# Arthroscopic Volar Wrist Ganglionectomy

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**Abstract**

As an original technique developed by our department, the preliminary result of arthroscopic resection of volar wrist ganglion was first published in 2003. Since then, there were few reports in the literature concerning this new treatment method. The aim of the study is to evaluate the long-term outcome of this treatment technique. From August 1997 to April 2005, 21 volar wrist ganglia with average size of 2 cm (range 1-4 cm) were treated. The average age of patients was 48.6 (range 18-63). Thirteen ganglia had previous treatment including either aspiration or open excision. Seventy-one percent of the operations were performed under local anesthesia. Wrist arthrogram was performed in 9 cases. Seven cases showed origin from radiocarpal joint and all proceeded to arthroscopic resection successfully. Arthroscopically, 75% of ganglia arose from the interval between radioscaphocapitate and long radiolunate ligament, and 25% from the interval between long radiolunate and short radiolunate ligament. Sixteen of the 21 ganglia could be excised by arthroscopic technique. The average follow up was 56 months (range 101 – 9 months). There were 2 recurrences. One was treated with repeated arthroscopic excision and the other by open excision. There was no impairment of wrist motion and function in all patients. No neurovascular complication was encountered. Arthroscopic resection was an effective treatment method for well-selected volar wrist ganglion arising from the radiocarpal joint in long run.

**Introduction**

Volar wrist ganglion is the second most common location for wrist ganglion occurrence [1]. Similar to dorsal wrist ganglion, most of the ganglia arise from the wrist joint [2]. According to Greendyke, 68% originates from the radio-carpal joint and 34% from scaphotrapezial joint [3]. However, the exact pathological site has not been described. Conventionally surgical treatment involves open excision of ganglion cyst. Significant morbidity has been reported due to its proximity to the radial artery and palmar cutaneous branch of median nerve. Recurrence rate of up to 33% is anticipated [4].

Arthroscopic treatment of wrist ganglion was first described by Lee Osterman in 1995 [5]. Its clinical application was limited to dorsal wrist ganglion of which the stalk arises from scapho-lunate ligament in 90% of cases, according to Angelides [1]. Principle of arthroscopic treatment involves identification of stalk, abolition of the check-valve phenomenon, decompression of the ganglion cyst followed by spontaneous regression of the cyst without actual removal of the cyst wall. Recurrence rate ranging from 0-7% has been reported in several studies [5,6,7,8,].

Based on the same principle, the author developed arthroscopic technique for treating volar wrist ganglion arising from the radio-carpal joint since 1997 and the result was first published in 2003 [9].

**Surgical Technique**

The operation can be performed under general, regional or local anaesthesia. The author prefers portal site local anaesthesia [10, 11] as it is always effective and minimizes the surgical risk to the patient. In contrast to the common belief, tourniquet is not required in most situations as bleeding is rarely a problem during the surgical procedure. In fact, it is preferable not to use tourniquet as this can help to monitor any possible iatrogenic damage to the radial artery and its branches during the surgery.

Wrist arthrogram can be performed immediate prior to the arthroscopic intervention or as separate investigation procedure. The use of intra-op arthrogram can facilitate the confirmation and identification of stalk of ganglion as arising from the radial carpal joint. Absence of demonstrable contrast filling stalk with communication of the radio-carpal joint may preclude the use of the technique. With the patient lying supine and arm supported by hand table, 3-5c.c.non-ionic contrast solution admixed with 2% lignocaine is injected to the radio-carpal joint at the ¾ portal under fluoroscopic guidance. Typically the stalk of ganglion, and occasionally the cyst itself can be shown up at one of the volar radio-carpal ligament intervals. Ganglion arising from interval between the radio-scapho-capitate ligament and the long radio-lunate ligament will show up at the more lateral aspect of the distal radius, while those arising from interval between the long and short radio-lunate ligaments will show up at the more central position of the distal radius. The relative position of the contrast-filling stalk can aid the identification of the true stalk during the actual arthroscopic procedure and hence facilitate subsequent decompression. As a rule, ganglion arising from the mid-carpal joint or STT joint will not be revealed by

arthrogram, unless one of the intercarpal ligaments at the proximal carpal row is ruptured so that free communication between the radio-carpal and the mid-carpal joint exists.

