

Physical examination methods for the main pathologies in the carpal region: experience based on evidence: original

Abstract

This study aims to explore the anatomy of the carpal region and investigate the presence of the leading pathologies that have been described in the wrist with the main signs of physical exploration.

Keywords: anatomic alignment, musculotendinous portions, motor function, avascular necrosis, hyperemia

Volume 6 Issue 2 - 2018

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Received: March 11, 2018 | **Published:** April 04, 2018

Abbreviations: DIP, distal interphalangeal joints; PIP, proximal interphalangeal joint; MCP, Metacarpophalangeal joint; TFCC, triangular fibro cartilage complex; APL, abductor pollicis long us; EPB, extensor pollicis brevis

Introduction

Physical exploration of an isolated injury in the hand must begin by evaluating the general appearance which may include macroscopic deformities, active hemorrhage, amputation or avulsion, as well as the attitude in which the patient keeps the limb at rest.¹ Next, the integrity of the skin should be evaluated, looking for laceration, swelling, deformities, tumors, crepitation, changes in skin color, capillary refill and tenderness.² Bone examination must be done in order to determine anatomic alignment, sensitivity and passive and active ranges of motion. If there is a ligamentous lesion, examination must be done placing tension in varus and valgus in the injured joints, especially in the distal interphalangeal joints (DIP), proximal interphalangeal joint (PIP) and Metacarpophalangeal joint (MCP). Special attention and care must be paid to the vascular, neurological and musculotendinous portions of the physical examination.³ Normally, vascular exploration is based on the detection of pulses distal to the injury. Since hand trauma is more frequently distal to the radial and cubital arteries, it is much more useful to evaluate the warmth, color and capillary filling.⁴ Neurological hand tests include the motor and sensory functions of the 3 main nervous distributions: ulnar, radial and median. These tests must be performed before administration of local anesthetics or regional nerve blocks may be performed. Although the sensory dermatomes and motor functions of the hand are complex.⁵ The following suggested maneuvers isolate the motor function and function sensation of each nerve. It is importance to consider that the motor function is ruled by a delicate balance between the intrinsic and extrinsic hand muscles.⁶ Musculotendinous lesions are a feared complication of lacerations and other hand injuries. As such, all lacerations must be thoroughly explored for visible tendon injuries. Complete and partial lacerations can be seen through a latency window while observing the tendon through a full range of movement.^{7,8}

Objectives

To identify the most important signs in physical examination in the principal wrist pathologies such as: Ulnar Impaction Syndrome; Distal Radioulnar Joint Instability; Ulnar, Radial and Dorsal Synovial Cysts; De Quervain's tenosynovitis, Scapholunate Ligamentous Injury, Avascular Necrosis, Carpal Tunnel Syndrome and Guyon's Canal (Ulnar) Syndrome.

Identify the hand's kinematics and its importance related to the carpal bones.

Physical exploration methods

Dorsal wrist pain

This injury, also known as Dorsal Capsulitis and Wrist Pain Syndrome, often occurs in gymnasts with a complaint of diffuse dorsal wrist pain with hyperemia and edema. It is usually the result of a chronically charged flexi form wrist that is injured from repetitive impact.⁹

Ulnar impaction syndrome

- The Ulnar Impaction Syndrome is simply the impaction of the ulnar head against the triangular fibro cartilage complex (TFCC) and the ulnar carpal bones; this results in progressive degeneration of these structures. Differential diagnosis in individuals who present with ulnar wrist pain and limitation of movement may also have distal radioulnar joint instability. This syndrome may cause instability of the TFCC (disc) and chondromalacia of the lunate and triquetral bones.¹⁰
- Muscle Test for Extensor Carpi Ulnar is: the instability of this tendon inside its sheath may be demonstrated by performing an ulnar counter-resistance deviation.¹⁰
- Reagan's Test: this test is done by placing the thumb and the index finger of one hand of the examiner on the pisiform and the triquetral bone doing compression movements, and the rest of

