

# Prospective Outcomes and Associations of Wrist Ganglion Cysts Resected Arthroscopically

Scott G. Edwards, MD, John A. Johansen, MD

**Purpose** To prospectively evaluate objective and subjective outcomes of arthroscopic dorsal wrist ganglion cyst resection, and to identify and examine intra-articular pathologies associated with ganglion cysts.

**Methods** We prospectively evaluated 55 patients with dorsal wrist ganglion cysts who underwent arthroscopic resection with a minimum follow-up of 24 months. Ten had recurrent ganglion cysts previously treated with open resection. Grip strength, wrist motion, and Disabilities of the Arm, Shoulder, and Hand questionnaire scores were evaluated preoperatively and at 6 weeks, 6 months, and 2 years postoperatively. Intraoperative findings were reviewed.

**Results** In primary ganglion cysts a discrete stalk was present in 4 of 45 cases and diffuse cystic material and redundant capsular thickening were present in 38 of 45 cases. Cystic material appeared to arise from the radiocarpal joint exclusively in 11 of 42 cases, extended into the midcarpal joint in 29 of 42 cases, and arose exclusively from the midcarpal joint in 2 of 42 cases. The scapholunate joint demonstrated instability types I (2 of 45 cases), II (22 of 45 cases), III (20 of 45 cases), and IV (1 of 45 cases). The lunatotriquetral joint demonstrated instability types II (6 of 45 cases) and III (39 of 45 cases). At 6 weeks, average grip strengths increased by 5.9 kg and wrist flexion decreased 13°. Preoperative Disabilities of the Arm, Shoulder, and Hand scores improved from 14.2 to 1.7 at 6 weeks and remained stable at 2 years. At 2 years, all patients demonstrated motion to within 5° of preoperative measurements, and there were no recurrences.

**Conclusions** Patients experienced significant increases in function and decreases in pain within 6 weeks after arthroscopic ganglion cyst resection, and the recurrence and complication rates appear to be comparable to open resections. Ganglion cysts also have a high association with certain interosseous laxities, and recurrent ganglion cysts originating from the midcarpal joint are not contraindications for arthroscopic resection. Assessment of the midcarpal joint is necessary for complete resection of most ganglion cysts, and identification of a discrete stalk is an uncommon finding and not necessary for successful resection. (*J Hand Surg* 2009;34A:395–400. Copyright © 2009 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Therapeutic IV.

**Key words** Arthroscopy, ganglion cyst, laxity, outcomes, resections.

**D**ESPITE BECOMING A well-accepted practice, arthroscopic ganglion cyst resection remains poorly understood, with most of the current literature offering mainly retrospective case studies

with small cohorts.<sup>2–5,7,8</sup> Arthroscopic ganglion cyst resection provides several theoretical advantages over open techniques, including faster recovery,<sup>2,3,5,7,8</sup> lower complication and recurrence rates,<sup>2,4,7</sup> and more satis-

From the Department of Orthopedic Surgery, Georgetown University Hospital, 3800 Reservoir Road, NW, Washington, DC.

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**Corresponding author:** John A. Johansen, MD, Department of Orthopedic Surgery, Georgetown University Hospital, 3800 Reservoir Road, NW, Washington, DC 20007; e-mail: johansj2@gmail.com and sge1@gunet.georgetown.edu.

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fying cosmetic results.<sup>2-5,7,8</sup> The current literature, however, lacks significant scientific support for these claims of superior outcomes.<sup>2-5,7,8</sup> Furthermore, the role of arthroscopic excision for recurrent cysts has been controversial (Singh D, Culp R. presented at the American Society for Surgery of the Hand, 2002), and although scapholunate laxity and other intra-articular findings have been associated with ganglion cysts, there has been no specific evaluation and classification of these laxities. Regarding technique, some surgeons evaluate the midcarpal joint routinely during the resection (Singh D, Culp R. presented at the American Society for Surgery of the Hand, 2002),<sup>2</sup> whereas others do not, with only anecdotal support for or against each practice.<sup>3,4</sup> Also, the inconsistent identification of a distinct ganglion cyst stalk<sup>2,3,8</sup> suggests that its importance has been overstated.

