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Enchondromas

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ABSTRACT

Objectives: Enchondromas are benign cartilage tissue tumors composed of mature hyaline cartilage. Most enchondromas are discovered incidentally during radiological examinations. Differentiating between low-grade chondrosarcoma and enchondroma can be difficult both clinically, radiologically, and histologically. Malignant tumors can mimic benign tumors. Therefore, it is crucial to accurately diagnose enchondromas, as the treatments for both tumors are very different. We aimed to contribute to a better understanding of the clinical features and treatment challenges of patients diagnosed with enchondroma.

Methods: Thirty patients who presented to the Department of Orthopedics and Traumatology at Manisa Celal Bayar University Faculty of Medicine between 2010 and 2023 and were diagnosed with enchondroma in hand after surgical treatment were retrospectively evaluated in our study. The patients were classified according to the Tordai and Takigawa classifications.

Results: Nineteen women and 11 men were examined. The lesions were observed in the left hand in 15 patients and in the right hand in 15 patients. The proximal phalanx was the most affected area. Fractures developed in 2 patients during postoperatively, requiring revision surgeries. No wound complications were observed during follow-up, and except for 2 patients who experienced refractures, both clinical and radiological complete healing was observed at the 8-week follow-up.

Conclusions: This study aims to understand better the clinical features and treatment challenges of patients diagnosed with enchondroma. We believe that immobilization for at least 4 weeks or implant application would be appropriate to increase stability in patients with intramedullary involvement of more than 50% in the dominant hand. Enchondromas still present many unknowns, more research is necessary to increase knowledge about these tumors. This study provides important data regarding enchondromas and serves as a foundational step for further research and investigation in this area.

Keywords: Chondroma, chondromatosis, neoplasms, bone

Enchondromas are benign cartilage tissue tumors composed of mature hyaline cartilage. They account for approximately 3% of bone tumors and about 13% of benign bone tumors [1, 2]. These tumors arise in the bone marrow and usually grow slowly. Although enchondromas are generally found in a single bone, they can occasionally appear in multiple bones [3]. Enchondromas that occur in

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multiple locations often accompany syndromes, the most notable being Ollier disease, with Maffucci syndrome being another syndrome where hemangiomas are added to Ollier disease.

The exact cause of enchondromas is still not fully understood. Genetic factors are thought to play a role, but this is still being researched. Enchondromas may be associated with a family history and can sometimes occur alongside other bone disorders. The gender distribution is almost equal. The clinical course is slow and often asymptomatic, and it usually does not present symptoms until the age of 20 [4].

Enchondromas are more commonly observed in tubular bones, particularly in the proximal phalanx and distal metacarpal region, with medullary involvement. They are relatively less common in long bones, with metaphyseal involvement [5, 6].

Enchondromas can persist without causing any symptoms in many cases. However, if symptoms do occur, they are often due to pain and swelling secondary to pressure on surrounding tissues. Additionally, fractures may occur as a result of cortical weakening. Most enchondromas are discovered incidentally during radiological examinations. They can cause pathological fractures by expanding the bone and thinning the cortex, resulting in a lytic lesion surrounded by a sclerotic rim in small tubular bones. In long bones, where they are less common, enchondromas typically present as metaphyseal lesions with areas of calcification, without cortical thinning, as seen in small tubular bones [7]. They can cause cortical thinning, known as cortical scalloping, which may also indicate malignancy in long bones. Particularly in long bones, computed tomography (CT) is more prominent in showing calcifications and cortical changes. Magnetic resonance imaging (MRI) is more useful for evaluating the lobular structure and identifying soft tissue components. Enchondromas appear hypodense on T1 sequences and hyperintense on T2 sequences [8].

The treatment approach for enchondromas varies [9] Approaches differ between axial skeleton involvement and appendicular skeleton involvement. Lesions in the hand that cause cortical thinning or fractures, as well as those that involve bone marrow edema or soft tissue spread, require surgical intervention.

Differentiating between low-grade chondrosarcoma and enchondroma can be difficult both clinically, radiologically, and histologically. Malignant tumors can mimic benign tumors [10] Therefore, it is crucial to accurately diagnose enchondromas, as the treatments for both tumors are very different [11].

We aimed to contribute to the literature by evaluating the effectiveness of using allograft or calcium phosphate as grafts and their effects on the development of complications in our patients diagnosed with hand enchondroma whom we treated between 2010 and 2023.

