Article published online: 2022-05-19

Case report

Use of Marrow Scintigraphy to Confirm Compensatory Marrow Rather than Active Myeloma

Twyla B. Bartel, Tracy L. Yarbrough, Lorraine E. De Blanche[1]

Global Advanced Imaging, PLLC, Little Rock, Arkansas, [1]Central Arkansas Radiation Therapy Institute, Little Rock, Arkansas, USA

Abstract

We present the case of a 40-year-old male with multiple myeloma for whom bone marrow scintigraphy was utilized to help differentiate between active bony myelomatous disease versus treated lesions with compensatory marrow uptake. This case demonstrates technetium (Tc-99m) sulfur colloid imaging as an inexpensive technique to quickly distinguish between active focal bone disease and reactive marrow.

Keywords: Fluorodeoxyglucose, marrow scintigraphy, multiple myeloma, plasmacytoma

Introduction

F-18-fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET-CT) and magnetic resonance imaging/diffusion-weighted imaging with background body signal suppression (MRI/DWIBS) are well-established imaging modalities for the identification of myelomatous bone disease and for gauging response to treatment. However, previously active foci may not demonstrate immediate resolution on imaging (such as MRI) after therapy, or focal uptake may be confounded by a marrow response to treatment. In addition, there are times when focal uptake on FDG-PET after treatment is discordant with clinical and laboratory parameters of remission. We present the case of a 40-year-old male with a history of multiple myeloma who was in remission after treatment by all parameters except FDG-PET/CT where there were an increased number of foci of uptake in the appendicular skeleton. Technetium (Tc-99m) sulfur colloid bone marrow scintigraphy was utilized to clarify this discrepancy and demonstrate that the uptake was due to compensatory marrow rather than new active myelomatous bone foci.

Access this article online

Quick Response Code:

Website: www.wjnm.org

DOI: 10.4103/1450-1147.172303

Case Report

On initial evaluation, a 40-year-old white male was diagnosed with an isolated left proximal humerus solitary plasmacytoma at a time in which his bone marrow biopsy was normal. Free kappa (normal, 0.33–1.94 mg/dL) and lambda (normal, 0.57–2.63 mg/dL) light chain (LC) levels were elevated at 50 mg/dL and 13.1 mg/dL, respectively. Despite being treated with radiotherapy to the left shoulder (5,040 cGy in 28 fractions) and with concomitant steroids, free LC levels continued to rise indicating that the left shoulder plasmacytoma was unlikely to be the only site of disease involvement.

When the patient first presented to us for further workup, FDG-PET/CT imaging was performed and demonstrated increased focal uptake in the known left humerus plasmacytoma with a large lytic component. Measurement on corresponding MRI revealed a 4.9 cm × 3.2 cm × 2.6 cm anterior-posterior (AP) lesion without extension into the soft tissues. In addition, MRI/DWIBS and FDG-PET/CT imaging were concordant showing additional active myelomatous bone lesions elsewhere [Figure 1]. Bone marrow evaluation (taken from the iliac bone) showed 50% cellularity and 25–30% plasma cells. Kappa LC had risen to 118 mg/dL and lambda LC to 23 mg/dL. The patient was then treated with thalidomide and dexamethasone and showed improvement in all laboratory and pathological parameters.

Address for correspondence:
Dr. Twyla B. Bartel, Global Advanced Imaging, PLLC, PO Box - 241373, Little Rock - 72223, Arkansas, USA. E-mail: globaladvancedimaging@gmail.com

Subsequently, the patient had clinical hematopoietic recovery in the absence of stem cell support, and follow-up and MRI/DWIBS demonstrated stable focal bone disease without evidence of progression [Figure 2]. Of note, splenic visibility on DWIBS is highly variable and may not correlate with disease activity. All abnormal laboratory values had resolved. Despite this, FDG-PET showed multiple new focal areas of hypermetabolic activity in the appendicular skeleton, while prior known myelomatous lesions showed stability or resolved uptake [Figure 3a and b]. It was postulated that these new areas of FDG uptake represented expansion of normal bone marrow as a compensatory mechanism in a setting where the marrow stroma in other areas had been exhausted. This was confirmed with Tc-99m-sulfur colloid bone marrow scintigraphy [Figure 3c]. Areas of known prior active myeloma on FDG-PET (arrows) showed little to no uptake or uptake equivalent to background marrow activity on the marrow images. Reactive/compensatory marrow showed physiologically increased uptake on sulfur colloid imaging including in the areas of new focal appendicular uptake on FDG-PET (block arrows). Notably, the previously irradiated area in the left shoulder did not show uptake on any of the imaging studies, and the most intense focus seen on the initial FDG-PET at our institution in the right shoulder was equivalent to normal marrow activity on the Tc-99m sulfur colloid scan. The patient remained in remission, and subsequent FDG-PET/CT imaging demonstrated eventual resolution of all foci of abnormal uptake.

