Bosphorus Medical Journal
Boğaziçi Tıp Dergisi

Original Article

DOI: 10.14744/bmj.2022.44265

Bosphorus Med J 2022;9(2):132–138

Evaluation of Phalangeal Benign Soft-Tissue Tumors of the Hand and Systemic Review of the Literature

Eldeki Falangeal Benign Yumuşak Doku Tümörlerinin Değerlendirilmesi ve Literatürün Sistemik İncelenmesi

Numan Atılgan,[1] Mehmet Rauf Koç,[2] Numan Duman,[3] Turgut Emre Erdem,[4] Onur Bilge[4]

[1]Department of Hand Surgery, Mehmet Akif Inan Training and Research Hospital, Sanliurfa, Turkey
[2]Department of Hand Surgery, Izmir Tepecik Training and Research Hospital, Izmir, Turkey
[3]Department of Orthopedics and Traumatology, Uskudar University Medicine Faculty, Npıstanbul Brain Hospital, Istanbul, Turkey
[4]Department of Orthopedics and Traumatology, Necmettin Erbakan University Meram Medicine Faculty, Konya, Turkey

Cite this article as: Atılgan N, Koç MR, Duman N, Erdem TE, Bilge O. Evaluation of Phalangeal Benign Soft-Tissue Tumors of the Hand and Systemic Review of the Literature. Bosphorus Med J 2022;9(2):132–138.

Received: 21.01.2022
Accepted: 02.03.2022

Correspondence:
Dr. Mehmet Rauf Koç. İzmir Tepecik Eğitim ve Araştırma Hastanesi El Cerrahisi Bilim Dalı, İzmir, Türkiye
Phone:
+90 507 787 15 57
e-mail:
mehmetraufk@hotmail.com

ABSTRACT

Objectives: Our aim in this study is to evaluate patients with phalangeal benign soft-tissue tumors of the hand and to evaluate their short-term complications after surgery.

Methods: Between January 2019 and October 2021, 59 patients (31 female, 28 male; mean age 48.96±13.33, range 20–75 years) with phalangeal soft-tissue tumors were evaluated according to demographic data, histopathological diagnosis, satisfaction level, recurrence, and complications.

Results: The most common phalangeal soft-tissue tumor was tenosynovial giant cell tumors (n=15, 38.4%). Other frequent histologies included ganglion cysts (12.8%), epidermal inclusion cyst (10.25%), and fibrolipoma (7.6%). Soft-tissue tumors were most commonly found on second and third phalanx (both 26.2%), followed by fourth (13.8%), first (12.3%), and fifth (9.2%) The location of soft-tissue tumors was found in the phalanx of hands that were 40% proximal, 29.2% distal, and 30.8% in different parts of the phalanx. The mean visual analog scale score was 5.9±3.1 before excisional surgery; it was 3.47±1.3 at the last follow-up ($p<0.01$). Seven patients had recurrence after the surgery (11.8%). Surgical site infection was the other complication and seen in three patients (5%).

Conclusion: Our experience has shown that the most frequently observed soft-tissue phalanx tumors are tenosynovial giant cell tumors. Excisional surgical treatment of soft-tissue tumors of the phalanx is a surgery that requires attention to get good satisfaction rates and low recurrence and complication rates.

Keywords: Bening soft tissue tumours; excisional surgery; histopathological; phalanx; visual analogue scale.

ÖZET

Amaç: Bu çalışmanın amacı, eldeki falangeal benign yumuşak doku tümörlü hastaları ve cerrahi sonrası kısa dönem komplikasyonlarını değerlendirmektir.

Yöntem: Ocak 2019-Ekim 2021 tarihleri arasında falanks yumuşak doku tümörlü 59 hasta (31'i kadın, 28'i erkek; ortalama yaş 48,96±13,33 yıl, dağılım 20-75 yıl) demografik veriler, histopatolojik tanı, memnuniyet düzeyi, nüks ve komplikasyonlar açısından değerlendirildi.

