Sonography of Masses of the Wrist and Hand

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OBJECTIVE. The aim of this article is to present the sonographic appearance of the most common masses of the wrist and hand and to discuss the role of sonography in their diagnosis.

CONCLUSION. Sonography is a readily available imaging technique that can detect and assess masses of the wrist and hand. Together with standard radiography, sonography can be used as a first-line radiologic technique in this field.

Recent improvements in hardware and software have made sonography an excellent noninvasive, cost-effective, and dynamic imaging technique for assessing the musculoskeletal system [1–3]. New electronic high-frequency transducers, working at frequencies of 10–17 MHz, have excellent resolution in the near field of view and allow optimal judgment of the most superficial soft tissues such as those of the wrist and hand [1, 2]. Masses of the wrist and hand are frequent and can be secondary to tumors, infections, inflammations, and degenerative and traumatic disorders [4]. Clinical examination and history-taking remain the cornerstones of mass assessment, although they rarely allow a definite diagnosis. Imaging techniques are necessary for further characterization of the masses and for surgical planning. Sonography has high resolution and it is cost-effective, noninvasive, and dynamic. Sonography helps in assessing mass size, internal structure, relation to adjacent structures, and internal vascularity, and it can guide biopsy. With radiography, sonography can be used as a first-line imaging technique in this field and allows a definite diagnosis in most cases. The aims of this article are to present the sonographic findings of different masses of the wrist and hand and to discuss the role of sonography in their assessment.

Ganglia

Ganglia are the most common masses of the wrist and hand [5]. They are cysts filled with viscous fluid and lined with a fibrous capsule. They usually arise from the dorsal capsule of the wrist (60–70%) near the dorsal band of the scapholunate ligament. A less common location is the radial aspect of the volar face of the wrist, close to the radial artery, and the palmar aspect of the fingers, near the A1 pulleys. Ganglia on sonography usually appear as hypoechoic or anechoic, well-delineated masses that can show internal septa and are usually located near a joint or a tendon sheath [1, 2, 4–7] (Fig. 1).

The sonographic appearance of ganglia depends on their size and chronicity [6]. Larger cysts are often anechoic, and old lesions are echogenic and show internal thick septa. Color Doppler sonography can show a hypervascular wall in symptomatic patients (Fig. 2), although vascularity does not always correlate with symptoms and vice versa. Smaller dorsal ganglia, also known as occult ganglia, are difficult to detect clinically and frequently cause local pain and limitation of movement [7]. Sonography shows them as 1- to 3-mm unilocular, anechoic cysts located near the dorsal band of the scapholunate ligament (Fig. 3). Sonography can assess their relation to the overlying extensor tendons and to the posterior interosseous nerve. In addition, sonography can assess the scapholunate ligament [8, 9] and rule out effusions of the radiocarpal joint.

Volar wrist ganglia usually are found near the flexor carpi radialis tendon and often displace the radial artery and its palmar branch. Color Doppler sonography easily assesses the internal flow of the artery and can differentiate ganglia from arterial pseudoaneurysms. The differential diagnosis of volar ganglia also includes tenosynovitis of the...
Accessory Muscles

Accessory muscles can be detected as incidental findings on routine sonography or may present as masses mimicking a tumor or compressing adjacent nerves.

The accessory abductor digiti minimi is the most common accessory muscle of the wrist and can be found in approximately 24% of normal individuals. It runs inside the Guyon canal in close contact with the ulnar artery and nerve. Although usually asymptomatic, the accessory abductor digiti minimi may cause compression of the ulnar nerve during contraction.

Tenosynovitis

Tenosynovitis can present as a mass if significant synovium hypertrophy, fluid accumulation, or thickening of the retinaculum is present. Sonography shows the tendons surrounded by an anechoic fluid collection or by a hypoechoic hypertrophied synovium.

In addition, sonography allows direct visualization of the internal structure of the tendons and can assess the presence of partial or complete tears. Color Doppler sonography permits accurate study of synovial vascularity and disease activity. Because synovial fluid cannot be differentiated from hyperechoic synovium clinically, sonography is helpful in assessing its presence and guiding a diagnostic needle sampling when indicated. An accurate technique of examination is required because excessive local pressure with the transducer can displace fluid and lead to a false-negative examination. When guiding injections, sonography helps to avoid damage to the tendons by the needle as well as extrasynovial injections. As previously described, when it affects the flexor carpi radialis, tenosynovitis can mimic ganglion at physical examination.

