

Dorsal and volar wrist ganglions: The results of surgical treatment

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Abstract

Background. The wrist, especially its dorsal surface, is the most common location of ganglion cysts in the human body.

Objectives. The purpose of this study was to present our experience in the treatment of wrist ganglions and to evaluate the results obtained with the operative management of this type of lesion.

Material and methods. A total of 394 patients (289 females and 105 males, aged 10–83 years) treated operatively for wrist ganglions between 2000 and 2014 were included in the study. The results of surgical treatment were evaluated after a minimal 2-year-long follow-up in 69.4% of patients operated on for dorsal wrist ganglions and in 70.6% of patients after the excision of volar wrist ganglions. The shape and size of postoperative scar, range of motion of the wrist, grip strength, severity of pain, and presence/absence of ganglion recurrence were assessed. The influence of demographic factors on the risk of recurrence was statistically analyzed.

Results. Persistent limitation of wrist palmar flexion was observed in 6 patients after the removal of dorsal wrist ganglions. There were no cases of postoperative grip strength weakening. An unesthetic scar developed in 15 patients after the excision of dorsal wrist ganglions and in 6 patients after the removal of volar wrist ganglions. Postoperative pain was observed in 7 patients with ganglion recurrence and in 17 patients without recurrence. Ganglion cysts recurred in 12.1% of patients treated for dorsal wrist ganglions and in 10.4% of patients operated on for volar wrist ganglions. No influence of patient gender, age, body side, or cyst location on ganglion recurrence was detected.

Conclusions. Operative treatment is a widely recognized method of management of wrist ganglions. The rate of resulting persistent complications is low. Recurrence of ganglion cysts is unpredictable and independent of patient demographic factors. It can be observed even in cases, in which a perfect surgical technique has been used.

Key words: surgery, wrist, ganglion cysts, benign tumors

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Introduction

Ganglion cysts can develop in close proximity to any joint or tendon sheath in the human body.^{1–4} They are most commonly located around the wrist and its dorsal aspect is affected more often.¹ The majority of dorsal wrist ganglions have a connection with the scapholunate ligament; they are located between the tendons of the extensor digitorum communis and the extensor pollicis longus muscles.^{5–7} Volar wrist ganglions are most often found at the radial side of the wrist between the tendons of flexor carpi radialis and abductor pollicis longus muscles.^{5,6} These ganglion cysts usually communicate with the radioscaphoid-scapholunate interval, scaphotrapezial joint or metacarpotrapezial joint.^{1,3,8} The purpose of this work was to present our experience in the treatment of wrist ganglions and to evaluate the results obtained with operative management of this type of lesion.

Material and methods

The study group consisted of 394 patients: 289 females and 105 males, aged from 10 to 83 years (mean age: 39.2 ± 16.2 years). The patients were treated operatively at the Clinic of Traumatology and Hand Surgery in Wrocław, Poland, for ganglion cysts located in the wrist region between the years 2000–2014. The subjects were scheduled for an operation on the basis of the presence of a tumor mass around the wrist. Many patients had an X-ray and ultrasound examination or a magnetic resonance imaging (MRI) of the wrist performed on the outpatient basis, but these imaging studies were not mandatory before the operative treatment. A medical history was collected, with the emphasis on the time the tumor first appeared, the dynamics of its growth, the character and severity of symptoms (including pain), previous injuries, and conservative or operative treatment. Preoperative clinical examination consisted of: evaluation of the tumor size in palpation, assessment of its mobility against the underlying tissue, the appearance of the skin overlying the tumor and its mobility against the tumor, range of motion of the wrist joint in comparison to the opposite side, and evaluation of grip strength in comparison to the healthy side.

