Case Report

Non-osseous uptake on Tc99m methylene diphosphonate in multiple muscles confirmed on SPECT/computed tomography

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ABSTRACT

A 55-year-old female presented with complaints of pain in the left hip radiating to the left lower limb since 1 year. Computed tomography (CT) abdomen and pelvis revealed bony destruction of pubic symphysis with associated soft tissue component suspicious of infective or metastatic etiology. Magnetic resonance imaging Lumbo-sacral spine performed later revealed altered bone marrow signal in sacral 1-3 vertebrae. Wholebody bone scan with 25 mCi of Tc-99m methylene diphosphonate (MDP) was performed, which revealed multiple skeletal metastases and extraosseous soft tissue uptake was seen involving multiple muscles. We performed single photon emission tomography single photon emission computed tomography (SPECT)/computed tomography (CT) images to precisely delineate the muscle involved and noted calcification on CT images in one of the muscle at site of Tc-99m MDP uptake, no definite calcification was noted in the other muscles. Thus, the final diagnosis was multiple skeletal metastasis with metastatic calcification in multiple muscle from an unknown primary.

Keywords: Bone scan, muscle, SPECT-computed tomography, skeletal metastasis, Tc-99m methylene diphosphonate

INTRODUCTION

Radionuclide bone scan is an important diagnostic tool in the evaluation of the patients with a variety of osseous abnormalities and it has played a very important role in the evaluation of bone metastases for more than 30 years. Sometimes extraosseous uptake of a bone-seeking radiotracer is noted incidentally and the recognition of such conditions will help the interpretation of bone scans. In this report, we present a rare case in which Tc-99m methylene diphosphonate (MDP) bone scan detected metastatic calcification in multiple muscles in a patient with an unknown primary. In this context, obtaining single photon emission computed tomography (SPECT)/computed tomography (CT) images clarifies the exact localization of incidental soft-tissue findings on the bone scan and CT findings also noted calcification in muscles at sites of Tc-99m MDP uptake.

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CASE REPORT

A 55-year-old female presented to the physician with complaints of pain in the left hip radiating to the left lower limb since 1 year, gradually increased to unbearable leading to inability in walking since 1 month. She was a known case of rheumatoid arthritis since 2004, under treatment on phenylbutazone and steroids. On physical examination, we noted mild tenderness in anterior thigh muscles of left lower limb, restriction of movements in the left lower limb. No significant joint deformities. Blood investigations and biochemistry revealed hemoglobin of 12.9 g/100 ml, white blood cell: 23,000, erythrocyte sedimaentation rate (ESR): 44 mm/h (0-20), lactate dehydrogenase LDH: 521 mU/ml (100-190), serum creatine: 0.7 mg% (0.6-1.3), serum phosphate: 7.0 (2.5-4.5), uric acid: 18.9 (2.6-7.2), creatinine phosphokinase CPK: 6592 mU/ml (21-232), serum calcium: 8.9 (8.8-10.5). CT abdomen and pelvis revealed bony destruction of pubic symphysis with associated soft-tissue component suspicious of infective or metastatic etiology, diffuse osteoporotic changes, and insufficiency fracture of sacrum. Magnetic resonance imaging Lumbo-sacral spine performed later revealed altered bone marrow signal in sacral 1-3 vertebrae, grade 1 forward spondylolisthesis L5 over S1, degenerative spondylitic and disc changes with facet joint involvement of L4/L5 vertebrae.

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Subsequently, patient was referred for a bone scan to look for bone metastases. Whole body bone scan with 25 mCi of Tc-99m MDP was performed, which revealed multiple skeletal metastases [Figure 1]. In addition, extraosseous soft-tissue uptake was seen involving multiple muscles. We performed SPECT-CT images to precisely delineate the muscle involved, i.e., right adductor magnus muscle, left rectus femoris muscle and right gastrocnemius muscle. We noted calcification on CT images in right adductor magnus muscle at site of Tc-99m MDP uptake, no definite calcification was note in the left rectus femoris muscle and right gastrocnemius muscle. Subsequently, biopsy was performed from left rectus femoris muscle, which mentioned suspicion of adenocarcimatous cells.

