The Wrist: Clinical Anatomy and Physical Examination—an Update
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The wrist is a complex, elegant joint that serves as a key linkage between the forearm and hand that is critical in many sport-specific motions. Swinging a bat, the tennis serve, the hockey wrist shot, and the basketball jump shot all require a pain-free, functional wrist for optimum performance. A basic understanding of wrist and related anatomy allows for appreciation of the biomechanics of wrist movement. This in turn provides the primary care clinician better understanding of the mechanisms of injury, helping to direct a more efficient history and examination, with improved diagnostic accuracy and treatment outcome. This article provides a review of wrist anatomy, including related structures, and an approach to the clinical examination of the wrist from a primary care perspective.

Clinical anatomy

The anatomic position of the wrist defines the volar or palmar surface as anterior, the dorsal surface as posterior, adduction as ulnar deviation, and abduction as radial deviation. The ulna is considered medial and the radius lateral. These standard designations aid in describing physical examination findings and injury patterns.

Bony anatomy

The wrist is defined as the distal aspect of the radius and ulna, the eight carpal bones, and their articulations with the proximal aspects of the metacarpals (Fig. 1). The distal radialulnar joint (DRUJ) is a L-shaped,
pivot or trochoid joint that allows for forearm and hand pronation and supination. The joint is vulnerable to both acute and chronic injury, including dorsal and volar dislocations, chronic instabilities, and degenerative joint disease. Significant DRUJ stability is provided by the triangular fibrocartilage complex, extensor carpi ulnaris, interosseous ligament, pronator quadratus, and associated forearm muscles. The distal radius articular surface is convex, and forms an ellipsoidal joint with the proximal row of carpals, specifically the scaphoid, lunate, and triquetrum. The distal ulna, or ulnar head, articulates with a fibrocartilaginous disc that separates it from the medial carpals. Both the distal radius, which extends beyond the end of the ulna, and the distal ulna have palpable styloid processes, which are clinically relevant as part of the wrist examination and in evaluating wrist injury. In the skeletally immature athlete, both distal radius and ulna have open physes, which first appear at 1 year and 5 to 6 years respectively, and typically close between 15 and 17 years of age [1].

The eight irregularly shaped carpals are divided into a proximal row, through which most wrist motion occurs, and a distal row, which moves with the hand. The proximal row consists of the scaphoid, lunate, triquetrum, and pisiform. The scaphoid bone, from the Greek “scaphe” meaning “dug-out, trough, or boat,” traverses the midcarpal joint. Its
convex proximal surface articulates with the scaphoid fossa of the radius proximally, the lunate and capitate medially, and the trapezium and trapezoid distally (known as the triscaphe joint) [2]. Over 80% of its surface is covered with articular cartilage [3], with blood supply provided by branches of the radial artery. The dorsal scaphoid branch typically enters the dorsal ridge at the level of the scaphoid waist and supplies the proximal 70% to 80% of the bone. The volar scaphoid branch of the radial artery enters the more distal tubercle and supplies the distal 20% to 30% of the bone (Fig. 2). The tenuous blood supply to the proximal pole of the scaphoid explains the increased frequency of delayed union or nonunion of fractures through this area.

The lunate, which lies medial to the proximal pole of the scaphoid in the proximal carpal row, demonstrates variability in its morphology. Type I lunates, with an incidence of 27% to 34.5%, lack a medial facet, whereas Type II lunates, with an incidence of 65.5% to 73%, appear with a medial facet that articulates with the proximal hamate (Fig. 3) [4,5]. There appear to be differences in wrist kinematics between the two lunate types, with pathologic findings of cartilage erosion and subchondral bone exposure at the proximal pole of the hamate more prevalent in wrists with Type II than Type I lunates [4,6]. Blood supply to the lunate is variable, and may arise from palmar and dorsal nutrient vessels (80%) or palmar vessels alone (20%) [7]. The lunate is stabilized in the proximal row by the scapholunate (SL) and lunatriguetral interosseous ligaments as well as the extrinsic radiocarpal ligaments, a key point in understanding perilunate injuries. Further stability is provided by its seating in the lunate fossa of the distal radius.

