Distal Radius Fractures
What is Best and When?
What’s the best way to treat distal radius fractures?
What’s the Evidence?
Cochrane Collaboration
Closed reduction methods for treating distal radial fractures in adults

- Handoll and Madhok
- 2003 (updated 2007)
- 3 trials
- “There is insufficient evidence for comparisons tested within randomized controlled trials to establish the relative effectiveness of different methods of closed reduction used in the treatment of displaced fractures of the distal radius in adults.”
Conservative interventions for treating distal radial fractures in adults

- Handoll and Madhok
- 1999 (updated 2005)
- 37 trials
- “Not enough evidence to tell what type of non-surgical treatment is best for treating a broken wrist.”
Surgical interventions for treating distal radial fractures in adults

- Handoll and Madhok
- 2001 (updated 2003)
- 48 trials
- 25 treatment comparisons
- “Not enough evidence to tell when surgery, or what type of surgery, is best for treating a broken wrist.”
Percutaneous pinning for treating distal radius fractures in adults

- Handoll, Vaghela, and Madhok
- 2007
- 13 trials
- 25 treatment comparisons
- “Though there is some evidence to support its use, the precise role and methods of percutaneous pinning are not established. The higher rates of complications with Kapandji pinning and biodegradable materials casts some doubt on their general use.”
External fixation versus conservative treatment for distal radial fractures in adults

• Handoll, Huntley, and Madhok
• 2007
• 15 trials
• “There is some evidence to support the use of external fixation for dorsally displaced fractures of the distal radius in adults. There is insufficient evidence to confirm a better functional outcome, external fixation reduces redisplacement, gives improved anatomical results and most of the excess surgically-related complications are minor.”
Different methods of external fixation for treating distal radius fractures in adults

- Handoll, Huntley, and Madhok
- 2008
- 9 trials
- “There is insufficient robust evidence to determine the relative effects of different methods of external fixation. Adequately powered studies could provide better evidence.”
Bone grafts and bone substitutes for treating distal radial fractures in adults

• Handoll and Watts
• 2008
• 10 trials
• “Bone scaffolding may improve anatomical outcome compared with plaster cast alone but there is insufficient evidence to conclude on functional outcome and safety; or for other comparisons.”
Rehabilitation for distal radius fractures in adults

- Handoll, Madhok, and Howe
- 2002 (updated 2006)
- 15 trials
- “The evidence from randomized controlled trials is insufficient to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius.”
Level 1 Evidence

Levels of evidence for clinical application

- Level 1 - formal, open, clinical randomised-controlled trials
- Level 2 - case controlled trials (comparisons made but not randomised)
- Level 3 - observational studies (including surveys and questionnaires)
- Level 4 - anecdotal evidence (including independent user comments and reviews)
- Level 5 - methodological verification and validation studies

reproducible
Goals of Treatment

• Goals
  • General functional outcome correlates with maintenance/restoration of normal distal radial morphology
  • Physiologic age significant factor in the above
  • Digital stiffness correlates with poor functional outcome
Goals of Treatment
Restore Normal Anatomy
Angular alignment

Radial inclination
20 degrees

Volar tilt
12 degrees

Radial length
+/− 2 mm

Restoration of DRUJ
Goals of Treatment

• Radiographic Goals
  • Intra-articular step-off (B)/gap (A)
    • Restoration of articular congruity <= 2 mm
    • Significant (>2 mm) stepoff -> radiographic evidence of post-traumatic arthritis 
      (*Knirk and Jupiter, JBJS 1986*)
  • Radial length (C) within 2 mm of normal
  • Dorsal tilt, neutral to no more than 10 °
Goals of Treatment

- Treatment Recommendations
  - Must be individualized
    - Physiologic age
    - Individual needs
    - Medical co-morbidities
  - Primary decision – non-operative vs. operative treatment
Classification of Distal Radius Fractures

- Classification Schemes
  - Allow comparison of fracture types for outcome studies
  - Generally do not guide treatment
  - Many cumbersome
  - Inter-observer variability common

- Common schemes
  - Eponymic: Colles, Smith, etc.
  - Frykman (8 types)
  - Melone (4 types)
    - Intra-articular fractures only
  - AO (27 types)
  - McMurtry and Jupiter (5 types)
  - Universal (9 types)
  - Fernandez (5 types)
Intra-articular Fractures

- Intra-articular
  - Non to minimally displaced
  - Radial styloid fracture
    - Associated injuries
      - SLIOL Tear
      - Perilunate dislocation
      - Scaphoid fracture
**Intra-articular Fractures**

- **Intra-articular**
  - Impaction/axial load
    - Pattern varies
      - Typically 3 major fragments
      - Radial styloid - 1
      - Dorsal portion of lunate facet – 2
        - Die punch fragment
      - Volar Portion of lunate facet - 3
    - Comminution varies
      - Angle of impact
      - Energy imparted
      - Quality of bone
Radiographic Evaluation

- Standard AP and lateral radiographs
- Oblique radiographs
  - Evaluate for non-displaced fractures not visualized on the AP and lateral views
Radiographic Evaluation

- Evaluation
  - Tilt views – improve assessment of articular surface
    - Lateral elevated 20°
    - PA elevated 10°