METHODS

Thirty patients who presented to the Department of Orthopedics and Traumatology at Manisa Celal Bayar University Faculty of Medicine between 2010 and 2023 and were diagnosed with enchondroma in hand after surgical treatment were retrospectively evaluated in our study. After obtaining approval from the Ethics Committee of Mamisa Celal Bayar University (Decision no: 20.478.486/2470 anddate: 05.06.2024), informed consent was obtained from the patients for participation in the study. Diagnoses were confirmed with X-ray and Magnetic Resonance Imaging (MRI). The diagnosis was confirmed with computed tomog-

Table 1. Characteristics of patients

	Data
Average age (years)	35.7 (1-73)
Gender	
Female	19
Male	11
Direction	
Right	15
Left	15
Pain	
Coincidental	9
Presented with pain	21
Imaging	
X-ray	30
MRI	30
CT	14

MRI=Magnetic Resonance Imaging, CT=Computed Tomography

raphy (CT) in patients with pain and pathological fractures. A Histopathological examination was then performed. Patients were evaluated based on age, gender, presence of pain, tumor location, and histopathological examination results. Additionally, the patients were classified according to the Tordai and Takigawa classifications. The classification described by Takigawa, first defined in 1971, is considered the most used classification for the morphological classification of enchondromas today [12]. Radiological consolidation was evaluated according to the Tordai Classification. According to the Tordai Classification, Group 1 includes those with normal cortical bone or bone defects less than 3 mm in diameter. Bone defects with a diameter between 4 and 10 mm are considered Group 2, and those with bone defects larger than 10 mm are considered Group 3 [13].

All surgeries in our study were performed under general anesthesia. The surgeries were carried out in the supine position with a tourniquet on the arm. The dorsolateral approach was used for lesions in the phalanx and a direct dorsal approach was applied for lesions in the metacarpal region. Curettage and bone grafting with either calcium phosphate or allograft were performed on all patients. After deflating the tourniquet, hemostasis was achieved, and the wound was closed according to standard procedures, followed by the application of a splint. No neurovascular complications or tendon injuries were observed during or after surgery.

Postoperatively, patients were evaluated at 3, 6, 8, and 12 weeks. The sutures were removed at 3 weeks to prevent wound complications, and rehabilitation began afterward.

Statistical Analysis

Descriptive statistics were presented as unit number, percentage, mean, minimum, and maximum values. These calculations were made via a computer program.

RESULTS

A total of 30 patients, including 19 women and 11 men, were examined. The lesions were observed in the left hand in 15 patients (50%) and the right hand in 15 patients (50%). While 26 patients (86.6%) dominant hand that was right, 4 patients (13.4%) dominant hand that was left. The average age of the patients was 35.7 years (ranging from 1 to 73 years) (Table 1). Of the 30 patients, 9 (30%) had lesions in the little finger, 8 (26.6%) in the ring finger, 6 (20%) in the middle finger, 5 (16.6%) in the index finger, and 2 (6.6%) in the thumb. The lesions were in the proximal phalanx in 16 cases (53.3%), 6 (20%) in the middle phalanx, 3 (10%) in the distal phalanx, and 5 (16.6%) in the

