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Evaluation of the Characteristics of Hand and Wrist Ganglion Cysts and Their Relationship with Ligamentous Injury

El ve El Bileği Ganglion Kistlerinin Özellikleri ve Ligament Hasarıyla İlişkilerinin Değerlendirilmesi

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ABSTRACT

Objective: The present study aimed to examine the characteristics of ganglion cysts in the hand and wrist region using magnetic resonance imaging (MRI) and to evaluate the relationship between these cyst existence and ligamentous injuries.

Methods: Patients who were diagnosed with ganglion cysts after being evaluated with wrist MRI due to chronic wrist pain between January 2018 and December 2022 were retrospectively reviewed. Patients with a history of hand or wrist trauma in the last 3 months or previous hand and wrist surgeries were excluded from the study. The ganglion cysts were assessed in terms of location, size, and accompanying to the triangular fibrocartilage complex (TFCC) and intercarpal ligament (ICL) injuries.

Results: A total of 156 patients were included in the study The average age of the patients was 37.53 (± 15.02) years. The ganglion cyst was located dorsally in 85 patients (54.5%), volarly in 68 patients (43.6%), and both dorsally and volarly in 3 patients (1.9%). TFCC injury was detected in 33 patients (21.1%). There was no statistically significant relationship between TFCC injury and cyst location (dorsal, volar) (p = 0.187). ICL injury was present in 2 patients (1.2%). Dorsal cysts were more frequent in patients younger than 40 years old.

Conclusion: The majority of patients with ganglion cysts did not have accompanying ligament injuries this finding raises doubts about the role of ligament injuries in the formation of ganglion cysts. While dorsal ganglion cysts were slightly more common overall, the frequency of volar localization increased with age.

Keywords: Ganglion cyts, ligament injury, TFCC, intercarpal ligament

ÖZ

Amaç: Bu çalışmanın amacı, el ve el bileği bölgesindeki ganglion kistlerinin manyetik rezonans görüntüleme (MRG) ile özelliklerini incelemek ve bu kistlerin varlığı ile ligaman yaralanmaları arasındaki ilişkiyi değerlendirmektir.

Yöntemler: Ocak 2018 ile Aralık 2022 tarihleri arasında kronik el bileği ağrısı nedeniyle el bileği MRG ile değerlendirilen ve ganglion kisti tanısı alan hastalar retrospektif olarak incelendi. Son 3 ay içinde el veya el bileği travma öyküsü bulunanlar ile daha önce el veya el bileği cerrahisi geçirmiş hastalar çalışma dışı bırakıldı. Ganglion kistleri; lokalizasyon, boyut ve eşlik eden triangular fibrokartilaj kompleks (TFCC) ve interkarpal ligaman (ICL) yaralanmaları açısından değerlendirildi.

Bulgular: Çalışmaya toplam 156 hasta dahil edildi. Hastaların ortalama yaşı 37,53 (±15,02) yıldı. Ganglion kistleri 85 hastada (%54,5) dorsal, 68 hastada (%43,6) volar yerleşimliydi; 3 hastada (%1,9) ise hem dorsal hem volar yerleşim mevcuttu. Otuz üç hastada (%21,1) TFCC yaralanması saptandı. TFCC yaralanması ile kist lokalizasyonu (dorsal, volar) arasında istatistiksel olarak anlamlı bir ilişki bulunmadı (p = 0,187). İki hastada (%1,2) ICL yaralanması tespit edildi. Dorsal yerleşimli kistler 40 yaş altındaki hastalarda daha sık izlendi.

Sonuç: Ganglion kisti olan hastaların büyük çoğunluğunda eşlik eden ligaman yaralanması bulunmamaktadır. Bu bulgu, ganglion kistlerinin oluşumunda ligaman yaralanmalarının rolü konusunda şüphe uyandırmaktadır. Genel olarak dorsal ganglion kistleri biraz daha sık görülmekle birlikte, yaş ilerledikçe volar yerleşim sıklığının arttığı izlenmiştir.

Anahtar Sözcükler: Ganglion kisti, bağ yaralanmaları, TFCC, interkarpal bağlar

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INTRODUCTION

Ganglion cysts are the most common tumor-like condition of the hand and wrist region, reportedly accounting for 70% of lesions in this area (1,2). Studies have shown that they are more frequently located on the wrist, particularly on the dorsal side (3, 4). Additionally, they are more commonly observed in women than in men (5).