Operative technique

The operations were performed mostly using conduction anesthesia, and in exceptional cases using general or local anesthesia, with the use of an arm tourniquet. The type of surgical incision used depended on the location of the ganglion cyst. In operative treatment of dorsal wrist ganglions, a longitudinal or transverse incision directly above the tumor was used. An attempt was made to dissect the cyst as a whole, without perforation of its wall. Dissection was continued along the ganglion stalk to the joint

capsule. The capsule of the joint communicating with the ganglion cyst was incised in a semicircular fashion, and the capsule flap was raised. Small intraarticular cysts were excised along with the duct connecting the ganglion with the joint. The defect in the joint capsule created after the resection of the basis of the cyst, measuring approx. 1 cm in diameter, was left without repair. (Fig. 1,2)

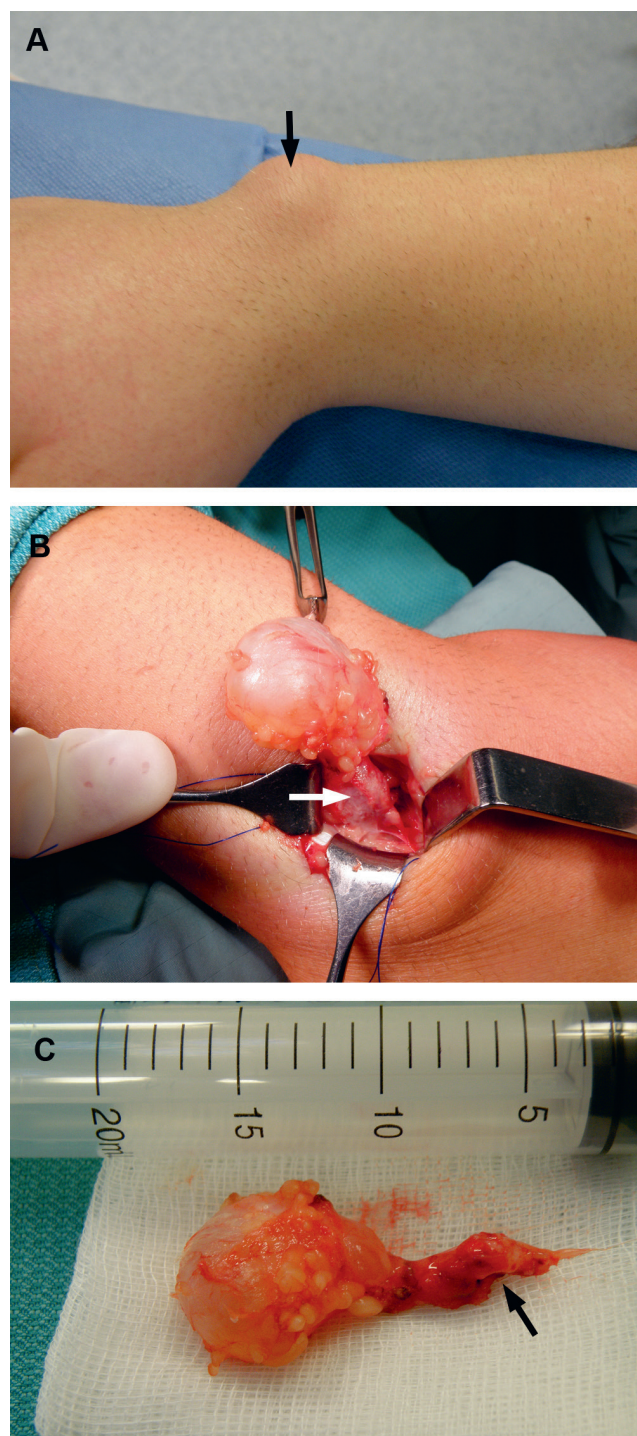


Fig. 1. Dorsal wrist ganglion

A – clinical appearance of a dorsal wrist ganglion (black arrow); B – intraoperative view: exposure of the ganglion cyst along with the duct (white arrow); C – postoperative view: appearance of the ganglion cyst along with the duct (black arrow) after resection.

