



## EM CASES SUMMARY

### Episode 190 Carpal Bone Injuries

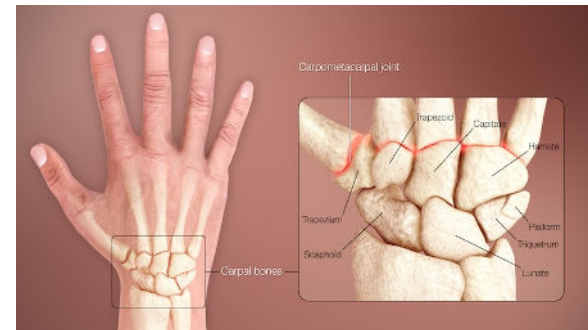
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#### **Carpal bones mnemonic memory aid**

**So Long to Pinky, Here Comes The Thumb** mnemonic – starting at proximal row, radial wrist

- Scaphoid
- Lunate
- Triquetrum
- Pisiform
- Hamate
- Capitate
- Trapezoid
- Trapezium



Source: wikipedia

#### **The Big 4 carpal bone injuries**

The following carpal bone injuries are commonly missed with serious consequences for patients. Other carpal bone injuries are less common and may co-occur with the “Big 4” injuries:

1. **Triquetrum chip fractures**
2. **Scapholunate sprains/dissociation/dislocation**
3. **Hook of the hamate fracture**
4. **Scaphoid fracture**

#### **Understanding carpal bone injuries: Age related prevalence of disease**

Age plays a significant role in determining the prevalence of musculoskeletal injuries. Younger individuals with open growth plates are more likely to sustain fractures involving growth plates or diaphyseal/metaphyseal junction of the distal radius, while older individuals with low bone density are more prone to classic long-bone fractures. For individuals between 15 and 60 years old carpal non-long bone and inter-carpal ligament injuries occur more often. Hence, **carpal bone injuries occur predominantly in young adults as a result of a high energy mechanism.**

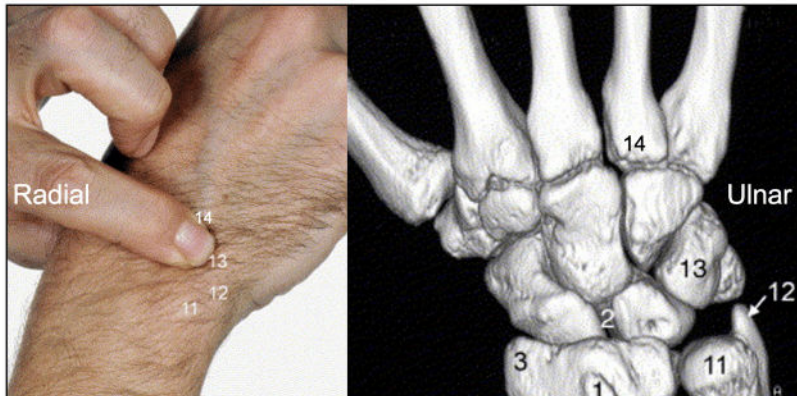
## 1. Triquetrum chip fracture – the commonly missed ulnar wrist injury

We tend to concentrate on the radial aspect of the wrist for patients who have sustained a wrist injury. The 2nd most common carpal bone injury comprising 20% of carpal bone fractures, and the most common ulnar wrist injury is a triquetrum chip fracture, highlighting the need to scrutinize the ulnar aspect of the wrist on physical exam and x-ray.

Dorsal aspect of triquetrum avulsed or knocked off.

**Mechanism:** FOOSH (most common), also fall on back of the hand (volar injuries are more likely to lead to carpal instability and require orthopedic intervention)

**Surface anatomy/physical exam:** dorsal, ulnar side of hand, palpate the divot distal to the ulnar styloid and proximal to the 4th metacarpal



**Triquetrum Chip Fractures: Surface Anatomy** (Dorsal view of the R. Hand)

- 11: Head of the Ulna
- 12: Ulnar Styloid Process
- 13: Triquetrum
- 14: Base of 4<sup>th</sup> Metacarpal

**X-ray:** whether the mechanism was FOOSH or fall on back of the hand, the x-ray findings are similar, often subtle and most often picked up on the lateral view



**Triquetrum chip fracture, lateral x-ray.** Source: <https://www.orthobullets.com/hand/322147/triquetrum-fracture>

**Treatment:** for dorsal injury mechanism (FOOSH), removable splint x 3-4 weeks; for volar or injury mechanism (fall on back of hand) or unknown mechanism of injury, plaster/fibreglass splint and early orthopedic follow-up

