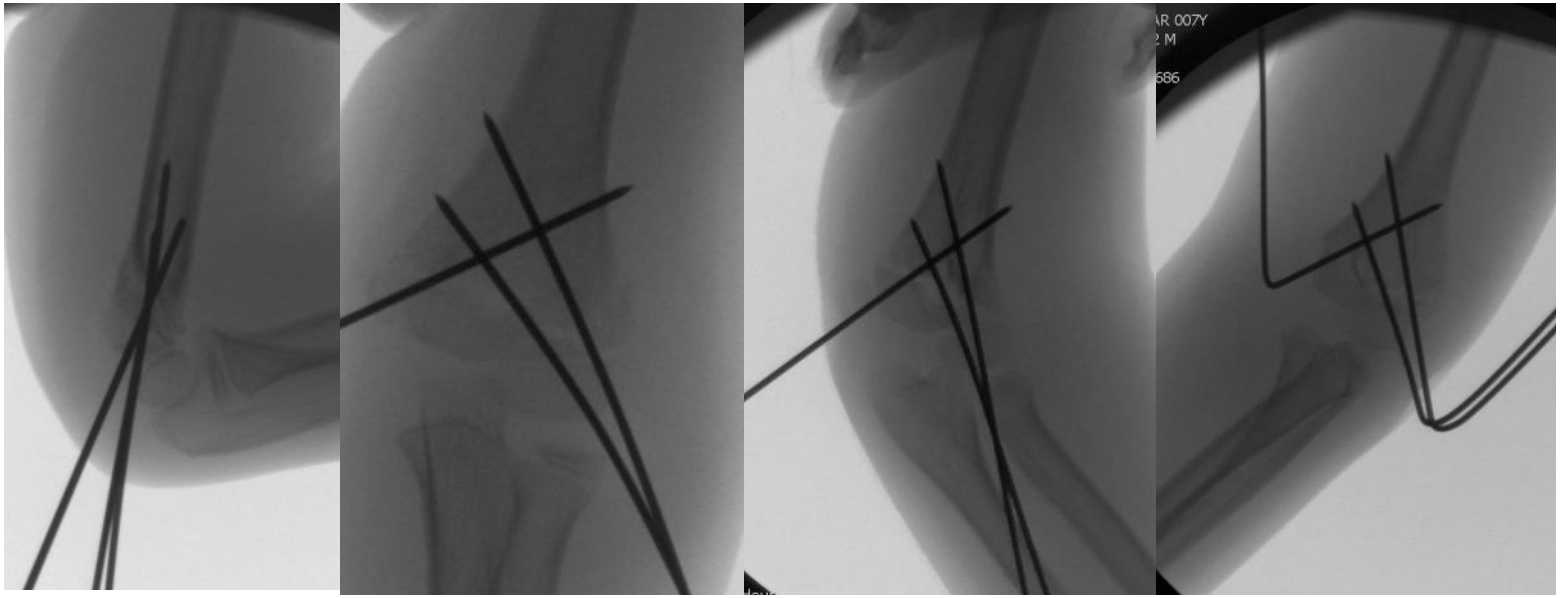




Pin Configuration



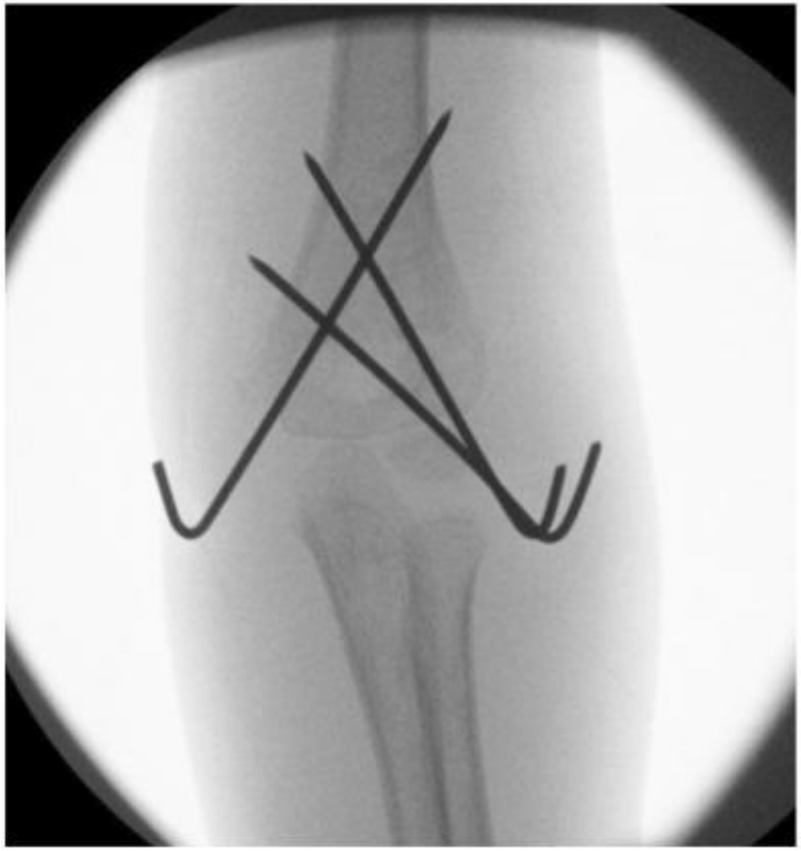
C-arm Views



Oblique views with the C-arm can be useful to help verify the reduction.

