

ORIGINAL RESEARCH ARTICLE

Plastic surgery treatment approaches and results for ganglion cysts: retrospective analysis of 1,784 patients

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ABSTRACT

Introduction: Ganglion cysts are tumor-like formations that develop as a result of herniation of synovium around muscles, tendons, and joints. Sometimes recurrence develops after primary treatment and secondary treatment is planned as a result.

Objective: The aim of this study was to perform a retrospective analysis of plastic surgery treatment approaches and patient outcomes in 1,784 patients with ganglion cysts.

Method: The study type was descriptive and longitudinal. Patients were followed up from at least 6 months to 5 years after the primary ganglion cyst was treated. Data collection was retrospectively extracted from the patient records of the clinic where the study was conducted. Descriptive tests, chi-square test, and post hoc analysis were used for data analysis.

Results: The mean age of patients with ganglion cysts in this study was 34.49 ± 8.21 years, 61% were female. 83.4% had ganglion cysts in the upper extremity and 58.9% of them were localized in the dorsal wrist. For treatment, 36.3% underwent cyst excision and 23.6% underwent cyst resection. Recurrence occurred in 27.2% of the total number of patients. None of the patients with recurrence underwent a second cyst aspiration, 33.8% underwent cyst excision.

Conclusion: Ganglion cysts were mostly localized to the hand and wrist and needle aspiration may be preferred for diagnosis as it provides a definitive result as to whether the mass is benign or not. Recurrences after surgical excision, resection or joint arthrodesis were found in the literature.

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Introduction

Ganglion cysts are tumor-like formations that develop around the joint capsules, muscles and tendons of the upper and lower extremities [1, 2] and are characterized by mucinous degeneration of the peri-articular connective tissue [3], mostly in the post-traumatic period [4]. Ganglion cysts are filled with mucopolysaccharide species and hyaluronic acid and surrounded by collagen fiber and fibrin network [4]. Functional limitation, tenderness and pain are common symptoms in extremities with ganglion cysts [5, 6].

Soft tissue herniation of the synovium lining the inner surface of the joints occurs as a result of injury or trauma and leads to ganglion cysts [7]. The use of ultrasonography in the diagnosis of ganglion cysts attracts attention with its ability to make a correct diagnosis of around 90% and low cost [8, 9]. Magnetic resonance imaging (MRI) is known to be effective in ruling out intraarticular abnormalities [2]. Surgical excision and arthroscopic resection may be considered in cases where conservative methods such as steroid injection, hyaluronidase treatment and needle aspiration are ineffective in the treatment of ganglion cysts [3, 10].

In a previous literature review, clinical results of arthroscopic resection of ganglion cysts were reported by Bontempo and Weiss.

Accordingly, it was reported that ganglion cyst recurrence after arthroscopic resection ranged between 0 and 17.3%, with an average of 7.9% [11]. When the recurrence rates of other treatments were analyzed, it was reported to be 59% (range 47 to 70%) after needle aspiration and 21% (range 13 to 28%) after open excision [12]. The reduced risk of recurrence, as well as less incision scar and pain, increases the preferability of arthroscopic resection compared to open surgical excision [13, 14].

Although the therapeutic effect of needle aspiration remains weak compared to surgical methods, it is superior in diagnostics thanks to its minimally invasive feature. Crosby and colleagues performed needle aspiration with a prediagnosis of ganglion cyst before arthroscopic resection and found that the formations in the dorsal wrist were the result of inadequate resection of soft tissue sarcoma [15]. Accurate diagnosis of ganglion cysts, selection of the correct imaging technique during diagnosis, treatment with appropriate treatment strategies and minimizing the possibility of recurrence are of great importance. In this study, we aimed to perform a retrospective analysis of plastic, reconstructive and aesthetic surgical treatment approaches and outcomes of ganglion cysts.

