Case Report

Chronic Venous Insufficiency Causing a Diagnostic Conundrum on Tc-99m Bone Scan Done for Osteosarcoma Surveillance: Awareness is the Key!

Abstract

Bone scans are the most commonly used imaging technique to rule out local recurrence or metastasis during surveillance of malignant bone tumors after treatment. Although bone scans are very sensitive in detecting recurrence or metastasis, they are less specific. There are many nonmalignant conditions which can mimic either recurrence or metastasis on a Tc-99m bone scan. Therefore, physicians must be aware of such conditions to avoid unnecessary workup and invasive procedures. We present such an interesting case where chronic venous insufficiency mimicked either osteomyelitis or regional metastasis on a Tc-99m bone scan done for osteosarcoma surveillance.

Keywords: *Chronic venous insufficiency, diagnostic conundrum, osteosarcoma surveillance, Tc-99m bone scan*

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Introduction

Nuclear bone scans have become an integral part in the evaluation of malignant bone tumors both in treatment planning and surveillance. Bone scans have the advantage of imaging the entire skeleton in addition to the primary bone tumor; this allows for evaluation of the extent of the disease.[1] Bone scans are cost-effective and sensitive imaging technique for the detection of metastasis or recurrence; however, it is less specific. Certain benign conditions can mimic tumors on bone scans causing a diagnostic dilemma. This may, in turn, result in further costly investigations and biopsies, putting an unnecessary financial burden on individuals and health-care system.[2] We present such an interesting case in which chronic venous insufficiency (CVI) from preexisting deep-vein thrombosis (DVT) led to increased uptake on bone scan in the distal tibia, causing a diagnostic dilemma.

Case Report

A 62-year-old female presented with pain in the right knee. She was given analgesics for the pain initially, but the pain was persistent. Radiograph of the right knee joint revealed a mixed lytic and blastic exophytic lesion extending from the posterior distal right femoral diaphysis. Computed tomography (CT)-guided biopsy of the lesion revealed high-grade parosteal osteosarcoma. Tc-99m bone scan revealed abnormally increased uptake of the radiotracer in the distal right femur and adjacent soft tissue consistent with biopsy-proven osteosarcoma. The patient received neoadjuvant chemotherapy followed by radical resection of the distal right femur and proximal tibia with a modular knee implant.

Bone scans done subsequently for surveillance revealed a gradual increase in radiotracer uptake in the distal tibia extending into the right foot bones [Figure 1]. There was relative swelling of the right lower extremity (RLE) with mildly increased uptake in the soft tissue. The differentials which were considered initially were osteomyelitis with cellulitis and regional metastasis/recurrence; however, the patient was asymptomatic, and the uptake pattern was atypical for metastasis or recurrence. Radiographs of the right leg and foot showed no obvious periosteal reaction, no destructive or lytic lesions [Figure 2]. Retrospectively, there was mildly increased uptake in the distal tibia on the initial presurgical bone scan. A careful review of the medical chart revealed that the patient

