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Case Report

Primary lymphoma of the distal radius of a child: imaging features

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ABSTRACT

Primary lymphoma of bone (PLB) is a rare entity, defined as a lymphoma confined to the bone without evidence of systemic involvement. The disease commonly affects middle-aged to elderly population and it accounts for less than 1% of all malignant lymphomas. We present a case of a 10-year-old child affected by PLB of the forearm and the frontal bone. Characteristic imaging features of PLB and the main differential diagnosis were discussed.

Introduction

Primary lymphoma of the bone (PLB) is a rare variant of extra-nodal non-Hodgkin lymphoma [1–3]. According to the World Health Organization classification, lymphoma involving bone can be divided into four groups: (1) single skeletal site without regional lymph node involvement; (2) multiple-bone involvement without visceral or lymph node involvement; (3) bone lesion with involvement of visceral sites or multiple lymph nodes at multiple sites; and (4) patient with known lymphoma and bone biopsy confirming involvement of bone. Groups 1 and 2 are considered primary lymphomas of the bone [3,4]. PLB account for less than 1% of all malignant lymphomas and 7% of malignant bone tumors. Only 4%-5% of extra nodal non-Hodgkin's lymphomas manifest as PLB [2, 5] and histologically most primary bone lymphomas are primary bone diffuse large

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B-cell lymphomas (PBDLBCLs). The disease commonly affects middle-aged to elderly population, with a median age of 48 years [2]. In this report, we describe the case of a 10-year-old boy affected with PLB presenting with a rare double involvement of the forearm and the frontal bone, focusing on PLB imaging features and differential diagnosis.

Case report

A 10-year-old boy came to our attention with a 2-month history of pain in the left forearm, in absence of trauma. On physical examination, a subcutaneous swelling was note in the frontal region. No other symptoms or signs were present; no history of fever, weight loss or sweating was reported. All blood tests were negative. A radiography showed structural alteration of the distal diaphysis of the radius, consisting in alternated areas of hyperlucency and sclerosis, associated with focal interruption of the cortex (Fig. 1a and b). The patient was admitted to the Pediatric Orthopedic department for further investigations. Considering the radiography findings, CT was performed. CT examination confirmed a 7-cm long structural alteration of the distal diaphysis of the radium with a multilayered periosteal reaction (lamelated or "onion skin" periosteal reaction), with bone rarefaction within the lesion, without involvement of the epiphysis, joint and adjacent bones. A CT of the frontal region was performed showing a second osteolytic lesion, with lenticular morphology, superficially spreading into soft tissues and deeply into the subdural bone, with enhancement after iodinate contrast medium administration (Fig. 2a-d). A 1.5T MRI was performed to evaluate the radial lesion that appeared markedly hypointense on T1-weighted images and slight hyperintense on T2-weighted images. There was also periosteal reaction with soft tissue edema. There was no soft-tissue mass (Fig. 3a-c). A Technetium bone scan was performed for staging of the disease. It showed focal uptakes in the radial lesion and in the frontal bone (Fig. 4). Additional investigation including whole body CT with contrast medium administration, spinal tap, a bone marrow aspiration and biopsy were all negative. An open surgical biopsy of the radial lesion was performed, revealing atypical large cells diffusely infiltrating the bone. Immunophenotyping showed positivity for CD20 staining, weak expression of BCL2, and negativity for CD3, CD10, CD30, BCL6, TdT (terminal deoxynucleotidyltransferase) and broad-spectrum cytokeratins; in situ hybridization for Epstein-Barr virus was also negative. Tumor cells showed a high proliferation index (90%) as determined by evaluation with anti-Ki67 antibody (Fig. 5a-d). The patient underwent four cycles of polychemotherapy according to the non-Hodgkin lymphoma (NHL) 97 protocol (consecutive blocks of polychemotherapy containing dexamethasone, cyclophosphamide, methotrexate, vincristine, cytarabine, etoposide, ipofosfamide, ara-c, daunomycine, and intrathecal therapy with methotrexate, cytarabine, and prednisolone). After two cycles of chemotherapy, the child underwent re-staging that showed partial regression of both radial and frontal lesions. After three more cycles of chemotherapy, a second open surgical biopsy was performed; showing complete remission of the disease, and MRI of the frontal bone

