

Transscaphoid Perilunate Injuries: Assessment, Approach and Fixation

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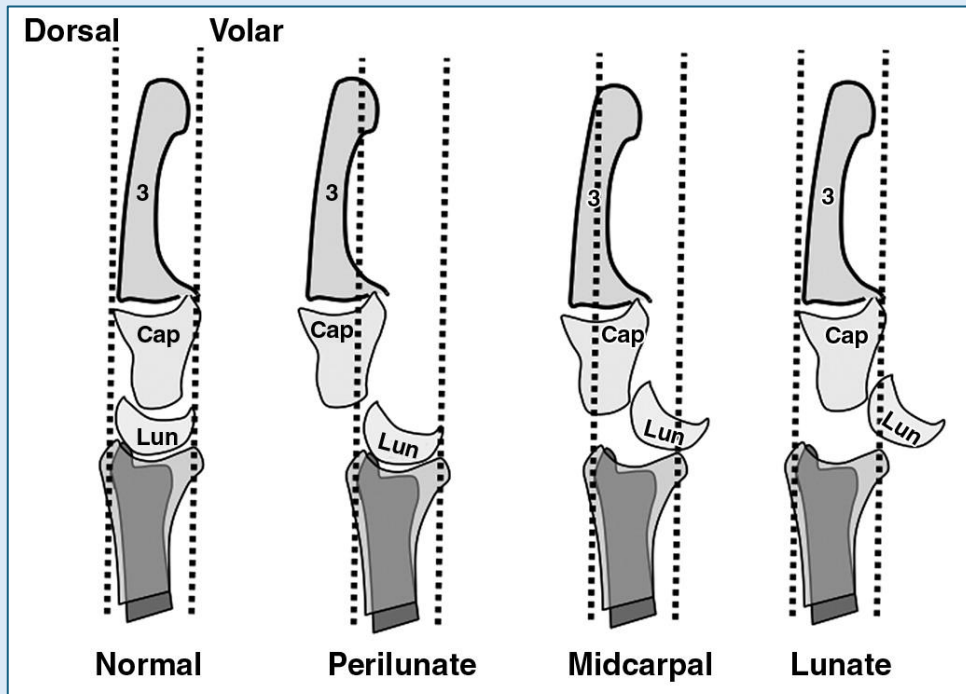
Incidence

- Wrist injuries account for about 2.5% of all ED visits
- Of carpal injuries, about 5-7% are perilunate injuries
- **Younger** population – good bone stock
- Approximately 25% are **MISSED**



Perilunate Injuries

- Perilunate fracture-dislocations (**PLFD**) and Perilunate dislocations (**PLD**)
 - **2 PLFDs: 1 PLDs**
- 97% are dorsal, 3% palmar
- Dorsal trans-scaphoid perilunate dislocations comprise **61%** of all injuries



PERILUNATE DISLOCATIONS	PERILUNATE FRACTURE-DISLOCATIONS	
	Intact scaphoid	Trans-scaphoid
		

