



## Original Research

# Comparative Outcomes of Open Surgical Excision for Dorsal and Volar Wrist Ganglion Cysts: A Minimum 2-Year Follow-Up Study

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### Abstract

**Objectives:** The aim of this study is to evaluate and compare the minimum 2-year functional outcomes, clinical scores and complications of patients in whom we performed open volar and dorsal ganglion cyst excision.

**Methods:** Patients were divided into two groups based on cyst location: dorsal and volar. The surgical outcomes were analyzed, encompassing the size and localization of the cyst, wrist ROM (range of motion), VAS (visual analogue scale) for pain, QDASH (quick disability arm shoulder hand) questionnaire, and PRWE (patient rated wrist evaluation) scale. Additionally, complications and recurrence rates were examined.

**Results:** A total of 53 patients were evaluated in the study, including 34 dorsal ganglion cysts (19 women, 56%) and 19 volar ganglion cysts (15 women, 79%). The mean age of the patients was 34.1 years (range: 18 to 68), and the mean follow-up period was 73.8 months (range: 26 to 136). The surgical duration was longer for volar cysts ( $p=0.01$ ). For extension, the change in ROM was  $3.9\pm6.3$  degrees in volar cysts ( $p=0.01$ ), whereas in dorsal cysts, this change was measured as  $2.0\pm6.0$  degrees ( $p=0.05$ ). The increase in wrist flexion in the postoperative period was significantly higher in volar ganglion cysts ( $p<0.01$ ). There were no statistically significant differences between the two groups for QDASH, PRWE, and VAS scores ( $p>0.05$ ). Recurrence and complication rates were approximately 2-fold higher in volar cysts.

**Conclusion:** Open surgical excision is a successful treatment method for wrist ganglion cysts based on middle and long-term outcomes, with high patient satisfaction and low recurrence and complication rates.

**Keywords:** Dorsal, excision, ganglion, outcomes, volar

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Ganglion cysts are benign soft tissue tumors which are filled with jelly-like fluid. They are the most common tumors of the hand and wrist. They are typically seen in the second and fourth decades of life.<sup>[1,2]</sup> They are cystic lesions arising from the joint capsule or tendon sheath.<sup>[3,4]</sup> The prevalence of wrist pain in patients with ganglion cysts is 19%, while more than half remain asymptomatic.<sup>[5]</sup> Dorsal wrist ganglions are more common than volar wrist

ganglions.<sup>[6-8]</sup> Dorsal ganglions are connected to the joint via a pedicle, which may originate from a variety of other areas on the dorsal surface, including the scapholunate ligament, tendon sheath, or wrist capsule.<sup>[2,5,9]</sup> Volar wrist ganglions exit through a pedicle from the radioscaphoid-scapholunate interval, scaphotrapezial joint, or metacarpotrapezial joint, or they can originate from the tendon sheath.<sup>[5,7]</sup>

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Patients who have ganglion cysts seek treatment when they experience pain, weakness, cosmetic concerns, decreased functionality, or harbor fears of malignancy.<sup>[10,11]</sup> Various treatment options such as observation, aspiration, steroid injection, and surgical excision can be considered.<sup>[12,13]</sup> Although successful outcomes have been reported in non-surgical treatment, current literature strongly indicates that recurrence rates are significantly higher compared to open and arthroscopic surgery.<sup>[11,12]</sup> Complete removal of the ganglion stalk is necessary to prevent recurrence. Therefore, open surgical excision is widely used in treatment.<sup>[12,14]</sup>

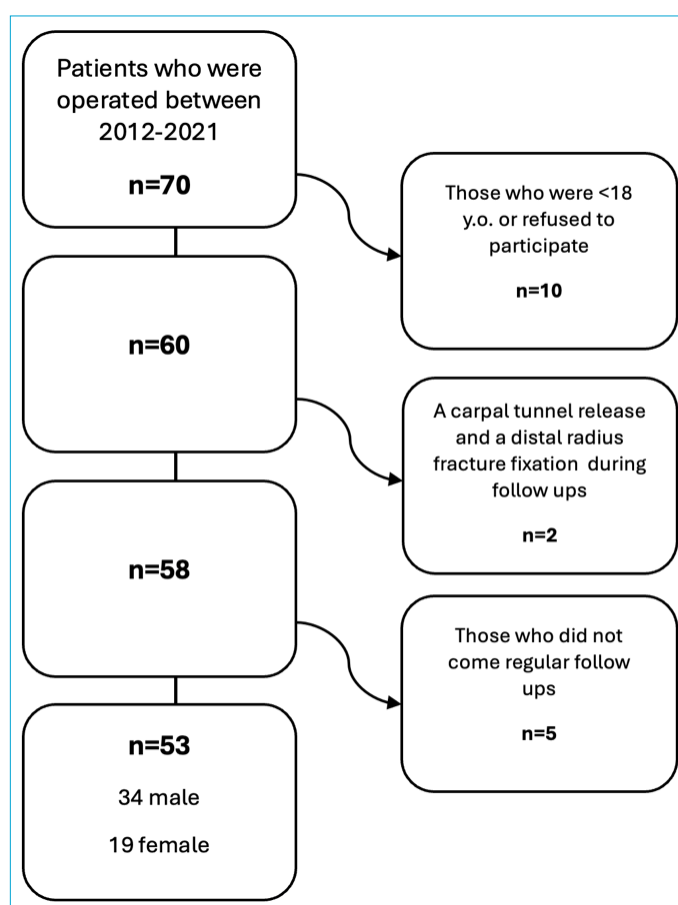
In this study, the aim was to compare and see if there are significant differences in terms of patient-reported outcome measures (PROMs), complications, and functional outcomes in patients who underwent open surgical excision due to dorsal and volar wrist ganglion cysts during a minimum follow-up period of two years. Our hypothesis is that complication and recurrence rates will be higher in volar ganglion cysts.

