

## A Diagnostic Approach to Symptomatic Distal Tibial Enchondroma in a Child

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**Abstract - Objective:** We present a diagnostic approach to an enchondroma at a very rare anatomical location, characterized by atypical clinical and imaging features.

**Case report:** A 10-year-6-month-old girl presented with a six-month history of pain and swelling of the left ankle, refractory to nonsteroidal anti-inflammatory drug (NSAID) therapy. Comprehensive clinical evaluation, conventional radiography, computed tomography (CT) and magnetic resonance imaging (MRI), as well as laboratory and microbiological investigations, were performed. These assessments excluded specific and nonspecific inflammatory conditions, traumatic injuries, bone infarction, overuse-related tenosynovitis, and other common etiologies; however, they proved insufficient for definitive diagnosis. Consequently, open intralesional curettage with biopsy was undertaken. Histopathological examination established the final diagnosis.

**Conclusions:** Enchondromas typically exhibit distinct clinical and radiographic features that facilitate straightforward identification. However, occurrence at atypical locations or presentation with pain may result in significant diagnostic uncertainty. We recommend biopsy with intralesional curettage as the most informative diagnostic approach for atypical bone lesions in the pediatric population.

**Key words:** enchondroma, simple bone curettage, distal tibia.

## 1. Introduction

Enchondroma is a benign, non-metastasizing cartilaginous tumor composed of mature hyaline cartilage. It is believed to originate from residual cartilage rests displaced from the physis and retained within the metaphysis and intramedullary canal of bones formed by endochondral ossification.<sup>1</sup> Enchondromas account for approximately 3–10% of all bone neoplasms and represent 13–27% of benign bone tumors. They are typically solitary, centrally located metaphyseal lesions, most commonly involving the small bones of the hands and feet, the distal metaphysis of the femur, and the proximal metaphysis of the humerus.<sup>2,3</sup>

Most enchondromas are asymptomatic and are incidentally detected on radiographic imaging in patients between 20 and 50 years of age.<sup>1</sup> However, lesions occurring in atypical locations—particularly when symptomatic—may present significant diagnostic and therapeutic challenges. In this report, we describe a case of enchondroma arising in the distal metaphysis of the tibia, characterized by an unusual anatomical location and atypical clinical and radiographic features.

## 2. Case Report

A 10-year-6-month-old female patient with normal somatic growth and age-appropriate neuropsychological development was evaluated. She was fully immunized in accordance with the national immunization schedule, including BCG revaccination at 7 years of age following a negative Mantoux test. The patient presented with a six-month history of progressive swelling of the left ankle, without antecedent trauma, constitutional symptoms, or documented subfebrile episodes. Initial evaluation by a rheumatologist led to treatment with hydroxychloroquine for 90 days, without clinical improvement. Due to persistent symptoms, magnetic resonance imaging (MRI) and computed tomography (CT) were obtained, and the patient was subsequently referred for pediatric orthopedic assessment.

On physical examination, localized swelling was noted over the lateral malleolus and the anterolateral aspect of the left ankle joint. Range of motion of the ankle was mildly restricted

(S: 10–0–25°), while subtalar joint motion was preserved. Laboratory evaluation revealed no evidence of active inflammation, including a differentiated blood count showing mild eosinophilia, a slightly elevated alkaline phosphatase level (ALP: 517.0 U/L), and a low-titer elevation of antinuclear antibodies (ANA) in serum. Conventional radiography demonstrated pathological bone remodeling of a predominantly osteosclerotic nature, with a peripheral radiolucent zone involving the distal metaphysis of the left tibia, without periosteal reaction. **Fig. 1 (A, B)**

Magnetic resonance imaging (MRI) demonstrated findings consistent with ankle joint inflammation, including joint effusion, inflammatory bone marrow edema of the distal tibia, and soft-tissue edema involving the synovium and the overlying periarticular tissues. A well-defined lesion measuring 2.58 × 2.0 cm was identified within the lateral aspect of the distal metaphysis, characterized by cystic components with enhancing contents following contrast administration. **Fig. 1 (C-E)**



**Fig. 1 (A, B)** Diagnostic anteroposterior (AP) and lateral radiographs of the left ankle. Findings are described in the text. **(C–E)** Preoperative magnetic resonance imaging (MRI) of the left ankle: T2-weighted sagittal and coronal images, and T1-weighted axial image. Findings are described in the text.

