

Catheter Related Artifacts on Bone Scans: Report of Two Cases

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(Received 20 September 2005, Revised 10 October 2005, Accepted 15 October 2005)

Introduction

Bone scanning using the ^{99m}Tc-phosphate analogs is an established diagnostic modality and a commonly requested radioisotope examination for a variety of pathologies involving the skeleton, such as osteomyelitis, bony metastases, and occult fractures. The bone scan is one of the most commonly requested procedure in most nuclear medicine department. The images show areas of increased and decreased activity usually related to the bone turnover. The bone scan is interpreted by evaluating the pattern of radioactive localization in the skeleton and identifying areas of increased uptake (hot spots) or, less frequently, decreased or absent activity (1). Unfortunately, the findings are most often very nonspecific and do not tell us the exact underlying cause of the abnormal activity. A variety of factors may change the normal distribution of bone-seeking radiopharmaceuticals. Although most of the times these areas of abnormal radiotracer activities are due to true pathologic bone states, however, it is not infrequent that they are caused by technical errors such as urinary contamination, nonuniformity of gamma camera, and attenuation of activity by foreign bodies. These artifactual causes warrant careful attention to prevent unnecessary interventions. In certain conditions, nonosseous structures other than the urinary tract are seen on the bone scan. For example, there may be localized muscle uptake, such as myositis ossificans, or localization in a pleural effusion. Such serendipitous findings may constitute welcome diagnostic information (1). On the other hand, soft-tissue uptake may at times hamper interpretation of the study by bringing in artifacts that degrade the quality of the images. Therefore, recognition of patterns of nonbony uptake is important for correct identification of artifacts and accurate interpretation of the scan (1). This paper presents two cases of artifactual causes of odd radiotracer activity in bone scans. In both cases the artifact is at least somewhat related to an indwelling catheter.

Key words: Bone scan, Catheter, Artifact

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Case 1

Central Venous Catheter Detected on a Routine Tc-99m MDP Bone Scan

A 23 yr old man with ALL was referred for a bone scan as part of investigation for left knee arthritis. Increased uptake in the region of the left knee was observed. Moreover, abnormal linear activities in the right border of sternum and right infraclavicular region were noted. These areas

were initially interpreted as abnormal bony lesions. CXR confirmed presence of a catheter in the right brachiocephalic vein and superior vena cava and was determined that the abnormal scintigraphic findings were because of radiotracer adhesion to the indwelling central venous line (2, 3). This case emphasizes the importance of obtaining accurate clinical history prior to interpreting scintigraphic studies.