A meta-analysis by Head et al. (6) reported recurrence rates after treatment for ganglion cysts of 21% for open excision, 6% for arthroscopic excision, and 59% for aspiration. One possible reason for these high recurrence rates is the unclear etiology and pathogenesis of ganglion cysts. Several theories regarding the pathogenesis of ganglion cysts exist, but no consensus has been reached (7).

Some theories suggest that repetitive wrist stress, as seen in gymnasts, weakens the joint capsule, leading to the formation of ganglion cysts (8,9). It has been proposed that myxoid degeneration of peri-articular tissue may cause cyst formation, or that cysts arise primarily from herniation of the joint capsule (10). However, the absence of a synovial lining, which is typically present in normal cystic lesions, raises questions about this theory. Moreover, the inflammatory theory, which posits that cyst formation is related to inflammation, has been discounted due to the lack of expected peri-cystic inflammatory changes in ganglion cysts (9, 11). Recent studies involving patients who underwent arthroscopic excision of ganglion cysts have linked these cysts to ligamentous injuries (5,12). It has also been suggested that ganglion cysts might arise from intercarpal ligament (ICL) injuries (5,12-14). While the dorsal cysts commonly arise from the scapholunate joint, volar ganglion cysts mostly originate from the scaphotrapeziotrapezoid and radiocarpal joints. the other major ligament of the wrist and hand is the (TFCC), which may also contribute to the etiology of ganglion cysts (12,15-17).

The aim of this study was to examine the characteristics of ganglion cysts of the hand and wrist using magnetic resonance imaging (MRI) and to evaluate the relationship between these cysts and non-acute ligamentous injuries of the hand and wrist.

MATERIALS AND METHODS

Patients diagnosed with ganglion cysts who underwent wrist imaging MRI for chronic hand and wrist pain lasting more than 6 weeks between January 2018 and December 2022 were retrospectively evaluated. Patients with a history of hand and wrist trauma within the last 3 months (n = 11) or previous hand and wrist surgeries (n = 5) were excluded from the study. The ganglion cysts in the patients were examined using MRI. The presence of solitary or multiple ganglion cysts was assessed. The patients were grouped based on the location of the ganglion cysts (volar or dorsal), the anatomic level (wrist, intercarpal, carpometacarpal, metacarpal, and metacarpophalangeal), and the presence of associated ligament injuries, such as injury to the triangular fibrocartilage complex (TFCC) or the ICL. Additionally, the patients were grouped by age (< 40 and ≥ 40 years). These groups were compared statistically to evaluate their association with the frequency of ganglion cysts.

Statistical Analysis

The statistical analyses were performed using SPSS version 21.0 (Statistical Package for Social Sciences, Chicago, IL, USA). All tests were conducted at a 95% confidence level, with a margin of error set at 0.05. A p-value of less than 0.05 was considered statistically significant. The normality of the distributions was assessed using the Shapiro-Wilk test. Variables that failed the normality test (Shapiro–Wilk test $p < 0.05$) were analyzed with non-parametric tests. For inter-group comparisons, Mann-Whitney U test, Kruskal-Wallis test, and chi-square tests were used.

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University of Health Sciences Türkiye, Ankara Training and Research Hospital (decision number: 135/2024, date: 24/07/2024), and informed consent was obtained from each patient.

RESULTS

A total of 156 patients were included in the study. Among the patients, 43 (27.6%) were male and 113 (72.4%) were female. The mean age of the participants was 37.53 ± 15.02 years. Sixty patients (38.4%) were under 40 years of age, while 96 patients (61.6%) were 40 years or older (Table 1).

The mean size of the ganglion cysts identified in the patients was 8.72 ± 6.87 mm. The smallest ganglion cyst measured 2 mm in length, while the largest measured 40 mm in length. Solitary ganglion cysts were found in 151 patients (96.7%), whereas multiple cysts were present in only 5 patients (3.3%). The ganglion cyst was located on the dorsal side in 85 patients (54.5%), on the volar side in 68 patients (43.6%), and on both the dorsal and volar sides in 3 patients (1.9%). In 136 patients (87.2%), the cyst was located at the wrist; in 19 patients (12.2%), at the hand; and in 1 patient (0.6%) at both the hand and wrist (Table 1). 75% (51/68) of the volar ganglion cysts were located at the radiocarpal joint; however, only 23.5% (20/85) of the dorsal cysts originated from the radiocarpal joint. 40% (34/85) of the dorsal cysts originated from the scapholunate joint, whereas only 2.9% (2/85) of volar cysts did.

