Elbow Fractures

- Anatomy
- Supracondylar Fracture
- Distal Humeral Physeal Separation
- Lateral Condyle Fracture
- Medial Epicondyle Fracture
- Radial Neck Fracture
- Monteggia Fracture - Dislocation
Ossification Centers

- Capitellum – 2yr
- Radial head – 4yr
- Medial epicondyle – 6yr
- Trochlea – 8yr
- Olecranon – 10yr
- Lateral epicondyle – 12yr

Supracondylar Fracture

- 60% OF ELBOW FRACTURES
- PEAK AGE 5-7 yrs
- 97% EXTENSION TYPE

Supracondylar Fracture

- Associated injuries/ Complications
  - Neurological 7% (usually AIN)
  - Associated forearm fracture 5%
  - Vascular 0.5%
  - Palsies – immediate reduction
  - Compartment syndrome 1%
  - Vascular malunion – 5 to 10%
- Gartland classification
  - TYPE 1
    - NON-DISPLACED
  - TYPE 2
    - EXTENDED, POSTERIOR CORTEX INTACT
  - TYPE 3
    - DISPLACED, NO BONY CONTACT
Supracondylar Fracture

- **Treatment**
  - Type 1 – cast
  - Type 2 – CR and cast, or CRPP
  - Type 3 – CRPP

Supracondylar Fracture

- **When?**
  - EMERGENT
    - NEUROVASCULAR COMPROMISE
    - OPEN FRACTURE
  - > 8 HOURS AFTER INJURY
    - NORMAL NEUROVASCULAR EXAM
    - SKIN INTACT
    - ISOLATED INJURY
- **How?**
  - Lateral pins vs medial and lateral pins

Reduction technique

- Traction
- Correct displacement
- Correct rotation
- Reduce with pressure on olecranon
- Flex in pronation
  - Line of reduction ~90° with cranial flexion

Millis, CORR, 1984
Supracondylar Fractures

- Open Reduction
  - Open fx, irreducible, vascular compromise continues after CR

Flexion-Type
  - CR by extension

DISTAL HUMERAL PHYSEAL SEPARATION

- Children < age 6
  - Difficult to diagnose if before ossification of capitellum
  - Resembles elbow dislocation
  - Elbow dislocations extremely rare in children under age 6
- Child abuse, difficult child birth
- Treatment
  - CR with splint or PP
  - Arthrogram/US cannal to document reduction

Lateral Condyle Fractures

- Milch
  - Type 1 – SH IV
  - Type 2 – SH II
- Jakob
  - By displacement
Lateral Condylar Fracture

- MINIMALLY DISPLACED FRACTURE
  - CAST
  - PERCUTANEOUS PINNING
- DISPLACED FRACTURE
  - OPEN REDUCTION AND FIXATION

Vascular Anatomy
Dissection should be neither distal nor posterior to fracture site, blood supply to lateral crista of trochlea enters from posterior.

Complications

- Cubitus varus or valgus
- Ulnar neuropathy with valgus deformity

Medial Epicondylar Fractures

- Avulsion injury with valgus stress
- Peak age 11y
- 25% associated with elbow dislocation, other fracture
Medial Epicondylar Fractures
- Isolated displacement well tolerated
- Unless significant repetitive loading anticipated
- Only absolute operative indication is entrapped fragment within joint

Elbow Dislocation
- 6% OF ELBOW INJURIES
- PEAK AGE 13Y
- POSTERIOR
- 11% NERVE INJURY
  - ULNAR

Radial Head / Neck Fractures
- Treatment
  - < 30°, splint / cast
  - 30 - 60°, attempt CR
  - > 60°, ORIF Avoid transcapitellar pins
- Complications
  - Stiffness
  - AVN
  - PIN palsy
  - Synostosis
Monteggia Fractures

- Monteggia fx is a radial head dislocation that occurs in conjunction with an ulnar fracture
- Common misdiagnosis

Monteggia Fractures

- Bado Classification
  - Type I
  - Type II
  - Type III
  - Type IV

Monteggia Fractures

- Bado **Type I** (70% Monteggia)
  - ANTERIOR DISLOCATION radial head with ULNAR diaphyseal fracture
  - HYPEREXT ELBOW -> BICEPS CONTRACTION -> ANT DISLOCATION RADIAL HEAD -> ULNA FX
Monteggia Fractures

- Bado Type I (70% Monteggia)
  - Close reduction:
    - 1st: Ulna reduction -> 2nd: Radial head
    - Immobilization: forearm supination and elbow hyperflexion, long arm cast x 3-4 wks + short cast x 3 wks
  - ORIF:
    - unstable ulna diaphysis or open fracture
    - plate and screws or intramedullary rod

Monteggia Fractures

- Bado Type II (rare)
  - POSTERIOR DISLOCATION radial head with ULNAR metaphyseal fracture
  - Fall on a partially FLEXION of the elbow
Monteggia Fractures

- **Bado Type II** (rare)
  - Close reduction:
    - 1st: Ulna reduction -> 2nd: Radial head
    - Long arm cast with elbow in extension for 3-4 weeks.
  - **ORIF**:
    - unstable ulna diaphysis or open fracture
    - plate and screws or intramedullary rod

- **Bado Type III** (2nd most common- 23%)
  - OLECRANON fracture with ANTEROLATERAL DISLOCATION radial head
  - VARUS stress to the elbow
  - High incidence PIN palsy (resolved 8-12 wks)

- **Bado Type III** (2nd most common)
  - Close reduction:
    - 1st: valgus force on Ulna metaphysis -> 2nd: Radial head
    - Long arm cast with elbow in extension with a valgus mold for 4 weeks.
Monteggia Fractures

- Bado Type III
  - ORIF:
    - unstable ulna diaphysis or open fracture
    - plate and screws or intramedullary rod

Monteggia Fractures

- Bado Type IV (rare)
  - BOTH FOREARM FRACTURE with ANTERIOR DISLOCATION radial head
  - MOI similar to TYPE I

Monteggia Fractures

- Bado Type IV
  - ORIF (recommended):
    - ORIF both forearm fracture and radial head reduction
    - Immobilization long arm cast in supination and flexion of forearm for 3 weeks
Monteggia Fractures

- Delayed/“Referred” Monteggia Fractures (>6wks)
  - Ulnar osteotomy followed by radial head reduction +/- annular ligament reconstruction / Bell Tawse procedure / triceps tendon slip
  - Worse prognosis: age patient, old fracture
  - Unable to treat when head malformed