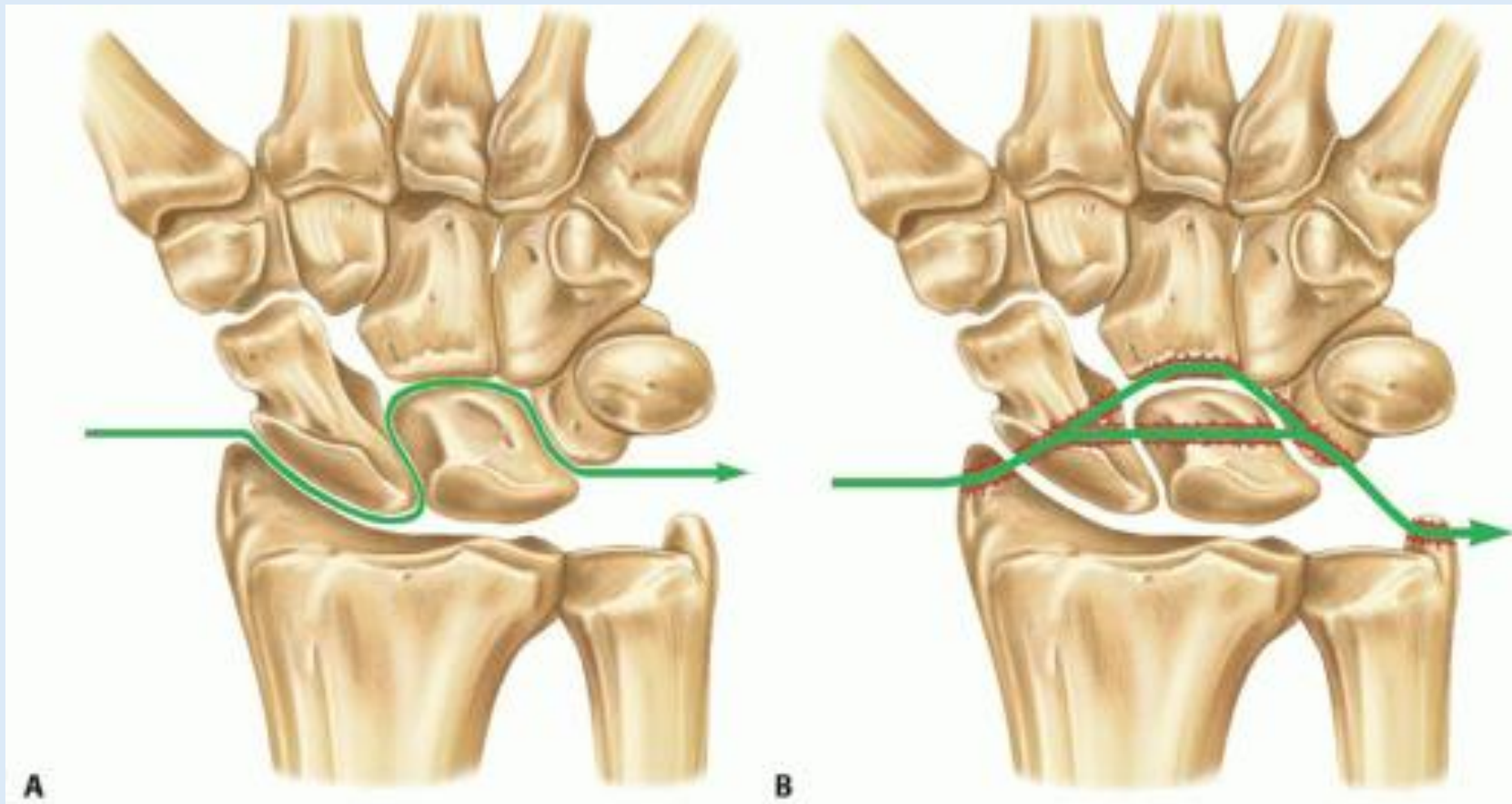
Lesser vs. Greater Arc injuries

Lesser Arc Injuries

- Purely ligamentous

Greater Arc Injuries

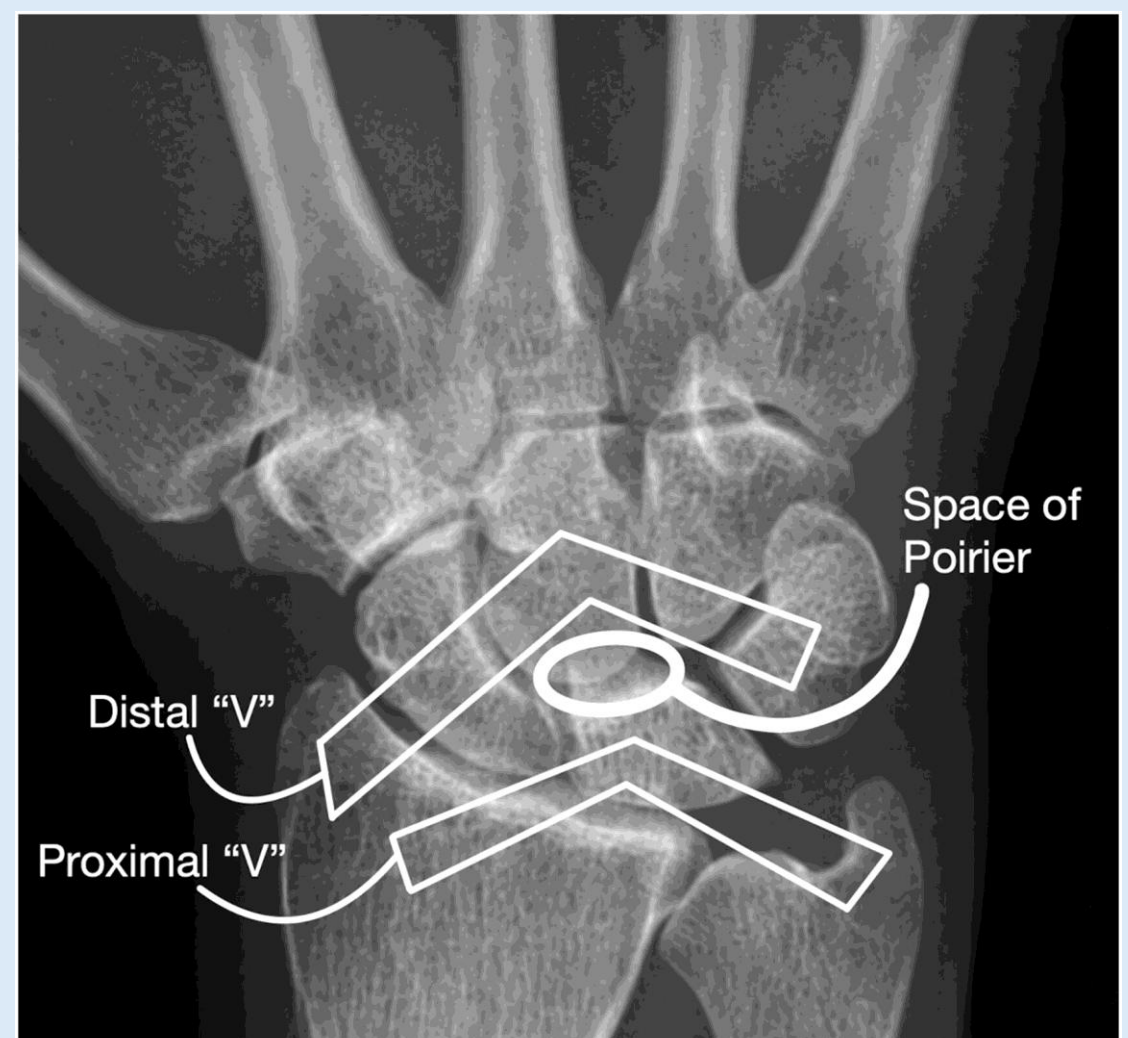
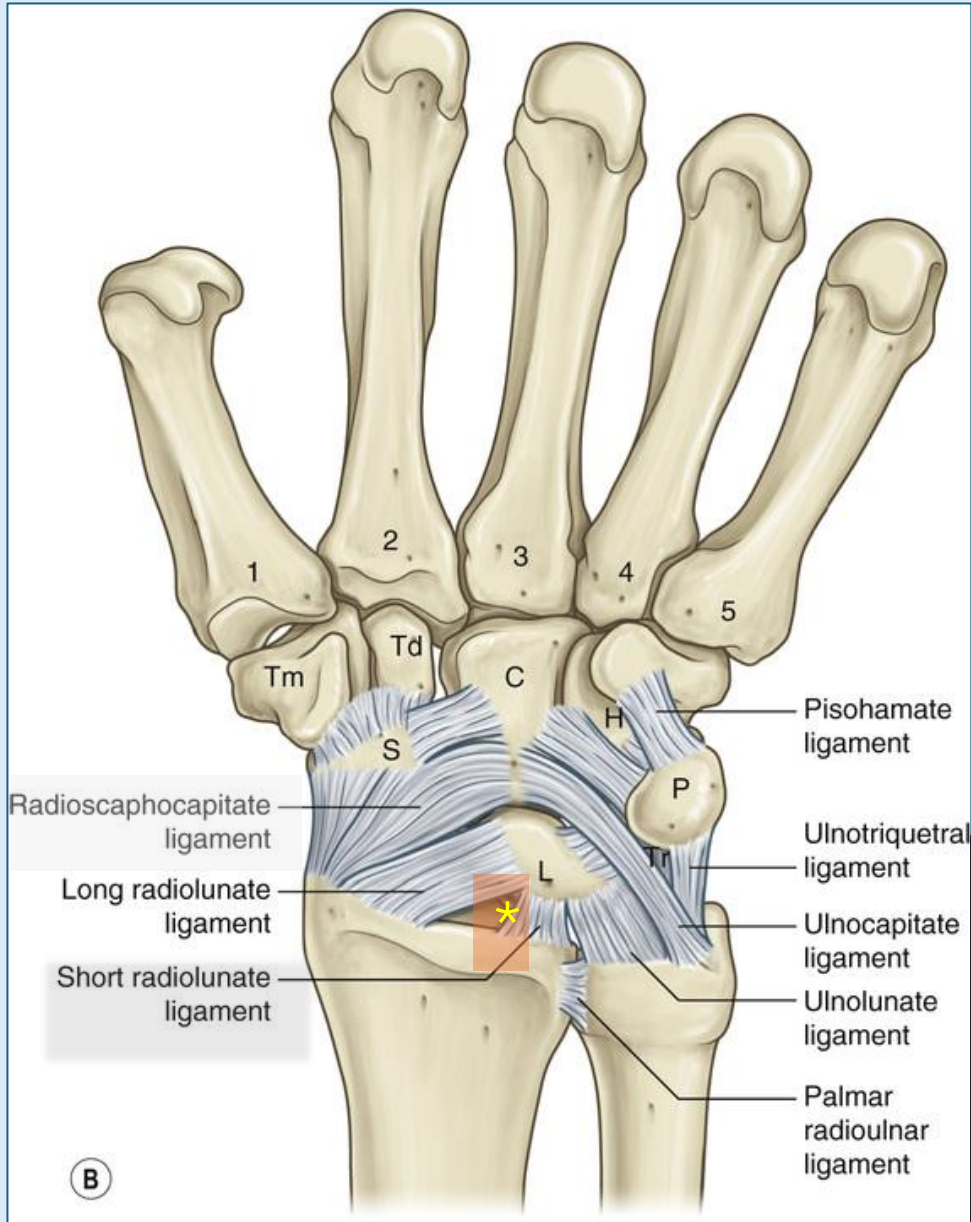
- Scaphoid**
- Capitate
- Lunate
- Triquetrum
