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Evident Sclerotic Skip Metastasis in Plain Radiograph in Juvenile Femoral Osteosarcoma: A Case Report of a 15-Year-Old Boy

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Abstract

Background: Osteosarcoma (OS) is an uncommon bone cancer presented by tissue swelling and nonspecific bone pain. In case of distant metastasis, this malignancy commonly invades the lungs. Skip metastasis is an uncommon type of invasion originating from the malignant bone to adjoining bone tissues detected by magnetic resonance imaging (MRI) with high accuracy. Skip metastasis is an uncommon finding in plain radiography of osteosarcoma cases.

Case presentation: In the current study, we have reported a case of juvenile osteosarcoma with multi-focal skip metastasis, detected by simple plain radiography at first assessments. Further imaging and pathology assessment confirmed skip lesions in the background of high-grade chondroblastic osteosarcoma. Despite the recommendations, the patient and his legal guardian did not consent for further follow up and treatment.

Discussion and conclusion: Skip metastases are rarely diagnosed by plain radiography in OS cases. This condition is usually diagnosed by magnetic resonance imaging. Here, we reported a neglected and late-diagnosed case of osteosarcoma with skip lesions in a young boy, simply detected by X-ray. The following article concentrates on the importance of detecting these metastases for their correlation with patient's survival, and describes different imaging modalities for finding them.

Key Words: Bone neoplasm, Femur, Jump metastasis, Lung metastasis, Osteosarcoma, Persistent bone pain, Sclerotic skip metastasis, Skip lesions, Tissue bulging.

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1- INTRODUCTION

Osteosarcoma is a highly malignant rare disease, mainly seen in children and adolescents. It has the highest prevalence compared to the other bone tissue malignancies. Epidemiologic findings demonstrate that black race and male gender are at higher risk for the disease. In addition, generally most children with osteosarcoma are aged between 9 to 15 years old, while the age peak varies between males and females. Females' peak age is less than 15 years old and the males' peak age is more than this cut-off (1).

The disorder is primarily found in long bones such as femur, tibia, and humorous; however, it can uncommonly originate from any skeletal bone, like craniofacial and pelvic bones. The disease clinically presents vague, persistent bone pain and tissue bulging (1-3). Lung metastasis is the most common site of distant invasion, and bone-to-bone metastasis is the second important invasion (3, 4).

One of the rare types of bone-to-bone metastasis is skip-lesion. This type of metastasis is defined as an interrupted local invasion of the tumor to the same bone. The condition was first introduced by Enneking et al. in a study in 1975 (5) and was named alternatively as skip lesions or jump metastasis (6, 7). Here, we report a rare case of sclerotic skip metastasis in a 15 years old young adult with femoral osteosarcoma.

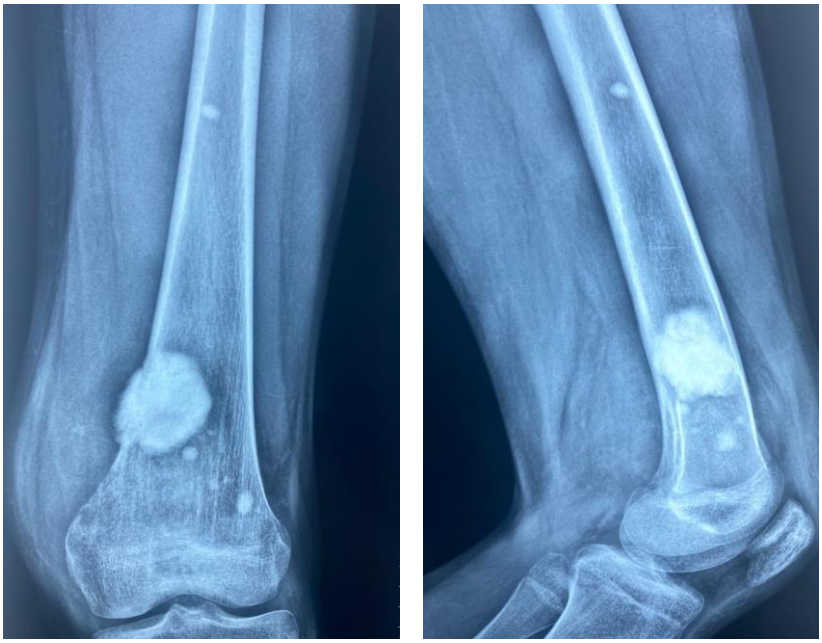
2- CASE PRESENTATION

A 15-year-old Afghan young adult presented to the pediatric department with severe knee swelling. He had a history of activity-related pain within the last seven months. Priorly, he was visited by an unqualified bonesetter and received some nonscientific homemade therapies, including joint immobilization and local herbal medication. Since the patient experienced no improvement after three months, he had referred to a general practitioner and later to an oncologist.