## Methods

### Study Group

The collection of patient data for the study was conducted after obtaining institutional ethics committee approval (Istanbul Medipol University Non-interventional Clinical Research Ethics Committee, date: 14.03.2024, number: 300). Patients who underwent open surgical excision for dorsal or volar wrist ganglion cysts between October 2012 and July 2021 were retrospectively reviewed. A total of 17 patients with follow-up periods of less than 24 months, those who underwent surgery for another condition in the same hand or underwent revision surgery, those who did not attend regular follow-ups, those with incomplete data, those under 18 years of age, and those who declined to participate were excluded from the study. As a result, 53 patients (19 women, 34 men) were included in the study (Fig. 1). All patients were informed about the purpose of the study according to the principles of the Helsinki Declaration and written/oral consent was obtained for their participation in the study. The patients and/or their families were informed that data from the case would be submitted for publication and gave their consent.

The diagnosis of ganglion cysts was made based on history and physical examination. Patients underwent surgery primarily due to wrist pain, poor cosmetic appearance, and fear of a malignity. Preoperative confirmation of the diagnosis was done with magnetic resonance imaging (MRI) in 27 patients and ultrasonography (USG) in 26 patients. Patients' previous history of conservative or surgical treat-



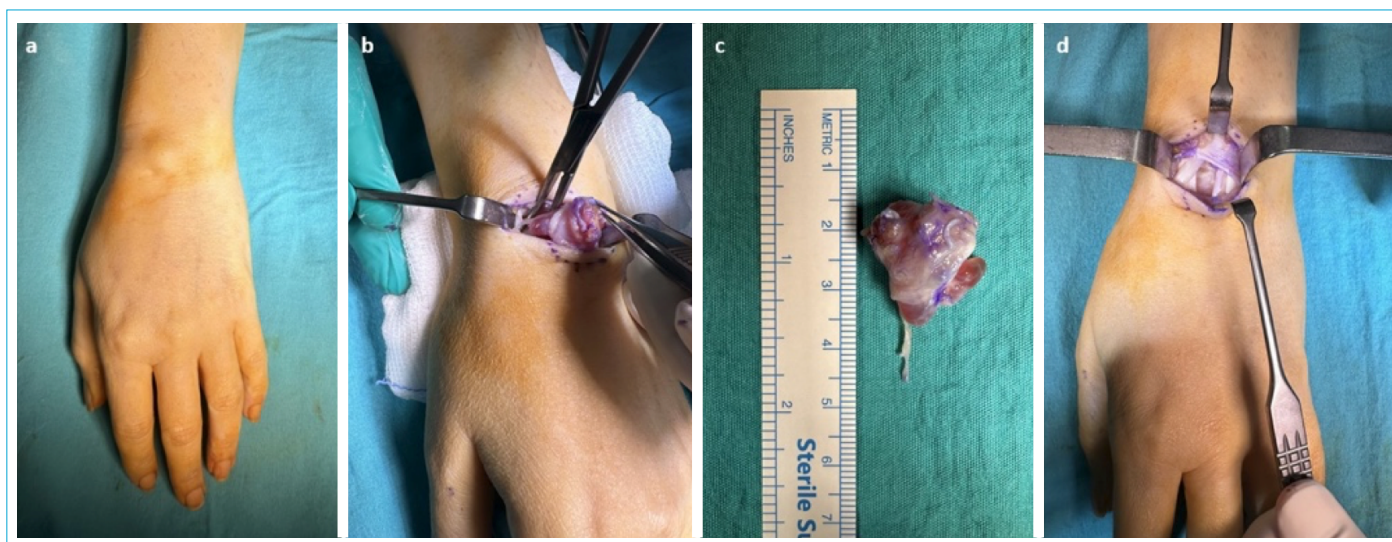
**Figure 1.** Flowchart of the study.

ment was investigated. Patients were divided into two groups based on the localization of the ganglion cyst in the wrist, namely dorsal and volar, and both groups were compared in terms of outcomes.

