SAGE Open Medical Case Reports
Volume 5: 1–4

DOI: 10.1177/2050313X17741824
journals.sagepub.com/home/sco
SAGE

Extra-osseous ^{99m}Tc methylene diphosphonate uptake detected enlargement of the knee joint in patient with polyarthritis

Maria Grazia Caprio[1], Mariarosaria Manganelli[2], Simona Limone[2], Massimiliano Sorbillo[1], Mario Quarantelli[1], Alberto Cuocolo[2] and Ciro Gabriele Mainolfi[2]

Abstract

Bone scintigraphy is a nuclear scanning test used to find abnormalities in the skeleton. Certain abnormal processes involving soft tissues can also cause skeletal accumulation of radiotracer during bone scintigraphy. We present a case of periarticular knee soft tissue ^{99m}Tc methylene diphosphonate uptake in a patient with asymmetric polyarthritis. A 33-year-old patient with asymmetric polyarthritis, skin lesions and joint pain underwent bone scintigraphy. Total body examination showed an extra-osseous uptake in periarticular soft tissue of knees joints. A detailed history checkup, physical examination and laboratory tests were carried out to understand the link between the extra-osseous uptake and the phosphonate binding in periarticular soft tissue. To improve the anatomical description of the soft tissue of the knees and to clarify the nature of the extra-skeletal ^{99m}Tc methylene diphosphonate uptake, magnetic resonance imaging scan was performed. ^{99m}Tc-labeled phosphonate binding has been reported in a number of extra-osseous conditions, but to our knowledge, there are a few cases showing bone tracer uptake in polyarthritis. In polyarthritic patients, whole-body bone scintigraphy were useful in examining the whole joints and detecting possible dubious extra-osseous uptake; in fact, it is able to select subjects who require further in-depth analysis, for example, magnetic resonance imaging.

Keywords

Bone scintigraphy, ^{99m}Tc methylene diphosphonate extra-osseous uptake, knee joint, polyarthritis

Date received: 17 March 2017; accepted: 16 October 2017

Introduction

Bone scintigraphy is a nuclear scanning test used to find many abnormalities in bone, such as bone tumors, skeletal metastases, infections and sites of skeletal trauma. ^{99m}Tc methylene diphosphonate (MDP) and its analogs localize to bone by chemisorption to the surface of hydroxyapatite crystals.[1]

Certain abnormal processes involving soft tissues can also cause skeletal accumulation of the radiotracer on bone scintigraphy with exception from the physiologic excretion of tracer through the urinary tract.[2]

Extra-osseous ^{99m}Tc MDP uptake is a common finding, but it has been reported occasionally in the literature,[3–5] and it is usually due to neoplastic, hormonal, inflammatory, ischemic, traumatic, excretory and artefactual causes.[6]

It is difficult to correctly localize such sites of extra-osseous uptake on planar bone scintigraphy alone; in fact, the addition of hybrid single-photon emission computed tomography-computed tomography (SPECT-CT) is often essential for the clarification ^{99m}Tc MDP uptake.[7]

[1]Institute of Biostructure and Bioimaging, National Research Council, Naples, Italy
[2]Department of Advanced Biomedical Sciences, University of Naples Federico II, Naples, Italy

Corresponding Author:
Maria Grazia Caprio, Institute of Biostructure and Bioimaging, National Research Council, Via Tommaso De Amicis, 95, 80145 Naples, Italy.
Email: mariagrazia.caprio@ibb.cnr.it

Table 1. Altered laboratory tests including inflammatory (VES and PCR) and rheumatologic (FR, antinuclear antibodies ANA, IgG-RF and IgA-RF) markers.

	Case reported values	Normal range
Calcium level	10.1 mg/dL	8.9–10.3
Protein concentration	9.7 g/dL	6.5–8.2
Antinuclear antibodies (ANA)	1.70 U	0.00–1.00
C-reactive protein (CRP)	2.92 mg/dL	0–0.50
Rheumatoid factor (RF)	<10.1 UI/mL	0–15
IgG-RF	23.700	7.00–16.00
IgA-RF	4.270	0.70–4.00

IgG-RF: immunoglobulin G rheumatoid factor; IgA-RF: immunoglobulin A rheumatoid factor.

Case report

We present an extra-osseous uptake of ^{99m}Tc MDP in a 33-year-old patient with asymmetric polyarthritis, skin lesions and joint pain, who underwent a bone scintigraphy.

In the rheumatology department, the patient has been clinically tested and subjected to laboratory tests including inflammatory (VES and PCR) and rheumatologic (FR, antinuclear antibodies (ANA), immunoglobulin G rheumatoid factor (IgG-RF) and immunoglobulin A rheumatoid factor (IgA-RF)) markers (Table 1). He was diagnosed a calcium pyrophosphate deposition disease (CPPD) at 27-year-old but the fast arthritis progression despite the therapy (low-dose oral prednisone and colchicine), no characteristic features of CPPD were observed in X-ray images (linear calcifications of articular cartilage, especially fibrocartilaginous) and seborrheic dermatitis overlap in sebo-psoriasis contradicted this diagnosis.

