

Metacarpal Base Fractures and Fracture-Dislocations:

Avoiding Complications

Michael J. Terry

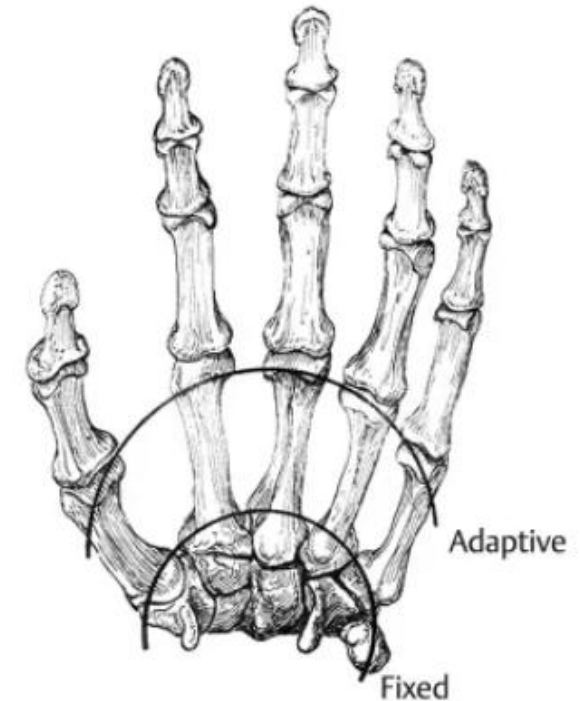
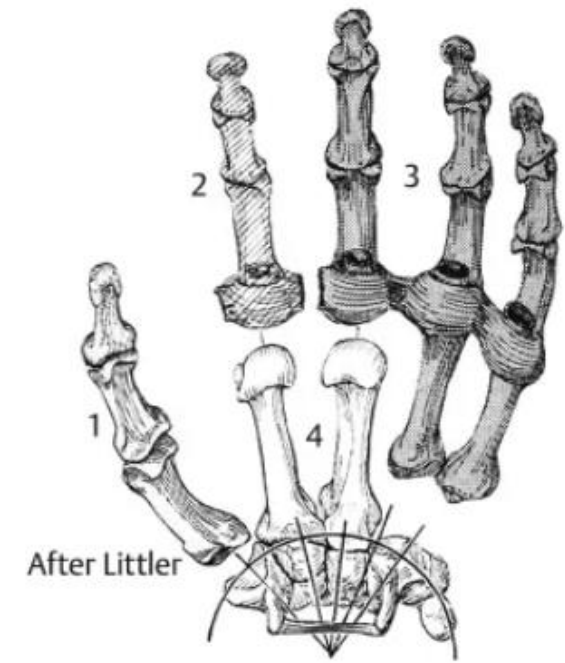
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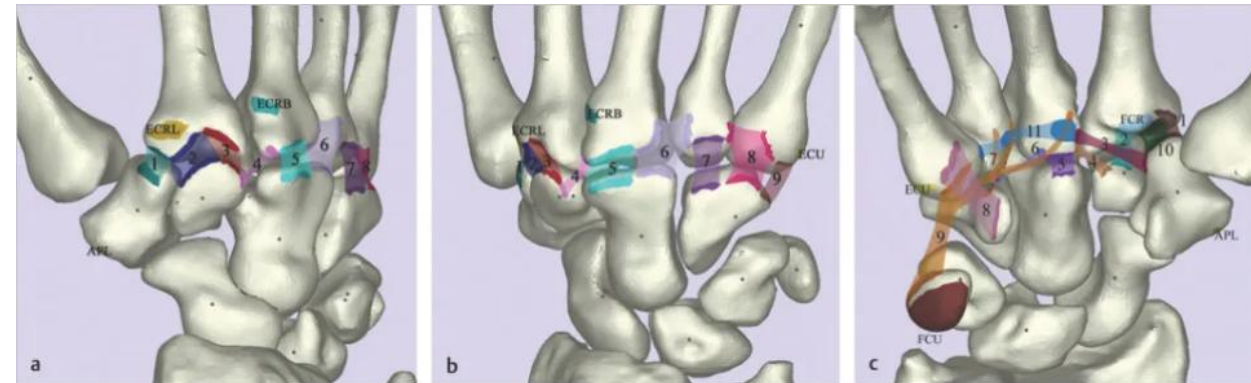
Carpometacarpal Joints: II-V

