Dilemmas in the Treatment of Distal Radius Fractures

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I have nothing financial to disclose
Distal Radius Fractures

- 280-440/100,000/yr
- 1/5 of all fractures
- 50% intra-articular
- 2 distinct groups
  - Young, high-energy
  - Elderly, low-energy

Objectives: Solve These Dilemmas

- Should we ever operate?
- If surgery
  - Which patients?
  - Which fractures?
  - Which device?
  - Is early motion beneficial after surgery?
The Rate of Emergency Room Visits (per 10,000 persons/year) with Hand And Forearm Fractures in the United States, 2008

History

- Fall on outstretched hand
- Fall from height
- Sports injuries
- MVA
- Elderly
Radiographic Evaluation

Four Measurements

- Palmar Tilt = 10-12° Volar
- Radial Inclination = Normal 22-23°
- Ulnar Variance
- Radial Length Normal = 11-12mm

CT is indicated for
- Suspected die punch fractures
- Volar lip fractures
- In the setting of a complex fracture for surgical planning purposes
- In equivocal fractures
In 1814

Colles Described the Fracture

- There was no Anesthesia 1846
- No Aseptic Surgery 1865
- No X-Ray 1895
- No Electric Lights 1879

"...One consolation only remains, that the limb at some remote period will again enjoy perfect freedom in all its motions, and be completely exempt from pain; the deformity will remain undiminished throughout life."

Abraham Colles, 1814
Lots of Great Men Have Been Wrong …But Was Colles Right?

The relationship between displacement and clinical outcome after distal radius (Colles') fracture

V. Finsen
Faculty of Medicine, Norwegian University of Science and Technology, and Department of Orthopaedic Surgery, St. Olav's University Hospital, Trondheim, Norway

- 260 patients
- Almost all degrees of malunion are compatible with good function
- Poor function may be seen in the presence of normal radiological anatomy
Dilemma

Distal Radius Fractures

• Cast, Ex-Fix or plate?

The Pendulum
**External Fixation**

- Classic position
  - Wrist flexion and ulnar deviation
  - MCP stiffness
- Agee, Szabo 1994
  - Decreased finger stiffness with neutral wrist position

**Dorsal Plates**

- \( \pi \) Plate
- Kambouroglou 1998 JHS
  - 2/8 tendon rupture
- Chiang 2002 JHS
  - 2/20 tendon rupture
- Rozental 2003 JHS
  - 9/28 required HWR of \( \pi \) Plate
  - 0/28 required HWR for low profile plate
Ruptures $2^0$ Titanium Plates

- 5/22 patients developed extensor tendonitis with $\pi$ plate in multicenter study
  - Ring & Jupiter JHS 1997

Ruptures $2^0$ Dorsal Titanium Plates
Ruptures 2° Dorsal Titanium Plates

- Orbay 2002 DVR in Young
  - N=31
  - All with good or excellent results with immediate postop motion
- Orbay 2004 DVR in Elderly
  - n=26
  - Good results with immediate postop motion

Volar Locking Plates

- Orbay 2002 DVR in Young
  - N=31
  - All with good or excellent results with immediate postop motion
- Orbay 2004 DVR in Elderly
  - n=26
  - Good results with immediate postop motion
**Volar Locking Plates**

- Complications
  - Rozental 2006 JHS
    - N=43
  - 4 Loss of fixation/malunion
  - 1 MCP stiffness
  - 4 Tendon irritation

**ORIF - Complications**

- EPL rupture (0.07% to 0.88%)
  - Vascular or mechanical insults
  - Keep screws short near Lister’s

Benson 2006 CORR
ORIF - Complications

- 4mm necessary to see on lateral
  - 2mm penetration not seen

Failure of Fixation: Volar Lunate Fragment

- 7 DR fx with volar lunate facet fragment
**Fragment Specific Fixation**

- Dual 2.0 plates 50° to 90°
- Mechanically superior to
  - Ex-fix or
  - 3.5mm dorsal T-plate
- Comparable to volar locking plates

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**Fragment Specific Fixation**

- Benson JHS 2006
  - N=85 F/U = 32 mo
  - Gartland Werley
    - 61 excellent
    - 24 good
  - Flexion = 85%
  - Extension = 91%
  - Grip Strength = 92%
Treatment – What We Tend to Do

- **Extra-articular**
  - Stable – cast
  - Unstable - surgery
- **Intra-articular**
  - Anatomic reduction

Lafontaine: 5 factors indicate instability

1. initial dorsal angulation >20°
2. dorsal comminution
3. radiocarpal intraarticular involvement
4. associated ulna fractures
5. age > 60 years

3 or more of these → loss of reduction
Assessment of Instability Factors in Adult Distal Radius Fractures

JHS 2004 Nesbitt

Odds Ratios and 95% Confidence Intervals for Unacceptable Results

- **Patient age**
  - 1.064 (1.016–1.113)

- **Dorsal angulation**
  - 0.998 (0.964–1.033)

- **Comminution**
  - 5.052 (0.366–69.772)

- **Radial Shortening**
  - 0.999 (0.894–1.118)

- **Intra-articular extension**
  - 1.181 (0.231–6.030)

- **Associated ulna fracture**
  - 0.671 (0.150–3.009)

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Assessment of Instability Factors in Adult Distal Radius Fractures

JHS 2004 Nesbitt

**Graph:**
- **Probability of Unacceptable Result at 4 weeks**
- **Age, years**
- **Probability of Unacceptable Result**
  - 0.00
  - 0.25
  - 0.50
  - 0.75
  - 1.00
- **Key Points:**
  - Initial reduction (p=0.008)
  - At 1 week (p=0.041)
  - At 2 weeks (p=0.088)
Is Early Internal Fixation Preferred to Cast Treatment for Well-Reduced Unstable Distal Radial Fractures?