- the carpus on the other hand of the examiner. This allows for an examination of the stability of the lunopiramid ligamentous. The test should perform comparatively on the other hand of the patient. Excess mobility implies instability between the triquetral and similar bones and the triquetral and the hamate bone.¹⁰
- d. De Quervain's Tenosynovitis: This is a progressive disease that affects the tendon sheaths of the first dorsal compartment of the extensor zone. This compartment houses the tendons of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL). Excessive use activities that involve the thumb or movements of radial/ulnar deviation of the wrist cause the greatest on these structures, which produce pain, tenderness and possibly crepitus in the area of the distal radius.¹¹
 - e. Direct palpation of the area may cause pain. This pain can cause weakness when making the clamp or grip positions, compared to the opposite hand.¹¹
 - f. Muckard's Test: this test helps determine acute or chronic tenosynovitis of the tendon of the abductor pollicis longus and extensor pollicis brevis (De Quervain's disease). The patient makes an ulnar deviation of the hand through the wrist joints; the fingers are extended and the thumb is adducted.¹¹
 - g. Pain in abduction or extension of the thumb against resistance also indicates pathology of the first extensor compartment.¹¹
 - h. It is possible to reproduce the pain through Finkelstein's test, where the patient closes the fist over the flexed thumb, and then an active tilt of the wrist is performed in ulnar direction. The tension generated in the APL and the EPB during this test reproduces the pain caused by the movement of the tendons inside a thickened and stenosis synovial sheath and raises suspicion of De Quervain's tenosynovitis.¹¹

Scapholunate ligamentous injury

This is one of the most frequently injured ligamentous of the wrist. As mentioned above, charging the flexed wrist with heavy loads may cause injury; in this case, the rupture of this interosseous ligamentous, the Triangular Fibro cartilage Complex (TFCC). Some patients may complain of acute pain on the ulnar side of the wrist that intensifies with loading or twisting the wrist that is supporting weight. A fall or overload of the TFCC, together with the hyper rotation of the wrist, can produce tears or perforations of the disc that lead to radioulnar instability.¹²

The hyper rotation test is very sensitive for lunotriquetral joint pathology. First the lunotriquetral joint is stabilized between the examiner's thumb and index fingers and, while the wrist is being held with the examiner's other hand, the joint is rotated in a poster anterior direction.¹²

The Lunotriquetral Shear Test has been described to be the most sensitive test to diagnose lunotriquetral pathology. In this test, the examiner places one thumb against the pisiform bone and the other thumb stabilized the lunate bone in its posterior surface. When the examiner's thumbs move towards the carpus, a shearing force is created on the lunotriquetral joint.¹⁴

The Pressure Test has 100% sensitivity for TFCC tears. In the Pressure Test, the patient holds both sides of the seat of a chair while sitting on it. Then, they support all their weight as if to get up and, if

there is pain on the ulnar side of the wrist, then the test is positive. Once normality of the lunotriquetral joint has been proven, the TFCC must be explored.¹⁵

TFCC Oppression Test is very sensitive for diagnosing TFCC tears and instability of the Distal Radioulnar Joint. Placing the wrist on neutral rotation and cubical inclination, it is moved in anterior and posterior directions. Pain or clicking indicate TFCC tear. When it is done with the forearm placed in complete pronation, the posterior radioulnar ligamentous is explored. With the forearm placed in complete supination, the anterior radioulnar ligamentous is explored.¹⁵

The Piano Key Test evaluates Distal Radioulnar Joint stability. With the forearm placed in complete pronation, the distal ulna is moved from posterior to anterior direction. This test correlates with the "Piano Key Sign" that is seen in lateral projections on wrist radiography.¹⁴

Watson's test: It is a carpus stability test. This test is done while the patient is seating and their elbow is being supported. The scaphoid is taken to maximal ulnar abduction of the wrist joint and is fixed between the examiner's thumb placed on the distal pole of the scaphoid tubercle, thus keeping the scaphoid extended. The wrist joint is abducted radically, which normally would go along a scaphoid flexion. However, due to the examiner's thumb pressure, this flexion is inhibited.¹⁴

Instability Test or Scapholunate Wobble: This test allows examining carpal stability. The examiner holds the scaphoid and lunate bones firmly with the thumb and index fingers of both hands, moving them in the opposite direction towards the dorsal and ventral areas, respectively. If a decrease of the resistance capacity of the scapholunate ligamentous apparatus is seen, then it confirms instability. If the shearing movement is painful, this too suggests ligamentous injury.¹⁴ Scapholunate instability often occurs as the result of a fall on the thumb with a pronated forearm and the wrist joint extended in ulnar abduction, or collision trauma in ball sports. A torn ligamentous gap between the scaphoid and the lunate bones is produced.¹⁵ chronic scapholunate instability can also occur without trauma, for example, after removal of lymph nodes or due to degenerative changes. Patients may complain of a strong pain when pressuring and moving the proximal radial part of the carpus, especially when leaning, as well as decrease in muscle strength. Sometimes, they may also describe cracking while doing ulnar abduction movements of the wrist joint.¹⁵

Colles' fracture: This is a complete fracture of the distal radius with posterior displacement of the most distal fragment. The injury mechanism is normally secondary to a fall on an outstretched hand.¹

Smith's fracture: Sometimes called Inverse Colles' Fracture, it is a complete fracture of the distal radius but with anterior displacement of the distal fragment.¹³