- Radial styloid



Lesser Arc

Greater Arc

Palmar Ligaments



CRUCIAL for carpal stability: prevent translation, rotation and angulation.

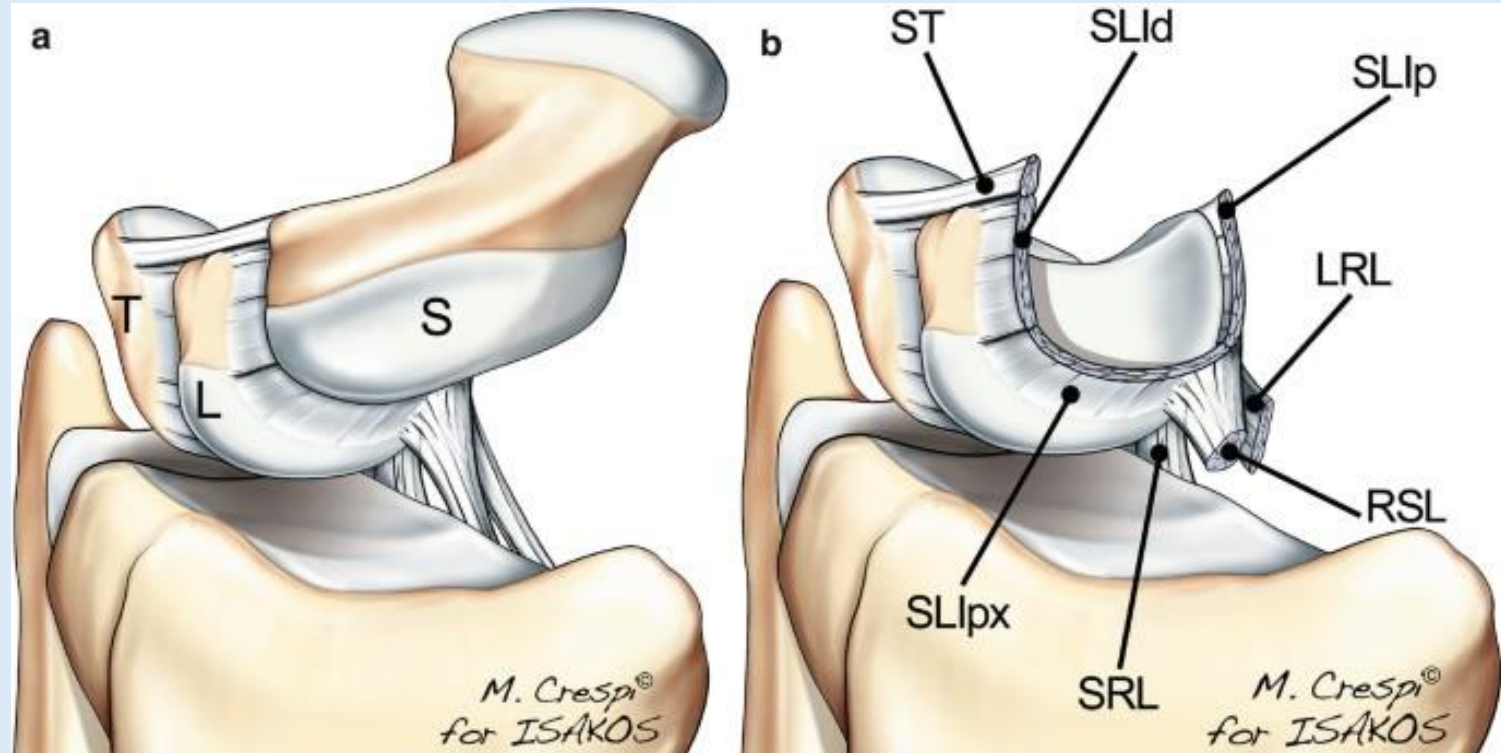
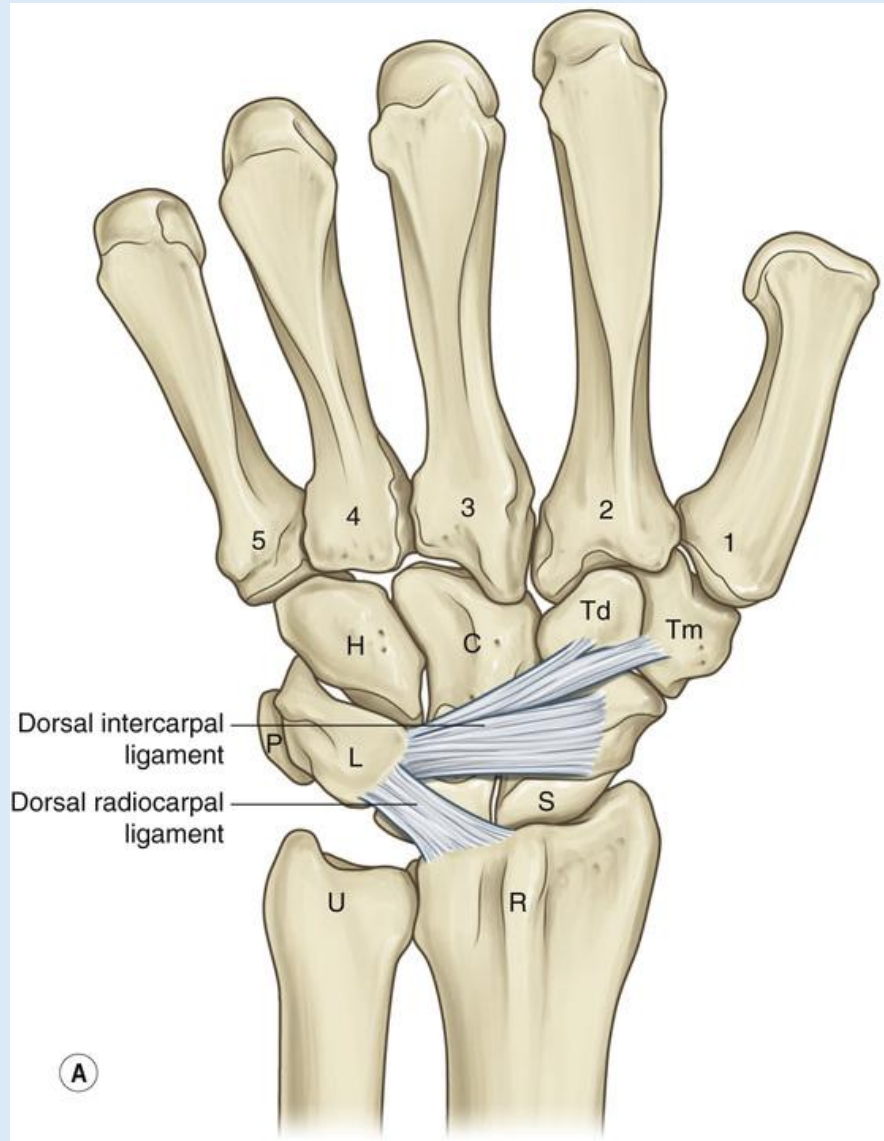
Proximal: Radiolunotriquetral, ulnotriquetral, ulnolunate