AP view  AP tilt view  Lateral view  Lateral tilt view
CT Scans

• Evaluation

• 2-D CT

• More accurate than plain film x-rays in identifying:
  • Radio-carpal extension
  • Articular gap and step off
  • Comminution, metaphyseal defects
3D CT Scans

- 3-D CT
  - Improved reliability determining:
    - articular comminution
    - number of fragments
  - Reconstructions performed on pre-existing 2-D CT films
Operative Treatment

• Options
  • Closed reduction and percutaneous pinning (CR/PP)
  • External fixation (Ex-Fix)
  • Arthroscopically assisted reduction
  • Open reduction internal fixation (ORIF)
    • Dorsal approach/plate
    • Volar approach/plate
    • Fragment specific fixation
  • Combination of above
Closed reduction and percutaneous pinning (CR/PP)

- Indications
  - Isolated radial styloid fracture
  - Extra-articular fractures
  - Minimal comminution

- Intrafocal vs. extrafocal pinning
  - Intrafocal - pins placed in fracture site
  - Extrafocal- pins used to pin fragment(s) to metaphysis

- Requires supplemental casting
- Pins removed in office @ 6 weeks
External fixation (Ex-Fix)

- **Indications**
  - Displaced fractures
  - Comminution (intra-articular)
  - Able to achieve satisfactory reduction via closed or percutaneous means
  - Fixator may be used as a neutralization device
  - **Must** be supplemented with percutaneous pinning or limited internal fixation
  - Open approach to pin placement recommended
External fixation (Ex-Fix)

- Usually removed at six weeks
- Advantages
  - Less invasive
  - Excellent stability
  - Neutralizes deforming forces
  - Relatively simple
- Disadvantages
  - Bridging Ex-Fix prevents wrist motion until removal
  - Overdistraction may produce wrist stiffness
  - Extreme position may promote
    - Extrinsic tightness
    - Carpal tunnel syndrome
  - Pin track infections
Arthroscopically Assisted Articular Reduction

- Evaluate/ manipulate articular surface in conjunction with
  - Percutaneous pinning with or without external fixation
  - Limited open procedures
- Best done within the first few weeks

Lunate facet fx - 6 R portal  Post arthroscopic assisted reduction
**Volar Buttress Plate**

- Plate supports volar margin fractures
- Relies on solid screw fixation at uninvolved radial shaft
- Primarily indicated for partial articular fractures of the volar rim (volar Barton)
- Screw fixation at the metaphysis is optional and not always reliable
Dorsal Buttress Plate

- Plate resists dorsal displacement of dorsally displaced fractures
- Allows buttressing of dorsal articular fragments
- Dorsal approach through 3rd dorsal compartment
- Allows limited visualization of articular surface with concomitant arthrotomy
- May irritate extensor tendons
  - Associated tendon rupture
  - May require late plate removal
Volar Fixed-Angle Locked Plates (VFAP)

- VFAPs - introduced 2000
- Precontoured
- Facilitates application
- Template for fracture reduction
- Low profile devices
  - Threaded guide holes in transverse part of plate
  - Threads oriented to match tilt and inclination of normal articular surface
Volar Fixed-Angle Locked Plates (VFAP)

- Theoretical advantages of VFAP
  - Avoid zone of dorsal comminution leaving its blood supply undisturbed
  - Fewer soft tissue complications
    - tendon irritation and rupture
  - Soft tissue flexor tendon protection provided by:
    - concave surface of the volar distal radius
    - terminates at the volar lip- watershed line
    - pronator quadratus muscle
Volar Fixed-Angle Locked Plates (VFAP)

- Subchondral position resists/blocks redisplacement of articular surface
- May allow limited purchase of dorsal cortical fragments
- Generally stable fixation which may allow early range of motion
- Relies significantly on fluoroscopy to evaluate articular surface and screw or peg placement
Volar Fixed-Angle Locked Plates (VFAP)

- Stable fixation:
  - Distal peg placement adjacent to the subchondral bone (within 2 mm)
  - Cortical screw purchase in diaphyseal bone proximally
Volar Fixed-Angle Locked Plates (VFAP)
Site of Best Fit Varies

Zimmer       Synthes JA     Hand Innov        Trimed           Acumed       Hand Innov    Synthes EA
0.31 mm       0.7 mm       1.07 mm         1.1 mm        1.51 mm      1.68 mm       4.69 mm
distal          proximal     proximal        proximal       proximal      proximal       proximal
Volar Fixed-Angle Locked Plates (VFAP)
Volar Fixed-Angle Locked Plates (VFAP)
Fragment Specific Fixation

- System of small internal fixation devices to address specific components of distal radius fractures
  - Utilizes combination of pins, buttress plates, screws, wire forms and bone grafts
  - Utilizes multiple small incisions
  - Elements of system utilized varies from case to case depending upon fracture pattern
  - Main advantage is the ability to obtain and maintain stable articular reduction
  - Relies heavily on fluoroscopy
Fragment Specific Fixation

- Generally excellent stability allowing early range of motion
  - Learning curve
    - Steep
    - Technique somewhat tedious
What’s the best way to treat distal radius fractures?

- No clear data
- Patient dependent
- Fracture dependent
- What works the best for you