Treatment of Distal Radial Fractures
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Incidence – 643,000 per year United States
15% of all fractures, peak occurrence age 60 – 70,

Classification - AO/OTA (Murray 2013)

Table 1

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<th>Indication</th>
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| AO/OTA fracture type        | A: Extra-articular fracture  
B: Partial articular fracture  
C: Complete articular fracture |
| Mechanism of injury         | High energy  
Low energy               |
| Functional demands          | Homebound  
Independent  
Normal  
High                      |
| ASA status (comorbidities)^a| ASA 1–3  
ASA 4                   |
| Associated injuries         | No associated injuries  
Grade I or II open fracture  
Grade III open fracture  
Median nerve injury  
Other ipsilateral injury |

ASA = American Society of Anesthesiologists
^a ASA 1 = normal, healthy patient; ASA 2 = patient with mild systemic disease; ASA 3 = patient with severe systemic disease; ASA 4 = patient with severe systemic disease that is a constant threat to life

Radiographic Parameters for Reduction (ideal):
Radial angulation/inclination – 16 to 28 degrees
palmar tilt 0 to 22 degrees
radial length 11 to 12 mm
articular step off < 1 mm

**Radiographic Findings Consistent with Poor Clinical Result:** (Altissimi)
- Ulnar inclination (radial angulation) < 5 degrees
- Palmar tilt > - 15 degrees (reverse tilt)
- Radial length > 5 mm loss
- Articular step off > 3 mm

**Radiographic Findings consistent with Good Clinical Results:** (Altissimi, Kreder, McQueen)
- Ulna inclination (radial angulation) > 5 degrees
- Palmar tilt neutral
- Radial length neutral
- Articular step off < 2 mm
- Stable DRUJ

**Associated Intracarpal Soft Tissue Injury** –
Geissler – 60 patients: 41 (68%) with intra-articular soft tissue injuries: 49% TFCC, 32% SL ligament 15% LT
Hanker – 65 patients: 55% TFCC, 75% SL, 30% chondral injury
Lindau – 50 patients: 78% TFCC, 54% SL, 16% LT, 32% chondral injury
Richards – 118 patients: TFCC 35% intra-articular & 53% extra-articular fractures,
 SL ligament tear 21.5% intra-articular & 6.7% extra-articular fractures,
 LT ligament – 6.7% Intra-articular & 13.3% extra-articular fractures,
 Combined SL & LT in 5.6% of intra-articular fractures.

Post reduction radiography under estimates fracture gap width. No significant difference in articular stepoff (Edwards) but arthroscopy in 33% (5 cases) found > 1mm step off after adequate closed reduction assessed by xray.

**Treatment Options**
**External Fixation**
- Indications: Dorsally displaced unstable fractures
- Limitations: volar lip fractures, impacted articular fragments, distraction for 8-12 weeks
- Advantages: Minimal surgical exposure of fracture
- Complications: Loss of reduction due to metaphyseal bone loss, finger stiffness/contracture

**Percutaneous Fixation**
- Indications: dorsally displaced extra articular fracture, Intra articular fracture with minimal comminution
- Limitations: severe osteoporosis, comminution
- Advantages: limited surgical approach
- Complications: loss of reduction, nerve irritation, tendon irritation/rupture

**Fragment Specific Fixation**
- Indications: articular incongruity, fracture instability
- Limitations: severe osteoporosis, proximal shaft extension, severe comminution of
Articular surface, non-compliant patient

Advantages: independent fixation of each fragment, load sharing fixation, multi-planar
Complications: Tendon irritation/rupture

**Dorsal Plate**
Indications: impacted articular fracture, dorsal rim fracture, dorsal ulnar corner fracture, carpal pathology – fracture, intercarpal ligament injury
Limitations: volar lip fractures, severe osteoporosis, severe comminution
Advantages: easy surgical approach, dorsal buttress to deforming force
Complications: extensor tendon irritation/rupture

**Volar Plate**
Indications: volar displaced fractures, dorsally unstable fractures, bilateral fractures, poly trauma
Limitations: dorsal and radial marginal fractures, intra-articular evaluation not possible
Advantages: easy surgical approach, strong fixation allows early motion
Complications: Flexor/extensor synovitis/tendon rupture, intra-articular screw placement

**Arthroscopic Assisted Reduction Distal Radial Fracture**
Indications: young patient, intra-articular fracture, greater than 1 mm articular step off, significant displacement of radial fracture

**Results of Arthroscopic Assisted Reduction**
Accurate reduction of articular surface, Minimal capsular and adjacent soft tissue dissection and scarring. Significantly improved wrist ROM compared with open reduction(Doi)