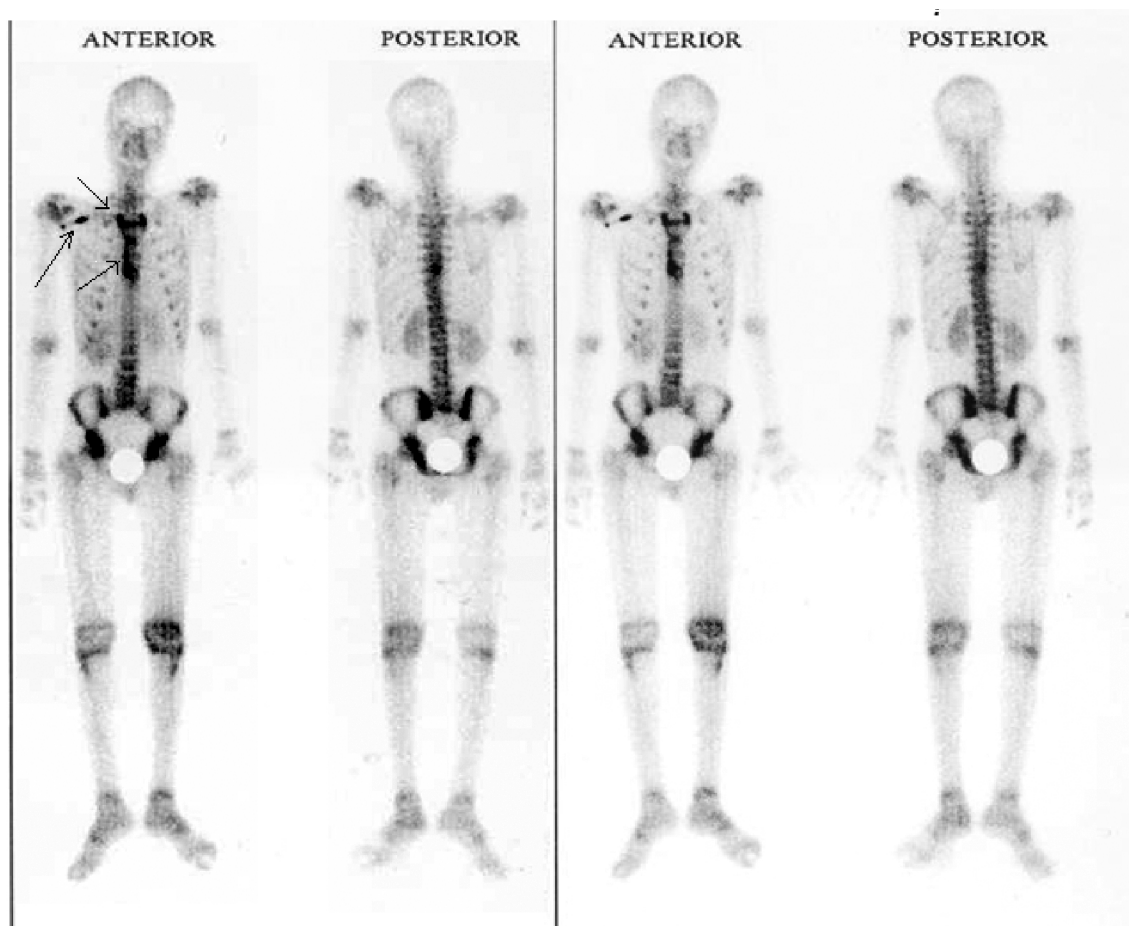


Fig 1. Skeletal scintigraphy using Tc-99m MDP of a 23-year-old man with ALL (acute lymphocytic leukemia) who had experienced few days of swelling and pain in the left knee. The scan showed zones of abnormal activity in the right parasternal area and also a linear activity in the right infraclavicular region (arrows). A Chest radiograph was requested for better assessment of the underlying cause.



Fig 2. A posterior chest radiograph was obtained and showed a percutaneous central venous line placed in the right brachiocephalic vein and superior vena cava, corresponding to the zones of abnormal radiotracer activity in the right infraclavicular and parasternal areas of whole body bone scan. Abnormal scan findings were interpreted then as radiotracer adhesion to the catheter walls.

Case 2

Unusual Misplacement of a Subclavian Vein Catheter Detected on a Bone Scan

A 19-year-old severely ill female with a previous history of nonhodgkin lymphoma and congestive heart failure presented with low back pain and was referred for a whole body bone scan as part of investigation for possible skeletal metastases. Presence of the diffuse superficial phlebitis of the extremities made the superficial venipunctures difficult. After multiple unsuccessful try of venipuncture of the upper and lower extremities for direct intravenous radiotracer injection, 740 MBq (20 mCi) of Tc-99m MDP was injected via the indwelling central venous catheter inserted in the right

subclavian vein. Whole body static imaging (Fig. 3) was performed 3 hours later and revealed unexpectedly increased radiotracer accumulation in the liver. Radiological images (not available) showed that the indwelling catheter had passed the right side of the heart and located in the inferior vena cava. Therefore, it was concluded that radiotracer was pushed into the hepatic vein (via the indwelling catheter misplaced in the common hepatic vein) and distributed retrogradely throughout the liver.