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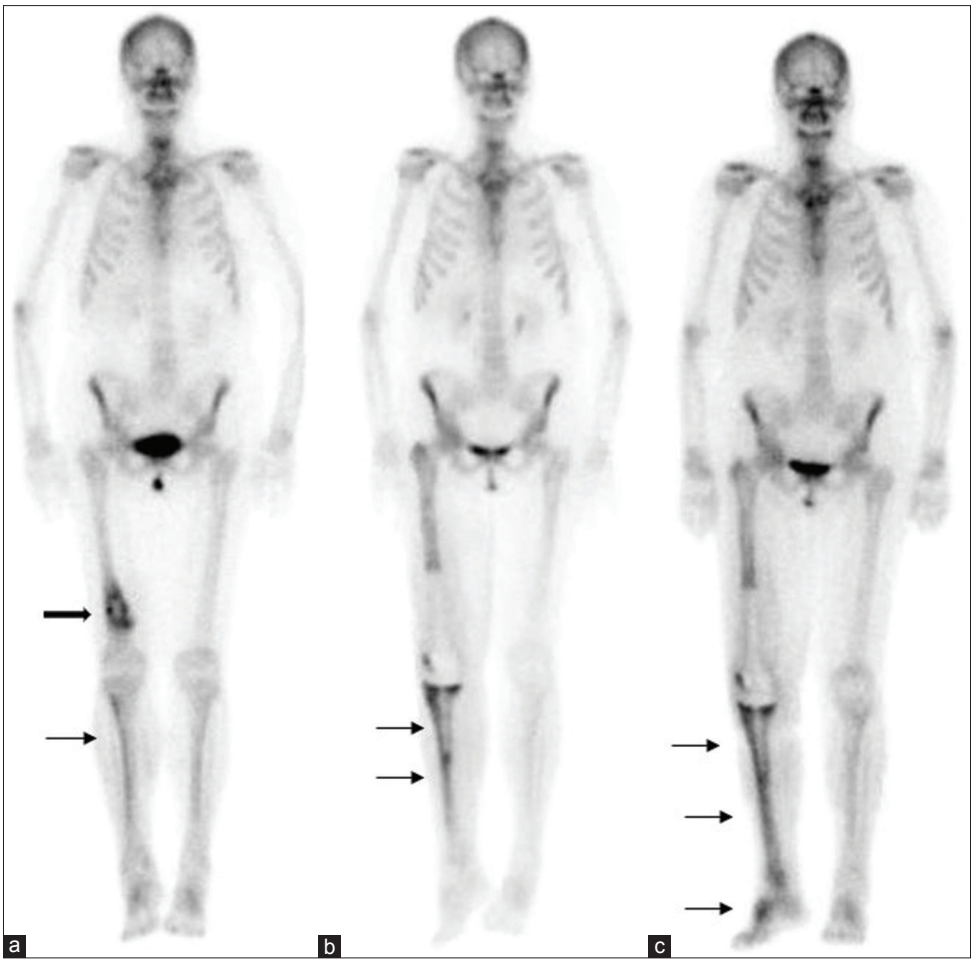

Figure 1: Bone scan (a) done before surgery, anterior planar image shows increased radiotracer uptake in the distal right femur (thick arrow) consistent with osteosarcoma. Mild asymmetric increased uptake noted in the proximal and mid right tibia (thin arrow). Bone scans (b and c) done 3 and 6 months postsurgery, respectively; anterior planar images show a gradual increase in the radiotracer uptake (thin arrows) in the right tibia extending into the foot bones (c). Postsurgical changes of the distal femur and proximal tibia resection with knee implant (b and c). No abnormal uptake elsewhere to suggest metastasis

had developed RLE swelling 2 months prior to surgery. Doppler ultrasound at that time had revealed DVT of the right popliteal, posterior tibial, and peroneal veins with extension into the superficial femoral vein [Figure 3]. She was put on anticoagulation. It was concluded that the increased uptake in the distal tibia and foot bones was likely due to periostitis secondary to CVI. Bone scans show increased uptake in the bones before any significant changes are evident on radiographs.

Discussion

Bone scans are well-established imaging technique used in the diagnostic workup and surveillance of malignant bone tumors. The main goals of performing bone scans in this clinical setting are to evaluate the extent of the primary bone tumor and to detect the presence of other skeletal lesions which help in treatment planning.[3] After the treatment, which is either surgery and/or chemotherapy, bone scans help in the detection of locoregional or metastatic recurrence. In the past, the primary treatment for osteosarcoma was surgical. In those cases, bone scans were not very useful as multicentric osteosarcoma is rare and bone metastases are rarely seen before pulmonary metastases. Management has changed since the introduction of neoadjuvant chemotherapy. About 1.5% of patients who receive neoadjuvant chemotherapy develop bone metastasis before lung metastasis. Therefore, it has become essential to do bone scans during the follow-up to rule out metastasis.[4] Although bone scans have moderate sensitivity, they have less specificity for the detection of skeletal metastasis. Agrawal *et al*. described that bone scans have a sensitivity and specificity of about 46%–70% and 32%–57%, respectively, for the detection of bone metastasis. Hence, physicians must be aware of nonmalignant conditions which can give false-positive results on bone scans. In such cases, single-photon emission CT (SPECT)/CT or anatomic correlation with CT and magnetic resonance imaging (MRI) imaging may help to increase reporting confidence in equivocal cases.[5] The various benign conditions which can show increased uptake on bone scans are Paget's disease, multiple myeloma, hypertrophic osteoarthropathy, thyroid acropachy, fibrous dysplasia, and stress fractures.[6]

