Isolated Bone Involvement Revealing a T-cell Lymphoma: A Case Report

introduction :

T-cell acute lymphoblastic leukemia (T-ALL), or T-cell lymphoblastic lymphoma, is a malignant proliferation of immature hematopoietic cells of T-lineage, typically involving the bone marrow and peripheral blood. In certain cases, lymph node or extranodal involvement may precede medullary infiltration, making early diagnosis more challenging [1] .

Lymphoproliferative malignancies are known for their wide heterogeneity in histopathological, immunophenotypic, and genotypic features, which contributes to diagnostic complexity-particularly in pediatric cases [1]. Among the various presentations, long bones of the lower limbs are commonly affected, with lesions predominantly involving the metaphyseal and diaphyseal regions. From a differential diagnosis standpoint, most pediatric T-cell lymphomas originate from pre-thymic lymphocytes [2] .

Leukemias represent approximately 40% of all childhood cancers, with acute lymphoblastic leukemia (ALL) accounting for 85% of these cases. Although isolated musculoskeletal involvement as the initial manifestation of pediatric ALL has been recognized since 1913 , it remains an underdiagnosed presentation due to the non-specific nature of the osteoarticular symptoms [3] .

This article aims to highlight the diagnostic challenges and clinical implications of primary bone involvement in pediatric T-cell lymphoblastic malignancies, through the analysis of a rare and illustrative case.

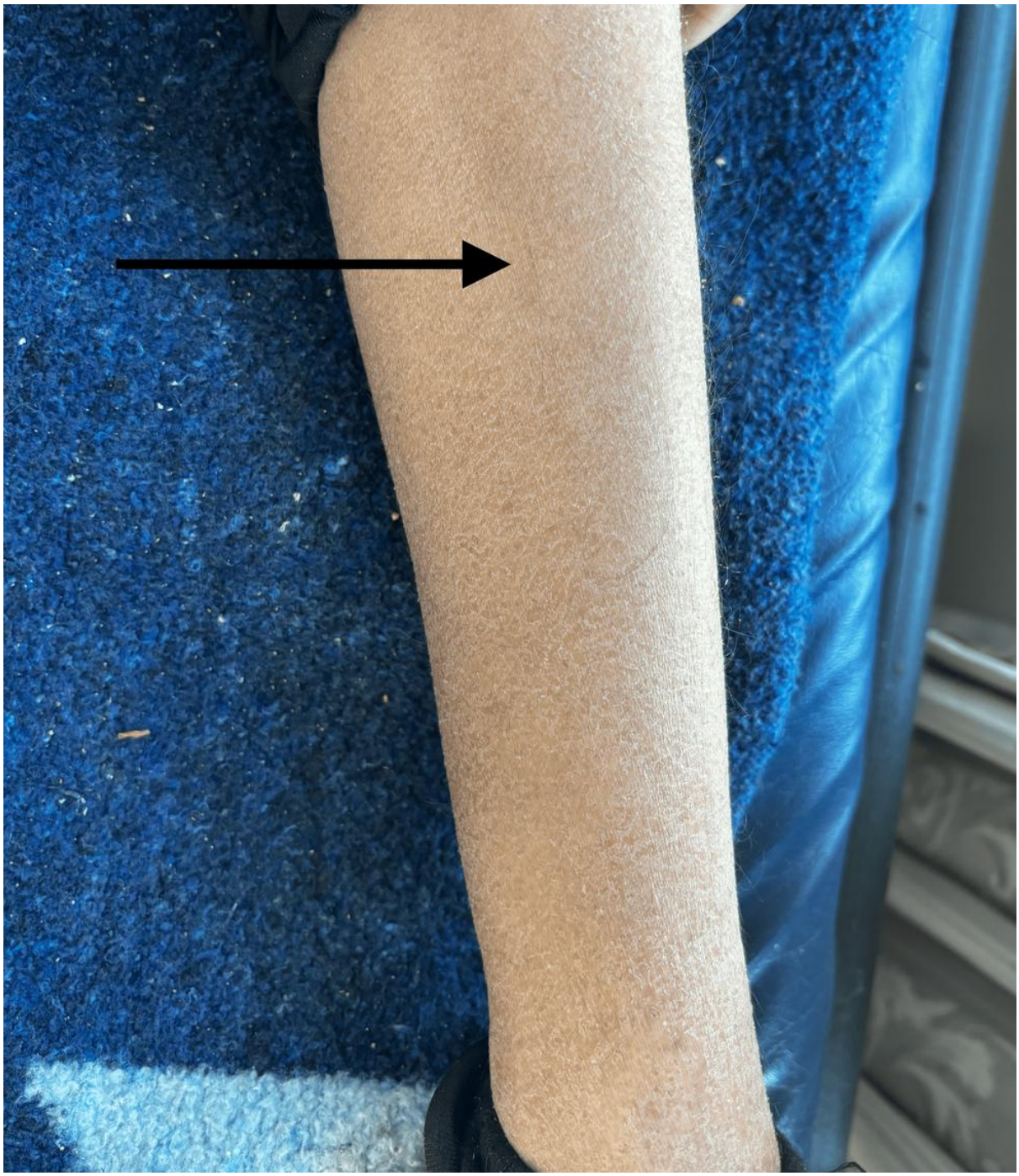
Case Presentation :