A wrist traction tower with 5 -6kg traction is used with the aid of plastic finger traps applied to index, middle and ring fingers. Local anaesthetic infiltration to the portal sites is carried out using 1% lignocaine with 1:200,000 adrenaline. [10] The portal sites are palpated and marked, and then the local anaesthetic injected to the skin and subcutaneous tissues down to the capsule with or without intra-articular infiltration. A sterile tourniquet may be applied to the proximal forearm but is not inflated unless necessary. Conversion to forearm intravenous regional anaesthesia can be done if the patient cannot tolerate the discomfort during any part of the procedure. Twenty to twenty-five c.c.0.5% pure lignocaine diluted with saline can be injected through a venous access at dorsum of hand after forearm is being exanguinated with Esmach bandage and tourniquet over proximal forearm muscle inflated to 100mmHg above systolic blood pressure. Complete anaesthetic effect is usually attained within 5- 10 minutes after intra-venous injection of lignocaine. Most patients can tolerate the FIRA procedure well for 30-45 minutes without overt discomfort. In all cases, radio-carpal joint arthroscopy is routinely performed. For a right-handed surgeon operating on the right wrist, the scope entry site is typically ½, and working portal is ¾. For the left wrist, the sites are reversed. (Fig. 1) The outflow portal is 6U in all cases. A 2.7 mm video-arthroscope is being used most often, though there is tendency to use smaller sized arthroscope such as 1.9mm in order to achieve maximal cosmetic benefit in term of scar size. Irrigation fluid is given by gravity infusion alone using 3-litre saline bag.

Routine diagnostic arthroscopic examination of the radio-carpal joint is performed and followed by localization of the ganglion. In our first 7 cases there were synovial and capsular abnormalities at the interval between the radioscaphocapitate (RSC) and long radiolunate (LRL) ligaments. Subsequent similar changes could also be seen at the ligament interval between long radiolunate and short radiolunate ligament. Alternatively the site of ganglion connection with the joint can also be identified by direct external manual compression of the ganglion, which will cause internal bulging of the ligamentous interval, or even expression of gelatinous content from the ganglion into the joint. A 2.0/2.9 mm arthroscopic shaver is then introduced to debride the region, while gentle external pressure is applied on the ganglion. The working portals may be swapped between ½ and ¾ depending on the direction of access to the ganglion stalk. The radial artery should be palpated from time to time. When sufficient enlargement of the capsule communication of the ganglion is achieved, a sudden gush of the gelatinous content into the radiocarpal joint can be seen, and this is removed by suction, until the ganglion completely disappeared. In the process the capsular opening is enlarged a bit further, but care is taken not to advance the shaver too deep into the ganglion cyst, and the radial artery is palpated to ensure that the shaver is not getting too near to it. A capsular defect about 5-10mm in size is usually resulted at the interligamentous sulcus after the procedure. The ganglion cyst will keep on bulging out under continuous fluid irrigation. However with successful decompression, it will characteristically regress completely upon gentle external manual pressure once the irrigation fluid inflow is stopped. Steri-strips are then used to close the portal sites without any stitch. The ganglion site is packed with thick gauzes and the wrist is protected with crepe bandage to provide continuous external pressure to the decompressed ganglion site. Light dressing is then changed at day 2 with waterproof dressing material such as Tagaderm. Patients are advised to have early mobilization and free use of the hand and wrist for daily activities soon after the arthroscopic resections, although heavy manual exertion is to be avoided

for 1 month. They are also instructed to perform frequent daily digital massage at the decompression site for up to 3 weeks to discourage recollection of the cyst due to articular fluid aggregation. Dressing and steri-stripes can usually be removed between days 10-12 after operation. At the final follow-up, all patients are assessed with regard to recurrence, complications, limitation of activities and the degree of satisfaction with the procedure.

**Materials and Methods**

From August 1997 to April 2005, 21 cases of volar wrist ganglia were subjected to arthroscopic resection. There were 11 males and 10 female patients. The average age was 48.6 (range 25 to 69). Eleven cases occurred on the dominant wrist and 10 on the non-dominant wrist. All of them presented with a visible lump on the radial side of the volar aspect of the wrists. The size of the ganglia ranged from 1 cm to 4 cm with average of 2cm. The average duration of symptom was 24 months (range 6 to 60 months). Thirteen patients had received previous treatment for the ganglia including aspiration in 11 cases and open excision in 2 cases. Among the patients, there were 8 manual workers, 6 housewives, 4 clerks and 3 retired persons. Fifteen cases (71%) were performed under portal site local anaesthesia while 6 cases (29%) were done with forearm intravenous local anaesthesia.

