Sonography-Assisted Arthroscopic Resection of Volar Wrist Ganglia: A New Technique

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**Abstract:** Although satisfactory arthroscopic resection of volar wrist ganglia has been reported recently, the risk of damage to arteries, nerves, and tendons remains. Furthermore, ganglia and their stalks cannot be visualized arthroscopically in many cases, and surgeons must perform a blind resection of the joint capsule until ganglion cysts or their stalks appear. Sonography has limited resolution, but recent improvements in hardware and software have made it an excellent noninvasive and dynamic imaging technique for assessing the musculoskeletal system. Ganglia, tendons, nerves, and vessels around the lesion can be clearly observed by sonography. Furthermore, the cyclic motion of the arthroscopic shaver tip makes identification by sonography easy and assists in guiding the surgeon to the lesion.

Endoscopic surgery has gained much popularity over the past decade because of its low invasiveness and better visualization of target tissues. There is a steep learning curve regarding many aspects of arthroscopic surgery. Even for surgeons with advanced skills, the risk of inadvertent injury to the arteries or nerves surrounding the joint cannot be eliminated, because the surrounding tissues outside the joint cannot be observed directly.

Satisfactory arthroscopic resection of volar wrist ganglia has been reported recently. Generally, arthroscopic decompression has the advantages of avoidance of extensive soft-tissue dissection, reduced postoperative pain, scarring, and early return of function compared with open resection. On the other hand, the surgeon cannot confirm the depth and direction of the arthroscopic instruments, especially when dealing with extra-articular lesions including ganglia. In fact, a previous article regarding arthroscopic treatment for volar wrist ganglia reported complications of injury to branches of the radial artery and neuro-praxia. Furthermore, ganglia or their stalks cannot be observed arthroscopically in most cases. Therefore, arthroscopic surgeons have to localize the ganglion by an indirect technique such as external pressure to the ganglion and dissect the joint capsule until the ganglion cysts or their stalks appear, while worrying about the risk of neurovascular injury.

Sonography has limited resolution, but recent improvements in hardware and software have made it an excellent noninvasive and dynamic imaging technique for assessing the musculoskeletal system. Sonography helps assess the mass size, internal structure, and relation to adjacent structures such as nerves, vessels, and tendons, and it can be used to guide biopsy.

The purpose of this article is to introduce how to combine the complementary features of sonography and arthroscopy to make arthroscopic resection of volar wrist ganglia a safer and more reliable surgical procedure.

**Surgical Technique**

The patient is examined preoperatively with plain radiographs of the wrist to rule out pre-existing osse-
ous lesions and carpal instability. A magnetic resonance imaging study of the wrist is also examined to confirm the diagnosis, as well as to localize the ganglion and its stalk preoperatively. The indication for arthroscopic surgery is a persistently symptomatic ganglion after failed nonoperative treatment including aspiration, injection of medication, or splinting (Fig 1A).

Wrist arthroscopy is performed with the patient under sonography-guided axillary block. The patient is placed in a supine position on the operating table. The upper extremity is placed on an arm board with the shoulder in 90° of abduction, the elbow in 90° of flexion, the forearm in neutral rotation, and the wrist in a neutral position to a position of slight palmar flexion. A tourniquet is applied to the upper arm but not inflated unless necessary. A standard small-joint arthroscope (diameter of 1.9 or 2.3 mm) with a 30° viewing angle is used with a wrist traction tower. Distraction is applied by use of Chinese finger traps with 4 to 5 kg of traction. The radiocarpal joint is initially inspected through the 3-4 and 4-5 portals. If needed, the midcarpal joint and distal radioulnar joint are then inspected. Radial ganglia mostly occur at the interval between the radioscaphocapitate ligament and the long radiolunate ligament. When external pressure on the ganglion is applied, synovial and capsular bulging is seen at this site. A 2.5-mm small-joint full-radius arthroscopic shaver (Stryker, Kalamazoo, MI) is introduced through the portal and used to debride the ganglion or its stalk.

A high-frequency linear-array transducer at a frequency of 13 MHz (Prosound α10; ALOCA, Mitaka, Japan) is covered by a sterilized drape (Surgi Transducer Cover; Civco, Kalona, IA) and simultaneously

![Figure 1](image_url)

**Figure 1.** (A) Preoperative gross view of hand. This patient underwent aspiration at a previous hospital more than 20 times, but the ganglion cyst (arrows) did not heal, and she complained of wrist pain and an abnormal appearance. (B) Postoperative gross view of hand. After 1 week, the wound had healed and the patient was allowed to perform light work. The ganglion became smaller, but slight swelling at the lesion (arrows) remained because of residual cysts. (C) One month after surgery, there was no swelling (arrows) and no pain. The patient could fully return to work and sporting activities.
used by an assisting surgeon during the wrist arthroscopy. The monitors for the arthroscope and sonography are placed beyond the patient to be easily viewed by surgeons (Fig 2). Visualization of the ganglion stalk and adjacent structures (i.e., vessels, nerves, and tendons), as well as the cycling tip of the arthroscopic shaver, is possible. Color Doppler sonography can show the branches of the radial artery. The arthroscopic shaver is clearly visualized with the acoustic shadow during shaving (Fig 3). Therefore it is easy to guide an arthroscopic shaver to the ganglion stalk and control both the depth and the direction of the shaver. The surgeon can confirm that the arthroscopic shaver goes toward the ganglion cyst and not to the radial artery or its branches. Arthroscopic debridement continues until the shunt between the ganglion cyst and joint has been completed. At the end of the operation, resection of the ganglion cyst is confirmed by both sonography and arthroscopy (Video 1).

