

Proximal Row Carpectomy

Overview

- At long-term followup, all patients older than thirty-five years of age at the time of proximal row carpectomy maintained a satisfactory range of motion, grip strength, and pain relief and were satisfied with the result [1].
- Proximal row carpectomy with interposition arthroplasty is an effective motion-sparing procedure for patients with proximal capitate and/or lunate fossa arthritis, improving pain and function [6].
- Short- to mid-term outcomes in patients with end-stage wrist arthritis affecting the capitate who undergo proximal row carpectomy and meniscus interposition arthroplasty are comparable with those receiving proximal row carpectomy alone [7].

Anatomy & Pathophysiology

BONY ANATOMY

- The wrist includes the distal radioulnar, radiocarpal, and ulnocarpal joints and the eight carpal bones and their proximal and distal articulations and attached ligaments [23].
- The proximal row of carpal bones consists of the scaphoid, lunate, triquetrum, and pisiform [23].
- The distal row of carpal bones consists of the trapezium, trapezoid, capitate, and hamate [23].
- The capitate is the largest carpal bone [23].
- The pisiform and trapezoid are the smallest carpal bones [23].
- The capitate articulates with seven other bones [23].
- The pisiform articulates with one other bone, the triquetrum [23].
- The radiocarpal joints are formed by the articulation of the distal radius with the scaphoid and lunate through their respective concave facets on the distal radius and the triquetrum on the triangular fibrocartilage [23].
- The distal concave articular surfaces of the proximal carpal row form the midcarpal articulations with the distal row [23].

- The distal radius has three articular components: the scaphoid fossa, the lunate fossa, and the sigmoid notch [27].
- The scaphoid and lunate fossae allow articulation with the scaphoid and lunate bones, respectively [27].
- The sigmoid notch allows articulation with the ulna medially [27].
- A ridge between the scaphoid and lunate fossa corresponds with the scapholunate interval [27].
- The concave elliptical distal radius is oriented in the sagittal plane with an average of 11 degrees of volar tilt [27].
- In the frontal plane, the average radial inclination of the distal radius is 23 degrees [27].
- Radial length, measured from the tip of the radial styloid to the ulnar articular surface, averages 13 mm [27].
- The distal ulnar convexity articulates at the lesser sigmoid notch of the distal radius [23].
- The sigmoid notch articular surface accommodates the ulnar head through two thirds of its arc [23].
- There is about a 20-degree inclination of the distal ulna at its articulation with the radius [23].

LIGAMENTS

- Extrinsic carpal ligaments connect the radius or the ulna to the carpus [28].
- In general, volar ligaments are stronger than dorsal ligaments [28].
- The radioscaphocapitate ligament connects to the waist of the scaphoid, around which the scaphoid rotates, and limits ulnar translation of the carpus [28].
- The long radiolunate ligament helps to limit ulnar translocation of the carpus [28].
- The short radiolunate ligament helps control lunate position [28].
- The radioscapholunate ligament is a vascular conduit, not a true ligament, also known as the ligament of Testut [28].
- The ulnocapitate ligament attaches to the ulnar head and originates from the volar margin of the ulnar fovea [28].
- The ulnocapitate ligament is the most superficial or palmar of the palmar ulnocarpal ligaments [28].
- The dorsal radiocarpal ligament has a trapezoidal shape and passes from the dorsal rim of the distal radius to the lunate and the triquetrum [28].
- Fibers of the dorsal radiocarpal ligament insert onto the dorsal lunotriquetral interosseous ligament [28].
- The scapholunate interosseous ligament is a major stabilizer of the wrist and the most commonly injured wrist ligament [28].
- The scapholunate interosseous ligament is C-shaped, consisting of dorsal, palmar, and interosseous portions, with the dorsal portion being the strongest and thickest [28].
- The scapholunate interosseous ligament provides a flexion force on the lunate given its attachment to the scaphoid [28].

- The lunotriquetral interosseous ligament is C-shaped, where the volar portion is the thickest and strongest [28].
- The lunotriquetral interosseous ligament provides an extension moment on the lunate given its attachment to the triquetrum [28].
- The capitolunate ligament is a thick ligament, 5 × 5 mm in cross section, with extensions to the third or fourth metacarpals [28].
- The dorsal intercarpal ligament passes from the dorsal tubercle of the triquetrum to the distal pole of the scaphoid [28].
- The dorsal intercarpal ligament reinforces the elastic dorsal wrist capsule and helps stabilize the scapholunate articulation with a contribution to the dorsal scapholunate interosseous ligament from its deep fibers [28].
- The space of Poirier is an area adjacent to the proximal capitate without ligamentous attachment, situated ulnar to the radioscapohamate ligament and radial to the long radiolunate in the floor of the carpal tunnel [28].
- The space of Poirier is a weak area that is vulnerable to instability [28].
- The distal carpal row separates from the lunate through the space of Poirier during a perilunate dislocation [28].
- The triangular fibrocartilage complex includes the ulnar collateral ligament, the dorsal and volar radioulnar ligaments, the articular disc, the meniscal homologue, the extensor carpi ulnaris sheath, and the ulnolunate and ulnotriquetral ligament [23].
- The triangular fibrocartilage attaches to the base of the ulnar styloid and separates the hyaline cartilage-covered ulnar head from the styloid [23].