Computed tomography (CT) revealed irregularity and small nodular lytic areas along the anterolateral aspect of the distal metaphysis of the left tibia, accompanied by a reactive osteosclerotic response of the adjacent cancellous bone. There were no signs of periosteal reaction or epiphyseal involvement. An osteoporotic area of the calcaneus was also noted, most likely related to reduced weight-bearing due to pain. **Fig. 2(A–C)**

Based on the combined clinical presentation, laboratory findings, and imaging features, a broad differential diagnosis was considered, including bone infarction, Langerhans cell histiocytosis, chondrosarcoma, tuberculous osteitis, and an aseptic necrotic process secondary to subacute trauma, among others. Consequently, a bone biopsy with curettage of part of the lesion was performed, with tissue samples obtained for histopathological examination, microbiological analysis, and PCR testing using the GeneXpert assay.

The procedure was performed through an anterolateral approach, with lateral retraction of the superficial peroneal nerve. Following ankle arthrotomy, an increased

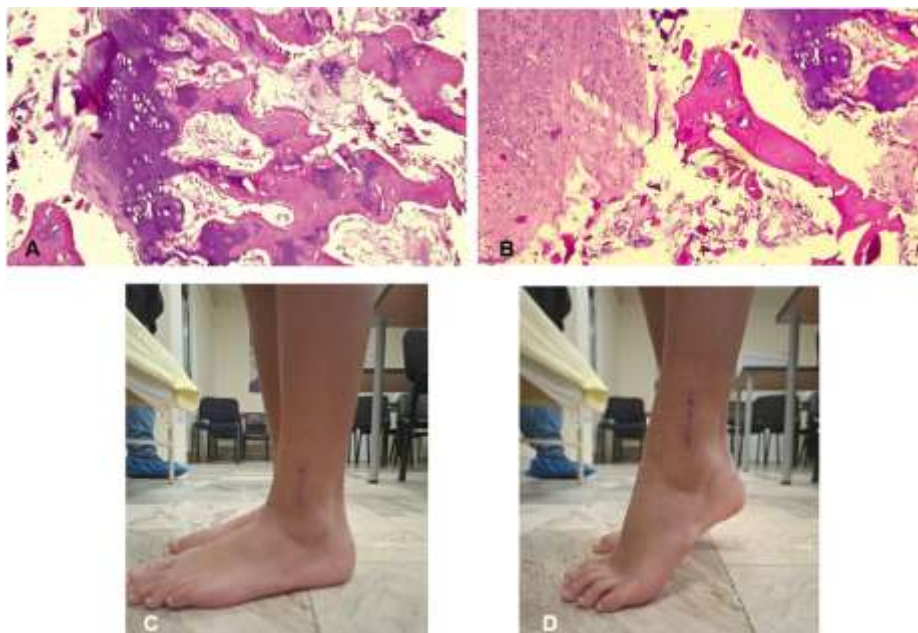
volume of joint fluid was evacuated, without evidence of suppuration. The cortical bone overlying the lesion, which was localized fluoroscopically, appeared intact and without macroscopic abnormalities. After cortical trephination, visibly altered cancellous bone was encountered, and a  $1.0 \times 1.5$  cm area was curetted. Particular care was taken to preserve the physis during the procedure. There was no significant intraoperative bleeding; therefore, no drain was placed, and the wound was closed in layers.



**Fig.2 (A-C)** Diagnostic computed tomography (CT) images of the left distal tibia. Findings are described in the text. **(D-F)** Early postoperative CT demonstrating the extent and precise localization of the curettage cavity. Performance of the procedure under direct visual control ensured preservation of physeal integrity.

Microbiological analysis of the synovial fluid and curetted cancellous bone, including cultures for aerobic and anaerobic organisms, demonstrated no microbial growth. Ziehl–Neelsen staining revealed no evidence of *Mycobacterium tuberculosis* or other acid-fast bacilli. In addition, the PCR-based GeneXpert assay was negative, further excluding tuberculous infection.

The definitive diagnosis was established based on histopathological examination, independently reviewed by three pathologists. Microscopic analysis demonstrated cartilaginous tissue with a lacunar architecture and hypocellularity, adjacent to coarse, irregular bony lamellae. The chondrocytic changes were associated with mature hyaline cartilage structures. The chondrocytes exhibited round, uniform nuclei without cytological atypia, consistent with a benign cartilaginous lesion. **Fig.3 (A, B)**



**Fig.3** (A) Histological section stained with hematoxylin and eosin (H&E) showing fragments of hyaline cartilage with low cellularity, adjacent to coarse bony lamellae. No nuclear atypia or mitotic activity is identified. (B) H&E-stained section demonstrating predominantly cartilaginous tissue (“cartilaginous nodule”) composed of small, lymphocyte-like nuclei without atypia, low cellularity, focal degenerative changes, and microcalcifications. No invasive growth into adjacent bony lamellae is observed. (C, D) Restored range of motion of the ankle joint at three months postoperatively.