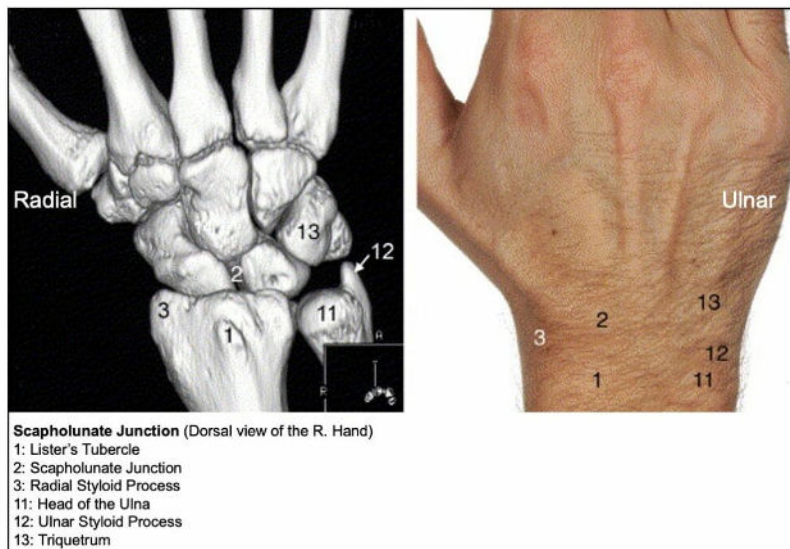
**Pearl:** a fall on the back of the hand (volar injury), or falling backwards is generally more serious than a FOOSH and resultant wrist injuries usually require immobilization and early orthopedic follow-up due to the higher likelihood of carpal instability

## 2. Lunate ligamentous injuries are on a spectrum: Scapholunate sprains, dissociation and dislocation

Lunate ligamentous injuries are the 3rd most common carpal bone injury comprising 10% and range in severity from sprains to dissociations to frank dislocations.

**Mechanism:** most commonly FOOSH.

**Surface anatomy/physical exam:** divot distal to Lister's tubercle and a few millimetres ulnar is the scapholunate space; also 2cm ulnar to the snuffbox.



**Surface Anatomy of the Lunate and Scapholunate Junction.** Source: Adapted from: <https://doi.org/10.1016/j.cuor.2005.02.008>.

**The spectrum of lunate ligamentous injuries from least morbid to most includes:**

**Grade 1 scapholunate ligament sprain** – normal standard x-rays and normal *clenched fist view* – if there is clinical suspicion, immobilize in a splint and follow-up with orthopedics

**Grade 2 scapholunate ligament sprain** – normal standard x-rays but slight gap (<3-5 mm) on *clenched fist view*, splint for 6-10 weeks



Clenched fist view revealing right widened scapholunate space, Grade 2 scapholunate ligament sprain. Source: Radiopaedia <https://radiopaedia.org/articles/wrist-clenched-fist-view-1>

**Grade 3 scapholunate dissociation** – complete tear/rupture of scapholunate ligament, surgical management in the first few weeks

**SLAC (Scapholunate Advanced Collapse)** is a consequence of untreated scapholunate dissociation (complete tear/rupture of ligament) where the capitate puts stress on the dissociated scaphoid and lunate, especially in wrist flexion, and can lead to advanced collapse of the capitate towards the radius with long term consequences such as arthritis of the wrist.

**X-ray for scapholunate dissociation:** Widening of the scapholunate space (3-5 mm) or *Terry Thomas sign* or *David Letterman sign* (these performers' front incisors appear wide). To properly assess for scapholunate dissociation, a *clenched fist view* is

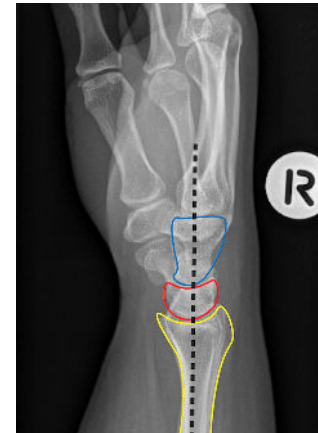
required (Note: *actively* clenching, not just closing the fist gently, is important to reveal the gap in the scapholunate space)

**Pearl:** To pick up a subtle scapholunate dissociation and distinguish it from baseline physiologic widening of the scapholunate space, consider bilateral X-rays of the wrist as some people have baseline physiologic widening.