Scaphoid Bone: The scaphoid fracture is the most frequent and is classified by the location of the fracture on the bone. Normally, the injury is wrongly diagnosed as a wrist dislocation. The patient presents with pain in the anatomical snuffbox area (where the scaphoid meets the abductor pollicis longus and the extensor pollicis brevis). Due to poor proximal blood supply, a fracture in this area can take up to three to six months to heal, if it heals. Consequently, it may be susceptible to avascular necrosis. Depending on the severity of the injury, an anatomical reduction and stable fixation may be needed. Fractures of other bones of the carpus are not very common.¹³

Lunate Bone: A potential injury that involves the lunate bone is a palmar dislocation. This normally occurs as a result of hyperextension (dorsiflexion) with heavy wrist loading.¹³ Another pathology that involves the lunate bone is Kienbock's disease, also known as avascular necrosis of the lunate. This is the most commonly observed osteochondrosis in the general population. A slightly shortened ulna relative to the radius is a predisposing factor.¹³

Lunotriquetral Ballotment Test: Identical maneuvers are performed between the lunate and the triquetral bones to evaluate the state of the lunotriquetral ligamentous.¹⁴

Kleinman's Test: This test applies a palm-to-dorsal force in the lunotriquetral ligamentous, with one hand. To carry out the test, the opposite hand to the one being examined is used. The lunotriquetral complex is compressed by performing a digital clamp, in which the index compresses the lunate towards the palm, while the thumb exerts a force dorsally on the pisiform. This test is positive when there is a break or injury of the scapholunate ligamentous.¹⁴

Carpal Tunnel Syndrome: Because of its limited space, the carpal tunnel is the most common site of nerve entrapment in the body. In this case, the median nerve is compressed under the flexor retinaculum of the wrist. This compression may be the result of trauma, collagen diseases or even pregnancy. The main symptoms consisting of burning, tingling and numbness are normally distal to the wrist and usually get worse at night.¹⁴

- a. **Flick sign:** this is the sign with the highest predictive value. It is positive when the patient mentions during the interrogation that the symptoms are worse at night and get better shaking the hand in the same way as to "bring down the mercury temperature indicator inside a thermometer".¹⁴
- b. **Phallen sign:** this sign refers to the presence of a characteristic type of palmar flexion of the wrist is performed at 90 degrees for one minute. Because the space in the carpal tunnel is reduced, hand paraesthesia are triggered.¹⁵
- c. **Tinel sign:** Percussion of the annular ligament of the wrist with a reflex hammer. If the tunnel is compromised, a cramping sensation will be produced on the first, second and third fingers.¹⁵
- d. **Circle sign:** when the patient tries to oppose the first and second fingers (such as making the figure of a circle), they are not able to flex the phalanges properly.¹⁵
- e. **Guyon's canal syndrome:** Also known as the Ulnar Tunnel Syndrome, chronic compression of the ulnar nerve as it passes through Guyon's canal (formed by the pisiform and the hamate bones and the ligament that connects them) may cause numbness and tingling in the palmar and dorsal areas of the little finger and half of the ring finger. This may occur in people who use crutches, cyclists who travel long distances while leaning on the handlebar, and people who use pneumatic hammers.¹⁶
- f. **Ganglion cyst:** A ganglion cyst is a common mass composed of soft tissue that is usually found on the back of the wrist and is a source of recurrent discomfort. It usually develops over a joint capsule or a tendinous sheath and may present itself with great tenderness. In contact sports, it can actually break and then reappear slowly. Most of the time, these cysts can be removed or aspirated carefully.¹⁶ Ganglions are not associated to redness or heat and can light up easily. Posterior ganglions are more

prominent when the wrist is flexed. Palpation can produce slight discomfort and provocation movement (extreme flexion or extension of the wrist) normally causes pain. Differential diagnosis of an anterior wrist ganglion includes vascular injuries, so the Allen test should be performed in order to check for vascular integrity. There can also be hidden ganglions that cause wrist pain but can only be seen and diagnosed through MRI or ultrasound.

Conclusions

We can conclude that the physical examination and assessment of parameters such as the range of joint mobility it is very important when assessing the degree of disability in the wrist as well the pathologic problem exploring nerve conduction as parestesias, disesthesia, and tumor in the dorsal and palmar surface. . However, it is necessary to incorporate other tools for the evaluation of results, such as the measurement of the hand strength of the hand, visual analog scales of pain assessment and satisfaction, clinical score scales and questionnaires that assesses the quality of life perceived by the patient. The functional assessment of the wrist and of the upper extremity in general, can be done quite accurately using the physical examination, secondary studies and imaging.

Acknowledgements

None.

Conflict of interest

Author declared that there is no conflict of interest.

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