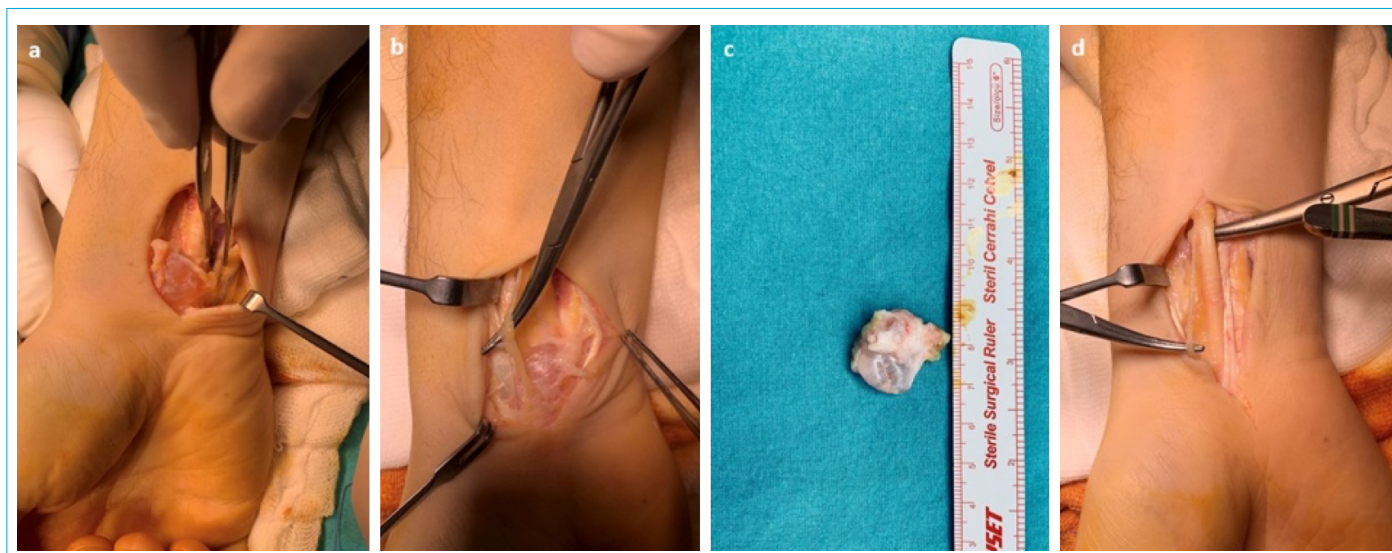
### Surgical Technique

The surgeries were performed by three different surgeons; one was an experienced hand surgeon and the other two had 5 to 10 years of practice in the field of orthopedics. Operations were done under local anesthesia (n=18, 34%), peripheral block anesthesia (n=8, 15%), and general anesthesia (n=27, 51%).

For dorsal ganglions, a transverse incision was made over the cyst (Fig. 2), while for volar ganglions, a longitudinal incision was performed (Fig. 3). After dissecting the cyst and its pedicle up to the relevant joint capsule without damaging the cyst wall, it was completely removed along with the joint capsule, approximately 0.5 to 1 cm in size. Cysts originating from the tendon sheath were excised along with the associated tendon sheath. After hemostasis, the joint capsule was not repaired, and the subcutaneous tissue and skin were sutured. The excised cyst was sent to pathology for histopathological examination. The duration of surgical



**Figure 2.** Preoperative view of the dorsal bump (a), intraoperative view of the ganglion during excising (b), excised ganglion with its stalk (c), intraoperative view of the wrist after excision (d).



**Figure 3.** Intraoperative view of the ganglion arising from Flexor Carpi Radialis tendon sheath (a), Note that the palmar cutaneous branch of the median nerve in close proximity with ganglion (b), excised ganglion cyst (c), median nerve palmar cutaneous branch along with the palmaris longus tendon (d).

procedures and any complications during surgery were recorded. Immobilization was not applied in the postoperative period, and wrist and finger exercises were gradually initiated in the first week.

### Evaluated Parameters

Our primary objective was to compare the functional outcomes and pain relief achieved after surgery. The secondary objective was to evaluate the incidence of complications and assess PROMs. At the final follow-up, clinical evaluations were conducted for all patients. Surgical outcomes were analyzed, including details such as the size and localization of the ganglion cyst, wrist range of

motion, presence of wrist pain, recurrence, and functional outcomes, along with any complications. Recurrence was defined as the presence of the cyst in the same location on ultrasound or physical examination. Vascular patency was assessed with the Allen test. The range of motion of the wrist joint in flexion and extension was measured using a goniometer.