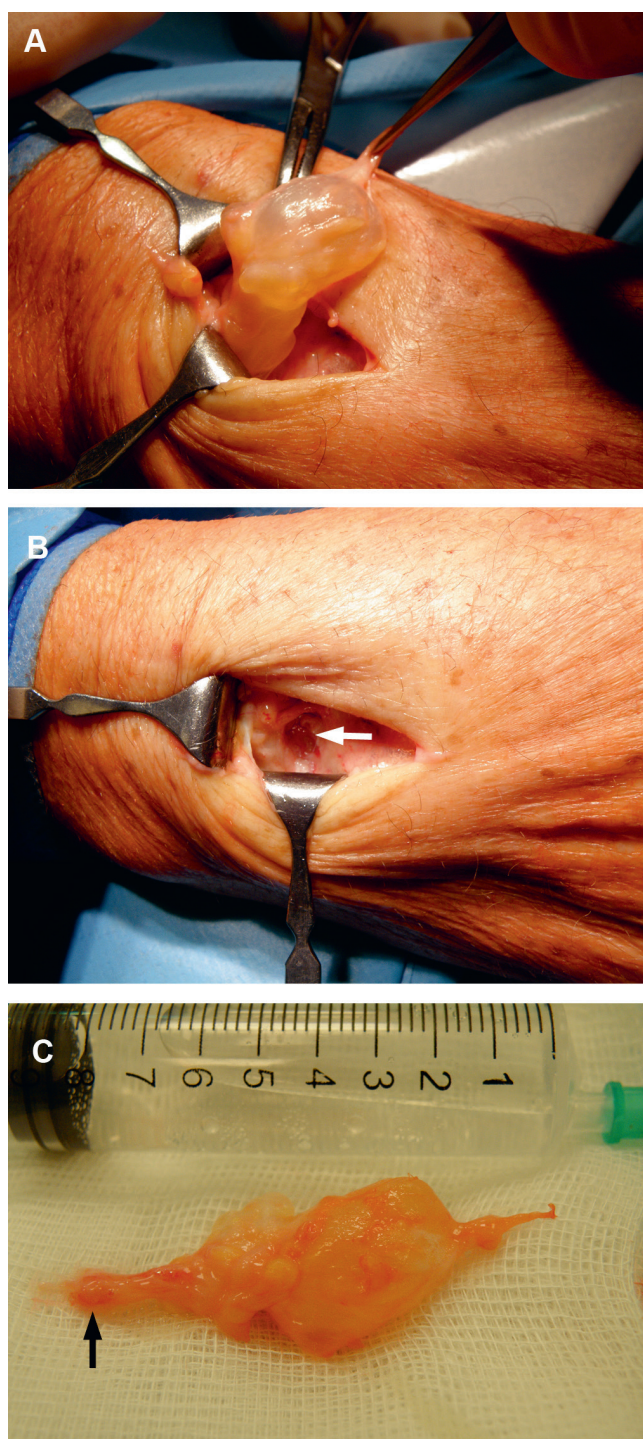


Fig. 2. Dorsal wrist ganglion

A – intraoperative view: exposure of the ganglion cyst; B – intraoperative view: exposure of the site of origin of the ganglion (where the stalk of the ganglion is connected with the scapholunate ligament), along with the defect in the joint capsule (white arrow); C – postoperative view: appearance of the ganglion cyst along with the duct (black arrow) after resection.

In the cases of volar wrist ganglions, a longitudinal or arcuate incision was used, usually on the radial side of the cyst. During ganglion dissection, radial artery or ulnar artery and ulnar nerve, depending on the ganglion cyst location, were identified and secured. Continuing the dissection along the stalk, the joint capsule was reached and

incised. The duct and the capsular attachments were resected, which resulted in a joint capsule defect, not exceeding 5 mm in diameter. If leakage of gelatinous substance was observed as a result of applying pressure to the surrounding tissues, the decision was made to resect them. The defect in the joint capsule was left without repairing (Fig. 3).

Wounds were closed with single 4–0 or 5–0 non-absorbable sutures. In the postoperative period, immobilization in a short plaster splint, reaching distally to the level of metacarpophalangeal joints, was used for 5–7 days. Afterwards, a rehabilitation program was started with a gradually increasing range of wrist joint motion. Resected tissue was subjected to a histopathological analysis.

