Chapter 8
Wrist

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Introduction

- Anatomic bridge from forearm to the hand.
- Assists in force transmission, helps generate and execute powerful/coordinated movements of the hand, and provides strict stabilization during performance of fine motor activities.
- Methodical approach is key to appropriately diagnosing and managing these fragile, yet often complex injuries.

Wrist (Carpal) Anatomy

- Formed by eight carpal bones, roughly arranged in two rows, with numerous ligamentous attachments that assist in maintaining stability and coordinating movement.

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- ***Bony Anatomy:***

    1. *Proximal row (radial → ulna direction):* scaphoid (spans both rows), lunate, triquetrum, and pisiform; only scaphoid and lunate articulate with the distal radius.
    2. *Distal row:* trapezium, trapezoid, capitate and hamate; these bones articulate with metacarpal bones of the hand (See Fig. 8.1).

- It is also composed of several joints:

    1. ***Distal radioulnar joint (DRUJ)****:* acts as a pivot point to generate forearm pronation/supination.

FIGURE 8.1 Carpal bones: A (scaphoid), B (lunate), C (triquetrum), D (pisiform), E (trapezium), F (trapezoid), G (capitate), H (hamate), 1 (radius), 2 (ulna). (Reprinted with permission from Dr. Jochen Lengerke. Retrieved from https://commons.wikimedia.org/wiki/File:Xray_hand_with_color.jpg)

2. ***Radio-carpal joint:*** region between radius and proximal carpal row; this articulation permits wrist flexion/extension and radial/ulnar deviation.
3. ***Midcarpal joint:*** area between the two carpal rows; considered a "functional" rather than "anatomical" unit, as it does not contain an uninterrupted ("classic") articular surface (See Fig. 8.2).

- ***Carpal Tunnel:*** fibro-osseous passageway on palmar aspect of the wrist; transmits median nerve and nine extrinsic flexor tendons to the hand. Median nerve compression can lead to paresthesias, pain, numbness, and/or weakness within its anatomic distribution (See Fig. 8.3).
- ***Guyon's Canal:*** structural space created on ulnar aspect of the wrist that transmits ulnar artery/nerve from forearm to the hand (See Fig. 8.4).

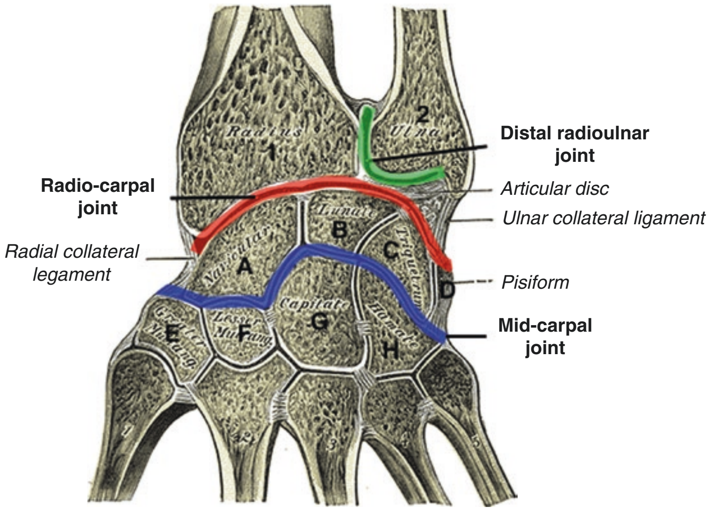

FIGURE 8.2 Joints of the wrist. (Adapted with permission from https://commons.wikimedia.org/wiki/File:Gray336.png)

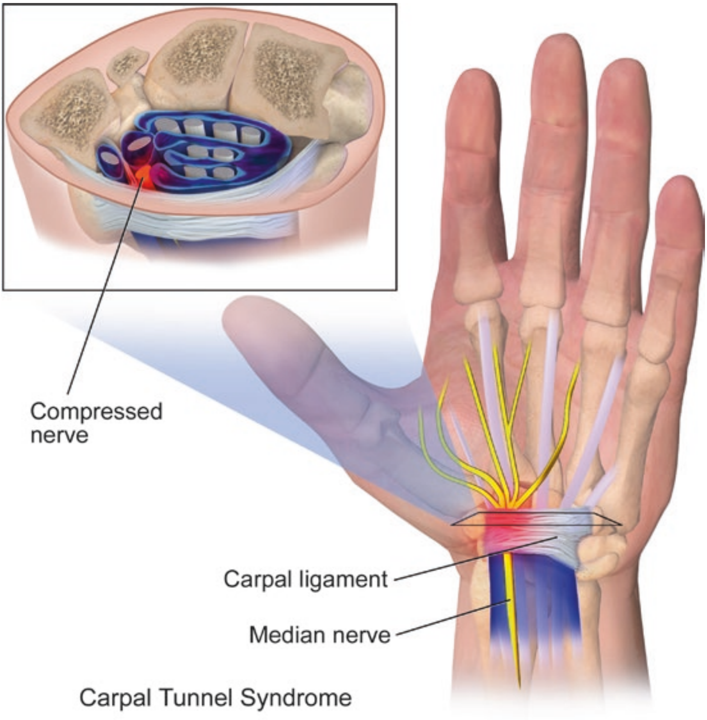

Figure 8.3 Carpal tunnel syndrome. (Reprinted from Blausen.com staff. Medical gallery of Blausen Medical 2014. WikiJournal of Medicine. 2014;1(2). doi:https://doi.org/10.15347/wjm/2014.010. ISSN 2002-4436. https://commons.wikimedia.org/wiki/File:Carpal_Tunnel_Syndrome.png. With permission from Bruce Blaus)

- ***Extensor Tendon Compartments:*** dorsal side wrist tunnels that transport extrinsic extensor tendons to their digital insertion sites; tendons held firmly in place by extensor retinaculum and travel in synovial tendon sheaths to facilitate their excursion over dorsal wrist surface.
- ***Anatomic Snuffbox:*** triangular structural deepening on the radial/dorsal aspect of the hand; contains radial artery, cephalic vein, and dorsal cutaneous branch of radial nerve

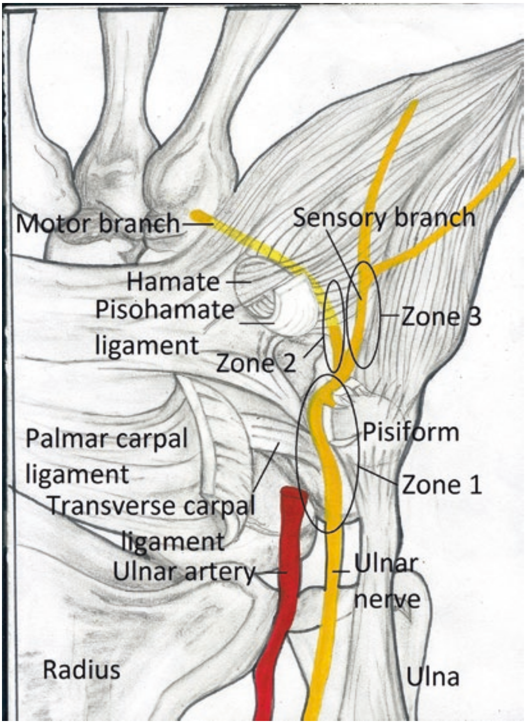

FIGURE 8.4 Guyon's canal: labeled "Zone 1" floor (transverse carpal ligament), roof (palmar carpal ligament), ulnar border (pisiform), radial border (hook of hamate). (Reprinted from http://www.ehealthstar.com/anatomy/guyons-canal. With permission from Ehealthstar.com)

(superficial radial nerve). Borders accentuated with *thumb extension*.

