Distal Radius Fractures: Staying Out of Trouble

Brad Palmer, MD
Allegheny General Hospital
Pittsburgh, PA

Disclosures

- Nothing to Disclosure
- in the past 12 months, neither my spouse nor myself have had a financial relationship with a commercial interest (any entity producing, marketing, re-selling, or distributing health care goods or services consumed by or used on patients; with the exception of providers of clinical service directly to patients)

Epidemiology

- Most common fracture of UE
- 1/6 of all fractures in ER
- 74% of all forearm fractures
- 195.2/100,000 persons per year
- $164,000,000 was spent on hospitalizations related to distal radius fracture in 2007
- Bimodal
  - High energy in predominantly young males
  - Low energy in predominantly older females
History

• Abraham Colles (1814)
  – “This fracture takes place at about an inch and a half above the carpal extremity of the radius ... The carpus and base of the metacarpus appear to be thrown backward so much as on first view, to excite a suspicion that the carpus is dislocated.”

Treatment Trends

• Trend towards ORIF
  • Finland 1998-2008
    – 2x increase in surgical treatment
    – 13x increase in use of open reduction and plate fixation
  • ASSH
    – Members more often treated patients with ORIF vs nonmembers (33% vs 16%, P<0.001)

AAOS Guidelines

• December 5, 2009
• Large work group
• Evidence based literature review
• Treatment of distal radius fracture in patients older than 19 years
AAOS Guidelines

• 219 page document
• 29 recommendations
  – 14 inconclusive
    • Could not recommend for or against a treatment modality
  – 6 limited
    • Treatment modality is an option
  – 6 moderate
    • Suggest treatment modality based on evidence
  – 3 consensus
    • Not enough evidence to support a modality but the work group all agreed the modality was reasonable

AAOS Recommendation

• We are unable to recommend for or against any one specific operative method for fixation of distal radius fractures.
• Inconclusive

AAOS recommendation

• Closed reduction and percutaneous fixation vs. ORIF
• Non-bridging vs. bridging external fixation
• Augmented bridging external fixation vs. percutaneous pinning
• Augmented bridging external fixation vs. bridging external fixation
• Augmented bridging external fixation vs. plate
• Augmented bridging external fixation vs. volar locking plate
• Bridging external fixation vs. percutaneous pinning
• Bridging external fixation vs. medullary pinning
• Bridging external fixation vs. pins and plaster
• Dorsal locking plate vs. dual plating
ORIF

• Indications:
  – shearing marginal fx of joint surface
    • Barton’s fx, reverse Barton’s fx, radial styloid fx
  – unstable, extra-articular fx
  – complex intra-articular fx
  – irreducible fx
  – radiocarpal fracture-dislocation
  – associated carpal fx
  – ipsilateral forearm or elbow fx

ORIF

• Volar Plating
• Bridge Plating

Volar Plating

• Evolution of the blade plate
• Locking distal screws
• Fixed angle device
• Now many versions with fixed or variable angle distal locking screws
So many choices


Adverse Events

• Carpal tunnel syndrome
• Tendon ruptures
• Intra-articular screw protrusion
• Loss of fixation

Carpal Tunnel Symptoms

• 12 of 60 patients treated nonoperatively
  – 20%
• 17 of 69 patients treated with volar plating
  – 25%

AAOS Recommendation

• We are unable to recommend for or against performing nerve decompression when nerve dysfunction persists after reduction.
• Inconclusive
Volar Approaches

- Eighty-three patients entered the CTR group. Thirty-one patients showed median nerve dysfunction 6 weeks after surgery.
- Ninety-five patients entered the HRY group. Temporary median nerve paraesthesia was seen in 4 patients in the HRY group 6 weeks after surgery.
- After 1 year, persistent median nerve irritation was observed in 4 patients of the CTR group and none of the HRY group.
- Grip strength, range of motion, and Patient-Rated Wrist Evaluation were similar after 1 year.