Bulgular: En sık görülen falanks yumuşak doku tümörü tenosinovyal dev hücreli tümörlerdi (n=15, %38,4). Diğer sık görülen histolojiler ise ganglion kistleri (%12,8), epidermal inklüzyon kisti (%10,25) ve fibrolipom (%7,6) idi. Yumuşak doku tümörleri en sık ikinci ve üçüncü falankslarda (her ikisi de %26,2) bulunurken, bunu dördüncü (%13,8), birinci (%12,3) ve beşinci (%9,2) falanksla takip etti. El falanksında tümörler %40 proksimal, %29,2 distal ve %30,8 falanksın farklı bölgelerindeydi. Ortalama VAS skoru eksizyonel cerrahi öncesi 5,9±3,1 idi; son kontrolde 3,47±1,3 idi ($p<0,01$). Yedi hastada ameliyat sonrası nüks görüldü (%11,8). Cerrahi alan enfeksiyonu diğer komplikasyondu ve 3 (%5) hastada tespit edildi.

Sonuç: Deneyimlerimiz, en sık gözlenen yumuşak doku falanks tümörlerinin tenosinovyal dev hücreli tümörler olduğunu gösterdi. Falanksın yumuşak doku tümörlerinin eksizyonel cerrahi tedavisi, iyi memnuniyet oranları ve düşük nüks ve komplikasyon oranları elde etmek için dikkat gerektiren bir cerrahidir.

Anahtar sözcükler: Benign yumuşak doku tümörleri; eksizyonel cerrahi; falanks; histopatolojik; VAS.

Both hands represent only 2% of the total body surface area and they make up only 1.2% of the total body mass, but hand soft-tissue tumors make up 15% of all soft-tissue tumors.[1,2] Soft-tissue tumors of the hand are common and generally benign. The soft-tissue tumors of the hand can be categorized using different anatomical subunits of the hand. Each subunit represents a different clinic. In particular, musculoskeletal, vascular, bone, paronychia, cutaneous, and soft-tissue elements may develop benign lesions that may present as localized masses in the hand.

The hand is an extremely complex and surgically specialized body part. The soft-tissue tumors of the hand are common and it is important to know the spectrum histopathologically.[3] Hand tumors remain a special site because their symptoms, appearance, treatment, and prognosis differ from other tumors in the body. The soft-tissue tumors of hand surgery have complex anatomy and functional significance.

Hand soft-tissue tumors are categorized as benign, malign, and pseudotumor except for skin malignancy. About 95% of tumors on the hand are benign.[2] The most common tumors are ganglion cysts, giant cell tumors of the tendon sheath, and epidermal inclusion cysts. These tumors are detected early because of their pain and swelling.[4] Treatment is mostly excisional surgery.[5,6] There is confusing information in the literature also the information about the clinic and post-operating evaluation studies of phalanx soft-tissue tumors are very limited and not sufficient.

This study evaluates the characteristics and post-operative experience of benign soft-tissue tumors of the phalanx. In this study, patients with phalangeal soft-tissue tumors of the hand who underwent excisional surgery were evaluated. Post-operative results were compared in terms of satisfaction rates, complications such as wound infection and neurovascular injury in patients and recurrence rates.

Methods

Patients clinic archives were retrospectively analyzed from January 2019 to October 2021 by looking for international classification of disease codes for the benign soft-tissue tumors of the phalanx. Ethical approval was obtained from the Ethics Committee of Necmettin Erbakan University Faculty of Medicine. The mean age of 59 patients (31 females and 28 males) who underwent excisional surgery for soft-tissue tumors of the phalanx was 48.96 years (20–75 years). Analyzed data of patients were localization, histopathological features, satisfaction level, complications such as wound infection, neurovascular injury, and recurrence. The satisfaction level of the patients was evaluated using the visual analog scale (VAS) score before surgery and at final follow-up according to the scores they gave out of 10.[7] Tumor patients with bone involvement and pediatric patients were excluded from the study. SPSS (Statistical Package for the Social Sciences) for Windows 11.5 program was used for statistical analysis. Descriptive statistical methods were used while evaluating the study data. Student t-test was used to define parametric data and the One-sample Kolmogorov–Smirnov test was used for non-parametric data. $P<0.05$ was considered significant.