Supracondylar Humerus Fractures

- If pin fixation is used, the pins are usually bent and cut outside the skin
- The skin is protected from the pins by placing Xeroform and a felt pad around the pins
- The arm is immobilized
- The pins are removed in the clinic 3 to 4 weeks later
  - After radiographs show periosteal healing
- In most cases, full recovery of motion can be expected



Supracondylar Humerus Fractures: Indications for Open Reduction

- Inadequate reduction with closed methods
- Vascular injury
- Open fractures

Supracondylar Humerus Fractures: Complications

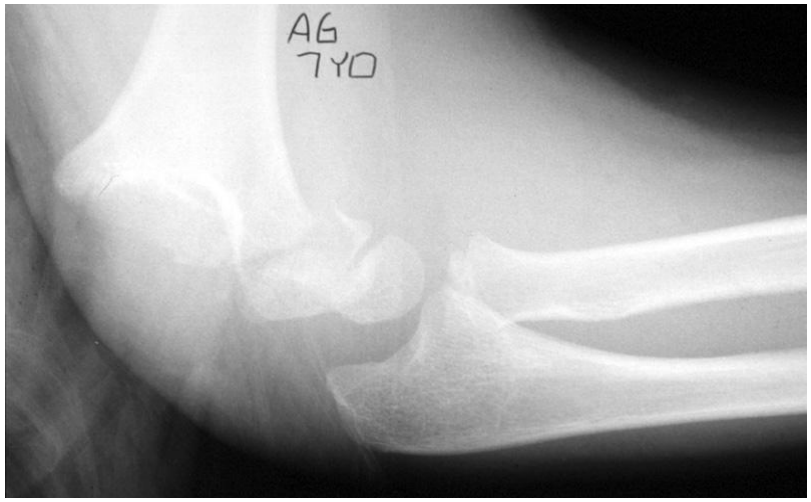
- Compartment syndrome
- Vascular injury/compromise
- Loss of reduction/malunion
  - Cubitus varus [GUNSTOCK DEFORMITY]
- Loss of motion
- Pin track infection
- Neurovascular injury with pin placement

Medial Impaction Fracture

Cubitus varus 2 years later

Supracondylar Humerus Fractures Flexion type

- Rare, only 2%
- Distal fracture fragment anterior and flexed
- Ulnar nerve injury more common
- Reduce with extension
- Often requires 2 sets of hands in OF
  - Hold elbow at 90 degrees after reduction to facilitate pinning