Traumatic Disorders

In complete tendon tears, the ends of the retracted tendon can present as focal masses. Sonography confirms the diagnosis, showing the swollen, hypoechoic irregular tendon ends that can be surrounded by a synovial effusion. More interestingly, sonography accurately locates the tendon ends and helps in deciding between end-to-end suture and tendon transfer. Color Doppler sonography shows local hyperemia in acute tears.

Foreign bodies are frequently found at the level of the wrist and hand and can present as localized masses if surrounded by an abscess in acute cases or by granuloma in chronic cases. Sonography shows foreign bodies as hyperechoic fragments with variable shapes. Frequently, a posterior artifact can be found and allows easier detection of smaller fragments. Abscesses surrounding foreign bodies appear as heterogeneous, ill-defined fluid collections showing peripheral hypervascular changes on color Doppler sonography.

Tumors and Pseudotumors

In the wrist and hand, most cases of pigmented villonodular synovitis, a rare proliferative disorder of uncertain cause that affects the synovium, present in the nodular form, also known as giant cell tumor of the tendons sheath (GCTTS). GCTTS is the most common soft-tissue tumor of the hand...
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The main limitation of sonography in assessing lipomas is the difficulty in evaluation of larger and deeper masses, which are better evaluated with MRI.

Bursitis

Bursitis appears on sonography as fluid-filled anechoic masses (Fig. 14). Less frequently, the bursa is completely filled by hypoechoic synovium. Aspiration and steroid injection of the inflamed bursa are easily performed under sonographic guidance.

Dupuytren’s Disease

Sonography shows Dupuytren nodules as hypoechoic fusiform thickening of the palmar aponeurosis (Fig. 15). Dynamic examination performed during finger movements allows detection of adhesions to the flexor tendons.

Conclusion

In summary, masses of the wrist and hand are frequently encountered in daily practice. Clinical evaluation does not allow sufficient diagnosis. Sonography is a powerful, easy, and inexpensive imaging tool that allows accurate assessment of mass size, internal structure, and vascularity, as well as its relation to the adjacent structures. With radiography, sonography allows a definite diagnosis in most cases.

References

25. Wang Y, Tang J, Luo Y. The value of sonography...

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**Fig. 1**—24-year-old woman with ganglion of dorsal aspect of wrist.

**A,** Sagittal sonogram obtained over dorsal aspect of wrist shows ganglion (arrow) located between lunate (Lun) and extensor tendons (ETs). Ganglion has hypoechoic wall and thin internal septum. Internal viscid fluid appears anechoic. Cap = capitate, Rad = radius.

**B,** Corresponding T1-weighted gadolinium-enhanced sagittal MR image obtained in slightly more lateral position than **A** shows ganglion (arrow) has isointense internal signal. Note contrast enhancement of wall. Sc = scaphoid, Rad = radius.

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**Fig. 2**—35-year-old woman with painful ganglion of dorsal aspect of wrist.

**A,** Sagittal sonogram obtained over dorsal aspect of wrist shows ganglion (calipers). Note thickening of wall (arrowheads) and internal septum. Cap = capitate, Lun = lunate, Rad = radius.

**B,** Corresponding color Doppler sonogram shows flow signals (arrowheads) inside cyst wall and adjacent tissues.
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Fig. 3—22-year-old woman with occult ganglion on dorsal aspect of wrist. Lun = lunate, Sc = scaphoid, Cap = capitate.
A, Transverse color Doppler sonogram (shown here in black and white) shows 2.5-mm occult ganglion (arrow) located close to posterior band of scapholunate ligament (arrowhead). No local flow signals are evident.
B, Transverse fat-suppressed T2-weighted MR image shows normal scapholunate ligament (arrowhead) and small overlying ganglion (arrow).

Fig. 4—51-year-old woman with carpal tunnel syndrome.
A, Sagittal sonogram obtained over palmar aspect of wrist shows ganglion (asterisk) located deep in relation to flexor tendons (FTs). Cyst displaces tendons anteriorly and causes compression of median nerve (arrowheads) against transverse carpal ligament.
B, Corresponding sagittal fat-suppressed T2-weighted MR image shows ganglion (asterisk) and palmar displacement of tendons. Median nerve is not visualized. FTs = flexor tendons.