Initial evaluation, including plain radiography (X-ray), demonstrated an ill-defined mass with cortical destruction and soft tissue edema at the left distal femur along with sclerotic skip metastasis (**fig. 1**). The patient was followed with further imaging modalities, including computed tomography (CT) and magnetic resonance imaging (MRI). CT scan findings showed four sclerotic foci in distal femoral metaphysis and diaphysis accompanied by cortex destruction and soft tissue invasion (**fig. 2**). MRI assessments also approved the same pathologies (**fig. 3**). A whole-body scan (WBS) confirmed bone neoplasm with only local metastasis (**fig. 4**). Moreover, a hyper-flow and hyperemic tumoral mass in the distal femur was detected in the early phase of WBS. The patient underwent a biopsy assessment which confirmed osteosarcoma.

He was admitted to our setting with bone pain, knee swelling, and reduced range of motion. There was not any evidence of distant metastasis at the previous evaluations. Further metastasis work-up using lung high-resolution computed tomography (HRCT) in our service demonstrated multiple nodular-shaped metastases in the field of both lungs, unlike the previous imaging assessments.

We reassessed the previous pathology slides (**fig. 5 A & B**) for further details. The results confirmed high-grade chondroblastic osteosarcoma. Due to the distant metastasis of the lungs, the patient was in stage IV-A, according to the American joint committee on the cancer system for staging bone sarcoma (3). With this regard, the patient was planned to receive neoadjuvant therapy along with tumor resection. Our first course of therapy included high-dose methotrexate, cisplatin, and doxorubicin. Unfortunately, after the patient dischargement, his parents refused to continue the treatment.



(A) (B)

Fig. 1: AP (A) and lateral (B) x-ray. There is sclerotic lesion in the distal of femur with cortical destruction and soft tissue swelling and mass. There are four small sclerotic lesions near the main lesion, highly suggestive for skip metastasis that is rarely seen in radiography.

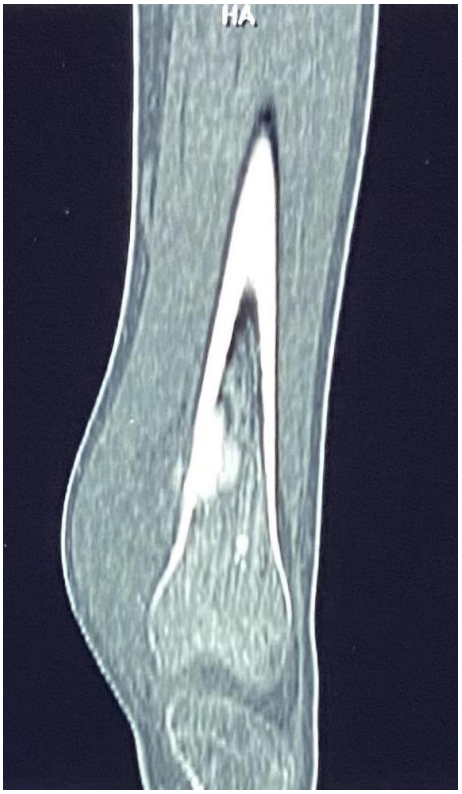
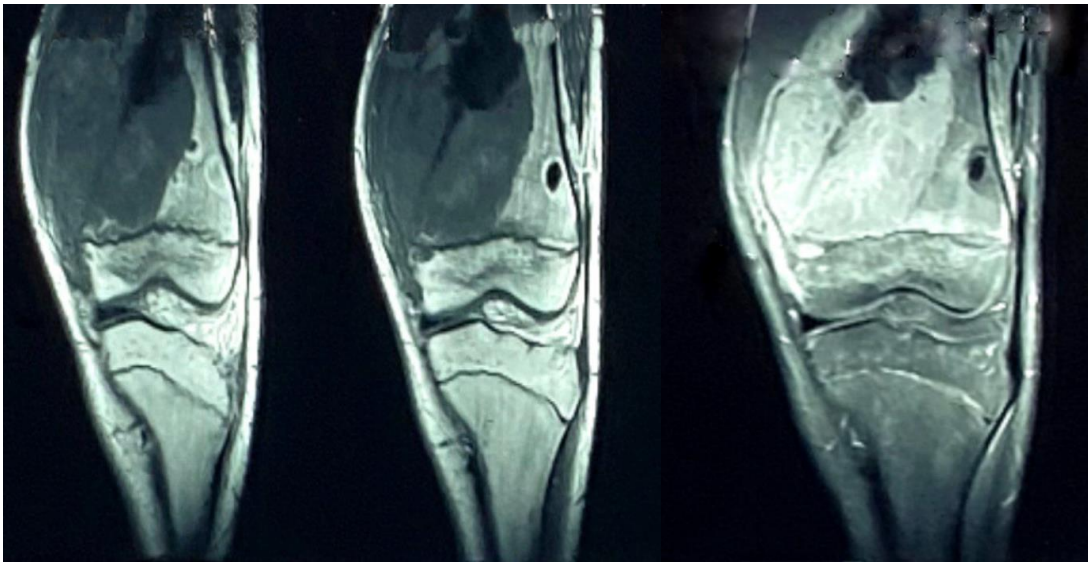