The patients' pain was evaluated using the VAS (visual analogue scale) score before and at the last control examination; 0 indicating no pain and 10 indicating severe pain. Daily functional limitations were assessed subjectively using the QDASH questionnaire, consisting of 11 items.<sup>[15]</sup>

The PRWE (Patient-rated Wrist Evaluation) scale, consisting of the pain and function subscales and a total of 15 questions, was used to measure the patient's self-assessed pain and disability. (0=no pain/difficulty; 10=maximum perceived pain/unable to do at all).<sup>[16]</sup>

## Statistical Analysis

The data was analyzed using SPSS software (ver.29.0; IBM Corp., Armonk, NY, USA). To assess the normality of the data distribution, skewness and kurtosis values were utilized and Kolmogorov-Smirnov test is used to determine whether the data are normally distributed. Categorical variables were compared using the Pearson chi-squared test and Fisher's exact test while an independent sample T-test was employed to compare parametric variables. Quantitative variables were presented as the mean±standard deviation, and qualitative variables were expressed as numbers (n), frequencies, or ratios. Statistical significance was considered for p-values less than 0.05.

## Results

A total of 53 patients were evaluated in the study, including 34 dorsal ganglion cysts and 19 volar ganglion cysts. There were no statistically significant differences between the two groups in terms of age, gender, affected side, employment status, and surgical indication (Table 1).

It was determined that 27 of the dorsal ganglion cysts originated from the scapholunate joint, five from the scapho-capitate joint, and two from the extensor tendon sheath. Regarding volar ganglion cysts, nine originated from the

radioscaphoid joint capsule, eight from the scaphotrapezoidal joint capsule, and two from the flexor carpi radialis tendon sheath.

All patients had undergone nonoperative treatment before surgical management. Non-operative treatments included non-steroidal anti-inflammatory drugs, splints, and activity modification. Additionally, ganglion cyst aspiration was performed in nine patients.

The clinical outcomes and follow-up durations of the study groups are presented in Table 2 and Table 3. The postoperative change in wrist flexion and extension were statistically significant for both volar and dorsal ganglion cysts.

**Table 2.** Comparison of clinical outcomes and complications between dorsal and volar ganglion cyst excision surgery

|                                  | Dorsal        | Volar         | p                                      |
|----------------------------------|---------------|---------------|----------------------------------------|
| Follow up (months)               | 73.1±33.8     | 75.1±29.5     | 0.8                                    |
| Ganglion size (mm <sup>3</sup> ) | 1607.9±1784.0 | 1106.2±1423.4 | 0.2                                    |
| Surgical Time (minutes)          | 41.2±11.6     | 51.3±15.9     | <b>0.01*</b>                           |
| Flexion (degree±SD)              |               |               |                                        |
| Preop                            | 81.9±6.9      | 65.5±15.2     | <b>&lt;0.01*</b><br><b>(10.2-22.5)</b> |
| Postop                           | 85.0          | 83.4±3.7      | <b>0.01*</b><br><b>(0.2-2.8)</b>       |
| Extension (degree±SD)            |               |               |                                        |
| Preop                            | 82.9±6.0      | 80.2±7.7      | 0.1<br>(-1.1-6.5)                      |
| Postop                           | 85.0          | 84.2±2.5      | 0.07<br>(-0.4-1.9)                     |
| QDASH Score(±SD)                 |               |               |                                        |
| Preop                            | 37.1±16.4     | 37.6±20.1     | 0.9<br>(-10.7-9.6)                     |
| Postop                           | 4.8±10.2      | 4.6±7.6       | 0.9<br>(-4.8-5.1)                      |
| PRWE score                       |               |               |                                        |
| Preop                            | 42.7±20.7     | 49.1±22.6     | 0.3<br>(-18.7-5.9)                     |
| Postop                           | 5.6±11.7      | 5.1±7.8       | 0.8<br>(-5.5-6.5)                      |
| VAS (±SD)                        |               |               |                                        |
| Preop                            | 7.0±1.9       | 6.1±2.1       | 0.1<br>(-0.2-2.1)                      |
| Postop                           | 0.9±1.8       | 0.3±0.6       | 0.1<br>(-0.2-1.4)                      |
| Complications (%)                |               |               |                                        |
| Keloid                           | -             | -             | N/A                                    |
| Nerve Injury                     | 1 (3)         | 1 (5)         | N/A                                    |
| Vascular Injury                  | -             | 1 (5)         | N/A                                    |
| Recurrence                       | 4 (12)        | 4 (21)        | 0.3<br>(-4.9-2.9)                      |

SD: Standart deviation; VAS: Visual analogue score; QDASH: Quick disabilities of arm, shoulder and hand; PRWE: Patient rated wrist evaluation. \* Significance defined as p<0.05, in bold. (95% Confidence interval).

**Table 1.** Demographic and clinical parameters

|                | Dorsal, n (%) | Volar, n (%) | p   |
|----------------|---------------|--------------|-----|
| Patients       | 34            | 19           |     |
| Age (Years±SD) | 33.9±10.2     | 34.4±15.6    | 0.8 |
| Sex            |               |              |     |
| Female         | 19 (56)       | 15 (79)      | 0.1 |
| Male           | 15 (44)       | 4 (21)       |     |
| Side           |               |              |     |
| R              | 18 (53)       | 11 (58)      | 0.7 |
| L              | 16 (47)       | 8 (42)       |     |
| Employment     |               |              |     |
| Yes            | 25 (74)       | 10 (53)      | 0.1 |
| No             | 9 (26)        | 9 (47)       |     |
| Indication     |               |              |     |
| Pain           | 25 (73.5)     | 11 (58)      | 0.5 |
| Cosmetic       | 8 (23.5)      | 7 (37)       |     |
| Malignity      | 1 (3)         | 1 (5)        |     |

SD: Standart deviation; n: Number of patients. Chi-square statistic is significant at the 0.05 level.