Fig. 2. Scaphoid arterial blood supply. The dorsal scaphoid branch (1) enters at the waist and supplies the proximal 70%–80% of the bone. The volar scaphoid branch of the radial artery (2) supplies the distal 20%–30%. (From Rettig AC. Management of acute scaphoid fractures. Hand Clin 2000;16(3):382; with permission.)
Medially, the proximal carpal row consists of the triquetrum and pisiform, the former of which intercalates with the triangular fibrocartilage complex (TFCC) proximally and the hamate distally. The distal ulna does not articulate directly with the carpus, but serves as an attachment for a number of the stabilizing ligaments that make up the ulnar wrist. The TFCC interposes between the distal ulna and carpus, serving as both a force-transmitting and a stabilizing structure of the ulnar wrist [8]. It consists of a fibrocartilagenous, articular disk (the triangular fibrocartilage or TFC), the distal radio-ulnar ligaments, a meniscal homolog, the ulnolunate and ulnotriquetral ligaments, extensor carpi ulnaris sheath, and the ulnar capsule (Fig. 4). The thickness of the TFC varies inversely with ulnar variance, (ie, ulnar negative wrists have a thicker disk, ulnar positive wrists a thinner one) [9]. Blood supply is greater in the periphery of the TFC, near the dorsal and volar radioulnar ligaments, allowing for healing capacity not found in the relatively avascular central and radial

![Fig. 3. Lunate morphology. (A) Type I lunate. (B) Type II lunate. Abbreviations: C, capitate; H, hamate; L, lunate; S, scaphoid; T, triquetrum. (From Viegas SF, Wagner K, Patterson RM, et al. The medial (hamate) facet of the lunate. J Hand Surg 1990;15A:565; with permission from The American Society for Surgery of the Hand.)](image)

![Fig. 4. TFCC anatomy. (From Lichtman DM, Alexander AH. The wrist and its disorders. 2nd edition. Philadelphia: WB Saunders; 1997. p. 388; with permission.)(image)
portions [10,11]. These combined structures help form the ulnar side of the wrist, which biomechanically carries approximately 20% of axial loading across the wrist [12].

The distal carpal row, consisting of the trapezium, trapezoid, capitate, and hamate, articulates through the midcarpal joint with the proximal carpal row and distally with the metacarpal bases. The trapezium articulates with the distal pole of the scaphoid and also with the base of the first metacarpal, playing an important role in thumb function and vulnerable to trapeziometacarpal osteoarthritis through repetitive use injury [13]. The capitate, largest of the carpal bones, articulates proximally with the lunate and distally with the base of the third metacarpal and, variably, with the fourth metacarpal. This variation appears to have clinical implications in perihamate type injuries [4]. The hamate articulates with the ulnar side of the capitate, as well as the fourth and fifth metacarpal bases distally and the triquetrum proximally. The hook of the hamate projects from the volar surface approximately 1 to 2 cm distal and radial to the pisiform. Its ossification is not complete until about 15 years of age [14]. The hook has, or is proximate to, multiple ligament attachments, including the pisohamate ligament, transverse carpal ligament, and the flexor carpi ulnaris tendon, and has a tenuous blood supply entering at the base and tip, leading to increased vulnerability of the hook to displacement and nonunion of fractures [15]. It also serves as the ulnar border for the carpal tunnel and the radial border for Guyon’s canal.