- Role is to form part of stable arch
- “Fixed unit” of the wrist
 - Longitudinal arch
 - Transverse arch



Carpometacarpal Joints: II-V

- Index/long CMCJ have less movement than ring/small
- 3rd CMCJ: 'keystone'
- 9 dorsal ligaments
- 11 volar ligaments



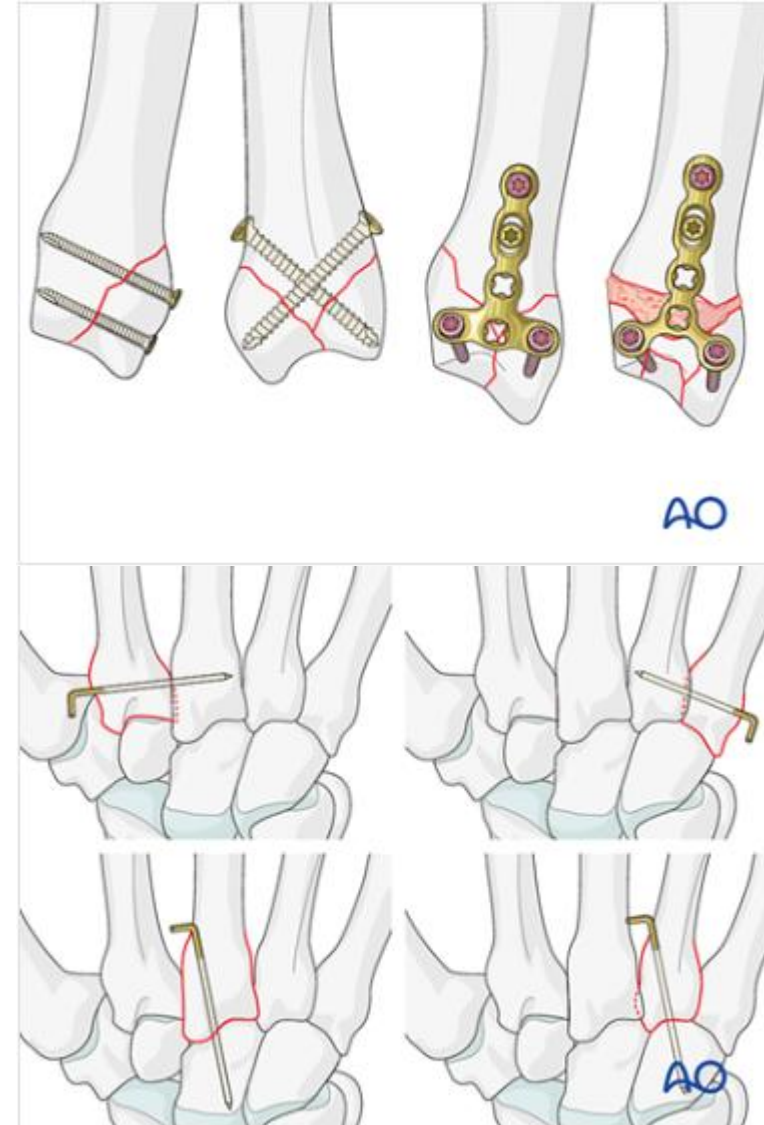
CMCJ fracture-dislocations

- Rare: <1% of hand trauma
- Mechanism:
 - axial loading (misplaced punch, high energy MVA)
 - Forced flexion of wrist with extended arm
- Little/ring finger more common



Management

- Closed Reduction
- Surgical Management
 - Open reduction
 - Fixation of fractures
 - Lag screw
 - Direct plate
 - Joint-spanning plate
 - Stabilization of joint
 - Temporary K-wire



CMCJ fracture-dislocations

- Often misdiagnosed



- Misdiagnosis leads to inadequate treatment
 - Malunion
 - Residual subluxation
 - Hand deformity
 - Pain
 - Arthritis
 - Long-term loss of grip strength/ROM



Index metacarpal base fractures/fracture-dislocations

- Rare; few case reports
- Lack of motion should make joint congruency less important
- ECRL avulsion fractures: Conservative management often fails due to ECRL pull
- Most studies recommend open reduction with k wire stabilization