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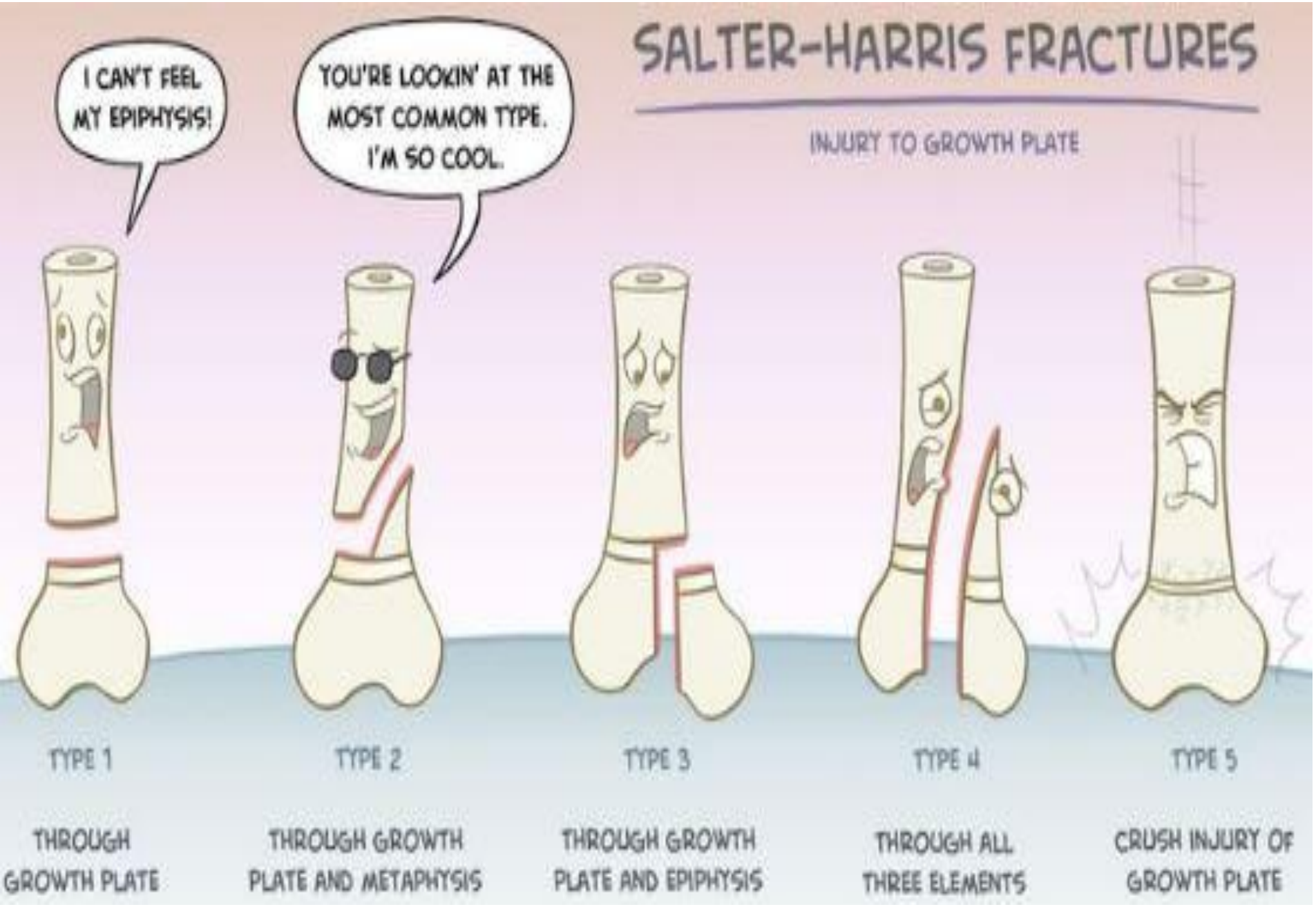
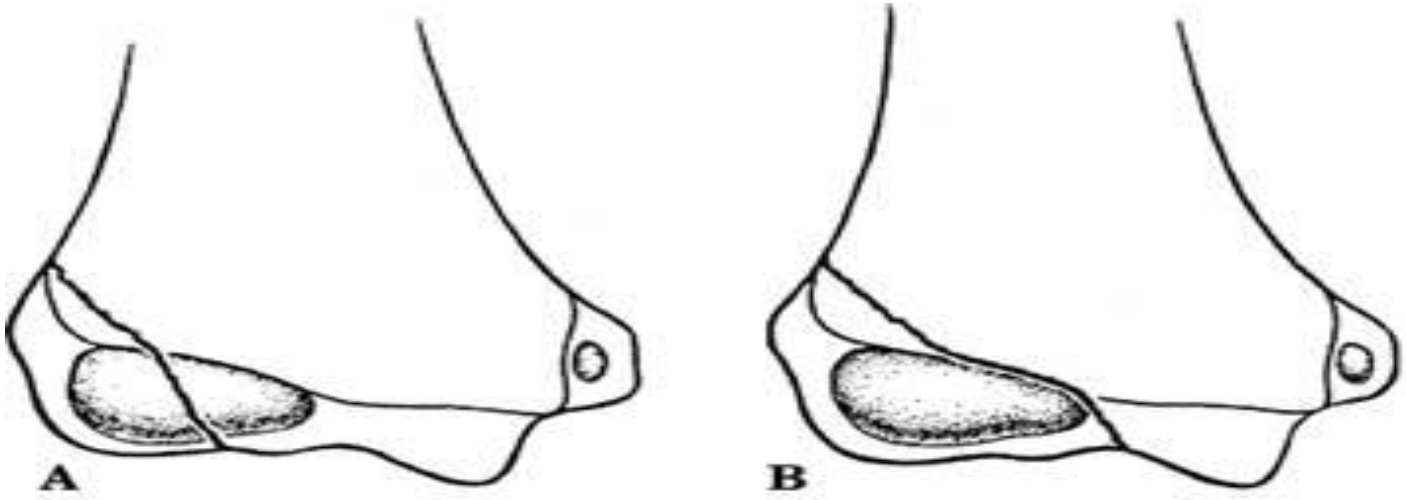
Flexion Type


SALTER-HARRIS FRACTURES
INJURY TO GROWTH PLATE
I CAN'T FEEL MY EPIPHYSIS!
YOU'RE LOOKIN' AT THE MOST COMMON TYPE. I'M SO COOL.
TYPE 1
THROUGH GROWTH PLATE
TYPE 2
THROUGH GROWTH PLATE AND METAPHYSIS
TYPE 3
THROUGH GROWTH PLATE AND EPIPHYSIS
TYPE 4
THROUGH ALL THREE ELEMENTS
TYPE 5
CRUSH INJURY OF GROWTH PLATE

Lateral condyle fractures: Milch classification

Milch I
- Fracture line traverses lateral to capitello-trochlear groove
- Relationship between humerus and forearm is intact
- Elbow is stable.