Surgical Procedure

Operations were performed under regional anesthesia (digital nerve block) and a tourniquet was used as standard procedure in patients who underwent surgery. In the post-operative period, non-steroidal anti-inflammatory drugs and if necessary, oral antibiotics (cefazolin tablet 1 g 2 times a day/oral) were given for 1 week. Dressings were done every 3 days. The sutures of the patients were removed in the 2nd post-operative week and were seen as the final control at the 6th and 12th weeks.

Results

Demographic data of the patients and pathology results by gender are shown in Table 1. The patients were followed up for an average of 14 months (range 9–16 months). Of the patients, 31 (52.4%) were female and 28 (47.6%) were male. Thirty cases were located on the right hand and 29 cases on the left hand.

The anatomical distributions of tumors in the hand are described in Table 2. Soft-tissue tumors were most commonly found on second and third phalanx (both 26.2%), followed by fourth (13.8%), first (12.3%), and fifth (9.2%). The location of soft-tissue tumors in the phalanx of hand was 40% proximal, 29.2% distal, and 30.8% in different parts of the phalanx.

In the analysis of pathology, results of the patients by order of frequency are giant cell tumor of the tendon sheath in 18 patients, ganglion cyst in eight patients, epidermal cyst in six patients, glomus tumor in five patients, lipoma in five patients, pyogenic granuloma in four patient, angiolipoma

Table 1. Demographic data of the patients and pathology results by gender

Benign soft-tissue tumors	Number of patients	Age (mean)	Gender (F/M)	Side (right/left)
Tendon sheath giant cell tumor	18	51.6	10/8	9/9
Ganglion cyst	8	49.2	6/2	6/2
Epidermal inclusion cyst	6	47.8	3/3	5/1
Glomus tumor	5	51.5	2/2	2/2
Lipoma	5	38.8	3/2	1/4
Pyogenic granuloma	4	45	1/3	3/1
Fibrolipoma	3	46.3	2/1	0/3
Neuroma	3	46.3		0/3
Angiolipoma	1	72	0/1	0/1
Angioleiomyoma	1	49	0/1	1/0
Benign Fibrous Histiocytoma	1	55	1/0	1/0
Mesenchymal neoplasia	1	32	1/0	1/0
Fibroma	1	65	1/0	1/0
Chondroid neoplasm	1	48	1/0	1/0

Table 2. Anatomical distribution of tumors

Benign soft-tissue tumors	Phalanxes				
	1st	2nd	3rd	4th	5th
Tendon sheath giant cell tumor	2	6	7	2	1
Ganglion cyst	1	2	2	1	2
Epidermal inclusion cyst	1	1	2	2	-
Glomus tumor	1	1	1	1	-
Lipoma	-	2	1	2	-
Pyogenic granuloma	-	2	1	1	-
Fibrolipoma	-	1	2	-	-
Neuroma	-	-	3	-	1
Angiolipoma	-	-	-	-	5
Angioleiomyoma	1	-	-	-	
Benign Fibrous Histiocytoma	-	1	-	-	-
Mesenchymal neoplasia	-	-	-	1	-
Fibroma	-	-	-	-	1
Chondroid neoplasm	-	2			

in one patient, angioleiomyoma in one patient, benign fibrous histiocytoma in one patient, mesenchymal neoplasia in one patient and fibrolipoma in three patients, chondroid neoplasm in one patient, neuroma in one patient, and fibroma in one patient (Fig. 1). All of the patients stated that they were satisfied with the surgical treatment (p=0.2). The mean VAS score was 5.9±3.1 (range, 2–10, median, 5.6) before excisional surgery; it was 3.47±1.3 (range, 1–7, median, 3) at the last follow-up (p<0.01). Seven patients had recurrence (11.8%); four patients with giant cell tumors, two patients with ganglion cysts, and one patient with glomus tumor. A local infection developed as a complication in one patient with benign fibrosis histiocytoma; in one patient with mesenchymal neoplasia; and in one patient with tendon sheath giant cell tumor during follow-up. All of these patients recovered after oral antibiotic treatment.

