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ORIGINAL STUDY

Sonography-guided arthroscopic excision is more effective for treating volar wrist ganglion than dorsal wrist ganglion

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The purpose of this study was to compare the treatment results of sonography-guided arthroscopic excision for volar and dorsal wrist ganglions.

A total of 42 patients with wrist ganglions underwent sonography-guided arthroscopic resection. Clinical outcome measures included wrist range of motion, grip strength, patient-rated questionnaire Hand20, and numerical pain rating scale. All patients were assessed for recurrence throughout the follow-up period.

Ganglions were located at the dorsal wrist in 26 cases and at the volar wrist in 16 cases. The mean Hand20 and pain scores were significantly improved after sonography-guided arthroscopic resection for both volar and dorsal wrist ganglions. Recurrence was seen in six cases (23%) of dorsal wrist ganglion but no cases of volar wrist ganglion (P < .05).

The use of sonography-guided arthroscopic ganglion excision is better for treating volar wrist ganglion than dorsal wrist ganglion.

Keywords : arthroscopy ; resection ; sonography ; wrist ganglion.

INTRODUCTION

Dorsal and volar ganglions are two of the most common problems of the wrist. Indications for treatment include pain, appearance, stiffness and weakness. There are several reports of satisfactory arthroscopic resection of wrist ganglion *(6,10, 11,13)*. Generally, arthroscopic decompression has the advantage of avoiding extensive soft tissue dissection, reducing postoperative pain and scarring, and allowing for early return of function as compared to open resection. However, the surgeon cannot confirm the depth and direction of the arthroscopic instruments, especially when treating extra-articular lesions, including wrist ganglions. In fact, arthroscopic treatment for wrist ganglion has been reported to adversely result in extensor tendon lacerations, extensor tenosynovitis, and injury to branches of the radial artery, median nerve, and dorsal branches of radial nerve*(2, 3, 12, 15)*. Furthermore, not all ganglion cysts or stalks can be observed arthroscopically. Therefore, surgeons

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using arthroscopy must localize the cyst or the stalk by an indirect technique, such as applying external pressure to the ganglion and dissecting the joint capsule until the cyst or stalk appears, while also being cautious of neurovascular or tendon injury.

We previously reported the successful use of sonography-guided arthroscopy to treat wrist ganglions *(19,20)*. Sonography-guided wrist arthroscopy provides several advantages for surgeons, including visualization of the ganglions and their stalks, in addition to adjacent structures such as nerves, vessels, and tendons for patient safety.

The purpose of this study was to compare the results of sonography-guided arthroscopic excision of volar wrist ganglions to dorsal wrist ganglions. We hypothesized that sonography-guided arthroscopic excision was preferable for volar ganglion treatment. Because we use dorsal portals for arthroscopy, the sonography transducer can impede the shaver for excision of dorsal wrist ganglions.

METHODS

A total of 42 consecutive patients (15 men, 27 women; age 13–73 years) with wrist ganglion who underwent sonography-guided arthroscopic excision between 2008 and 2014 were evaluated. The mean follow-up period was 20 months, with a range of 16 to 36 months.

The indication for arthroscopic surgery in all cases was a persistently symptomatic ganglion after failed nonsurgical treatment.

Clinical outcome measures included wrist range of motion, grip strength, patient-rated Hand20 questionnaire scores, and a numerical pain rating scale scores. The Hand20 questionnaire is a 20-item questionnaire designed to measure the subjective function of the hand (from 100 (worst) to 0 (best)) *(16)*. All patients were assessed for recurrence throughout the follow-up period. Clinical outcomes and recurrence rates were compared between patients with volar wrist ganglions and those with dorsal wrist ganglions.