Milch II
- Fracture passes through the capitello-trochlear groove
- Elbow is unstable



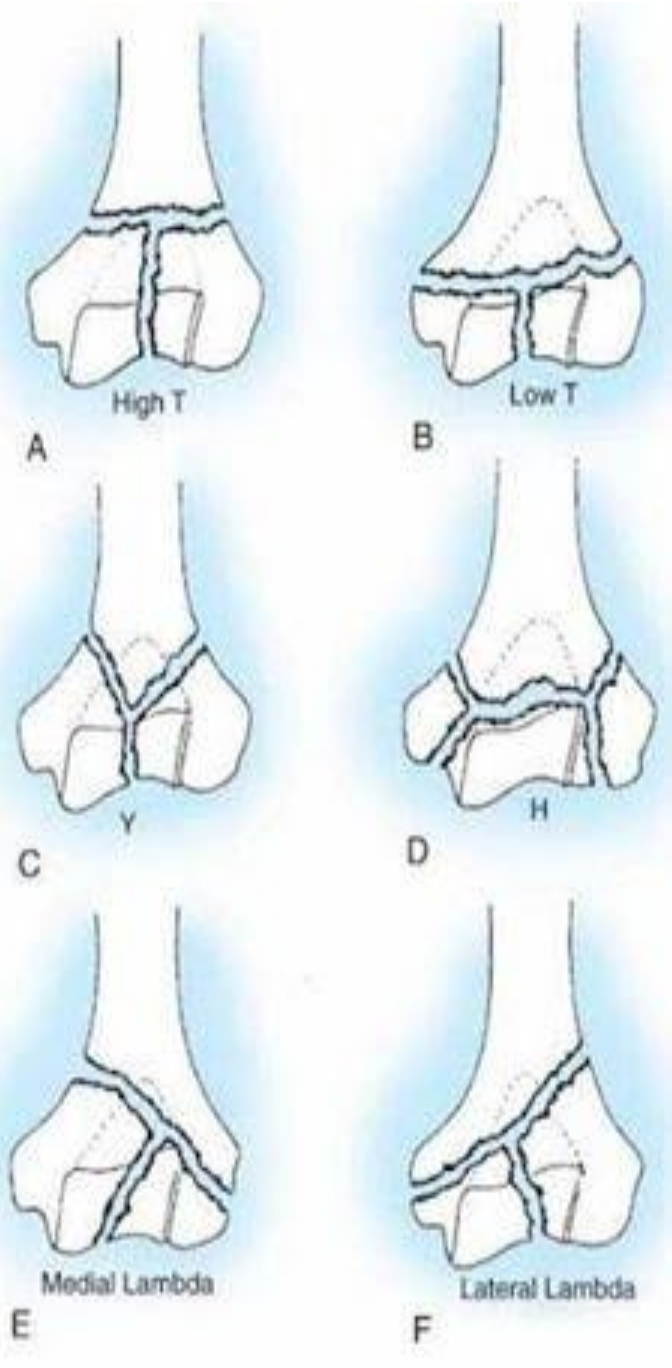
INTERCONDYLAR HUMERUS FRACTURES

INTERCONDYLAR HUMERUS FRACTURES ARE RARE IN CHILDREN AND ARE USUALLY ADULT INJURIES.

THESE FRACTURES INVOLVE JOINT AND NEED ANATOMICAL REDUCTION.

THEREFORE OPEN REDUCTION AND INTERNAL FIXATION

STRONGER IMPLANTS LIKE LOCKING PLATES ARE REQUIRED



Elbow dislocation

- Common in adults , rare in paediatric age
- Three bony point relationship disturbed [triangle]
- Shorting of arm in supracondylar fracture
- Shortening of forearm in elbow dislocation

Early closed reduction, and later treatment of ligamentous injuries only in instability persists