Fig. 2: CT scan-coronal plane. There is sclerotic lesion in the distal of femur with cortical destruction and soft tissue swelling and mass. There are three small sclerotic lesions near the main lesion which are highly suggestive for skip metastasis



(A) (B)

Fig. 3: (A). T1 coronal view; hypointense mass in distal femur metaphysis with soft tissue mass and very hypointense (signal void) skip lesion is detectable. Signal void skip lesion is due to sclerosis which is very rare in osteosarcoma. (B). T1 post-contrast demonstrates avid enhancement in main mass and sclerotic skip lesions.

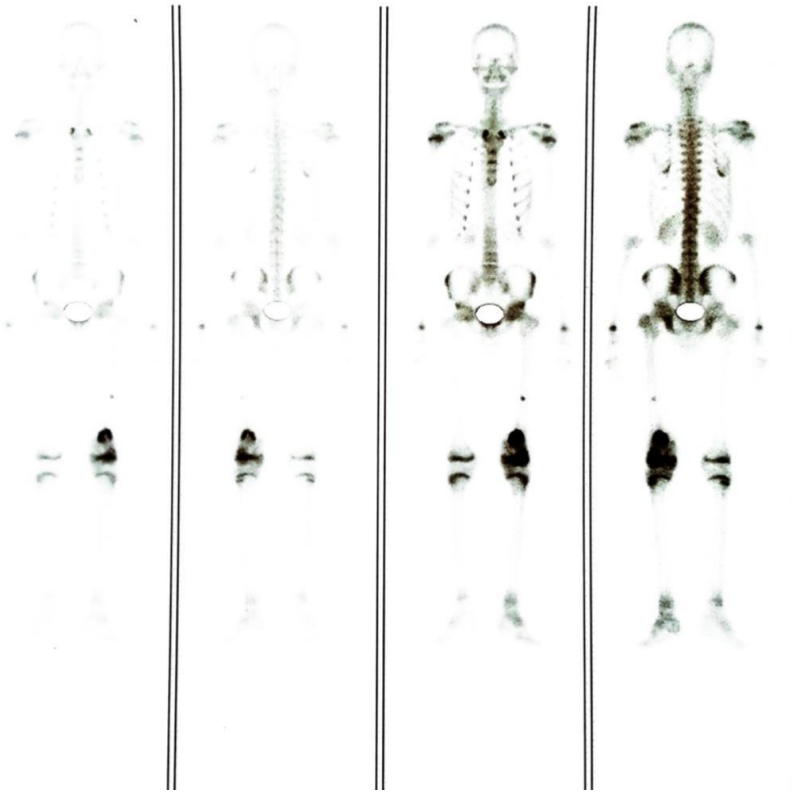
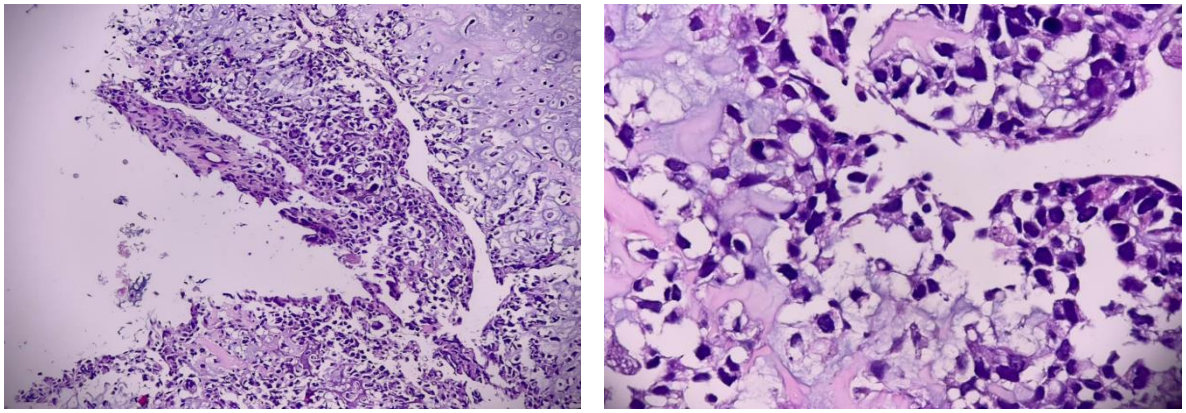


Fig. 4: Whole body scan findings are in favor of an active tumoral lesion involving the distal left femur accompanied by satellite lesions in the same bone.