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Materials and methods

Research design and sampling characteristics

The type of this retrospective study is descriptive and longitudinal. The sample of this study consisted of patients with ganglion cysts treated in the last 10 years in a Plastic, Reconstructive and Aesthetic Surgery clinic in western Turkey. Ganglion cysts arising in various body parts of adult patients were diagnosed, treated and followed up. The results of these patients with ganglion cysts were reported in this study. The purposive sampling method was used for sample selection. G*Power-3.1.9.2 software was used to calculate the sample size. When calculating the sample size, at least $n = 288$ patients with ganglion cysts should have participated in the study with a margin of error of 0.05 and 95% confidence interval, $n = 1,784$ patients were included in the sample. The inclusion and exclusion criteria for patients with ganglion cysts are given next.

Inclusion and exclusion criteria

The inclusion criteria for this study were determined as (1) being treated in the Plastic, Reconstructive and Aesthetic Surgery clinic where the study was conducted, (2) having completed the treatment process at least 6 months ago and being followed up (3) having been diagnosed with a ganglion cyst and being followed up regularly after the treatment process. Patients with masses and tumoral formations other than ganglion cysts who did not meet these criteria were excluded.

Data collection methods and tools

The data for this study were retrospectively extracted from electronic data records and patient files. Data were collected between January 1, 2014 and December 31, 2023. Patient and clinical characteristics form was used for data collection. Information about the data collection tool is given next.

Ganglion cyst patient information form

The patient information form for ganglion cysts included questions related to personal and clinical characteristics. These questions were related to age, gender, primary diagnosis, information about ganglion cyst, complications and follow-up results of patients with ganglion cysts.

Table 1. Characteristics of patients with ganglion cysts.

Characteristics	Mean $\pm$ SD	Min., Max.	<i>n</i>	%
Age	34.49 $\pm$ 8.21	9, 76	-	-
Gender				
Female	-	-	1,088	61
Male	-	-	696	39
Location (Hand, Wrist)			1,487	83.4
Dorsal Wrist	-	-	877	58.9
Volar Wrist	-	-	178	11.9
Volar Retinacular	-	-	148	10
Extensor Tendon	-	-	104	7
Distal Interphalangeal Joint	-	-	75	5.1
Proximal Interphalangeal Joint	-	-	75	5.1
Carpometacarpal Boss	-	-	30	2
Location (Foot, Ankle)			297	16.6
Fibular	-	-	50	16.8
Knee-ulnar	-	-	20	6.7
Knee-tibial	-	-	14	4.7
Elbow-tibial	-	-	169	57
Ankle-ulnar	-	-	34	11.5
Ulnar	-	-	10	3.3

Statistical analysis of data

The retrospective data of this study were coded in excel and then transferred to Statistical Package for the Social Sciences (SPSS) 27.0 IBM (Armonk, NY). According to the Kolmogorov–Smirnov test, there was no normal distribution. Descriptive statistics (number, percentage, mean, standard deviation, minimum and maximum value) and Chi-Squared test were used in data analysis. In addition, the Kruskal–Wallis test was used to compare independent groups and means. The reasons for differences in more than two categories were determined by post hoc Bonferroni test. In the interpretation of the results, $p < 0.05$ statistical significance level and 95% confidence interval were taken into consideration.

Ethical aspects of the study

Before starting this study, Ethics Committee Permission was obtained from Istanbul Nişantaşı University, Faculty of Health Sciences, Clinical Research Ethics Committee (Date: 18 Nov 2024, Document Number: 20241118-006). In line with the Declaration of Helsinki, the research steps were followed without access to the personal information of the participants to eliminate the possibility of any violation of rights. Written and verbal informed consent was obtained from the patients whose photographs were used.