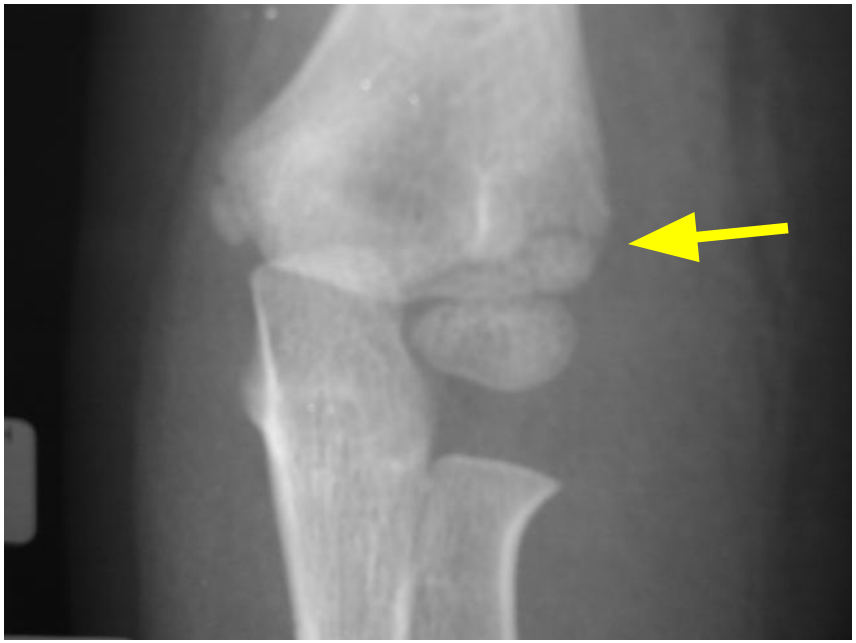
Elbow dislocation

Lateral Condyle Fractures

- Common fracture, representing approximately 15% of elbow trauma in children
- Usually occurs from a fall on an outstretched arm

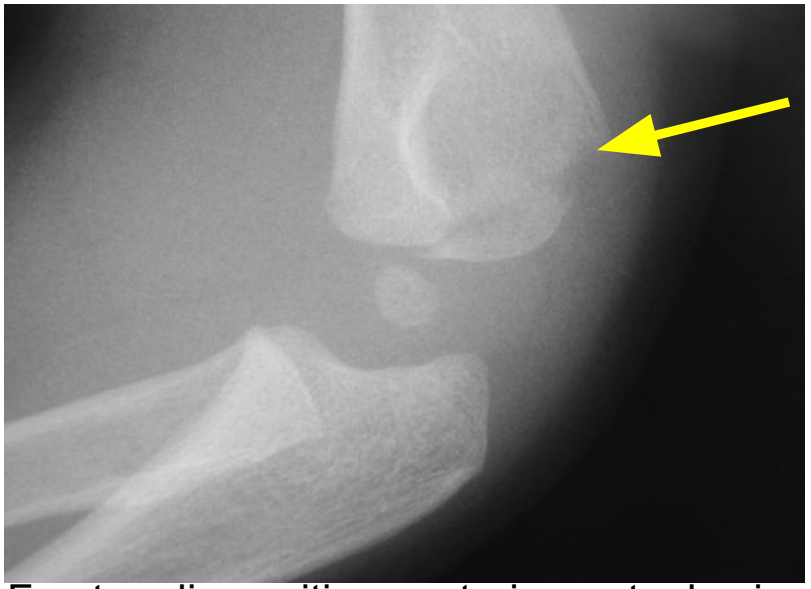
Lateral Condyle Fractures

- Oblique radiographs may be necessary to confirm that this is not displaced. Frequent radiographs in the cast are necessary to ensure that the fracture does not displace in the cast.



Lateral Condyle Fractures

- Displaced more than 2 mm
  - On any radiograph (AP/Lateral/Oblique views)
  - Reduction and pinning
  - Closed reduction can be attempted, but articular reduction must be anatomic
- If residual displacement and the articular surface is not congruous
  - Open reduction is necessary

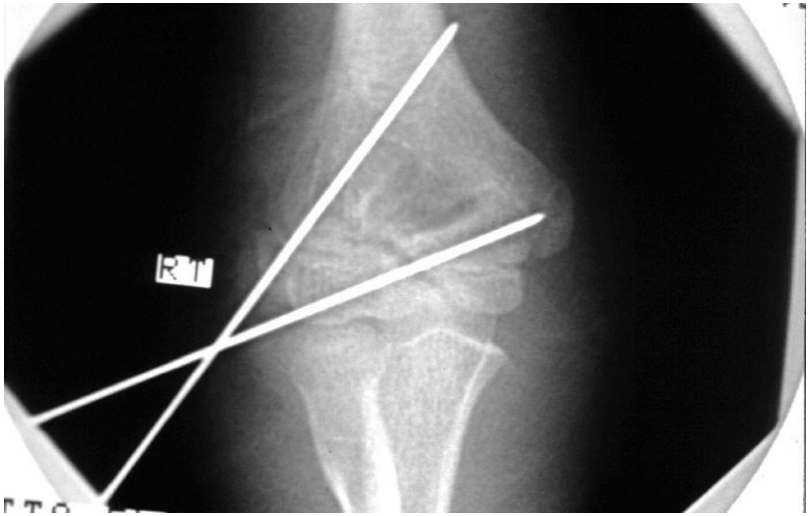


Fracture line exiting posterior metaphysis (arrow) typical for lateral condyle fractures

Lateral Condyle Fractures

- ORIF is *almost always* necessary
- A lateral Kocher approach is used for reduction, and pins or a screw are placed to maintain the reduction
- Careful dissection needed to preserve soft tissue attachments (and thus blood supply) to the lateral condylar fragment, especially avoiding posterior dissection

