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Ultrasound of Wrist Ganglion Cysts: Which Location is Most Common?

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Abstract

Objective: The literature states that wrist ganglion cysts are most commonly dorsal; however, our experience suggests a volar location is more common. The purpose of this study was to identify the locations of ganglion cysts of the wrist as imaged with ultrasound.

Methods: After IRB approval with informed consent waived, retrospective review of wrist ultrasound reports from January – April 2016 was completed. Only patients who had a comprehensive evaluation that included the dorsal and volar wrist were included. Ultrasound images were reviewed to characterize wrist ganglion cysts.

Results: The study group consisted of 98 subjects (78% female, 22% male) (average age 51 years, range 13 – 79) with 124 wrist ganglion cysts where 69% (86/124) were volar and 31% (38/124) were dorsal. Ganglion cysts were located between the radial artery and flexor carpi radialis in 63% (78/124), followed by a dorsal location superficial to the scapholunate ligament in 20% (25/124), other dorsal locations in 11% (13/124), and other volar locations in 6% (8/124). With dorsal ganglion cysts, the scapholunate ligament when imaged appeared normal in 91% (20/22). Ganglion cysts were multilocular/multilobular in all subjects.

Conclusions: The most common location for wrist ganglion cysts is in the volar wrist, particularly between the radial artery and flexor carpi radialis tendon, appearing multilocular or multilobular with a mean largest dimension of 1.0 cm. Given the propensity of ganglion cysts to

occur at this site, attention to this area when imaging the wrist with ultrasound or MR imaging should be considered.

Introduction

Ganglion cysts are benign mucin-filled cysts typically located near joints and tendons and are the most common soft tissue masses of the wrist^{1,2}. Although their etiology is unknown, theories include joint stress leading to leakage of fluid through a joint capsule, mucoid degeneration of periarticular connective tissue, or stimulation of mucin secretion by periarticular mesenchymal cells^{2,3}. Ganglion cysts commonly present with pain, tenderness, and interference of activity^{1,2}. Accurate diagnosis is important both to differentiate ganglion cysts from other pathologic conditions, as well as to identify such cysts, as they can be effectively treated with ultrasound-guided aspiration⁴.

Sonography is commonly used to accurately detect wrist ganglion cysts^{5,6}. Wrist ganglia most commonly appear well-defined, multilobular or multilocular, non-compressible, and hypoechoic on ultrasound measuring between 7 - 30 mm^{5,6}. Common sites for wrist ganglion cysts include the dorsal wrist superficial to the scapholunate ligament, and the volar wrist between the radial artery and flexor carpi radialis tendon². While one limited study describes a volar location as more common, the majority of the literature states that ganglion cysts of the wrist are most commonly located dorsally, with 60 - 70% of ganglion cysts in this location^{2,3,5,7}.

In our clinical practice, ultrasound is routinely used to assess for hand and wrist pathology, including ganglion cysts. We have anecdotally observed that a volar location may be more common than the current literature states. The purpose of this study was to

retrospectively review the ultrasound locations of wrist ganglion cysts to clarify their most common locations.

Materials and Methods

The Institutional Review Board approved our study and informed consent was waived. A retrospective search for all wrist extremity ultrasound reports performed at our institution from January 2016 to April 2016 was completed. Wrist ultrasound reports that did not include a comprehensive evaluation of the dorsal and volar wrist were excluded. Ultrasound reports were then reviewed by one author to determine if a ganglion cyst was described, and then location and size of the ganglion cyst was recorded.

Ultrasound examinations of the wrist were performed by an ultrasound technologist supervised by one of 11 fellowship-trained musculoskeletal radiologists (experience ranged from 8 – 18 years) as part of routine clinical care. High frequency probes (12 – 18 MHz) were used (Philips, Model Epiq, Bothell, Washington; GE, Milwaukee, Wisconsin, Model E9). The criteria used to diagnose a ganglion cyst was that of a well-defined, anechoic or hypoechoic, unilocular or multilocular/multilobular fluid collection not representing an anatomic bursa or joint recess, as described in the literature^{6,8}.

In subjects with reported ganglion cysts, static ultrasound images and cine clips were then retrospectively reviewed on an imaging workstation in consensus by two authors to

confirm the presence of a ganglion cyst, to ensure size and location of the ganglion cysts were accurately recorded, to record the locularity of the ganglion cyst (unilocular or multilocular/multilobular), to record blood flow on color Doppler imaging (presence or absence), and to assess the appearance of the dorsal component of the scapholunate ligament if a dorsal wrist ganglion was present. A scapholunate ligament was deemed to be normal if hyperechoic and fibrillar seen in the v-shaped articulation between the lunate and scaphoid in the axial plane, while the absence of normal ligament was classified as abnormal.⁹ Subject demographics were also recorded. The term “multilobular” refers to the lobularity of the outer border of the cyst, while the term “multilocular” refers to the internal separate rounded areas separated by thin walls or septae, and are used synonymously for this research given their sonographic similarities at retrospective review. Patient medical records were reviewed with regard to indication for ultrasound examination, surgical data, and other imaging. Any patient with history of prior wrist surgery or prior treatment of a ganglion cyst was excluded.