Figure 2: Radiographs of the right leg and foot (a-d) show no obvious periosteal reaction. Note is made of knee implant

We present such an interesting clinical scenario where CVI from preexisting DVT resulted in increased radiotracer uptake in the tibia and foot bones, complicating the clinical picture. CVI occurs when venous valves are defective, and the resulting impaired venous drainage leads to stasis and edema. It most commonly affects the lower limbs and sometimes the upper limbs. The sequences of events leading to CVI are obstruction and valve incompetence. The venous obstruction can occur due to phlebitis, thrombus, trauma, or tumor. The obstruction slowly increases the back pressure leading to valve incompetence.[7] The resultant venous hypertension causes pain, edema, and skin changes such as eczema and pigmentation. In advanced cases lipodermatosclerosis, atrophie blanche, and healed or active ulcers are seen.[2] Most of the cases of CVI are caused by previous acute DVT or superficial venous thrombosis.[6] The resultant venous stasis leads to increased mean interstitial pressure (exerting pressure) on the periosteum causing solid undulating periosteal reaction.[8] Bone scans are very sensitive in detecting the changes of periostitis which is characterized by round cell infiltration with deposition of bland osteoblasts, fibrous stroma, and immature bone on histopathology. The changes of periostitis on bone scans are noted even before clinical symptoms or radiographic changes of periosteal new bone formation are evident. It is important to detect these changes early in the course of disease as it may change the clinical management.[9,10]

Awareness of the appearance of CVI on bone scans and the clinical presentation of these patients can help to narrow the differential diagnosis. In this case, local recurrence was excluded as the changes were developing over time

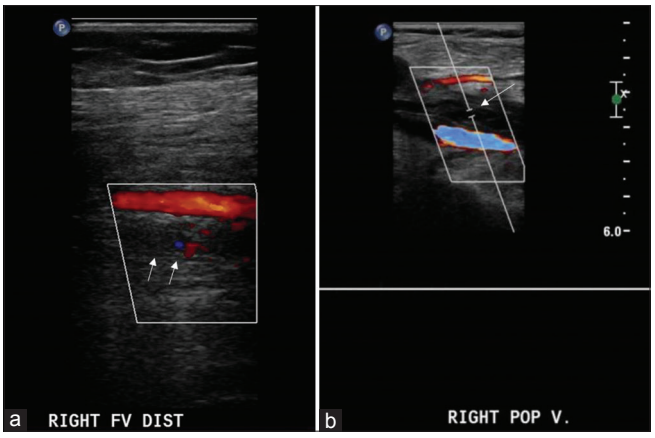

Figure 3: Doppler ultrasound image (a) shows hypoechoic filling defect (thin arrows) in the noncompressible distal right superficial femoral vein with no color flow, consistent with thrombus. Spectral Doppler image (b) shows the absence of waveform in the right popliteal vein (thin arrow) also consistent with thrombus

and serial radiographs were negative. Osteomyelitis was unlikely given the normal white blood cell counts and inflammatory markers and the absence of signs of inflammation. Complex regional pain syndrome was among the differential however was excluded given the absence of pain and local skin changes.

Conclusion

Bone scans play a very important role in the management of many oncological conditions. All lesions that show increased uptake on bone scans are not malignant. Many benign conditions can show increased radiotracer uptake on bone scans. Awareness is the key in such situations. Proper knowledge about the uptake pattern, aided by SPECT/CT or MRI imaging, and careful review of clinical history may increase diagnostic accuracy, thereby avoiding unnecessary investigations and invasive procedures.

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 for interest

There are no conflicts for interest.

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