**Table 3.** Compression of preoperative and postoperative patients' reported outcomes measurements within groups for dorsal and volar cyst excision

|                | Localization | Preop     | Postop   | Significance (p) |
|----------------|--------------|-----------|----------|------------------|
| VAS(±SD)       |              |           |          |                  |
|                | Volar        | 6.1±2.1   | 0.3±0.6  | <b>&lt;0.01*</b> |
|                | Dorsal       | 7.0±1.9   | 0.9±1.8  | <b>&lt;0.01*</b> |
| QDASH(±SD)     |              |           |          |                  |
|                | Volar        | 37.6±20.1 | 4.6±7.6  | <b>&lt;0.01*</b> |
|                | Dorsal       | 37.1±16.4 | 4.8±10.2 | <b>&lt;0.01*</b> |
| PRWE(±SD)      |              |           |          |                  |
|                | Volar        | 49.1±22.6 | 5.1±7.8  | <b>&lt;0.01*</b> |
|                | Dorsal       | 42.7±20.7 | 5.6±11.7 | <b>&lt;0.01*</b> |
| FLEXION(±SD)   |              |           |          |                  |
|                | Volar        | 65.5±15.2 | 83.4±3.7 | <b>&lt;0.01*</b> |
|                | Dorsal       | 81.9±6.9  | 85.0     | <b>0.01*</b>     |
| EXTENSION(±SD) |              |           |          |                  |
|                | Volar        | 80.2±7.7  | 84.2±2.5 | <b>0.01*</b>     |
|                | Dorsal       | 82.9±6.0  | 85.0     | 0.06             |

SD: Standart deviation; VAS: Visual analogue score; QDASH: Quick disabilities of arm, shoulder and hand; PRWE: Patient rated wrist evaluation. \* Significance defined as  $p < 0.05$ , in bold.

The wrist flexion in the postoperative period was statistically significantly higher in dorsal ganglion cysts ( $p=0.01$ , CI: 0.95, 0.2-2.8), while no significant difference was observed in terms of extension between dorsal and volar cysts ( $p=0.07$ , CI: 0.95, -0.4-1.9).

During the excision of a dorsal ganglion cyst, one patient experienced an injury to the radial nerve dorsal branch while a radial artery and a palmar cutaneous branch of the median nerve injury was seen in 2 patients with volar cysts. The patient with radial nerve sensory branch injury had been operated under local anesthesia, while the patients with radial artery and palmar cutaneous branch of the median nerve injury under peripheral block anesthesia. The radial artery injury was primarily repaired intraoperatively. Nerve injuries were detected not during surgery but postoperative follow-ups.

During follow-up examinations, recurrence was observed in eight patients (Table 2). No significant relationship was found between recurrence and gender, side, localization, comorbidities, occupation, cyst volume, and surgical duration ( $p > 0.05$ ). Among 27 patients who were operated under general anesthesia, recurrence was observed in five cases (18%), in two out of eight patients (25%) with peripheral block, and in only one case (5.5%) of those who were operated under local anesthesia. However, there was no statistically significant relationship between the type of anesthesia and recurrence ( $p=0.34$ ). Of the eight patients who

experienced recurrence, five underwent repeat surgery to excise the cyst. Although the rate of complications was 2-fold higher in volar ganglion cysts compared to dorsal ganglion cysts (31.5% and 14.7%, respectively), this difference did not reach statistical significance.

## Discussion

This study provides a comprehensive analysis of open excision outcomes and related factors in patients with dorsal and volar ganglion cysts. In both dorsal and volar ganglion cases, improvement in pain scores and joint range of motion compared to the preoperative period was observed during a minimum two-year follow-up post-surgery. Additionally, there was no difference in complication and recurrence rates between the two groups, and our results were similar to the literature (5.5% and 15%, respectively).

Although preoperative symptoms may differ, pain is one of the most commonly reported symptoms.<sup>[17]</sup> The frequency and severity of pain can vary in each patient depending on their activities. While the exact cause of pain is not fully understood, pain at rest may originate from the dorsal wrist ganglion's local compression on the posterior interosseous nerve (PIN).<sup>[12]</sup> In our study, 70% of the patients presented with pain as the main problem. Consistent with our findings, Kuliński et al.<sup>[17]</sup> indicated that 70% of their patients underwent surgery due to pain, while Dermon et al.<sup>[18]</sup> reported that 80% of their patients did so for the same reason. A study compared open and arthroscopic surgical methods for painful wrist ganglion excision and noted that open excision provides better pain relief.<sup>[19]</sup> Similar to existing studies<sup>[17-19]</sup>, in our study, the majority of patients reported pain relief in the postoperative period, and the VAS score significantly decreased. We believe that open surgical excision is a suitable option that allows the evaluation of extracapsular pathologies, including PIN and extensor tenosynovitis, and for comprehensive debridement.

