Multimodality Molecular Imaging in Arthropathy Associated with Multiple Myeloma

Abstract

We report a patient with multiple myeloma (MM) and polyarthritis of large joints. During the staging of the disease, bone marrow diffusely involved by MM was clearly demonstrated by 99mTc-2-methoxy-isobutyl-isonitrile (MIBI) single-photon emission computed tomography/computed tomography (SPECT/CT) but not by 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography/CT images. On the other hand, a very intense uptake of 18F-FDG was detected in periarticular tissues of multiple joints, with nonabnormal 99mTc-MIBI accumulation. Rheumatology tests were negative. A subsequent bone scintigraphy demonstrated radiolabeled bisphosphonate accumulation in periarticular tissues, suggesting amyloid arthropathy.

Keywords: *18F-fluorodeoxyglucose, 99mTc-methylene diphosphonate, 99mTc-sestamibi, arthropathy, light-chain amyloidosis, multiple myeloma*

Ludmila Santiago Almeida, Stephan Pinheiro Macedo de Souza, Fernando Vieira Pericole de Souza[1], Fabiano Reis[2], Celso Dario Ramos

Department of Radiology, Division of Nuclear Medicine, Faculty of Medical Sciences, University of Campinas, [1]Department of Internal Medicine, Division of Hematology, Faculty of Medical Sciences, University of Campinas, [2]Department of Radiology, Faculty of Medical Sciences, University of Campinas, São Paulo, Brazil

A female patient, 46-year-old, presented nausea, vomiting, lower limb pain, weakness, and weight loss. Laboratory tests revealed renal failure, anemia, hypercalcemia, and monoclonal peak. Multiple lytic lesions in several ribs and vertebral bodies were identified on chest computed tomography (CT). Myelogram found 44% of clonal plasma cells, consistent with multiple myeloma (MM). The patient also exhibited polyarthritis of large joints, especially in the shoulders and hips. Rheumatology tests were negative. The patient was referred to the nuclear medicine unit for staging.

Marked 99mTc-2-methoxy-isobutyl-isonitrile (MIBI) uptake throughout the skeleton, consistent with diffuse bone marrow (BM) involvement by MM, was evidenced by planar images (arrows on posterior view in [Figure 1a] and single-photon emission computed tomography (SPECT)/CT (arrows on axial plane in Figure 1b). 18F-fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT did not detect BM disease [Figure 1c]. This divergence was previously described between the two methods, which were reported as complementary.[1-5] In fact, MIBI is more sensitive than FDG to identify diffuse BM involvement by MM.[1-5]

On the other hand, FDG PET/CT revealed multiple hypermetabolic areas symmetrically involving large joints, especially the pelvic girdle, suggestive of active arthropathy (arrows in Figure 1d). MIBI images, which are not sensitive for inflammatory processes, presented normal tracer uptake in these areas [Figure 1a and b]. Periarticular FDG uptake in arthropathy associated with MM has been previously reported[6] and related to light-chain amyloid arthropathy. FDG uptake in rheumatoid arthritis and other rheumatic diseases has also been reported.[7,8] Biopsy of periarticular lesions was indicated for the confirmation of amyloid deposition, which could not be performed owing to the severity of the clinical condition of the patient.

Planar and SPECT/CT 99mTc-methylene diphosphonate (MDP) images were then carried out. These images showed high periarticular and articular MDP uptake in the same joints with FDG uptake, including periarticular soft tissues, more intense in the pelvic girdle (arrows Figure 1e), suggesting extraosseous periarticular amyloid deposits clearly demonstrated by SPECT/CT images (arrows in Figure 1f). There was no CT evidence of calcification in these areas (Figure 1f).

Bone scintigraphy has long been reported to have no place in the routine staging of MM because of its very low sensitivity

How to cite this article: Almeida LS, de Souza SP, de Souza FV, Reis F, Ramos CD. Multimodality molecular imaging in arthropathy associated with multiple myeloma. Indian J Nucl Med 2022;37:290-2.