Br J Sports Med 2001;35:133–135

Avulsion fracture of the extensor carpi radialis longus in a rugby player: a case report

D Jena, K A Giannikas, R Din

Index, Long metacarpal base avulsion fractures

- Initially thought to result in little disability, closed tx was recommended
- However: Gunther et al: impossible to maintain reduction by closed methods
- Sadr and Lalehzarian: could not attach ECRL after 12 days; recommended early intervention
- Boles and Durbin; Sadr and Lalehzarian: noted decreased grip strength without anatomic tendon repair;
- Crichlow and Hoskinson: treated 3 ECRL avulsion closed: resulted in weak dorsiflexion, painful bony prominence requiring surgical removal
- Overall rec: ORIF of fxr and anatomic fixation of tendon
 - Improved grip/dorsiflexion strength
 - Avoid kwire related complications



Isolated index metacarpal base fracture-dislocations



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CLINICAL ARTICLE

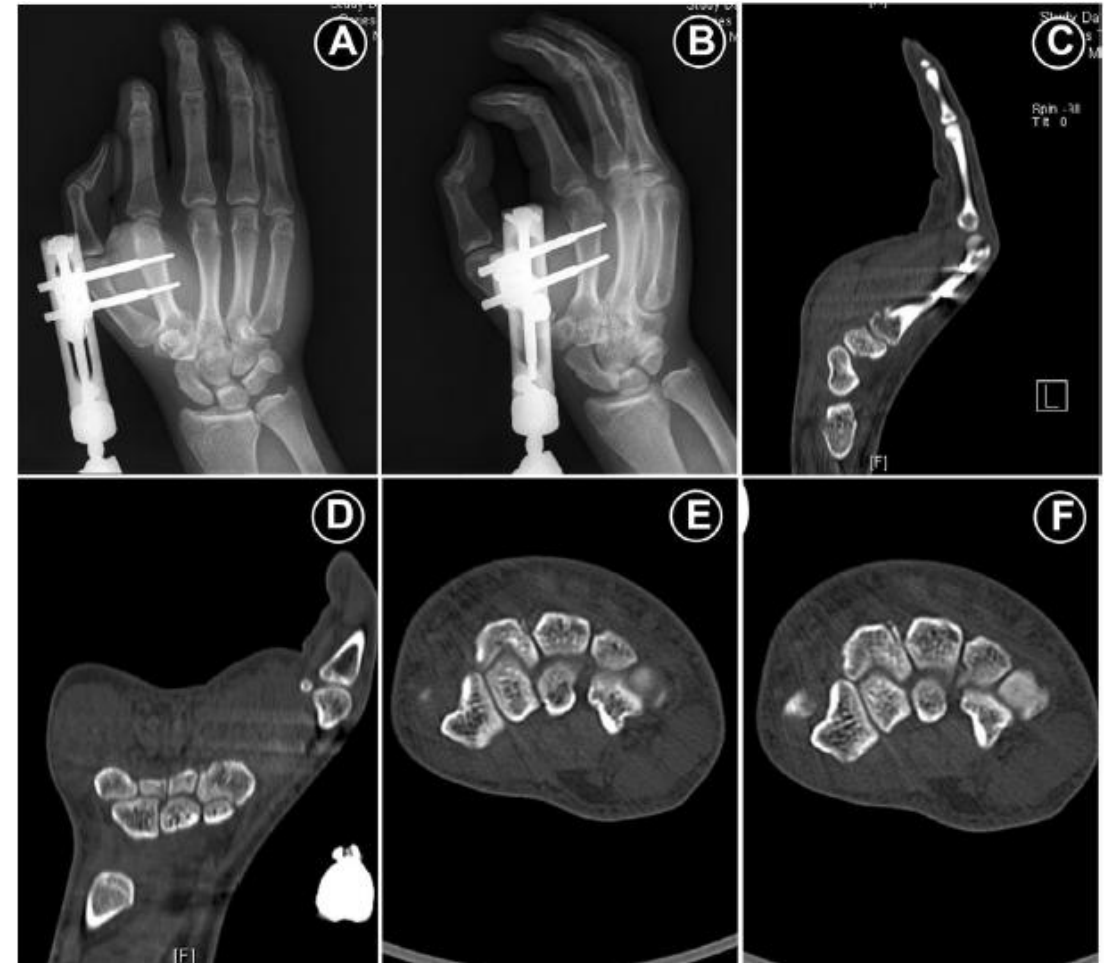
Clinical Outcomes of Closed Reduction and External Fixation for Isolated Second Metacarpal Base Fracture-Dislocations

