Osteogenic Sarcoma Presenting with Skip, Lymph Nodal, Pulmonary, Pleural Metastases and Malignant Effusion: An Unusual Appearance on Bone Scan

Abstract
Osteogenic sarcoma is an aggressive malignant bone tumor arising from primitive mesenchymal bone-forming cells. Ossification is the characteristic feature of the metastases in osteosarcoma which aids their detection on $^{99m}$Tc-MDP bone scintigraphy. Although lung is the most common site of metastasis in osteogenic sarcoma, pleural involvement with effusion and skip metastases are rare. Herein, we report a case of osteogenic sarcoma of distal femur with diffuse calcified pleural thickening leading to malignant pleural effusion, calcified lung, lymph node, and bone metastases illustrated on bone scan.

Keywords: Bone scan, osteogenic sarcoma, pleural nodules, skip metastases

Case Summary
A 14-year-old female presented with a history of pain and swelling in the right thigh for 1-month duration. Her MRI of the right knee revealed T1-weighted hypointense lesions in the distal right femur and proximal right tibia with provisional differentials of osteosarcoma and Ewing’s sarcoma. Histopathology from the lesion in the distal right femur established the diagnosis of osteogenic sarcoma. In the meantime, the patient developed right-sided chest pain, fever, and dyspnea. She underwent contrast-enhanced computed tomography of the thorax, which revealed diffuse calcified right pleural thickening, massive right-sided and mild left-sided pleural effusion, and calcified left pleural based and bilateral parenchymal lung nodules. $^{99m}$Tc-methylene diphosphonate bone scan acquired subsequently demonstrated intense tracer uptake in the primary site in the distal right femur, skip metastases, and distant skeletal metastases in the pelvic bone [Figure 1]. In addition, there were increased tracer uptake in the calcified pleural, pulmonary, and lymph nodal metastases [Figure 2a-d], giving the bone scan a very peculiar appearance.

Discussion
Osteosarcoma is a high-grade primary skeletal malignancy most commonly seen in children and adolescents. It is characterized by spindle cells of mesenchymal origin which deposit immature osteoid matrix and has a predilection for metaphysis of long bones. Metastasis is an important predictor of prognosis in osteosarcoma with >75% of metastases occurring the lungs.[1] Although lung micrometastases are usually present in most of the patients at the time of diagnosis, radiologically detectable metastases are seen in approximately 15% of the patients.[2,3] Pleural metastases are rare and are usually associated with concomitant lung parenchymal nodules. Diffuse pleural thickening with ossification and pleural effusion at the initial presentation is extremely rare as in the index case and only few such cases are reported in the literature.[2,4] Pleural metastases can either result from direct extension from lung parenchymal lesions or through hematogenous spread.[5]

Skip metastases are also very unusual, occurring only in 1.5%-6.5% of the patients. Patients with skip metastasis are more likely to have associated distant metastasis with lower survival rate. Mineralized lymph node metastases are seen in <10% of the patients.[6]
Osteosarcoma with multiple sites of skeletal involvement in the absence of lung metastasis is multifocal osteosarcoma. One lesion has features of primary and most of the other lesions mimic skeletal metastasis on radiology. Multifocal variant has a poorer prognosis when compared to unifocal variant.\(^7\)

Whole-body bone scan is routinely recommended for the evaluation of osseous metastases. In addition, it also provides the extent of the disease.\(^8\) The prognosis and management of the patient with metastatic osteosarcoma depend on number, size, and site of metastases. Complete resection of the primary with metastatic lesions can be considered as curative of osteosarcoma. Although lung metastases carry a poor prognosis, resection of localized pleural and pulmonary metastatic disease has shown to improve the survival, whereas unresectable metastases are treated with systemic chemotherapy.\(^1,3\)

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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