- ***Lister's Tubercle:*** palpable prominence on dorsal distal radius; serves as pulley for EPL tendon and reference landmark for wrist joint arthrocentesis (See Fig. 8.5a, b).
- ***Ulnar Styloid Process:*** distal ulna bony prominence that serves as attachment point for triangular fibrocartilage

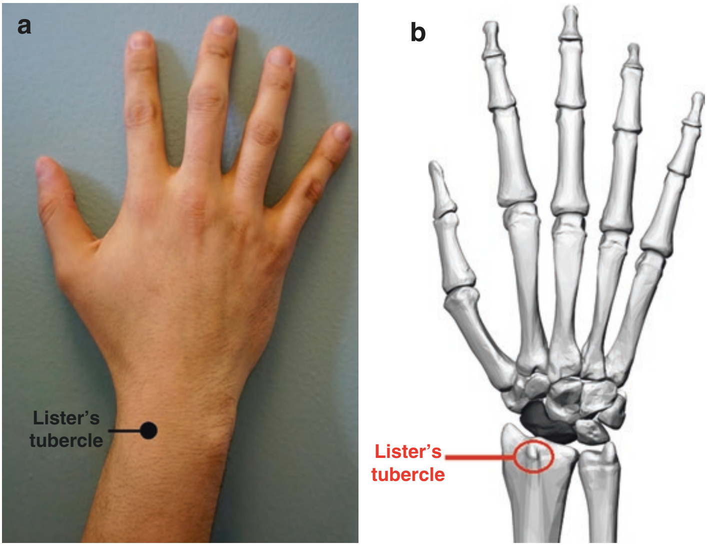

Figure 8.5 Lister's tubercle: (**a**) surface anatomy, (**b**) skeleton. (**b**: Adapted from https://commons.wikimedia.org/wiki/File:Left_hand_dorsal_view_Arabic_YM.png with permission from Creative Commons License: https://creativecommons.org/licenses/by-sa/4.0/deed.en)

complex (TFCC); disruption may signal damage to TFCC, instability of DRUJ, or concomitant distal radius injury (See Fig. 8.6).

Wrist/Hand Blood Supply:

- Contains rich vascular network supplied by radial/ulnar arteries; these vessels branch to perfuse distal digits while also coalescing to form overlapping collateral circulation through formation of two major palmar arches.

  1. ***Superficial palmar arch:*** distal to deep arch; supplied predominately by *ulnar artery*.
  2. ***Deep palmar arch:*** supplied principally by deep branch of *radial artery* (See Fig. 8.7).

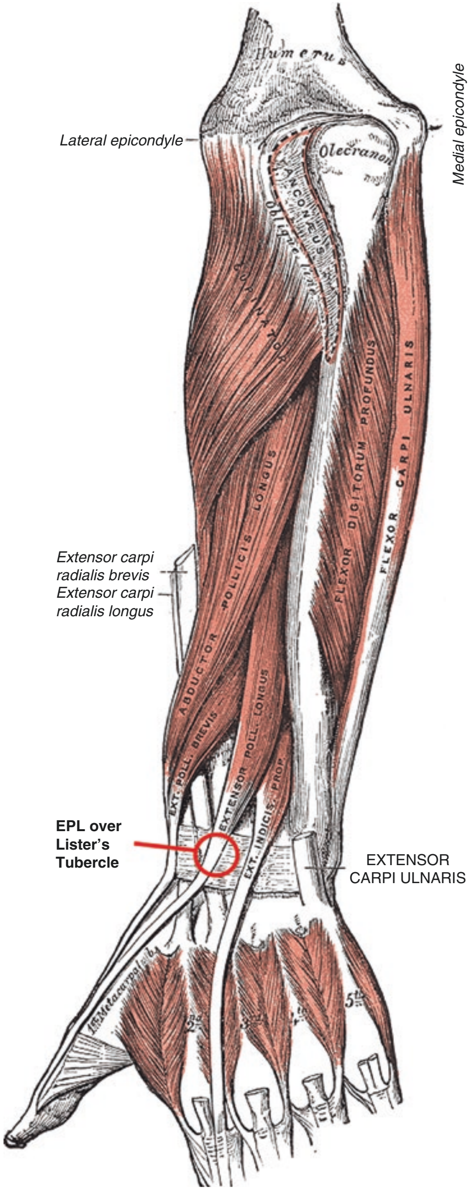

FIGURE 8.6 EPL and Lister's tubercle: anatomic relationship. (Adapted from with permission from https://commons.wikimedia.org/wiki/File:Gray419.png)

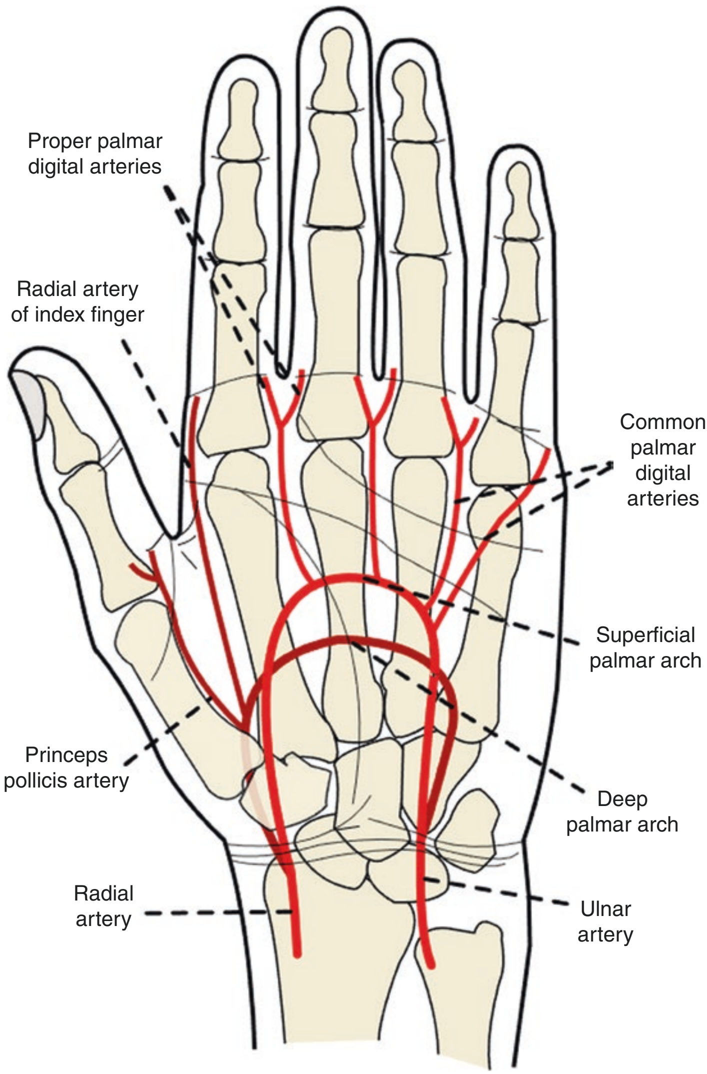

FIGURE 8.7 Blood supply of the hand. (Reprinted with permission from https://commons.wikimedia.org/wiki/File:Gray1237.svg)

Clinical Assessment

- ***History:***
  - Determine the timing/mechanism of injury, previous/associated injuries, loss of function *(neuromotor/perfusion deficits)*, position of the wrist at time of injury, activities and/or motion(s) that alleviate/exacerbate patient discomfort, previous treatment, etc.
  - Be sure to document hand dominance, employment-specific requirements, and/or recreational /professional activity needs (e.g., surgeon, musician, etc.)