Considering that the bone scintigraphy is more sensitive in detecting inflammatory joint disease and in clarifying the nature of this arthritis, the patient was referred for a bone scan, which was performed 3 h after the intravenous injection of 740 MBq of ^{99m}Tc MDP. Whole-body images revealed an increased tracer activity in all of the clinically actively involved joints (wrist, finger, knee and ankle joints), and an extra-skeletal uptake of ^{99m}Tc MDP in the periarticular soft tissue of both knees (more on right one) extended almost up to the proximal extremity of the right leg (Figure 1).

To improve the anatomical description of the soft tissue of the knees and to clarify the nature of extra-skeletal ^{99m}Tc MDP uptake, a magnetic resonance imaging (MRI) of this region was performed with T1-weighted turbo spin-echo coronal and axial pulse sequences (T1w TSE), T2-weighted turbo spin-echo fat-suppressed coronal and axial pulse sequences (T2w TSE FS) and T1-weighted fast-field-echo fat-suppressed axial pulse sequences (T1w FFE FS).

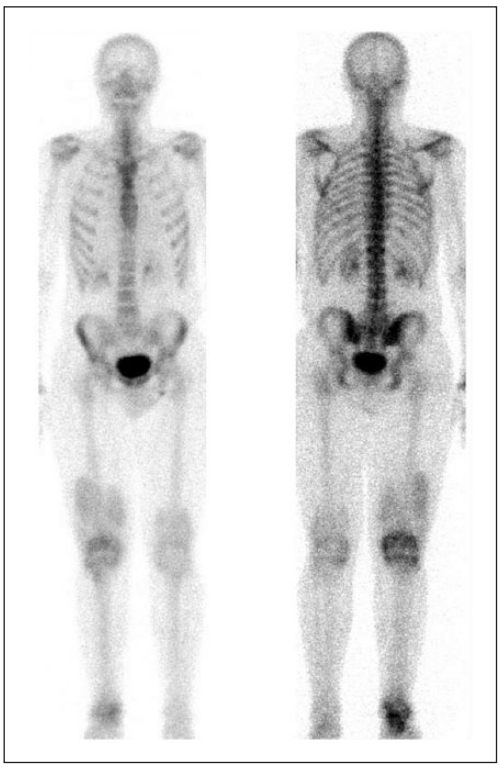

Figure 1. Whole-body images of ^{99m}Tc MDP anterior and posterior views with a high-resolution collimator using a 256 × 1024 matrix (>200,000 counts).

The MRI images demonstrated a remarkable fluid relaxation of the joint cavity of both knees (more on the right one) that was maximal at the entheseal insertions, and it was extended up to vastus lateralis and medialis muscles. Moreover, the synovial membrane appeared very dense and thickened as expected in chronic inflammatory disease. Morphological analysis of knee synovial membrane obtained by arthroscopy confirmed vascularity and inflammatory cell infiltration such as synovitis or arthritis. The image fusion between the two techniques is shown in Figure 2.

Discussion

Our case report is not the only work in which the bone scintigraphy has shown extra-skeletal uptake of ^{99m}Tc MDP; furthermore, many studies are shedding light regarding this.

In particular, a retrospective study describes the radionuclide three-phase whole-body bone imaging (TPWBBI) technique and its capacity in detecting abnormalities of the captation of the ^{99m}Tc MDP.

This study recruited 542 subjects, on which a triphasic scintigraphy was performed. Results showed that 394 patients had abnormal extra-osseous uptake during phases one and two. Of these, specifically, 166 presented extra-osseous lesions, including various vascular diseases: abdominal aortic aneurysms, peripheral vascular diseases and renal

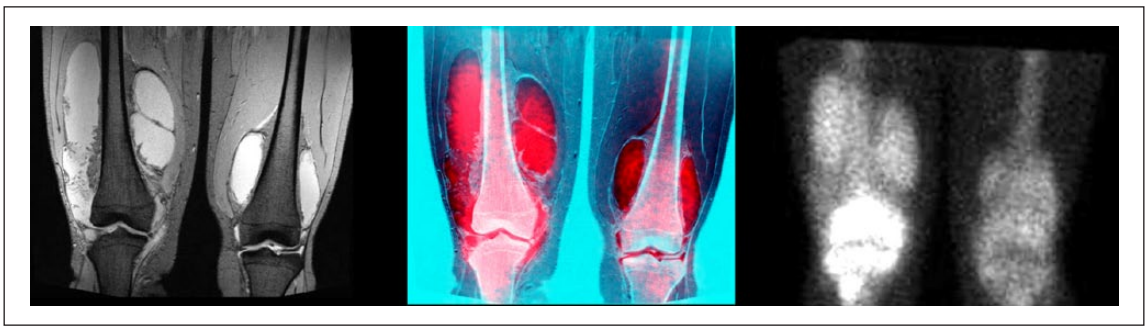

Figure 2. Coronal T2*-weighted gradient-echo image (left) and planar ^{99m}Tc MDP (right). In the center, for visualization purposes, the MR image is represented in inverted color scale, with the red channel of the RBG image substituted by the MDP image.