Distal: Radioscaphocapitate, ulnocapitate

Blood Supply: Lig. of Testut (RSL ligament)*

Space of Poirier: Area of weakness

Dorsal Ligaments



Scapholunate IO ligament

- C-shaped
- Volar, Dorsal and Membranous components
- Dorsal: 2-3mm thick (Stability)
- Volar: 1mm thick
- Stability from Extrinsic ligaments as well

Mechanism of Injury

- High energy (work, MVA, sport)
- Wrist extension, ulnar deviation and supination at the midcarpal joint
 - Fall on outstretched hand
- Disturbance of ligaments

TABLE 2. Injury Characteristics

Injured extremity	
Right	20 (61%)
Left	13 (39%)
Injury mechanism	
Fall from 0 to 10 feet	8 (24%)
Fall from greater than 10 feet	8 (24%)
Motor vehicle accident	8 (24%)
Bicyclist struck by automobile	3 (10%)
Assault	3 (10%)
Pedestrian struck by automobile	2 (5%)
Crush injury	1 (3%)

HAND SURGERY

Descriptive Epidemiology and Management of Perilunate Injuries

Alap U. Patel, MD,^a Jack Thiara,^b Zuivanna Rivas, BS,^c and Scott L. Hansen, MD^a

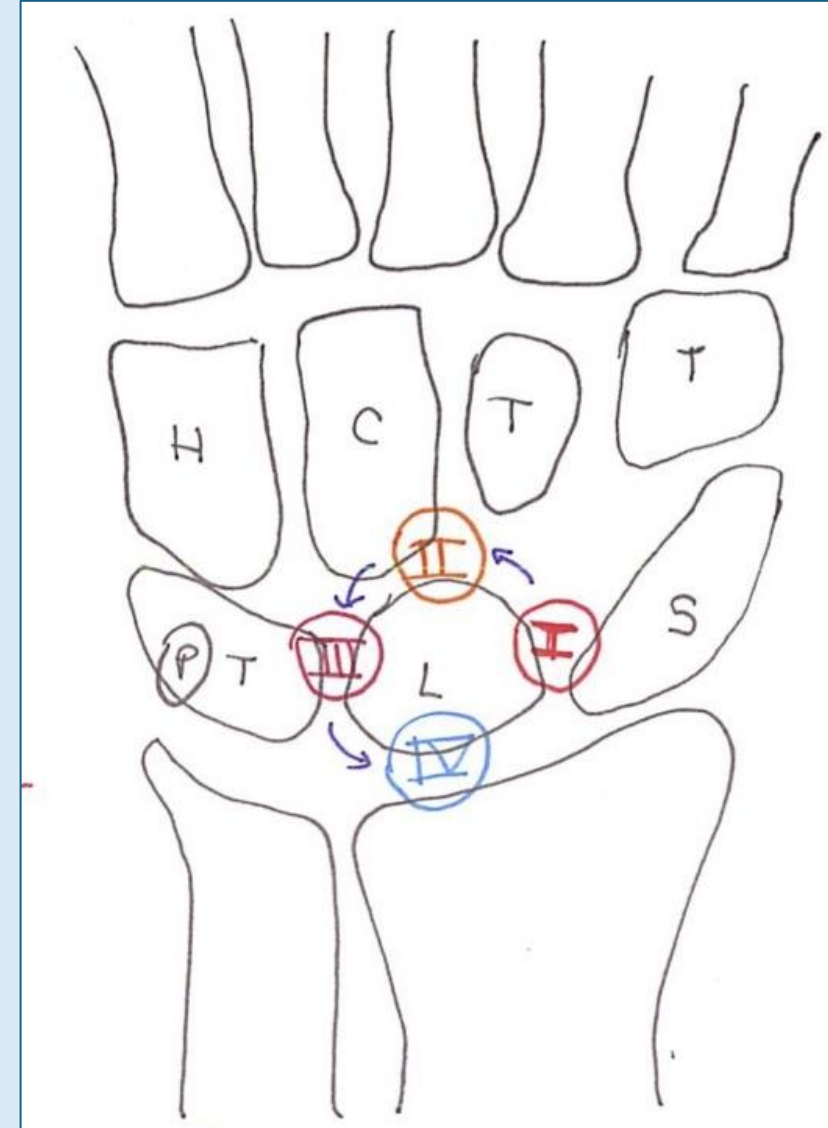
ZSFG 2014-2023
N=33 cases

Hansen SL, et al, 2024

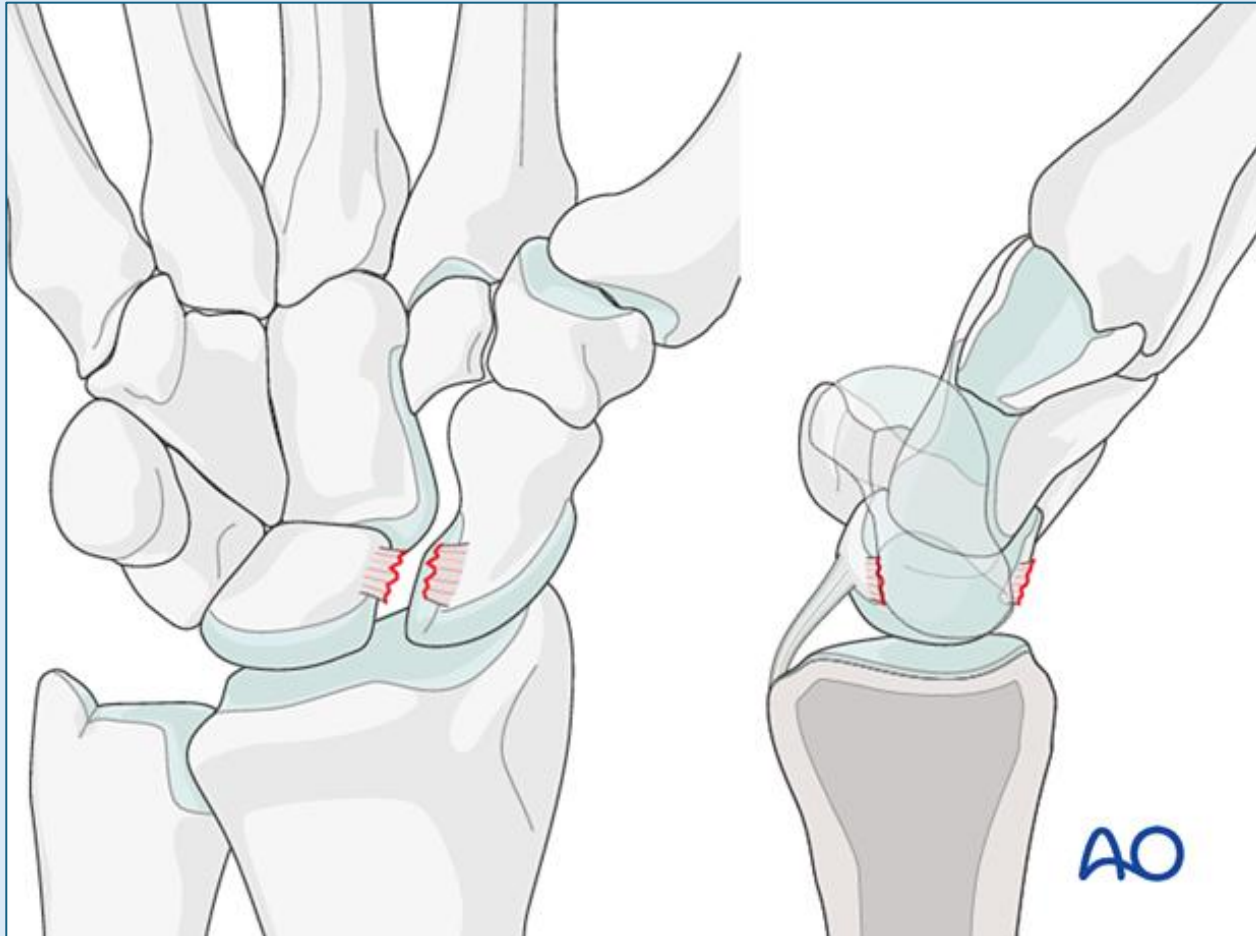
Perilunate Injury

Mayfield Classification (Radial to Ulnar disruption)

- PLI 1 – scaphoid fracture or S-L disruption
- PLI 2 – lunocapitate dislocation
- PLI 3 – L-T disruption
- PLI 4 – lunate dislocation



Stage I: Scapholunate Ligament Injury



Scapholunate dissociation

- Tearing of the scapholunate ligaments (dorsal, interosseous, and palmar).

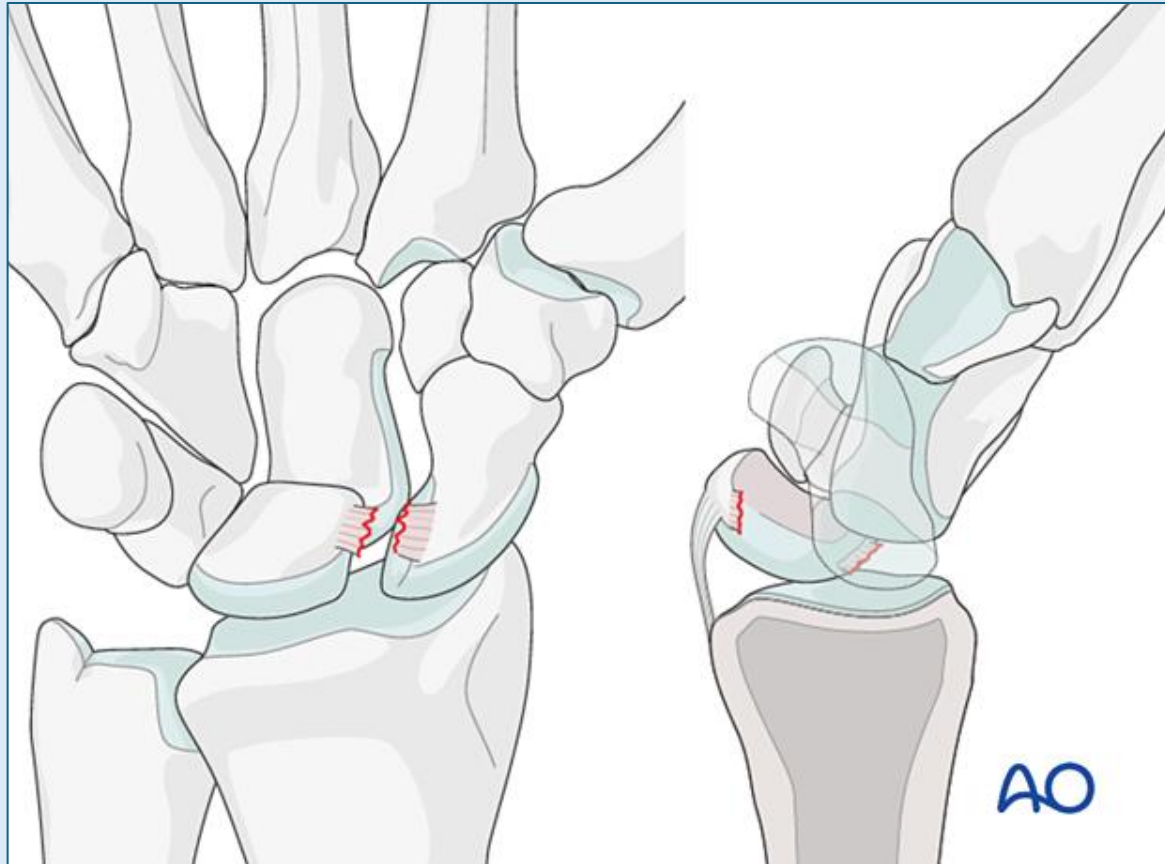


Stage II: Lunocapitate Dislocation

- **AKA perilunate dislocation**

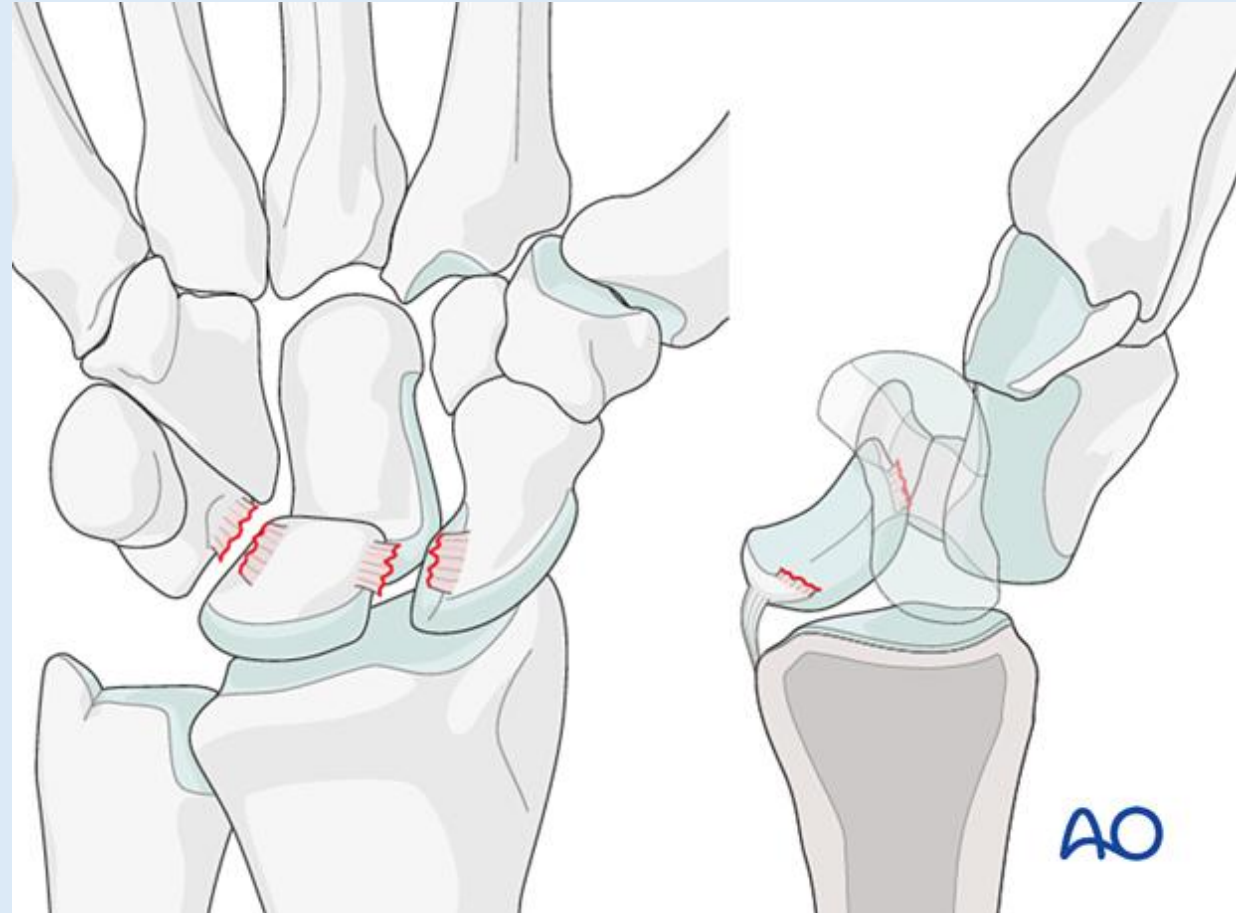
- Scapholunate and lunocapitate ligament rupture.
- lunate remains aligned with the distal radius,- the surrounding carpal bones are displaced.