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- 10 patients
- Treated with closed reduction and ex fix
- No difference to non-injured hand:
 - Grip strength, pinch strength, PIP, DIP flexion
- TAM scores lower
- QuickDASH scores higher
- 1 pt with asymptomatic posttraumatic arthritis



Long finger proximal metacarpal fractures

- Rare
- Usually result from forced hyperflexion of wrist w/clenched fist
- Most studies recommend surgical repair of intraarticular fractures, as this is site of ECRB
 - Plates
 - Lag screws



MILITARY MEDICINE, 171, 2:136, 2006

Avulsion of the Extensor Carpi Radialis Brevis Insertion: A Case Report and Review of the Literature

Guarantor: MAJ Anthony E. Johnson, MC USA

Contributors: MAJ Anthony E. Johnson, MC USA*; MAJ Eric G. Puttler, MC USA†

AVULSION FRACTURE OF THE EXTENSOR CARPI RADIALIS BREVIS INSERTION

E. TSIRIDIS, J. KOHLS-GATZOULIS and C. SCHIZAS

From the Department of Orthopaedics, The Whittington Hospital, London, UK

Avulsion of the extensor carpi radialis brevis at wrist level is rare. We present a case of an avulsion fracture involving the extensor carpi radialis brevis insertion at the base of the middle finger metacarpal.

Journal of Hand Surgery (British and European Volume, 2001) 26B: 6: 596–598

- Case report of 32 M with avulsion fracture of base of long finger metacarpal, with ECRB avulsion from the fragment
- Treated with open reduction and internal fixation with tendon reattachment with suture anchor



Ulnar metacarpal base fracture-dislocations

- Isolated ring finger CMCJ fracture-dislocation
 - Essentially nonexistent
 - Occurs with 5th MC base fxr
- Surgical Options:
 - Closed reduction/casting
 - Closed reduction percutaneous pinning
 - Open reduction, internal fixation
 - Dorsal buttress or bridging of CMCJ



Outcomes

- 2020 analysis
 - 6 studies included
- 90 patients
 - 11% CRPP
 - 31% ORPP
 - 8.9% ORIF w CMCJ bridging
 - 16.7% ORIF w dorsal buttress plate
 - 31.1% closed reduction only

Surgical Management of Ulnar Metacarpal Base Fracture-Dislocations: A Systematic Review

John B. Fuller^{1,2}, Andres S. Piscoya³ , DesRaj M. Clark³ , Kevin Markose⁴, and John C. Dunn¹ 

Table 2. Patient Treatment Methods.

Article	Surgical technique (implant material if mentioned)	Postop protocol	Average length of follow-up (months)
Kural et al ⁹	ORPP (9)	5–6 wks short arm splint	19.4 (range: 14–36)
Tan et al ⁴	ORIF dorsal buttress (4)	Ulnar gutter splint AROM 1st week	NR
Iwata et al ⁸	ORIF w/ titanium dorsal buttress hamate + CRPP 4th and 5th CMCJs (1)	5 wks removable splint 4 wks K-wires	6
Tay et al ¹⁰	ORIF dorsal buttress (11)	Ulnar gutter splint AROM 1st week	7.7 (range: 0.9–24.8)
Zhang et al ¹	CR acute (20) CR subacute (3) ORIF subacute (2) ORPP subacute (1)	Acute CR: 4 wks A + P splint Subacute CR: 4 wks A + P splint Subacute ORIF/ORPP: 2 wks splint, physiotherapy	26 (range: 15–44)
Gehrmann et al ¹¹	CR (5) CRPP (10) ORPP (18) ORIF (6)	5 wks K-wires Dorsal splint until union	Total cohort: 13 (range: 9–48) 5th CMCJs: 17.6 (range: 9–48) 4th and 5th CMCJs: 12.3 (range: 9–21)
Totals and weighted averages	CR: 28 (31.1%) CRPP: 10 (11.1%) ORPP: 28 (31.1%) ORIF: 8 (8.9%) ORIF dorsal buttress: 16 (17.8%)	4.2 wks splint	16.8 (range: 0.9–48)

Note. fx = fracture; dx = dislocation; fx-dx = fracture-dislocation; MC = metacarpal; CMC = carpometacarpal; CMCJ = carpometacarpal joint; ORIF = open reduction internal fixation; ORPP = open reduction percutaneous pinning; CR = closed reduction; CRPP = closed reduction percutaneous pinning; AROM = active range of motion; wks = weeks; NR = not recorded; A + P = anterior and posterior.