The portals are not sutured because of drainage and for avoidance of scar formation caused by nylon strings. Only a soft dressing without a splint is applied, and it is removed 7 days postoperatively (Fig 1B). Patients are advised to move their fingers and wrists from day 2, although heavy manual activity should be avoided for 1 month (Fig 1C).

DISCUSSION

We have used the described method since 2008 for volar wrist ganglia in 5 cases. No intraoperative complications or recurrence has occurred, but in a ganglion located volar to the triangular fibrocartilage complex, we converted to an open resection because the arthroscopic shaver did not reach the ganglion stalk from either the radiocarpal joint or the distal radioulnar joint portals.

In 2003 Ho et al.1 reported arthroscopic resection of volar ganglia of the wrist. In their report, synovial and capsular abnormalities were seen at the interval between the radioscaphocapitate and long radiolunate ligaments in all cases. They confirmed the connection of the ganglion to this site by external pressure on the ganglion,

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**FIGURE 2.** Under axillary block, the patient is placed in a supine position on the operating table. The upper extremity is placed on an arm board with the shoulder in 90° of abduction, the elbow in 90° of flexion, the forearm in neutral rotation, and the wrist in a neutral position to a position of slight palmar flexion. Traction of the wrist is achieved by use of a sterile wrist tower with digits held by finger traps. A standard small-joint arthroscope (1.9 or 2.3 mm in diameter) with a 30° viewing angle is used. A high-frequency linear-array transducer (curved arrow) at a frequency of 13 MHz (Prosound α10) is covered by a sterilized drape (Surgi Transducer Cover) and simultaneously used by an assisting surgeon during the wrist arthroscopy.
which resulted in synovial and capsular bulging at this site. The procedure can also be aided by needle puncture. However, the ganglion or its stalk can barely be visualized directly with an arthroscope. Ho et al. also cautioned that the shaver must not be advanced too anteriorly into the volar aspect of the wrist joint, because this could damage the important structures volar to the joint.

Rocchi et al. conducted a prospective randomized study of volar wrist ganglia to compare the clinical results of arthroscopic resection with open excision. Arthroscopic resection had a lower complication rate and allowed a faster return to activities of daily life compared with open resection; however, 2 complications (1 injury to a branch of the radial artery and neurapraxia) and 2 recurrences of the ganglion occurred in 25 cases.

These results suggest the need for a safer and more reliable arthroscopic procedure for the treatment of volar wrist ganglia. With our methods, ganglia, vessels, nerves, and tendons around the lesion are clearly observed by sonography. The cycling tip of an arthroscopic shaver can also be seen with sonography and can be guided to the lesion. Finally, complete resection of the stalk or shunt between the ganglion cyst and joint is confirmed intraoperatively.

Recent improvements in hardware and software have made sonography an excellent noninvasive and dynamic imaging technique for assessing the musculoskeletal system. Sonography helps assess mass size, internal structure, and relation to adjacent structures, and it can guide biopsy. Nakamichi and Tachibana reported the case of a pregnant woman who had ganglion-associated ulnar tunnel syndrome that was successfully treated with ultrasonography-assisted aspiration and splinting.

On sonography, most ganglia are complex rather than simple. Complex ganglia are larger than simple ganglia, are located within the dorsal or volar wrist, and usually have well-defined margins, thick walls, locules, and acoustic enhancement. With our technique, not only volar but also dorsal ganglia can be identified clearly during arthroscopic resection. Usually, wrist arthroscopy is performed through dorsal portals. A linear-array transducer can be used for dorsal wrist ganglia at the same time as arthroscopy, but it is easier for surgeons to treat volar wrist ganglia than dorsal wrist ganglia, because the sonography transducer does not interfere with the arthroscope or shaver in the case of volar wrist ganglia.

This method has several limitations. First, it is difficult to detect a tiny or occult ganglion even if a high-frequency linear-array transducer is used. Second, when an arthroscopic working portal is created near the ganglion, the sonography transducer can overlap with the arthroscope or shaver. Therefore preoperative planning including imaging techniques is important before creation of portals. However, with our methods, not only ganglia but also vessels, nerves, and tendons around the lesion can be clearly observed by sonography. In addition, the cycling tip of the motorized shaver can be safely guided to the lesion while the surgeon confirms its relation with surrounding tissues. These features significantly reduce the risk of serious complications. At the end of surgical procedure, complete resection of the stalk and creation of the perfect shunt between the ganglion cyst and the wrist joint can be confirmed by detection of the smooth bidirectional fluid flow.

In summary, we report sonography-assisted arthroscopy. Ganglia, vessels, nerves, and tendons around the lesion can be clearly observed with sonography. Arthroscopic shavers can be identified with sonography and guided to the lesion. This method is safer and more reliable because the relation between the ganglion and surrounding tissue is clearly visualized so that blind resection of the ganglion or its stalk is not
required. This technique can be used not only in wrist surgery but also in arthroscopic surgery of other regions such as the elbow, shoulder, hip, knee, and ankle joint. This procedure has the potential to enhance the reliability of arthroscopic surgery.

REFERENCES