Five surgeons (M.Y., H.H., S.K., K.I., T.N.), each with more than 10 years of hand surgery experience and more than 1 year of sonography experience, performed the ganglion cyst arthroscopic resections. A tourniquet was applied to the upper arm but was not inflated unless necessary. A standard small joint arthroscope (diameter 1.9 or 2.3 mm) with a 30° viewing angle was used with a wrist traction tower. Distraction was applied using “Chinese” finger traps with 4 - 5 kg of traction. The radiocarpal joint (RCJ) was initially inspected using the 3 - 4 and the 4 - 5 portals. If needed, the midcarpal joint (MCJ), the scaphotrapeziotrapezoid joint (STTJ) and distal radioulnar joint (DRUJ) were then inspected. Indications for MCJ, STTJ and DRUJ arthroscopy depended on the location of the ganglion. A 2.5-mm full radius arthroscopic shaver was introduced through the portal and used to debride the ganglion cyst or ganglion stalk. Arthroscopic debridement continued until the path between the ganglion and joint was completed.

A high-frequency linear array transducer at a frequency of 13 MHz (Prosound α10, ALOCA Co. Ltd., Tokyo, Japan) was covered by a sterilized drape and used by an assisting surgeon during the wrist arthroscopy. All assisting surgeons had experience with hand surgery over the previous 5-year period and with sonography over the previous 1-year period. The surgeon who performed the arthroscopy directed the use of sonography. The monitors for the arthroscope and sonography were placed beyond the patient so that they could be easily viewed by the surgeons (Fig. 1).

Analysis of data was performed using the Student’s t-test. Ganglion recurrence was compared using Fisher’s exact probability test. Analysis of data was performed with Statcel QC software (OMS Publishing, Inc., Saitama, Japan).

RESULTS

Ganglions were located at the dorsal wrist in 26 cases and at the volar wrist in 16 cases. The mean age of patients with volar wrist ganglion was 42 (+16) years and higher than dorsal wrist ganglion of 33 (+12) years ($p = 0.05$). The mean range of motion and grip strength did not differ significantly between volar and dorsal wrist ganglions. The mean range of motion and grip strength did not differ

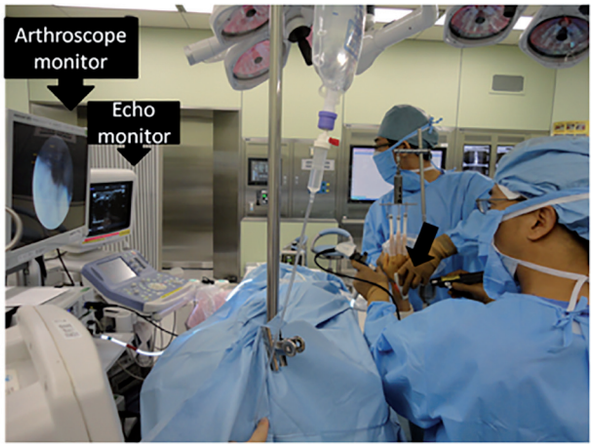

Fig. 1. — Simultaneous use of sonography and arthroscopy. A high-frequency linear-array transducer (black arrow) at a frequency of 13 MHz (Prosound α10, ALOCA Co. Ltd., Tokyo, Japan) was covered by a sterile drape and used by an assisting surgeon during wrist arthroscopy. The monitors of the arthroscope and for sonography were placed beyond the patient for easy viewing by the surgeons

significantly between pre and post surgery for both volar and dorsal wrist ganglions.

The mean Hand20 and pain scores were not significantly different between patients with volar wrist ganglion and those with dorsal wrist ganglion. However, the mean Hand20 and pain scores were significantly improved after sonography-guided arthroscopic ganglion resection in both volar and dorsal wrist ganglion groups.