BIOMECHANICS AND KINEMATICS

- The wrist joint's motion planes include flexion, extension, radial deviation, ulnar deviation, and circumduction [28].
- There is minimal carpal motion with pronosupination [28].
- Approximately 62° of wrist extension occurs through the radiocarpal joint [28].
- 62% of wrist flexion occurs through the midcarpal joint [28].
- The midcarpal joint is mostly responsible for 20° and 40° of radial and ulnar deviation, respectively [28].
- The midcarpal joint is responsible for the “dart thrower’s motion,” which involves moving from radial extension into ulnar flexion positioning of the wrist [28].
- The radius bears 80% of the axial load transmitted through the radiocarpal joint in neutral ulnar variance [28].
- The ulna bears 20% of the axial load transmitted through the radiocarpal joint in neutral ulnar variance [28].

- The proximal row of carpal bones forms an intercalated segment between the distal carpal row and the distal radius and is bound into a functional unit by the scapholunate interosseous ligament and lunotriquetral interosseous ligament [28].
- The distal row is rigid, with little motion between its bones due to stout intercarpal ligaments, and acts as a functional unit with the scaphoid bridging both rows [28].
- During wrist flexion from neutral, the distal row flexes and ulnarly deviates slightly while the scaphoid also pronates [28].
- During wrist flexion from neutral, the proximal row flexes differentially, with more rotation through the scaphoid, followed by the triquetrum and the lunate [28].
- The proximal row translates dorsally during wrist flexion [28].
- During wrist extension from neutral, the distal row extends and radially deviates slightly while the scaphoid also supinates [28].
- During wrist extension from neutral, the proximal row extends differentially, with more motion in the scaphoid, followed by the triquetrum and then the lunate [28].
- The proximal row translates palmarly during wrist extension [28].
- Hysteresis can be quantified using 4DCT wrist kinematics and is greater in wrists with scapholunate ligament injury than in healthy wrists [31].
- A normative range of median radiolunate interosseous proximities during wrist motion has been quantified [20].

Classification

- Triquetro-lunate fusions are the commonest type of fusions in the carpal region [22].

Clinical Presentation

- In patients with continued pain over the radial side of the carpus, attention should be given to the other carpal bones and the distal radius and not just the scaphoid [14].
- Os styloideum must be suspected in patients with persistent pain in the dorsal aspect of the hand or wrist [33].

Investigations

IMAGING MODALITIES

- MRI is the modality of choice for imaging radiographically occult fractures of the hand and wrist [29].

- The primary advantages of MRI compared with CT and radiography are improved tissue characterization, especially of soft tissues such as ligamentous structures in the wrist and synovium in the hand, and the lack of ionizing radiation [29].
- Modern MRI is generally at 1.5T or 3T, with 3T being much preferred for hand and wrist imaging, especially for imaging small fields of view [29].
- 7T MRI has recently become approved for clinical use and has the potential to become a powerful tool for hand and wrist imaging as applications are developed [29].
- MRI with contrast enhancement is most commonly used to determine whether soft-tissue lesions are solid or cystic or, in the case of rheumatologic imaging, to better visualize erosions and synovial burden [29].
- Dynamic contrast enhancement has been used with inconsistent results to assess for the presence of avascular necrosis in the lunate or scaphoid after injury [29].
- MR arthrography can be performed for evaluation of the triangular fibrocartilage and intercarpal ligament tears, but this is generally unnecessary with the increasing availability of high field MRI [29].

ARTHROSCOPY

- To be successful with wrist arthroscopy and mitigate iatrogenic injury, a clear understanding of the topographical and 3-dimensional spatial anatomic relationships in the wrist as well as a patient's unique anatomic variances is critical [12].
- A good experience in wrist arthroscopy is necessary for the realization of arthroscopic radioscapolunate fusion [8].
- In a comparative study of needle arthroscopy versus conventional arthroscopy, there was no difference between radiocarpal or midcarpal visualization and surgeon-rated ease of use, while diagnostic confidence was the same between the two groups [17].

Treatment

- At long-term followup, all patients older than thirty-five years of age at the time of proximal row carpectomy maintained satisfactory range of motion, grip strength, and pain relief and were satisfied with the result [1].
- Regardless of the construct used, if the distal radius articular surface is well reduced and other principles of fracture fixation are applied, most patients treated with a dorsal spanning plate can expect to regain functional wrist range of motion [2].
- The use of a wrist fixator allows open wound care and permits free access to the wrist for early secondary operations [10].
- No complications occurred due to the arm and elbow supports or fingertraps in the context of horizontal fingertrap traction in distal radial fractures [9].