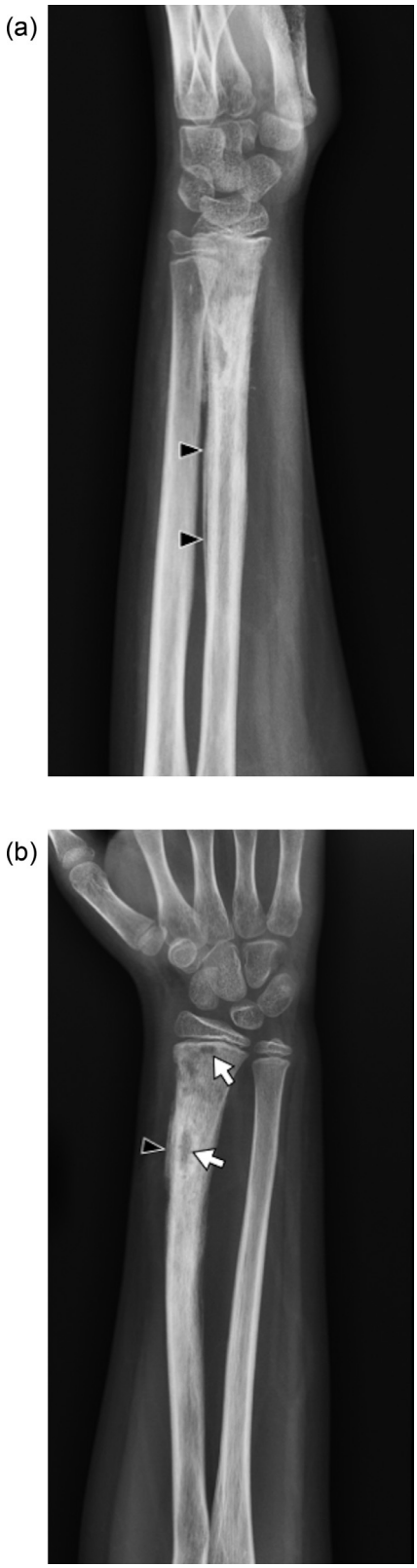

Fig.1 – Laterolateral projection (a) and anteroposterior projection (b) radiographs of the forearm showing a structural alteration of the distal diaphysis of the radius with alternated areas of hyperlucency (arrows) and sclerosis. A regular periosteal reaction is evident (arrowheads).

