# Complications of distal radius fractures

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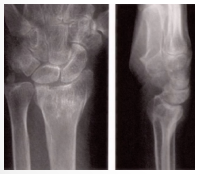
## Complications

- Reduction errors / loss of reduction
- Plate positioning errors
  - Too proximal / too distal
  - Too radial / too ulnar
- Screw positioning errors
  - Too long / too short
  - Intraarticular
- Complications associated with material (foreign body)
  - Arthrosynovial cyst
  - Tendinous lesions: irritation and rupture
  - Nervous lesions
  - Complex regional pain syndrome
  - Infection
  - …

## Reduction

The best possible articular reduction is desirable.

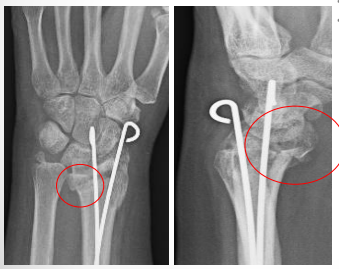
- Plaster casts
  - Frequent early loss of reduction and poor functional outcome Howard et al. 1989
  - Especially in intraarticular fractures Lafontaine et al. 1989



Howard et al. External Fixation or Plaster for Severly Displaced Comminuted Colles' Fractures? A Prospective Study of Anatomical and Functional Results. J Bone Joins Sur 1989
Lafontain et al. Stability Assessment of Fistal Radius Fractures. Injury 1989

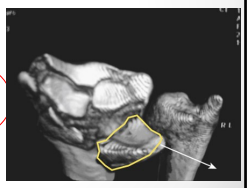
## Reduction

- Percutanoeus pinning



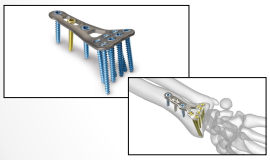
Ulnar corner fragment must be fixed

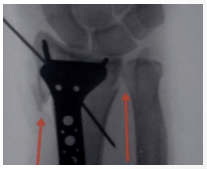
- subluxation of the carpus
- blocking of flexion and pro-/supination



## Reduction

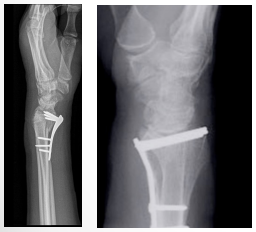
- Plates
  - Full modularity
  - Multiple fragments

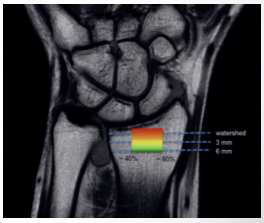




## Plate positioning

- Too proximal / too distal
  - Optimal screw position in subchondral bone, collapse if too proximal Drobetz et al. 2006
  - **Watershed line** – "danger zone" for flexor tendons

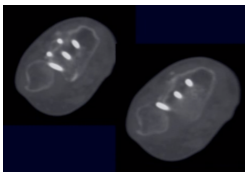





Drobetz et al. Volar fixed-angle plating of distal radius extension fractures: influence of plate position on secondary loss of reduction--a biomechanic study in a cadaveric model. J Hand Surg Am 2006

# Plate positioning

- Too ulnar / too radial

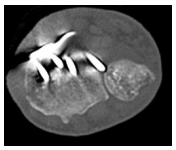
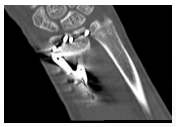



# Screw positioning

- Screws need only be 75% depth of distal radius
- Too long / too short

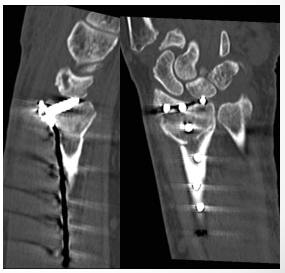

# Screw positioning

- Joint perforation

# Screw positioning

- Joint perforation

# Nervous lesions

| Complications Due to Surgical Treatments | Overview of Evidence: Level I | Level II | Level III | Level IV | Level V |
|---|---|---|---|---|---|
| Failure of reduction | 7 | 3 | 14 | 1 | 0 |
| Hardware discomfort/pain | 1 | 4 | 3 | 0 | 0 |
| Tendon irritation/Rupture | 8 | 10 | 31 | 15 | 2 |
| Infection | 9 | 4 | 8 | 1 | 0 |
| Complex regional pain syndrome | 8 | 4 | 17 | 1 | 1 |
| Neuropathy | 11 | 5 | 18 | 2 | 1 |
| Stiffness | 0 | 3 | 2 | 0 | 0 |

