Complex fractures of the distal humerus and their complications

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Distal Humeral Fractures

• Goals
  – Restoration of articular surface
  – Early motion
  – Union

• Problems!
Demographics

Distal humerus fractures
- Approx. 2% of all fractures
- 15% of all humerus fractures.
Trauma mechanisms

- High velocity injury in younger patients
Trauma mechanism

• Low energy fall
Fracture patterns

- Shear force
- Coronal plane fractures
  - Capitellum
  - Trochlea
Fracture Patterns (AO)
Complex (triplane fractures)

- +/- comminution
Outline

• History
• Challenges & Problems
• Treatment options
• Complications
• (my) Concept
Historical overview

• Pionering operative tactics
  Lamotte 1913

• "Bag-of- bones"
  Eastwood 1937
  Brown & Morgan 1971

• Stabl fixation
  » Morrey et al 1981

• Precontoured plates
  Shawn O’Driscoll 2002
Challenges & Problems

• Complex anatomy and Biomechanics
• Limited bonemass
• Crushed (avital) joint surface
• Lack of (surgical) experience
Distal humerus
Bone stock

pQCT
Crushed (low)fractures

- Imaging
  - CT (always)
  - 3-D reconstruction
  - MRI (seldom)
Treatment Modalities & Techniques
Non-operative treatment

91 years old lady
6 months
Surgical Technique

• Straight Incision “around” the olecranon to avoid flap necrosis
Surgical technique

- Identify and release the Ulnar nerve
Triceps Sparing/Split
Olecranon-osteostomy

- Olecranon osteotomy is seldom necessary (fix with a plate)
ORIF Technique

- K wires
- Screws
ORIF Technique
Classical 90° technique (AO)
ORIF Technique

- Parallel plates
- Precontoured plates
- Locking screws
ORIF Technique
Double-column fixation
Difficult fractures to treat

- Low fractures
- Tri-plane fractures
- Comminuted fractures
- Poor soft tissues
- Open fractures
Coronal Shear Fracture

type 1-3

Milch type fractures
Coronal Shear fractures

- 1% of all elbow fractures
- Uniquely difficult to repair

Dubberly: 2006
Type 1 CS Fracture
Type 1 CS Fracture
Type 1 CS Fracture
Type 3 CS Fracture
Medial Collum Fracture
(Milch type II)
Anglestabl plate osteosynthesis
Results

• Conservative treatment
  – Patients with limited functions manage with limited ROM

• Surgical treatment
  – 75% can expect good outcome

Ring & Jupiter 1999
Elbow Kinematics

- Painfree and stable function:

- 100° flexion
- 100° Supination /pronation

Morrey et al JBJS 63A:1981
Results (review)

- Wide range of injury and treatment are reported
- Small series
- Union rates are excellent (91%-100%)
- MEPS
- 84%-100% good to excellent outcomes
- Flexion arc 90°-106°
- Complication-rate high
McKee type 4
Hemi arthroplasty
Hemi-Arthroplasty for Acute Distal Humerus Fractures

**Indications**

- “Elderly” osteopenic low demand patients
- Adequate fixation of a comminuted distal humeral fracture is unlikely to be achieved with ORIF

LATITUDE ANATOMIC™- Tornier
Complex fractures

- 82 Years old lady
- Osteoporosis
Total Elbow Replacement
Arthroplasty for Acute Distal Humerus Fractures

**Indications**

- “Elderly” osteopenic low demand patients
- Supracondylar fracture with pre-existing arthritis
- Unstable pseudoarthroses

DISCOVERY, Biomet
Full methal jacket
Open Fractures
60 Years Male - Liver Disease
Minimal osteosynthesis
External Mobile Fixation

Post-OP

6 weeks
Minimal osteosynthesis
External Mobile Fixation

3 months post OP
Gunshot (low velocity)
Temporary DJDII
DJD2
Chronic Instability applications
Complications

- Mal-union
- Pseud-arthroses
- Stiffness
- Infection
- Neuro-vascular
- Neuropathy
- Heterotopic bone
- (Early) Arthrosis
Review article
30% Complications

- Inadequate osteosynthesis
- Ulnar nerve palsy
- Non-union
- Malunion
- Infection

Ring & Jupiter JSES 1999
Complications

**Early**
- 37 cases AO type C
- Precontoured parallel plates
- 53% complications
- 16% nerve injuries
- *J Orthop Trauma* 2009

**Late**
- 30 cases
- Posttraumatic arthritis in 80% after 19 years (12-25)
- Despite optimal surgical treatment
- *JBJS* 2007; 89A:1524
Approach related Complications

- Incisional
- Olecranon osteotomy
  - Non-union
  - Malunion
  - Hardware failure
  - Pain

- Triceps split
  - Extension deficits
  - Weekening of the Triceps
  - Triceps reflecting approach better than division of the tendon
  - *J Shoulder Elbow Surg* 2007:849
Aproach Related Complications
Triplane Fracture
62 years old lady
Poor reduction
Stable osteotomy?
26 years old Male, Top-Skier
Poor reduction
Stable osteotomy?
Double pseud-arthrosis

8 months Post-OP
Complications
Ulna osteotomy

20 years old male
Ulna osteotomy related complications

- 25 cases
- Tension band wiring.
- 36% of bad quality
- 1 pseudarthrosis
  - *Chirurgie de la Main* 28, 2009:

- 94 cases
- Different techniques
- 19% symptomatic fixations
  - Journalagent.com 2009
46 years old male
(Alcoholic)
44 years old male
Car accident
Post OP
Radial nerve paresis
10 months Post-OP
Re-Osteosynthesis
Neuro-vascular lesions

• Less frequent
• Serious
Heterotopic ossification
Stiffness/HO
Heterotopic Bone

• Gofton et al.
  J hand Surg 2003

• 13% of cases
• Recommended prophylaxis with Indomethacin.

• Leugmair et al.
  J Shoulder Elbow Surg 2008

• 11% of cases
• Most important complication that limited ROM
Entrapment
radial nerve
Radial nerve entrapped under the plate
Reoperations in 20% of trauma cases

- Insufficient osteosynthesis
- Poor access
- Poor reduction
- Incorrect use of implants
- Underestimation of soft tissue lesions

Review 2006

- Incomplete understanding of trauma mechanism
- Not daytime surgery
- Surgical experience!
How to avoid complications

- Experienced surgeons
- Daytime surgery
- Centralized Treatment
Summary Distal Humerus

• Preoperative planning
  – CT scans
  – Approach (posterior)

• ORIF successful in the majority of patients
  – Reestablish jointsurface anatomally
  – Stability between distal fragment og Humeral shaft

• Early Rehabilitation
  – Active and passive ROM

• Severe bone loss (low demand seniors)
  – Consider primary elbow arthroplasty !
  – TEA or hemiarthropasty
Thanks

Don’t do an Olecranon osteotomy unless you have to!
Princip-based after-treatment

- Rehabilitation
  - Infra-clavicular block/catheter
  - Early ROM
  - (CPM)