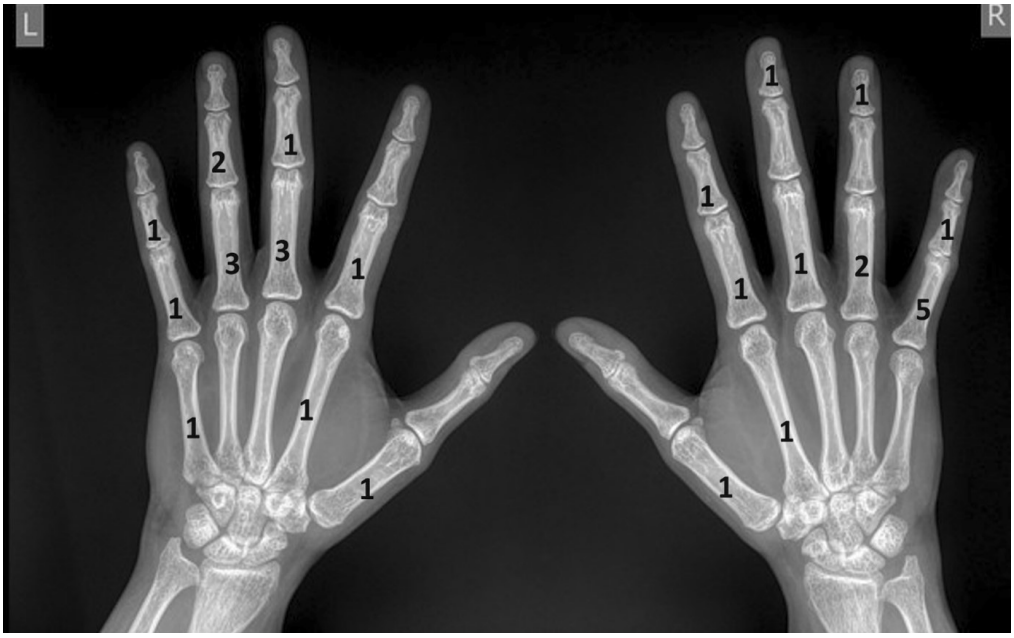

Fig. 1. Distribution of enchondromas on the hand.

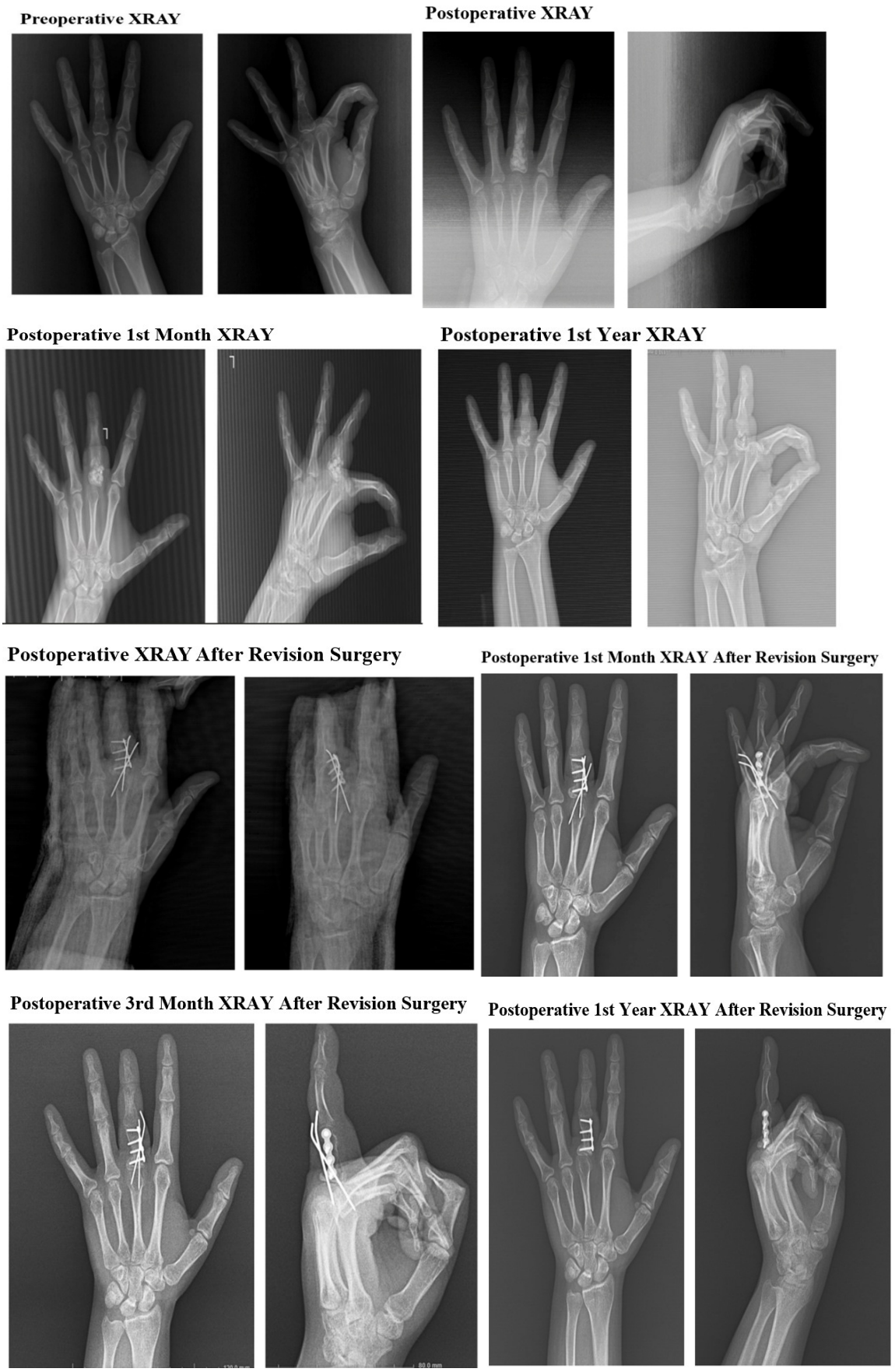

Fig. 2. Complication and revision surgery in a 34-year-old female patient

metacarpal bones (Fig. 1). The proximal phalanx was the most affected area.