We report the case of a 9-year-old boy born from a second-degree consanguineous marriage. His personal medical history includes two hospitalizations for septic arthritis of the left leg at a provincial hospital. On the family side, there is a history of laryngeal cancer in the paternal grandfather.

The patient was admitted to our department for evaluation of bilateral lower limb bone pain, occurring in the context of a general decline in overall health status.

Upon admission, the clinical examination revealed a conscious child, clinically compromised with general malaise and cachexia, but hemodynamically and respiratorily stable. The osteoarticular examination identified diffuse polyarthralgia involving both elbows, both shoulders, and both knees, without evidence of deformity or inflammatory signs. Additionally, the child presented with severe bone pain and swelling in both lower limbs (figure *1*) . The heel-to-buttock distance measured 16 cm on the right and 14 cm on the left, while the finger-to-floor distance was 5 cm on the right and 6 cm on the left.

Figure 1 : **Bony swelling in the left leg**



The abdominal examination revealed a soft abdomen, with no hepatosplenomegaly or palpable masses. The cutaneous and mucosal inspection was unremarkable, with no purpuric or ecchymotic lesions, and no signs of erythema nodosum or leukemia cutis. The lymph nodes were non-palpable, and auscultation of the heart and lungs revealed no abnormalities. Additionally, a periorbital swelling was noted (figure *2*) , which had not been initially observed.

Figure 2: periorbital swelling in our patient

Given the clinical presentation suggestive of a systemic tumor process, an X-ray of both legs showed a cortical bone breach on the left side. A CT scan of the brain, cervical, thoracic, abdominal, and pelvic regions was performed. The

scan revealed asymmetric thickening of the nasopharynx with infiltration of the tonsils, a tissue mass adjacent to the external angle of the left orbital roof, mild homogeneous hepatomegaly, and inguinal and external right iliac lymphadenopathy.

Figure 3: X-ray of both legs showed a cortical bone breach on the left side.