Discussion

Tc-99m sulfur colloid scintigraphy is based upon an intact reticuloendothelial system (RES). Of particular interest to us in this case was imaging of phagocytic reticular cells in the bone marrow. Normal marrow scintigraphy demonstrates homogenous uptake in the axial skeleton and the proximal one-third of the humeri and femurs.[1,2] When there is peripheral expansion of the marrow (which can be seen after irradiation or chemotherapy), uptake may be seen more distally in the appendicular skeleton; the pattern of uptake in this setting has been reported to be occasionally more focal than homogeneous, as in our case. Additionally, it has been reported that RES marrow extension is predictive of poor tolerance to further chemotherapy. Processes that would infiltrate the marrow such as infection or tumor (such as with multiple myeloma), and even areas of infarction or prior irradiation, can show cold defects (decreased uptake compared to the normal marrow) on marrow scintigraphy.[3-6]

This is a single case in which marrow scintigraphy helped to confirm marrow expansion rather than tumor involvement when FDG-PET was discordant with clinical and laboratory parameters. It is known that the time course of focal lesion resolution on MRI is longer than that of FDG-PET and, therefore, MRI was not useful in differentiating between disease improvement versus progressing disease in this setting. While marrow scintigraphy has been used previously in similar settings involving other tumor types and in another single case regarding multiple myeloma, we are unaware of reports specifically discussing its use in the management of a myeloma patient when other imaging studies such as FDG-PET and/or MRI/DWIBS are discordant.[7] Also, marrow scintigraphy utilized as a

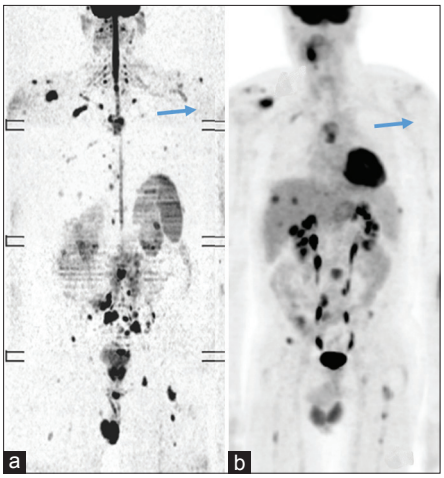

Figure 1: MRI/DWIBS (left, a), FDG-PET (right, b) maximum intensity projection images at the time of patient presentation to us demonstrate multiple foci of abnormal bony uptake. The reported left humerus plasmacytoma uptake had resolved (blue arrows) after treatment (which included radiation) at another institution prior to presentation to our institution

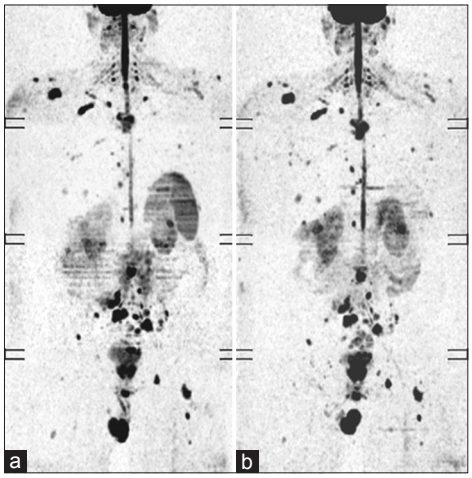

Figure 2: MRI/DWIBS maximum intensity projection images (left, a –initial presentation to us, same as image in Figure 1a; right, b after treatment at our institution). When the patient initially presented to us, there were multiple foci on DWIBS. This was concordant with laboratory and clinical parameters at that time for active myelomatous bone disease. These foci remained stable and/or decreased in intensity after treatment without new foci seen (b). This was concordant with concurrent clinical and laboratory parameters (It has been shown that foci do not immediately resolve on MRI after treatment)