**Results**

Five patients were converted to open resection due to the following reasons: 1) In 2 cases, ganglia were found arising from the STT joint upon open excision; 2) in 1 case, the pedunculated stalk of the ganglion arising from radio-carpal was too long; 3) in 2 cases, ganglia were found to be not arising from joint but from tendinous structures.

We have performed intra-op wrist arthrogram in 9 patients. Seven of them showed abnormal contrast filling of the ganglion cyst and stalk at the radiocarpal joints. All 7 patients proceeded to arthroscopic resection successfully.

For the 16 patients successfully treated, stalk of the ganglion could be identified arthroscopically in all cases. Twelve of them originated from the interligamental sulcus between radio-scapho-capitate and long radio-lunate ligament, while 4 of them arose from the long and short radio-lunate ligament. The most consistent and obvious pathology found in them were synovitis, fibrillation of the capsule or ligaments at the ligament interval. (Fig.2) The average operation time was 28 minutes (range 20 to 60 minutes). There was no fluid extravasation, neurovascular injury or other complication in all cases.

Postoperative the redundant cyst wall persisted in 5 patients for a variable duration in the form of a non-tender, soft and easily reducible swelling over the previous site of the ganglion. The swelling resolved completely with time, in all cases within 3-6 weeks. 11 patients did not require any analgesic after the surgery. The remaining 5 patients required from 1days to 5 days of analgesic intake for pain relief. The average follow up period was 56 months, ranging from 9 to 101 months. All patients resumed full use of their hands without limitation of daily activities and were pain free. No patient complained of limitation of wrist motion. The average wrist flexion range was 72.7° and extension 67.7°. The average length of the combined scar site was less than 1 cm. Majority

were almost invisible and all patients were satisfied with the scar appearance. Twelve patients were highly satisfied with the procedure, 2 were satisfied and the remaining 2 considered the procedure acceptable. All patients resumed their normal work and duty within 2 weeks of time. There were 2 cases of true recurrence.

Case 1 was a 65 years old man presented with a large painless volar wrist ganglion of size 4 x 3cm. Wrist arthroscopy showed typical synovial change at interval between RSC and LRL ligament. Gush of gelatinous fluid was readily expressed into the joint from the stalk upon gentle massage of the cyst. Arthroscopic ganglionectomy was performed under portal site local anesthesia, which was converted to forearm intravenous anaesthesia after 20 minutes because of pain experienced upon shaving of the ganglion stalk. Surgery was successful and the ganglion disappeared completely. However the ganglion recurred after 1 year though the size had reduced to 2 x 2.5cm. Repeated arthroscopy under portal site local anesthesia was performed 30 months after the index surgery and the ganglion was decompressed completely again. There was no recurrence or symptom at 48 months post-op. (Fig. 3) Case 2 is a 36 years old man presented with left volar wrist ganglion of 3.5 x 2 cm size for 4 years and failed aspiration. Filling defect was seen at wrist arthrogram at radial border of distal radius. Arthroscopy proceeded and showed synovitis at RSC ligament and radial styloid region. Stalk was confirmed to be at interval between RSC and LRL ligaments. There were coincidental findings of central degenerative tear of TFCC and mild chondromalacia change over ulnar head and ulnar aspect of proximal lunate. Arthroscopic ganglionectomy was completed in 20 minutes. He was seen at post-op one week and noticed recollection of fluid in cyst wall presented as soft lump. Aspiration yielded 3.5cc thin blood stained fluid and the mass disappeared. However the mass recurred within one week and persisted thereafter. Ultrasonography confirmed reformation of ganglion of 1.4 x 3.7cm at original site. He requested open excision, which was done 4 months later. Intra-operatively it was shown that the ganglion stalk arose from the volar scapho-lunate ligament area. Excision was complete and he was symptom free with no further recurrence upon final follow.