- Strongest evidence

# Nervous lesions

- Carpal tunnel syndrome (CTS)
  - Non-operative treatment **20%** Bienek et al. 2006
  - Operative treatment **12,5%** Ward et al. 2011
    - up to **29%** in elderly patients (over 65y) Lutz et al. 2014
  - **NO benefit in prophylactic release** ! Griffin et Chhabra 2014
- Superficial radial nerve irritation
  - 3% due to temporary K-wire Ward et al. 2011
  - 12% due to pin (ex-fix) Richard et al. 201

Bienek et al. Peripheral Nerve Compression Neuropathy After Fractures of Distal Radius. J Hand Surg Br. 2006
Griffin et Chhabra. Complications After Volar Plating of Distal Radius Fractures. JHS 2014
Ward et al. Early Complications of Volar Plating of Distal Radius Fractures and Their Relationship to Surgeon Experience. Hand 2011
Richard et al. Analysis of the Complications of Palmar Plating Versus External Fixation for Fractures of the Distal Radius. JHS 2011
Lutz et al. Complications Associated With Operative Versus Nonsurgical Treatment of Distal Radius Fractures in Patients Aged 65 Years and Older. J Hans Surg Am 2014

# Tendinous lesions

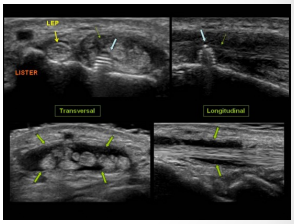
| Complications Due to Surgical Treatments | Overview of Evidence: Level I | Level II | Level III | Level IV | Level V |
|---|---|---|---|---|---|
| Failure of reduction | 7 | 3 | 14 | 1 | 0 |
| Hardware discomfort/pain | 1 | 4 | 3 | 0 | 0 |
| Tendon irritation/Rupture | 8 | 10 | 31 | 15 | 2 |
| Infection | 9 | 4 | 8 | 1 | 0 |
| Complex regional pain syndrome | 8 | 4 | 17 | 1 | 1 |
| Neuropathy | 11 | 5 | 18 | 2 | 1 |
| Stiffness | 0 | 3 | 2 | 0 | 0 |

- Most prevalent across evidence levels

# Tendinous lesions

- Extensor tendons
  - EPL (pollicis longus)
    - Tenosynovitis 2,8%
    - Rupture 1,4% Arora et al. 2007
  - EDL (digitorum longus)

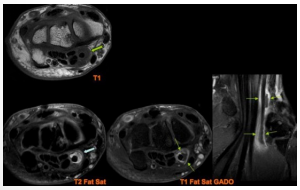
Screws too long ?!
However not always protruding → may or may not be related to the implant Griffin et Chhabra. 2014




Arora et al. Complications Following Internal Fixation of Unstable Distal Radius Fracture With a Palmar Locking Plate. J Orthop Trauma 2007
Griffin et Chhabra. Complications After Volar Plating of Distal Radius Fractures. JHS 2014

# Tendinous lesions

- Flexor tendons
  - FPL (pollicis longus)
    - Tenosynovitis 2%-6,3%
    - Rupture 1.4% Ward et al. 2011; Arora et al. 2007
  - FD (digitorum)




Arora et al. Complications Following Internal Fixation of Unstable Distal Radius Fracture With a Palmar Locking Plate. J Orthop Trauma 2007
Ward et al. Early Complications of Volar Plating of Distal Radius Fractures and Their Relationship to Surgeon Experience. Hand 2011