Terry Thomas/David Letterman sign. Widening of the scapholunate space on the AP x-ray view of the wrist. Source: <https://www.orthobullets.com/hand/6041/scapholunate-ligament-injury-and-disi>

**X-Rays for suspected Lunate and Peri-lunate dislocation** – on the normal lateral view of the wrist the head of the radius, the lunate and capitate are all aligned and appear as 3 “teacups” stacked on top of one another in the vertical axis



“Cups of Tea” normal alignment of the radius (yellow), lunate (red) and capitate (blue) on a lateral wrist x-ray. Source: <https://www.emcurious.com/blog-1/2015/7/8/1ftadghymctqd2flw27ao4zwl1m6tb>

**Lunate dislocation** – high energy mechanism in a young adult, best seen on lateral x-ray, Spilled teacup sign where the lunate tips anteriorly



Spilled Teacup Sign in Lunate Dislocation on lateral x-ray. Source: <https://emcow.wordpress.com/2013/03/28/lunate-dislocation/>

**Perilunate (posterior capitale) dislocation – high energy mechanism in a young adult, more accurately termed posterior dislocation of the capitale, best seen on lateral x-ray: while the alignment of the radius and lunate remain intact the capitale no longer sits in the concavity of the lunate – termed an Empty teacup sign**



Empty teacup sign of Perilunate dislocation, lateral x-ray wrist. Source: doi:10.1017/CBO9781316084328.004

**Reduction of Lunate and Perilunate dislocations: both require reduction in the ED to reduce pain and to reduce the chance of avascular necrosis of the lunate.**

1. Palpate the contralateral normal wrist for comparison and to establish a goal for reduction
2. Attain adequate muscle relaxation with sedation +/- finger traps
3. Place the wrist in the position that the injury occurred (i.e. usually a FOOSH position), stabilize the lunate on the palmar aspect of the wrist, and then flex the wrist; you should feel the lunate clunk into place.

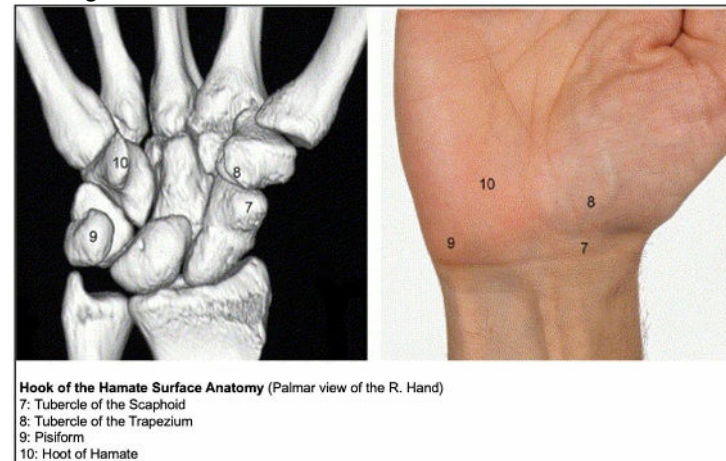
It is important to avoid multiple reduction attempts if the first attempt was not initially successful, as this can cause further injury to the wrist; if a single attempt at reduction fails, consider orthopedic consultation in the ED.

### 3. Hook of the hamate fracture – a key palmar carpal bone injury that is easy to miss

4th most common carpal bone injury comprising 2%, which if missed and not immobilized, may lead to non-union and the need for surgical intervention

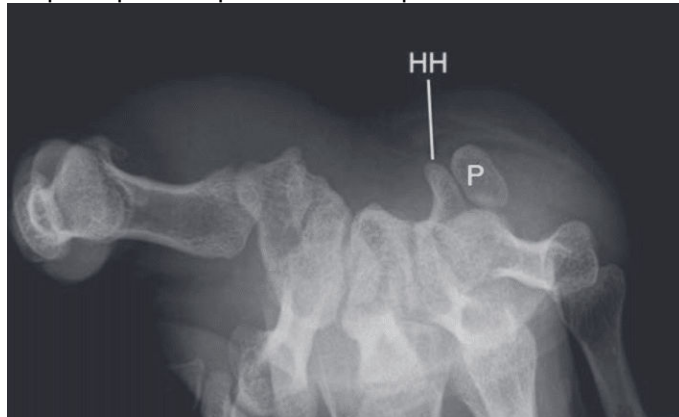
**Mechanism of injury:** classically a result of a sudden stop of a swinging elongated implement held in the hand (golf club, ski pole, tennis racket etc.) that rests against the hamate, but equally commonly results from a FOOSH, which is under-recognized

**Surface anatomy/physical exam:** 1-2 cm distal and radial to pisiform (which is at the base of the hypothenar eminence of the palm) on the radial border of the hypothenar eminence in line with the 4th finger



**Hook of Hamate Surface Anatomy.** Source: Adapted from:  
<https://doi.org/10.1016/j.cuor.2005.02.008>.

**Extra x-ray view: Hook of the Hamate or Carpal Tunnel view** is more sensitive than the standard wrist x-ray views for hook of hamate fractures but only about 50% sensitive. This view is also useful to pick up subtle pisiform and triquetrum fractures.