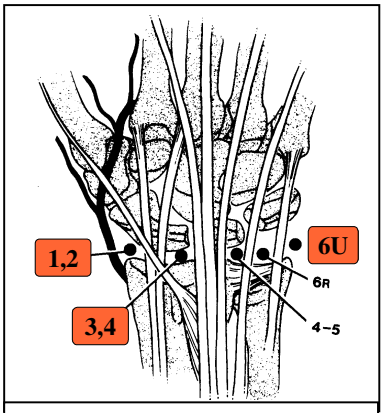


Fig.1 Portals used

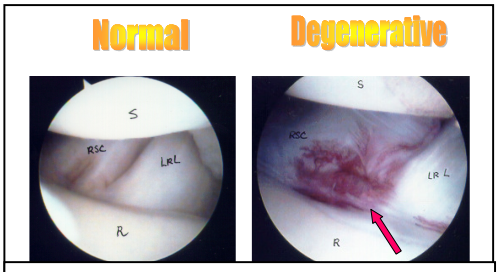
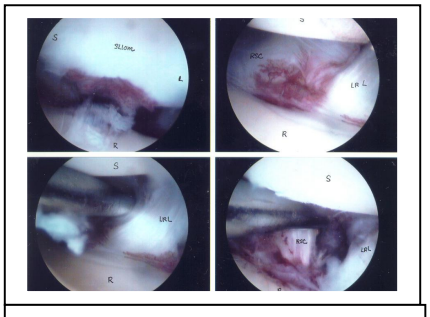


Fig.2 Typical degenerative change at RSC/LRL Interligamentus sulcus


Case illustration –male 24 yr


Arthroscopic findings, showing shaver in interligamntus sulcus


12 months post-op, no recurrence

Fig. 3 Case 1 of recurrence: Repeated arthroscopic ganglionectomy at interval between RSC and LRL, no recurrence after 24 months


**Discussion**

Volar wrist ganglion is the second most common tumour around the wrist (18-20%). [1] Surgical excision gives predictable outcome [12] but it is not without complications. Jacob [13] reported a recurrence rate of 28%, and also damage to the palmar cutaneous branch of the median nerve (28%), and unsatisfactory scar (28%). The risk of damage of the radial artery was also stressed. [1,14] . Open ganglionectomy was described as trading a scar for a lump.[1] Other series of open excision reported recurrence rate ranging from 15-33%.[4,15,16] The overall complication rate had been reported as high as 56% [15].

Osterman reported satisfactory results with arthroscopic resection of ***dorsal*** wrist ganglia [5]. It was postulated that the 'one-way valve' effect was removed after resection of the ganglion stalk, and a wide opening was created to enable free drainage of its content, a procedure similar to 'marsupialization'. Since a similar pathology is also operating in volar wrist ganglia, the authors believed that the ***volar*** wrist ganglion should also be resectable with an arthroscopic approach. This had been confirmed in a previous report in 2003 by the author. [9] C Mautholin published the result of similar technique and observation in 32 cases of volar wrist ganglion in 2004 [17]. At an average of 26 months of post-op follow up (range 12 – 39 months), there was no recurrence and complication. All patients were pain free with similar mobility as the opposite wrist.

Similar to Osterman's approach, the ganglion is decompressed or drained from inside the joint. No attempt is being made to remove the cyst wall. The principle of the surgery is to resect the stalk of the ganglion and thus

remove the pathologic "check valve" of the ganglion. The purpose of creating a capsular defect is to enhance the chance of eradicating the stalk and its check valve effect. The chance is theoretically increased with larger capsular defect. However, the size of the defect has to be balanced with the potential risk of iatrogenic damage to the important volar supporting ligaments of the radio-carpal joint. In practice, capsular defect of size between 5-10 $mm^2$ should be sufficient and the integrity of the adjacent ligaments should be preserved. The defect will be replaced by natural fibrosis in 3-6 weeks of time, during which there should also be natural involution of the cyst. Because of continued communication with the wrist joint in the interim period, joint fluid may accumulate in the cyst wall before fibrosis can heal the capsular defect. Thus it is not surprising to observe "pseudo-recurrence" between first and third weeks after the surgery in some patients. Therefore all patients undertaking this surgery should be forewarned and explained about such phenomenon and advised to continue intermittent self –massage and local pressure to the ganglion site for at least 3 weeks after the surgery.

It is noted that in all successful cases synovial abnormalities were seen at the interligamental sulcus between the volar radio-carpal ligaments, which indicated the primary origin of the volar wrist ganglion. The precise patho-anatomy of volar wrist ganglion arising from radio-carpal joint was therefore revealed for the first time in the literature. In the case where the ganglion was subsequently found to arise from the STT joint or other non-articular sites, there was actually no abnormality seen at the ligament interval. Thus this arthroscopic sign can serve as a guideline to determine whether arthroscopic resection should proceeded.