In addition to the specific ligaments previously mentioned, there is a complex array of extrinsic and interosseous ligaments that serve to guide and constrain movement about the wrist. The extrinsic wrist ligaments can be grouped by their location into palmar and dorsal radiocarpal, ulnocarpal, intercarpal, and midcarpal. The interosseous ligaments are divided into proximal and distal, corresponding to the respective carpal row in which they are found. They are further subdivided into dorsal and palmar structures, all serving to interconnect specific carpal bones (ie, the SL and pisotriquetral proximally and the trapezocapitate and capitohamate distally) [16]. For the nonsurgeon, appreciating this complex array of ligamentous structures, including those most likely involved in specific injuries, in the context of bony anatomy and wrist biomechanics will aid in the clinical evaluation of the athletically injured wrist.

Two clinically relevant anatomic spaces are present at the wrist and worth noting. The carpal tunnel is defined by the flexor retinaculum volarly and the carpal bones dorsally. It is ovoid in shape and nondistensible, due to the rigid structures that compose its boundaries [17]. Through it run the flexor digitorum superficialis (FDS) and profundus (FDP) tendons, the flexor pollicis longus (FDL) tendon, and the median nerve [18]. The flexor carpi radialis (FCR) tendon lies outside the carpal tunnel, contained in its own osteofibrous tunnel. Guyon’s canal is bounded by the volar carpal ligament, the retinacular ligament, pisiform, and hamate. Through it runs
the ulnar nerve, which bifurcates distally in the canal into a superficial sensory and deep motor branch. Like the carpal tunnel, Guyon’s canal is indistensible, and its contents are vulnerable to compression injuries from repetitive use and acute trauma. The specific clinical entities that result from this are described elsewhere in this issue.

Soft tissue anatomy

There are no intrinsic muscles of the wrist, further defining its role as an intercalated segment linking forearm and hand movement. Muscle groups acting on the wrist can be divided into flexor-extensor, ulnar-radial deviator, and pronator-supinator groups. All have their origins proximal to the wrist joint and insert at the hand, predominantly through the metacarpals, with the exception of the flexor carpi ulnaris, which inserts at the pisiform and fifth metacarpal base. The primary wrist flexors are the FCR and the flexor carpi ulnaris (FCU), with assistance from the palmaris longus and abductor pollicus longus. The digital flexors are involved only when the fingers are held in extension [19]. The FCR and FCU originate from a common site on the medial epicondyle of the humerus at the elbow, and insert at the volar base of the second and third, and fifth metacarpals respectively. The FCR is innervated by the median nerve; the FCU is innervated by the ulnar nerve. Wrist extension occurs through the action of the extensor carpi radialis longus (ECRL) and brevis (ECRB) and extensor carpi ulnaris (ECU), which share a common origin through the common extensor tendon arising from the lateral epicondyle of the humerus, and a common innervation by the radial nerve (C6–C8). The ECRL, ECRB, and ECU insert at the dorsal base of the second, third, and fifth metacarpals, respectively. The thumb and digital extensors can also participate in extension with a clenched fist [19]. Ulnar deviation is achieved through contraction of the flexor and extensor ulnaris muscle; radial deviation is achieved primarily through contraction of the ECRL and FCR muscles. The ECRB and thumb extensors and abductors may also contribute to this motion.

Pronation and supination occur primarily through the proximal and distal radioulnar joints. Supination is generally a more powerful movement, likely from the contribution of the biceps brachii, which is most effective with a flexed elbow. Supination is a combined effort from the supinator and biceps brachii muscles. The supinator originates from the proximal ulna laterally and the lateral epicondyle, and inserts on the proximal radius, receiving its innervation from the radial nerve. The biceps brachii has a long and short head proximally, originating from the superior glenoid rim and coracoid process of the scapula, and inserting on the proximal radial tuberosity and bicipital aponeurosis, with innervation from the musculocutaneous nerve (C5–C6). Pronation is achieved primarily through the action of the pronator teres and pronator quadratus muscles, with some
contribution from the FCR when the wrist is flexed. The pronator teres is the more proximal muscle, originating from the medial epicondyle and coronoid process of the ulna and inserting distally on the mid-shaft of the radius. The pronator quadratus is located in the distal forearm, arising from the distal ulna, with fibers running obliquely to attach on the distal radius. Both the pronator teres and quadratus, and the FCR, are innervated by the median nerve [19].