Outcomes

- Nonunion rate: 0% for all surgically managed patients
- Some studies showed decreased grip strength, but did not appear functionally significant

Table 3. Study Outcomes.

Article	Outcomes	Mean time to union (days)	Rate of union (X-ray) (%)	Postoperative instability?
Kural et al ⁹	ROM: NR Grip strength: 81.3% of CS Other: NR	NR	100	No
Tan et al ⁴	ROM: 100% of CS Grip strength: NR Other: NR	NR	100	No
Iwata et al ⁸	ROM: 87.5% WE, 77.8% WF vs CS Grip strength: 94.5% vs CS Other: QuickDASH 2.25	NR	100	No
Tay et al ¹⁰	ROM: 56° (50-80) WF, 65° (60-80) WE, Full ROM fingers Grip strength: 79% (range: 43%-100%) vs CS Other: NR	48 (range: 30-88)	100	No
Zhang et al ¹	Acute CR: ROM: normal vs CS ^a Grip strength: normal vs CS ^a Other: MHOQ @ 1 yr 98 ± 2. No degenerative arthritis Chronic CR: ROM: 80% vs CS in 1 pt (33%) Grip strength: 60% of CS Other: MHOQ @ 1 yr 72 ± 5; noticeable deformity; 2 pts w/pain in cold weather; 2 pts w/ degenerative arthritis Chronic-Surgical: ROM: normal vs CS ^a Grip strength: normal vs CS ^a Other: MHOQ @ 1 yr 96 ± 5. No degenerative arthritis	NR	100	No
Gehrmann et al ¹¹	ROM: NR Grip strength: overall cohort: 84.1% vs CS 5th CMCJ: 82.5% vs CS (SD: 11.8, range: 0%-40%) ^a 4th and 5th CMCJ: 86.2% vs CS (SD: 10.3, range: 0%-36%) ^a Other: DASH score, overall cohort: 6.8 DASH score, 5th CMCJ: 7.2 (range: 0-17.5) ^a DASH score, 4th and 5th CMCJ: 6.0 (range: 0.8-17.5) ^a DASH score, CR: 10.4 (range: 3.3-17.5) DASH score, CRPP: 9.3 (range: 0.8-13.3)	NR	100	No

Complications

- Complication rate 14%
 - 33% for plate/screw constructs
 - Hardware-related symptoms all resolved after removal of hardware

Table 4. Complications.

Article	Minor complications	Major complications
Kural et al ⁹	3—pain with heavy labor	0
Tan et al ⁴	0	1—HWR due to pain
Iwata et al ⁸	0	0
Tay et al ¹⁰	2—temporary numbness	2—HWR after implant failure 3—HWR due to pain
Zhang et al ¹	0	2—HWR
Gehrmann et al ¹¹	0	0
Totals and weighted averages	Total: 5 minor complications (5.6%)	Total reoperation: 8 (8.9%) HWR: 8 (8.9%)

Avoiding Complications: Zhang et al. 2015

- Closed reduction for patients presenting with **acute instability**
 - 20 patients with 4th/5th MC base fracture-dislocations
 - <3 days
 - MHQ: 98+/-2
 - Grip, ROM no sig difference from contralateral
 - Sensation, return to work, fine motor movements unchanged
 - No post traumatic arthritis
- Chronic instability
 - 6 patients
 - >2 weeks
 - Surgery (n=3):
 - MHQ: 96 +/-5
 - Grip, ROM: no sig difference from contralateral
 - Sensation, return to work, fine motor movements unchanged
 - No post traumatic arthritis
 - Closed Reduction (n=3):
 - MHQ: 72 +/-5
 - 40% grip str loss
 - 2 pts with post-traumatic arthritis



Avoiding Complications

- Conclusion:
 - Need to avoid delay in diagnosis
 - Chronic (>2 weeks) instability should be treated surgically
 - Patients presenting acutely (<3 days) can do well with either closed reduction
 - Importance of early, timely diagnosis and treatment