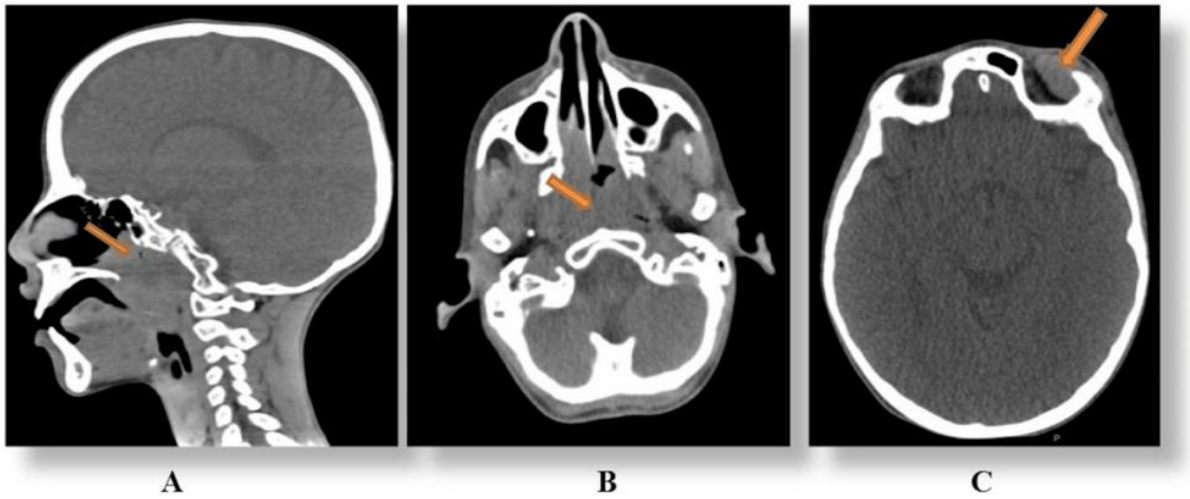


Figure 4: CT scan of the brain in sagittal view (A) and axial views (B) and (C).

The biological workup did not reveal any abnormalities, notably the absence of cytopenias or tumor lysis syndrome. Additionally, the immunological workup was negative.

An MRI of the lower extremities demonstrated bilateral, diffuse bone marrow infiltration, highly suggestive of a malignant hematological disorder, particularly T-cell lymphoma or acute leukemia.