Although misplacement of subclavian catheters into the inferior vena cava have been widely appreciated (4, 5), however, as to our knowledge, this unusual pattern indicative of catheter entrance into the hepatic vein and

retrograde distribution of radiotracer into the liver parenchyma has not been reported in the medical literature. In fact, it was only an accidental finding and can be a well-known fact for those who are familiar with nuclear medicine practice (6, 7, 8). However, it makes a new and easy approach for checking the exact and correct positioning of the internal catheters. In current practice, chest radiographs are conventionally performed after central venous catheter insertion to define catheter position. We suggest that as an alternative approach to the postinsertion radiological control of catheters, it can be possible to control the proper localization of the various kinds of the internal catheters with the injection of small doses of readily available radiotracers, such as ^{99m}Tc -pertechnetate. A

small dose of ^{99m}Tc -pertechnetate (e.g. 37-74 MBq), with a radiation dose of only 0.05-0.1 mSv effective equivalent dose to total body, have a lower radiation dose comparing to the conventional radiological procedures commonly used for these purposes. Also if a gamma probe is available, the procedure of localization of the tip of the catheter can be performed on the bedside of the patient. However, this approach must be addressed in large series of patients.

Conclusion: The appearance of both skeletal and soft-tissue uptake depends heavily on imaging technique (such as the route of radiotracer administration) and the practitioner should be aware of the impact of technical factors on image quality.

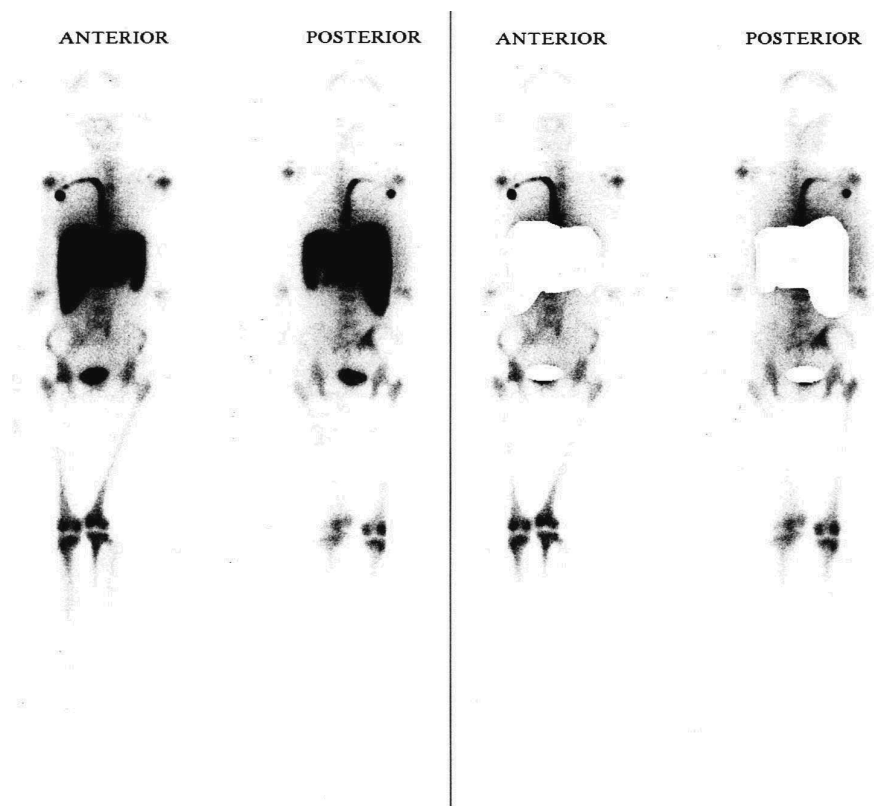


Fig 3. Whole body static images showed increased ^{99m}Tc -MDP accumulation throughout the liver.

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