None of the patients had Ollier or Maffucci syndromes. The initial complaint of 21 patients was pain, while the lesion was incidentally found in 9 patients. 21 patients (70%) were active smokers, while 9 (30%) did not smoke. All patients underwent direct radiography and MRI during their first visit. Among the radiographic imaging performed, 14 patients (46.6%) had pathological fractures, while 16 patients (53.3%) did not have fractures. No soft tissue involvement was observed in any of the 30 patients. CT was performed on 14 patients (46.6%) who had pathological fractures. Fractures developed in 2 patients during postoperative follow-up, requiring revision surgeries (Fig. 2).
Calcium phosphate was used in 17 patients, and allograft was used in 13 patients in surgical grafting. Allografts were used in 13 patients' operations because they provided allografts covering the cost. An iliac crest autograft was used in one patient who underwent revision surgery. No wound complications were observed during follow-up, and except for 2 patients who experienced refractures, both clinical and radiological complete healing was observed at the 8-week follow-up. Postoperative rehabilitation was completed, and all patients achieved the same range of motion as the contralateral limb at the 12-week follow-up.

Thirteen patients (43.3%) were categorized as eccentric, 6 patients (20%) as polycentric, 6 patients (20%) as giant, and 5 patients (25%) as central in our study, according to the Takigawa classification (Fig. 3).

Fifteen patients were in group 1, 13 patients were in group 2 and 2 patients were in group 3, according to the Tordai classification (Fig. 4).

DISCUSSION

This study presents a retrospective analysis of patients diagnosed with enchondromas in the hand at the Department of Orthopedics and Traumatology, manisa Celal Bayar University Faculty of Medicine. Enchondromas are known as benign cartilage tissue tumors and typically arise within the bone marrow [14]. However, they may undergo malignant transformation into chondrosarcoma [15]. These rare tumors still present many unknowns in the literature and this study aims to contribute to the growing knowledge in this field.

It was observed that the gender distribution of these tumors is almost equal and that symptoms generally become apparent by the age of 20. This confirms that enchondromas grow slowly and have a quiet clinical course.

Enchondromas are frequently found in the hand, and rarely in other regions such as the proximal humerus, proximal femur, distal femur, and distal tibia [16]. No cases of Ollier or Maffucci syndromes were identified in hand enchondromas in our study, though these syndromes are rare and can present independently [17].

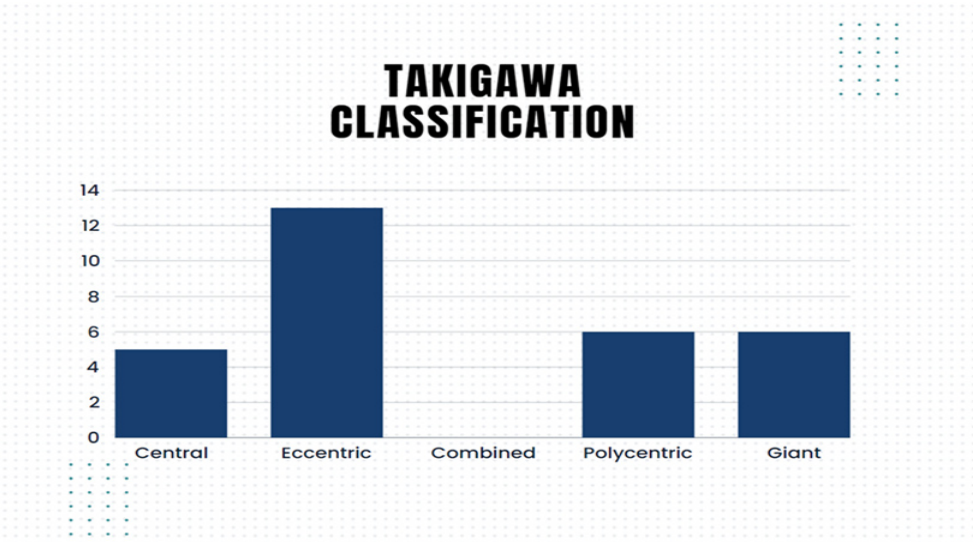

Fig. 3. Distribution of lesions according to Takigawa classification.