Wrist range of motion is typically preserved in most cases after surgery and can even improve.<sup>[9]</sup> The presence of limited ROM postoperatively may indicate inadequate healing.<sup>[17]</sup> Joint stiffness is a common complication following open ganglion excision, with reported incidence ranging from 4% to 14% among patients.<sup>[7, 18, 20]</sup> Jacobs et al.<sup>[21]</sup> utilized a splint for 7 to 18 days postoperatively in 66% of their patients who underwent ganglion excision. They identified a significantly higher incidence of wrist stiffness among those who used a splint Kuliński et al.<sup>[17]</sup> reported that six out of 285 dorsal ganglion patients developed permanent ROM limitation of 10-15 degrees. However, they did not report any limitation in volar ganglion patients. In our study, joint stiffness was observed in 3.7% of patients ( $n=2$ ). We

also observed improvement in functional outcomes in our own study. Factors such as prolonged immobilization, delayed rehabilitation programs, inappropriate surgical technique for cyst excision, and tight closure of the joint capsule can contribute to joint motion restrictions. The rates in our study are lower than those reported in the literature. This could be attributed to factors such as our smaller sample size, our practice of avoiding splinting and promoting early mobilization, as well as our decision not to repair the joint capsule, which may lead to reduced joint stiffness.

In our study, there was a significant improvement in the scoring systems (PRWE & QDASH) used in the evaluation of ganglion cyst excision results. While the average PRWE score after dorsal ganglion cyst excision is 5.6 and the QDASH score 4.8, the average PRWE score after volar ganglion cyst excision was 5.1 and the QDASH score 4.6. These results are similar to the scoring systems used for the same purpose in other studies in the literature.<sup>[19,22]</sup> This shows that the wrist function becomes comparable to the normal population after open resection.

Keloids, injuries to the median and radial nerve sensory branches, and radial artery injuries are commonly reported complications after surgical excision of ganglion cysts.<sup>[1]</sup> A systemic review indicated complication rates of 14% after open surgical excision, 4% after arthroscopic surgery, and 2% after aspiration.<sup>[1]</sup> Due to the close proximity of volar wrist ganglions to the radial artery and the median nerve palmar cutaneous branch, their surgical treatment can be more challenging, leading to higher complication rates compared to dorsal wrist ganglion excision.<sup>[5,23]</sup> The rate of radial artery injury during volar ganglion excision has been reported between 5% to 20% in the literature.<sup>[6,7,17,20]</sup> Aydin et al.<sup>[7]</sup> reported a complication rate of 5% radial artery injuries, and 7.5% median nerve palmar cutaneous branch injuries in patients who underwent volar wrist ganglion excision. However, in a study comparing 40 patients, among those who underwent dorsal ganglion excision, one (3.8%) experienced injury to the superficial branch of the radial nerve, whereas among patients who underwent volar ganglion excision, two (14.8%) had injury on the superficial branch of the median nerve and two (14.8%) experienced injury to the superficial branch of the radial artery which were ligated intraoperatively.<sup>[20]</sup> On the other hand, in a study examining the active-duty military population, it was reported that there were no complications or recurrences following open excision. However, it should be noted that patients in this study reported their outcomes at the six-month follow-ups.<sup>[22]</sup> In our series, vascular and neurological injuries occurred in three patients (5.5%), consistent with the literature. We think that ganglion cyst surgery should not be considered as a simple surgery. Adequate

surgical exposure and proficiency in anatomical structures can diminish the risk of complications. We advocate for surgical procedures, particularly volar wrist ganglion excisions, to be carried out by hand surgeons or by experienced surgeons. Also, patients scheduled for volar cyst excision, in particular, should be thoroughly informed before surgery.