Fig. 5—47-year-old man with ganglion on palmar aspect of third finger.
A and B, Sagittal (A) and transverse color Doppler (shown here in black and white) (B) sonograms obtained over palmar aspect of third finger show ganglion (asterisks) located in close contact with A2 annular pulley (arrowheads, A). Flexor tendons (FTs) are normal. Note posterior enhancement of cyst; in B, note palmar displacement of radial collateral digital artery (arrowhead) by cyst. PP = proximal phalanx.
Fig. 6—Accessory muscles. 
A, 39-year-old man with right accessory abductor digiti minimi. Transverse sonogram obtained over Guyon’s canal shows accessory muscle (asterisk) lying inside canal. Muscle is located lateral and palmar to pisiform (Pis). Note ulnar artery (solid arrowhead) and nerve (open arrowhead).
B, 48-year-old woman with left accessory abductor digiti minimi. Transverse sonogram obtained over Guyon’s canal shows accessory muscle (asterisk) located between ulnar artery (solid arrowhead) and nerve (open arrowhead). Pis = pisiform.

Fig. 7—43-year-old woman with accessory extensor indicis proprius muscle. 
A and B, Transverse (A) and sagittal (B) sonograms obtained over dorsum of hand show solid hypoechoic mass (asterisks) with internal structure typical of normal muscle. Muscle inserts into tendon of extensor indicis proprius (arrowhead, A) and lies near extensor tendons (ETs) of third compartment of wrist. Cap = capitate.

Fig. 8—50-year-old woman with rheumatoid tenosynovitis of extensor tendons. 
A and B, Transverse (A) and transverse color Doppler (B) sonograms obtained over the dorsal aspect of wrist show synovial sheath filled by fluid (black arrowhead, A) and hypertrophic pannus (white arrowhead, A). Extensor tendons (asterisks) present irregular echostructure. In B, note flow signals (small arrowheads, B) inside inflamed synovium.
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Fig. 9—71-year-old woman with tenosynovitis of flexor carpi radialis tendon. 
A, Transverse sonogram shows large effusion (arrowheads) inside tendon sheath and surrounding normal-appearing tendon (asterisk). 
B, Sagittal sonogram depicts effusion, normal fibrillar structure of tendon (asterisks), and relation of tendon to scaphotrapezium joint. Tpz = trapezium, Sc = scaphoid.

Fig. 10—Foreign bodies. 
A, 23-year-old man with recent open trauma of dorsum of hand. Sagittal color Doppler sonogram obtained over intermetatarsal space shows wood splinter (arrow) surrounded by hypoechoic collection (white arrowheads). Note flow signals inside surrounding tissues (black arrowheads) related to hyperemia. 
B, 43-year-old man with foreign body granuloma. Sagittal sonogram obtained over palmar aspect of thenar eminence shows wood splinter (arrow) surrounded by hypoechoic well-defined granuloma (arrowheads).

Fig. 11—63-year-old woman with giant cell tumor of tendon sheath of fourth finger. 
A and B, Transverse (A) and sagittal color Doppler (B) sonograms obtained over palmar aspect of fourth finger show solid, heterogeneous hypoechoic mass (asterisk, A) located near flexor tendons (FTs) and developing between tendons and middle phalanx (MP). In B, note sparse internal flow signals (small arrowheads, B) and palmar displacement of radial collateral digital artery (large arrowhead, B).
Fig. 12—45-year-old woman with schwannoma of ulnar nerve. 
A and B, Transverse (A) and sagittal color Doppler (B) sonograms obtained over palmar aspect of wrist show well-marginated, hypoechoic mass (asterisks) located inferiorly to flexor carpi ulnaris muscle and tendon (FCU). Mass presents irregular echostructure. In A, note close relation of mass to displaced ulnar nerve (white arrowhead, A); in B, note internal sparse flow signals (arrowhead, B). Black arrowhead in A indicates ulnar artery.

Fig. 13—18-year-old woman with hemangioma of palm of hand. IOM = interosseous muscle, Mc = fourth metacarpal, FTs = flexor tendons of fourth finger. 
A, Transverse sonogram shows mass (arrows) with internal mixed echostructure made by hyper (white arrowheads) component related to intralesional fat and anechoic (black arrowheads) areas corresponding to dilated vessels. 
B, Transverse gadolinium-enhanced T1-weighted MR image shows contrast enhancement of vascular portion of hemangioma (asterisk). Note hypointense internal foci corresponding to intralesional fat.
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Fig. 14—51-year-old woman with bursitis secondary to carpal boss.
A. Sagittal sonogram obtained over dorsal aspect of wrist shows well-marginated fluid collection (black arrows) overlying carpal boss (white arrow).
B. Lateral radiograph obtained after intrabursal injection of 1 mL of iodinated contrast agent confirms diagnosis of bursitis (arrow).

Fig. 15—47-year-old man with Dupuytren’s disease. Sagittal sonogram shows hypoechoic, well-delineated mass (arrows) located close to palmar aponeurosis. LM = lumbrical muscle, FTs = flexor tendons.