Trans-CMCJ vs non-trans-CMCJ plate fixation

Zhao
Journal of Orthopaedic Surgery and Research (2023) 18:736
<https://doi.org/10.1186/s13018-023-04225-2>

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Surgery and Research 2023

RESEARCH ARTICLE

Open Access



A comparative study on the clinical efficacy of microplate trans-carpometacarpal joint fixation and non-trans-carpometacarpal joint fixation in treating fractures with dislocation or subluxation of the base of the fourth and fifth metacarpal bones

Liang Zhao^{1*}

- 100 pts with 4th and/or 5th MC base fracture dislocations
- Randomized to
 - Transarticular fixation (n=50)
 - Non-transarticular fixation (n=50)



Results

- No difference in fracture healing/healing time
- After 6 months
 - No difference in grip strength
 - Trans-articular fixation group had limited 4th/5th CMCJ ROM
 - All hardware was removed at 6 months from this group

• Conclusion

- Both methods can achieve good fracture fixation and healing
- Transarticular fixation:
 - Ensures no re-dislocation
 - Can allow for joint arthrodiastasis
 - Must be removed in second operation to restore 4th/5th CMC function



Avoiding Complications: acute carpal tunnel

- 24 y/o M presents 1 day after punching wall
- Dysesthesias in median nerve distribution
- Swelling and pain at base of 2nd and 3rd metacarpals
- Xray and CT showed volar migration of index MC base fracture fragment

Annales de chirurgie plastique esthétique (2021) 66, 180–183



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CLINICAL CASE

Volar fracture dislocation of the 2nd metacarpal base associated with acute carpal tunnel syndrome: A case report

Fracture luxation de la base du 2^e métacarpien associée à un syndrome du canal carpien aigu : un cas clinique

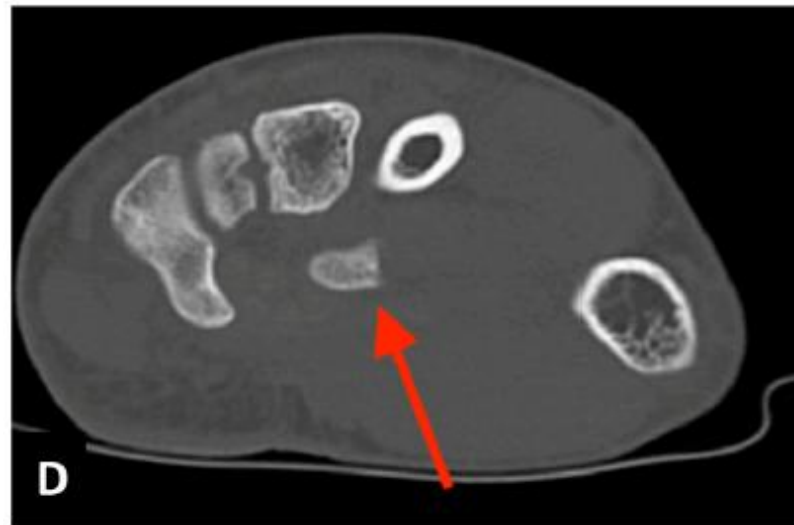
S. Piereschi^a, H. Remy^a, O. Camuzard^{a,b,*}

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Avoiding complications: acute carpal tunnel

- Pt taken to OR for OCTR and ORPP
- Recovered and healed uneventfully



Avoiding Complications: acute carpal tunnel

- Metacarpal fractures resulting in ACTS are rare
 - Weiland et al 1976: volar fxr-disloc of 2nd/3rd MC bases
 - Al-Qattan et al 2008: ACTS associated with multiple metacarpal fractures and severe hand swelling
- Conclusion:
 - Have high index of suspicion in cases of trauma presenting with sensory deficit with hyperesthesia in median nerve distribution



Avoiding Complications: ulnar nerve injury

- Risk of iatrogenic ulnar motor nerve injury with dorsal fixation of 4th and 5th CMCJ fxr-disloc and coronal hamate body fractures
 - Due to quick advancements of drill bits or sharp k wires that penetrate the volar cortex



Avoiding Complications: ulnar nerve injury

SCIENTIFIC ARTICLE

Dorsal Fixation of Coronal Hamate and Fifth Metacarpal Base Fractures: An Anatomic Evaluation of the Ulnar Nerve

