Extraosseous Metastases Masquerading as Urine Contamination on Bone Scans

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Urine contamination is probably the most common cause of focal soft-tissue activity in the pelvis, thigh or legs as seen on a radionuclide bone scan. We report two cases of focal softtissue activity which were initially thought to represent urine contamination but were later proven to be extraosseous metastases. We present these two cases to illustrate that softtissue activity which is presumed to be caused by urine contamination must always be verified by washing off the suspected area and then obtaining an additional image to see if the activity has been removed or persists. This is particularly important in patients with primary malignant bone tumors and in tumors which have a propensity to produce calcification.

Focal areas of soft-tissue activity observed during technetium-99m (^{99m}Tc) bone scans are usually due to urine contamination, but may be due to an underlying lesion. The following case reports demonstrate such instances.

CASE REPORTS

Case 1

A 14-yr-old male presented with an osteosarcoma of the distal left femur (Fig. 1A). This was resected and a graft was inserted. A repeat radionuclide bone scan performed 6 mo later showed a small focal area of tracer in the medial aspect of the soft tissues of the distal left leg (Fig. 1B). This was assumed to represent urine contamination and was therefore overlooked. A subsequent study performed 3 mo later demonstrated marked enlargement of the soft-tissue lesion together with the appearance of other soft-tissue and bony metastases (Fig. 1C).

Case 2

A 40-yr-old male presented with an osteosarcoma of the proximal left tibia (Fig. 2A), and was treated with an aboveknee amputation. A repeat radionuclide bone scan performed 9 mo later demonstrated an area of tracer uptake in the left inguinal region. Upon washing this area to remove any possible urine contamination, a firm nodule was palpated, and repeat scanning confirmed the persistence of increased uptake (Fig. 2B). Biopsy of this nodule demonstrated metastatic osteosarcoma.

Case 3

A 32-yr-old man with an osteogenic sarcoma of the distal left femur demonstrated an area of tracer uptake in the medial left groin on initial radionuclide bone scan (Fig. 3A). Washing of this area caused the uptake to disappear (Fig. 3B), confirming that it was due to urine contamination.

DISCUSSION

Soft-tissue uptake of ^{99m}Tc-MDP (methylene diphosphonate) has been reported in many conditions (1-12). Although this is usually caused by processes that cause soft-tissue calcification or infarction, other mechanisms, including focal increased blood flow, increased blood content of lesions, collections of extracellular fluid and changes in endocrine function, have also been described (13). While metabolic disturbances tend to cause generalized or diffuse soft-tissue uptake of the bone scanning agents in the involved regions, neoplasms and their metastases usually cause more focal areas of soft-tissue uptake which may be mimicked by or attributed to urinary contamination. While the most common tumors which cause soft-tissue uptake of bone scanning agents include osteogenic sarcoma, chondrosarcoma, neuroblastoma, mucin-producing carcinomas and extraosseous plasmacytomas, many other tumors have been reported to take up boneseeking radiopharmaceuticals, including breast carcinoma, lung carcinoma, ovarian carcinoma, and lymphoma among others (14). When the calcification produced by these tumors of their metastases is macroscopic, it may often cause abnormal soft-tissue uptake on the bone scan. Occasionally the calcification may be demonstrated on radiographs and more frequently on computed tomography scans.

All bone imaging radionuclides are cleared from the blood stream predominantly by renal excretion with rapid accumulation of activity within the bladder (14). Therefore, it is common practice to ask the patient to void just before commencing the bone scan to eliminate the activity from the bladder. However, voiding often results in small amounts of radioactive contamination on the skin or clothing in the

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FIG. 1. (A) Radionuclide bone scan following i.v. administration of 15 mCi of ^{99m}Tc-MDP demonstrates focal increased tracer uptake in the distal left femur due to osteosarcoma. (B) Six months after resection of the osteosarcoma and insertion of a graft, a repeat scan with 15 mCi of ^{99m}Tc-MDP demonstrates no tracer uptake in this region. A small focal area of tracer uptake in the medial aspect of the soft tissues of the distal leg (arrow) was assumed to represent urine contamination. (C) A repeat scan 3 mo later with 15 mCi of ^{99m}Tc-MDP demonstrates marked enlargement of the soft-tissue lesion together with the appearance of other soft-tissue and bony metastases.



FIG. 2. (A) Radionuclide bone scan following i.v. administration of 15 mCi of 99mTc-MDP demonstrates focal increased tracer uptake in the proximal left tibia due to osteosarcoma. (B) A repeat scan 9 mo later with 15 mCi of 99mTc-MDP demonstrates a focal area of tracer uptake in the left inguinal region. The technologist was asked to repeat the study after cleaning this area. A large firm nodule was palpated, and repeat scanning showed persistence of the uptake. Biopsy of this mass revealed this to be a soft-tissue metastasis from the osteogenic sarcoma.

genital and inguinal regions. Occasionally, radioactive urine which is passed from the urethra to the fingers or hand can be deposited in more distant areas of the body by subsequent touching or scratching. Removal of contaminated clothing and/or cleansing of the skin may be required to prevent such contamination from obscuring or mimicking pathologic softtissue uptake.

The three case studies discussed in this report emphasize



FIG. 3. (A) Radionuclide bone scan following i.v. administration of 15 mCi of ^{99m}Tc-MDP demonstrates a focal area of tracer uptake in the medial left groin (arrow). (B) Repeat imaging after removal of urine showing disappearance of the apparent tracer uptake.

the importance of definitively excluding the presence of urine contamination. In the first case, the small focal area of uptake in the lower left leg was assumed to represent urine contamination and was therefore overlooked, and was actually an early soft-tissue metastasis from the patient's osteogenic sarcoma. In the second patient, a palpable soft-tissue metastasis from osteogenic sarcoma was found to cause the area of presumed contamination. In the third patient, an area of urine contamination mimicked a soft-tissue metastasis, but was removed on washing the area.

CONCLUSION

Although it requires more time and effort by the physician and technologist to prove whether an area of soft-tissue uptake on a bone scan is due to urinary contamination or not, active cleansing of areas of suspected urine contamination should

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be performed. This maneuver should prevent falsely diagnosing a soft-tissue lesion by presuming that an area of focal softtissue activity was due to urine contamination. This attention to detail is especially important in patients with pathologic conditions which are known to cause abnormal soft-tissue uptake of bone scanning agents.

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