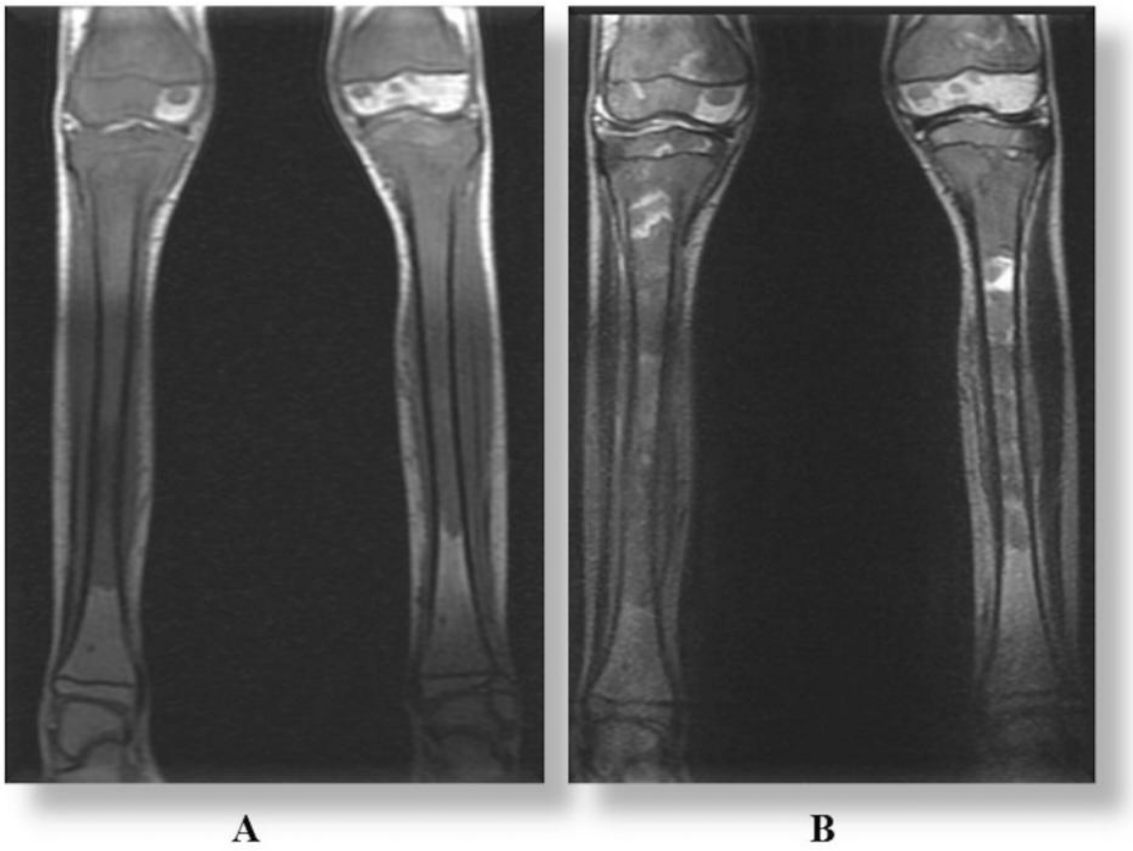


Figure 5: MRI of both legs in coronal view, T1-weighted sequence (A) and T2-weighted sequence (B).

Histopathological examination confirmed the malignant nature of the process. Both bone biopsy and nasopharyngeal biopsy, performed on the same day, revealed histological and immunohistochemical findings consistent with T-cell lymphoblastic lymphoma, confirming a high-grade lymphoid proliferation.

The staging workup, including a bone marrow biopsy (BMB) and a bone marrow aspirate, did not reveal any marrow infiltration at this stage. The pre-chemotherapy assessment was unremarkable. Subsequently, chemotherapy was initiated according to the EURO-LMT 2004 protocol.

Discussion :

Non-Hodgkin lymphoma is a primary malignant neoplasm of the lymphatic system [4,5]. Osseous involvement is observed in approximately 5 to 15% of all lymphoma cases [4].

In Morocco, Burkitt lymphoma is the most frequently diagnosed subtype, accounting for approximately 77,6% of pediatric non-Hodgkin lymphomas (NHL), followed by lymphoblastic lymphoma (18%), diffuse large B-cell lymphoma, and anaplastic large-cell lymphoma. The average age at diagnosis is 6,5 years, varying with histological subtype, with a clear male predominance [6].

T-lymphoblastic lymphoma most commonly manifests as a mediastinal mass, occurring in approximately 50% of patients [1] . Craniofacial localizations are less frequent and predominantly involve the palatine tonsils (3,6%), the maxilla (2,2%), the nasopharynx (4,5%), and the orbit (9%) [6]. Osseous involvement may present either as secondary dissemination via hematogenous spread or by direct extension. Clinical presentation is heterogeneous, ranging from solitary bone lesions without extraskeletal manifestations to multifocal involvement [5]. Additional potential sites of extranodal dissemination include peripheral lymph nodes, skin, liver, spleen, central nervous system, and gonads. Orbital and skeletal involvement, however,remain uncommon [1].

Osseous involvement in lymphomas typically occurs in regions of active red bone marrow, with a preferential involvement of the metaphyseal regions of long bones [5,7], as observed in our patient.

Predisposing factors for leukemia are rarely identified. However, multiple cases of lymphoma may occasionally occur within the same family, suggesting a possible genetic predisposition. Environmental factors have also been implicated, including in utero exposure to ionizing radiation, radiotherapy, and chemotherapy [8].

Bone involvement in lymphomas typically occurs in areas of active red marrow, with a predilection for the metaphyseal regions of long bones. The limbs are most commonly affected, particularly the femur (in 20% of cases), followed by the spine-especially the thoracic and lumbar regions-and the pelvis, notably the iliac crest. The thoracic skeleton is involved in 15% of cases, and the skull in 10% [7].