Lateral Condyle ORIF



Lateral Condyle Fractures
Complications

- Non-union
  - This usually occurs if the patient is not treated, or the fracture displaces despite casting
  - Well-described in fractures which were displaced more than 2 mm and not treated with pin fixation
  - Late complication of progressive valgus and ulnar neuropathy reported

Lateral Condyle Fractures
Complications

- AVN can occur after excessive surgical dissection

Radiologically lateral condyle appears small & irregular

Medial Epicondyle Fractures

- Represent 5% to 10% of pediatric elbow fractures
- Occurs with valgus stress to the elbow, which avulses the medial epicondyle
- Frequently associated with an elbow dislocation

Medial Epicondyle Fractures Treatment

- Nondisplaced and minimally displaced
  - Less than 5 mm of displacement
  - May be treated without fixation
  - Early motion to avoid stiffness (3 to 4 weeks)

Medial Epicondyle Fractures Treatment

- Displaced more than 5 mm
  - Treatment is controversial
  - Some recommending operative, others non-operative treatment
  - Some have suggested that surgery is indicated in the presence of valgus instability, or in patients who are throwing athletes.
- Only absolute indication is joint - entrapped fragment after dislocation with incongruent elbow joint
  - First attempt closed reduction
- Long term studies favor nonoperative treatment

Medial Epicondyle Fracture
Elbow dislocation with Medial Epicondyle Avulsion

Treated with ORIF

Olecranon Fractures

- Relatively rare fracture in children
  - May be associated with elbow subluxation/ dislocation, or radial head fracture
- The diagnosis may be difficult in a younger child
  - Olecranon does not ossify until 8-9 years
- Anatomic reduction is necessary in displaced fractures to restore normal elbow extension.

Olecranon Fractures

- Olecranon fracture treated with ORIF in 14 year old, with tension band fixation.

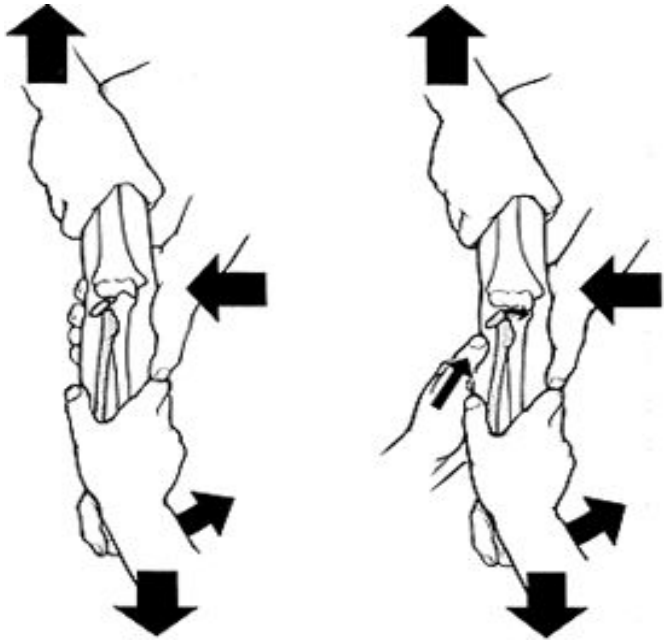
Proximal Radius Fractures

- 1% of children's fractures
- 90% involve physis or neck
- Normally some angulation of head to radial shaft (0-15 degrees)
- No ligaments attach to head or neck
- Much of radial neck extraarticular (no effusion with fracture)

Proximal Radius Fractures

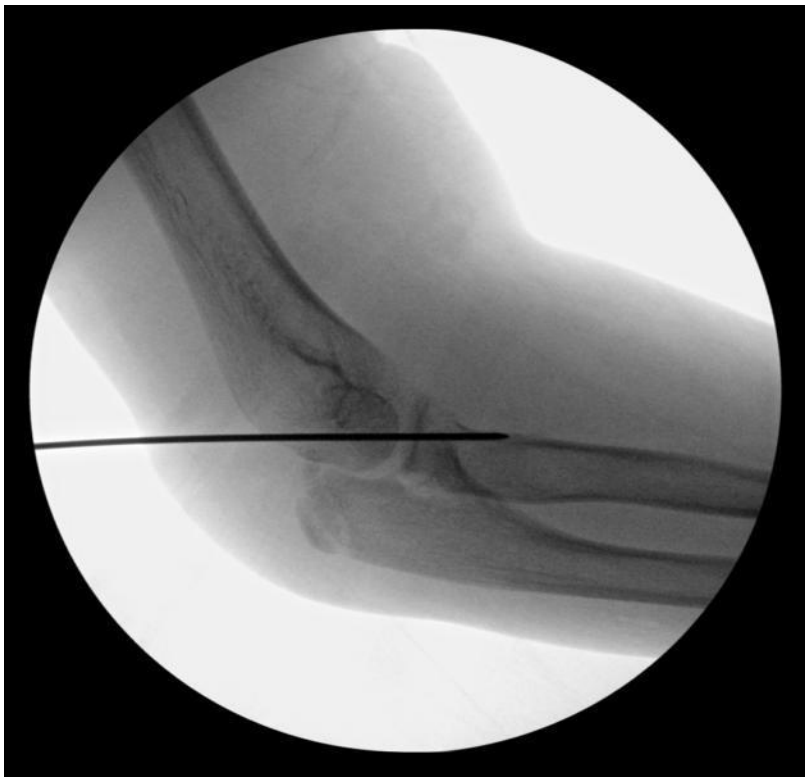
Proximal Radius Fractures Treatment

- Greater than 30° angulation
  - Attempt manipulation
  - Usually can obtain acceptable reduction in fractures with less than 60° angulation
  - Traction, varus force in supination & extension, flex and pronate
  - Ace wrap or Esmarch reduction