The purposes of this study are to prospectively evaluate objective and subjective outcomes of dorsal wrist ganglion cysts resected arthroscopically, and to identify and examine intra-articular characteristics associated with ganglion cysts.

## MATERIALS AND METHODS

A total of 55 patients with dorsal wrist ganglion cysts were prospectively enrolled in this study after failing nonsurgical treatment. They consisted of 33 women and 22 men with an average age of 42 years (range, 15–52 years). Ten patients had previous open excisions with consequent recurrence prior to evaluation. Twelve patients had previous aspirations with consequent recurrences. Of the 45 patients who had not had prior surgery, 34 had failed some form of nonsurgical treatment (eg, anti-inflammatory medication, splinting, aspiration, or steroid injection); the remaining 11 patients elected to have resection without attempting nonsurgical options. Whereas no patients reported acute trauma within 6 months of ganglion cyst occurrence, 7 recalled specific trauma to the wrist in the remote past. A total of 48 patients reported pain as a primary reason for surgery, whereas 7 did not have pain but did not like the appearance of the ganglion cyst. The average duration of ganglion cyst symptoms before surgery was 10 months (range, 2–52 months). Institutional review board approval was granted before initiation of the study, and patients gave informed consent for participation.

### Preoperative evaluation

Preoperatively, we measured grip and pinch strengths and wrist motion using standard assessment instrumen-

tation. Patients also completed a preoperative visual analog pain scale (0–10) and Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, with all data obtained within 1 month prior to surgery. Patients were separated into 2 groups; 45 had primary cysts (group 1) and 10 had recurrent cysts after previous surgery (group 2). We evaluated groups 1 and 2 separately because previous surgical intervention may influence intra-articular findings.

### Postoperative evaluation

Six weeks, 6 months, and 2 years after surgery, we again obtained grip strengths, wrist motions, and DASH scores. Throughout the follow-up period, patients were specifically assessed for any recurrences of cysts or complications such as hematoma, painful neuroma, infection, paresthesias, decreased sensation, tenosynovitis or tendon injury, complex regional pain syndrome, hypertrophic scarring, and any subjective reports of problems that lie outside of what might be expected.

### Surgical technique

All surgeries and postoperative evaluations were performed by the senior author or under the senior author's direct guidance. A tourniquet was placed on every patient as a precaution and inflated in the event intra-articular bleeding obscured visualization, which occurred in approximately one third of patients. Operative time averaged 25 minutes.

All patients underwent arthroscopic examination, in which both the radiocarpal and midcarpal joints were evaluated with a 2.7-mm arthroscope. The presence of a cystic stalk, the origin of cystic material, ligament laxity, and extrinsic or interosseous ligament integrity were documented. We evaluated interosseous ligament laxity using the arthroscopic classification system described by Geissler et al.<sup>1</sup> (Table 1).

While the patient's arm is suspended in a traction tower with 5 to 8 kg of traction applied, a 6-R portal is created as a visualization portal. The more radial 3-4 or 4-5 portals are avoided at this time to prevent inadvertently decompressing the cyst. With the arthroscope introduced through the 6-R portal, a working portal might traditionally be a 3-4 portal. Nevertheless, because dorsal ganglion cysts often overlap the general vicinity of the 3-4 portals, we typically create the working portal adjacent to the immediate area of the cyst, rather than directly over the 3-4 portal. Consequently, the working portal is usually just distal and sometimes slightly radial to the actual 3-4 portal. A 2.9-mm,

**TABLE 1. Arthroscopic Classification of Interosseous Ligament Tears<sup>1</sup>**

Grade	Description
I	Attenuation and/or hemorrhage of interosseous ligament as observed from the radiocarpal joint. No incongruence of carpal alignment in midcarpal space.
II	Attenuation and/or hemorrhage of interosseous ligament as observed from the radiocarpal joint. Incongruence and/or step-off as observed from midcarpal space. A slight gap (less than the width of a probe) between carpal bones may be present.
III	Incongruence and/or step-off of carpal alignment are observed in both the radiocarpal and midcarpal space. The probe may be passed through gap between carpal bones.
IV	Incongruence and/or step-off of carpal alignment are observed in both the radiocarpal and midcarpal space. Gross instability with manipulation is noted. A 2.7-mm arthroscope may be passed through the gap between carpal bones.

full-radius shaver is introduced through this modified portal, with every attempt not to decompress the cyst with simple introduction of the shaver.