**Carpal Tunnel/Hook of Hamate X-Ray View.** Source:  
<https://www.sportsmedreview.com/blog/diagnosing-hook-of-hamate-fractures/>



**Method for Acquisition of Carpal Tunnel/Hook of Hamate View.** Source:  
[http://www.wikiradiography.net/page/Carpal\\_Tunnel\\_Radiography](http://www.wikiradiography.net/page/Carpal_Tunnel_Radiography)

**Pitfall:** a pitfall is assuming no fracture if clinically a hook of hamate fracture is suspected and the standard wrist views as well as the hook of hamate/carpal tunnel view are negative. The sensitivity of the hook of hamate view is only about 50% for hook of hamate fracture, so if clinically suspected, immobilize and arrange orthopedic follow-up regardless of the x-ray findings.

**Treatment of suspected or confirmed hook of the hamate fracture is immobilization and orthopedic follow up.** If missed and not immobilized, a hook of hamate fracture can lead to non-union and chronic pain and require surgical intervention.

#### **4. Scaphoid fractures – nuanced recognition and ED management of occult scaphoid fractures**

Most common carpal bone fracture – about 2/3 of all carpal bone fractures.

**Age related prevalence** – scaphoid fractures occur predominantly in young adults.

**Mechanism of injury** – high energy FOOSH.

There are **3 physical exam tests**, with some nuances in performing them, that our experts recommend for suspected scaphoid fracture. If any are positive in the patient with a consistent history, consider immobilization in a removable velcro or radial gutter splint, even if the x-rays do not show a fracture:

1. **Snuffbox tenderness** should be done with the wrist in *ulnar deviation* to bring the proximal scaphoid into the snuffbox



**Palpation of the Anatomical Snuffbox in Ulnar Deviation (Dorsal view of the R. Hand)**  
 3: Radial Styloid  
 4: Waist of the Scaphoid  
 5: Trapezium  
 6: Base of 1<sup>st</sup> Metacarpal

**Palpation of anatomical snuffbox in ulnar deviation.** Source: Adapted from: <https://doi.org/10.1016/j.cuor.2005.02.008>.

2. **Palmar scaphoid tenderness** at base of thenar eminence with the wrist in *neutral or radial deviation* to bring out the scaphoid

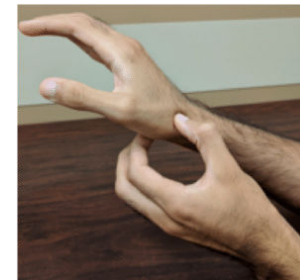


**Surface anatomy of the scaphoid on the palmar/volar wrist.** Source: <https://www.aafp.org/pubs/afp/issues/2004/0415/p1941.html>

3. **Thumb axial load tenderness** (note: false positives occur in older patients with CMC osteoarthritis)

**Two additional signs for scaphoid fractures:**

1. **Pain on resisted supination of the wrist** has been shown to have a 100% sensitivity for scaphoid fracture
2. **Clamp sign**, patient uses a pincer grasp around their scaphoid with their thumb in the snuff box and index finger over the palmar scaphoid when asked where the point of maximal pain is; high positive likelihood ratio for scaphoid fracture



**Clamp Sign Scaphoid Fracture.** Source: <https://doi.org/10.1111/acem.12317>

**Options for further imaging for suspected scaphoid fracture** after negative standard wrist x-ray views:

1. Scaphoid cone view x-ray
2. CT scaphoid

**Note:** CT may miss significant scapholunate ligament injuries and may falsely reassure clinicians to not immobilize the wrist/provide follow-up, as well as delay CT imaging for other patients in the ED with more morbid conditions.

**ED management of suspected scaphoid fracture that is occult to standard wrist x-rays according to our experts:**

1. Obtain scaphoid cone view x-ray
2. Immobilize in removable Velcro or radial gutter splint, follow up 10-14 days for re-examination +/- x-ray (only remove for bathing)

**Pitfall:** In some centers, CT wrist is done in the ED after a negative wrist x-ray for suspected scaphoid fracture. A common pitfall is assuming that there is no significant injury if the CT is negative. Scapholunate ligament injuries may be missed by CT.

**Pearl:** The most commonly missed occult fracture involving the wrist is the distal radius (not the scaphoid)