To avoid the bowstring effect that would inevitably occur with muscle contraction in their absence, flexor and extensor retinaculum are present at the wrist to help constrain the tendons in a well organized manner to facilitate function (Fig. 5). Of particular clinical interest are the six dorsal synovial compartments that contain the tendons and their synovial sheaths of the wrist and digit extensors. The first compartment, numbered from radial to ulnar side, contains the tendons of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL), and is the site of involvement seen in deQuervain’s tenosynovitis. The second dorsal compartment contains the ECRL and ECRB tendons; the third, the extensor pollicis longus (EPL) tendon; the fourth, the extensor digitorum and extensor indicis; the fifth, the extensor digiti minimi; and the sixth, the extensor carpi ulnaris. Of note, the distal posterior interosseous nerve, a branch of the radial nerve, runs along the floor of the fourth dorsal compartment and is vulnerable to irritation from repetitive wrist extension, as seen in gymnast’s

Fig. 5. Gross dissection of the dorsal wrist, demonstrating the extensor retinaculum and extensor tendons that traverse the six dorsal compartments.
palsy [20]. The flexor tendons, as discussed previously, are constrained by the flexor retinaculum and the structures of the carpal tunnel.

Three nerves of clinical significance in the athletic population traverse the wrist and are vulnerable to injury. The median nerve, as discussed, courses through the carpal tunnel on its way to supplying sensation to the palmar radial three and one-half digits, and motor innervation to the thenar muscles and first two lumbricals. Proximal and superficial to the carpal tunnel, a palmar cutaneous branch comes off the median nerve to supply sensation to the base of the thenar eminence [21]. The ulnar nerve (C8–T1), after giving off branches to the FCU and palmar cutaneous and dorsal sensory branches, passes superficial to the flexor retinaculum and through Guyon’s canal. At the distal end of the canal, the ulnar nerve bifurcates into a superficial sensory branch supplying the ulnar one and one-half digits and palm, and a deep motor branch innervating the interossei, the third and fourth lumbricals, the adductor pollicis brevis, and the deep head of the flexor pollicis brevis. The deep motor branch passes around the base of the hook of the hamate, with the superficial sensory branch coursing near the tip of the hook, making both vulnerable to injury with trauma to the hamate hook. Of note, the ulnar artery courses with the ulnar nerve through Guyon’s canal and is susceptible to injury, as in Hypothenar Hammer Syndrome [22,23]. The superficial radial nerve, originating from the radial nerve in the mid-forearm, emerges from under the distal brachioradialis to lie superficial to the tendons of the first dorsal compartment muscles (APL and EPB), and the extensor retinaculum as it provides sensory innervation to the skin of dorsal radial hand and thumb. Its superficial orientation makes it vulnerable to direct trauma or traction injury, as in Wartenberg’s syndrome (see the article elsewhere in this issue) [24].

Physical examination

The physical examination of the wrist, as with any other joint or system, should be systematic, reproducible, and follow the examiner’s knowledge of the relevant anatomy, biomechanics, and recognizable patterns of injury. Gathering historical data that can help focus the clinical examination is critical, given the myriad anatomic structures that may be involved and the complex patterns of injury that can occur. Table 1 lists key aspects of the clinical history needed for assessing any wrist injury. Before examining a painful, injured wrist, the clinician should have a good understanding of the patient’s self-reported location of pain, acuity, history of swelling and deformity, and degree of disability. This will allow the examination to be organized in such a way as to avoid examining more obviously painful areas first, helping to reassure the patient and avoid undue guarding. Proper positioning of the patient for various aspects of the examination will also help to insure patient comfort and examiner access.
Inspection should begin before the formal examination, noting the patient’s posture and carriage of the affected wrist and extremity, its use in handling papers or shaking hands, and any braces or strapping present. More formally, a survey of surface anatomy with comparison to the unaffected side may reveal obvious deformities or subtle differences in the