Bone pain is a nearly constant feature, usually inflammatory in nature, and may be accompanied by palpable swelling in cases of superficial involvement. Pathological fractures can occasionally be the initial sign of osseous lymphoma. Spinal involvement may result in neurological deficits. General systemic symptoms (fever, weight loss, night sweats) or biological signs of inflammation are suggestive of a malignant etiology but are inconsistently present [4].

Cerebrospinal fluid (CSF) analysis should be systematically performed to detect the presence of lymphoma cells. Blood electrolyte panel, along with serum urea and creatinine levels, should be assessed to screen for tumor lysis syndrome [1].

Radiographs may initially appear normal, as bone destruction must exceed 50% of the osseous matrix for radiographic detection, despite the presence of extensive medullary infiltration in some cases [4] .

The radiological findings are diverse and may include poorly defined, scattered, or coalescent bone lesions. Other possible manifestations include cortical disruption, periosteal reactions, or extension into surrounding soft tissues. In spinal involvement, lymphomatous lesions may present as the characteristic 'ivory vertebra' [9].which refers to osteolytic lesions predominantly localized to the axial skeleton [4] .

MRI allows for early diagnosis by detecting medullary infiltration, which is clearly highlighted by fat-saturation sequences. MRI is the imaging modality of choice for assessing the extent of lesions within the bone marrow and soft tissues during staging. Staging typically utilizes bone scintigraphy as the baseline examination [4,5].

With positron emission tomography being used more frequently in the diagnostic work-up of NHL patients, secondary bone involvement in NHL is likely to be detected more often and hence will provide further insights into the prognostic significance of SBL [10] .

The rest of the workup is performed in preparation for chemotherapy and will specifically include a hepatic evaluation and echocardiography with measurement of the ejection fraction.

The histological analysis of the differential diagnosis of malignant bone infiltration by small round cells in a child should include Ewing's sarcoma, rhabdomyosarcoma, other types of lymphomas, neuroblastoma, and primitive neuroectodermal tumor (PNET) [1,11,12]. Although Langerhans cell histiocytosis and osteomyelitis may present with similar clinical features, analysis of cellular markers helps differentiate these entities.

The treatment is tailored to the type of lymphoma and its prognostic group. Symptomatic treatment plays a crucial role, particularly during the initial phase. It should prioritize the prevention and treatment of tumor lysis syndrome, appropriate transfusions, and the prevention and treatment of infections. The treatment involves polychemotherapy, consisting of several phases. Equally important is the cornerstone of the approach: educating the families [13].

Furthermore, approaches to diagnosis, staging, and treatment have evolved over time. Advances in chemotherapy have significantly improved prognosis in recent years [14] .

Orbital localization of T-cell lymphoblastic lymphoma is very rare in children and poses a diagnostic challenge, often leading to delays in the initiation of appropriate treatment. An urgent biopsy is crucial in such cases. The role of the ophthalmologist is essential in the diagnostic process, and their collaboration with the oncologist ensures optimal management of this condition [1] .

Pediatric non-Hodgkin lymphoma (NHL) can generally be classified as either localized disease in favorable sites or disseminated disease and/or involvement of unfavorable primary sites. A truly localized bone lymphoma represents a favorable presentation and can be easily cured with modern treatments [11] .

The favorable progression after chemotherapy, despite the severity of the clinical presentation, is notable. T-cell acute lymphoblastic leukemia/lymphoblastic lymphoma is known to be of high malignancy grade with a poor prognosis in children [1] .

Conclusions

Although bone involvement does not appear to influence the clinical prognosis of pediatric non-Hodgkin lymphoma, understanding its imaging features remains essential for the diagnosis of primary bone lymphomas, symptomatic lesions, and treatment monitoring. Osseous presentation of T-cell lymphoblastic lymphoma is exceptionally rare in children and represents a diagnostic challenge that may delay therapeutic intervention. Prompt biopsy is critical in such cases. The pediatric surgeon plays a key role in the diagnostic pathway, and a multidisciplinary approach involving pediatric oncology is vital for optimal patient management.

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