Complications

- Postoperatively, extension of the fingers remained poor for over 3 months following an unusual carpometacarpal fracture-dislocation [4].
- No complications occurred due to arm and elbow supports or fingertraps during horizontal fingertrap traction in distal radial fractures [9].

Recovery

- At long-term follow-up, all patients older than thirty-five years of age at the time of proximal row carpectomy maintained a satisfactory range of motion [1].
- At long-term follow-up, all patients older than thirty-five years of age at the time of proximal row carpectomy maintained satisfactory grip strength [1].
- At long-term follow-up, all patients older than thirty-five years of age at the time of proximal row carpectomy maintained satisfactory pain relief [1].
- At long-term follow-up, all patients older than thirty-five years of age at the time of proximal row carpectomy were satisfied with the result [1].
- Proximal row carpectomy with interposition arthroplasty improves pain in patients with proximal capitate and/or lunate fossa arthritis [6].
- Proximal row carpectomy with interposition arthroplasty improves function in patients with proximal capitate and/or lunate fossa arthritis [6].
- Short- to mid-term outcomes for patients with end-stage wrist arthritis affecting the capitate who undergo proximal row carpectomy and meniscus interposition arthroplasty are comparable with those receiving proximal row carpectomy alone [7].
- Postoperatively, recovery of the wrist was rapid in a case of unusual carpometacarpal fracture-dislocation [4].
- In a case of unusual carpometacarpal fracture-dislocation, extension of the fingers remained poor for over 3 months postoperatively [4].

Key Evidence

- [L4] At the time of long-term followup, all patients older than thirty-five years of age at the time of a proximal row carpectomy had maintained a satisfactory range of motion, grip strength, and pain relief and were satisfied with the result. [1] ([10.2106/jbjs.e.00261](#))
- [L4] Regardless of the construct used, if the distal radius articular surface is well reduced and other principles of fracture fixation are applied, most patients treated with a DSP can expect to regain functional wrist ROM. [2] ([10.1177/15589447241247335](#))

- [L5] Postoperatively recovery of the wrist was rapid, though extension of the fingers remained poor for over 3 months. [4] ([10.1016/0020-1383\(94\)90161-9](#))
- [L4] Proximal row carpectomy with interposition arthroplasty is an effective motion-sparing procedure for patients with proximal capitate and/or lunate fossa arthritis, improving pain and function. [6] ([10.1177/15589447241298721](#))
- [L3] Our short- to mid-term outcomes in patients with end-stage wrist arthritis affecting the capitate who undergo PRC and meniscus interposition arthroplasty are comparable with those receiving PRC alone. [7] ([10.1177/15589447241262052](#))
- [L5] The authors present their technique and tips for performing this arthroscopic intervention, noting that a good experience in wrist arthroscopy is necessary for its realization. [8] ([10.1016/j.eats.2022.02.015](#))
- [L4] No complications occurred due to the arm and elbow supports or fingertraps. [9] ([10.1016/s0020-1383\(99\)00161-8](#))
- [L4] The use of a wrist fixator allows open wound care and permits free access to the wrist for early secondary operations. [10] ([10.1016/s0020-1383\(99\)00267-3](#))
- [L5] To be successful with wrist arthroscopy and mitigate iatrogenic injury, a clear understanding of the topographical and 3-dimensional spatial anatomic relationships in the wrist as well as a patient's unique anatomic variances is critical. [12] ([10.1016/j.eats.2024.103223](#))
- [L4] In patients with continued pain over the radial side of the carpus, attention should be given to the other carpal bones and the distal radius and not just the scaphoid. [14] ([10.1016/0020-1383\(95\)00081-j](#))
- [L2] In this study, there was no difference between radiocarpal or midcarpal visualization and surgeon-rated ease of use, while diagnostic confidence was the same between two groups. [17] ([10.1177/15589447241265982](#))
- [Paper] This study quantifies a normative range of median radiolunate interosseous proximities during wrist motion. [20] ([10.1177/15589447251352124](#))
- [L5] Triquetro-lunate fusions are the commonest type of fusions in the carpal region. [22] ([10.1016/0020-1383\(95\)00192-1](#))
- [L3] This study demonstrated that hysteresis can be quantified using 4DCT wrist kinematics and is greater in wrists with scapholunate ligament injury than in healthy wrists. [31] ([10.1177/17531934261468199](#))
- [L4] Os Styloideum is an infrequent pathology and must be suspected in patients with persistent pain in the dorsal aspect of the hand or wrist. [33] ([10.1177/15589447251317232](#))

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