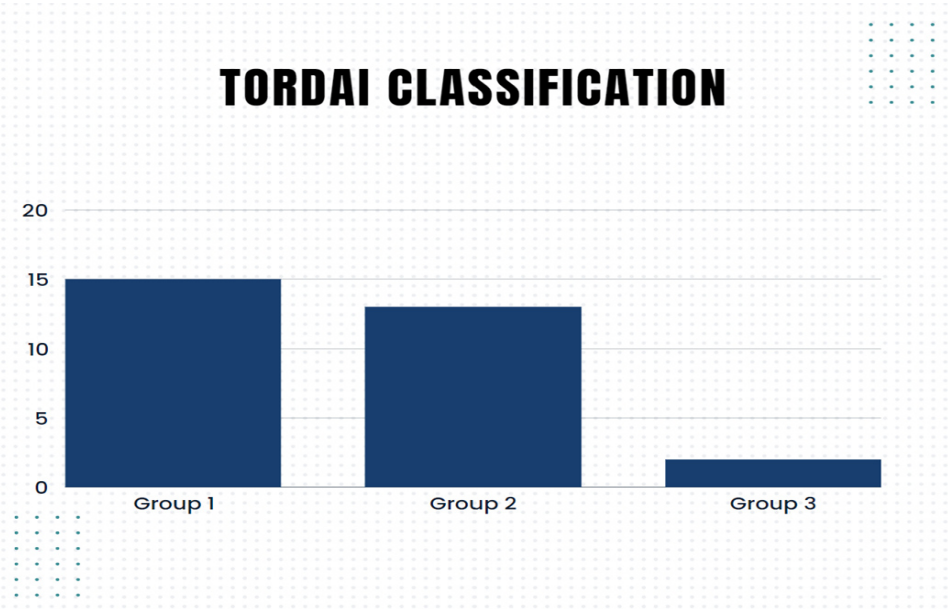

Fig. 4. Distribution of patients according to Tordai classification.

Radiologically, enchondromas often show endosteal erosion, and cortical destruction is rarely observed. MRI and CT are important for diagnosis and evaluation of lesions. MRI is valuable for assessing soft tissue involvement and lobularity of the lesion, while CT is essential for evaluating the cortex and calcification. As in the literature, we believe that MRI and CT imaging would be beneficial, especially in patients with soft tissue extension, pathological fractures, and dominant pain symptoms. Biopsy remains a critical step for histopathological diagnosis and helps in the differential diagnosis of low-grade chondrosarcoma. Although the literature mentions that biopsy is important, especially in distinguishing low-grade chondrosarcomas, we did not perform biopsy on our patients.

Treatment varies depending on the duration of enchondroma diagnosis, the extent of cortical destruction, and bone expansion. Surgical intervention is favored for enchondromas that cause fractures, soft tissue involvement, or deformity due to cortical destruction. In our surgical treatment approach involving curettage and grafting, no neurological complications or tendon damage were observed.

Two patients who underwent revision surgery had more than 50% intramedullary involvement and underwent calcium phosphate grafting. It was also observed that the hands that developed fractures in these patients were their dominant hands. Stability was deemed sufficient in their first surgery and no implants were applied in these patients. Although our patient number is limited and therefore statistically insignificant, we believe that immobilization for at least 4 weeks or implant application would be appropriate to increase stability in patients with intramedullary involvement of more than 50% in the dominant hand.

No recurrence was observed in our 1-year follow-up. We believe that early motion is appropriate in patients with sufficient stability to preserve joint range of motion.

CONCLUSION

This study aims to contribute to a better understanding of the clinical features and treatment challenges of patients diagnosed with enchondroma. It emphasizes that when enchondromas present with atypical localization and nonspecific clinical and imaging features, diagnosis can be challenging, and enchondromas should be considered in epiphyseal lesions. Although enchondromas still present many unknowns, more research is necessary to increase knowledge about these tumors. This study provides important data regarding enchondromas and serves as a foundational step for further research and investigation in this area.

Ethical Statement

After obtaining approval from the Ethics Committee of Mamisa Celal Bayar University (Decision no: 20.478.486/2470 anddate: 05.06.2024), informed consent was obtained from the patients for participation in the study.