- **Capitate and scaphoid** remain together and dissociate from the lunate and triquetrum. The rupture in the carpal joint capsule creates a gap in the **space of Poirier**.



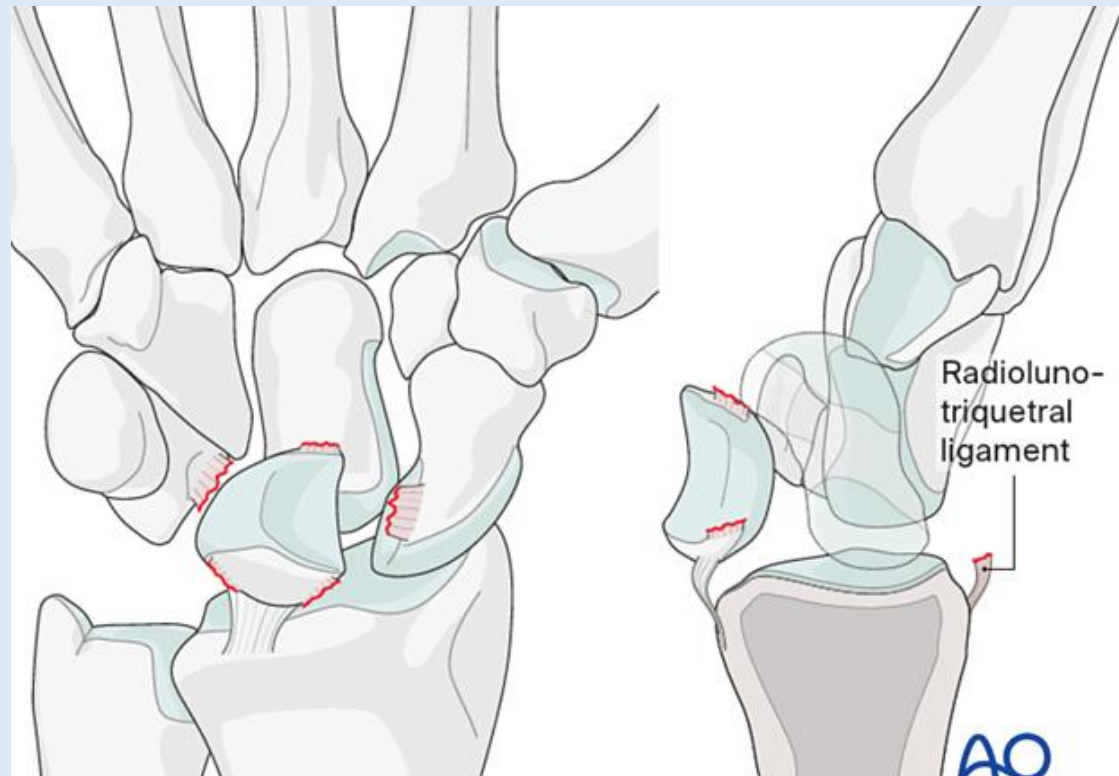
Stage III: Midcarpal Dislocation

- The **lunotriquetral ligament** is ruptured and/or a partial avulsion of the triquetral bone occurs. Lunate and capitate lose alignment with the distal radius.



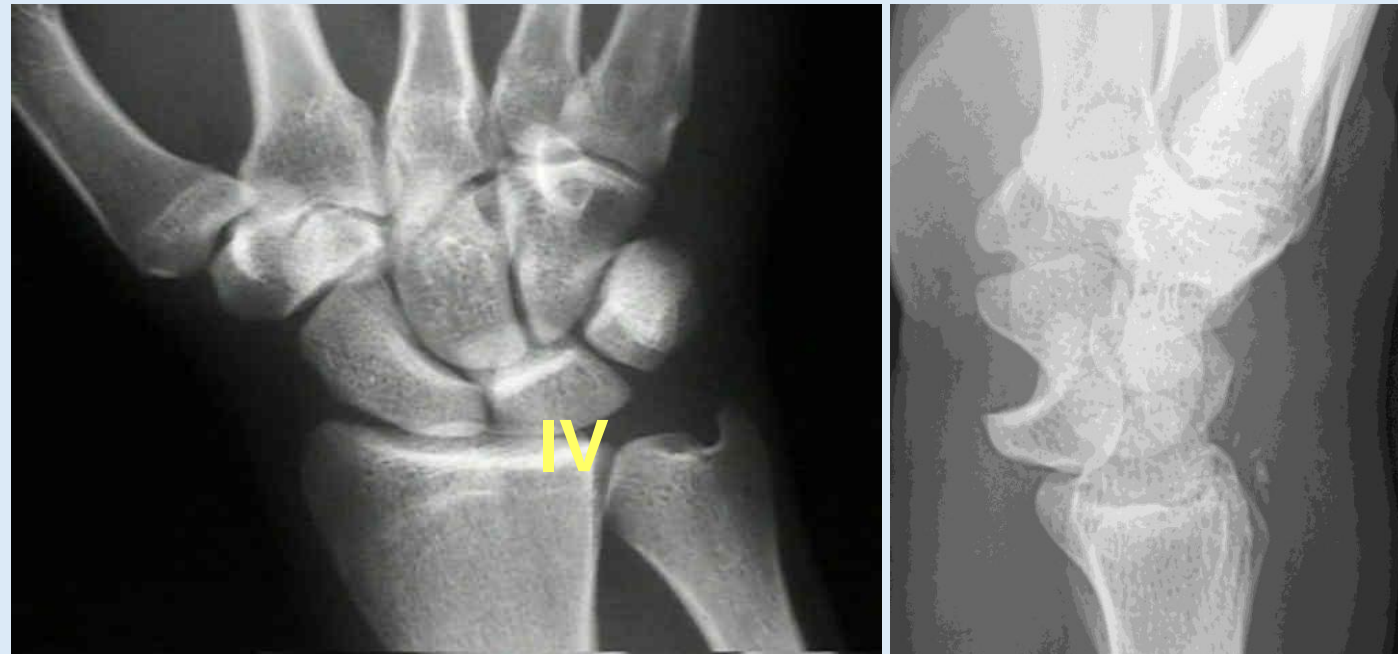
Stage IV: Lunate Dislocation

- The lunate is dislocated and the dorsal radiolunate ligament is ruptured
 - Creates what is known as the spilled teacup sign.



Result of circumferential disruption of the Lunate:

- Lunate rotation and dislocation through the space of Poirier



Assessment: Presentation

- 10% are open, typically palmar laceration
 - Lunate extrusion
- Significant wrist swelling
- Fingers flexed, pain with passive ROM
- 24-45% with median nerve paresthesia's
- 26% associated with polytrauma

TABLE 1. Demographics

Gender	
Male	32 (97%)
Female	1 (3%)
Age	
Average	33.9
SD	9.9



Diagnosis

- **Often missed** (up to 25%)!
- High clinical suspicion
- Very impressive swelling
- X-ray

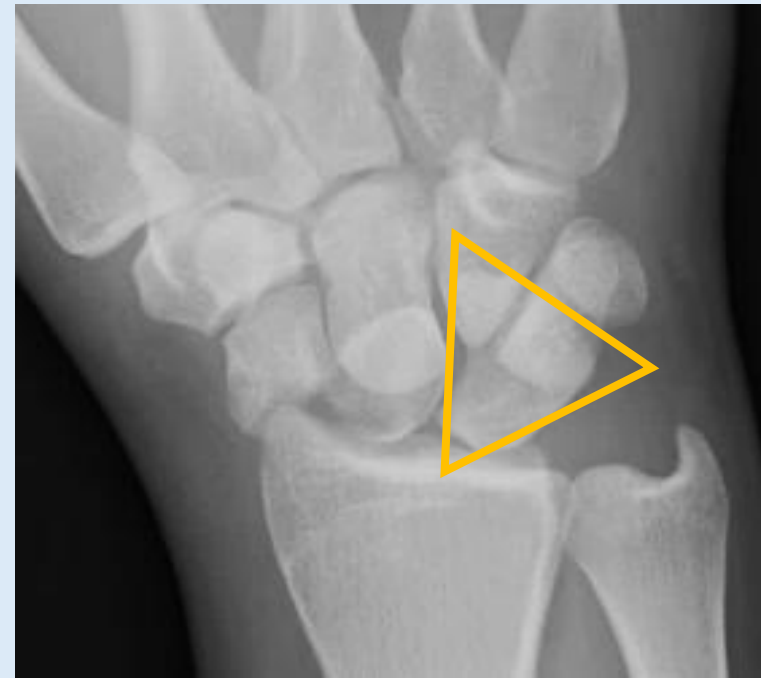


Diagnosis

Trans-scaphoid perilunate dislocation	20 (61%)
Perilunate dislocation	8 (24%)
Perilunate fracture dislocation	3 (10%)
Perilunate dislocation + other nonscaphoid carpal bone injury	2 (5%)
Mayfield classification	
I	1 (3%)
II	1 (3%)
III	18 (55%)
IV	13 (39%)
Symptoms of median nerve compression on initial exam	
Yes	16 (48%)
No	17 (52%)