100% Displaced
Failed Closed Reduction

Pin fixation augmented by cast for 3 weeks

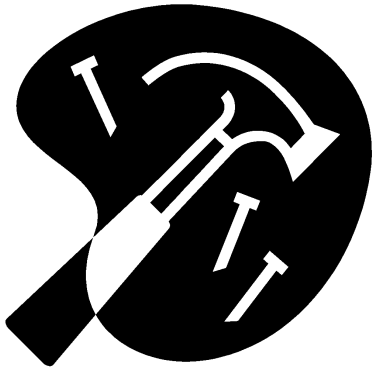


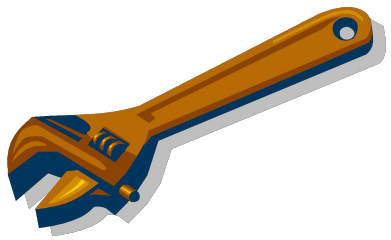
Lateral Epicondylitis (tennis elbow)

- Pathology
  - 30 – 50 years old
  - Repetitive micro-trauma
  - Chronic tear in the origin of the extensor carpi radialis brevis

Lateral Epicondylitis (tennis elbow)

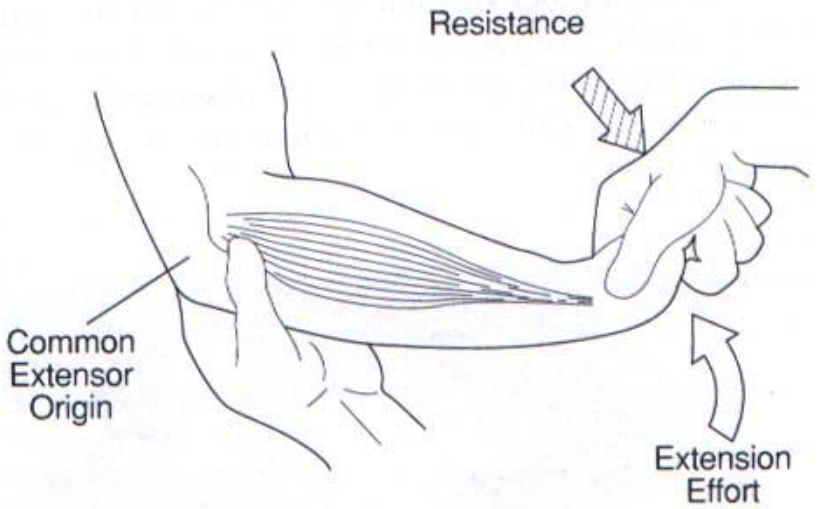
- Mechanism of Injury
  - Overuse syndrome caused by repeated forceful wrist and finger movements
  - Tennis players
  - Prolonged and rapid activities



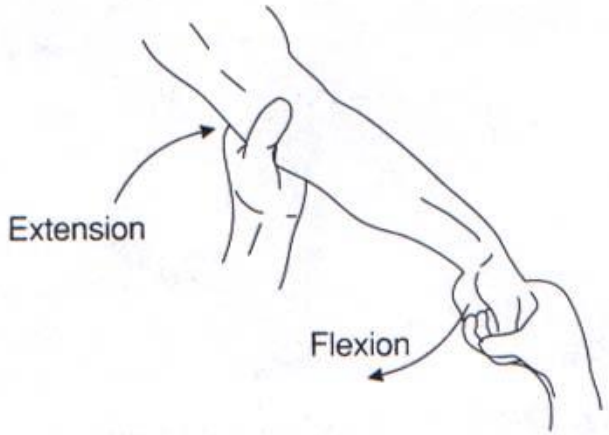


Lateral Epicondylitis (tennis elbow)

- Clinical Signs and Symptoms
  - Increased pain around lateral epicondyle
  - Tenderness in palpation CET
  - Tests
    - AROM; PROM
    - Resisted tests
    - Lidocaine


Resistance
Common
Extensor
Origin
Extension
Effort

A


Extension
Flexion

B

Treatment of Tennis Elbow

Quick Facts

SIGNIFICANT RELIEF OF SYMPTOMS OF LATERAL EPICONDYLITIS[a]