- ***Physical Examination:***
  - Visual inspection-note evidence of swelling, ecchymosis, associated skin changes, and/or positional deformity.
  - Measure passive/active ROM (compare with contralateral wrist).
  - Palpate bony prominences (Lister's tubercle, scaphoid tubercle, ulnar styloid, etc.) and any areas of communicated patient discomfort.
  - Assess overall appearance, temperature alterations/differences in handedness, pulse strength, digital capillary refill, and consider systemic disease that may affect healing and/or contribute to future potential complications (e.g., DM, peripheral vascular disease, etc.).
  - Evaluate potential neuromotor deficits and record results of overall strength, functional capacity, and neurologic assessment.

- ***Plain Radiographic Examination:*** (See Fig. 8.8a–c)

  A. ***Carpal bone alignment:*** standard joint spacing is suggested when carpal bones are visualized in parallel when examined in profile; physical overlap can be suggestive of abnormal tilting, dislocation, and/or carpal fracture.

FIGURE 8.8 Hand X-ray: (**a**) PA, (**b**) lateral, (**c**) oblique A–C. (Used with permission from http://www.wikiradiography.net/page/Hand+Radiographic+Anatomy)

FIGURE 8.8 (continued)

c

FIGURE 8.8 (continued)

B. ***Carpal (Gilula) arcs:*** three smooth, continuous arcs should be identified on PA view.

I. ***First arc:*** outlines proximal surfaces of the scaphoid, lunate, and triquetrum.

II. ***Second arc:*** traces their distal surfaces.

III. ***Third arc:*** follows proximal curvatures of the capitate and hamate (See Fig. 8.9).

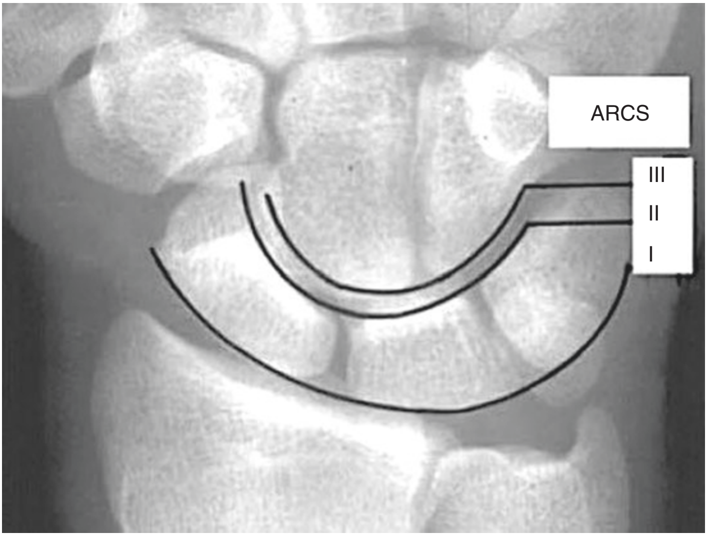

FIGURE 8.9 Carpal arcs. (Reprinted from http://www.radiologyassistant.nl/en/p42a29ec06b9e8/wrist-carpal-instability.html. With permission from Robin Smithuis)

****An arc is disrupted if it cannot be traced smoothly and continuously; disruption is generally indicative of ligamentous tear and/or fracture.*****

1. ***First arc:*** radio-carpal row; disruption is suggestive of *lunate dislocation*.
2. ***Second arc:*** mid-carpal row; disruption is suggestive of *peri-lunate dislocation*.
3. ***Third arc:*** outlines proximal surface of distal carpal row.

Selected Individual Bones

A. ***Scaphoid (navicular):*** second largest carpal bone; *most commonly fractured carpal bone*.

- ***Shape:*** changes with wrist movement; lengthens in extension/ulnar deviation, yet shortens with flexion/

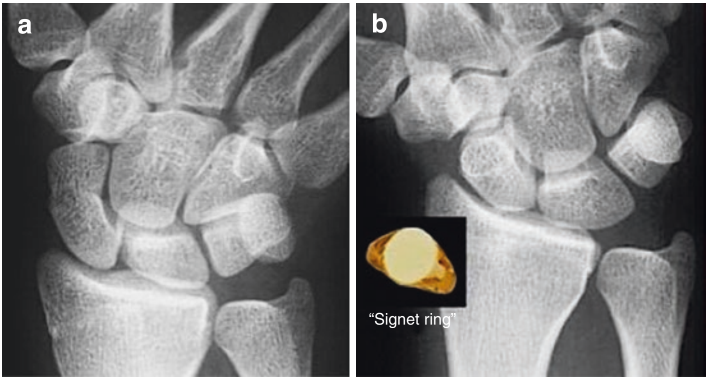

Figure 8.10 Scaphoid: (**a**) extension/ulnar deviation, (**b**) flexion/radial deviation ("signet ring" sign). (Reprinted from http://www.radiologyassistant.nl/en/p42a29ec06b9e8/wrist-carpal-instability.html. With permission from Robin Smithuis)

radial deviation, displaying a "signet ring" cortical appearance (See Fig. 8.10)

- Contains three anatomic regions: proximal pole, distal pole (tubercle), and the waist (mid-portion that separates the two poles)
- Functions as link across the mid-carpal joint, providing functional continuity between the proximal and distal carpal rows
- Approximately 80% of its surface is covered in cartilage, leaving only a small area for arterial blood supply; this reduces its capacity for periosteal healing and leads to an increased risk of delayed, malunion, and/or nonunion.

- ***Blood Supply:***

1. ***Dorsal carpal branch of radial artery:*** provides ~ 70–80% of vascular supply, entering slightly distal to scaphoid waist at the dorsal ridge; provides perfusion to proximal aspect of scaphoid in retrograde fashion

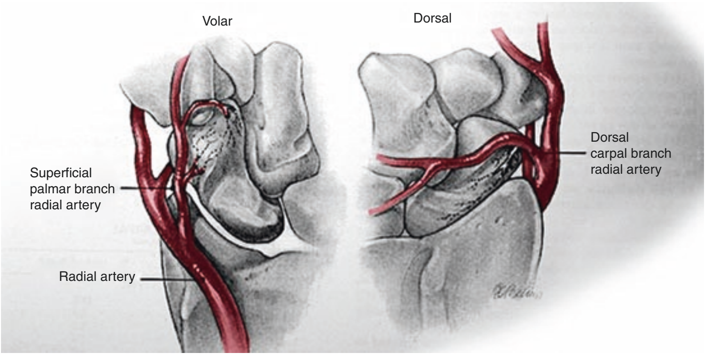

FIGURE 8.11 Blood supply of scaphoid: Majority of perfusion occurs in retrograde fashion in a distal to proximal direction. More proximal fractures thus have higher rates of nonunion due to a diminished blood supply. (Reprinted from http://morphopedics.wikidot.com/scaphoid-fractures with permission from Creative Commons License: https://creativecommons.org/licenses/by-sa/3.0/)

2. ***Palmar and superficial palmar branches (scaphoid branches):*** enter at distal tubercle and accounts for remaining vascular supply *(none of which reaches the proximal pole)* (See Fig. 8.11).
   Generally accepted that with proper treatment (immobilization), nearly 100% of tuberosity/distal third fractures and 80–90% of waist fractures will heal uneventfully; however, it has been reported that only 60–70% of proximal pole fractures heal free of complication(s).