(A) (B)

Fig. 5: Light micrograph showing large atypic cells in the background of myxoid tissue in ×100 magnitude (A) and ×400 magnitude (B) indicative of high-grade chondroblastic osteosarcoma.

3- DISCUSSION

Osteosarcoma is a mesenchymal bone neoplasm, manifested as the most common bone malignancy. Still, the condition has infrequent epidemiology in children, with an incidence of about 0.00044 percent annually (8, 9). OS becomes even rarer in the case of skip metastasis. Skip metastasis is a rare local bone-to-bone metastasis within the same bone. It is reported that only 6 to 28 cases per million have skip lesions (10). However, depending on the type of imaging and accuracy of the detection, skip metastasis may have a higher prevalence range, as some studies reported that it can involve 16 to 25 percent of high-grade tumors. However, these accurate findings were based on whole bone MRI or tissue histology (5, 11).

MRI can more accurately detect skip lesions, and only a lesser number of cases are diagnosed by plain radiography. Barnett et al. claimed that whole-bone-MRI has a high accuracy match compared to pathology slides with a sensitivity of 88.2%, specificity of 97.6%, and diagnostic accuracy of 96.7% for detecting skip metastasis (12). Still, it is reported that the presence of enchondroma may mimic skip metastasis and can cause some false-positive cases; these are usually differentiated through histology examination (7, 11). It is reported that CT scans and even radioisotopes may present some false-negative results in skip metastasis detection. Maybe MRI is superior to other modalities, but the evidence is insufficient (13). Our case was easily diagnosed in plain radiography, and further MRI and pathology assessment confirmed the presence of skip lesions.

Skip metastasis is usually found in long bones, especially in osteosarcoma cases of the femur and tibia. It is less commonly reported in the humerus, ulna, radius, and fibula (11, 14). Moreover, skip lesions can be single or multiple and even trans-articular (11). The case of our study had multiple skip metastasis in the distal part of the femur.

The literature also mentions that the presence of skip metastasis brings a poor prognosis (15). Typically, depending on early or late initiation of therapy, 20 to 40 percent of patients have less than five years of survival, respectively (8). However, it is proposed that around 70 percent of osteosarcoma cases with skip lesions can survive less than 36 months

(15). Sajadi et al. (14) reported an average survival rate of 32.5 months. Kager's et al. proposed that 50 percent of osteosarcoma cases with skip metastasis have a 5-year-survival rate (7). Jump metastasis is associated with a higher cancer stage, as it is considered a far-site metastasis (16). The presence of skip lesions can be a poorer prognostic factor than even the presence of lung metastasis; and with this regard, it is important to find these lesions (17).

Besides all those mentioned above, the accurate detection of skip metastasis is important for treatment planning. The location of the skip metastasis is valuable for the patient's surgical management. In the presence of a near-site skip lesion, there will be no change in the management of the patient, and there may be a partial bone resection along with prosthetic bone replacement. However, vaster resection is needed when the tumor lies in the diaphyseal part, and there is a skip lesion in the far part of the diaphysis (11).

Due to the rarity of the condition, little is known about the patient's treatment. The surgery should be done along with polydrug chemotherapy for a higher success rate, but there is no established chemotherapy protocol for osteosarcoma patients with skip lesions. However, the suggestive regimen should be further investigated (13). There are different proposed chemotherapy regimens for osteosarcoma patients, but cisplatin, doxorubicin, and methotrexate are found in most of them. Ifosfamide-included regimen has shown promising outcomes in patients with lung metastasis (18). Current protocols have suggested a combination therapy of methotrexate with other chemotherapeutic agents (8). Our patient was prescribed combination therapy of high-dose methotrexate, cisplatin, and doxorubicin. But our case was a loss to follow up and we couldn't assess the outcome of the patient.

4- CONCLUSION

Skip lesions are a rare type of same bone to bone metastasis in osteosarcoma and are considered to be a poor prognostic factor. It is, even, reported that it should be considered as distant metastasis in terms of staging and management of the patients. The condition has a higher incidence in the accurate MRI imaging but can be rarely detected in plain radiographs. Further studies are needed to propose a treatment approach for osteosarcoma cases with skip metastasis.

5- CONFLICT OF INTEREST

None.

6- AUTHORS' CONTRIBUTION

M.Z gathered the patient's data. M.Z and A.O were involved in draft writing. All authors critically revised the report, commented on drafts of the manuscript, and approved the final report.

7- ETHICAL CONSIDERATIONS

This study was performed in accordance with the Helsinki Declaration and the ethics was approved by the research committee of Mashhad University of Medical Sciences. Written informed consent was obtained from the patient's mother to publish this report in accordance with the journal's patient consent policy.

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