Results

The initial key word search for wrist ultrasound identified 272 subjects, in which a complete wrist extremity ultrasound examination was performed from January 2016 to April 2016. Of this group of subjects, 36% (98/272) had a wrist ganglion cyst at ultrasound, where 78% (76/98) were female and 22% (22/98) male subjects. The average age of all subjects was 51

years (range 13-79 years). No subjects were excluded due to history of prior wrist surgery or treatment of a ganglion cyst.

In the 98 subjects where a wrist ganglion was identified at ultrasound, a total of 124 ganglion cysts were present due to multiplicity of cysts in some subjects. Of these 124 ganglion cysts, 60% (75/124) were located volar and solitary, 22% (27/124) were dorsal and solitary, and 18% (22/124) were located both volar and dorsal in a unilateral wrist. Overall, 69% (86/124) of ganglion cysts were volar (Figs. 1 and 2) and 31% (38/124) were dorsal (Figs. 3 and 4) (Table 1). Out of the above 98 subjects, 12 had bilateral ganglion cysts either volar (9/12), dorsal (1/12), or in both locations (2/12). With regard to volar wrist ganglion cysts, 81% (54/67) of subjects were female with an average age of 55 years (range 13 – 70 years). With regard to dorsal wrist ganglion cysts, 71% (22/31) of subjects were female with an average age of 44 years (range 17 – 74 years). Of the 124 wrist ganglion cysts, 2% (3/124) had surgical or histologic confirmation.

Of the 86 ganglion cysts located in the volar wrist, 91% (78/86) were located between the radial artery and the flexor carpi radialis tendon. The remaining 9% (8/86) volar wrist ganglia were located at the radiocarpal joint (4/86), at the pisiform (2/86), at the capitate (1/86), and between the scaphoid and trapezium (1/86). Of the 38 ganglion cysts located in the dorsal wrist, 66% (25/38) were located superficial to the scapholunate ligament. Of the remaining 34% (13/38), 8% (3/38) were located at the first extensor compartment, 5% (2/38) at the radiocarpal joint, 5% (2/38) at the extensor carpi radialis tendons, 5% (2/38) at the fourth

extensor compartment, 5% (2/38) between the fourth and fifth extensor compartments, 3% (1/38) at the extensor carpi ulnaris tendon near the triangular fibrocartilage complex, and 3% (1/38) at the first carpometacarpal joint.

The mean largest dimension of the ganglion cysts was 1.0 cm (range 0.2 - 2.5 cm). All of the ganglion cysts (124/124) were multilocular or multilobular and none (0/124) were unilocular. Of the 22 dorsal ganglion cysts that were adjacent to the scapholunate ligament, 91% (20/22) were associated with a normal appearing scapholunate ligament at ultrasound (Fig. 4).

Discussion

In our patient population, 36% of all wrist ultrasound examinations showed a ganglion cyst. The most common location for wrist ganglion cysts was the volar wrist located between the radial artery and flexor carpi radialis (63%), followed by a dorsal location superficial to the scapholunate ligament (20%), other dorsal locations (11%), and other volar locations (6%).

Ganglion cysts were multilocular or multilobular in all subjects.

Ganglion cysts are soft tissue myxoid masses with a fibrous capsule and no synovial lining². Their exact etiology is uncertain, but they are thought to be related to trauma or degenerative change, and they often have a connection to a nearby joint recess or tendon sheath. One popular theory is that ganglion cysts are created when fluid from these spaces is

forced into surrounding tissues². Indeed, a communicating neck or pedicle between dorsal wrist ganglion cysts and the dorsal radiocarpal joint recess, and between a volar wrist ganglion cyst and the volar radiocarpal joint recess has been described¹⁰. While not specifically assessed in our retrospective study, similar connections between ganglion cyst and joint recess were identified. The propensity for ganglion cysts to occur in such specific anatomic locations may relate to sites of greatest mechanical stress or capsular weakening; the theory that injury is a prerequisite to ganglion cyst formation has been refuted³. Indeed specific locations of ganglion cysts reported in the literature include between the radial artery and flexor carpi radialis tendon, and superficial to the scapholunate interosseous ligament, which is similar to our study where 83% (103/124) were in these two locations².