- ***Injury Mechanism:*** Similar to distal radius fractures, a fall on an outstretched hand (FOOSH injury) transmits a large hyperextension force across the wrist joint; *however*, unlike distal radius fractures, scaphoid fractures are more common among young men, with a peak incidence in the second and third decades.

A. Extreme ***hyperextension*** locks scaphoid into the distal radial scaphoid fossa, with the capitate acting as a fulcrum for fracture generation.
B. **"Punch"** ***mechanism:*** involved metacarpal delivers a palmar-directed shear force across distal scaphoid.

- Kinematic effect(s) of an "unstable" scaphoid fracture essentially describes a loss of functional continuity between the carpal rows.

- ***Clinical Evaluation/Treatment:*** (See Figs. 8.12 and 8.13)

  – Anatomic snuffbox tenderness, described as "classic" physical finding, may be "overly sensitive" with false-positive results elicited through compression of superficial radial nerve; tenderness at the scaphoid tubercle is also quite limited in detecting scaphoid fractures when implemented in isolation.
  – ***Compression test:*** involves loading scaphoid via axial compression of the thumb along the line of the first metacarpal (See Fig. 8.13).
  – Preceding provocative maneuvers, along with "scaphoid series," should minimize possibility of missing an acute scaphoid fracture.
  *****Never Rely on Imaging Alone*****
  – Estimated as much as 30% of all scaphoid fractures might not be detected on initial X-rays *(even with perfect radiographic technique and an experienced physician interpreting the films).*
  *****Cortical disruption may not be radiographically evident in acute injury period*****
  *****Any clinical suggestion of fracture, despite negative imaging analysis, should prompt immobilization in thumb spica splint/cast*****
  *****If left untreated, there is a heightened risk of nonunion/AVN and associated future potential complications*****

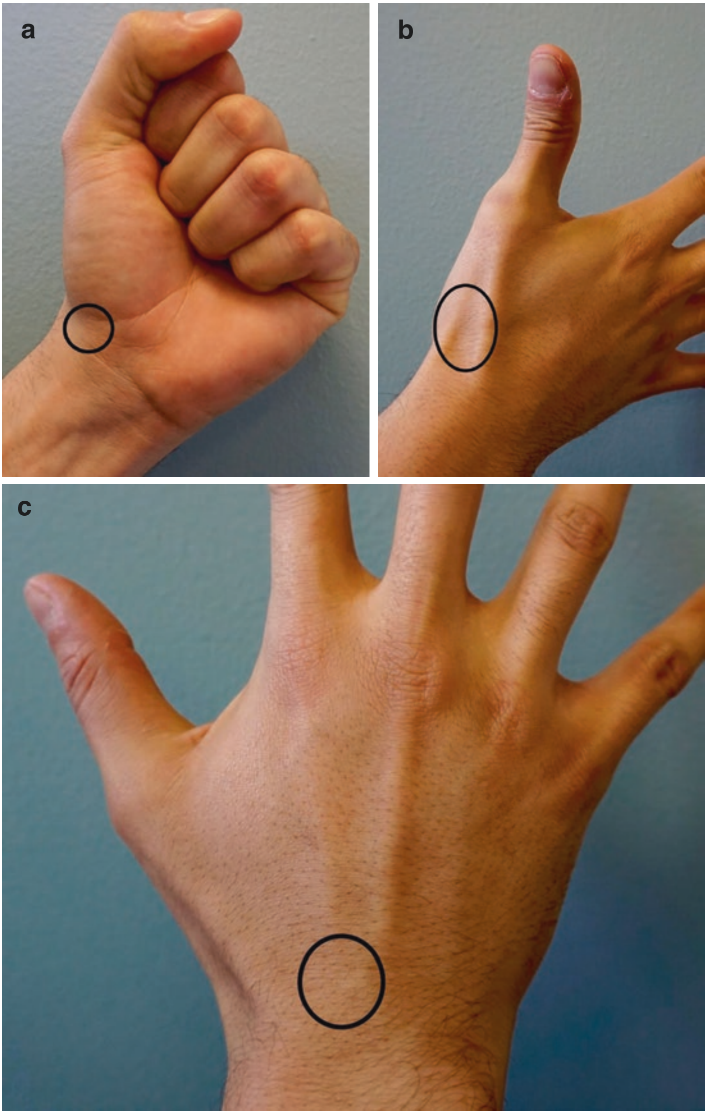

FIGURE 8.12 Locations to palpate scaphoid: (**a**) tubercle, (**b**) anatomical snuff box, (**c**) proximal pole

FIGURE 8.13 Scaphoid compression test: axial compression of the scaphoid

- Based upon its high sensitivity/specificity, *MRI* is considered "gold standard" in diagnosis of occult scaphoid fractures; however, in many instances, MRI is neither practical nor available. Thus, adequate clinical follow-up and repeat imaging should lead to detection.
- Average time for healing of non-displaced scaphoid fracture treated with immobilization, free of complication(s), is ~8 to 12 weeks.
- Common post-traumatic complications include pain, arthritic degeneration, functional deficits, delayed union, malunion, and/or nonunion.

- ***Preiser's disease (scaphoid osteonecrosis):*** development of osteonecrosis (AVN) of scaphoid with no previous history of substantial trauma; etiology secondary to repetitive microtrauma and/or side effects of medications (e.g., steroids/chemotherapy) in conjunction with existing defective vascular perfusion; most commonly involves proximal pole.

B. ***Lunate:***

- "Keystone" of proximal carpal row, yet ***most commonly dislocated carpal bone.***
- Isolated injuries are rare and often overlooked on routine imaging secondary to superimposed structures. Slightly oblique X-ray imaging may better delineate suspected fractures, or CT should be considered.
- ***Shape:*** normally appears trapezoidal; if becomes tilted, can appear triangular ("piece-of-pie" sign), which may indicate ligamentous injury and/or potential dislocation (See Fig. 8.14a, b).
- ***Lunate dislocation:*** radio-lunate articulation disrupted, as the residual carpus remains stable.
- ***Peri-lunate dislocation:*** radio-lunate articulation is maintained, while the remaining carpus becomes displaced.
- *****Lunate dislocation:*** **can mimic** ***peri-lunate dislocation,*** **especially on PA projection –> lateral imaging is** ***key*** **to make this distinction.**** (See Figs. 8.15a, b and 8.16)

    A. ***Lunate Dislocation:*** *Lunate tilted out, while capitate and residual carpus remains centered over radius.*
    B. ***Peri-lunate Dislocation:*** *Lunate remains centered over distal radius, while capitate and remaining carpus are displaced.*

FIGURE 8.14 Lunate dislocation: PA clenched fist view; note the pie-shaped lunate and loss of parallelism. (Reprinted from http://www.radiologyassistant.nl/en/p42a29ec06b9e8/wrist-carpal-instability.html. With permission from Robin Smithuis)