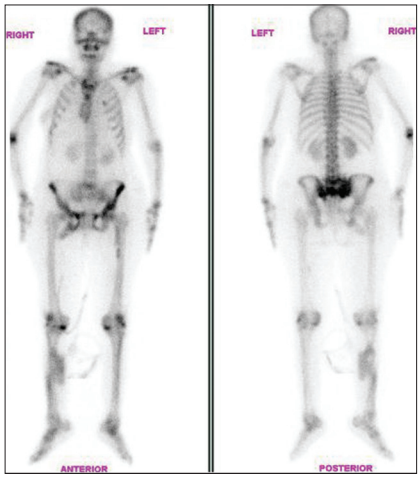

Figure 1: Planar wholebody bone scan findings is suggesstive multiple skeletal metastasis involving the left 4th and right 10th ribs, sacrum, bilateral acetabulum and pubic symphysis, right superior and inferior pubic ramii, left superior pubic ramus. A note is made of multiple abnormal extraosseous radiotracer concentration

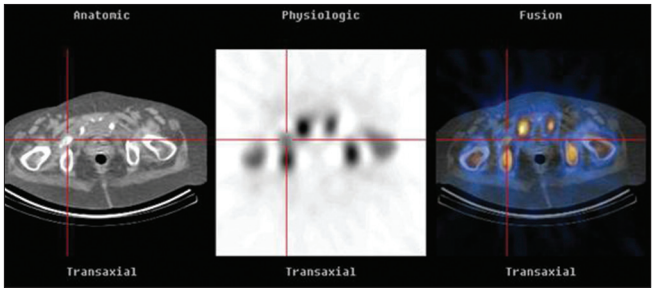

Figure 2: SPECT-computed tomography images reveal abnormal extraosseous radiotracer concentration involving the right adductor magnus muscle. Calcification seen on CT images in the right adductor magnus muscle

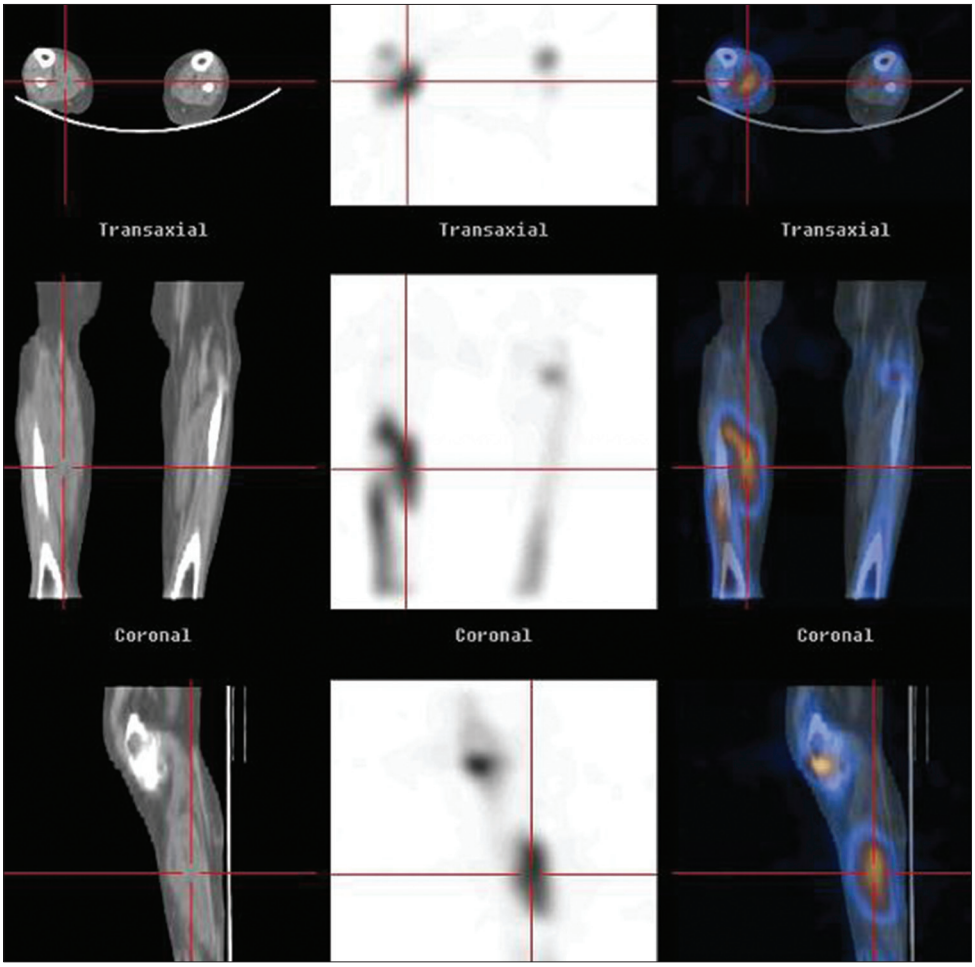

Figure 3: SPECT-computed tomography images reveal abnormal extraosseous radiotracer concentration involving the right gastrocnemius muscle with no definite calcification seen on CT images