![Surface anatomy of the wrist](image)

**Fig. 6.** Surface anatomy of the volar (A) and dorsal (B) wrist, with relevant landmarks.

Abbreviations: ADL, activities of daily living; DM, diabetes mellitus.
appearance of various structures (Fig. 6). Note should be made of any loss of normal contours, such as from swelling or muscle atrophy, as well as the integrity of the overlying skin, including the presence and pattern of ecchymosis. Skin that is red, hot, pale, dusky, calloused, abraded, punctured, atrophic, sweaty, or waxy may give clues to mechanisms of injury, associated conditions, or underlying systemic illness.

Range of motion (ROM) assessment should include both active and passive testing, noting the quality and ease of movement as compared with the unaffected side. Noting where in the range that pain occurs, with knowledge of wrist biomechanics, can further help predict which structures may be involved. Assessing the end feel, either bony or soft tissue, present at the extremes of passive motion can be suggestive of pathology if different from the uninvolved side or expected patterns. With the arm at the side, elbow flexed 90°, and forearm, wrist, and hand in anatomic neutral, the expected range of pronation and supination of the forearm is 85° to 90°, typically with a soft-tissue end feel [25]. Limitation of pronosupination with pain at the distal forearm is suspicious for DRUJ pathology. For radial and ulnar deviation, expected ranges are 15° and 30° to 45°, respectively, usually with a bony end feel. Wrist flexion and extension, affected by the position of the digits (extended versus clenched fist) and the subsequent effects their associated tendons have on wrist motion, is 80° to 90° and 70° to 0°, respectively, with a soft-tissue end feel. Objectively measuring ROM in three planes, both actively and passively, can aid in monitoring clinical progression between visits.

Palpation of the injured wrist should proceed in an orderly fashion, saving known painful areas for last. Given the superficial nature of many important anatomic structures, the examiner has relatively easy access to localize specific areas for direct palpation. Knowledge of wrist mechanics will also allow ideal positioning to facilitate direct palpation of various structures. For instance, the palmar tuberosity of the scaphoid can be readily palpated at the radial-volar wrist in most positions, whereas the articular-nonarticular (ANA) junction is palpable just distal to the radial styloid in the anatomic snuff box, with the wrist in ulnar deviation [26]. The anatomic snuffbox is a clinical landmark that appears as a depression just distal to the radial styloid that is bounded anteriorly by the tendon of the EPB and APL and posteriorly by the EPL tendon, has the radial artery running through it, and is made more prominent by extensions and abduction of the thumb [26]. Its floor, which can be more readily palpated with the wrist ulnar deviated, is the scaphoid. Direct pressure on the scaphoid is typically uncomfortable, even in asymptomatic individuals, and should be compared with the unaffected side in assessing the level of discomfort. Pain in the anatomic snuffbox is suggestive of a scaphoid fracture or injury.

Tracing the third metacarpal proximally will reveal a recess that lies over the capitate, with the SL joint just proximal to this [27]. Tenderness in this area is suggestive of fracture, ligamentous injury, joint pathology, or
Keinbock’s disease (avascular necrosis of the lunate). The SL joint can also be localized by following a line distally from Lister’s tubercle, a bony prominence on the dorsal aspect of the distal radius. At the medial wrist, the ulnar styloid can be readily palpated, with pain suggestive of fracture or ligamentous injury. A depression present between the ulnar styloid, pisiform, and FCU tendon corresponds to the location of the TFCC, which, if painful when palpatated, may indicate injury to this structure [28]. The pisiform is easily palpated on the volar-ulnar aspect of the wrist, with the hook of the hamate palpable deep in the soft tissue of the hypothenar eminance 2 cm distal, along a line that runs from the pisiform to the head of the second metacarpal [27]. Tenderness at either site should raise suspicion for fracture or repetitive use injury.