- A decision analytic model to compare early internal fixation with volar plate to non-operative treatment
- QALY estimated for each management approach
- Data from the literature used to estimate rates of treatment complications and outcomes

Koenig et al, JBJS 2009

For nearly all scenarios, ORIF was the preferred treatment

- The difference was small, however (.08 QALY or 29.2 days).
- The most important driver of the decision was the likelihood of attaining a painless union (higher for the ORIF group).
- Patients >64 years of age may not demonstrate a meaningful gain from ORIF (have to weigh activity level, etc).
If you elect to treat operatively for an unstable distal radius fracture …

**ORIF or CRPP?**

- Prospective randomized Level 1 study
  - 45 AO types A1-3 and types AO C1 and 2 fxs
- ORIF > CRPP in DASH scores at 6, 9, and 12 weeks, greater R/M and strength at 6 and 9 weeks, and greater satisfaction scores.

Rozenthal and Day, JBJS 2009

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A Meta-Analysis of Outcomes of External Fixation Versus Plate Osteosynthesis for Unstable Distal Radius Fractures

Zvi Margaliot, MD, Steven C. Haase, MD, Sandra V. Kotsis, MPH, H. Myra Kim, ScD, Kevin C. Chung, MD, Ann Arbor, MI

JHS 2005;30A:1185

- There was no evidence to support the use of internal fixation over traditional external fixation
There is no robust scientific evidence to support most of the decisions necessary to manage these fractures.
Elderly patient

- Concept is not defined by physiologic criteria such as bone density or functional lifestyle but rather societal customs and legal definitions of retirement age.
- Geriatric literature, lacking objective criteria seems to accept age 65 as a cutoff point.

Dilemma

Most studies of distal radius fractures in elderly patients have found no association between radiological displacement and clinical outcome.
One year after fracture

- Comparing 44 patients > 65 years old treated operatively to 46 patients treated conservatively:
  - the operated patients had better radiographic parameters and grip strength
  - DASH scores, pain scores, and ROM were the same in the two groups


- 46 consecutive patients
  - Average wrist extension, ulnar deviation, palmar tilt & radial height were statistically better in the EF group at the final follow-up
  - No statistically significant difference in DASH scores, wrist flexion, radial deviation, pronation, supination, grip strength, pinch strength, ulnar variance or radial inclination
A Prospective Randomized Trial Comparing Nonoperative Treatment with Volar Locking Plate Fixation for Displaced and Unstable Distal Radial Fractures in Patients Sixty-five Years of Age and Older

Robert Avera, MD, Martin Lutz, MD, Christian Deml, MD, Dietmar Knappinger, MD, PhD, Luzian Haug, MD, and Markus Gobli, MD

Investigation performed at the Department of Trauma Surgery and Sports Medicine, Medical University Innsbruck, Innsbruck, Austria

• At 12 month follow-up examination
  – ROM, pain level, PRWE & DASH scores were not different between the operative and non-operative treatment groups
  – Patients in the operative treatment group had better grip strength through the entire time period
• Achieving anatomical reconstruction did not convey any improvement in terms of the range of motion or the ability to perform daily living activities in our cohorts

21 English-language papers on the management of patients > 60 years with unstable distal radius fractures

• Cast immobilization =
  – worse radiographic outcome
• Clinical result =
  – same as in those treated with volar plates, external fixation, or K-wire stabilization
• Complications requiring surgery
  – 11% of patients who had volar plates
  – 1% in those immobilized in a cast

Diaz-Garcia et al. JHS 2011, 36: 824–35
Variations in the Use of Internal Fixation for Distal Radial Fracture in the United States Medicare Population

Kevin C. Chung, MD, MS, Melissa J. Shauver, MPH, Huiying Yin, MA, H. Myra Kim, ScD, Omar Buser, PhD, and John D. Hirkaneyer, MD

- 85,924 Medicare patients were treated for a distal radial fracture in 2007
  - 74.0%, were treated with closed reduction and casting
  - 7.6% were treated with internal fixation
- Hand surgeons treated 33.7% of the DRF with ORIF and 60.4% closed
- Other orthopaedic surgeons treated only 17.6% of the fractures with internal fixation and 71.8% with closed treatment

Large regional variations were observed with clusters of higher and lower use across the country

"The occurrence of regional variations in the treatment of distal radial fractures in the elderly is not surprising, given the lack of consensus regarding the optimal treatment of such fractures in this age group"
Surgery was recommended to 114 patients aged 70 with reduced dorsally displaced fractures that had redisplaced to > 20° dorsal angulation, 3 mm radial shortening, or had an intra-articular step of ≥ 2 mm. 61 patients refused surgery, who continued non-operative treatment without re-reduction (mean follow-up 53 months). 53 pts. were treated with ORIF/volar plate (mean follow-up 62 months). No significant difference between the two groups with regard to ROM, grip strength, DASH, PRWE, or Green and O'Brien (1978) scores. VAS for pain was significantly higher in the operated group.


The AAOS (2011) found the evidence to be inconclusive to support operative treatment for patients over age 55 with distal radius fractures.
Ideally we would like to take an Evidence Based Practice Approach.

What about “Generalizability” ??

“Men are more apt to be mistaken in their generalizations than in their particular observations”

-Niccolo Machiavelli
Case

- 39 y/o LHD M
- Fall from 12 foot roof
- Open DR fx
- Pain and numbness in MN distribution