Postoperative assessment

The final results of the treatment after the follow-up period of min 2 years (mean: 38 months; range: 24–118 months) were evaluated in 198 patients operated on for dorsal wrist ganglions (69.4% of all patients treated operatively for this type of ganglion cysts) and 77 patients with volar wrist ganglions (70.6% of all patients operated on for this type of lesion). The following criteria were considered during follow-up examinations: the presence/absence of ganglion recurrence, size and shape of postoperative scar, range of motion of the wrist joint in comparison to the opposite side, evaluation of grasp strength in comparison to the healthy side, presence/absence of pain.

Statistical analysis

Statistical analysis was performed with the use of STATISTICA software v. 12 (StatSoft Inc., Tulsa, USA). The risk factors for recurrence were identified using the χ^2 test or its modifications (Fisher's exact test, χ^2 test with Yates' correction and V^2 test) for the categorical variables and the Mann-Whitney U test for the continuous variables. The level of statistical significance was set at 0.05 ($p < 0.05$).

Results

Preoperative examination results

Ganglion cysts of the wrist were found significantly more often in females (73.3%) than in males (26.7%), with a 2.75:1 ratio. The right wrist was affected in 178 patients (45.2%) and the left wrist in 216 patients (54.8%). Dorsal wrist ganglions were diagnosed in 285 patients, in whom a total number of 286 ganglions (constituting 72.4% of all ganglion cysts) were removed. Two lesions were observed in the dorsal aspect of the left wrist of a 25-year-old male,