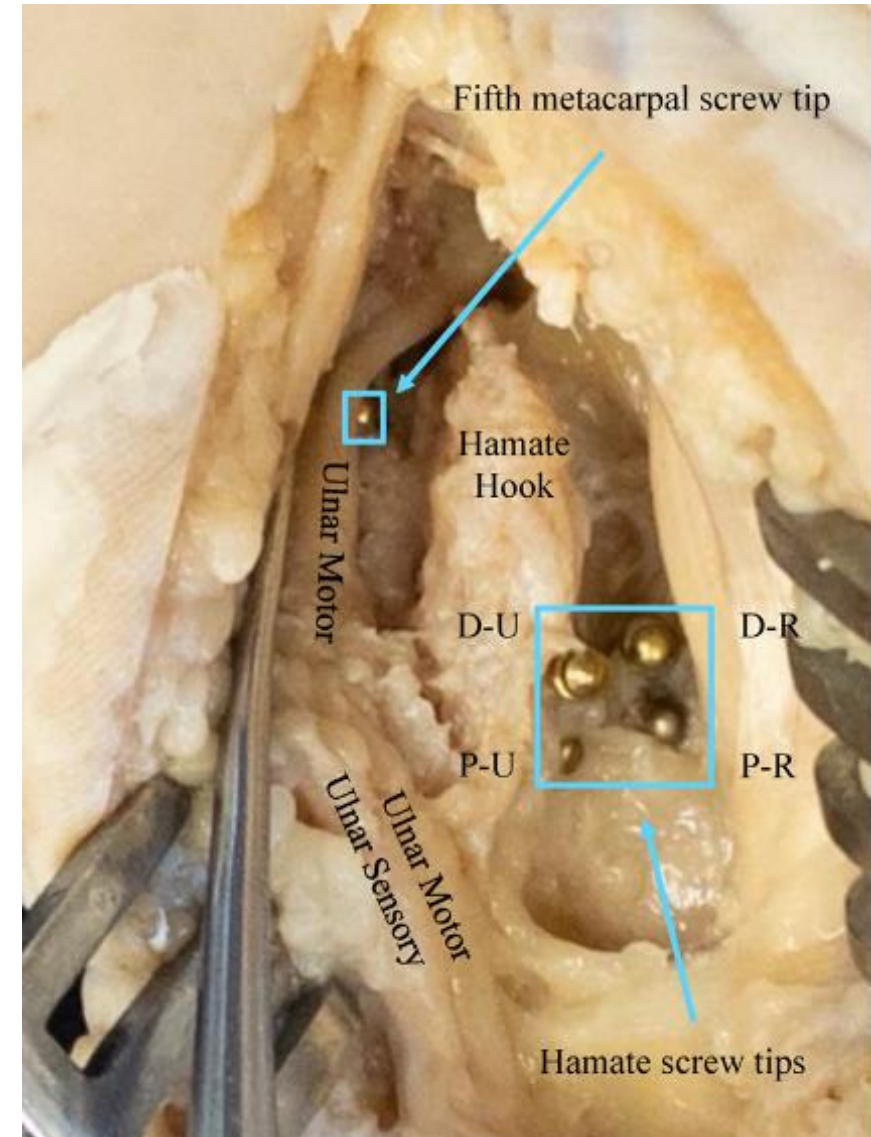
Pierce L. Janssen, MD,*† Christopher P. Bellaire, BA,*† Dani C. Inglesby, MD,*† Dylan M. Taub, Peter J. Taub, MD, MS,* Eitan Melamed, MD*†

- Janssen et al, 2024
- Anatomic study
 - 10 cadaver hands
 - Hamate divided into quadrants
 - Screws placed in 4 quadrants, as well as 5th metacarpal base, with 5mm overshoot
 - Distance to ulnar motor nerve structures were measured



Avoiding Complications: ulnar nerve injury

- 6/10 5th metacarpal screw tips abutted the ulnar motor nerve, and were within 1mm in other specimens
- Hamate screw tips relatively distant; closest was prox-ulnar
- Conclusion:
 - Use extreme care with direct dorsal-to-volar pin or screw fixation of base of 5th metacarpal
 - Reduce risk with oblique angle: entry on ulnar, midaxial side and aimed at hamate body



Thank you!

- Michael J. Terry MD
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