Findings

Table 1 shows the characteristics of patients with ganglion cysts. The mean age of the patients was 34.49 ± 8.21 years. A total of 61% were female and 39% were male. Of those with hand and wrist locations, 58.9% were dorsal wrist, 11.9% were volar wrist and 10% were volar retinacular ganglion cysts. Ganglion cysts arising in the hand, wrist and other upper extremity structures accounted for 83.4% of the total, while the remaining 16.6% included patients with lower extremity ganglion cysts involving the foot and ankle. Of the lower extremity ganglion cysts, 16.8% were fibular, 57% were elbow-tibial, and 11.5% were ankle-ulnar.

Table 2 shows the common symptoms in patients with ganglion cysts and the imaging method used for initial diagnosis. Pain was present in 95.3%, tenderness in all, palpable mass in 95.1%, and functional limitation in 36.3% of patients with ganglion cysts. For diagnostic purposes, cyst aspiration was performed in 8%, ultrasonography (USG) in 85% and MRI in 50%.

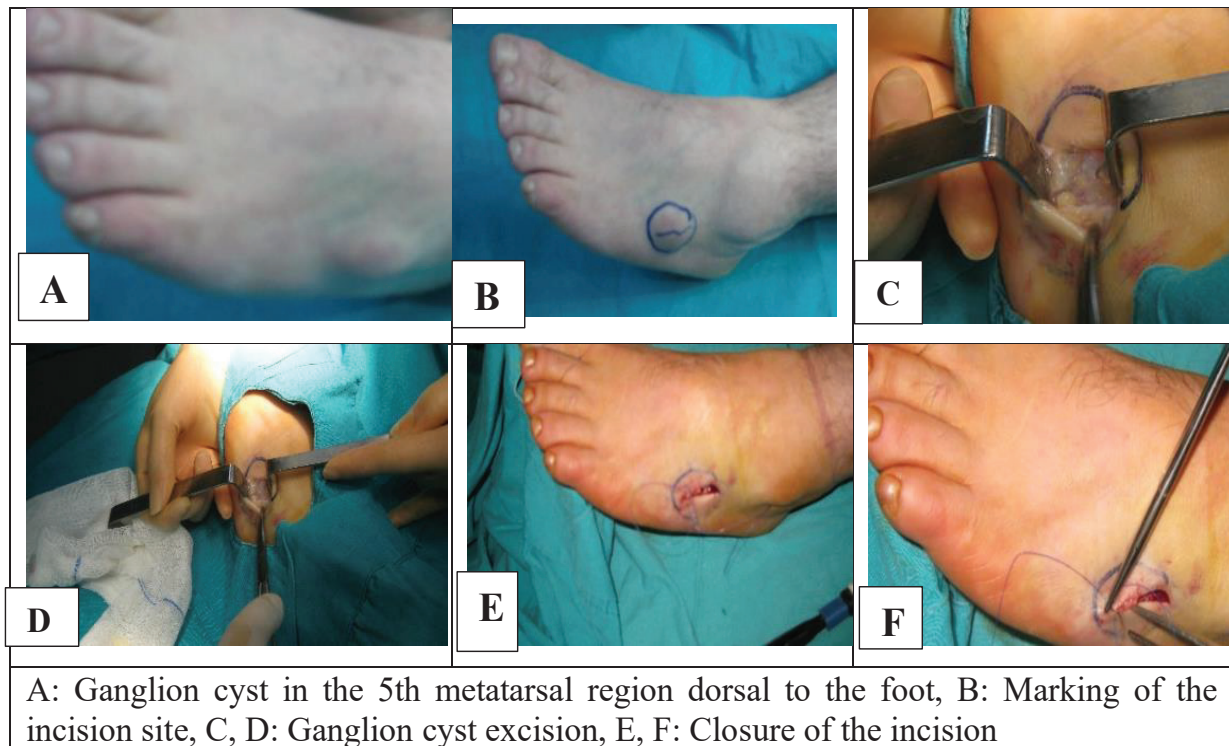
Figure 1 shows images of foot ganglion cyst excision. For the excision of the ganglion cyst, which was palpable and visible on the dorsal aspect of the foot, a superficial incision of approximately 1 cm was made and the procedure was performed.