CTS after Volar Plating

- 10 patients
- Volar plate ORIF
- Insert slit catheters
- 24 hour continuous monitoring of carpal canal


CTS after Volar Plating

- 10 patients
- 9 patients
  - Pressures below 40 mmHg
- 1 patient
  - 65 mmHg
- No patients had median nerve symptoms

Adverse Events

- Carpal tunnel syndrome
- Tendon ruptures
- Intra-articular screw protusion
- Loss of fixation

Tendon Ruptures

- Has been reported as high as 12%
- Many potential causes
  - Previous steroid injections
  - Plate material
  - Plate prominence
  - Plate/hardware placement


Plate Position

- Retrospective review 4 year period
- 2 Groups
- Compared complications

Plate Position

- Grade 0
  - Dorsal to red line
- Grade 1
  - Volar to red line but proximal to the volar rim
- Grade 2
  - Plate at the rim or beyond


Volar Plate Positioning

- Retrospective Review
- Patients SP ORIF of DR with volar plate
- 8 patients with flexor tendon ruptures
- Evaluate for radiographic parameters to identify risk factors for flexor tendon ruptures

Volar Plate Position

A. The measurements of plate position and prominence are demonstrated on this facet lateral radiograph. The plate-to-critical line distance (PCL) is measured with negative values for plates dorsal to the critical line (like the plate in this figure) and positive values for prominent plates volar to the critical line. The plate-to-volar rim (PVR) distance is measured with positive numbers for plates proximal to the volar rim (as demonstrated in the figure) and negative values for plates distal to the volar rim. The facet lateral radiograph in this figure was chosen for clarity, but for analysis, all PCL and PVR measurements were made on standard lateral radiographs. B. The plate is Soong grade 0 because it is both dorsal to the volar critical line and proximal to the volar rim. Soong 1: plates volar to the volar critical line (but proximal to the volar rim). Soong 2: Distal plates that extend to the level of the volar rim or beyond.

Volar Plate Position

- Risk Factors for flexor tendon rupture following distal radius fracture fixation with volar plates.
- recommend considering elective hardware removal after union in symptomatic patients with plate prominence greater than 2.0 mm volar to the critical line or plate position within 3.0 mm of the volar rim.


Adverse Events

- Carpal tunnel syndrome
- Tendon ruptures
- Intra-articular screw protusion
- Loss of fixation
Screw Protrusion

- Intra-articular screws
  - Radiocarpal degeneration
- Out the dorsal cortex
  - EPL tendon ruptures

Intra-articular Screws

- 22° tilted lateral view


Dorsal Screw Protrusion

- Extensor tendon ruptures
- Difficult to accurately evaluate on Lateral or angled lateral views
Lateral views can be inaccurate
Need to drill the dorsal cortex?
Screw Length

- Biomechanical SawBones Study
- Locked unicortical distal screws of at least 75% length produce construct stiffness similar to bicortical fixation


Adverse Events

- Carpal tunnel syndrome
- Tendon ruptures
- Intra-articular screw protusion
- Loss of fixation

Loss of Fixation

- 72 year old female
- Slipped in the tub
- Volar <1cm open wound
- No neurologic deficits
Lunate Facet Fragment

- Fixation can be challenging
- Attachment of the volar ligaments
- Loss of reduction leads to loss of extension and supination

Recognition

- Tear drop angle
- Lateral view
- Longitudinal axis of the radius
- Line parallel with the subchondral bone
- Normal ~70°
- If <45° there is marked dorsal tilt


How to Fix?

- Careful positioning of a volar plate on the ulnar-most aspect of the distal radius can allow for at least 2 points of fixation into the lunate facet fragment
- Volar plate fixation can also be augmented by adding a single cannulated screw with a washer to secure the lunate facet fragment
- Fragment-specific fixation
- Low-profile plates
- Wire loop fixation


How to Fix?
Specific Plates

Comminuted Volar Rim
AAOS Recommendation

• In order to limit complications when using external fixation, it is an option to limit the duration of fixation.
• Limited

Bridge Plating

• Spanning wrist plate
  – “internal” external fixation
• Ligamentaxis
• Supplemental fixation
• High energy distal radius fractures
• Allow weightbearing

Bridge Plating in the Elderly

• 33 patients (mean age, 70 y)
• distraction plating for comminuted distal radius fractures
• all fractures had healed
• radiographs demonstrated mean palmar tilt of 5° and mean positive ulnar variance of 0.6 mm. Mean radial inclination was 20°
• Mean values for wrist flexion and extension were 46° and 50°, respectively. Mean pronation and supination were 79° and 77°, respectively.
• At final follow-up, the mean DASH score was 32.

Take Home Points

• Volar Plating
  – Plate Position
  – Beware the lunate Facet fracture
• Dorsal Horizon View and Tilted Lateral View
• Bridge Plate

Contact

• bpalmer1@wpahs.org