Treatment	*% Relief*
Changing tennis stroke or getting lessons	92
Stretching and strengthening exercises	84
Wearing forearm splint or brace	83
Use of medication	
Aspirin	70
NSAIDs	85
Steroid injection	88
Modalities	
Heat	73
Cold	63
Ultrasound	53
Rest > 1 month	72

[a] Complete relief (lack of recurrence) requires combined, intensive therapy.[35]

Medial Epicondylitis (golfer's elbow)

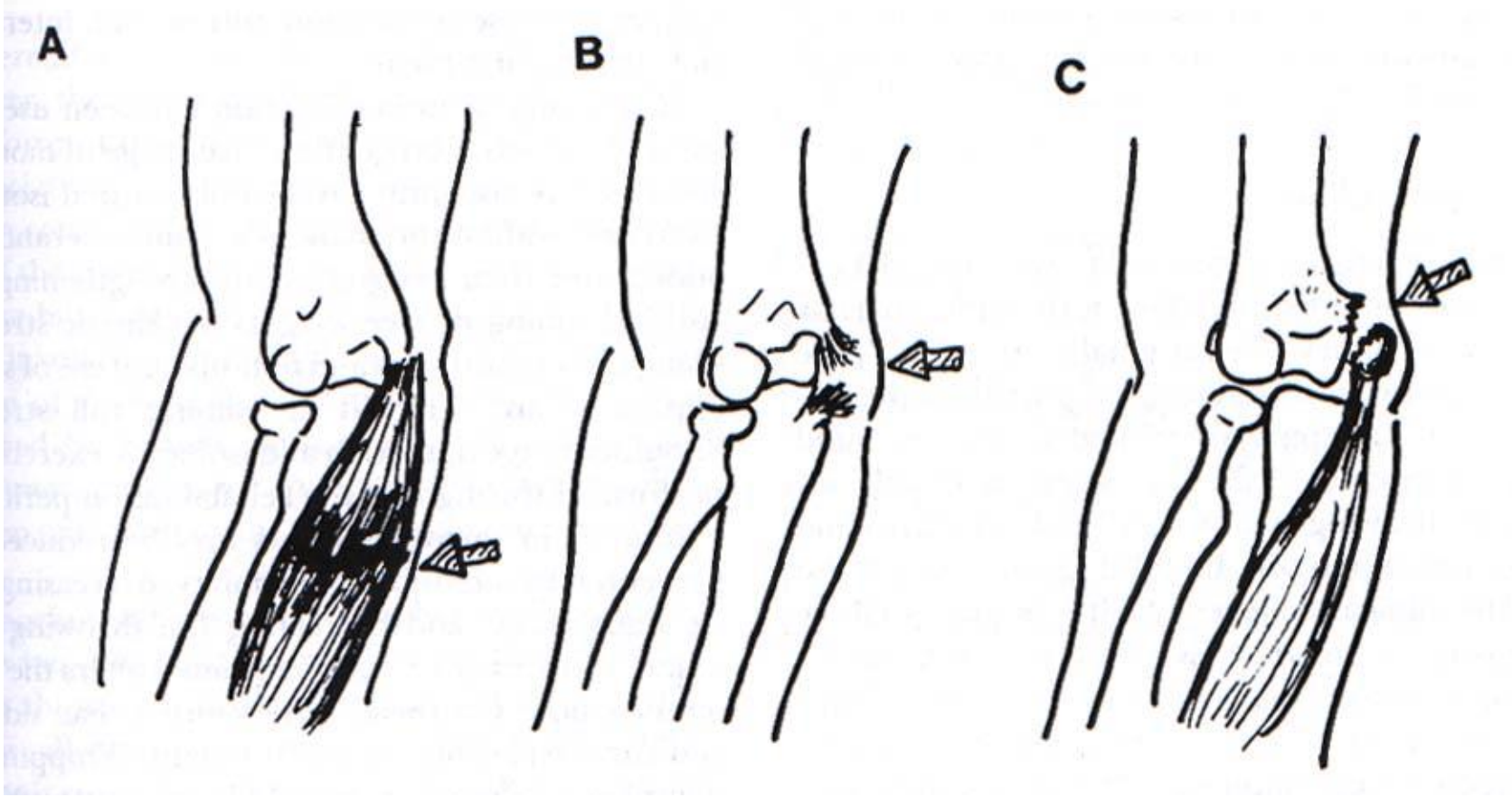
- Pathology
  - 30 - 50 years old
  - Repetitive micro trauma to common flexor tendon

Medial Epicondylitis (golfer's elbow)

- Mechanisms of injury
  - Throwing a baseball
  - Racquetball or tennis
  - Swimming backstroke
  - Hitting a golf ball

Medial Epicondylitis (golfer's elbow)

- Clinical signs and symptoms
  - Increased pain over medial epicondyle
  - Tenderness on palpation CFT
  - Tests
    - AROM; PROM
    - Resisted tests
    - Lidocaine


A
B
C

- ***Thank you***