**Distal Radius Fractures**
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**About Me**
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**Agenda**
- Anatomy
- Radiographic evaluation
- Classification schemes
- Cases
  - Initial evaluation & treatment
  - Operative indications
  - Operative options

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A quick word on goals

- We are trying to achieve:
  - Pain-free, functional range of motion
  - Postponement of post-traumatic arthrosis
  - Avoidance of complications
- We accomplish this by:
  - Restoration of anatomy
  - Obtaining (& maintaining) stability

Ultimately...
we need to give you something to work with...

Technical Goals

- Articular congruity
- Radial alignment and length
- Motion (functional)
- Stability

Anatomy

- Osseous
- Ligamentous
- Functional

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Osseous Anatomy

- Radial styloid
- Scaphoid fossa
- Lunate fossa
- Sigmoid notch
- Volar lip
- Lister's tubercle

Ligamentous Anatomy

- Important role in indirect reduction
- Volar ligaments are thicker, stronger
- Dorsal ligaments are thinner & lengthen with distraction
**Ligamentous Anatomy**

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**Functional Anatomy**

- Three column framework
- Developed by Rikli and Regazzoni
- Helps us to conceptualize the mechanical structure

**Ligamentous Anatomy**

- TFCC
  - Primary stabilizer of the DRUJ
  - Allows radius & carpus to rotate around the ulnar via the sigmoid notch
  - With the ulna, carries as much as 20% of axial load

**Functional Anatomy**

- Radial column
  - Radial styloid & scaphoid facet
  - Restore for length & alignment of the articular surface in frontal & sagittal
- Intermediate column
- Ulnar column

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Functional Anatomy

- Radial column
- Intermediate column
  - Lunate facet, sigmoid notch
  - Dorsal die-punch, impacted articular fragments, volar-ulnar corner, DRUJ
  - Primary load-bearing column of radius
- Ulnar column

Radiographic Evaluation

- Starts with plain radiographs
  - PA, lateral, oblique (+/- “facet lateral”)
  - Evaluate radial height, radial inclination, and volar tilt
  - Assess DRUJ, AP distance, teardrop angle
  - Articular step-off

Computed Tomography (CT)

- Comminuted, intra-articular fractures
- Pre-operative planning
  - Combined approaches
  - Implant choice (i.e., fragment-specific)
  - Need for bone graft (i.e., central die-punch)
  - Associated carpal injuries (i.e., scaphoid)
1. Radial Inclination
2. Radial Height
3. Ulnar variance
4. Scapholunate interval
5. Gilula’s lines
1. Radial Inclination
2. Radial Height
3. Ulnar variance
4. Scapholunate interval
5. Gilula’s lines

Clues for DRUJ Disruption
- Radial shortening >5mm on PA
- DRUJ widening on PA
- Dorsal subluxation of ulna on lateral
- Base of ulnar styloid fracture
Widened AP Distance

Significance of Articular Step-Off

- Based on Jupiter and Knirk’s retrospective review of plain radiographs in 1986
- Found that:
  - 91% patients had arthrosis with any incongruity
  - 100% patients had arthrosis with 2 mm or more
- Ignited an enthusiasm for articular reduction

Teardrop Angle

Flawed but Influential

- No control
- Ignored confounders, such as radial malalignment & associated injuries
- Predates functional outcome scores
- Radiographic arthrosis ≠ clinical significance
Acceptable Parameters

- Radial Inclination: < 5 degree loss
- Radial Height: within 2-3 mm of contralateral wrist
- Palmar Tilt: 0 to 10 degrees dorsal
- AP Distance: M ~20mm, F ~18mm
- Teardrop Angle: ~70 degrees
- Articular step-off: < 2 mm

Classification Schemes

- Anatomic descriptions
- Eponyms
- AO/OTA
- Various others (Frykman, Melone, Mayo, Fernandez, etc...)

Bottom Line...

- Our goals are to:
  - Restore anatomy
  - Provide stability for functional ROM
  - Postpone sequelae
  - Avoid complications

Eponyms

- Colles’
- Smith’s
- Barton’s
- Chauffer’s
AO/OTA

- Ability to categorize nearly every variation of fracture
- Little inter-observer reliability with subdivisions

Fernandez’ Classification

- Mechanism-based
- Details associated soft tissue injuries
- Suggests treatment options for each

Melone Classification

Medoff’s Classification

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Bottom Line for Classifying Fractures

- Consider the mechanism & energy of the injury
- Understand the personality of fracture & how it will behave (i.e., stability…)
- Identify associated injuries
- Tailor your treatment plan to each fracture

Case 1

- 52 year old female falls onto outstretched hand
- No wounds
- NVI

Closed Reduction

More views…
Many Can Be Treated Closed

Case 2

- 53 year old female presents after fall while exercising
- No wounds
- Numbness, tingling in median nerve distribution

More Views…

Reduction Attempted
Operative Indications

- Open
- Neurovascular compromise
  - Acute carpal tunnel syndrome
  - Compartment syndrome
- Associated injuries
- Failure of non-op

What are our fixation options?