Because of some failure experience, we had employed wrist arthrogram intra-operatively before the operation to determine the origin of the ganglion in the later part of our study. Wrist arthrogram is a relatively non-invasive procedure accepted by most patients. In the 9 cases of athrogram we performed, we could demonstrate the stalk and communication with wrist joint in 7 cases and all these cases could be successfully treated by arthroscopic resection. (Fig 4) When arthrogram shows no communication or stalk locating in mid-carpal joint instead of radio-carpal joint, one should consider abandon the arthroscopic attempt and proceed to open excision.

Fig. 4 Radiocarpal joint arthrogram showing communication
of the volar ganglion with wrist joint through the stalk ( white arrow)

Another useful clinical sign to determine the surgical indication is to observe the relation of the ganglion with the wrist crease. It is more likely for those sessile ganglions lying directly opposite to the proximal wrist crease, or those pedunculated ganglions with stalk around the proximal wrist crease to be arising from the radio-carpal joint. Ganglion lying closed to the distal wrist crease is likely arising from the STT joint and will preclude application of the current surgical technique. Ganglion with long pedunculated stalk of more than 1 cm is also more likely to fail in surgery.

From technical point of view, arthroscopic resection of volar ganglion is a more direct procedure than resection of dorsal ganglion. Because of the volar tilt of the distal radius, the ligament interval was directly visualized after introduction of the scope either through the 3 / 4 or the 1 / 2 portal. Instrumentation to achieve shaving also followed a more or less straight route, making the procedure more easy and safe than resection of dorsal ganglion. The stalk of the ganglion is also more readily visible and located than dorsal wrist ganglion. The radial artery has been reported to be closely adhered to the ganglion wall in 54% of cases [13] and is thus at risk of being injured during arthroscopic resection. By palpating the pulsation of the radial pulse intermittently during the operation, taking care not to advance the shaver too far anteriorly, and instead, pushing the ganglion closer to the joint during the decompression, as well as leaving the cyst wall behind are the usual and effective measures to avoid injury to the radial artery, which did not occur in the our patients. Without the use of tourniquet in portal site local anaesthetic technique, any abnormal bleeding can be observed with action taken immediately.

From our point of view, arthroscopic resection of volar wrist ganglion offers the following advantages compared to open excision:

1. Surgical scar is minimal with excellent cosmesis irrespective of the size of the ganglion. Jacob reported average scar length of 3cm in 71 cases of open ganglion excision, ranging from 1.4cm to 9cm. Twenty eight percent of the patients had an unsatisfactory outcome. [6] In our series, none of the patients had combined scar length of more than 1 cm and all were satisfied with the cosmetic appearance. Thus the larger the size of the ganglion is, the more indicated is this type of surgery.
2. Anaesthetic risk is minimized as the surgery can be performed under local portal site anaesthesia without the use of tourniquet
3. The chance of iatrogenic damage to the radial artery and palmar cutaneous branch of median nerve is remote.
4. Arthroscopic technique is not demanding and visibility of lesion is superior than in dorsal wrist ganglion due to the more direct approach
5. The primary pathology can be better-illustrated and tackled during arthroscopy and thus help to contribute a lower reported recurrence rate (0 - 12.5%) compared to open excision.

However, there are also potential disadvantages:

1. The current technique is not applicable to ganglion arising from mid-carpal joint or STT joint
2. The surgery is more difficult for pedunculated ganglion with long stalk
3. Occurrence of "pseudo-recurrence" soon after operation is not uncommon and require patent's understanding and cooperation in post-op management

4. The placement of two scars of the arthroscopic portals over the dorso-radial aspect of the wrist, despite the small size, can be more conspicuous than the conventional scar over volar-radial side of the wrist in open excision. Nevertheless, as the scar usually heals excellently and compared to the high incidence of hypertrophic and sensitive scar in volar wrist, this may not be a necessary trade off.
5. The operation is potentially more costly than conventional open surgery in uncomplicated situation.

**Conclusion**

In conclusion arthroscopic ganglionectomy is an effective, safe treatment approach for well-selected volar wrist ganglion, and can be performed under portal site local anaesthesia without tourniquet. It is best indicated for volar wrist ganglion of sessile type arising from radio-carpal joint, as demonstrated by positive wrist arthrogram finding and the topographic location in relation to the proximal wrist crease.

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