Ganglion recurrence was seen in six cases (23%) of dorsal wrist ganglion but no cases of volar wrist ganglion ($P < .05$) (Table1). Recurrences of dorsal ganglions were seen at 6, 8, 9, 10, 12, and 16 months after surgery. All six of these patients were treated conservatively, including corticosteroid injection for four patients and observation alone for two patients. No intraoperative complications occurred in either group. However, in two cases in which a ganglion was located volar to the triangular

Table 1 — Clinical outcomes for volar and dorsal wrist gangion

	Volar wrist ganglion (n=16)	Dorsal wrist ganglion (n=26)	P Value
Age	42 (±16)	33 (±12)	0.05
Follow-up period (months)	19 (±2)	22 (±7)	0.12
Wrist flexion pre-op	75 (±12)	74 (±18)	0.91
Wrist flexion post-op	77 (±12)	76 (±12)	0.89
Wrist extension pre-op	82 (±10)	75 (±16)	0.28
Wrist extension post-op	83 (±10)	82 (±10)	0.66
Grip strength (ratio of normal side) pre-op	0.99 (±0.1)	0.95 (±0.2)	0.61
Grip strength (ratio of normal side) post-op	1.00 (±0.1)	0.97 (±0.2)	0.7
Hand20 score pre-op	17 (±14)	24 (±13)	0.12
Hand20 score post-op	6 (±7)	8 (±12)	0.61
Pain score pre-op	3.2 (±2)	4.6 (±2)	0.1
Pain score post-op	1.0 (±1.5)	1.2 (±1.6)	0.76
Recurrence number (%)	0 (0%)	6 (23%)	< .05

fibrocartilage and volar scaphotrapeziotrapezoidal (STT) joint, we converted the procedure to open ganglion resections because the arthroscopic shaver did not reach the ganglion stalk from either the RCJ, the MCJ, the DRUJ or STTJ portals.

DISCUSSION

In this study, we found that the recurrence rate of dorsal wrist ganglion was significantly higher than that of volar wrist ganglion. Sonography-assisted arthroscopic ganglion excision is better for treating volar wrist ganglion than it is for dorsal wrist ganglion. Because we use dorsal portals for arthroscopy, the sonography transducer can impede the shaver for dorsal wrist ganglion. In some cases of dorsal wrist ganglions, it was difficult to use both sonography and arthroscopy at the same time. However, in cases of volar wrist ganglion, sonography was always effective to visualize the relationship of the shaver, ganglion, and surrounding structures. Therefore, the surgeon could use the shaver until making the path from joint to ganglion without concern for a neurovascular or tendon injury.

A recent systematic review of complications and recurrence rate of arthroscopic volar ganglion resection reported a mean recurrence rate of 6.03%, with a range of 0 to 20% *(7)*. There were 16 (6.89%) complications including partial lesion of the median nerve, paresthesia of the dorsal radial nerve, hematoma, and injury to the radial artery *(7)*. Furthermore, some cases found no connection with the ganglion, with those procedures converted to open surgery *(9)*. In a study of five patients by Rocchi et al., only one patient was treated successfully because the ganglions was from the volar STT joint *(14)*. In our study, two cases of volar wrist ganglion were converted to open surgery because either the ganglion arose from volar side of the STT joint or the ganglion was located volar to the triangular fibrocartilage, and the arthroscopic shaver did not reach the either ganglion stalk from the RCJ, the STT, or the DRUJ.

Both arthroscopic resection and open excision of volar wrist ganglions have been reported to have high complication and recurrence rates. Gündeş et al. reported the retrospective study of 40 wrist ganglions operated over four years. In their results, the complication rate was 56% for volar ganglions, 12.5% for dorsal ganglions, with recurrence rates of 31.2% and 8.3%, respectively. They suggested that the significantly higher complication rate after excision of volar ganglions in contrast to dorsal ganglions might indicate that the former should be approached more carefully and preferably by a senior surgeon *(8)*. Dias and Buch reported a prospective study of the natural history and patient-reported treatment outcomes. At 5 years no significant differences were observed in the recurrence rates which were 42% after excision of a palmar wrist ganglion and 47% after aspiration. However, the complication rate for the excision group (20%) was higher than that of the aspiration