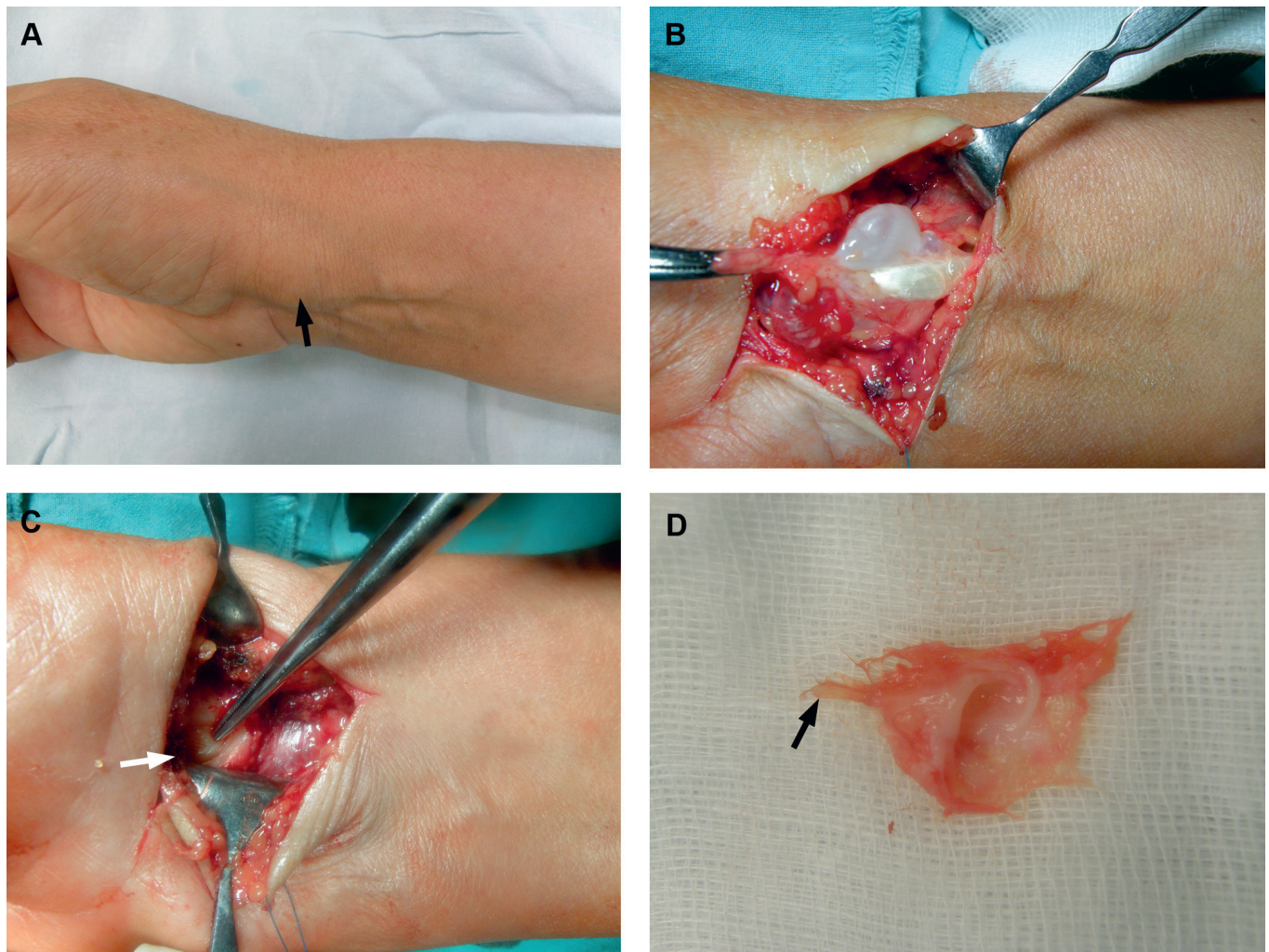


Fig. 3. Volar wrist ganglion

A – clinical appearance of a volar wrist ganglion located at the radial side of the wrist (black arrow); B – intraoperative view: exposure of the ganglion cyst; C – intraoperative view: the site of connection of the stalk of the ganglion with the radiocarpal joint (white arrow); D – postoperative view: appearance of the ganglion cyst along with the duct (black arrow) after resection.

one of which was located at the radial and the other at the ulnar side of the wrist. Volar wrist ganglions, all manifested as solitary tumors, were found in 109 patients (27.6% of all ganglions). A visible and palpable tumor mass was found during preoperative clinical examination in all of the patients. The majority of the patients reported moderate pain on palpation of the tumor and at end ranges of wrist motion. In the study, 280 patients (71% of the studied group) complained of pain on exertion (elicited by sporting activities or overworking) and the maximal severity of pain reported was 4 on the Visual Analogue Scale (VAS). About 35% of the patients (138 persons) noticed changes in ganglion volume dependent on their level of activity (increase in ganglion cyst dimensions after overworking and decrease in its dimensions after a period of rest). Slight weakening of grip strength in comparison to the healthy side was found in 28% of the patients (111 subjects). Limitation of dorsiflexion or palmar flexion not exceeding 10° in comparison to the opposite side was found in 32% of the patients (127 persons).

Histopathological examination results

The size of ganglions removed as a whole varied from 0.5 cm to 3 cm in diameter. The cyst wall was built of collagen fibers organized in layers, and the inside of the cysts was filled with gelatinous matter.

Operative treatment results

No intraoperative complications were observed during the removal of dorsal wrist ganglions. Excision of volar wrist ganglions was, however, associated with injury to the radial artery, resulting in its complete disruption in 3 cases. The artery was reconstructed in 2 cases; in the remaining case, the stumps were ligated. No insufficient blood supply to the upper limb was observed in any of these patients during the postoperative course. In 10 patients operated on for dorsal wrist ganglions, symptoms of irritation of the superficial branch of the radial nerve were observed in the early postoperative period. Eight patients, who had volar wrist

ganglions located at the radial portion of the wrist removed, complained of symptoms of dysfunction of the cutaneous branch of the median nerve, while 3 patients after excision of volar wrist ganglions located at the ulnar portion of the wrist manifested symptoms of the ulnar nerve irritation. The symptoms resolved in all of the patients within 6 months after the operation. Limitation of the wrist joint range of motion was often observed in the early postoperative period, and in the majority of the cases it was caused by pain. Wrist joint function gradually improved in most patients after several weeks of rehabilitation. Swelling and redness of postoperative wound was observed in 10 patients after the removal of dorsal wrist ganglions and in 6 patients after the excision of volar wrist ganglions. Moreover, dorsal wrist ganglion removal was complicated by purulent infection in 2 patients, which resolved after intravenous antibiotic therapy. Persistent limitation of palmar flexion of the wrist ranging from 10° to 15° was observed in 6 patients in a minimal 2-year-long follow-up after resection of dorsal wrist ganglions. Volar wrist ganglion removal did not cause limitation of wrist joint motion in any patient. None of the patients manifested evident weakening of the grip strength in comparison to the healthy subjects. Excision of dorsal wrist ganglions left a widened, unesthetic postoperative scar in 15 patients, and the removal of volar wrist ganglions was associated with the formation of such a scar in 6 patients. Keloid formation was observed in 4 patients after resection of dorsal wrist ganglions.