Discussion

We retrospectively analyzed the diagnosis process and clinical features of operated phalanx tumors and whether post-operative complications developed. Hand soft-tis-

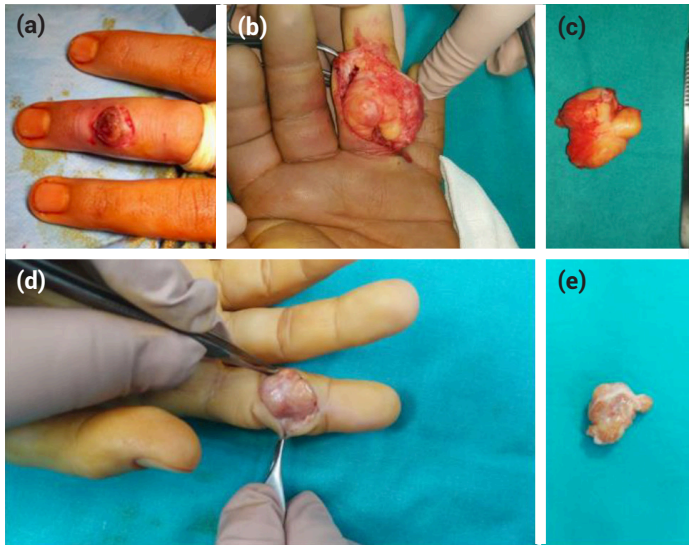

Figure 1. Some intraoperative case pictures. **(a)** Pyojenic granuloma. **(b, c)** Lipoma. **(d, e)** Tendon sheath giant cell tumour.

sue tumors are generally benign and present as a localized mass in the region.[8] Patients generally present with complaints of pain and swelling.[5] The diagnosis of these patients is made by physical examination and histopathological evaluation. Their treatment was generally excisional surgery. When we look at soft-tissue tumors of the phalanx, ganglion cyst, tendon sheath giant cell tumor, and epidermal inclusion cysts constitute the first three rows in the literature. In our study group, tendon sheath giant cell tumor, ganglion cyst, epidermal inclusion cyst, lipoma, and glomus tumor were found to be the most common ones. When we look at the distribution of soft-tissue tumors of the hand by gender, soft-tissue tumors of the hand and wrist are more common in women.[8] Similarly, in our study, we observed that the proportion of women was higher. Proximal phalanx was the most common location for the soft-tissue tumors of the hand, the distribution is similar to our study. Fujibuchi et al. [9] mentioned that benign soft-tissue tumors are most common located the ring finger among the digits. Conversely, we found that second and third phalanxes were the most common location among the digits.

Seven patients had recurrence with soft-tissue tumors on their phalanxes; four patients with giant cell tumors, two patients with ganglion cysts, and one patient with glomus tumor. Literature data are not enough knowledge of the cause for recurrence.[10] Thus, our study will shed light on this issue. The main subject for the treatment of soft-tissue tumor hand is that incomplete excision is a risk factor for the recurrence. We noticed the treatment depends on multifactorial such as anatomical sites and several hand surgery departments using a standardized treatment. Williams et al. [11] determined for giant cell tumors that three recurrences in 34 soft-tissue tumors of the hand localized to the thumb. In our study, three recurrences in 18 giant cell tumors of the hand localized to the thumb. Furthermore, incomplete excision or satellite tumors may be associated with recurrence; therefore, marginal excision should be preferred in the treatment of soft-tissue hand tumors. It was mentioned that the recurrence rate for soft-tissue hand tumors ranges from 5% to 60%.[2] We determined the recurrence rate of 11.8% of soft-tissue phalanx tumors after marginal excision.

To assess pain intensity, the VAS has been widely used to measure both acute and chronic pain since the 1970s.[12] Because pain is a personal experience, the VAS is used as a simple and frequently used pain rating tool to measure it.

The giant cell tumor of the hand is the second most common soft-tissue tumor of the hand and comes after ganglion cyst.[10] The giant cell tumor of the tendon sheet is 5% of all primary tumors of the hand. Metacarpal involvement was more than phalangeal involvement.[13] According to our patient population, it is the most common soft-tissue phalangeal tumor. Giant cell tumor of the hand develops especially at third to fourth decades.[14] However, in our study, the mean age for patients with giant cell tumor of the phalanx was 48.96 years. This disease is mostly seen with a female predominance. Similarly, our study showed that it is seen more than in the female population (10/8) compared to the male population. In a study, it was mentioned that the most affected area is the volar aspect of the first three fingers.[15] In our study, the most affected site is the second and third phalanxes. Surgical excision should be done meticulously, and parts of the tumor that have spread into the joint should be removed. It must be ensured that it is completely removed; in this way, relapse rates of up to 50% are prevented. In our study, we had a 22.2% recurrence rate in patients with giant cell tumors.