The focus of the resection begins at the site of ganglion cyst stalk or redundant capsular material, if identified. If neither is identified, the debridement begins adjacent to the dorsal scapholunate ligament and capsular reflection. The debridement continues until approximately 1 cm of capsule has been removed. The authors advise direct visualization of the extensor tendons to verify that complete capsulotomy has been performed.

Once the capsulotomy and cyst excision have been completed from the radiocarpal joint, the camera is removed and the dorsal wrist is palpated to determine the efficacy of the debridement. If a portion of the cyst remains, there is some degree of communication between the cyst and the midcarpal joint that has not yet been addressed. To remedy this, the arthroscopic camera is introduced through an ulnar midcarpal portal and a similar capsulotomy is performed adjacent to the scapholunate interval through the radial midcarpal portal. During debridement from the midcarpal joint, often a fenestration is created between the midcarpal and radiocarpal joint through the capsular reflection. On removing the arthroscopic equipment, the wrist is palpated again to ensure that the cyst has been completely excised. This may be difficult, especially given the possibility of fluid extravasation, substantial amounts of

adipose tissue obscuring the cyst, or the existence of a small cyst before resection.

## RESULTS

### Grip, pinch, range of motion, and DASH questionnaire

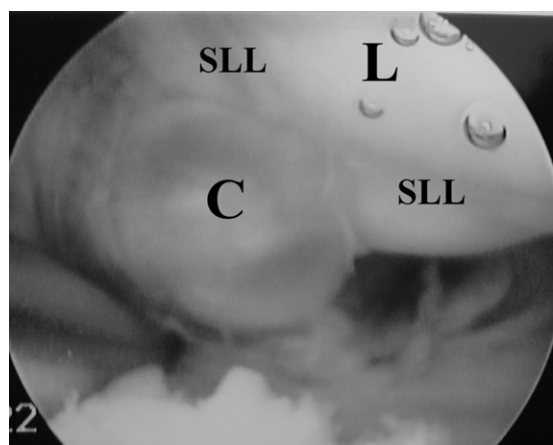
At 6 weeks, average grip and pinch strengths increased by 5.9 and 2.3 kg, respectively. Average wrist extension decreased 9°, flexion decreased 13°, radial deviation decreased 5°, and ulnar deviation decreased 4°. Pain scores averaged 4 (range, 0–7) preoperatively, whereas all patients reported 0 on the pain scale at 6 weeks after surgery and continued to have no pain throughout the follow-up period. Preoperative DASH scores improved from 14.2 to 1.7 at 6 weeks after surgery. Six months after surgery, all patients continued to demonstrate improved grip strengths from preoperative measurements, and motion improved to within 5° of preoperative measurements in all directions. These results were maintained after 24 months postoperatively (Table 2). There were no appreciable differences between patients in group 1 and group 2, and neither group had any recurrences. Three patients developed painless extensor tenosynovitis postoperatively during the first 3 months, 2 of whom underwent open extensor tenosynovectomy to improve appearance. Tenosynovectomy was performed within 6 months of the ganglionectomy in both cases, and there was no recurrence of either the ganglion cysts or the tenosynovitis throughout the remaining follow-up.