The postoperative course included standard antibiotic prophylaxis and gradual weight-bearing, progressing to full weight-bearing by 30 days. At three months postoperatively, the patient was asymptomatic, with full range of motion of the ankle joint and restored quality of life. **Fig.3** (C, D)

### 3. Discussion

Enchondromas are most frequently asymptomatic or associated with vague, nonspecific symptoms. When occurring in the distal regions of the appendicular skeleton and demonstrating typical clinical and radiographic characteristics, as well as in the context of Ollier disease or Maffucci syndrome, the diagnosis is generally straightforward.<sup>1</sup> In contrast, metaphyseal involvement at atypical anatomical locations, particularly outside the classic distribution, mandates a more extensive diagnostic evaluation.

In the present case, a comprehensive clinical assessment effectively excluded mechanical causes of ankle synovitis, including pes planovalgus deformity and overuse-related tenosynovitis.<sup>4-7</sup> Furthermore, normal inflammatory markers and negative microbiological analysis of synovial fluid failed to corroborate the initial outpatient diagnosis of juvenile idiopathic monoarthritis or a septic process, most commonly attributable to methicillin-sensitive *Staphylococcus aureus*.<sup>8,9</sup>

Conventional radiography of both ankle joints obtained in two projections demonstrated the described pathological bone remodeling, effectively excluding traumatic epiphysiolysis, bone infraction—for which there was no supporting clinical history—as well as post-traumatic processes with periarticular soft-tissue calcifications.<sup>10-12</sup>

Computed tomography (CT) and magnetic resonance imaging (MRI) are valuable adjuncts for assessing matrix mineralization, cortical integrity, and for identifying aggressive or destructive features, such as peritumoral edema and epiphyseal cartilaginous involvement. From an imaging standpoint, enchondroma and low-grade chondrosarcoma frequently demonstrate overlapping characteristics, rendering radiologic differentiation challenging. Both entities typically exhibit low signal intensity on T1-weighted images and reciprocal high signal intensity with a lobulated growth pattern on T2-weighted sequences.<sup>13</sup>

Proposed imaging features suggestive of benign behavior—such as an enchondroma size below 2 cm, absence of cortical contact, and lack of interval growth exceeding 6 mm per year—are not sufficiently reliable indicators of benignity when considered in isolation.<sup>14</sup> In contrast, both CT and MRI allow reliable differentiation between enchondroma and bone infraction, based on distinct matrix and structural characteristics.

We contend that, in the present case—and in similar lesions with atypical localization and inconclusive clinical and radiologic features—histopathological examination remains the only definitive diagnostic modality. Microscopically, enchondromas are characterized as gray-blue, translucent, hypocellular, and avascular tumors composed predominantly of abundant hyaline cartilage. The chondrocyte nuclei are relatively uniform and regular, with rare mitotic figures. Punctate calcifications within the chondroid matrix are a defining microscopic feature. Histologically, the tumor consists of well-circumscribed nodules of benign hyaline cartilage, with limited engulfment of adjacent lamellar and cortical bone. The chondrocyte nuclei are small, uniformly round, and exhibit condensed chromatin, while binucleated forms are uncommon.<sup>1</sup> These features are consistent with a benign cartilaginous neoplasm and allow reliable distinction from malignant cartilaginous tumors when correlated with clinical and imaging findings.

Based on the bone biopsy findings, one of the primary working diagnoses—tuberculous osteitis—was definitively excluded, despite the patient's prior BCG immunization. In this context, we recommend the use of both Ziehl–Neelsen staining and PCR-based GeneXpert testing, as the latter offers excellent specificity and rapid detection of *Mycobacterium tuberculosis* DNA, including in smear-negative specimens.<sup>15</sup>

In the present case, wide intralesional curettage not only enabled definitive histopathological diagnosis, but also resulted in significant local improvement and complete resolution of the patient's symptoms. The resulting cavity was not filled with

an autograft, allograft, bone substitute, or bone cement. This decision was based on the preserved cortical integrity, the intact tibiofibular syndesmosis, and the high regenerative potential of the pediatric metaphyseal bone. At three months postoperatively, the patient had returned to a normal daily routine, including resumption of sports activities, without pain or functional limitation. Nevertheless, we recommend annual follow-up with CT and MRI to allow early detection of the rare (<1%) risk of malignant transformation into chondrosarcoma after skeletal maturity.<sup>16</sup>