Ganglion cyst is the most common soft-tissue tumor in the literature. However, in our study, ganglion cyst was the second most common soft-tissue tumor of the phalanx. Giant cell tumors of the tendon sheath appear in the literature as masses that can be hard, painful, and are more common in women.[16-18] The prevalence of women in our study group

is similar to the literature. In a series of 285 cases, recurrence was observed in 28 patients after an average of 2.4 years. It is stated that the risk of recurrence is related to the mitotic number in the primary tumor. It has been determined that the risk of recurrence increases by 10% for each additional mitosis.[19] No recurrence was observed in patients with ganglion cyst in our study. However, with a longer follow-up time, this might change. Ganglion cysts are usually located in the wrist and dorsal ganglion cysts (60–70%) are more common than volar (15–10%). It has been reported that it is more common in women in the third and fourth decades.[20,21] In our study, the most commonly involved fingers in patients with ganglion cysts were the second and third phalanxes and their proximal parts. In a series of 402 cases, it was reported that 361 of these patients had soft-tissue tumors and 125 of them had ganglion cysts. In the same study, it was reported that the mean age of the patients was 41.9.[21] In our study, it was seen that 70% (14 patients) of ganglion cysts were dorsal cysts and 30% (6 patients) were volar cysts, they were more common in women and the mean age was 42.6. It is understood that the patients in the study group showed compatibility with the literature. Ultrasonography guided aspiration, open surgery, and arthroscopic surgery methods are used in the treatment of ganglion cyst.[22,23] It has been reported that recurrences are seen at different rates as a result of the treatments applied. In a study, it was reported that recurrence rates were close to each other in the two groups that underwent arthroscopic surgery (7.9%) and open surgery (9.8%).[24] Although the recurrence rates are close to each other in the studies performed, the superiority of open surgery stands out when the cost analysis is considered. [25] All of the patients in our study group underwent open excisional surgery and no recurrence was observed.

Ganglion cysts often originate from the scapholunate ligament and it has been observed that the probability of recurrence decreases when these cysts are properly excised and the dorsal capsule is repaired.[26] There are rare case reports in the literature with scapholunate ligament instability after dorsal ganglion cyst excision.[27] Ganglion cysts commonly occur between the age second and fourth decade. In our study, there were 51.2-year-old patients with ganglion cysts. In the dorsal ganglion cyst excision cases in our study, the dorsal capsule was left open after excision and was not repaired, and it was confirmed that there was no instability. No recurrence was observed in the patients.

Epidermal inclusion cysts are frequently ranked third among soft-tissue tumors in the literature, while in some series, they are ranked 2nd.[28] In our study group, epidermal inclusion cysts shared third place. These cysts appear as a mass in the distal phalanx due to trauma, mostly in males.[29] In another study with a 27-year follow-up period, surgery was performed on 101 epidermoid cysts, and it was reported that these cysts were mostly located in the palmar region and were seen more frequently in men.[30] In our study group, it is seen that epidermal cysts are located in the palmar region and are more common in males (at a ratio of 3 to 1), which is consistent with the literature.

Lipomas are found in the subcutaneous fascia, lipomatous neoplasms occasionally occur in deeper layers in the hand of fatty tissue and wrist in relation to the thenar and hypothenar muscle groups. Patients with untreated compression syndromes may experience decreased neurological function and persistent neuropathic pain. In a series of 25 cases, pathology after excisional surgery revealed lipoma in 23 patients, fibrolipomatous hamartoma in one patient, and liposarcoma in one patient. In our study group, two female and two male patients were found to have lipoma after surgical excision. Excisional biopsy or borderline excision is convenient and the recurrence rate is more than 5%.[31] In the cases, the lesion was certainly dissected from located surrounding tissues. Postoperative complications include neurovascular injury, hematoma, and bleeding. In addition, division of nerves can produce permanent dysesthesia and is seen rarely. Recurrence can be alarming and is typically associated with incomplete excision of deep and infiltrative lesions entangled in neurovascular structures.[32] In the present study, we have no complications in our patients with lipomas in the post-operation period.