X-Ray Findings

- Disruption of carpal arcs
- Overlapping of carpal bones
- Crowded or jumbled carpal bones
- Foreshortened carpus
- Lunate triangular
- Greater arc fractures

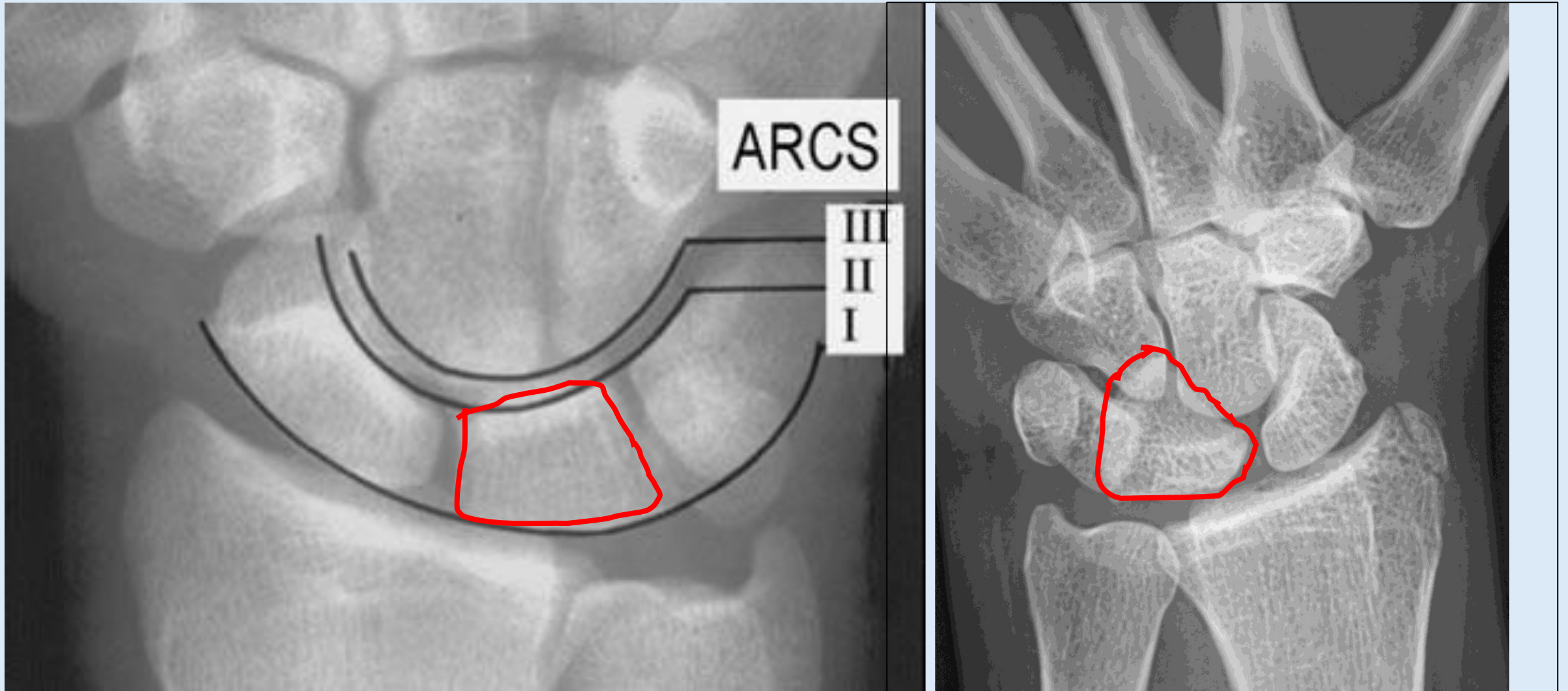


Initial imaging modality

XR	19 (58%)
CT	2 (6%)
XR and CT	12 (36%)

Hansen SL, et al, 2024

Carpal Arcs- Gilula's Lines



Imaging: Lateral View

- Lunate and/or Distal Row not aligned with radius
- Abnormal Scapholunate/Radiolunate angles
- Spilled Teacup

***Loss of collinearity between capitate, lunate and distal radius**



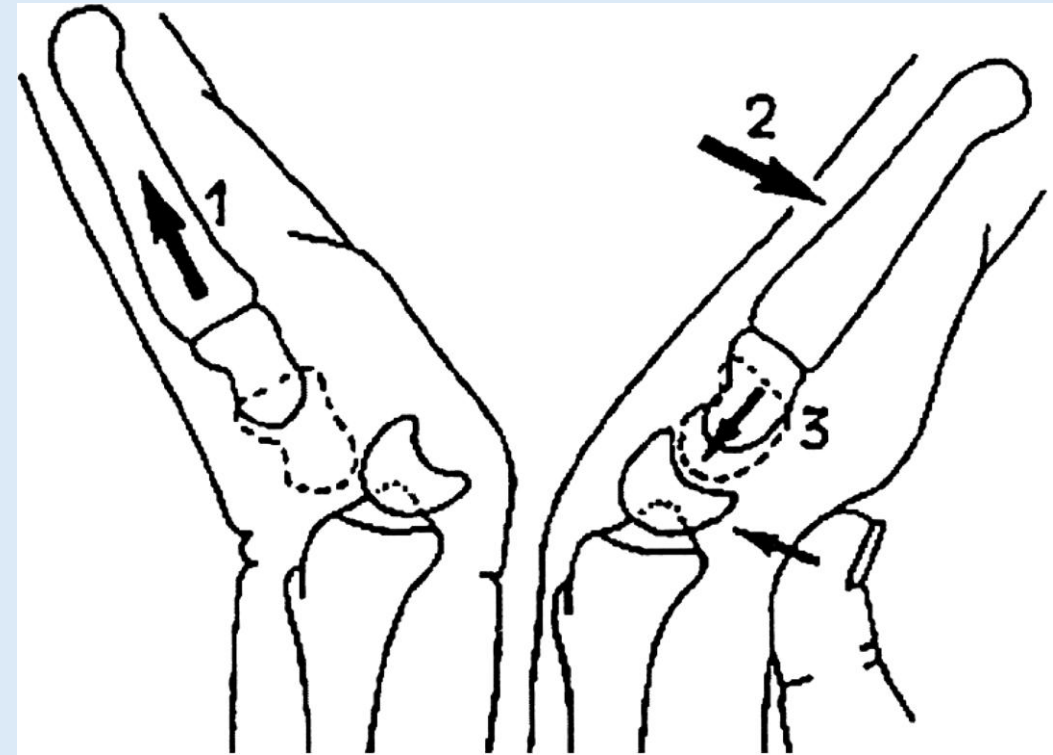
Physical Exam

- Moderate/Severe Swelling
 - Evaluate for acute CTS>>compartment syndrome of forearm/hand
 - Neuropraxia may be only exam finding
- Short and thick wrist
- Limited motion / crepitus
- Palmar or Dorsal prominence
- Median nerve symptoms
 - Lunate dislocated



Initial treatment

- Closed reduction with adequate sedation
 - In finger traps with 10-15 lbs. Traction for 5-10 minutes
 - Earlier = less swelling and easier
 - Takes pressure off median nerve (check 2PD)
- Maneuver
 - Wrist extension
 - Counterpressure -palmar over lunate
 - Gradual wrist flexion with direct pressure over capitate
- If the lunate is completely out of the fossa- closed reduction is unlikely and may damage vascularity (RSL ligament disrupted)



Operative or Non-Operative?

- **Operative!!!!**
- Goals
 - Anatomic reduction of carpal bones
 - Ligament repair
 - Median nerve release
- When is operative intervention an emergency?
 - Progressive median nerve symptoms
 - Open fracture
 - Enucleated lunate

TABLE 3. Management

Consulting team	
Orthopedic surgery	18 (55%)
Plastic surgery	15 (45%)
Initial ED treatment	
Reduction successful with delayed OR	19 (60%)
Reduction successful with immediate OR	5 (15%)
Splinting only (no documented reduction)	4 (12%)
Reduction successful with no OR intervention	2 (5%)
Reduction unsuccessful with immediate OR	2 (5%)
Initial presentation to clinic/outpatient	1 (3%)
OR treatment	
Yes	30 (91%)
No	3 (9%)
Time to OR (n = 30)	
Within 24 hours	10 (33%)
>24 hours to 1 week	16 (53%)
>1 week to 6 months	4 (14%)
Specific OR intervention (n = 30)	
ORIF	17 (56%)
ORPP	9 (30%)
OR reduction only (no ORIF or CRPP)	2 (7%)
CRPP	2 (7%)
Needs for CTR	
Yes	17 (52%)
No	16 (48%)

Closed Reduction Percutaneous Pinning

- Most (all) injuries require fixation to maintain reduction
- +/- Arthroscopy
- Reduce and pin:
 - Lunate to radius
 - Capitate to lunate
 - Scaphoid to lunate
 - Lunate to triquetrum
 - Scaphoid to capitate
- Doesn't address ligament injuries
- Median nerve compression



