

Unintentional human skeletal imaging with ^{99m}Tc -methylene diphosphonate 45 months beyond expiration

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Eight patients were inadvertently administered, and imaged with, ^{99m}Tc -labeled MDP which was 45 months expired. Two cases are presented. All patients were subsequently imaged with normal MDP. The images obtained with expired MDP were clinically acceptable. No differences in scan abnormalities were observed compared with normal MDP for any of the patients. None of the patients suffered any side effects attributable to the expired MDP.

Key words: MDP skeletal imaging, expired MDP, MDP chemical stability, skeletal imaging with expired MDP

INTRODUCTION

RECENTLY at my institution eight planar, whole body skeletal scintigraphy patients were inadvertently administered, and subsequently imaged with, ^{99m}Tc -labeled, expired methylene diphosphonate (MDP). The MDP in the single vial utilized (Amersham Healthcare, Arlington Heights, IL, USA) was determined to be 45 months beyond its manufacturer's specified expiration date at the time of administration to the patients. The expired MDP vial had been stored in darkness at temperatures between 2°C and 4°C. This single, isolated event due to an administrative error is presently under hospital administration review. All eight patients were scanned with normal (unexpired) MDP at a later date. The human *in-vivo* toxicity and image quality of MDP as a function of time have been investigated to set practical limits on a safe and useful shelf-life for the compound. No apparent human toxicity of MDP as a function of time is reported in the literature.^{1,2} Analytic laboratory methods have been employed to study the long term stability of the ^{99m}Tc -labeled MDP molecule. These investigations have determined that the efficiency and strength of the labeling bond tend to degrade as a function of MDP age.^{3,4} Further animal and human studies have shown that as the age of the MDP

increases, the loss of efficiency and strength in the ^{99m}Tc -MDP bond results in free pertechnetate concentrating in the thyroid gland.^{5,6} No reports of human imaging with MDP years beyond the manufacturer's specified expiration date were found in the literature. In general the images obtained with the expired MDP were determined to be clinically acceptable, and no differences in scan abnormalities between expired and normal MDP images were observed for any of the patients. Due to legal requirements, only the images obtained with normal MDP were included in the patients' medical files. Two cases are presented.

CASE REPORTS

Patient #1 is a 39-year-old female with metastatic breast carcinoma with one previous cycle of chemotherapy and no prior surgery. The image (Fig. 1) was obtained as part of a routine metastatic follow up and scan parameters were as follows: posterior whole body image obtained with a planar gamma camera (Toshiba model 501, Japan) and a LEGP collimator. 740 MBq (20 mCi) of ^{99m}Tc -MDP were injected intravenously and the image was obtained two hours after injection. At the time of injection the MDP was 45 months beyond the manufacturer's specified expiration date. A single focal area of increased tracer uptake in the rear, 9th left rib was observed, consistent with a known lesion from previous scans. The mismatch between the two halves of the cranium was due to patient motion during image acquisition. The rest of the

Received January 18, 1999, revision accepted June 14, 1999.

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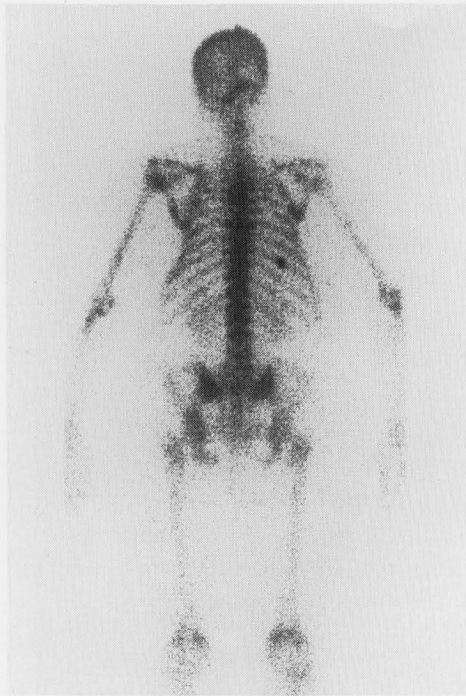


Fig. 1 Scan of patient #1 with expired MDP. The single abnormality in the posterior 9th rib was consistent with previous scans and a subsequent scan obtained with normal MDP. The mismatch in the skull was caused by patient motion during image acquisition.

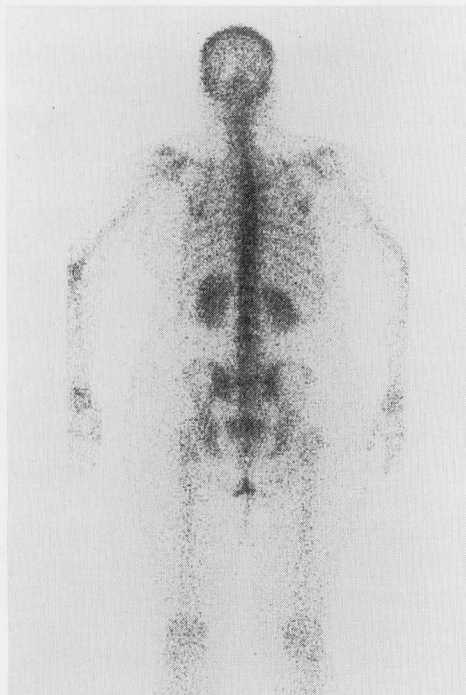


Fig. 2 Scan of patient #2 with expired MDP. The scan is normal, consistent with previous and a subsequent scan, with normal MDP.

scan is unremarkable.

Patient #2 is a 51-year-old female with a five year history of metastatic breast carcinoma who underwent a mastectomy and multiple cycles of chemotherapy. The image (Fig. 2) was obtained as treatment follow up, and scan parameters were as follows: posterior whole body image obtained on the same camera/collimator as patient #1, with 1110 MBq (30 mCi) of ^{99m}Tc -MDP. The image was obtained two hours after injection and the MDP was 45 months expired. No scan abnormalities were observed.

DISCUSSION

Patient obesity and the short time interval (2 hours) between radiopharmaceutical administration and image acquisition were important image quality degrading factors in both images. The MDP manufacturer states that images may be acquired two to four hours after radiopharmaceutical administration with the optimum time being three hours to optimize the skeletal to soft tissue uptake ratio. Due to busy workloads, we routinely image patients two hours after radiopharmaceutical administration, a time interval less than ideal but still within the manufacturer's recommended interval. In an attempt to improve image quality, patient #2 was injected with a higher dose (1110 MBq or 30 mCi) of the radiopharmaceutical. The factors affecting image quality therefore appear to be unrelated to the age of the MDP.

All eight patients in this group were scanned with normal MDP at a later date and no scan differences between the expired and normal MDP images were observed for any of the patients. These images suggest that it may be possible, although in no case recommendable, to obtain clinically acceptable skeletal images with expired MDP. None of the eight patients scanned suffered from any side effects attributable to the expired MDP.

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