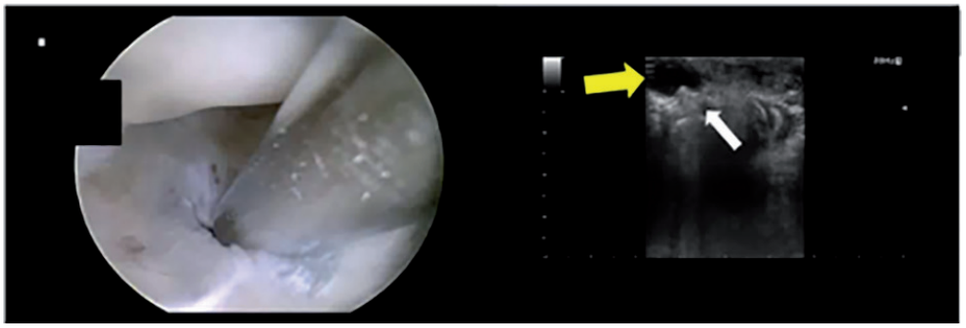

Fig. 2. — Arthroscopic and sonographic view
Left monitor shows the arthroscopic view while shaving the volar capsule of the radiocarpal joint. Right monitor shows the sonographic view while shaving. Yellow arrow indicates volar wrist ganglion cyst. White arrow indicates the arthroscopic shaver which is excising the volar capsule of the radiocarpal joint capsule

group (5%) *(4)*. Although the follow-up period was relatively short, our results following volar wrist ganglion excision were comparable with previous reports. The use of sonography can help to avoid injury of surround tissues, and can significantly reduce the complication rate of arthroscopic volar wrist ganglion resection.

The reported recurrence rate of arthroscopic resection for the dorsal wrist ganglion ranged from 0 to 29.7% *(1,11)*. On the other hand, recurrence rate of open surgery is reported to range from 4% to 40%. Both open and arthroscopic surgery for dorsal wrist ganglion have a wide range of recurrence rates *(5,18)*. The exact causes of ganglion recurrence may in fact be more multifaceted than the straightforward concept of insufficient removal of the stalk. Most recurrences occurred around one year after arthroscopic resection. Therefore, one of the reasons for the recurrence might be insufficient regeneration of the capsule resulting the reformation of a one-way bulb. In our study the mean age of dorsal wrist ganglion was younger than volar wrist ganglion ($p = 0.05$). Age and activity of the patients may also influence the recurrence rates.

Although complication rate of arthroscopic resection of dorsal wrist ganglion is not high, extensor tendon lacerations which required tendon transfer has been reported *(3)*. By using the sonography, not only ganglions but also vessels, nerves, and tendons around the lesion can be clearly observed. In addition, the cycling tip of the motorized shaver can be safely guided to the lesion while confirming its relationship with surrounding tissues. These features greatly reduce the risk of serious complications. At the end of the surgery, complete resection of the stalk and creation of the perfect shunt between the ganglion and wrist joint can be confirmed by detecting the smooth, bidirectional fluid flow. We used wet arthroscopy from the beginning of the surgery, however, dry arthroscopy may have one option to identify the stalk more easily.

The Hand20 is valid and comparable to the Japanese version of the Disabilities of the Arm, Shoulder and Hand questionnaire *(17)*. Although significant postoperative changes in the mean range of motion and grip strength were not observed in the cases of both dorsal and volar wrist ganglions, both the mean Hand20 and pain scores were significantly improved at the final follow-up. Recurrence rates of dorsal and volar wrist ganglion were significantly different, however, patients with both dorsal and volar ganglions experienced significantly increased function and decreased pain after sonography-assisted arthroscopic ganglion resection.

This study has several limitations. The sample size is small. Our recurrence rate of the dorsal wrist ganglion is not lower than previously reported studies without sonography. However, sonographic guidance might help the surgeon to achieve the best results without causing harm, especially for volar wrist ganglions.

In conclusion, we found that the recurrence rate of dorsal wrist ganglion was significantly higher than that of volar wrist ganglion. The use of sonography-guided arthroscopic ganglion excision is better for treating volar wrist ganglion than dorsal wrist ganglion.

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