Authors' Contribution

Study Conception: MB, HKT; Study Design: MB, KG, MY, HKT; Supervision: MB, KG, MY, HKT; Funding: MB, KG, MY, HKT; Materials: MB, HKT; Data Collection and/or Processing: MB, KG, MY, HKT; Statistical Analysis and/or Data Interpretation: MB, KG, MY, HKT; Literature Review: MB, HKT; Manuscript Preparation: MB, KG, HKT and Critical Review: MB, KG, MY, HKT.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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Editor's note

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REFERENCES

1. Hakim DN, Pelly T, Kulendran M, Caris JA. Benign tumours of the bone: a review. J Bone Oncol. 2015;4(2):37-41. doi: 10.1016/j.jbo.2015.02.001.
2. Mulligan ME. How to diagno seen chondroma, bone infarct, and chondrosarcoma. Curr Probl Diagn Radiol. 2019;48(3):262-273. doi: 10.1067/j.cpradiol.2018.04.002.
3. Lucas DR, Bridge JA. Chondromas: enchondroma, periosteal chondroma, and enchondromatosis. In: Fletcher CDM, Unni KK, Mertens F, editors. World Health Organization Classification of Tumours. Pathology and Genetics of Tumours of Soft Tissue and Bone. Lyon: IARC Press; 2002. p.237-240.
4. Romeo S, Hogendorn PC, Dei Tos AP. Benign cartilaginous tumors of bone: from morphology to somatic and germ-line genetics. Adv Anat Pathol. 2009;16(5):307-315.
5. Schajowicz F, ed., Cartilage-forming tumors. In: Tumors and Tumor-like Lesions of Bone. Springer: Berlin-Heidelberg-New York. 1994.
6. Unni KK, ed., Dahlin's Bone Tumors General Aspects and Data on 11,087 Cases. 5th ed. Lippincott-Raven: Philadelphia. 1996.
7. Flemming DJ, Murphey MD. Enchondroma and chondrosarcoma. Semin Musculoskelet Radiol. 2000;4(1):59-71. doi: 10.1055/s-2000-6855.
8. Mirra JM. Intramedullary cartilage and chondroid-producing tumors. In: Mirra JM, ed. Bone tumors: clinical, radiologic, and pathologic correlations. Philadelphia, Pa: Lea & Febiger, 1989: p. 439-535.
9. Wessel LE, Christ AB, Athanasian EA. Impact of Patient and Tumor Characteristics on Range of Motion and Recurrence Following Treatment of Enchondromas of the Hand. J Hand Surg Am. 2023;48(5):512.e1-512.e7. doi: 10.1016/j.jhsa.2021.11.027.
10. Sophia A Strike, Mark E Puhaindran. Tumors of the Hand and the Wrist. JBJS Rev. 2020;8(6):e0141. doi: 10.2106/JBJS.RVW.19.00141.
11. Yue KC, Lans J, Castelein RM, et al. Benign Hand Tumors (Part I): Cartilaginous and Bone Tumors. Hand (N Y). 2022;17(2):346-353. doi: 10.1177/1558944720922921.
12. Takigawa, K. Chondroma of the bones of the hand. A review of 110 cases. J. Bone Joint Surg. Am. 1971;53(8):1591-1600.
13. Tordai P, Hoglund M, Lugnegård H. Is the treatment of enchondroma in the hand by simple curettage a rewarding method? J Hand Surg Br. 1990;15(3):331-334. doi: 10.1016/0266-7681_90_90013-t.
14. Potter BK, Freedman BA, Lehman RA Jr, Shawen SB, Kuklo TR, Murphey MD. Solitary epiphyseal enchondromas. J Bone Joint Surg Am. 2005;87(7):1551-1560. doi: 10.2106/JBJS.D.02404.
15. Kramer HD, Valentine MJ, Pettinelli N, Kim J, Kramer RC. Ollier Disease: A Case Report and Review of Treatment Options. Cureus. 2023;15(8):e43815. doi: 10.7759/cureus.43815.
16. Lubahn JD, Bachoura A. Enchondroma of the Hand: Evaluation and Management. J Am Acad Orthop Surg. 2016;24(9):625-633. doi: 10.5435/JAAOS-D-15-00452.
17. Schwartz HS, Zimmerman NB, Simon MA, Wroble RR, Millar EA, Bonfiglio M. The malignant potential of enchondromatosis. J Bone Joint Surg Am. 1987;69(2):269-274.