In our study group, glomus tumor shared third place with lipoma. Glomus tumors include a neuromyoarterial apparatus underlying the fingertips.[2] While glomus tumor is seen at a rate of 1–5%,[33] it was found at a rate of 8.47% in our study. Difficult diagnosing may suggest that its statistics may be lower. In our study, the patients with glomus tumors affected the phalanxes except the fifth phalanx.

Here, we discussed the diagnoses and clinical characteristics of phalanx tumors undergone surgery including the most common benign tumors.

Conclusion

Giant cell tumor is in the first place among soft-tissue tumors of hand in our study. It should be kept in mind that there may be regional differences. Excisional surgical treatment of hand soft-tissue tumors is an operation that requires attention to achieve high satisfaction rates, low recurrence, and complications. Detailed pre-operative evaluation, a careful intraoperative approach, uncomplicated procedure, and careful post-operative follow-up should be priorities. The strength of our study is that the patients in our study group had good satisfaction rates as well as low recurrence and complications. The relatively small number of cases and the short follow-up period should be considered as limitations of our study. As general advice, minimum of 5 years of follow-up is recommended.

Disclosures

Ethics Committee Approval: Necmettin Erbakan University Non-Pharmaceutical and Medical Device Research Ethics Committee Decision Number of Meetings:124 Meeting Date: 22 January 2021, Number of decisions: 2021/3050.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – N.A.; Design – M.R.K.; Supervision – N.A.; Materials – N.D.; Data collection &/or processing – M.R.K.; Analysis and/or interpretation – O.B.; Literature search – O.B.; Writing – M.R.K.; Critical review – N.A.; Fundings – T.E.E.