Address for correspondence:
Prof. Celso Dario Ramos, Department of Radiology, Division of Nuclear Medicine, Faculty of Medical Sciences, University of Campinas, Zeferino Vaz Avenue, S/N. PO Box 6149, São Paulo, Brazil.
E-mail: cdramos@unicamp.br

Received: 19-12-2021
Revised: 12-02-2022
Accepted: 23-02-2022
Published: 02-11-2022

Access this article online

Website: www.ijnm.in

DOI: 10.4103/ijnm.ijnm_205_21

Quick Response Code:

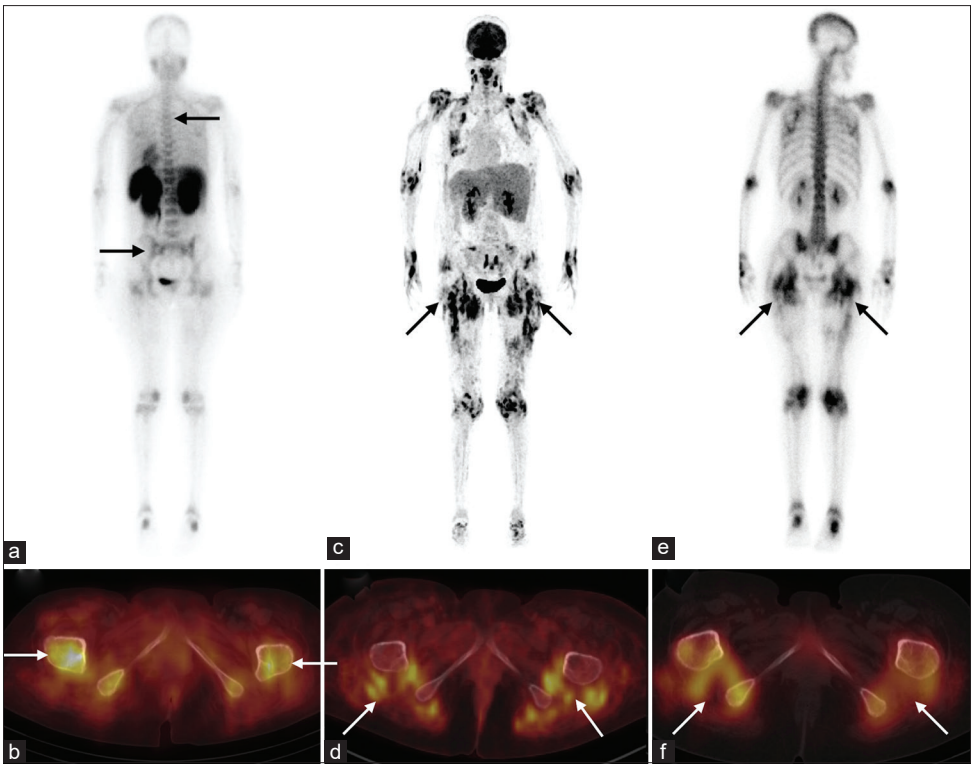

Figure1: 46-year-old female patient diagnosed with multiple myeloma. Posterior planar view (a) and SPECT/CT axial slice (b) of 99mTc-MIBI images showed tracer uptake throughout the skeleton, consistent with diffuse bone marrow involvement (arrows). Maximum intensity projection (c) and axial slice of FDG-PET/CT images (d) detected multiple hypermetabolic areas symmetrically involving large joints, especially the pelvic girdle, suggestive of active arthropathy (arrows). Posterior planar view (e) and SPECT/CT axial slice (f) of 99mTc-MDP images showed high periarticular and articular MDP uptake in the same joints with FDG uptake, more intense in the pelvic girdle, suggesting extraosseous periarticular amyloid deposits (arrows)

for bone and extraosseous lesions.[9] However, MDP and other bisphosphonates have been reported to accumulate in MM-associated light-chain amyloidosis, affecting different organs and tissues, with relatively high specificity,[10-12] including periarticular tissues.[10] On the other hand, MDP is not expected to accumulate in the periarticular tissue in rheumatoid arthritis or osteoarthritis.[13]

Molecular imaging can access several aspects of disease activity in MM-associated arthropathy, including neoplastic activity, inflammation, and amyloid deposition.