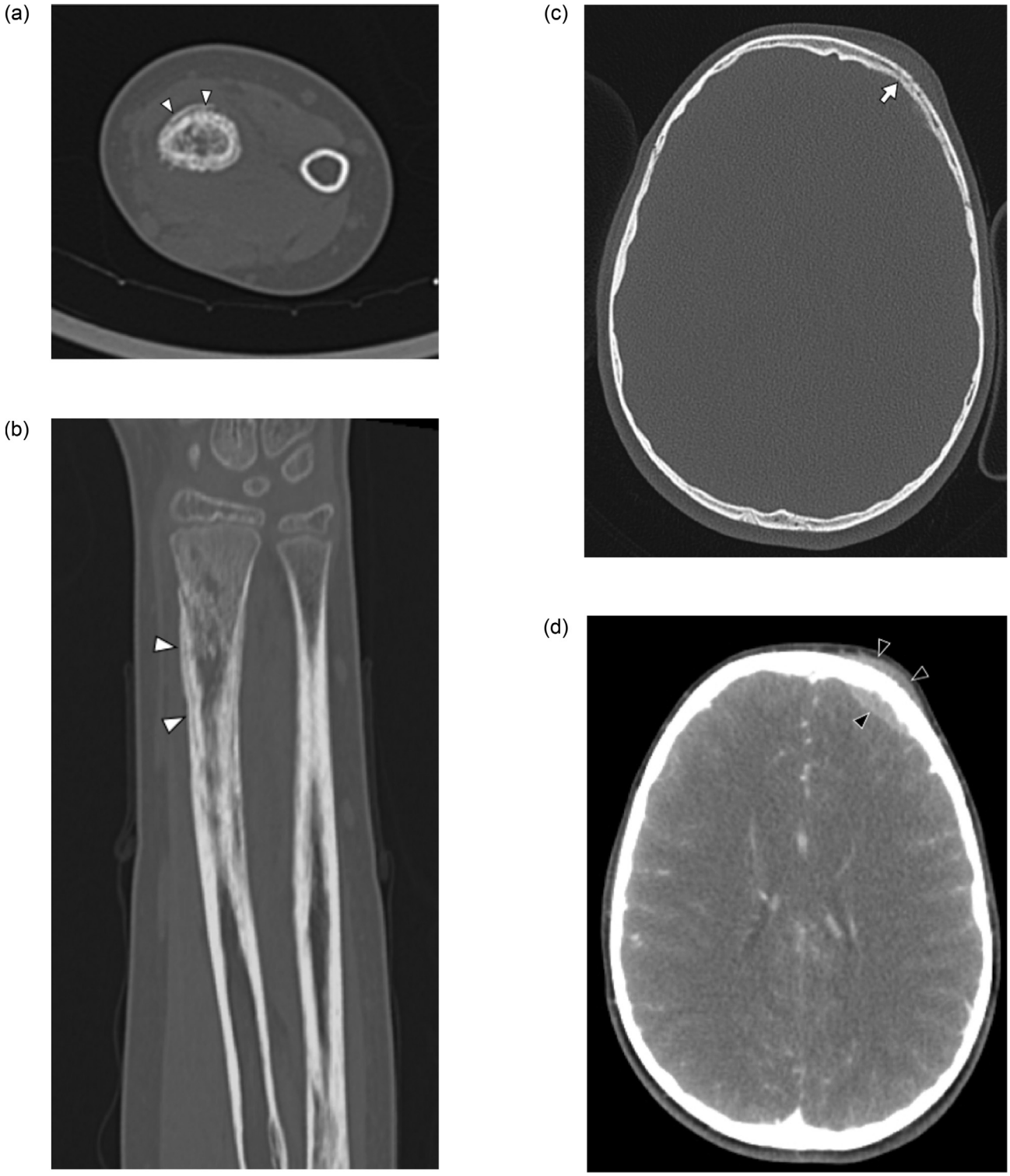

Fig. 2 – Axial (a) and coronal reconstruction (b) CT of the forearm. A 7-cm long structural alteration of bone rarefaction of the distal diaphysis of the radium is evident. Multilayered periosteal reaction (lamellated or "onion skin" periosteal reaction) is present (arrowheads). There is no involvement of the epiphysis joint and adjacent bones. Bone window (c) and soft tissue window (d) of head CT after iodinate contrast medium administration, showing an osteolytic area (arrow) of the frontal bone associated with a lenticular shaped neoplastic lesion (arrowheads) spreading into the soft tissue.