- Pins / K-wires
- External fixation +/- augmentation
- Dorsal plates
- Volar plates
- Fragment-specific plates
- Bridge plating

Unstable Fractures

- By definition
  - Displaced shear
  - Comminuted & displaced articular fractures +/- impaction
  - Fracture-dislocations
  - Significant metaphyseal comminution

- By features (predictors)
  - Dorsal angulation more than 20 degrees
  - Dorsal comminution*
  - Intra-articular
  - Ulnar fracture
  - Age older than 60 years*
  - Radial shortening >3mm

Pins & Plaster

- Extra-articular
- Inexpensive
- “Minimally invasive”
- Requires cast immobilization
- Potential pin site complications

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Extra-articular, displaced

Percutaneous Pinning Still Works

Extra-articular, displaced

Intra-focal Pinning
(Kapandji’s Technique)

- Extra-articular
- Pins inserted thru fracture site & used to lever fragments into position
- Not rigid fixation
- Risk of collapse in older patients

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6 weeks after pinning

Ex-Fix +/- Augmentation

- Extra- or intra-articular
- Allows for ligamento-taxis across fracture site
- May require mini-open reduction +/- supplement with bone graft or subchondral pins
- Avoid over-distraction
- Make small incisions to protect nerves

Volar Locked Plating

- Allows reduction and fixation of dorsally angulated fractures
- Avoids disrupting dorsal comminution, extensors
- Still has issues
  - Flexor rupture
  - Long screws...

Fragment-Specific Fixation

- Advantages
  - Low profile
  - Rigid, multi-planar fixation > early ROM
  - Forces surgeon to think about each fragment
- Disadvantages
  - Increased OR time
  - Steep learning curve
  - Forces surgeon to think about each fragment

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All these options...what do you want to do?

Before You Leave

Volar Bearing Plate

2 weeks after surgery
2 weeks after surgery

Post-Op Protocol

- Sugar-tong splint in supination or volar splint
- IMMEDIATE digital ROM (+ elbow & shoulder)
- Suture removal 10-14 days later
- Removable splint for 6 weeks
- Early vs. late wrist ROM  
  – Probably doesn’t matter!
- Vitamin C 500 mg daily??

Case 3

- 50 year old RHD male
- High energy

Case 3

Thank you to Jeff Friedrich, MD at Harborview Medical Center/University of Washington.
Intra-op

Thank you to Jeff Friedrich, MD at Harborview Medical Center/University of Washington.

2 months post-op

Thank you to Jeff Friedrich, MD at Harborview Medical Center/University of Washington.

Volar Extensile Approach

Thank you to Jeff Friedrich, MD at Harborview Medical Center/University of Washington.

Case 4

- 43 year old RHD female fall during a marathon
- No deformity
• Why fix this?
• What if you miss this??

Volar Hook Plate

Extended Carpal Tunnel Approach

Case 5 – Missed Volar Ulnar Corner

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AF Presenting Xrays

AF 1/21/15

- Extended carpal tunnel approach
- Carpal tunnel release
- Osteotomy of malunion
- Dorsal spanning plate
- Fragment specific fixation of the volar ulnar corner

AF Pre-Op CT scan
2 weeks post-op

3 month follow up

3 Month Follow Up

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3 month follow up

- Pronation 80°, Supination 45°
- Teardrop angle <70°
- Pain well controlled
- Incisions well-healed
- Patient happy with results

14 weeks after index surgery

After Dorsal Spanning Plate Removal

14 weeks after index surgery
What was that big plate?

Dorsal Spanning Plate Technique

- “Internal” ex-fix
- Good for:
  - Comminuted meta-diaphyseal fractures w short distal segments
  - Multiply injured patient, especially lower extremity injuries
- Plate stays on for 10-12 wks
- Often used in combination with other fixation options
- But not always…

Bridge Plate/ Dorsal Spanning Plate

Case 6

- 65 year old LHD female falls from standing
- Right wrist deformity, pain and swelling
- NVI
Case 6

Options

• Closed reduction & well-molded splint
• Closed reduction & percutaneous pinning
• External fixation
• Open reduction & internal fixation

How about a Bridge Plate?!

My Preferred Set-up
As Taught by Doug Hanel, MD

• 10 lbs traction w/ finger traps (index & middle)
• Agee maneuver
• Large C-arm
10 Weeks Post-op
Controversies

• Older patients
• Ulnar styloid fractures
• Carpal tunnel release
  – Be alert for acute CTS symptoms
  – Ask about previous, unrelated symptoms
  – Release if acute CTS, consider if previous symptoms or concerned about swelling

Final Follow-up

• Older patients (what’s old?)
• Ulnar styloid fractures
  – Styloid-tip fractures probably don’t matter
  – Check stability of DRUJ to decide
• Carpal tunnel release

In the end…

• Consider the patient and the fracture
• Tailor your treatment to each scenario
• Involve patient in decision making
• And remember our treatment goals…