Left rectus femoris muscle did not show visible calcification radiologically (CT images) however, abnormal micro calcification was shown in muscle biopsy evaluation by electron microscopy. Myeloma profile was negative. Thus, the final diagnosis was multiple skeletal metastasis with metastatic calcification in multiple muscle from an unknown primary.

DISCUSSION

Normally, uptake of bone scanning agents is seen in osseous structures, kidney, and bladder. Occasionally, extraosseous uptake in soft-tissue can be seen on delayed images, due to local tissue abnormalities, blood flow changes, and metabolic conditions.[1] The pathogenesis of uptake of bone scanning agents in soft-tissue is multi-factorial; one of the primary underlying factors is excess calcium in the soft-tissue.[2] Scintigraphy with Tc-99m MDP delineates a wide spectrum of non-osseous disorders, i.e., Neoplastic, hormonal, inflammatory, ischemic, traumatic, excretory, and artifactual entities demonstrate abnormal soft-tissue uptake of Tc-99m MDP.[3] Mechanisms leading to increased extraosseous Tc-99m MDP uptake include extracellular fluid expansion, enhanced regional vascularity and permeability, and elevated tissue calcium concentration.[3] In this case report, tracer uptake in multiple muscles [Figures 2 and 3], which was demonstrated on Tc-99m MDP bone scan, due to necrotic tissue with calcification in the metastatic lesion. In Bonucci and Sadun study, patients CT images reveal abnormal calcification in the muscle.[4] There are cases, which showed radiologically no visible calcification, however, microcalcification noted in electron microscopy of muscle biopsy.[4] Damaged muscle tissue has an increased avidity to calcium, like that accounting for the labeling of recent myocardial infarct with 99mTc polyphosphate.[5] Areas of greatest bulk of abnormal muscle would be expected to show the most prominent labeling as seen in cases of polymyositis.[6] Uptake has not well-correlated with serum creatine kinase (CK) levels: Patients with polymyositis and minimal CK elevation have shown marked tracer uptake while patients with Duchenne type muscular dystrophy have shown minimal uptake in presence of elevated CK levels.[7] A bone scan in a patient with proved osteogenic sarcoma of the tibia showed intense focal uptake in the gluteal region on the side of his cancer, was proved to be a metastasis in the muscle.[8] Deposition of the bone radiotracer in heterotopic new bone formation (e.g., myositis ossificans) follows a pathway similar to bone localization. Soft-tissue visualization, the mechanism of uptake is less well-defined although soft-tissue calcification is thought to play an important role. Because calcium deposition in the soft-tissue can be found in a variety of disease processes (such as ischemia, necrosis, metastatic calcification in renal failure, or hypercalcemia of any cause), it is conceivable to find uptake of the bone radiotracer in any organ in the body. However, this is an oversimplification; the uptake patterns occurring in individual organs usually point to a specific pathology. For example, cardiac uptake might be due to a recent myocardial infarction or to the presence of amyloid deposits.[9] Pleural effusions may be delineated on the bone scan by diffuse increased uptake in a hemithorax. Such pleural uptake indicates a malignant effusion and is an ominous sign in patients scanned for skeletal metastases.[10] The spleen may be seen on the bone scan of sickle cell patients,[1] hereas, uptake in the liver may indicate metastases from colon cancer.[11] Although, bone scanning is a test primarily concerned with skeletal abnormalities, important non-osseous findings are occasionally present on the images. To gauge the significance of such non-osseous uptake and in particular, to determine whether these findings contain useful diagnostic information, the technical and medical staff in nuclear medicine must recognize the various patterns of non-bony uptake and understand their causes. SPECT-CT images can precisely delineate the non-osseous uptake, in our case it delineated muscles involved, i.e. right adductor magnus muscle, left rectus femoris muscle and right gastrocnemius muscle and also noted calcification in muscles at sites of Tc-99m MDP uptake. Thus, we also highlight the role of SPECT-CT images in precisely delineating the site of non-osseous uptake.

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