Table 2. Common symptoms in patients with ganglion cysts and imaging method used for initial diagnosis.

Symptoms*	<i>n</i>	%
Pain	1,700	95.3
Swelling	1,737	97.4
Functional limitation	648	36.3
Palpable mass	1,696	95.1
Tenderness	1,784	100
Objective initial diagnostic method before primary cyst treatment*		
Cyst injection/aspirate	144	8
USG	1,516	85
MRI	892	50

MRI: Magnetic Resonance Imaging; USG: Ultrasonography.

*Can have more than one options



A: Ganglion cyst in the 5th metatarsal region dorsal to the foot, B: Marking of the incision site, C, D: Ganglion cyst excision, E, F: Closure of the incision

Figure 1. Images of the excision of a ganglion cyst located on the 5th metatarsal of the dorsal foot.

Figure 2 shows images of hand ganglion cyst excision. The ganglion cyst, located on the dorsal part of the hand as a single cyst, was excised through a superficial incision of approximately 1 cm.

Table 3 shows the primary and secondary treatment approaches for patients with ganglion cysts and recurrences. When primary ganglion cyst treatments were analyzed, cyst aspiration was performed in 22.7%, cyst excision in 36.3%, cyst resection in 23.6%, and joint arthrodesis in 17.4%. After primary treatment of patients with ganglion cysts, recurrence developed in 83.5% of those who underwent cyst aspiration, 15% of those who underwent cyst excision, 6.7% of those who underwent cyst resection, and 7.1% of those who underwent joint arthrodesis. Recurrence was 27.2% of the total number of patients treated for ganglion cysts. Patients who underwent cyst injection had more recurrence than those who underwent surgical excision. Patients who underwent surgical resection and joint arthrodesis had a lower recurrence rate than those who underwent surgical excision. These differences were statistically significant. Patients who underwent primary ganglion cyst treatment underwent secondary treatment after recurrence developed. None of the patients who developed recurrence underwent cyst aspiration for the second time, 33.8% underwent cyst excision, 21% underwent cyst resection and 45.2% underwent joint arthrodesis. No patient developed recurrence for the second time after these treatments (Table 3).

Table 4 shows the relationship between the development of recurrence and age. The development of dorsal wrist, volar wrist, distal interphalangeal joint and proximal interphalangeal joint ganglion cysts increased with age and this difference was statistically significant.

Discussion

Ganglion cysts may occur in any joint or tendon sheath of the body, but the highest incidence is around the wrist and most involvement occurs in the dorsal regions [16]. Ganglion cysts in the dorsal part of the hand are associated with the scapholunate ligament, whereas

ganglion cysts in the volar region may be associated with the metacarpal trapezium or scaphotrapezoid joint as well as the radio scaphoid-scapholunate space [16, 17]. In this 10-year retrospective analysis of patients with ganglion cysts, 83.4% ($n = 1,487$) of 1,784 patients had hand and wrist ganglion cysts. Of the hand and wrist cysts, 58.9% were located in the dorsal wrist region. The second most common ganglion cyst of the hand and wrist was located in the volar wrist region with a rate of 11.9%. Another 14-year retrospective analysis included 394 patients with ganglion cysts and 69.4% had dorsal wrist ganglion cysts [18]. Although varying numbers were recorded in different centers, more than 50% of hand and wrist ganglion cysts were reported to be located in the dorsal wrist in related studies [3, 6, 19]. In this study, lower extremity ganglion cysts constituted only 16.6% ($n = 297$) of the total. We found that elbow-tibial ganglion cysts had a higher incidence rate (57%) compared to the others, and the second highest rate was 16.8% in ganglion cysts developing in the fibular region. In the study by Rozbruch and colleagues in which lower extremity ganglion cysts were examined, ganglion cysts were localized to the foot in 35 of 54 patients [1]. In the study by Ahn and colleagues, 35 (66%) of 53 patients had ganglion cysts on the dorsal aspect of the foot [20]. The results of the studies in the literature regarding the incidence of ganglion cysts are compatible with the results of our study.