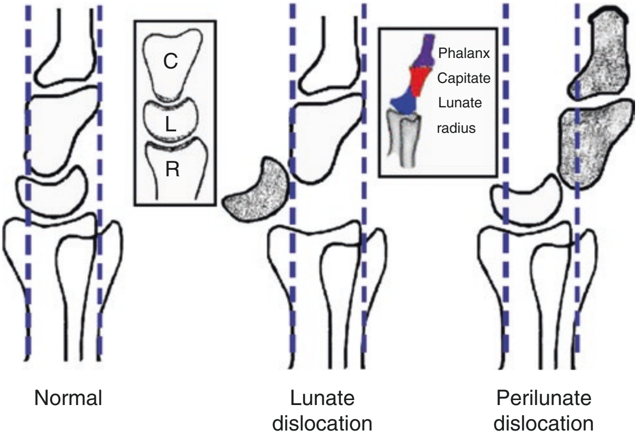

FIGURE 8.15 Wrist and carpal alignment: note aligned axis of distal radius, lunate, and capitate. (Image reprinted with permission from Medscape Drugs & Diseases (http://emedicine.medscape.com/), 2017, available at: http://emedicine.medscape.com/article/397035-overview)

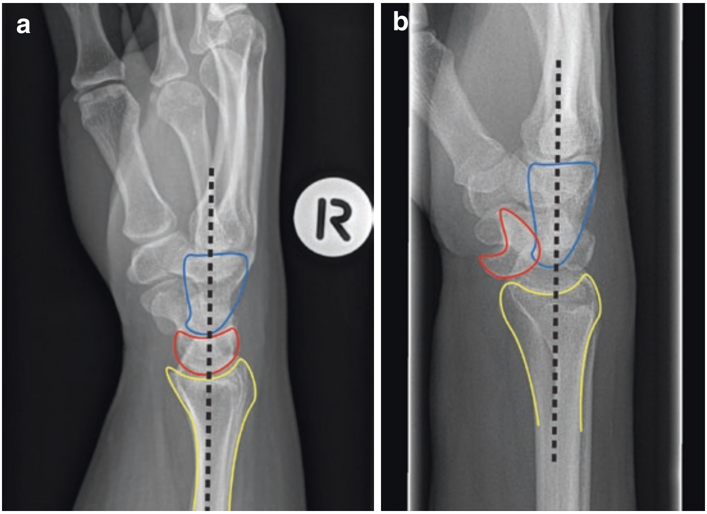

FIGURE 8.16 Lateral wrist X-ray: (**a**) normal alignment (yellow, radius; red, lunate; blue, capitate), (**b**) lunate dislocation – note the "spilled teacup" sign of the lunate. (Reprinted from http://www.emcurious.com/blog-1/2015/7/8/1ftadghymctqd2flw27ao4zwl1m6tb with permission from Creative Commons License: https://creativecommons.org/licenses/by/4.0/)

****Imaging Clues to Lunate Dislocation:***

1. PA: break in Gilula's arc (smooth contour), lunate/capitate overlap, and/or lunate appears triangular ("piece-of-pie" sign).
2. Lateral: loss of colinearity of radius, lunate and capitate ("spilled teacup" sign); capitate not positioned within distal articular cup of lunate.

****Imaging Clues to Peri-lunate Dislocation:***

A. ***PA View:*** disruption of expected smooth carpal arcs. Can also see "piece-of-pie" sign.
B. ***Lateral View:*** *usually* demonstrates dorsal perilunate dislocation *(lunate maintains normal relationship to distal radius, while capitate and remaining carpus are displaced dorsally)* (See Fig. 8.17a–c).

FIGURE 8.17 Peri-lunate dislocation X-ray: Lunate (yellow) remains centered over radius while capitate (blue) dislocates dorsally – scaphoid (red). (Used with permission from http://www.wikiradiography.net/page/Lunate+and+Perilunate+Dislocations)

- ***Injury mechanism:*** axial loading of the wrist in hyperextended/ulnar-deviated position.
- Dislocation can occur through greater arc (bone), lesser arc (ligaments), and/or combination of both.
- ***Sequence of injury:*** usually begins radially, with destabilization through body of scaphoid (fracture) and/or

through scapho-lunate interval (pure dislocation); *scaphoid bridges proximal and distal carpal rows; thus with dislocation between rows, the scaphoid must either rotate and/or fracture.*

Definitive Treatment Options

- ***Closed reduction and splinting/casting:*** despite initial success, usually generates poor long-term outcomes, with many patients experiencing functional deficit and/or recurrent dislocation.
- ***Closed reduction and percutaneous pin fixation.***
- ***Open reduction*** with ligamentous repair and/or percutaneous pin fixation.

  ****CLOSED REDUCTION TECHNIQUE****
- Place upper extremity in longitudinal traction, with the elbow at 90 degrees of flexion for ~10–15 min.
- Add 5–10 lbs of additional traction if possible to heighten distraction forces.
- **Dorsal peri-lunate dislocations are reduced through application of volar pressure to the carpus, with a counter-force applied to the lunate.**
- Palmar flexion then allows for reduction of the capitate into the concavity of the lunate (See Fig. 8.18).

  ****If closed reduction is achieved/verified, interim operative intervention is still generally necessary to achieve enduring carpal stabilization.****

  ****If closed reduction cannot be obtained, the patient should be taken promptly to the OR for open reduction.****
- Damage to ***median nerve*** is the most common associated injury; however, the associated *skin* can also become ischemic from the impinging radius/carpus.
- ***Fractures:*** typically follow hyperextension injury (FOOSH mechanism). Avulsions of dorsal pole are common in scapho-lunate dissociations (SLD), while fractures of ulnar aspect of palmar pole are associated with peri-lunate dislocations.

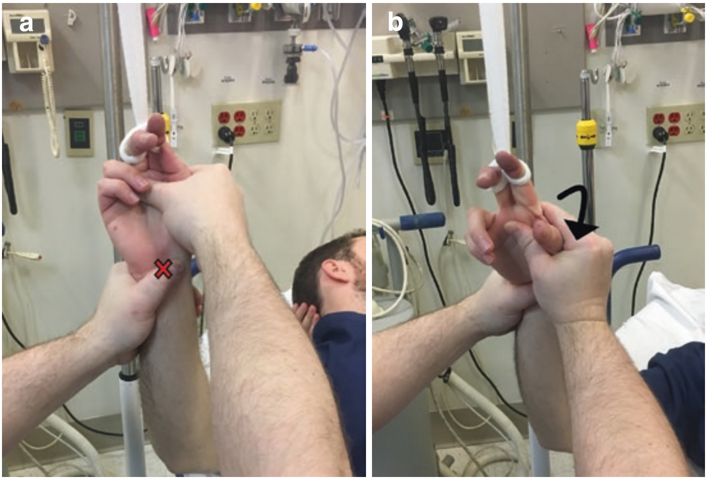

FIGURE 8.18 Lunate reduction: (**a**) The wrist is extended with the thumb placed over the proximal palmar lunate "X" to maintain concavity-up alignment, while the remaining fingers provide an opposing force to the residual carpus. (**b**) While maintaining manual longitudinal traction and applying pressure to palmar lunate, gradually flex the wrist to reduce the capito-lunate joint (arrow)

Treatment/Outcome:

- Most lunate fractures can be treated conservatively with immobilization. However, all fractures require serial imaging, ideally consisting of advanced imaging (MRI) to more definitively assess healing/revascularization, as there is a high incidence of nonunion, osteonecrosis, and potential for carpal collapse
- ***Kienbock's disease: (avascular necrosis lunate)*** probably no single cause – its origin may involve multiple factors (blood supply (arteries), blood drainage (veins), skeletal variations, and/or acute or repetitive trauma).