abnormalities, liver abnormalities, ascites and pleural effusions. Many of these significant findings were incidentally detected and would not have been identified on conventional static bone images. It helps to differentiate among acute and chronic fractures, active and inactive inflammatory diseases such as arthritis or osteomyelitis, and Paget's disease.[8]

Even if the scintigraphic scan was not acquired during the inflammatory phase of polyarthritis, as the laboratory tests proved, also in late phase of osteoarthritis, the inflammation of the synovial membrane is associated with alterations in the adjacent cartilage which in turn amplifies synovial inflammation, creating a vicious circle[9] and so the abnormal production of synovial fluid.

So, the increased regional perfusion and permeability in the chronically inflamed knee joint caused an extravasation of ^{99m}Tc MDP into the edematous and abnormal expanded synovial interstitium, but do not explain the extra-osseous ^{99m}Tc MDP uptake. The radiotracer has to bind to calcium and urate crystals[10] to obtain extra-osseous uptake, but neither macro- nor micro-calcification was present in the synovial membrane, as revealed through X-ray images and arthroscopy; moreover, a chronic smoldering abscess usually evokes a less severe exudative response.

Among the several techniques available in the diagnosis of arthritis, surely, the bone scintigraphy is one of the highly recommended methods due to permitting whole-body scan of the skeleton, using a low-dose radiations at a low cost.

The scintigraphic datum has the advantage of corroborating the information obtained by clinical tests and laboratory analysis; as a matter of the fact, the scintigraphy body scan is able to select in one single examination all involved joints or extra-osseous uptakes that need further diagnostic insights.

As reported in this case, the patient with acclaimed symptoms of arthritis first underwent to bone scintigraphy and afterward to MRI, in order to feature the pathological uptake of the ^{99m}Tc MDP.

In addition, bone scintigraphy can be performed on a larger number of patients, because it can be used in claustrophobic patients, in the presence of unsuitable magnetic metallic prosthesis and in subjects with including metallic foreign bodies or cardiac pacemaker bearers.

Conclusion

The bone scintigraphy plays an important role in the evaluation of polyarthritis both in diagnosis and in follow-up consultations.

In polyarthritic patients, whole-body bone scintigraphy has been useful in examining the totality of the joints and detecting possible extra-osseous uptake of dubious interpretation; in fact, it is able to select subjects who need further, if necessary, second-level instrumental examinations, such as MRI.

However, even if in the literature ^{99m}Tc-labeled phosphonate binding has been reported in a number of soft tissue conditions, the and casuistry of extra-osseous uptake in polyarthritic subjects more studies are required to better understand and characterize this pathology.

Acknowledgements

The authors thank the staff of the Diagnostic Imaging Clinics of the University of Naples Federico II. The authors state that all research materials related to paper can be accessed. The authors also thank Billy Samuel Hill for the linguistic review.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

References

1. Galasko CS. Mechanism of uptake of bone imaging isotopes by skeletal metastases. *Clin Nucl Med* 1980; 5: 565–568.
2. Loutfi I, Collier BD and Mohammed AM. Nonosseous abnormalities on bone scans. *J Nucl Med Technol* 2003; 31: 149–153.
3. Hervás Benito I, Vera Espallardo F, Bello Arques P, et al. Soft tissue malignant fibrous histiocytoma. Visualization in bone scintigraphy. *Rev Esp Med Nucl* 2001; 20: 544–546.
4. Ergun EL, Kiratli PO, Gunay EC, et al. A report on the incidence of intestinal ^{99m}Tc-methylene diphosphonate uptake of bone scans and a review of the literature. *Nucl Med Commun* 2006; 27: 877–885.
5. Ceylan Gunay E, Erdogan A and Apaydin D. Unusual extraosseous tumoral accumulation of ^{99m}Tc-MDP in non-Hodgkin's lymphoma in two cases. *Rev Esp Med Nucl* 2011; 30(3): 162–164.
6. Peller PJ, Ho VB. and Kransdorf MJ. Extraosseous Tc-99m MDP uptake: a pathophysiologic approach. *RadioGraphics* 1993; 13: 715–734.
7. Soundararajan R, Naswa N, Sharma P, et al. SPECT-CT for characterization of extraosseous uptake of ^{99m}Tc-methylene diphosphonate on bone scintigraphy. *Diagn Interv Radiol* 2013; 19: 405–410.
8. Yang DC, Ratani RS, Mittal PK, et al. Radionuclide three-phase whole-body bone imaging. *Clin Nucl Med* 2002; 27(6): 419–426.
9. Sellam J and Berenbaum F. The role of synovitis in pathophysiology and clinical symptoms of osteoarthritis. *Nat Rev Rheumatol* 2010; 6: 625–635.
10. Allwright SJ, Cooper RA and Nash P. Trochanteric bursitis: bone scan appearance. *Clin Nucl Med* 1988; 13: 561–564.