In our study, the complaints reported by patients with ganglion cysts were tenderness in all, pain and palpable mass in more than 95%, and functional limitation at the cyst site in 36.3%. In a study of 119 patients, it was reported that ganglion cysts caused excruciating and persistent pain according to the visual analog scale (VAS) and its incidence was 79.8% [20]. In other studies on ganglion cysts, it was reported that patients felt pain at rates ranging from 49.2% to 80% [21–24]. Westbrook and colleagues investigated the reasons why patients sought medical attention for ganglion cysts and found that 38% of patients expressed cosmetic concerns, 28% were concerned about malignancy and only 26% were concerned about pain [25]. In

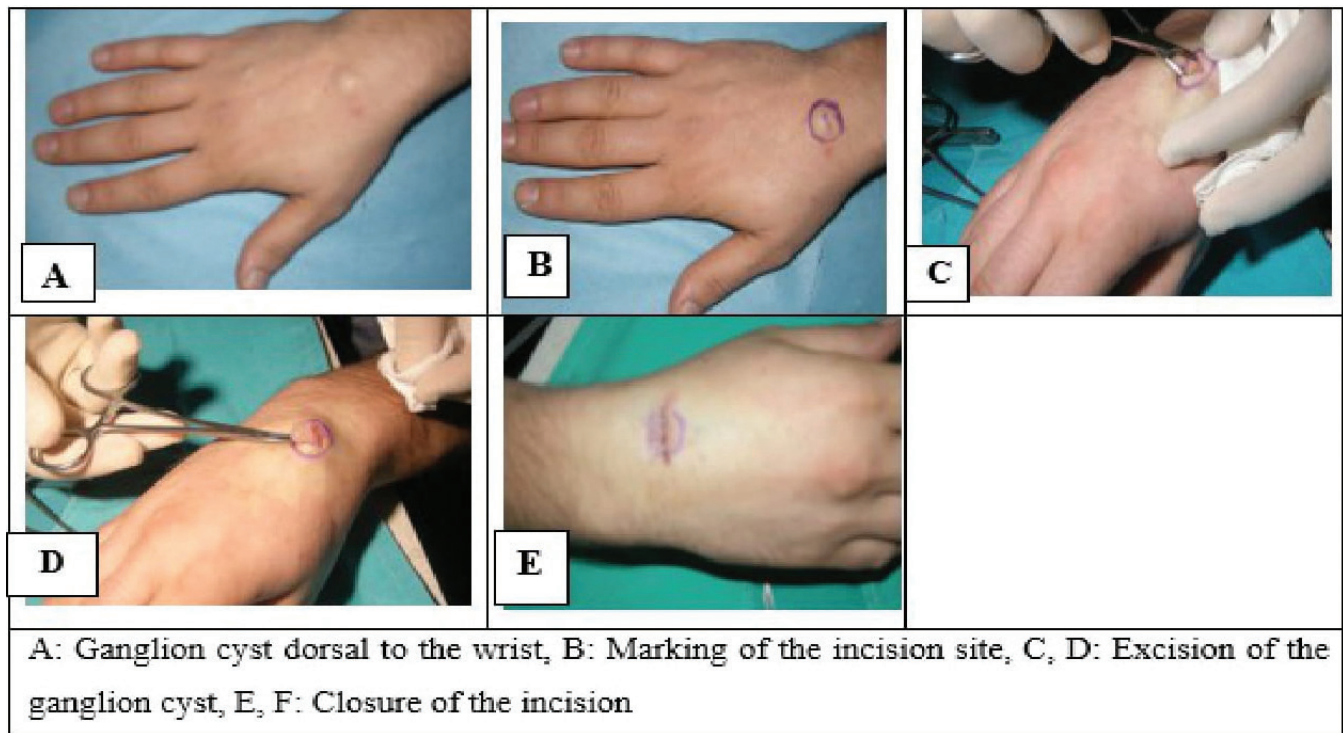


Figure 2. Images of the excision of a ganglion cyst on the dorsal hand are shown.

