

CASE REPORT

^{99m}Tc-MIBI scintigraphy for establishing the benign nature of an active lesion on a bone scan

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Abstract

Occasionally, bone infections may present a diagnostic or therapeutic dilemma for the clinicians. We report a case of 17-year-old male who presented with a painful swelling in the upper left leg, which was seen to be due to a lytic lesion in the upper left tibia on x-ray. The bone scan also showed increased tracer uptake at this site. However, correlative 99mTc-MIBI scan showed no significant uptake here and hence contributed to the diagnosis by establishing a benign cause for the pathology. Subsequent MRI confirmed the lesion as focal osteomyelitis.

***Key words**: Osteomyelitis, bone scan, MIBI scan*

Introduction

Occasionally it is quite difficult to establish a conclusive diagnosis of osteomyelitis, which can only be ascertained through a combination of multiple diagnostic modalities (e.g. MRI, aspirate from bone lesion, blood culture, etc.) that together help in determining the wxCT nature of the lesion.

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In osteomyelities, the 3-phase bone scan is classically positive with increased flow, blood pool and delayed uptake at the site of osteomyelitis. The sensitivity of this finding is high but the specificity is low.

Case report

A 17-year-old male presented with history of painful swelling just below the left knee for 3 years. There was no history of trauma. On examination, the area was tender but there was no redness or discharge. Gait was normal. The patient had been taking painkillers off and on. X-ray (Figure 1) showed a lytic lesion at the upper end of left tibia with marked surrounding sclerosis but no significant periosteal reaction. The clinicians were unsure as to the exact nature of the pathology and needed imaging to establish a diagnosis of infective or neoplastic lesion.Bone scan (Figure 2) showed increased tracer distribution over the left upper leg in the initial and blood pool phases. Photon deficient (lytic) area with rim of increased tracer uptake was noted in the delayed images. Correlative ^{99m}Tc- MIBI imaging showed no significant abnormal uptake in the lesion over the upper end of left tibia (Figure 3). MRI showed evidence of localized area of signal abnormality involving the upper shaft of left tibia along with sinus tract at its medial aspect suggestive of abscess (Figure 4).

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Figure 1 *X-ray knee joint AP & lateral views show a lytic lesion at the upper end of left tibia with marked sclerosis around it and no significant peri-osteal reaction*

Figure 2 *3-phase bone scan shows focal area of increased tracer uptake at the proximal end of left tibia*

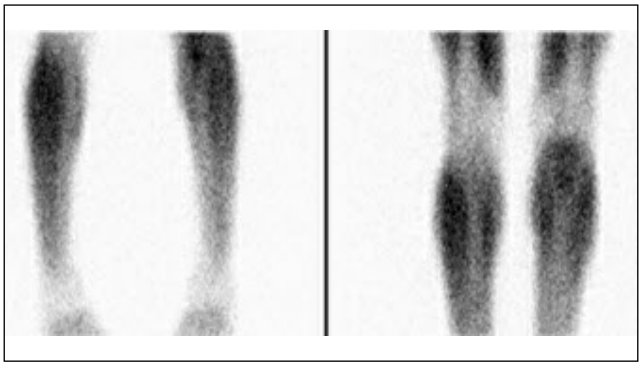

Figure 3 *^{99m}Tc-MIBI Scan shows no significant abnormal uptake*

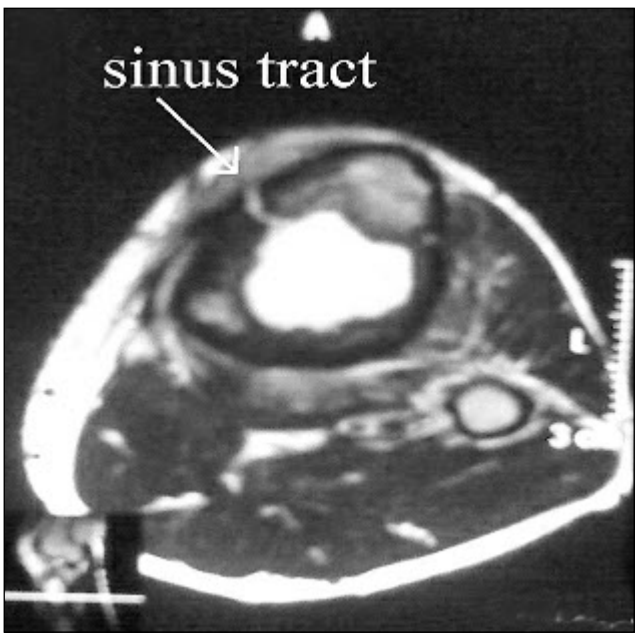

Figure 4 *MRI of left upper tibia shows localized area of signal abnormality along with sinus tract at the medial end of left tibia*

Discussion

Bone infection is usually bacterial in origin. The most common route by which bacteria reach the bone is blood stream [1]. However, traumatic modes such as penetrating injuries, fractures and intramedullary nailing and post-surgical complications are also common [2].

