Idiopathic Hepatic and Splenic Uptake of $^{99m}$Tc-Methylene Diphosphonate

Abstract
Tc-$^{99m}$methylene diphosphonate (MDP) bone scintigraphy is mainly directed toward identifying sites of altered skeletal metabolism and abnormal foci of calcium phosphate deposition due to various etiologies. One of the requirements of an ideal bone scintigraphy is little or no extraosseous uptake. Nonosseous uptake of MDP in the bone scintigraphy is an unusual finding. We report a case of carcinoma prostate referred for bone scan, where diffuse hepatic and splenic uptake has been seen on the bone scan. However, on a further repeat bone scan, there was no nonosseous uptake.

Keywords: Bone scan, idiopathic hepatic uptake, idiopathic splenic uptake, methylene diphosphonate, single-photon emission computerized tomography/computed tomography

A 67-year-old man, with type II diabetes mellitus for 25 years and hypertension for 15 years (on regular medication), biopsy-proven case of carcinoma prostate, was referred for bone scintigraphy to rule out the possibility of bone metastasis. He presented with complaints of low backache and swelling associated with pain in the left ankle for 2 months. The previous bone scintigraphy revealed increased osteoblastic activity at bilateral acetabulum and left ischium – metastatic. Ultrasonography of the abdomen and pelvis revealed Grade II prostatomegaly. Magnetic resonance imaging pelvis revealed features suggestive of carcinoma prostate with bony metastasis. The patient is on hormonal therapy for the past 1 year with no history of chemotherapy or radiotherapy. Biochemical investigations such as serum electrolyte, calcium, phosphate, creatinine, lactate dehydrogenase, and alkaline phosphate levels were in the normal limit during both the initial and repeat bone scans. The bone scan revealed diffuse and intense tracer uptake in the liver and, to a lesser degree, in the spleen. Relatively decreased skeletal uptake on the bone scan was also observed with foci of increased radiopharmaceutical uptake in the left pubic bone and the left side of the mandible [Figure 1].

Single-photon emission computerized tomography/computed tomography (SPECT/CT) of the pelvic region revealed increased radiopharmaceutical uptake in the superior rami of the left pubic bone with subtle sclerotic changes on low-dose CT. The bone scan of other patients done on the same day did not reveal such abnormal nonosseous tracer uptake.

A repeat bone scintigraphy with SPECT/CT of the pelvic region was performed 1 month later. There was considerably more skeletal uptake, and hepatic and splenic radiopharmaceutical localization was absent. Tc-$^{99m}$methylene diphosphonate (MDP) bone scintigraphy is routinely performed nuclear medicine procedure in the workup of a patient with carcinoma. Increased radiopharmaceutical uptake is seen in lesions having increased osteoblastic activity. Due to urinary excretion of Tc-$^{99m}$-MDP radiopharmaceutical, kidneys and urinary bladder are generally visualized [Figure 2].

Hepatic and splenic uptake of $^{99m}$Tc-MDP is an unusual finding in nuclear medicine practice, occurring less frequently than focal hepatic abnormalities. Table 1 lists several reported causes of diffuse hepatic uptake.

The most common reason in the current clinical scenario is scintigraphic studies involving the use of Tc-$^{99m}$-tagged colloid radiopharmaceuticals on the previous day to the bone scintigraphic study or misadministration of the radiopharmaceutical like $^{68}$Ga-citrate or $^{111}$In-labeled white blood cells. However, the patient did not have any scintigraphic study with radiocolloid on the previous day. Extraosseous localization of $^{99m}$Tc-MDP is rarely seen in literature. We report an unusual case of complete nonosseous uptake in the bone scintigraphy in a patient with carcinoma prostate.

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Table 1: Causes of abnormal diffuse hepatic activity with Tc-99m-methylene diphosphonate radiopharmaceuticals

| Cause                                                                 | Description                                                                 |
|----------------------------------------------------------------------|------------------------------------------------------------------------------|
| Residual radioactivity from previous colloid scan                     | Excess radioactivity from imaging system.                                     |
| Misadministration of radiocolloid                                     | Incorrect amount of radiopharmaceutical injected.                             |
| Excessive aluminum ion from generator                                  | High levels of aluminum in the body.                                          |
| Excessive serum aluminum                                              | Excess serum aluminum in the blood.                                           |
| Excessive hydrolyzed-reduced $^{99m}$Tc-MDP forming radiocolloids      | Formation of complexes that accumulate in tissues.                           |
| Injection of radioiodinated contrast medium following bone agent injection | Administration of radioactive substances after bone agent injection.          |
| Metastatic calcification                                              | Secondary bone growth due to cancer.                                          |
| Hepatic necrosis                                                      | Death of liver tissue due to injury or disease.                               |
| Metastatic calcification                                              | Secondary bone growth due to cancer.                                          |
| Conditions of iron therapy and iron overload                          | Iron accumulation due to treatment or disease.                               |
| MDP: Methylene diphosphonate                                           | Bone-seeking radiopharmaceutical.                                             |

Pathologic changes occur due to change in the normal physiological event. Extrasosseous localization of the bone-seeking radiopharmaceuticals in tissues other than kidney and urinary bladder should raise a suspicion of the underlying cause, and pathophysiological basis of pathology should always be kept in mind while interpreting the scan as it may have a tremendous impact on the further management and follow-up of the patient. Recognition of specific mechanisms and appearance of soft-tissue abnormalities on skeletal scintigraphy reduces the possibility of confusion and enhances the diagnostic value of the study.

Declaration of patient consent

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

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Conflicts of interest

There are no conflicts of interest.

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