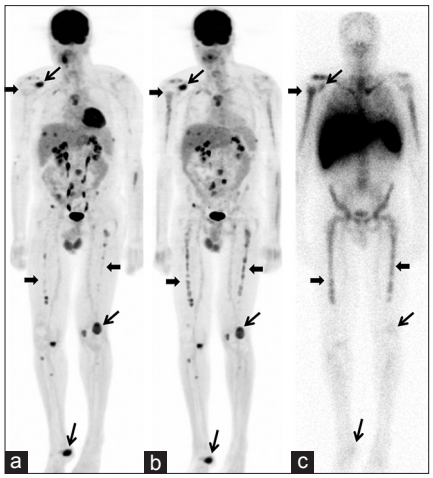

Figure 3: FDG-PET maximum intensity projection images (left, a – initial presentation to us, same as image in Figure 1b; middle, b after treatment under us) and Tc-99m sulfur colloid marrow scintigraphy after treatment at our institution (right, c). After treatment (b) prior known active myeloma bone foci were stable-to-improved by standardized uptake values on PET, but several new appendicular foci were noted. Marrow scintigraphy (c) confirmed the new appendicular foci to be compensatory rather than new myelomatous bone lesions which was concordant with concurrent laboratory and clinical parameters

whole-body approach for evaluation of the RES has not been reported frequently in recent years. With this case, we provide a current demonstration of its utility again, especially for a total body view of functioning marrow versus areas of tumor involvement.[8]

Overall, marrow scintigraphy is well-tolerated, inexpensive, and delivers a relatively low radiation dose to patients. Thus, we propose that marrow scintigraphy be considered in patients with multiple myeloma in whom the differentiation between active myelomatous disease and reactive marrow is necessary for treatment planning and decision-making.

References

1. Widding A, Smolorz J, Franke M, Linden A, Diehl V, Schicha H. Bone marrow investigation with technetium-99m microcolloid and magnetic resonance imaging in patients with malignant melolympho-proliferative diseases. Eur J Nucl Med 1989;15:230-8.
2. Dass C, Parker JA. Joint Program in Nuclear Medicine: Bone Marrow Scintigraphy. 1997. Available from: http://www.med.harvard.edu/JPNM/TF96_97/Feb11/WriteUp.htmlhttp://www.med.harvard.edu/JPNM/TF96_97/Feb11/WriteUp.html. [Last accessed on 2015 Sep 16].
3. Siddiqui AR, Oseas RS, Wellman HN, Doerr DR, Baehner RL. Evaluation of bone-marrow scanning with technetium-99m sulfur colloid in pediatric oncology. J Nucl Med 1979;20:379-86.
4. Henry RE, Fletcher JW, Saloric-George E, Donati RM. Effect of granulocytopenia, marrow suppressive drugs and infection on marrow reticuloendothelial patterns. J Nucl Med 1974;15:343-8.
5. Liu Y, Zhang Y, Hao W, Liu D, Li A, Chen C. Localized residual leukaemia in bone marrow of extremities. Nucl Med Commun 2008;29:542-5.
6. Agool A, Glaudemans AW, Boersma HH, Dierckx RA, Vellenga E, Slart RH. Radionuclide imaging of bone marrow disorders. Eur J Nucl Med Mol Imaging 2011;38:166-78.
7. Feggi LM, Spanedda R, Scutellari PN, Prandini N, Gennari M, Orzincolo C, *et al*. Bone marrow scintigraphy in multiple myeloma. A comparison with bone scintigraphy and skeletal radiology. Radiol Med 1988;76:311-5.
8. Datz FL, Taylor A Jr. The clinical use of radionuclide bone marrow imaging. Semin Nucl Med 1985;15:239-59.

How to cite this article: Bartel TB, Yarbrough TL, De Blanche LE. Use of marrow scintigraphy to confirm compensatory marrow rather than active myeloma. World J Nucl Med 2016;15:203-5.

Source of Support: Nil. **Conflict of Interest:** None declared.