In addition to establishing the presence of tenderness, palpation should also be sensitive to the existence of crepitance, tissue edema, calor, or clicking, such as with TFCC injuries. This is especially helpful in repetitive use injuries, in which individual soft-tissue structures can often be localized. The first dorsal compartment tendons, extensor pollicis brevis (ECB) and APL, can be palpated directly, aided by thumb extension and abduction. Tenderness, swelling, crepitance, and catching along these tendons and just proximal to the radial styloid can be seen in deQuervain’s tenosynovitis. Finkelstein’s test is a provocative maneuver performed by having the patient flex the thumb into the palm with the examiner ulnar deviating the wrist [29,30]. A positive Finkelstein’s test suggests deQuervain’s tenosynovitis. Similarly, tenderness with swelling and crepitus, which can often be audible, localized to the soft-tissue intersection of the first dorsal compartment tendons with the radial wrist extensors, ECRL and ECRB, is seen with intersection syndrome. Both the primary wrist flexors (FCU and FCR) and extensors (ECU and extensor carpi radialis (ECR)) can be directly palpatated, with tissue changes and pain suggestive of acute or repetitive use injury.

Neurovascular examination in wrist injury assessment requires attention to anatomic structures at the wrist as well as the hand structures they supply. Skin color, temperature, and texture of the hand may offer initial clues to an underlying neurovascular disorder, such as complex regional pain syndrome. Palpation of the quality of the radial pulse and performance of Allen’s test can help confirm patency of the radial and ulnar artery. Allen’s test is performed by initially occluding both the radial and ulnar artery with finger pressure and having the patient repeatedly clench his fist to express any remaining blood [31]. The skin of the palm should pale, reflecting the interrupted blood flow. Pressure on one of the arteries is then released and attention paid to palmar skin flushing, which should occur within 5 seconds. The other artery is then systematically tested in similar fashion. Failure of the skin to flush following release is suspicious for occlusion.

Assessment of nerve integrity at the wrist includes provocative testing and evaluation of strength and sensation. See Table 2 for specific
examination findings by nerve. The median nerve, passing through the carpal tunnel, is accessible to provocative testing by Tinel’s, Phalen’s, or median nerve compression maneuvers. Tinel’s sign is positive if percussion with a reflex hammer over the carpal tunnel and median nerve, with the wrist slightly dorsiflexed, recreates pain or tingling over a median nerve distribution distally. Phalen’s sign is positive if the same symptoms are elicited with the wrists held in a position of maximal flexion for up to 1 minute, by holding the backs of both hands together with the elbows bent and shoulders abducted (Fig. 7). Median nerve compression testing is another variation whereby the examiner applies steady pressure with the thumb or digits over the median nerve, with the wrist in slight flexion,
monitoring for the onset of median nerve irritation symptoms. The ulnar nerve can also be tested using the Tinel’s test at Guyon’s canal in an attempt to elicit pain or paraesthesias in an ulnar nerve distribution. Froment’s sign assesses the pinch grip strength by maintaining tip-to-tip contact of the thumb and index finger, with weakness seen in ulnar nerve or anterior interosseous nerve injuries.

Examination of the wrist for ligamentous injury and instability requires the use of specific maneuvers. The scaphoid shift maneuver, or Watson’s test, assesses the potential for SL instability as a cause of wrist pain [26,27]. The maneuver is performed with the examining hand holding the radial side of the wrist, and the examining thumb applying pressure to the volar scaphoid tubercle (Fig. 8). The wrist is moved from ulnar to radial deviation using the other hand, with pressure held over the tubercle as the fingers provide a counterforce. Eliciting pain consistent with the presenting complaint, or laxity, sometimes recognized as a clunk as the scaphoid is forced dorsally onto the dorsal rim of the radius, is suggestive of SL pathology. The maneuver is only significant in comparison with the patient’s uninvolved wrist and presenting complaints [32]. Shear tests can be employed in evaluating ligamentous injury, by exerting a shear force across two adjacent structures and monitoring for pain or increased joint play. Reagan’s test, performed by applying pressure on the lunate dorsally with the thumb, with a volar force from the index finger applied to the triquetrum, assesses the integrity of the lunotriquetral (LT) joint [33]. The finger extension test (FET) uses active, resisted contraction of the digital extensors, with the wrist in a flexed position, to exert a force across the

