CASE REPORT

Role of multimodality imaging for primary bone tumors among children: a case report

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ABSTRACT

Background: Bone lesions in children are very common and can be benign or malignant. Benign bone lesions, fortunately, are more common as compared to rare malignant neoplasms of bone. Osteosarcoma and Ewing sarcoma are the most common malignant bone tumors in the younger age group. Multimodality imaging plays a major role in bridging the gap between clinical diagnosis and final diagnosis.

Case Presentation: We present here a case of an 8-year-old male patient who complained of progressive soft tissue swelling and pain in the left thigh for 25-30 days. His X-ray of the left femur showed a mixed density, predominantly sclerotic lesion involving mid-diaphysis. His contrast-enhanced magnetic resonance imaging of the left thigh showed a large, ill-defined, abnormal signal intensity medullary lesion seen in the left femur involving the mid to lower diaphyseal shaft, extending to the metaphyseal region. His ^{99m}Tc MDP bone scintigraphy was done showing abnormal radiotracer uptake in the lower half of the left femur and adjoining soft tissue.

Conclusion: Single-modality imaging may not be enough to predict the true extent of bone pathologies. Multimodality imaging plays a major role in characterizing the lesions to differentiate benign from malignant and bridging the gap between clinical diagnosis and final diagnosis.

Keywords: Osteosarcoma, Ewing sarcoma, ^{99m}Tc MDP bone scintigraphy, case report.

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Background

Bone lesions can be benign or malignant. Several different kinds of tumors can grow in bones. Osteosarcoma (OS) and Ewing sarcoma are the most common malignant bone tumors in the younger age group. Although the overall incidence of OS is higher than Ewing sarcoma in adolescents younger than 20 years, Ewing sarcoma is more common in children younger than 10 years of age. The value of multimodality imaging for bony lesions in children is rarely reported. These multiple imaging modalities play a major role in bridging the gap between clinical diagnosis and final diagnosis.

Case Report

An 8-year-old male patient complained of progressive soft tissue swelling and pain in the left thigh which was more pronounced on bearing weight and severe at night, bothering him for 25-30 days. He had a history of minor contact trauma with his younger brother 30 days back. His X-ray of the left femur showed a mixed density, predominantly sclerotic lesion involving mid-diaphysis with associated codman triangle periosteal reaction, and medullary canal is narrowed at this point. Surrounding fat planes are unremarkable (Figure 1). Contrast-enhanced magnetic resonance imaging (MRI) of the left thigh showed a large, ill-defined, abnormal signal intensity medullary lesion seen in the left femur involving the mid to lower diaphyseal shaft, extending to the metaphyseal region. Marked adjacent soft tissue swelling/edema is seen circumferentially surrounding the lower femur, extending in muscle planes (Figure 2). The differential diagnosis includes Ewing sarcoma and inflammatory pathology (osteomyelitis). His ^{99m}Tc MDP bone scintigraphy showed abnormal radiotracer uptake involving the mid to lower half of the left femur and adjoining soft tissue (Figure 3). The interval between MRI and bone scintigraphy was 12 days and was revised again to identify missed observations. Based on all these findings differentials include Ewing sarcoma/

OS/inflammatory pathology (osteomyelitis). The final diagnosis of OS was made on the histopathology report.

Discussion

Bone lesions in children are very common and include true bone tumors and tumor-like lesions. Up to 42% of all bone lesions, including both benign and malignant etiologies, occur in the first two decades of life. This may be underestimated since many benign-appearing lesions are not biopsies or recorded in databases. More than half of all childhood bone tumors are benign [1].

Imaging assessment of bone tumors in children is essential because it helps to distinguish malignant from benign lesions and guides assessment, therapy, or subsequent observation of the patient [2]. Bone lesions can be benign or malignant. Fortunately, benign bone lesions are more common as compared to rare malignant neoplasms of bone [3]. Malignant bone tumors account for about 3% of childhood and adolescent tumors. OS and the Ewing sarcoma family of tumors (ESFTs) are the most common malignant bone tumors that cumulatively represent the majority of tumors. The remaining 6% of malignant tumors intrinsic to the bone include chondrosarcomas, malignant fibrous histiocytomas, and adamantinomas. In addition, the diagnosis of a malignant bone tumor can often be delayed by weeks or months as many adolescents and young adults frequently attribute the pain to a nonspecific trauma or an acute sports injury [4].

OS is the most common solid malignant tumor in childhood. The cause of OS remains for the most part unknown; however, its peak incidence during the adolescent growth spurt suggests a deformity in the growing bone cells that leads to malignant disease. Some OSs develop as a part of familial cancer syndromes such as Li-Fraumeni syndrome and some of these children will have germline mutations in P53 or retinoblastoma [5].

