• Elbow = 5% of fractures
  - 0.5% Distal Humeral
• Adults - Comminution ++
  - Kids - Supracondylar/condylar minimal comminution
Distal Humerus made up of 2 columns
- Medial and lateral
- Together have two articulations
- Ulna humeral - Hinge joint
- Radio humeral - Rotational joint
- Independent but related
• Very thin sections of bone at olecranon fossa, radial fossa, coronoid fossa
  – Provide room for ROM without impingment
  – Weak area
• Alignment
  – 4-8° of valgus (carrying angle)
  – 3-8° of external rotation
  – 40° of forward flexion
• Ligaments and muscles
  - Medial and Lateral Ulnar collateral ligament
  - Flexor and extensor origins
• Peri-articular - OTA Classification
  - A - Extra Articular
  - B - Partial Articular
  - C - Total articular - No continuity shaft to articular surface
Classification – Peri-articular

- **OTA/ AO**
• Standard X-rays
• Traction X-rays
• CT Scan with Recon
• Stress Views
Treatment Options - Type A Fractures

- As in Kids - Brachial artery injury is sometimes associated with this type
- AKA transcolumnar fractures
- Also classified into high, low or oblique
Management Options – Type A Fractures

- **Closed Reduction and Casting**
  - Now recommended only for those who are medically unfit
- **Closed Reduction and Traction**
  - Neither closed technique allows for early mobilization
- **Percutaneous Pinning**
  - As in kids, crossed k-wires
  - Must be immobilized in cast for 5-6 wks
- **Open Reduction Internal Fixation**
  - The current standard of care
Management Options – Type A Freactues

• Percutaneous Pinning
  - As in kids, first obtain closed reduction
    • Traction and flexion (if extension type)
    • Traction and posterior pressure on the forearm (if flexion type)
    • Then two crossed k-wires starting on the epicondyle and crossing the fracture site
    • Under flouro
  - Ulnar nerve a risk
  - Not stable construct - needs to be in cast/splint x 5-6 wks
  - Possibility of stiff elbow
Management Options – Type A Fractures

- **Open Reduction and Internal Fixation**
  - Method of choice
  - Allows for stable fixation and thus early ROM
  - Minimizes chance of stiff elbow
  - Can start ROM as soon as day 1

- **Technique** – Same as fixation for Type C
  - Will go over this later
Treatment Options - Type B Fractures

- Milch Classification for medial or lateral column fractures
  - Type I - Lateral wall of trochlea attached to main mass of humerus
  - Type II - Lateral wall separated
- High/ Low Classification
- OTA B1.1 or .2
- OTA B2.1 or .2
Treatment Options - Type B Fractures

- Non-operative
  - Non medically fit
  - Low, undisplaced intraarticular fractures

- Operative
  - Treatment of choice
  - Muscle Pull significant force of displacement
  - Cannulated screws / Lag screws
Management Options – Type B Fractures

- Articular Fractures
  - Capitellum
    - With or without involvement of the trochlea
    - If undisplaced – closed treatment
    - If displaced
      - Open reduction and internal fixation
      - Lateral or Anterior approach and Herbert type countersunk screws
Treatment Options - Type C Fractures

• Options
  - Non-operative - Classical teaching (1960s)
    - At the time poor outcomes with ORIF
    - Traction through olecranon pin - 3 wks, then cast
    - Collar and Cuff - Bag of Bones Treatment - Maximal flexion initially, encouraging ROM of hands and fingers
      - At 6 wks begin elbow ROM
  - Operative - Current Choice
    - ORIF is now recommended because we have a better understanding of fractures, imaging and implants
      - Can achieve reasonably functional outcomes because of early motion
    - Total Elbow - A few slides from now
Treatment Options – Type C Fractures

• 90-90 plating
  - Posterior lateral plate
  - Medial plate
    • Distal end of medial plate can be bent so that it includes orthogonal screws
    • Compression screw can be used across the condyle
  - Biomechanically the strongest construct
    • Helfet and Hotchkiss

- Pelvic reconstruction plates
- Pre-contoured plates
  • Accumed - Locking
  • Zimmer - Locking
Management Options - Type C Fracture

• **Total Elbow**
• **Currently only recommended in**
  - the elderly and those with low demand
  - Those with very poor bone quality
  - Extremely comminuted fractures
• **Cannot be used as a bailout if olecranon osteotomy used**
  - Must use either triceps split or osteotomy of epicondyles
  - Generally should be done by experienced arthroplasty surgeon
Outcomes In Type C Fractures

• Outcomes proportional to energy type of fracture
• Stiffness
  – Despite ORIF and optimal early ROM still can have 20-25° flexion contracture
• Pain
  – 25% can have exertional pain
• Strength
  – 75% of normal side
Challenges
- Avoiding articular surfaces
- Avoiding impingement of fossae
- Capturing multiple small fragments
- Cancellous bone
- Achieving stable fixation to allow early ROM
- Osteoporotic bone
ORIF Distal Humerus

- Posterior Approach to the elbow
  - Position lateral, or partial lateral
  - Arm across body, or with sterile bolster
  - Tourniquet applied high
  - Incision: straight posterior, or slightly medial, curving around medial side of olecranon tip up midline of arm
• **Posterior Approach Cont’d**
  - Dissection consists of exposing the triceps fascia
  - Identifying and the ulnar nerve on medial side +/- transposition depending on #
  - To get to the joint a triceps split or an olecranon osteotomy
    - Studies show no difference in muscle strength post-op
• **Posterior Approach Cont’d**
  - Pre-drill and tap olecranon
  - Create cevron apex distal
  - Protect the articular surface by going through the last millimeter with an osteotome
  - Aim for the ‘bare patch’ at the apex of the trochlear notch
ORIF Distal Humerus

- Posterior Approach
  - Pre-drill and tap olecranon
  - Create cephalic apex distal
  - Protect the articular surface by going through the last millimeter with an osteotome
  - Aim for the 'bare patch' at the apex of the trochlear notch
• **Postero-lateral Approach**
  - Used for isolated lateral column fractures
  - Position - Supine with arm across chest
  - Incision: curved from lateral epicondylar ridge to lateral border of ulnar
  - Internervous Plane:
    Anconeus and ECU supplied via radial and PIN respectively
  - Superficial dissection: incise deep fascia in line with skin incision to find ECU and Anconeus. They share common origin
Deep dissection: pronate forearm to move PIN away. Find Supinator at the deep part of the incision and strip if off as necessary from epicondyle.