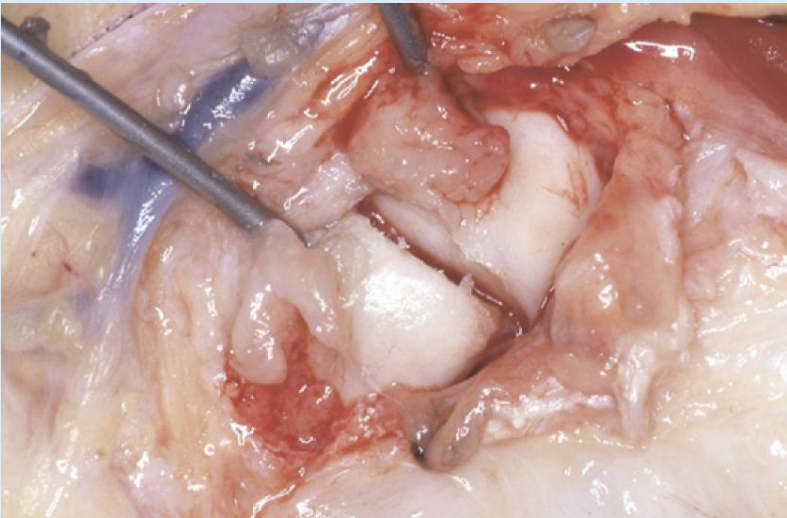
Fixation: Open Reduction Internal Fixation

- ORIF Preferred
 - Direct view of injury
 - Ligamentous repair
 - Decompression of median nerve
- Several Approaches –No clear evidence supporting one vs. another
 - Dorsal
 - Volar
 - Combined Dorsal/Volar

Operative Management: Dorsal vs. Volar

Dorsal

- Direct view of proximal carpal row
- Antegrade fixation of scaphoid, capitate
- Repair dorsal **SLIL**



Volar

- Carpal tunnel release
- Repair of capsular tear
- Reduce lunate
- Repair **LTIL** ligament

Fracture Fixation

- **Begin with fracture fixation**

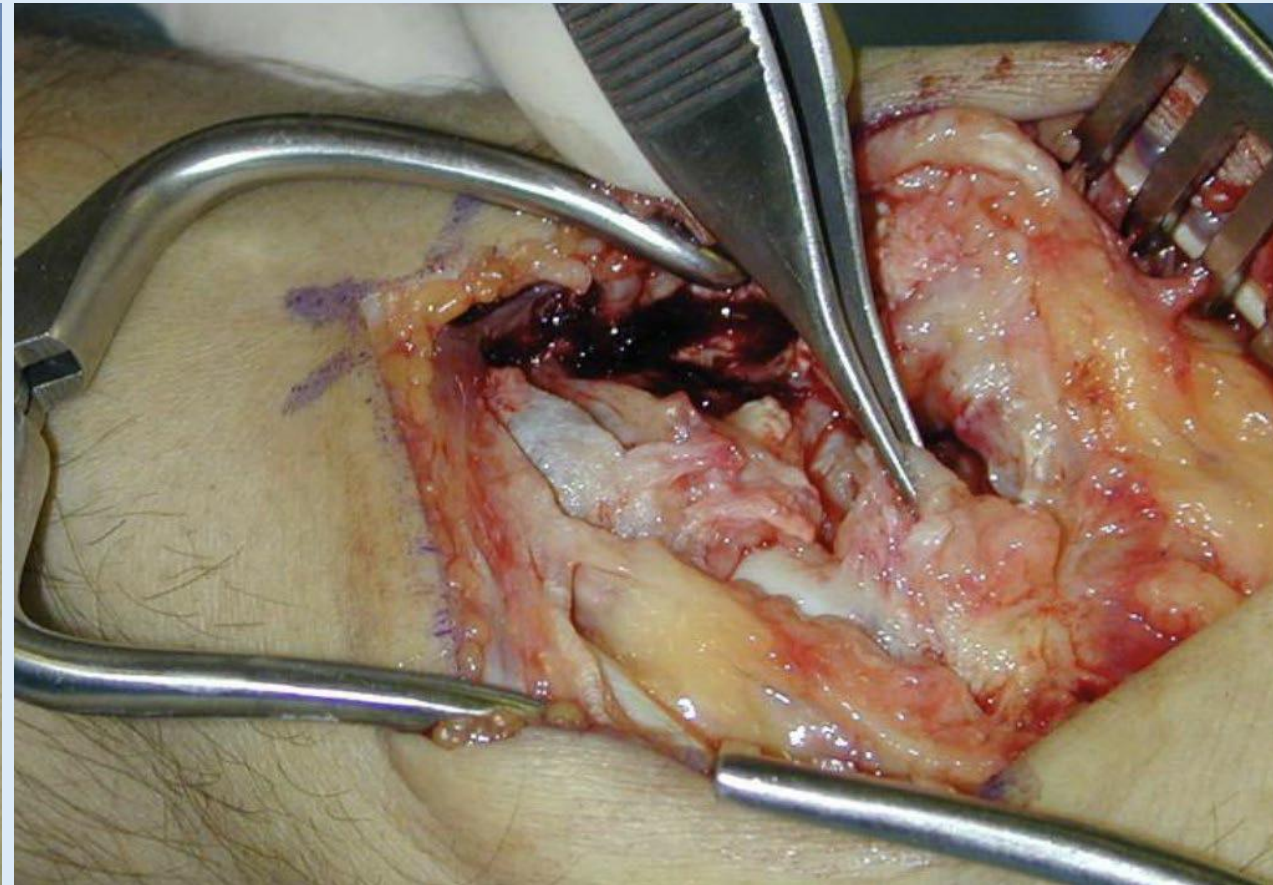
- Scaphoid and Capitate fractures are typically fixed from dorsal approach
- Repair radial styloid fracture

- **Ligament repair as needed**

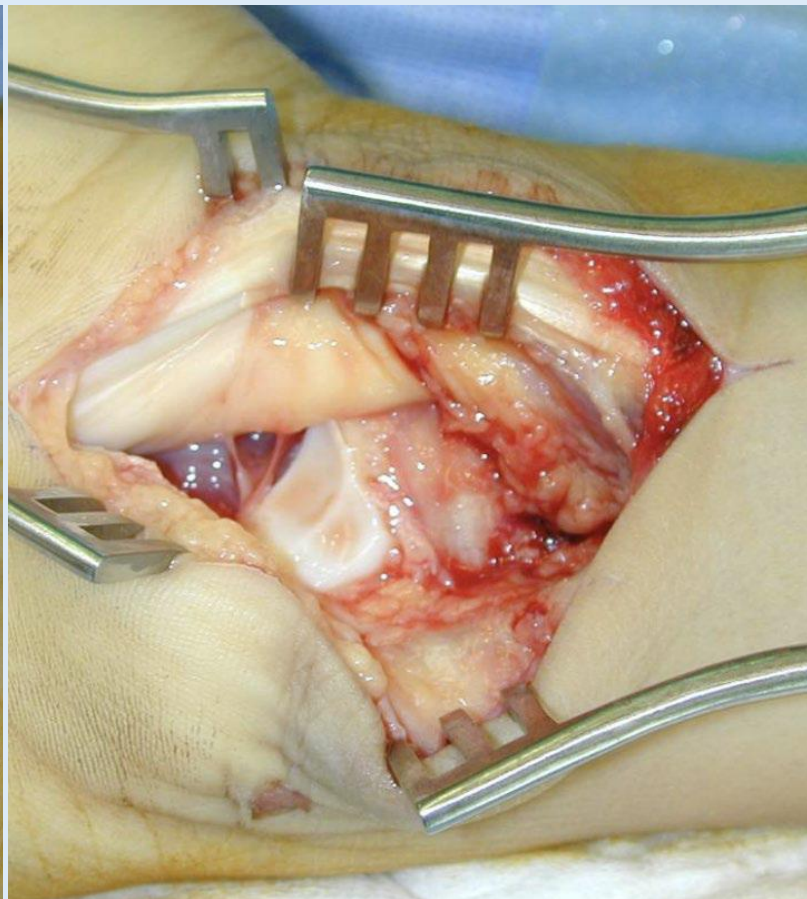
- SL ligament repairable
 - Direct repair where possible
 - Suture anchors
 - Reinforce S-L repair with DICL
- SL ligament not repairable
 - Dorsal capsulodesis
 - Tenodesis (Brunelli)