C. ***Triquetrum:*** located on medial side wrist, just distal to TFCC; articulates with lunate through luno-triquetral ligament (See Figs. 8.19 and 8.20a, b)

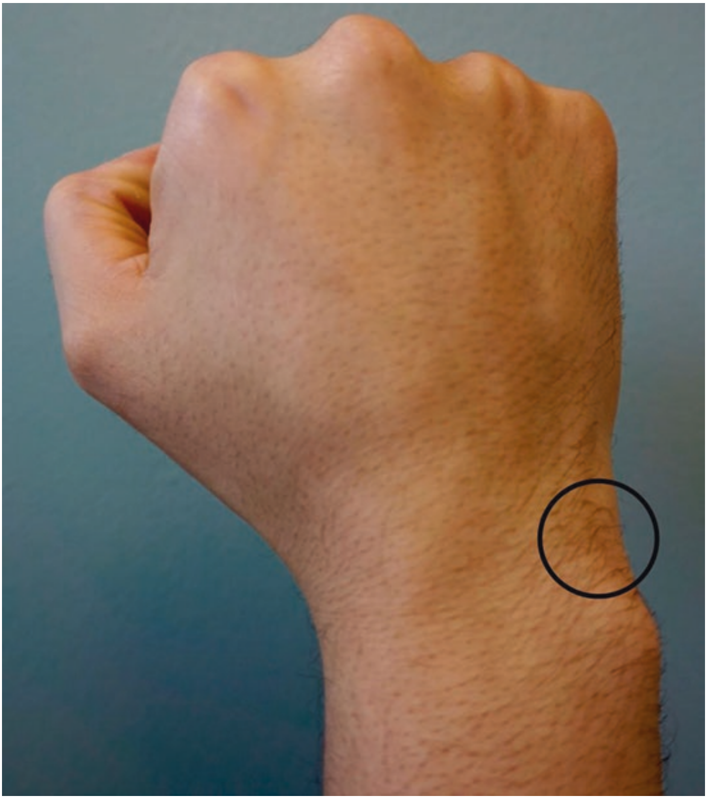

FIGURE 8.19 Triquetrum: just distal to ulnar styloid

- ***Fractures:*** most common mechanism of injury involves an impingement shear-type fracture, with the ulnar styloid contacting the dorsal aspect of the triquetrum with the wrist in extension and ulnar deviation.
- Physical examination generally reveals localized tenderness over dorsum of the wrist, just distal to the ulnar styloid.
- Frequently, only seen as ***dorsal chip*** fracture on the lateral projection, as the pisiform generally obscures the triquetrum on the frontal view (See Fig. 8.21a, b).

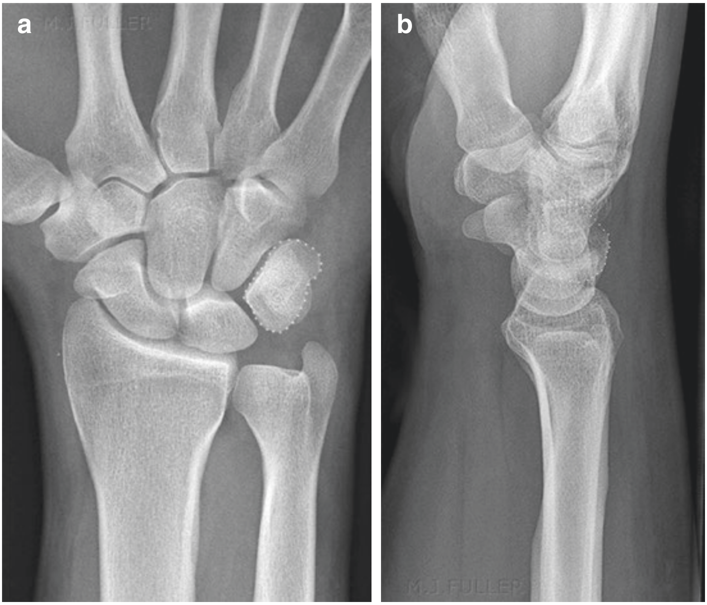

FIGURE 8.20 Triquetrum X-ray: (**a**) PA view, (**b**) lateral view. (**a**, **b**: Used with permission from http://www.wikiradiography.net/page/Triquetral+Fractures)

Treatment/outcome: generally depends upon location and amount of fracture displacement.

- Non-displaced/dorsal chip fractures *(non-articular injuries)* can usually be treated conservatively with immobilization (ulnar gutter splint/cast or volar splint).
- Rarely, more displaced fractures (>1 mm) or injuries that remain symptomatic despite significant healing time may ultimately require fragment excision.
- Triquetrium has abundant vascular supply, thus delayed/nonunion exceptionally rare.

D. ***Pisiform:*** sesamoid bone contained within the flexor carpi ulnaris (FCU) tendon; increases the moment arm (torque force) of the FCU muscle at its tendon traverses over the pisiform surface.

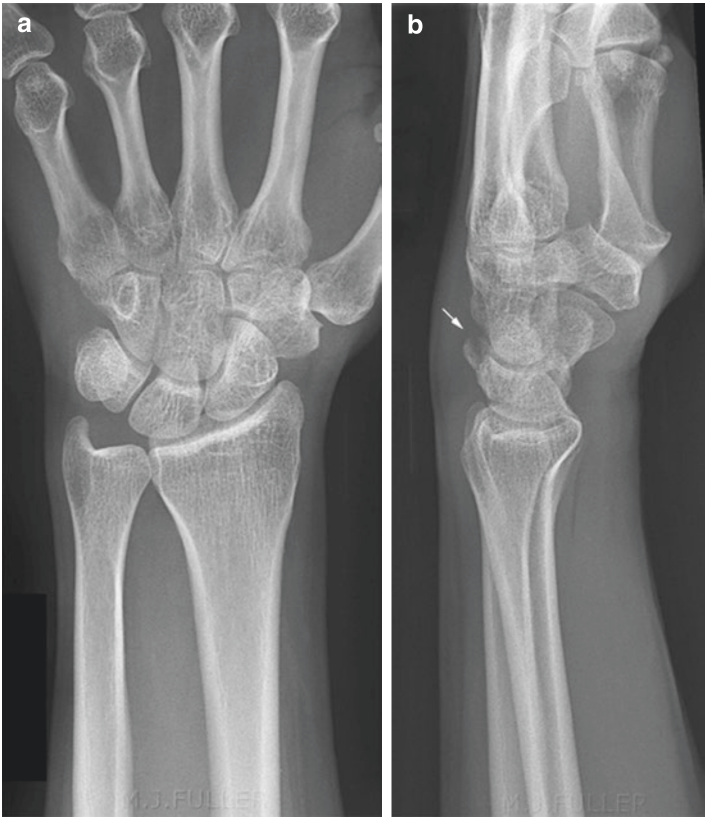

FIGURE 8.21 Triquetral fracture X-ray: (**a**) PA view, (**b**) lateral view, arrow points to pathognomonic dorsal chip fracture. (**a**, **b**: Used with permission from http://www.wikiradiography.net/page/Triquetral+Fractures)

- Delineates ulnar border of Guyon's canal, thus injuries to pisiform can also involve concomitant damage to ulnar nerve (See Fig. 8.22).
- ***Fractures:*** most sports-related, but injury may also occur following FOOSH mechanism. Diagnosis: can be difficult and they are easily missed upon initial examination.