It most frequently occurs in the areas of the highest growth plate proliferation: limb long bones, particularly in the distal femur (30%), proximal tibia (15%), and proximal humerus (15%). In the long bones, the tumor is

Figure 2. *MRI of left thigh (coronal and axial slice) showing large, ill-defined, abnormal signal intensity permeative medullary lesion seen in left femur involving mid to lower diaphyseal shaft, extending to metaphyseal region.*

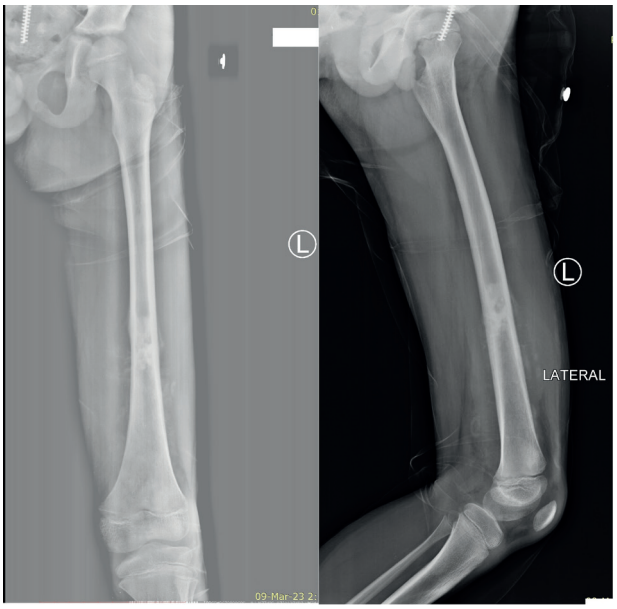

Figure 1. *Mixed density, predominantly sclerotic lesion involving mid-diaphysis of the left femur.*

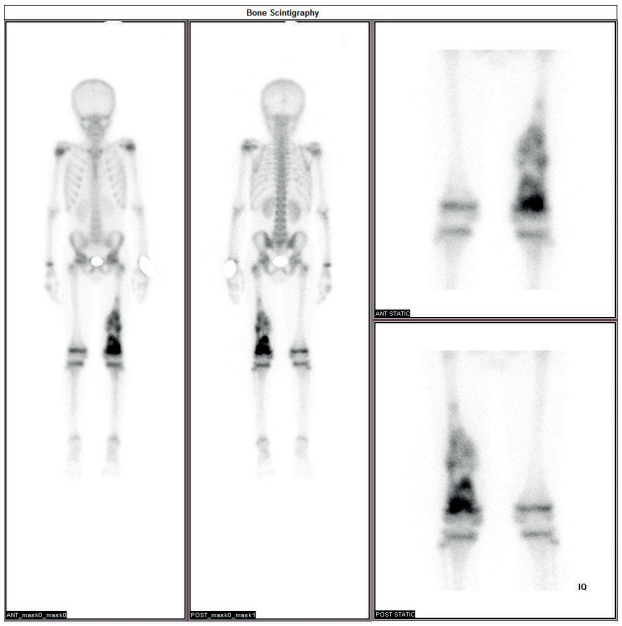

Figure 3. *^{99m}Tc MDP bone scan showing abnormal radiotracer uptake involving the mid to lower half of the left femur and adjoining soft tissue.*

located usually in the metaphysis (90%), less frequently in the diaphysis (9%), and very rarely in the epiphysis [6].

Ewing's tumor was originally described in 1921 by James Ewing as an endothelioma. Over the past few decades, it has become clear that Ewing's sarcoma derives from a primitive neuroectodermal cell with variable differentiation [7]. The ESFTs is an aggressive form of childhood cancer, which includes classic Ewing's sarcoma, Askin tumor, and a peripheral primitive neuroectodermal tumor. Nearly half of all patients with Ewing's family tumors are between 10 and 20 years of age, and 70% are under the age of 20, with a slight male predominance. About half of all Ewing's sarcomas arise in soft tissues rather than bone, and about a quarter of patients have detectable metastases at diagnosis. The lungs are the most common site for metastases (50%), followed by bone (25%) and bone marrow (20%) [8].

Conclusion

Single-modality imaging may not be enough in predicting the true extent of bone pathologies. Multimodality imaging plays a major role in characterize the lesions to differentiate benign from malignant and bridging the gap between clinical diagnosis and final diagnosis.

List of Abbreviations

ESFT	Ewing sarcoma family of tumors
MRI	Magnetic resonance imaging
OS	Osteosarcoma
Tc-MDP	Technetium methylene diphosphonate

Conflict of interests

The authors declare no conflict of interest regarding the publication of this article.

Funding

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Consent for publication

Informed consent was obtained from the patient for the publication of this case.

Ethical approval

Ethical approval is not required at our institution for publishing a case report in a medical journal.

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