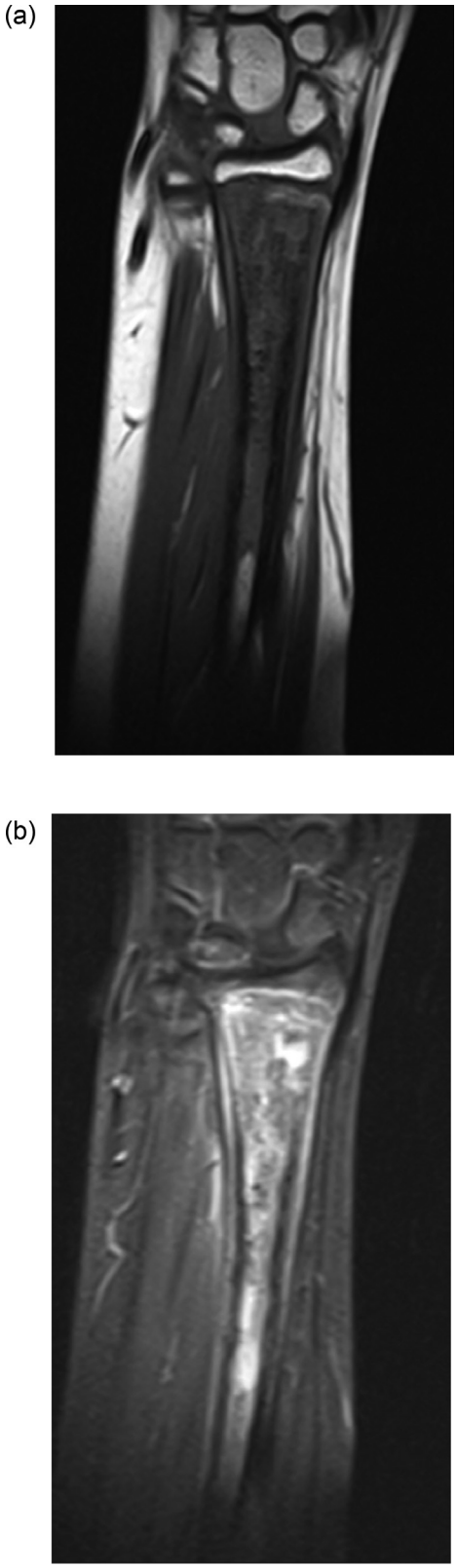

Fig. 3 – MRI of the forearm, coronal T1 (a) and T2 fat-saturated (b) weighted sequences. The radial lesion appeared heterogeneously hypointense on T1-weighted images and mainly hyperintense on T2-weighted images. There is no soft-tissue mass.

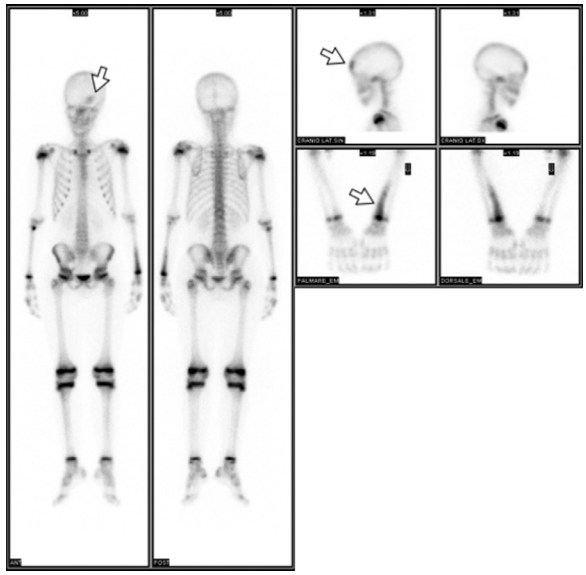

Fig. 4 – Technetium bone scan. There are focal uptakes both in the radial and in the frontal bone lesions (arrows). No other pathologic uptake was recognized.

and of the forearm confirmed the absence of recurrence. At 46 months of follow-up, the patient was healthy without evidence of the disease.

Discussion

Primary lymphoma of bone is a rare primary bone malignancy and is defined as a lymphoma that is confined to the bone or bone marrow without evidence of concurrent systemic involvement. PLB has a more favorable prognosis than systemic lymphoma with bone involvement, with 5-year survival greater than 95% [6]. In our case, no recurrence was detected after 3 years of follow-up.

PLB sites of bone involvement are femur (27%), pelvis (15%), tibia/fibula (13%), humerus (12%), spine (9%), mandible (2%), radius/ulna (1%), scapula (1%), and skull (1%) [2, 3]. The radius involvement is exceptionally rare, and Dahlin [7] reported only 6 cases out of a series of 905 malignant lymphoma of the bone. The metaphysis is the most common site of occurrence in long bones. The most commonly affected sites are the same for PLB, Ewing sarcoma, osteosarcoma, and the radius is a rare site of involvement in all of them [8, 9].

The appearance of PLB at imaging is usually variable and nonspecific [10, 11] and metastatic lymphoma is indistinguishable from primary bone lymphoma without whole-body staging to detect other disease localizations. Radiological findings include widespread lytic infiltration in the cortical bone (lytic-destructive pattern 70%) or sclerotic bone response accompanying lytic permeation (mixed lytic-sclerotic pattern 28%) as in our case [10]. The majority of PLB present as lytic lesion, more often localized in long bone metaphysis, with an infiltrative or moth-eaten pattern of destruction and aggressive periosteal reaction [10, 12]. The lesion can be associated