Fig. 8. Watson test showing the starting position (A) and end position (B).
radiocarpal joint (Fig. 9). Pain elicited on this maneuver may reflect underlying instability of the radiocarpal or midcarpal joints, scaphoid instability, or Kienbock’s disease [26]. The supination lift test, performed with the patient seated, arms supinated with palms flat on the underside of the table, is positive if the patient experiences ulnar wrist pain as he attempts to lift the table. A positive test is suggestive of a dorsal, peripheral tear of the TFCC [28].

Diagnostics

A complete evaluation of the athletically injured wrist often requires the use of additional diagnostics, including imaging and electrodiagnostic studies. Plain film radiographs are generally required in any acute, traumatic injury, as well as in overuse injuries with findings suggestive of bony involvement or significant ligamentous injury. Standard radiographic views of the wrist include the posterior-anterior (PA), oblique, and lateral (Fig. 10). Positioning for these views is critical to assure adequate visualization of the structures being examined. In the PA view, the wrist is held in neutral, with 0° of rotation required to accurately assess the relative lengths of the radius and ulna [34]. The oblique view allows evaluation of the radial side anatomy, including the radial styloid, triscaphe, and first carpometacarpal joints. The lateral view must be obtained with the wrist in 0° of rotation and the radial shaft and third metacarpal long axis collinear. True lateral views will show the pisiform projected over the scaphoid tubercle [34]. Additional views include the scaphoid (wrist in ulnar deviation to check for difficult to visualize scaphoid fractures), clenched fist view (to check for SL joint space widening seen in SL ligament disruptions), carpal tunnel, and “hook” view (to check for hook of the hamate fractures). When combined with standard views, the additional studies allow evaluation of bony anatomy and joint integrity, as well as ulnar variance.
SL angle, radial inclination, and palmar tilt [26]. The scaphoid fat pad can be seen as a faint, lucent line just lateral to the scaphoid on the PA view. Displacement or absence of the fat pad is suggestive of an underlying scaphoid fracture.

When plain film radiographs are equivocal, or the clinical scenario warrants further investigation, additional studies may be indicated. For persistent bony tenderness suspicious for fracture, infection, or chronic inflammatory condition, radionuclide bone scanning can facilitate

Fig. 10. Standard wrist radiograph series, including PA (A), oblique (B), and lateral (C) views. Note a scaphoid fracture on the oblique view.
diagnosis. Bone scans are particularly useful in evaluating the scaphoid in the face of a classic injury mechanism, suspicious examination findings (ie, snuff box tenderness) and negative radiographs. CT scans provide another means of recognizing fractures not seen on plain film, or for further delineating the extent of injury with known fractures. With increasing interpretive experience, MRI is becoming a more valuable tool in evaluating both bony and soft-tissue injuries about the wrist, including recognition of occult fractures, avascular necrosis, and TFCC pathology. When symptoms warrant, evaluation with electromyelography (EMG) and nerve conduction studies (NCS) can help confirm or refute suspected neuropathies, such as seen in carpal tunnel syndrome and Wartenberg’s syndrome (radial nerve compression in the forearm leading to decreased sensation to the dorsoradial hand, dorsal thumb and index finger—see the article elsewhere in this issue). With refractory symptoms and selected acute injuries, arthroscopy may offer a combined diagnostic and therapeutic option.

Summary

A pain-free, functional wrist joint is critical to many sporting and vocational activities. Assessing the painful wrist requires knowledge of common injury patterns and frequently seen conditions. The primary care physician with an understanding of basic wrist anatomy and biomechanics and a systematic approach to assessing the wrist will be more comfortable and effective with diagnosing and managing the athletically injured wrist.

References