The recurrence rates after ganglion cyst surgery vary between a wide range of 1 to 50% and it is more common after volar cyst excision.<sup>[1,7,12,17,18,20,23,24]</sup> The treatment method is important for the recurrence. A significantly higher recurrence rate is observed after aspiration compared to open surgical excision.<sup>[20]</sup> Moreover, arthroscopic surgery has not shown a significant superiority over open surgical excision in terms of recurrence, and similar recurrence rates have been reported.<sup>[1,9]</sup> On the other hand, a recent meta-analysis of 23 studies encompassing 1,670 cases has demonstrated a significantly higher patient satisfaction rate with arthroscopic excision compared to open excision, along with greater pain relief. Additionally, the recurrence and overall complication rate was significantly lower in the arthroscopic excision group.<sup>[25]</sup> Removing the pedicle of the ganglion cyst reduces the risk of recurrence to 1-5% in dorsal ganglions and up to 7% in volar ganglions.<sup>[5,12]</sup> Due to the proximity of volar wrist ganglions to neurovascular structures, identifying the pedicle of the cyst can be more challenging. Additionally, since the cyst can originate from two different joints, excising the cyst along with its pedicle can be more difficult, leading to higher recurrence rates.<sup>[5,20,21,23]</sup> Besides all of these techniques, there are some newer methods in the literature. In a randomized controlled trial comparing aspiration plus PRP and aspiration alone, there is no difference in terms of recurrence. The authors have indicated that PRP is not a superior choice.<sup>[26]</sup> In our study, consistent with the literature, we observed a recurrence rates of 21% in volar ganglia and 12% in dorsal ganglia. However, we did not observe a significant correlation between recurrence and factors such as gender, side, localization, comorbidities, occupation, cyst volume, and surgical duration. The importance of complete excision of the cyst along with a portion of the joint capsule after identifying the cyst's pedicle, as suggested in the literature, is also emphasized by us to reduce recurrence rates. Nonetheless, it should be acknowledged that even with meticulous surgical technique, the risk of recurrence may not be entirely eliminated, and patients should be informed about this possibility during the preoperative period.

### Study Limitations

The fact that our study was retrospective and conducted at a single center, with limited number of patients, and surgeries performed by different surgeons at different levels

of experience can be considered the most important limitations. Due to the retrospective nature of the study, some conflicts have been encountered such as inability to reach every patient and loss of some data. Increasing the number of patients can significantly impact recurrence and complication rates. Therefore, larger prospective studies comprising a more diverse patient population should be planned. These studies should involve more experienced surgeons to ensure more reliable results. Such studies would be important for standardizing surgical techniques and procedures, leading to better outcomes.

## Conclusion

In conclusion, open surgical excision is a successful treatment method for wrist ganglion cysts based on middle and long-term outcomes, with high patient satisfaction and low recurrence and complication rates. However, volar ganglion cysts have approximately 2-fold higher incidence of recurrence and complications compared to dorsal ganglions. Ganglion cyst surgeries should not be considered simple and especially for volar ganglion cysts, they should be performed by hand surgeons or experienced surgeons using meticulous surgical techniques.

## Disclosures

**Ethics Committee Approval:** The study was approved by the Istanbul Medipol University Non-interventional Clinical Research Ethics Committee (date: 14.03.2024, number: 300).

**Conflict of Interest:** The authors declared no conflict of interest.

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**Authorship Contributions:** Concept – A.U., K.U., N.C., M.B., M.A.C., O.S.H.; Design – A.U., K.U., N.C., M.B., O.S.H.; Supervision – A.U., K.U., N.C., M.B., O.S.H., M.A.C.; Fundings – A.U., K.U., N.C., O.S.H., M.A.C., M.B.; Materials – A.U., K.U., N.C., M.A.C., M.B., O.S.H.; Data Collection and/or Processing – A.U., K.U., N.C., M.A.C., M.B., O.S.H.; Analysis and/or Interpretation – A.U., K.U., N.C., M.A.C., O.S.H., M.B.; Literature Review – A.U., K.U., N.C., M.A.C., O.S.H., M.B.; Writing – A.U., K.U., N.C., M.A.C., M.B., O.S.H.; Critical Review – A.U., K.U., N.C., M.A.C., O.S.H., M.B.