#### 4. Conclusion

Atypical, symptomatic bone lesions require a comprehensive, multidisciplinary diagnostic strategy, integrating the expertise of orthopaedic surgeons, radiologists, microbiologists, and histopathologists. In cases of painful and swollen enchondroma, biopsy with intralesional curettage represents the most informative approach for establishing a timely and accurate diagnosis, as well as for differentiation from early low-grade chondrosarcoma.

#### 5. References

1. Biondi NL, Tiwari V, Varacallo MA. Enchondroma. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan. Updated 2024 Jan 30. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK536938/>
2. Nayak KR, Kulkarni MS, Vijayan S, et al. Enchondroma in the diaphysis of tibia: a case report and review of its characteristics and differentials in the diaphysis. *J Orthop Case Rep.* 2021;11(7):6–11. doi:10.13107/jocr.2021.v11.i07.2292
3. De Salvo S, Pavone V, Coco S, et al. Benign bone tumors: an overview of what we know today. *J Clin Med.* 2022;11(3):699. doi:10.3390/jcm11030699
4. Gecheva N, Gerchev A, Tserovski S, et al. Three-year randomized follow-up of Achilles tendon shortening in prepubertal children. *J Bulg Orthop Trauma Assoc.* 2025;62(1):134–143. doi:10.58542/jbota.v62i1.190
5. Velchov V, Gerchev A, Gecheva N, et al. Minimally invasive procedure for the correction of symptomatic flexible flatfoot in children. *J Bulg Orthop Trauma Assoc.* 2025;62(1):166–173. doi:10.58542/jbota.v62i1.192
6. Gecheva N, Chongov B, Gerchev A, et al. Flatfoot among school-aged children in Bulgaria: an epidemiological overview and analysis of risk factors. *J Bulg Orthop Trauma Assoc.* 2025;62(1):46–55. doi:10.58542/jbota.v62i1.164
7. Georgiev P, Kehaiov R, Gerchev A, et al. Elastic flat foot—orthopedic intervention: when and how? *J Bulg Orthop Trauma Assoc.* 2017;54(1):38–47.
8. Esbjörnsson AC, Aalto K, Broström EW, et al. Ankle arthritis predicts polyarticular disease course and unfavourable outcome in children with juvenile idiopathic arthritis. *Clin Exp Rheumatol.* 2015;33(5):751–757.
9. Stepanovich M, Shore BJ, Sanborn RM, et al. Characteristics of septic arthritis of the foot and ankle in children: review of a retrospective multicenter database. *J Am Acad Orthop Surg.* 2025;33(11):e625–e632. doi:10.5435/JAAOS-D-24-01120

10. Hsueh CJ, Huang GS, Juan CJ, et al. Synovial chondroma of the ankle in a young child after recent trauma: CT and MR features. *Clin Imaging*. 2001;25(4):296–299. doi:10.1016/S0899-7071(01)00300-X
11. Su AW, Larson AN. Pediatric ankle fractures: concepts and treatment principles. *Foot Ankle Clin*. 2015;20(4):705–719. doi:10.1016/j.fcl.2015.07.004
12. Georgieva S, Gerchev A, Tserovski S. Massive “risotto bursitis” of the greater trochanteric bursa after proximal femoral varus osteotomy with 5.0 LCP: a case report. *J Bulg Orthop Trauma Assoc*. 2022;59(1):44–49.
13. Agarwal A. Paediatric osteoarticular tuberculosis: a review. *J Clin Orthop Trauma*. 2020;11(2):202–207. doi:10.1016/j.jcot.2020.01.005
14. Jurik AG, Hansen BH, Weber K. Solitary enchondromas—diagnosis and surveillance. *Radiologe*. 2020;60(Suppl 1):26–32. doi:10.1007/s00117-020-00681-7
15. Benjelloun M, Tijani N, BenLahlou Y, et al. Tibial osteitis caused by Mycobacterium tuberculosis. *Access Microbiol*. 2025;7(7):000960.v4. doi:10.1099/acmi.0.000960.v4
16. Altay M, Bayrakci K, Yildiz Y, et al. Secondary chondrosarcoma in cartilage bone tumors: report of 32 patients. *J Orthop Sci*. 2007;12(5):415–423.

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