### Intraoperative findings

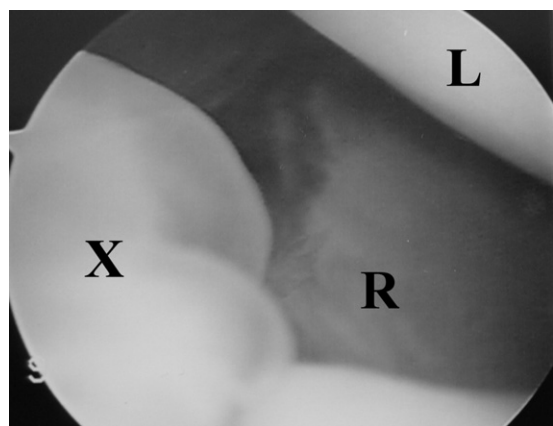
Operative time averaged 25 minutes and tourniquets were used approximately one third of the time. In group 1, discrete ganglion cyst stalks were present in only 10% of cases (Fig. 1). We encountered diffuse cystic material and redundant capsular thickening in 38 of 45 cases (Fig. 2). This tissue was differentiated from synovitis in that it appeared devoid of vasculature and lacked the characteristic fronds of synovitis. Cystic material appeared to arise from the radiocarpal joint exclusively in 11 of 42 cases and involved the midcarpal joint in 31 of 42 cases. It extended from the radiocarpal into the midcarpal joint in 29 of 42 cases and arose exclusively from the midcarpal joint in just 2 of 42 cases. The scapholunate joint demonstrated laxity types I (2 of 45 cases), II (22 of 45 cases), III (20 of 45 cases), and IV (1 of 45 cases). The lunatotriquetral joint demonstrated laxity types II (6 of 45 cases) and III (39 of 45 cases). The 10 patients in group 2 all had abundant scar tissue making it impossible to discern any discrete stalks or redundant capsular thickening. However, similar cystic material was seen in all cases. These recur-

**TABLE 2. Preoperative and Postoperative Data**

	Preoperative	Postoperative		
		6 wk	6 mo	2 y
Grip strength (kg)	31 (16–52)	37 (24–56)	37 (22–56)	37 (24–54)
Wrist flexion (degree)	61 (40–80)	48 (30–75)	60 (40–80)	61 (42–80)
Wrist extension (degree)	54 (40–75)	53 (38–80)	55 (40–75)	54 (40–75)
Wrist ulnar deviation (degree)	32 (20–45)	32 (15–45)	32 (20–45)	32 (20–45)
Wrist radial deviation (degree)	17 (10–28)	17 (10–28)	17 (10–28)	18 (10–28)
DASH score	14 (0.8–36.7)	1.7 (0–15.8)	1.7 (0–16.7)	1.6 (0–14.2)
Pain (0–10)	4 (0–7)	0	0	0



**FIGURE 1:** Discrete intra-articular ganglion cyst stalk. L, lunate; SLL, scapholunate ligament; C, ganglion cyst stalk.



**FIGURE 2:** Redundant capsule and cystic material. R, radius; L, lunate; X, redundant capsular tissue.

rent cysts were associated with scapholunate laxity type I (1 in 10 cases), II (5 in 10 cases), III (4 in 10 cases); and lunatotriquetral laxity type II (5 in 10 cases) and II (5 in 10 cases).

## DISCUSSION

Initial outcomes of wrist ganglion cysts resected arthroscopically have been favorable.<sup>2–5,7,8</sup> Although arthroscopic resection of wrist ganglion cysts is becoming more accepted, several questions remain unanswered.

The theoretical advantages of a minimally invasive procedure to remove wrist ganglion cysts reliably seem intuitive, but have not been validated previously. Reduced recovery times, less postoperative pain, and quicker return to work and athletics have been theorized but not reported in many series. This study attempts to demonstrate the short-term and long-term subjective and objective outcomes after arthroscopic ganglion cyst resection. At 6 weeks after surgery, patients reached near full motion and strength, and patient-based outcome scores were greatly improved. These assessment factors remained stable at 2 years after surgery. This high postoperative satisfaction rate occurred even with 17% of patients being asymptomatic preoperatively, and opting for surgery only to improve appearance. The satisfaction rates for open techniques with similar patient populations are not known.

Reported recurrence rates for arthroscopic resections are 0% to 10%<sup>2–5,7,8</sup>—lower than the recurrence rates reported for open excision (8% to 40%).<sup>9–11</sup> However, most previously reported studies had small cohort sizes, selection bias, and poorly defined follow-up, all of which could potentially distort the actual recurrence rates. This study reports 55 patients with no recurrences at 2 years. Rizzo et al.<sup>4</sup> reported 41 patients with a follow-up of 2 years with 2 recurrences, both within the first 6 months. Mathoulin et al.<sup>5</sup> reported 96 patients with an average follow-up of 34 months and 4 recurrences. Based on a critical review of the relevant literature, recurrence rates between open and arthroscopic

techniques are similar and should not be the sole determining factor in selecting either technique.