**Outcomes**

**Long term outcome of nonsurgically treated distal radial fractures (Foldhazy 2007)**
87 patients mean age 55 treated with closed reduction and casting 9-13 years follow up
52 of 66 patients with unilateral fractures were rated as excellent/good according to the Green and O’Brien score as modified by Cooney et al (GOBC score)
Fracture class according to AO did not correlate to outcome

Considerable fracture displacements remained:
- dorsal angulation (mean 13° in <60 y, 18° in ≥60 y)
- radial shortening (mean 2 mm in <60 y, 3 mm in ≥60 y)
- 5 patients had remaining joint step-off (1–2 mm) after reduction,
- 1 developed mild osteoarthritis.

Patients with an unsatisfactory outcome had sustained more displaced fractures
that also healed with greater displacement
The remaining subjective complaints were pain or reduced function during heavier tasks

Outcome was not correlated to age
Wrist mobility returned notably faster than grip strength
Patients over 60 years of age recovered slower in both mobility and strength
Closed reduction and plaster improved dorsal angulation but not radial shortening.

. **Radiographic outcomes of volar locking plating for distal radial fractures (Mignemi 2013)**
185 fractures – Normal palmar tilt 48%, radial angulation 43%
Articular congruence less than 2 mm 92%, radial height restored in 12%
no assessment of functional outcome.

Functional outcome and complications after volar plating for dorsally displaced, unstable
fractures of the distal radius (Rozenthal 2006)

41 patients mean age 53 years. Average followup 17 months
mean radial height 11 mm, radial inclination 21 degrees, and volar tilt 5 degrees
Average DASH score was 14
All good and excellent results by Gartland Werley scoring indicating minimal impairment
in activities of daily living
9 complications: 4 fracture collapse, 3 hardware removal for tendon irritation, 1 wound
dehiscence, 1 MP stiffness.

Volar locking plates versus external fixation and adjuvant pin fixation in unstable distal
radius fractures: A randomized, controlled study
(Williksen, Frihagen, Hellund, Kvernmo, Husby 2013)

111 unstable distal radial fractures randomized to treatment with external fixation (EF) or
volar locking plate (VLP)
mean age 54 yrs old, 7 patients lost to follow up,
104 patients evaluated at 1 yr by visual analog scale pain score, Mayo wrist score, Quick
DASH, range of motion and radiographic evaluation
Mayo wrist score VLP 90, EF 85
Supination VLP 89, EF 85
Ulnar shortening VLP +1.1 mm, EF + 2.8 mm
Quick DASH no significant difference

Prospective multicenter trial of a plate for dorsal fixation of distal radius fractures
Ring, Jupiter (Brennwald, Buchler, & Hasting, 1997)

22 patients
pi plate 2.5 mm thick Average f/u 14 months
Average ROM 76%
Average grip strength 56%
5 patients extensor tendon irritation

Functional outcome and complications following two types of dorsal plating for unstable
fractures of the distal part of the radius (Rozenthal, Beredjiklian, & Bozentka 2003)

28 Patients
19 pi plate / 9 low profile plate Mean f/u 21 months
9 patients with pi plate – extensor complications
Patients treated with pi plate significantly increase risk of complications compared with
low profile plate

Low profile dorsal plating for dorsally angulated distal radius fractures: an outcomes
study (Kamath, Zurakowski, & Day 2006)

30 Patients
low profile plate ( 1.2 mm ) Median f/u 18 months
93% good / excellent outcomes
80% ROM / strength
No plates removed
No extensor tendon ruptures 1 EPL tenolysis

Treatment of distal radius fractures with a low-profile dorsal plating system: an outcomes
assessment. (Simic, Robinson, Gardner, Gelberman, Weiland, & Boyer 2006)
60 fracture 59 patients
low profile plate Mean f/u 24 months
No extensor tendon irritation or rupture
1 hardware removal
ROM 80%
Grip strength 90%

Volar versus dorsal plating in the management of intra-articular distal radius fractures
(Ruch, Papadonikolakis 1997)

34 patients
20 dorsal / 14 volar plate f/u 12 months
No significant difference in DASH
Volar collapse of fracture in 5 dorsal plates
Dorsal : 1 extensor rupture
Volar : 2 median neuropathy

Complications of low-profile dorsal versus volar locking plates in the distal radius: a comparative study (Yu, Makhni, Tabrizi, Rosenthal, & Day 2011)

100 Patients – 104 cases
57 dorsal / 47 volar f/u 44 +/- 21 months
Dorsal low profile plates not associated with more tendon irritation of rupture
Volar plating associated with higher rate of neuropathic complications

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