Declaration of patient consent

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

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Mosci C, Pericole FV, Oliveira GB, Delamain MT, Takahashi ME, Carvalheira JB, *et al.* 99mTc-sestamibi SPECT/CT and 18F-FDG-PET/CT have similar performance but different imaging patterns in newly diagnosed multiple myeloma. Nucl Med Commun 2020;41:1081-8.
2. Fonti R, Pace L, Cerchione C, Catalano L, Salvatore B, De Luca S, *et al.* 18F-FDG PET/CT, 99mTc-MIBI, and MRI in the prediction of outcome of patients with multiple myeloma: A comparative study. Clin Nucl Med 2015;40:303-8.
3. El-Shirbiny AM, Yeung H, Imbriaco M, Michaeli J, Macapinlac H, Larson SM. Technetium-99m-MIBI versus fluorine-18-FDG in diffuse multiple myeloma. J Nucl Med 1997;38:1208-10.
4. Cascini GL, Cuccurullo V, Tamburrini O, Mansi L, Rotondo A. Nuclear medicine in multiple myeloma – More than diagnosis. Nucl Med Rev Cent East Eur 2010;13:32-8.
5. Myslivecek M, Bacovský J, Scudla V, Koranda P, Minarík J, Buriánková E, *et al.* 18F-FDG PET/CT and 99mTc-MIBI scintigraphy in evaluation of patients with multiple myeloma and monoclonal gammopathy of unknown significance: Comparison of methods. Klin Onkol 2010;23:325-31.
6. Mekinian A, Ghrenassia E, Pop G, Roberts S, Prendki V, Stirnemann J, *et al.* Visualization of amyloid arthropathy in light-chain systemic amyloidosis on F-18 FDG PET/CT scan. Clin Nucl Med 2011;36:52-3.
7. Hotta M, Minamimoto R, Kaneko H, Yamashita H. Fluorodeoxyglucose PET/CT of arthritis in rheumatic diseases: A pictorial review. Radiographics 2020;40:223-40.
8. Kubota K, Yamashita H, Mimori A. Clinical value of FDG-PET/

CT for the evaluation of rheumatic diseases: Rheumatoid arthritis, polymyalgia rheumatica, and relapsing polychondritis. Semin Nucl Med 2017;47:408-24.

9. Dimopoulos M, Terpos E, Comenzo RL, Tosi P, Beksac M, Sezer O, *et al.* International myeloma working group consensus statement and guidelines regarding the current role of imaging techniques in the diagnosis and monitoring of multiple Myeloma. Leukemia 2009;23:1545-56.
10. Kanoh T, Uchino H, Yamamoto I, Torizuka K. Soft-tissue uptake of technetium-99m MDP in multiple myeloma. Clin Nucl Med 1986;11:878-9.
11. Demirel K, Sadic M, Korkmaz M, Comak A, Atilgan HI, Koca G. Diffuse myocardial uptake of (99m) Tc-HDP in multiple myeloma. Nucl Med Mol Imaging 2013;47:208-11.
12. Janssen S, Piers DA, van Rijswijk MH, Meijer S, Mandema E. Soft-tissue uptake of 99mTc-diphosphonate and 99mTc-pyrophosphate in amyloidosis. Eur J Nucl Med 1990;16:663-70.
13. Abdelhafez YG, Hagge RJ, Badawi RD, Raychaudhuri SP, Chaudhari AJ. Early and delayed 99mTc-MDP SPECT/CT findings in rheumatoid arthritis and osteoarthritis. Clin Nucl Med 2017;42:e480-1.