The majority of patients with ganglion cysts (61.6%) were under 40 years of age. Dorsal cysts were more frequent in patients younger than 40 years, at a rate of 64.5%; however, volar cysts were more frequent in patients aged 40 years or older, at a rate of 60%. ($p = 0.001$) The side of the affected extremity was comparable between groups ($p = 0.739$) (Table 2).

TFCC injuries were identified in 33 patients (21.1%). There was no statistically significant association between TFCC injury and cyst location (dorsal vs. volar; $p = 0.187$) (Table 3). An ICL injury was present in two patients (1.2%). The injured ligaments were the scapholunate ligaments.

When the relationship between TFCC injury and patient age (under or over 40 years), cyst location ($p = 0.187$), cyst level ($p = 0.355$), and multiplicity ($p = 0.535$) was examined, no significant associations were found ($p = 0.901$) (Table 3).

DISCUSSION

The most important finding of the present study was that only 22% of patients with ganglion cysts and chronic wrist pain had associated ligament injuries. Among those with ligament injuries, only 3% had a complete rupture. The majority of ligament injuries were TFCC injuries, and only 1.2% of patients had ICL (Scapholunate ligament) injuries, which have been reported as the most common

Table 1. Patient and lesion characteristics

		n	%
Gender	Male	43	27.6
	Female	113	72.4
Age	< 40 years	60	38.4
	> 40 years	96	61.6
Multiplicity	Solitary	151	96.8
	Multiple	5	3.2
Cyst level	Hand	19	12.1
	Wrist	136	87.1
	Hand + wrist	1	0.8
Cyst location	Dorsal	85	54.4
	Volar	68	43.6
	Dorsal + volar	3	2

Table 2. The relationship between the side and location of the ganglion cyst and patient age groups

		< 40 years	≥ 40 years	p
Side	Right	55	36	0.739
	Left	41	24	
Cyst location	Dorsal	62	23	0.001*
	Volar	32	36	
	Dorsal + volar	2	1	

Table 3. The relationship between the incidence of ligament injury and ganglion cyst localization,level and multiplicity

		TFCC injury			
		No	Yes		
			Partial injury	Total injury (rupture)	p
		n	n	n	
Age	< 40 years	76	19	1	0.901
	≥ 40 years	47	10	3	
Cyst location	Dorsal	70	13	2	0.187
	Volar	50	16	2	
	Dorsal + volar	3	0	0	
Cyst level	Wrist	105	27	4	0.355
	Hand	17	2	0	
	Wrist + hand	1	0	0	
Multiplicity	Solitary	118	29	4	0.535
	Multiple	5	0	0	

TFCC: Triangular fibrocartilage complex

origin of ganglion cysts. Ganglion cysts are commonly reported, as they are often related to ICLs and most commonly arise from the scapholunate joint (18). Several studies have examined the relationship between ganglion cysts and TFCC injuries (5,13,14). Langner et al. (15) hypothised that TFCC injuries can also cause ganglion cysts, similar to meniscal tears in the knee. They evaluated the patients arthroscopically and concluded that recurrent radiopalmar ganglions are also associated with TFCC pathologies (19). In a study of arthroscopic findings in painful ganglion cysts, ICL injury was reported in 75% of patients (13). The authors proposed that joint anomalies, such as ligament injuries, may cause cysts similar to popliteal cysts of the knee. They also noted that wrist pain could persist even after ganglion excision, without recurrence of the cyst. This conflict may be attributable to the patient group in the referenced study consisted primarily of individuals with instability. In another study, Watson et al. (8) suggested that ganglion cysts might be a secondary manifestation of peri-scaphoid ligamentous injury and recommended that patients with persistent symptoms after excision be investigated for instability. McKeon and colleaguess (20), in a prospective study, suggested the presence of ligamentous hyperlaxity in patients with symptomatic ganglion cysts. El-Noueam et al. (21) reported associated ligament injuries in approximately 30% of symptomatic ganglion cyst cases. On the other hand, there are also studies in the literature that do not support this claim. Rizzo et al. (22) indicated that none of the patients treated for dorsal wrist ganglion cysts had scapholunate ligament instability. Similarly, Lowden et al. (23) found no evidence of ligament injury on MRI in patients with ganglion cysts, aligning with the present study's findings. Moreover, in a recent study that compared dynamic wrist radiographs of patients with or without ganglion cysts, the authors concluded that there were no differences in scapholunate gap and radiocarpal angles between the groups, and these findings do not support the instability hypothesis. With respect to the TFCC, the percentage of patients with ICL injuries was particularly low. Although TFCC injuries were commonly observed, a previous study using MRI to evaluate patients reported that TFCC injuries were present in up to 50% of the population, regardless of age. This suggests that while TFCC damage is frequently present, it may not always be directly related to the presence of ganglion cysts. In the present study, the absence of ligament injury in most patients suggests that ligament injury may not be a major factor in the etiology of ganglion cysts. Notably, the fact that symptomatic ganglion cysts often become asymptomatic with conservative treatment calls into question the role of ligamentous hyperlaxity in their etiology.