About 75% of the patients (206 out of 275 persons subjected to follow-up) reported preoperative pain: 152 in the dorsal wrist ganglion group and 54 in the volar wrist ganglion group. None of the patients who did not report preoperative pain (46 patients diagnosed with dorsal wrist ganglions and 23 patients with volar wrist ganglions) complained of pain during the follow-up examinations. In the group of patients operated on for dorsal wrist ganglions, pain was reported in 5 patients with ganglion recurrence and in 12 patients without recurrence. Out of the patients treated operatively for volar wrist ganglions, 2 persons with ganglion recurrence and 5 persons without recurrence complained of pain. The intensity of pain was not greater than 3 according to the VAS in any of the patients.

Ganglion cysts recurred in 24 patients operated on for dorsal wrist ganglions (12.1% of the studied group) and in 8 patients treated surgically for volar wrist ganglions (10.4% of the study group). Recurrences were observed between 7 and 22 months after operative treatment. Dorsal wrist ganglions recurred in 8 males and 16 females aged 19–83 years (mean age: 40.2 ± 18.8 years). Recurrences were observed in the left wrist in 15 patients and in the right wrist in 9 patients. Volar wrist ganglions recurred in 2 males and 6 females aged 33–54 years (mean age: 43.0 ± 7.2 years). The right wrist was affected in 5 patients and the left wrist in 3 patients. Statistical analysis did not confirm the influence of such factors as patient age, gender, body side (Tables 1, 2), and ganglion location at the volar or dorsal aspect of the wrist on ganglion recurrence (Table 3).

Table 1. The influence of age, gender and body side on recurrence in the volar wrist ganglion (VWG) group

Variable	Recurrence		p-value
	yes n = 8	no n = 69	
Gender			
male	2	20	0.859*
female	6	49	
Age			
x ± SD	43.0 ± 7.2	41.1 ± 12.3	0.493**
Me (range)	44.5 (33–54)	39.0 (19–68)	
Age			
<39 years	3	34	0.797*
≥39 years	5	35	
Side			
left	3	33	0.857*
right	5	36	

x – mean; SD – standard deviation; Me – median; * χ^2 test with Yates's correction; ** Mann-Whitney U test.

Table 2. The influence of age, gender and body side on recurrence in the dorsal wrist ganglion (DWG) group

Variable	Recurrence		p-value
	yes n = 24	no n = 174	
Gender			
male	8	40	0.269*
female	16	134	
Age			
x ± SD	40.2 ± 18.8	35.4 ± 16.7	0.192**
Me (range)	32.5 (19–83)	30 (11–82)	
Age			
<35 years	13	97	0.884***
≥35 years	11	77	
Side			
left	15	92	0.375***
right	9	82	

x – mean; SD – standard deviation; Me – median; * V^2 test; ** Mann-Whitney U test; *** χ^2 test.

Table 3. The influence of ganglion location (volar or dorsal aspect of the wrist) on recurrence

Variable	Recurrence		p-value
	yes n = 32	no n = 243	
Location			
VWG	8	69	0.688*
DWG	24	174	

VWG – volar wrist ganglion; DWG – dorsal wrist ganglion; * V^2 test.