Indications for arthroscopic excision of recurrent cysts have not been previously addressed in the literature. One study suggested that recurrent cysts after previous open surgical excision should be considered a contraindication for arthroscopic resection (Singh D, Culp R. Paper presentation, American Society for Surgery of the Hand, 2002). Although the data to support this recommendation are unclear, some studies have used recurrence as an exclusion criterion.<sup>3</sup> One significant exception was a series in which 15% of patients underwent arthroscopic resection after their cyst recurred after open excision.<sup>8</sup> In this study, nearly 20% of our patients presented with recurrent cysts, and their outcomes were comparable to primary cyst resections. Based on this, we believe that recurrent cysts should not be considered contraindicated for arthroscopic resection.

Three cases of extensor tenosynovitis occurred after resection, possibly owing to tendon or tenosynovial mechanical irritation at the time of capsulotomy. This complication has not been previously reported with arthroscopic ganglion cyst excision, but in our study it occurred in 6% of patients. One study evaluating the complications of wrist arthroscopy not limited to ganglionectomy reviewed 210 cases, and found extensor tendon irritation in only 4 cases.<sup>6</sup> The reason for the high incidence of this complication in our series is not clear, but may be related to the extensive capsulotomy required during ganglion cyst excision and not during other arthroscopic procedures. In any case, the risk of extensor synovitis and possible subsequent open tenosynovectomy should be part of the preoperative discussion with patients.

To preserve the cyst so that proper intra-articular observations could be made, we made every attempt to prevent premature decompression of the cyst until its removal. A common technique for arthroscopic ganglionectomy is to place the shaver through the cystic sac, as it often resides directly over the usual 3-4 portal. This action will consequently decompress the cyst and may obscure any presence of an intra-articular stalk. Some authors believe that this offers some therapeutic benefit; critics of the procedure will argue that arthroscopic excisions are nothing more than glorified aspirations. The technique we used attempted to avoid decompressing the cyst with the shaver before actual excision, to observe the possibility of an undisturbed cystic stalk and its path elsewhere outside the radiocarpal joint.

The significance of identifying intra-articular cystic

stalks in the current literature is ambiguous. According to previous reports, although not specifically stated, it is implied that the identification and surgical excision of the stalk is paramount when using standard arthroscopic technique for ganglion cyst excision. However, the presence of this important structure has been variable in the literature. Osterman and Rapheal<sup>2</sup> identified a stalk in two thirds of their patients undergoing arthroscopic ganglion cyst excision, but reported no recurrences and excellent results in the remaining third in whom the stalk was not identified. Other studies have reported a stalk incidence as low as 20% or 30%.<sup>3,4</sup> Despite different reports on stalk identification, the importance of such pathology must be questioned. In this study, discrete cystic stalks were identified in only 4 of 45 (9%) of cases. More commonly encountered, however, was intra-articular cystic material and redundant capsular tissue (38 of 45 [85%] of patients), which we made the primary focus of the ganglion cyst excision.

Previously, there has been no consensus as to whether entering the midcarpal joint is necessary when arthroscopically resecting ganglion cysts. Ho et al.<sup>3</sup> reported 2 recurrences after resection of ganglion cysts originating from the midcarpal joint, and ultimately concluded that arthroscopic resection was not indicated for cysts originating from this area. Another series reported success with arthroscopic resection of dorsal midcarpal ganglion cysts, but their cohort was small.<sup>7</sup> Many authors would agree that most dorsal wrist ganglion cysts originate from the scapholunate interval, but given the capsular limitation in the wrist, this interval is only partially visualized from the radiocarpal joint. This study observed that cysts communicated with the midcarpal joint in 31 of 42 (74%) of cases, which suggests that evaluation of the midcarpal joint is important for successful resection.

Osterman and Rapheal<sup>2</sup> associated intra-articular abnormalities with the incidence of ganglion cysts. In their series, nearly half of patients had some intra-articular pathology, the most common of which was a scapholunate ligament tear. This study shows that most ganglion cysts are associated with type II and III scapholunate and type III lunatotriquetral instabilities. Although it is reasonable to propose that increased intercarpal laxity may contribute to ganglion cyst formation, the actual significance is unclear since the natural incidence of these laxities in the general population is not known.

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