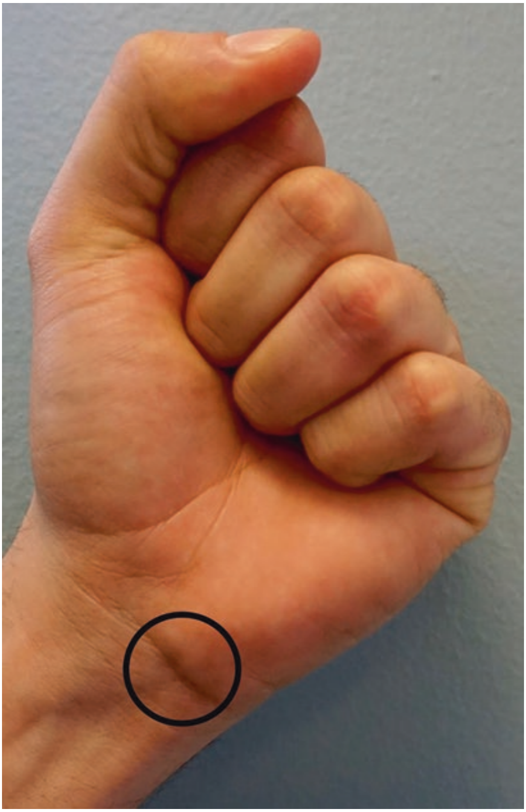

FIGURE 8.22 Pisiform

- Detection may require special imaging views such as an ~20–45° oblique image (wrist in radial deviation/mild supination) or "carpal tunnel" view (See Fig. 8.23a, b).
- *CT may also be required for diagnosis of occult fractures.*

Treatment/outcome: Most fractures heal with conservative measures, and patients are often treated with splint/cast immobilization.

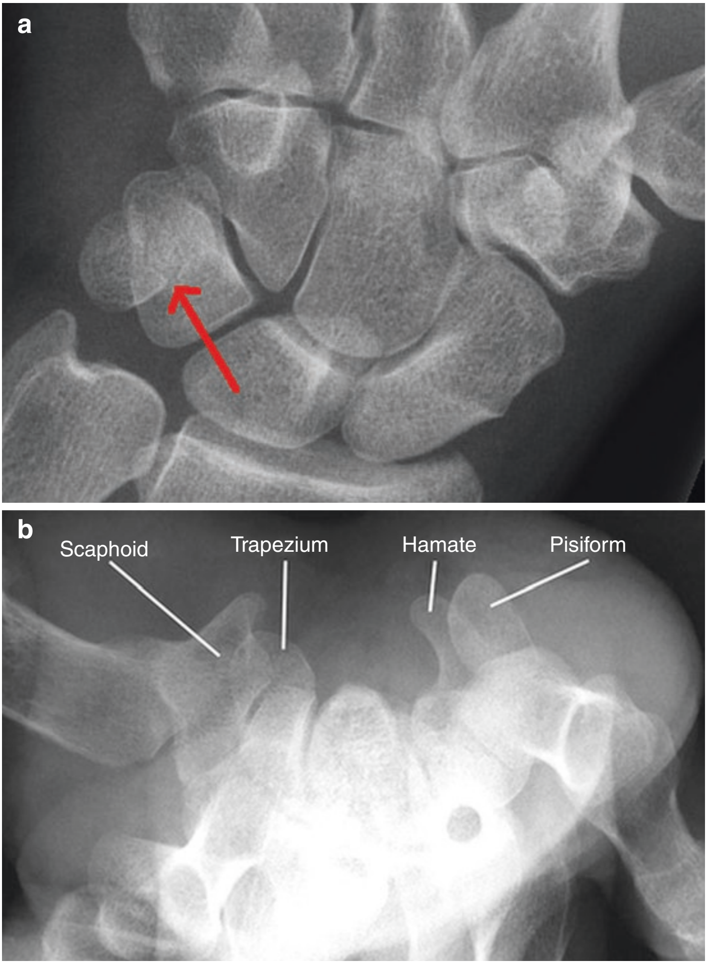

Figure 8.23 Pisiform X-ray: (**a**) oblique view showing fracture (arrow), (**b**) carpal tunnel view (no fracture). (**a**: Used with permission from Northwestern University, Feinberg School of Medicine, Department of Emergency Medicine. **b**: Reprinted from Watanabe A, Souza F, Vezeridis PS, et al. Ulnar-sided wrist pain. II. Clinical imaging and treatment. Skeletal Radiol. 2010;39(9):837–857. With permission from Springer Nature)

- However, some patients will continue to experience chronic discomfort despite adequate healing time. This occurs secondary to accelerated degenerative changes and may eventually require surgical excision *(usually associated with minor loss of grip strength)*.

E. ***Hamate:***

- Roughly triangular-shaped bone composed of both a body and "hook-like" process projecting from its volar surface; situated in distal carpal row, at extreme ulnar border of wrist.
- The "hook" serves as distal, lateral border of Guyon's canal; thus injury may signal potential ulnar artery and/or nerve involvement (See Fig. 8.24).
- ***Fractures:*** overall quite rare, with the body much less commonly injured than its accompanying "hook" (may require oblique images to demonstrate pathology).
- Physical examination findings are generally nonspecific and quite often absent. If symptoms are present, evaluation typically reveals discrete point tenderness over "hook," diminished grip strength, and/or paresthesias in ulnar nerve distribution.
- Two mechanisms that account for most "hook" fractures:
  - Repetitive microtrauma during sports activities (e.g., swinging clubs, bats, or racquets). Eventually leads to stress fracture development and often occurs in nondominant hand.
  - Direct trauma during sport-specific activities, whereby equipment rests directly on hamate, with force directly transmitted to the bone.
- Fracture of the "hook" most commonly occurs at or near its base.