Discussion

The analysis of relevant literature revealed huge differences in the intensity of preoperative symptoms manifested by patients in the studied groups. Reported symptoms included pain, limitation of wrist joint motion and weakening of grip strength. Pain can be elicited by applying

pressure to the tumor mass, overworking or by placing the wrist joint at the end ranges of motion (maximal palmar flexion or dorsiflexion). The frequency and severity of this symptom can vary significantly. Among our patients, 71% complained of pain, but its intensity was rated as low. In the study by Dermon et al. on 119 patients operated on for dorsal wrist ganglions (94 cysts), volar wrist ganglions (28 cysts) and ganglions located at the ulnar aspect of the wrist (2 cysts) over a period of 6 years, pain was reported by 79.8% of the patients. The intensity of persistent pain was high and reached levels 7–9 according to the VAS.¹ Similar percentage of patients (79%) suffering from pain in the preoperative period was observed by Craik and Walsh in their study group comprising 59 patients.⁹ Dias and Buch reported preoperative pain in 84% of their 79 patients treated for volar wrist ganglions.¹⁰ Out of 103 patients treated by Wong et al. (61 patients diagnosed with dorsal wrist ganglions and 42 patients with volar wrist ganglions), 44 complained of pain in the preoperative period.¹¹ In the patient group studied by Limpaphayom and Wilairatana, pain was reported in 58.3% of the total number of 24 patients.¹² Pain was the most common preoperative complaint among 26 patients treated by Singhal et al., observed in 46.2% of cases.¹³ According to Rocchi et al., in their patient group, only 6 out of 50 subjects operated on for volar wrist ganglions with the arthroscopic or open method complained of pain in the preoperative period.¹⁴ Out of 114 patients analyzed by Gallego and Mathoulin, 51 complained of pain ranging in severity from 1 to 6 according to the VAS. The remaining 63 patients (55.2%) did not report any pain, which corresponds to 0 according to the VAS.¹⁵

Other symptoms like wrist stiffness and weakness can also be manifested with varying severity. In our patients, these symptoms were found in 32% and 28% of cases, respectively. In the patient group studied by Craik and Walsh, comprising 59 cases, wrist stiffness was observed preoperatively in 31% of patients and weakness in 44% of patients. Moreover, 27% of the study participants complained of the presence of paresthesia and numbness.⁹ Dias and Buch reported the presence of preoperative weakness in 26% and wrist stiffness in 10% of the 79 patients with volar wrist ganglions.¹⁰ In 114 patients diagnosed with dorsal wrist ganglions, described by Gallego and Mathoulin, the mean palmar flexion deficit observed in the preoperative period was 15.2° when compared with the healthy subjects (59.9° vs 75.1°), while the mean dorsiflexion deficit was 8.3° in comparison to the healthy side (69.7° vs 78°). Moreover, the mean grip strength was diminished by 22% when compared with the opposite side.¹⁵ By contrast, none of the 50 patients with volar wrist ganglions treated by Rocchi et al. manifested a limitation of wrist range of motion or grip strength weakening in the preoperative period.¹⁴ Considering the discussed data, it should be noted that in many cases, the main indication for operative treatment was the presence of a tumor. Other motivations for

seeking operative treatment included concerns about the malignant character of the tumor and cosmetic aspects.^{9,16}

Surgical treatment of ganglion cysts carries the inherent risk associated with operative intervention in the intraoperative as well as early and late postoperative period. Careful preoperative planning and preparation is essential in surgical management of ganglion cysts. Surgical procedures should be performed using conduction anesthesia and tourniquet ischemia. The surgeon must have excellent knowledge on the operative anatomy of the hand and wrist as well as on the possible connections ganglion cysts may have with the neighboring joints. This ensures radical excision of the cyst and lowers the risk of recurrence.

Injury to the radial artery is a potential intraoperative complication associated with the removal of volar wrist ganglions located at the radial side of the wrist. Jacobs and Govaers observed the existence of a direct connection between the ganglion cyst wall and the arterial wall in 38 out of 72 patients operated on (54%).¹⁷ In the patient group described by Aydin et al., cysts adhered tightly to the arterial wall in 65% of patients, and in 5% of patients, the radial artery entered the ganglion.¹⁸ Iatrogenic injury to the radial artery occurred in 2 out of 40 patients treated operatively (5%).¹⁸ Rocchi et al. described iatrogenic arterial injury in 4 out of 20 patients treated surgically with the open method (20%).¹⁴ The incidence of this complication varies from 1% to 20% in the literature.^{14,19} In order to decrease the risk of arterial injury, Lister and Smith suggested a modification of the operative technique, in which a fragment of the cyst wall closely connected with the artery is retained.²⁰ This complication cannot always be prevented, despite the awareness of the risk of arterial injury associated with the dissection of volar wrist ganglions, as in the case of the 3 patients who suffered such a complication in our patient group.