our study, we did not define the severity of pain with the help of a scale. In addition, we have no data on the level of discomfort of tenderness and the degree of functional limitation. In this study, the anamnesis of the patients was analyzed and the patients verbally reported pain and tenderness. In this study, the proportion of patients who felt pain due to ganglion cysts was higher than in previous studies. This may be because a valid and reliable scale was not used.

USG is the primary imaging modality in patients with signs and symptoms of ganglion cysts. However, MRI is superior to USG in terms of functionality; therefore, MRI is performed in cases where USG is limited [26]. Needle aspiration can be performed for the diagnosis and treatment of ganglion cysts. In a study in which therapeutic needle aspiration of ganglion cysts was performed, it was reported that recurrence developed in a period of 3 to 12 months [27]. Although needle aspiration of ganglion cysts is associated with recurrence rates of up to 85% [28], it is clear that non-surgical treatments are preferred to be cheaper and less invasive [28, 29]. This study performed cyst aspiration in 8%, USG in 85%, and MRI in 50% of ganglion cysts for diagnostic purposes. Sending the material extracted during cyst aspiration to the pathology laboratory will

provide a definitive diagnosis and will save the patient time for surgical treatment even if recurrence may not occur or develop when the cyst is completely drained.

In this study, 36.3% of patients with ganglion cysts underwent excision and 23.6% underwent resection. Other treatments were steroid injection and needle aspiration (22.7%) and joint arthrodesis (17.4%). The recurrence rate after primary treatment was 83.5% after non-surgical treatments. Recurrence after surgical excision, resection and arthrodesis was 15%, 6.7% and 7.1%, respectively. In the literature, recurrence rates were reported to be up to 28% after surgical excision [12] and 17.3% after resection [11]. Arthrodesis was performed in 45.2%,

Table 3. Primary and secondary treatment approaches applied to patients with ganglion cysts and recurrent.

Treatment methods	Primary cyst treatment	Recurrent after primary treatment	Secondary cyst treatment
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Cyst injection/aspirate (1)	405 (22.7)	338 (83.5)	-
Cyst Excision (2)	648 (36.3)	97 (15)	164 (33.8)
Cyst Resection (3)	421 (23.6)	28 (6.7)	102 (21)
Joint Arthrodesis (4)	310 (17.4)	22 (7.1)	219 (45.2)
Toplam	1,784 (100)	485 (27.2)	485 (100)
Test and Sig.	-	$\chi^2 = 0.306$, $p = 0.001^{**}$	-
Post hoc		1 > 2 > 3,4	

Table 4. Relationship between recurrent development and age.

Characteristics	<i>n</i> (%)	Age Mean $\pm$ SD	Test and Sig.
Age			
Recurrence location			
Location (hand, wrist, upper extremity)	346 (100)	46.71 $\pm$ 10.96	KW = 0.754, $p = 0.002^{**}$ 1, 2, 5, 6 > 3, 4, 7
Dorsal Wrist (1)	277 (80.1)	48.3 $\pm$ 17.1	
Volar Wrist (2)	24 (6.7)	40.8 $\pm$ 10.5	
Volar Retinacular (3)	18 (5.2)	37.5 $\pm$ 14.5	
Extensor Tendon (4)	14 (4.1)	35.4 $\pm$ 11.8	
Distal Interphalangeal Joint (5)	3 (0.9)	66.8 $\pm$ 11.2	
Proximal Interphalangeal Joint (6)	7 (2.1)	59.7 $\pm$ 8.7	
Location (foot, ankle, lower extremity)			KW = 1.011 $p = 0.113$
Carpometacarpal Boss (7)	3 (0.9)	34.49 $\pm$ 8.21	
Fibular	139	42.5 $\pm$ 11.54	
Knee, ulnar	50	48.61 $\pm$ 11.16	
Knee, tibial	20	40.1 $\pm$ 10.3	
Elbow, tibial	14	42.7 $\pm$ 14.3	
Ankle and ulnar	169	40.5 $\pm$ 13.6	
Ulnar	34	41.3 $\pm$ 8.9	
	10	36.7 $\pm$ 9.4	