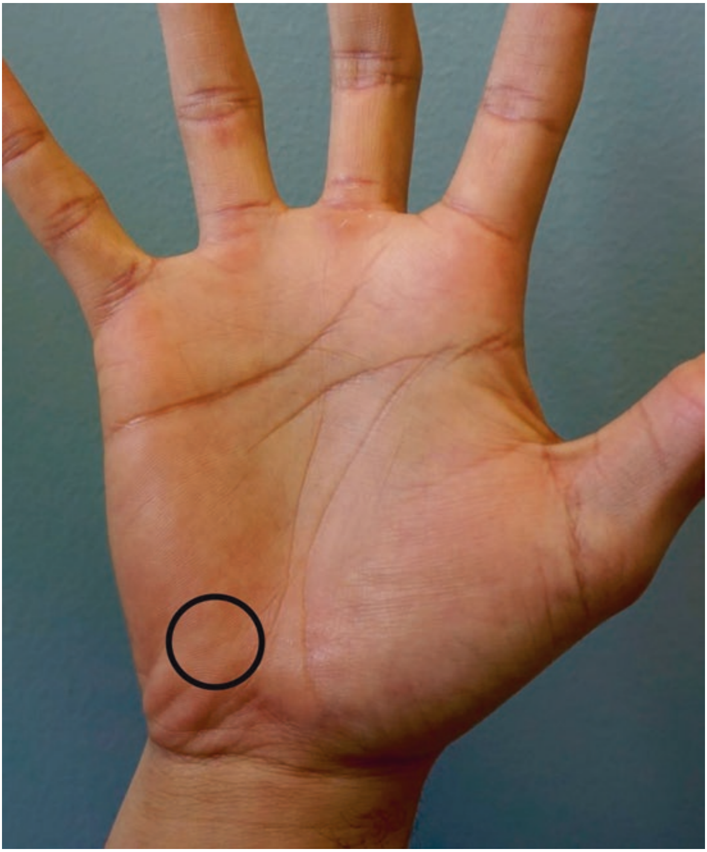

FIGURE 8.24 Hamate

- Similar to pisiform fractures, a *carpal tunnel view/CT may be necessary* to diagnose injury, with excision reserved for prolonged symptomatic injuries *(painful nonunion)*.
- Treatment involves immobilization if discovered early, yet many injuries are initially overlooked; this leads to

decreased healing potential based upon multifactorial contribution (fragment displacement, poor vascular supply, etc.).

- ***Pearls:***

A. ***Scapho-lunate (SL) dissociation ("Terry Thomas" sign):*** most common traumatic etiology of carpal instability; can occur in isolation or with wrist fractures.

   - Both the direction of traumatic force and the relatively weaker dorsal ligaments contribute to dorsal carpal displacement (FOOSH mechanism) (See Fig. 8.25).

Treatment:

1. ***Acute Tears:*** patients with partial tears and no evidence of carpal instability may be treated conservatively with splint/cast immobilization; this is ineffective when carpal instability is present, as they require opposite directions of movement to maintain reduction (scaphoid requires wrist extension, while lunate requires wrist flexion).
2. ***Chronic Tears:*** usually requires surgical intervention for symptomatic cases; degenerative soft tissue supporting structures are not commonly amenable to direct repair methods.

   - Without treatment, can lead to advanced SL collapse (SLAC wrist) and/or progressive, painful wrist arthritis.
   - Clenched fist view in ulnar deviation most effectively expands SL joint space, placing maximum stress on SL ligament; positive intercarpal widening is commonly referred to as "Terry Thomas" sign (>2 mm widening).

B. ***DRUJ instability:*** common cause of pain and limited ROM following distal radius fractures.

FIGURE 8.25 Scapho-lunate dissociation (arrow). (Used with permission from: http://www.wikiradiography.net/page/The+Terry-Thomas+Sign)

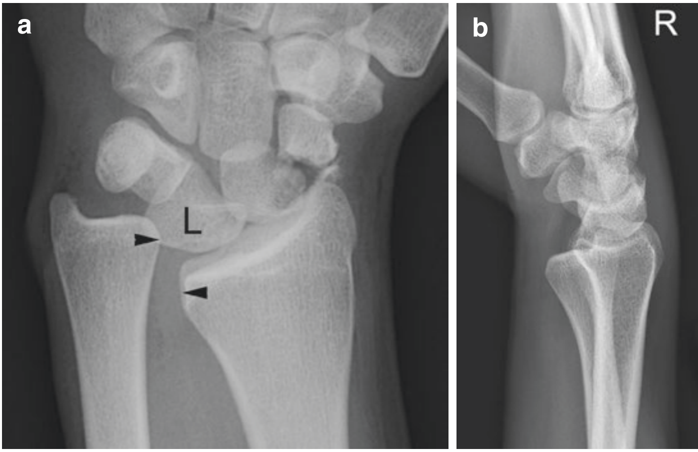

FIGURE 8.26 DRUJ injury: (**a**) PA view: distal radio-ulnar joint widening (arrowheads), (**b**) Lateral view: volar displacement of the distal ulna demonstrates subluxation of the DRUJ A. (Image reprinted with permission from Claire K Sandstrom, MD, University of Washington Medical Center and Harborview Medical Center, published by Medscape Drugs & Diseases (http://emedicine.medscape.com/), 2017, available at: http://emedicine.medscape.com/article/389069-overview; **b**: Used with permission from http://www.wikiradiography.net/page/Subluxation+of+the+distal+radioulnar+joint)

- Encountered as component of Galeazzi fractures, ulnar styloid fractures, TFCC injuries, and ulnar impaction syndrome (See Fig. 8.26a, b).
- Clinical findings suggestive of DRUJ instability:
  - Pain with pronation/supination of forearm (holding the wrist, not the hand).
  - Pain with lateral compression of radius against the ulna.
- **"Piano-key" test:** fully pronate hand and stabilize distal radius; apply an anterior-posterior force on the ulna with the other hand. If the ulna displaces with little

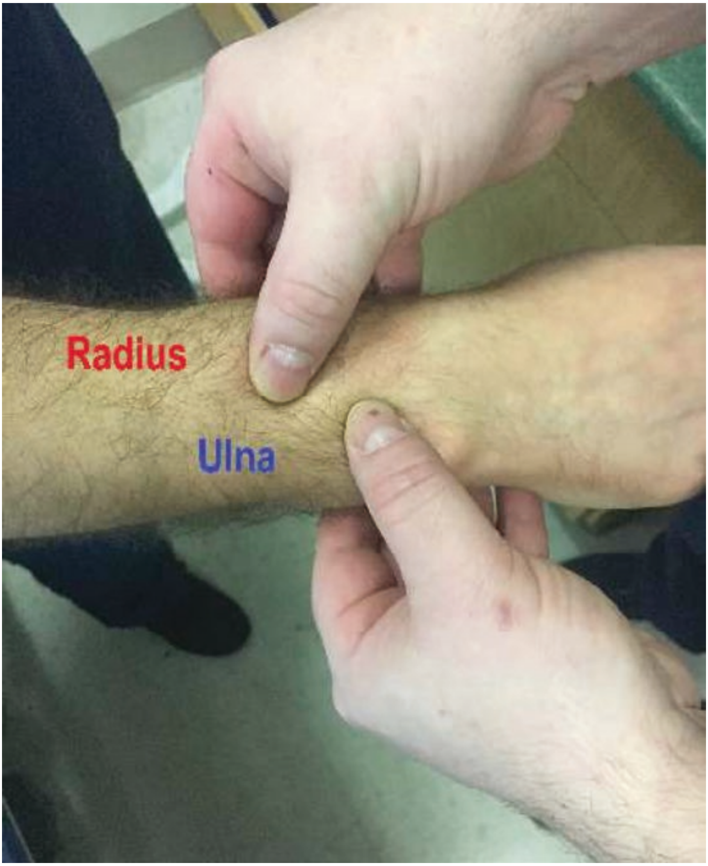

FIGURE 8.27 "Piano-key" test: stabilize the distal radius and apply an anterior-posterior force to the distal ulna

resistance ("like pressing a piano key"), DRUJ instability is present (See Fig. 8.27).

- ***Treatment/prognosis:*** primary method to prevent chronic disability is anatomic reduction of distal radius, which often results in an "anatomically reduced" DRUJ.

Suggested Reading

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