Another possible complication is the formation of an overgrown scar or a keloid. In order to prevent it, adequate surgical incision is essential. Angelides recommended transverse skin incision in all cases of dorsal wrist ganglions.⁶ Other authors used horizontal as well as transverse incisions in operative treatment of dorsal wrist ganglions, without noticeable differences in wound healing.^{1,19} Our observations regarding this aspect are similar. The use of either of the 2 approaches did not influence scar formation in our patient group. The process of wound healing and scar remodeling was undisturbed in the majority of the patients. Wound closure with the use of thin, atraumatic sutures could have contributed to uneventful healing.

Other possible postoperative complications are wrist stiffness and weakness. The presence of such symptoms in the postoperative period may represent a lack of clinical improvement in comparison to the preoperative state.^{10,21} Such symptoms can also be observed after surgery in patients who did not manifest them preoperatively.^{1,6,18} In the group of 50 patients treated by Dermon et al., postoperative

wrist stiffness was present in 3 patients (4.5%) and weakness in 2 patients (3%).¹ Aydin et al. observed wrist stiffness in 5 out of 40 operatively treated patients (12.5%).¹⁸ Two out of 25 patients (8%) operated with the open method, described by Rocchi et al. manifested postoperative wrist stiffness.¹⁴ In our study group, the limitation of palmar wrist flexion was observed in 6 out of 198 patients (3%) after the excision of dorsal wrist ganglions. Most authors agree that short-term immobilization after surgery and early rehabilitation decrease the risk of postoperative stiffness. Another important factor is adequate operative technique without attempts to suture the joint capsule or close its defect.^{1,6,13}

Surgical excision of a ganglion cyst is associated with the risk of recurrence. According to different authors, recurrence rate ranges from 1% to almost 50%.^{1,6,9,10,12,14,18,19,21–25} The frequency of ganglion recurrence observed in our patient group (12.1% for dorsal wrist ganglions and 10.4% for volar wrist ganglions) is acceptable. Huge differences in recurrence rates reported by different authors are the result of the heterogeneity of the studied patient groups, including different numbers of patients included in particular studies, varying postoperative follow-up periods, as well as different levels of surgeon experience, etc. It is currently believed that there is a close connection between the operative technique employed and the risk of ganglion recurrence. Removal of the main cyst along with the duct connecting it to the adjacent joint, a fragment of the joint capsule and microcysts located around the duct is essential.^{1,6} It must be emphasized, however, that even a perfect surgical technique does not eliminate the risk of ganglion recurrence completely.^{1,6} At the same time, the comparison of different methods used in the treatment of ganglion cysts (observation, aspiration, administration of an obliterating agent into the cyst, operative management) reveals that the highest patient satisfaction is associated with surgical treatment, even in the cases in which recurrence occurred.^{19,21} Operative treatment allows for fast tumor removal and carries a lower risk of recurrence than other methods.^{19,21}

Arthroscopic treatment can constitute an alternative to open surgery. Arthroscopic resection of a wrist ganglion was first conducted by Osterman and Raphael in 1995.²⁶ This method is used in the management of both dorsal and volar wrist ganglions.^{27–29} Like every operative treatment method, arthroscopy carries the risk of certain complications. Hematoma, injury to the vessels and nerves, wrist stiffness and weakness, tendinitis, paratenonitis, and ganglion recurrence are among the most common ones.¹⁵ In some situations, conversion to open surgery may be necessary.^{14,28,30} Neither of the methods has been proven to be evidently superior. Such factors as the patient's preference and surgeon's experience should be taken into consideration when choosing the optimal operative technique.²⁷

Conclusions

Operative treatment is a widely recognized method of managing wrist ganglions and it is characterized by a low rate of resulting persistent complications. Recurrence of ganglion cysts after surgery is unpredictable and independent of patient demographic factors. It can be observed even in the cases, in which perfect surgical technique has been employed during the initial excision of the ganglion cyst.

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