**Use of AI for Writing Assistance:** The authors declared that no artificial intelligence tool was used.

**Informed Consent:** Written informed consents were obtained from all the patients.

## References

- Head L, Gencarelli JR, Allen M, Boyd KU. Wrist ganglion treatment: systematic review and meta-analysis. *J Hand Surg Am* 2015;40:546–53. [\[CrossRef\]](#)
- Ahmad Shah A, Raina AH, Ganie MA, Kumar IA. Comparison of aspiration followed by intra-lesional steroid injection and surgical excision in management of dorsal wrist ganglion. *World J Plast Surg* 2019;8:181–4. [\[CrossRef\]](#)
- Gül M, Özkaya U, Parmaksızoğlu A, Sökücü S, Kabukçuoğlu Y. Drop foot case caused by a ganglion cyst. *Med Bull Sisli Etfal Hosp* 2008;42:25–7. [Article in Turkish]
- Seçkin MF, Kara A, Çelik H, Sönmez MM, Öztürk İ. A rare cause of shoulder pain: ganglion cysts in the spinoglenoid notch. *Med Bull Sisli Etfal Hosp* 2013;47:151–3. [Article in Turkish] [\[CrossRef\]](#)
- Meena S, Gupta A. Dorsal wrist ganglion: current review of literature. *J Clin Orthop Trauma* 2014;5:59–64. Retraction in: *J Clin Orthop Trauma* 2020;11(Suppl 5):S916. [\[CrossRef\]](#)
- Sawyer GA, DaSilva MF, Akelman E. Volar wrist ganglion excision through the flexor carpi radialis sheath. *Tech Hand Up Extrem Surg* 2012;16:145–7. [\[CrossRef\]](#)
- Aydin A, Kabakaş F, Erer M, Ozkan T, Tunçer S. Surgical treatment of volar wrist ganglia. *Acta Orthop Traumatol Turc* 2003;37:309–12. [Article in Turkish]
- Lee YK, Kim JH. Volar wrist ganglion associated with radial artery atherosclerosis: a case report. *Medicine (Baltimore)* 2023;102:e34351. [\[CrossRef\]](#)
- Mathoulin C, Gras M. Arthroscopic management of dorsal and volar wrist ganglion. *Hand Clin* 2017;33:769–77. [\[CrossRef\]](#)
- Lu S, Kerluku J, Nwawka OK, Miller TT, Fufa DT. No difference in reintervention at 1-year between ultrasound-guided versus blind dorsal carpal ganglion aspiration. *J Hand Surg Glob Online* 2023;5:728–32. [\[CrossRef\]](#)
- Steadman JN, Stephens AR, Wei G, Presson AP, Kazmers NH. Cost implications of varying the surgical setting and anesthesia type for dorsal wrist ganglion cyst excision surgery. *Plast Reconstr Surg* 2022;149:240e–7. [\[CrossRef\]](#)
- Kim JY, Lee J. Considerations in performing open surgical excision of dorsal wrist ganglion cysts. *Int Orthop* 2016;40:1935–40. [\[CrossRef\]](#)
- Chaudhary S, Mandal S, Kumar V. Results of modified thread technique for the treatment of wrist ganglion. *J Clin Orthop Trauma* 2020;13:57–62. [\[CrossRef\]](#)
- Rocchi L, Canal A, Fanfani F, Catalano F. Articular ganglia of the volar aspect of the wrist: arthroscopic resection compared with open excision. A prospective randomised study. *Scand J Plast Reconstr Surg Hand Surg* 2008;42:253–59. [\[CrossRef\]](#)
- Beaton DE, Wright JG, Katz JN; Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am* 2005;87:1038–46. [\[CrossRef\]](#)
- Öztürk Ö, Sarı Z, Özgül B, Taşykan L. Validity and reliability of the Turkish "Patient-rated wrist evaluation" questionnaire. *Acta Orthop Traumatol Turc* 2015;49:120–5. [\[CrossRef\]](#)
- Kuliński S, Gutkowska O, Mizia S, Martynkiewicz J, Gosk J. Dorsal and volar wrist ganglions: The results of surgical treatment. *Adv Clin Exp Med* 2019;28:95–102. [\[CrossRef\]](#)
- Dermon A, Kapetanakis S, Fiska A, Alpantaki K, Kazakos K. Ganglionectomy without repairing the bursal defect: long-term re-

- sults in a series of 124 wrist ganglia. *Clin Orthop Surg* 2011;3:152–6. [\[CrossRef\]](#)
19. Lee HLL, Lee KH, Koh KH, Won HJ, Cho HK, Park MJ. Excision of painful dorsal wrist ganglion by open or arthroscopic approach: a comparison study. *Acta Orthop Belg* 2017;83:315–21.
20. Gündeş H, Cırpıcı Y, Sarlak A, Müezzinoğlu S. Prognosis of wrist ganglion operations. *Acta Orthop Belg* 2000;66:363–7.
21. Jacobs LG, Govaers KJ. The volar wrist ganglion: just a simple cyst? *J Hand Surg Br* 1990;15:342–6. [\[CrossRef\]](#)
22. Clark D, Dingle M, Saxena S, Dworak T, Nappo K, Balazs GC, et al. Prospective evaluation of push-up performance and patient-reported outcomes following open dorsal wrist ganglion excision in the active-duty military population. *J Wrist Surg* 2022;11:493–500. [\[CrossRef\]](#)
23. Graham JG, McAlpine L, Medina J, Jawahier PA, Beredjiklian PK, Rivlin M. Recurrence of ganglion cysts following re-excision. *Arch Bone Jt Surg* 2021;9:387–90.
24. Balazs GC, Donohue MA, Drake ML, Ipsen D, Nanos GP 3rd, Tintle SM. Outcomes of open dorsal wrist ganglion excision in active-duty military personnel. *J Hand Surg Am* 2015;40:1739–47. [\[CrossRef\]](#)
25. Clark DM, Nelson SY, O'Hara M, Putko RM, Bedrin MD, Daniels CM. Surgical and patient-centered outcomes of open versus arthroscopic ganglion cyst excision: a systematic review. *J Wrist Surg* 2022;12:32–9. [\[CrossRef\]](#)
26. Hamlin K, Haddon A, Khan Y, Miller C, Lawrie D. Dorsal wrist ganglion: pilot for randomized control trial comparing aspiration alone or combined with injection of platelet-rich plasma. *J Wrist Surg* 2022;12:18–22. [\[CrossRef\]](#)