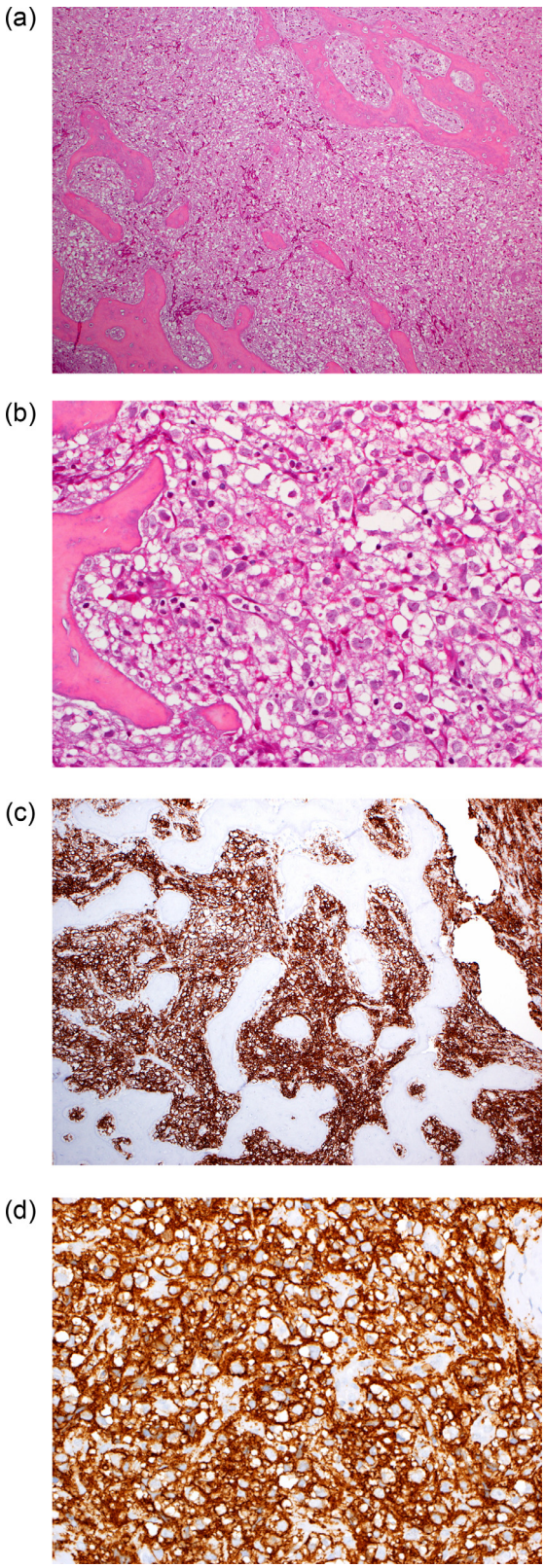

Fig. 5 – Low (a, c) and high (b, d) power view of bone biopsy stained with hematoxylin-eosin (a-b) and anti-CD20 (c-d). The medullary spaces are filled by large atypical B cells, strongly positive per CD20.

to a soft tissue mass [11] as for round cell tumors (including Ewing sarcoma), among which lymphoma is an example. On MRI the lesion most often has low signal intensity on T1-weighted images and it appears slightly hyperintense on T2-weighted images [11, 13]. The bone-marrow involvement is best demonstrated on T1-weighted images revealing areas of low signal intensity within the marrow, while on T2-weighted images these areas appear bright. After administration of Gadolinium, T1 fat-saturated sequences can demonstrate areas of enhancement within the lesion [10]. In our case the lesions did not show a permeative pattern which is typical of bone infiltrative neoplasms, but rather an irregular cortical disruption with periosteal reaction and onion-skin pattern. There was soft tissue edema and no soft tissue mass. The lesions were very hypointense in T1-weighted images and slight hyperintense in T2-weighted images.

In the first decade of life, Ewing sarcoma and osteosarcoma are the most common primary bone tumors, but malignant lymphoma of the bone is the third most common [7] and it should be always taken in consideration. Metastatic neuroblastoma, eosinophilic granuloma and osteomyelitis must be considered in the differential diagnosis too. In our case the imaging findings and the symptoms did not suggest the diagnosis of Ewing sarcoma because of the lack of an infiltrative pattern, fever and increased erythrocyte sedimentation rate [14]. The high-grade intramedullary osteosarcoma could mimic PLB. Osteosarcoma commonly presents with diffuse bone destruction alternated to areas of sclerosis and foci of hemorrhages and necrosis can be seen. Osteomyelitis in the early stages typically demonstrate an osteolytic lesion located adjacent to the growth plate in the metaphysis but with time progressive sclerosis can be seen around the lytic lesion [15].

In summary, primary lymphoma of bone is a rare condition, particularly in the pediatric population. The radiographic appearance of PLB is variable but the lytic-destructive pattern is more typical. Although osteosarcoma and Ewing sarcoma are more common, a solitary lytic lesion in a long bone should always raise the suspicion of PLB.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2018.08.025.

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