In acute hematogenous osteomyelitis, infection involves the red marrow of long bones as a result of the relatively slow blood flow in metaphyseal sinusoidal veins and a relative lack of phagocytes. In adults, the long bones are rarely affected due to replacement of red marrow by adipose tissue.

The initial diagnosis of osteomyelitis is usually made by physical signs and through sonographic depiction of early soft-tissue changes. Magnetic resonance imaging and bone scintigraphy are relatively most sensitive and specific. Conclusive diagnosis requires isolation of pathogen in aspirate from bone lesion and blood culture.

A 3-phase bone scan in otherwise normal bone is able to diagnose osteomyelitis with a high sensitivity and specificity. In patients with other osseous abnormalities, the specificity of the bone scan is lower [3]. Any cause for bone remodelling, e.g. healing fracture, bone tumour, orthopaedic implants and neuropathic osteodystrophy may result in a positive 3-phase scan [4]. Radiographs often demonstrate these potential problems.

The efficacy of a 3-phase bone scan decreases in follow-up or after treatment because the modifications of bone metabolism and the normalization of scintigraphic image are slow and lag behind. An increased uptake of ^{99m}Tc-MDP can persist for months or years after recovery of a bone fracture or osteomyelitis [5]. Septic bone necrosis can result in cold areas on MDP scan as seen in this patient in whom the bone scan showed a photon-deficient (lytic) area surrounded by rim of increased tracer uptake.

^{99m}Tc-hexakis-2-methoxyisobutylisonitrile (MIBI) is a lipophilic cation predominantly stored in subcellular structures in response to electric potentials. It was originally developed for myocardial perfusion studies and has recently been used as a tumour-imaging agent for various malignancies [6]. ^{99m}Tc- MIBI accumulation depends on cell viability and metabolic conditions [7]. The major diagnostic worth of ^{99m}Tc- MIBI scintigraphy is its high negative predictive value. The sensitivity, specificity, accuracy, positive predictive value and negative predictive value of the MIBI-perfusion index for malignant lesions are reportedly 87%, 75%, 81%, 77% and 86%,

and 86%, respectively [8].

^{99m}Tc-MIBI provide complementary information in the diagnostic evaluation of benign versus malignant lesions. If ^{99m}Tc-MIBI shows no significant uptake, then there is less chance of malignant lesion. In this case, MIBI results helped the authors to stratify the patient as having a benign pathology and to actively seek MRI evidence of a non-malignant lesion.

The present study demonstrates the worth of ^{99m}Tc- MIBI scan for differentiating between benign and malignant lesions. Although not capable of replacing tissue biopsy as a definitive diagnostic modality for musculoskeletal pathologies, ^{99m}Tc- MIBI scintigraphy does appear to have a role in preoperative assessment.

References

1. Karwowska A, Davies HD, Jadavji T. Epidemiology and outcome of osteomyelitis in the era of sequential intravenous-oral therapy. Pediatr Infect Dis J 1998;17(11):1021-6.

2. Carek PJ, Dickerson LM, Sack JL, Diagnosis and management of osteomyelitis Am Fam Physician 2001;63:2413-20.

3. Boerman OC, Rovers CP, Rennen HJ et al. The imaging of infection and inflammation. In: Cook GR, Maisey MN, Britton KE et al. Clinical Nuclear Medicine, 4th edition. London: Chapman and Hall; 2006: 95.

4. Thrall JH, Ziessman HA. Skeletal System. In: Nuclear Medicine ;The Requisites, 2nd edition. Mosby, Philadelphia. 2001; 115-121.

5. Concia E, Prandini N, Massari L. Osteomyelitis:clinical update for practical guidelines.Nucl Med commun 2006, 27:645-660.

6. Pinkas L, Robinson D, Halperin N, Mindlin L, Cohenpour M, Baumer M, Horne T. ^{99m}Tc-MIBI Scintigraphy in Musculoskeletal Tumors. J Nucl Med 2001; 42 : 33-37.

7. Chiu ML, Kronauge JF, Piwnica-Worms D. Effect of mitochondrial and plasma membrane potentials on accumulation of hexakis (2-methoxyisobutylisonitrile) technetium in cultured mouse fibroblasts. J Nucl Med 1990;31:1646-1653.

8. Koichi I, Noriaki T, Kyoji O, Hiroyuki N, Ryuji S, Kazufumi S, et al. Evaluating benign and malignant musculoskeletal lesions with radionuclide angiography and SPECT using ^{99m}Tc- MIBI. Clin Nucl Med 2005, 30 (9): 598-603.

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