Evaluating more specific locations of ganglion cysts, the prior literature states that the majority (60-70%) of wrist ganglion cysts occur in the dorsal wrist^{1-3,5,7}. Contrary to the literature, our study has demonstrated ganglion wrists to be more common in a volar location (69%). Most of the current literature cite older research regarding the most common locations of wrist ganglion cysts; much of this prior literature is based on clinical exam findings, where dorsal wrist ganglion cysts may be more readily identified. Surgical data on the most common locations of wrist ganglia are also likely to be heavily influenced by the clinical examination. The comprehensive ultrasound examination of the wrist in our subjects allowed a complete assessment for volar and dorsal ganglion cysts not biased by physical examination findings.

The high prevalence of wrist ganglion cysts in a volar location deserves further comment. While it is not known if the volar wrist ganglion cysts in this study specifically were symptomatic, causes of wrist pain may be multifactorial and symptoms may be referred. In addition, it has been shown that clinically occult wrist ganglion cysts may be a cause of wrist symptoms¹¹; therefore, evaluation of the volar wrist between the radial artery and flexor carpi radialis by ultrasound or MR imaging should be considered in patients with wrist symptoms given the propensity of ganglion cysts to occur at this location. One study using aspiration or surgery as the standard of reference showed that the majority of such treated ganglion cysts were indeed volar in location, which is further evidence of the potential clinical significance of volar ganglion cysts.

In our study, wrist ganglion cysts appeared hypoechoic, and in all cases the cysts were multilocular or multilobular. This may be explained by the proposed etiology of ganglion cysts where joint fluid is forced out through the joint capsule and subsequently dissects through tissue planes rather than distending a single compartment anatomic space, such as a joint recess or bursa. This also explains why ganglion cysts are typically non-compressible, unlike a joint recess or bursa¹¹.

The dorsal wrist ganglion cysts in our study were most commonly located superficial to the scapholunate ligament, similar to prior studies. While it has been reported that such dorsal wrist ganglion cysts are due to degeneration of the scapholunate ligament, in 91% of our

subjects the dorsal component of the scapholunate ligament had a normal hyperechoic and fibrillar appearance. This further supports that the location of such dorsal wrist ganglion cysts may not be related to scapholunate ligament tear, but rather distal extension of a ganglion cyst originating from the adjacent dorsal recess and joint capsule of the radiocarpal joint^{3,10}. A communicating neck or pedicle between the radiocarpal joint and dorsal ganglion cysts has been described in the literature and was seen in our cases^{3,10}.

One limitation of our study was that ultrasound examinations were performed at only one institution and validation of our results in a larger patient population would be important; however, our institution is a tertiary academic center with a large referral base, and likely approximates the general population. Another limitation was that surgical or histologic confirmation was only present in 2%, although established sonographic criteria for ganglion cysts were used for diagnosis. As an additional limitation, selection bias may be present as symptomatic patients are more likely to seek medical attention; however, every wrist was comprehensively evaluated with ultrasound regardless of symptom location or clinical history. Regarding the integrity of the scapholunate ligament, only the dorsal aspect was assessed with ultrasound. Finally, the clinical significance of the ganglion cysts identified in this study was not assessed.

In conclusion, the most common location for wrist ganglion cysts is in the volar wrist, particularly between the radial artery and flexor carpi radialis tendon, appearing multilocular or

multilobular with a mean largest dimension of 1.0 cm. Given the propensity of ganglion cysts to occur at this site, attention to this area when imaging the wrist with ultrasound or MR imaging should be considered.

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Table 1: Locations of wrist ganglion cysts

Volar: Radial Artery and FCR	Volar: Other Sites	Dorsal: Scapholunate Ligament	Dorsal: Other Sites
63% (78/124)	6% (8/124)	20% (25/124)	11% (13/124)

FCR, flexor carpi radialis

Figure Legends

Fig. 1 – 29-year-old female with volar ganglion cyst. Color Doppler ultrasound images of volar wrist in **(A)** transverse and **(B)** sagittal planes show anechoic multilobular ganglion cyst (arrows) located between flexor carpi radialis (FCR) and radial artery (colored red in **A**). Right side of image **B** is distal.

Fig. 2 – 57-year-old female with volar ganglion cyst. Ultrasound images of volar wrist in **(A)** transverse and **(B)** sagittal planes show hypoechoic multilobular ganglion cyst (arrows in **A**, between cursors in **B**) located between flexor carpi radialis (FCR) and radial artery (colored blue in **A**). Right side of image **B** is distal.

Fig. 3 – 36-year-old female with dorsal ganglion cyst. Ultrasound images of dorsal wrist in **(A)** sagittal and **(B)** transverse planes show anechoic multilobular ganglion cyst (between cursors). Right side of image **A** is distal.

Fig. 4 – 37-year-old male with dorsal ganglion cyst. Ultrasound images of dorsal wrist in **(A)** sagittal and **(B)** transverse planes show anechoic multilobular ganglion cyst (between cursors).

Note normal hyperechoic and fibrillar dorsal component of scapholunate ligament (arrowhead in **B**). Right side of image **A** is distal.