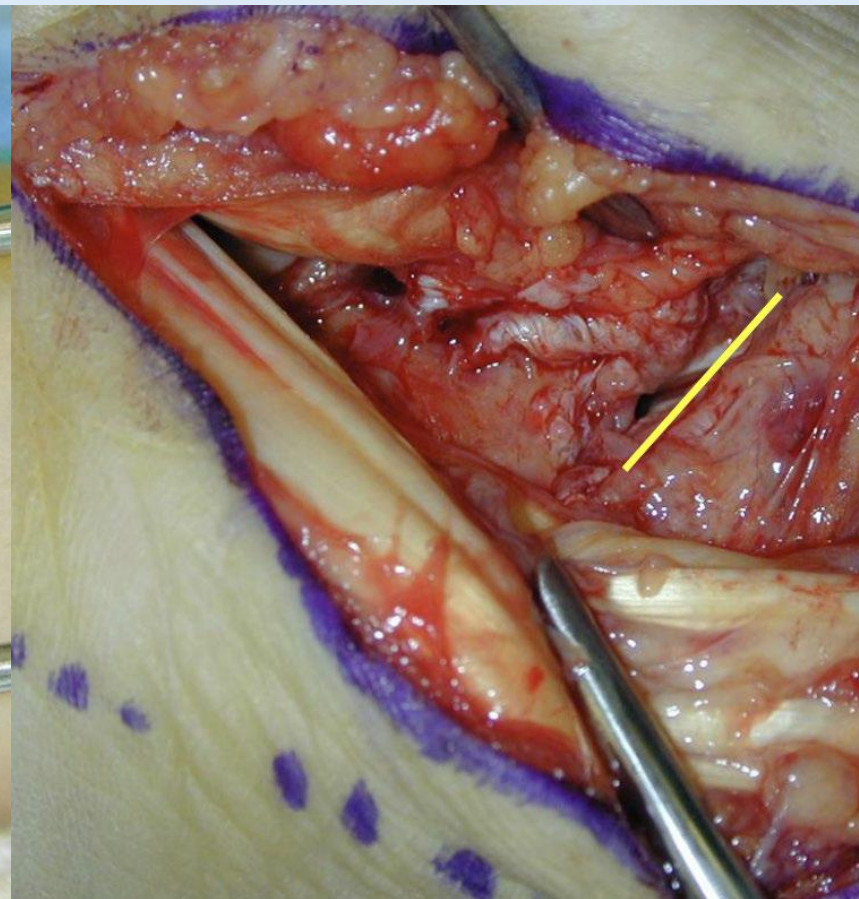
Dorsal Approach- Repair SL Ligament



Volar Approach



Lunate dislocated volarly

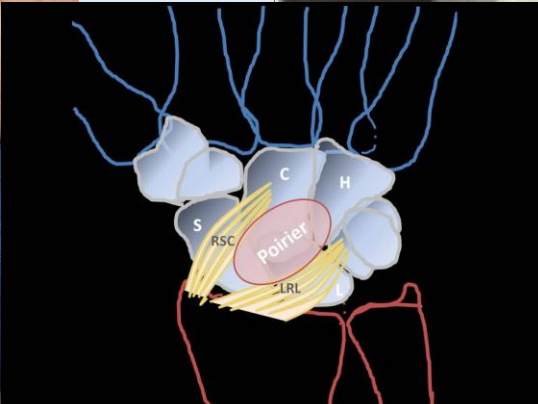
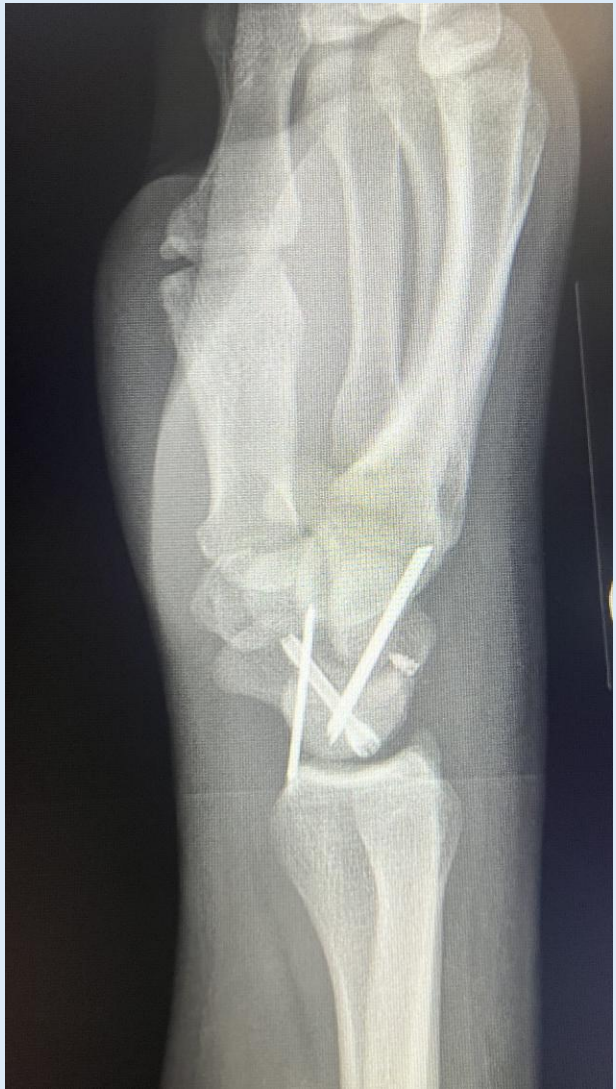


Volar mid-carpal ligament tear

Case

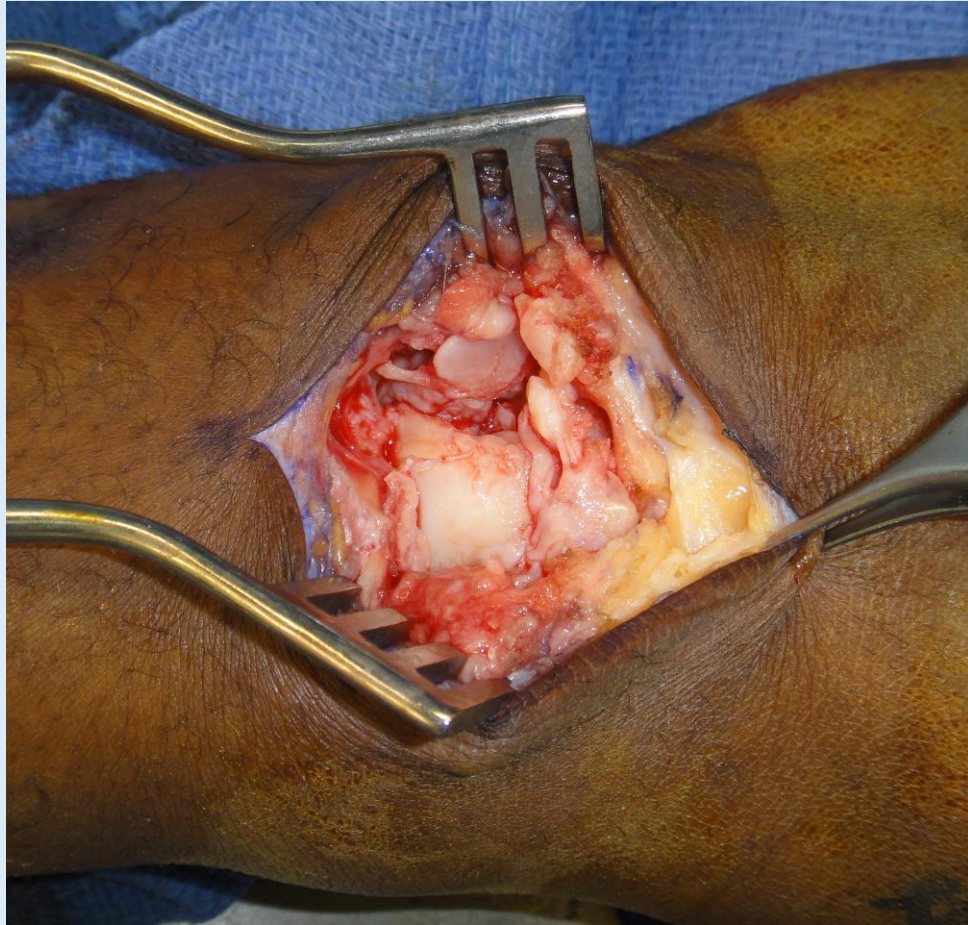






Case 2





Post-op Management

- Immobilization
- K-wire removal @8 weeks
- D/C cast and ROM at 10-12 weeks
 - Can begin wrist ROM earlier in reliable pt

Complications

- Arthrosis
- Avascular necrosis of scaphoid /lunate (disruption of RSL)
 - Transient ischemia more common
- Median neuropathy
- Residual carpal instability
- STIFFNESS!

Outcomes

- Poor prognosis for full return to previous function
- Poor prognostic factors:
 - Open injuries
 - Delayed treatment (after 45 days= sig. worse outcomes)
 - Osteochondral fractures of the head of the capitate
 - Carpal malalignment
- Nearly all patients experience decreased grip strength and range of motion
- Arthritis on imaging does not correlate with functional outcome scores
- Usually stiff, low pain, functional wrist despite arthrosis

Outcomes

- **25 transscaphoid PLFDs**

- ORIF scaphoid, dorsal approach, LTIL repaired, and LT pinned

- 45-month f/u
- 88% returned to work
- F/E 113°
- Grip 80% of uninjured side
- NO arthritis

- **14 transscaphoid PLFDs**

- ORIF scaphoid, dorsal approach

- F/E 112°
- + Midcarpal OA 92%

Summary

- High clinical suspicion
- Urgent closed reduction
- Open reduction, internal fixation, and ligament repair
- Advise pts about stiffness, weakness, and development of arthritis
 - 70-80% ROM and grip strength is a good result

Thank you!

- **Acknowledgements**

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