References

1. Rhodes J, Clay C, Phillips M. The surface area of the hand and the palm for estimating percentage of total body surface area: Results of a meta-analysis. Br J Dermatol 2013;169:76–84.
2. Mavrogenis AF, Panagopoulos GN, Angelini A, Lesenský J, Vottis C, Megaloikonomos PD, et al. Tumors of the hand. Eur J Orthop Surg Traumatol 2017;27:747–62.
3. Nepal P, Songmen S, Alam SI, Gandhi D, Ghimire N, Ojili V. Common soft tissue tumors involving the hand with histopathological correlation. J Clin Imaging Sci 2019;9:15.
4. Tripoli M, Cordova A, Moschella F. Characteristics, management techniques, and outcomes of the most common soft-tissue hand tumors: A literature review and our experience. Ann Plast Surg 2017;79:558–65.
5. Sobanko JF, Dagum AB, Davis IC, Kriegel DA. Soft tissue tumors of the hand. 1. Benign. Dermatol Surg 2007;33:651–67.
6. Ingari JV, Faillace JJ. Benign tumors of fibrous tissue and adipose tissue in the hand. Hand Clin 2004;20:243–8.
7. Hsu CS, Hentz VR, Yao J. Tumours of the hand. Lancet Oncol 2007;8:157–66.
8. Sherman CE, Murray PM. Tumor-like conditions of the hand and upper extremity. J Hand Surg Am 2017;42:1009–17.
9. Fujibuchi T, Imai H, Miyawaki J, Kidani T, Kiyomatsu H, Miura H. Hand tumors: A review of 186 patients at a single institute. J Orthop Surg (Hong Kong) 2021;29:2309499021993994.
10. Ozben H, Coskun T. Giant cell tumor of tendon sheath in the hand: Analysis of risk factors for recurrence in 50 cases. BMC Musculoskelet Disord 2019;20:457.
11. Williams J, Hodari A, Janevski P, Siddiqui A. Recurrence of giant cell tumors in the hand: A prospective study. J Hand Surg Am 2010;35:451–6.
12. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual analog scale for pain (VAS Pain), numeric rating scale for pain (NRS Pain), McGill pain questionnaire (MPQ), short-form mcgill pain questionnaire (SF-MPQ), chronic pain grade scale (CPGS), short form-36 bodily pain scale (SF-36 BPS), and measure of intermittent and constant osteoarthritis pain (ICOAP). Arthritis care res (Hoboken) 2011;63(Suppl 11):S240–52.
13. Ahmed O, Moore DD, Stacy GS. Imaging diagnosis of solitary tumors of the phalanges and metacarpals of the hand. AJR Am J Roentgenol 2015;205:106–15.
14. Koutserimpas C, Kastanis G, Ioannidis A, Filippou D, Balalis K. Giant cell tumors of the tendon sheath of the hand: An 11-year retrospective study. J BUON 2018;23:1546–51.
15. Ushijima M, Hashimoto H, Tsuneyoshi M, Enjoji M. Giant cell tumor of the tendon sheath (nodular tenosynovitis). A study of 207 cases to compare the large joint group with the common digit group. Cancer 1986;57:875–84.
16. Glowacki KA, Weiss AP. Giant cell tumors of tendon sheath. Hand Clin 1995;11:245–53.
17. Sağlık Y, Atalar H, Armangil M, Başarır K, Yıldız Y, Bilgin S. Management of tumors and tumor-like lesions of the hand: A review of 191 patients. Eklem Hastalik Cerrahisi 2013;24:149–55.
18. Linney LS, Al-Hassani F, Pikturnaite J, Mathew B, Thornton D, Wade RG, et al. Tenosynovial giant cell tumours of the hand: A multicentre case-control study. J Plast Reconstr Aesthet Surg 2019;72:918–23.
19. Angelides AC. Ganglions of the hand and wrist. Green's Operative Hand Surg 1999;2:2171–83.
20. Cavit A, Özcanli H, Sançmiş M, Ocak GA, Gürer Eİ. Tumorous conditions of the hand: A retrospective review of 402 cases. Turk Patoloji Derg 2018;34:66–72.
21. Kurkis G, Anastasio A, DeVos M, Gottschalk MB. Ultrasound-guided aspiration does not reduce the recurrence rate of ganglion cysts of the wrist. J Wrist Surg 2019;8:100–3.
22. Mathoulin C, Gras M. Arthroscopic management of dorsal and volar wrist ganglion. Hand Clin 2017;33:769–77.
23. Crawford C, Keswani A, Lovy AJ, Levy I, Lutz K, Kim J, Hausman M. Arthroscopic versus open excision of dorsal ganglion cysts: A systematic review. J Hand Surg Eur Vol 2018;43:659–64.
24. Pang EQ, Zhang S, Harris AHS, Kamal RN. Cost minimization analysis of ganglion cyst excision. J Hand Surg Am 2017;42:750.e1–.e4.
25. de Villiers CM, Birnie RH, Pretorius LK, Vlok GJ. Dorsal ganglion of the wrist--pathogenesis and biomechanics. Operative v. conservative treatment. S Afr Med J 1989;75:214–6.
26. Duncan KH, Lewis RC Jr. Scapholunate instability following ganglion cyst excision. A case report. Clin Orthop Relat Res 1988:250–3.

27. Lucas GL. Epidermoid inclusion cysts of the hand. J South Orthop Assoc 1999;8:188–92.
28. Saint Onge RA, Jackson IT. An uncommon sequel to thumb trauma: Epidermoid cyst. Hand 1977;9:52–6.
29. Lincoski CJ, Bush DC, Millon SJ. Epidermoid cysts in the hand. J Hand Surg Eur Vol 2009;34:792–6.
30. Ferrando PM, Garagnani L, Eckersley R, Weir J, Katsarma E. Lipomatous tumours of the hand and wrist A series of 25 cases and review of the literature. Ann Ital Chir 2014;85:587–92.
31. Weisstein J. Benign and malignant bone tumours. In: Trumbull CT, Budoff J, editors. Hand surgery updates IV. American Society for Surgery of the Hand, Rosemont III; 2007.
32. Rotunda AM, Ablon G, Kolodney MS. Lipomas treated with subcutaneous deoxycholate injections. J Am Acad Dermatol 2005;53:973–8.
33. Nazerani S, Motamedi MH, Keramati MR. Diagnosis and management of glomus tumors of the hand. Tech Hand Up Extrem Surg 2010;14:8–13.