The risk of developing ganglion cysts is three times higher in women than in men. A previous study reported that 60% of patients diagnosed with ganglion cysts were women (24). In our study, 72.4% of the patients diagnosed with ganglion cysts were female, consistent with the literature.

The mean age in the present study was 37.53 years, consistent with many previous studies. Kulinski et al. (25) reported an average age of 41.3 years in their retrospective study, while Dermon and colleagues (3) reported an average age of 37.2 years. Other studies of surgically treated patients found an average age of 43 years, while a study with a broader patient population reported an average age of 35.6 years (26). These findings indicate that ganglion cysts tend to be more frequent from the late 30s to the early 40s.

In a previous study of ganglion cysts, 76% of cases were reported to occur at the wrist (25). Similarly, in the present study, 87% of cysts were located at the wrist level. Regarding cyst localization, it has been suggested that 70% of ganglion cysts are found dorsally, 20% volarly, and 10% at other body sites (24). While the dorsal cysts commonly arise from scapholunate joint, volar ganglion cysts mostly originate from the scaphotrapeziotrapeziodal and radiocarpal joints. In contrast, several studies have reported that ganglion cysts are more common on the volar side (12,16,23,27). In the present study, ganglion cysts were located dorsally in 54.4% of patients and volarly in 43.6%. Also, the majority of the volar ganglion cysts originated from the radiocarpal joint while dorsal wrist ganglions commonly originated from the scapholunate joint, which is similar to previous studies' findings. Analysis of the relationship between cyst formation and age revealed that, among patients older than 40 years, 60% of ganglion cysts were located on the volar side. No significant difference was observed in the incidence of ligament injury between patients younger than 40 years and those 40 years or older. Previous studies have provided limited data on the relationship between age and cyst location. Kuliński et al. (25) also noted that patients with volar wrist ganglion cysts tended to be older than those with dorsal cysts. Degeneration has previously been suggested as a potential factor in cyst formation (28). The increased occurrence of volar ganglion cysts with advancing age may be related to their degenerative nature, warranting further histopathological studies.

In the current study, the mean ganglion cyst size was 8.72 ± 6.87 mm. A similar study examining wrist ganglion cysts on MRI found a mean diameter of 8 mm, with many studies reporting comparable findings (23,29,30). Despite recent research indicating that wrist ganglion cysts do not typically favor one side, the present study found that right-sided cysts were more frequent than left-sided cysts, at 58.3% and 41.7%, respectively (25,31,32).

Study Limitations

The study has several limitations. First, it was a single-center retrospective study. Diagnosis is based on MRI findings; however, the sensitivity of MRI for subtle TFCC or ligamentous pathologies may result in missed diagnoses. A further limitation is the lack of a control group without signs of ganglion cysts. However, the results of the present study were carefully discussed in relation to the findings in the literature to minimize the limitation arising from the absence of a control group.

CONCLUSION

The present study found that most patients with ganglion cysts did not have associated ligament injuries, raising questions about the role of ligament injuries in the formation of ganglion cysts. Additionally, most ganglion cysts were located at the wrist. Although dorsal ganglion cysts were slightly more common, volar cysts were more frequent in patients aged 40 years or older.

Ethics

Ethics Committee Approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University of Health Sciences Türkiye, Ankara Training and Research Hospital (decision number: 135/2024, date: 24/07/2024).

Informed Consent: Informed consent was obtained from each patient.

Footnotes

Authorship Contributions

Surgical and Medical Practices: T.K.E., Y.A., Concept: T.K.E., Design: T.K.E., Data Collection or Processing: Y.A., Analysis or Interpretation: T.K.E., Literature Search: T.K.E., Y.A., Writing: T.K.E., Y.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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