KW: Kruskal–Wallis Test. $^{**}p < 0.01$

excision in 33.8%, and resection in 21% of patients who developed recurrence, and no new recurrence was reported in those who underwent secondary cyst treatment after 6 months and 5 years of follow-up. In a previous study, it was reported that subcutaneous adipose tissue and pigmentation disorders were observed after steroid injection [3]. Surgical treatments have been reported to decrease the development of recurrence [30] and surgical excision is the most successful and gold-standard treatment method [31]. Complete removal of the ganglion cyst and the surrounding joint capsule together with the pedicle is mostly possible with surgical methods and we believe that this minimizes the development of recurrence.

In this study, the development of dorsal wrist, volar wrist, distal interphalangeal joint and proximal interphalangeal joint ganglion cysts increased with age and this difference was statistically significant. In a previous study, it was reported that mucoid cysts seen in the dorsal aspect of the distal interphalangeal joint were associated with osteoarthritis in elderly individuals [32]. The relationship between age and the mechanism of ganglion cyst development and/or recurrence after surgical treatment remains unknown. In addition, data on other causes of ganglion cyst development are not fully available. The inability to prevent the development of recurrence despite advanced surgical strategies and the variety of solutions applied by surgeons shows that uncertainties continue to exist in this field. The sample size of this study was quite large, but the variety of ganglion cysts was also high. This situation limits the generalizability of the treatment methods applied. Patients were followed up for 6 months to 5 years after ganglion cyst treatment, but outcomes beyond 5 years are unknown. Long-term follow-up (after 6 months) after the most recent treatment was performed by telephone and the results were based on patient self-report, which reduces the reliability of the results.

Conclusion

According to the results obtained in this study, ganglion cysts tended to be localized mostly to the hand and wrist. Localization to the dorsal and volar regions of the hand was more common than other upper extremity ganglion cysts. MRI was preferred in cases where USG was limited because it was more effective in making a definitive diagnosis. Although needle aspiration is associated with high recurrence rates, it saves time for patients who do not want surgery or who are considering surgery at a later stage. In addition, the aspiration material can be sent to the pathology laboratory and a definitive conclusion can be obtained that the mass is benign. Surgical excision, resection and joint arthrodesis were associated with varying rates of recurrence in patients with ganglion cysts. The fact that surgical interventions were performed by the same surgeon and recurrence could not be prevented draws attention to the existence of unknowns. The correlation between age and the development of ganglion cysts located in the dorsal wrist, volar wrist, distal interphalangeal joint and proximal interphalangeal joint warrants further prospective studies.

Authors' contributions

All of Authors (Contribution – performed measurements, manuscript preparation, study design, writing).

Declarations

Conflict of interest

The authors declare that they have no conflicts of interest related to the publication of this manuscript.

Data availability

The datasets generated and/or analyzed in this study are available from the corresponding author upon reasonable request.

Code availability

Not applicable.

Ethical approval

Before starting this study, Ethics Committee Permission was obtained from Istanbul Nişantaşı University, Faculty of Health Sciences, Clinical Research Ethics Committee (Date: 18 Nov 2024, Document Number: 20241118-006). In line with the Declaration of Helsinki, the research steps were followed without access to the personal information of the participants to eliminate the possibility of any violation of rights. Written and verbal informed consent was obtained from the patients whose photographs were used.

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