# Infection

- Strong evidence Level 1 Studies

| Complications Due to Surgical Treatments | Overview of Evidence: Level I | Level II | Level III | Level IV | Level V |
|---|---|---|---|---|---|
| Failure of reduction | 7 | 3 | 14 | 1 | 0 |
| Hardware discomfort/pain | 1 | 4 | 3 | 0 | 0 |
| Tendon irritation/Rupture | 8 | 10 | 31 | 15 | 2 |
| Infection | 9 | 4 | 8 | 1 | 0 |
| Complex regional pain syndrome | 8 | 4 | 17 | 1 | 1 |
| Neuropathy | 11 | 5 | 18 | 2 | 1 |
| Stiffness | 0 | 3 | 2 | 0 | 0 |

- Systematic review (21 studies)
  - 47% ExFix
  - 8% K-wires
  - 1% volar plate Diaz-Garcia et al. 2011

Botte et al. Complications of Smooth Pin Fixation of Fractures and Dislocations in the Hand and Wrist. Clin Orthop Relat Res 1992
Richard et al. Analysis of the Complications of Palmar Plating Versus External Fixation for Fractures of the Distal Radius. JHS 2013
Lutz et al. Complications Associated With Operative Versus Nonsurgical Treatment of Distal Radius Fractures in Patients Aged 65 Years and Older. J Hans Surg Am 2014
Diaz-Garcia et al. A Systematic Review of Outcomes and Complications of Treating Unstable Distal Radius Fractures in the Elderly. JHS 2011

# Elderly

- Systematic review (21 studies – Level 1-4) Diaz-Garcia et al. 2011
  - Cast immobilization 8%
  - External fixation 20%
  - Volar plating 17%
  - Percutaneous pinning 9%
- Meta analysis (20 studies - Levels 1-4) Kooner et al.2017
  - **Operative group 11,8%** vs **Non-operative group 8,3%** (p=0,008)
  - External fixation 22,5%
  - Dorsal plating 20%
  - Volar locked plating 16,3%
  - Percutaneous pinning 1,2%
- **No significant difference in patient-reported pain and disability** (at one year after injury) Lutz et al. 2014

Kooner et al. Complications of Distal Radius Fractures in the Elderly: A Systemic Review and Meta-analysis. 2017
Lutz et al. Complications Associated With Operative Versus Nonsurgical Treatment of Distal Radius Fractures in Patients Aged 65 Years and Older. J Hans Surg Am 2014
Diaz-Garcia et al. A Systematic Review of Outcomes and Complications of Treating Unstable Distal Radius Fractures in the Elderly. JHS 2011

# Risk factors

- Early complications
  - Fall from height
  - Ipsilateral elbow injury
- Late complications
  - High-volume surgeons
  - Plate design
- Not predictive:
  - Age and Gender
  - AO fracture type
  - Open injury
  - Ulna fracture
  - Surgeon specialization
  - Surgeon years since residency
  - Median or ulnar nerve injury

Soong et al. 2010 Risk Factors for Complications of Distal Radius Volar Plating. Level 2 Evidence

# Prevention

- Pronator repair ?
  - No difference in pronation
  - No difference in DASH Hershman et al. 2013
- Compression glove after surgery
  - Less swelling (p=0,002)
  - Less pain (p=0,0008)
  - Lower DASH score 36,9 vs. 51,2 (p=0,05)
  - Better mobility: full flexion in 81% vs 40% (p=0,02)
  - Less CTS and CRPS Shuler et al. 2011

Hershman et al. The Effects of Pronator Quadratus Repair on Outcomes After Volar Plating of Distal Radius Fractures. J Orthop Trau,a 2013
Shuler et al. Compression Glove may Reduce Complications Secondary to Distal Radius Fractures. 2011

# Conclusion

- Reduction !
- Adequate plate
  - Specific fragment fixation if necessary
- Placement of the screws
  - 75% rule
- Image intensifier intra-operatively

# Thank you