

Diffused Pulmonary Uptake of Tc-99m Methylene Diphosphonate Bone Scan in Patient with Prostate Cancer without Blood Test and Correlative/Cross-Sectional Imaging Abnormalities: A Case Report

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ABSTRACT

Introduction: Bone scan using Tc-99m methylene diphosphonate (MDP) is a commonly used procedure for evaluating bone metastasis in cancer patients. Extra-osseous pulmonary uptake in bone scans is mostly an incidental finding and occurs in a multitude of disorders. Clinicians should be alert to any findings on clinical or complementary diagnostic tools. We presented a case of prostate cancer male patients who demonstrated diffuse pulmonary uptake on Tc-99m MDP bone scan without any blood test and correlative/cross-sectional imaging abnormality.

Case Presentation: An 80-year-old male with adenocarcinoma of the prostate with a Gleason score of 6 (3+3). The PSA level was 0.009. The patient had a history of recurrent atrial fibrillation (AF), postural dizziness, HTN, Gout, and chronic renal failure, but all of these comorbidities were under control. The patient underwent a bone scan to annually check for the presence of bone metastases. Three hours after administering 740 MBq Tc-99m MDP intravenously. The reports didn't show any increased uptake that would indicate metastases in the bones. Instead, diffuse bilateral pulmonary uptake and a mild increase in cardiac uptake were present. On the same day, a computed tomography (CT) scan of the thorax revealed 3 micro-nodules in the right upper lung that were described as benign lesions, and a chest X-ray confirmed normal results. The patient's laboratory results were within normal range, and there were no clinical lung symptoms or complaints. Considering the patient history of persistent AF, chronic renal failure, and a complaint of postural dizziness, the bone scan finding may indicate involvement of amyloidosis. The relationship between amyloidosis and cancer was also widely noted.

Conclusions: Tc-99m MDP may play a role in evaluating amyloidosis involvement in an uncommon place such as the lungs. Future research should focus on analyzing diagnostic options in the patient's condition in this situation.

INTRODUCTION

A common procedure for assessing bone metastases in cancer patients is a bone scan using Tc-99m methylene diphosphonate (MDP) [1]. Extra-osseous pulmonary uptake of bone scan occurs in a wide variety of disorders, including hyperparathyroidism, hematologic malignancy, metastasis, renal failure, vasculitis, lung infection, and amyloidosis involvement, and is typically found as an incidental finding [2–6]. When faced with incidental observations of non-osseous pulmonary uptake, clinicians should be aware of any clinical symptoms, blood tests,

or imaging that may indicate the existence of an unsuspected disease process [7].

We described a case of a male patient with prostate cancer who had diffuse pulmonary uptake on a Tc-99m MDP bone scan but had no abnormal blood test results or cross-sectional imaging abnormalities. CASE PRESENTATION

An 80-year-old prostate cancer patient with a Gleason's score of 6 (3+3), had a PSA level of 0.009. The patient is receiving treatment for prostate cancer with Eligard, Casodex, and Hytrin. The patient's medical history included postural dizziness, persistent atrial fibrillation (AF), hypertension (HTN), gout, chronic renal

failure (CRF) that was currently under control, a creatinine level of 1.23 (normal range, 0.7–1.40) and an EGFR level of 55. At the time of the assessment, blood tests revealed serum levels of calcium (9.9; normal range 8.8–10.5), phosphate (4.0; normal range 2.5–4.5), and uric acid (4.5; normal range 3.0–7.0.) were generally considered normal, except for slightly elevated blood urea nitrogen (27; normal range 10–26). An annual bone scan was performed on the patient to check for the presence of bone metastases. Three hours after a 740 MBq Tc-99m MDP intravenous injection, a bone scan was carried out. The spine’s lumbar 5 showed higher uptake, which was described as a degenerative change. Otherwise, no abnormally high uptake in the bones may indicate metastases (Figure 1). Instead, diffused bilateral pulmonary uptake and slightly elevated cardiac uptake were found. There were no clinical signs or pulmonary complaints in the patient. Moreover, comorbidities were managed. On the same day, a computed tomography (CT) scan of the chest/thorax revealed three micro-nodules in the right upper lung that were classified as benign lesions (Figure 2), while a chest PA radiograph revealed a normal result (Figure 3).

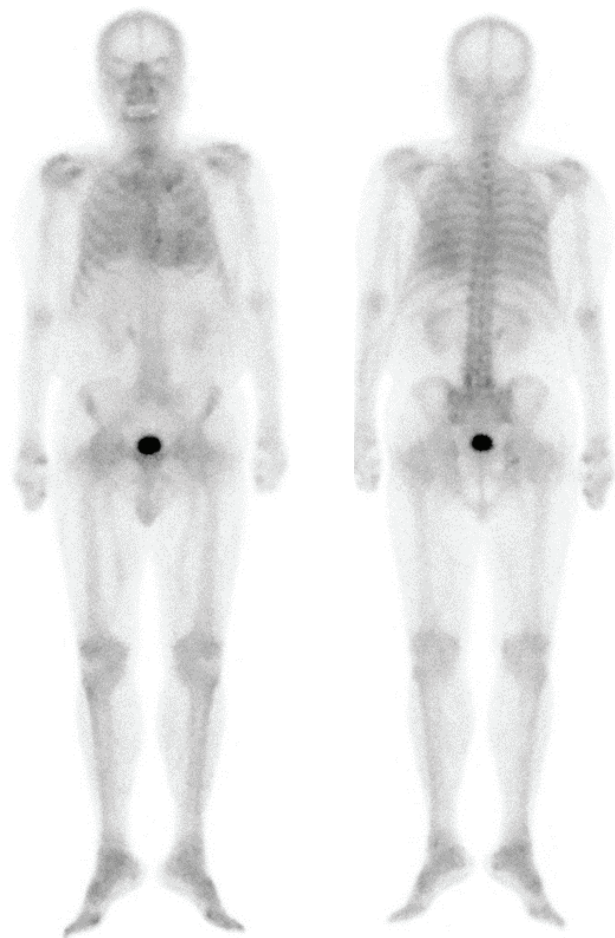


Figure 1. Whole body planar bone scan; no evidence of bone metastasis

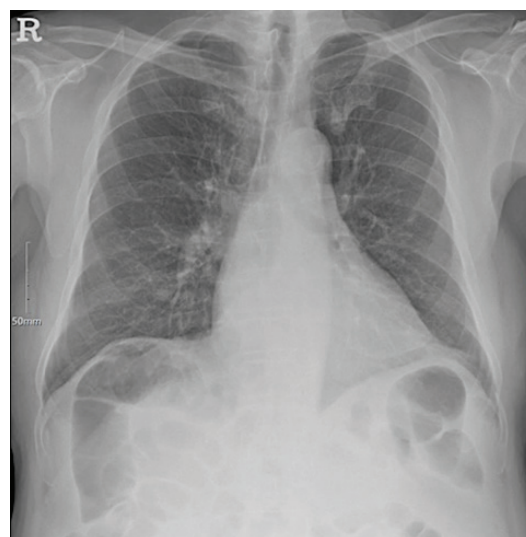


Figure 2. Chest X-ray; normal

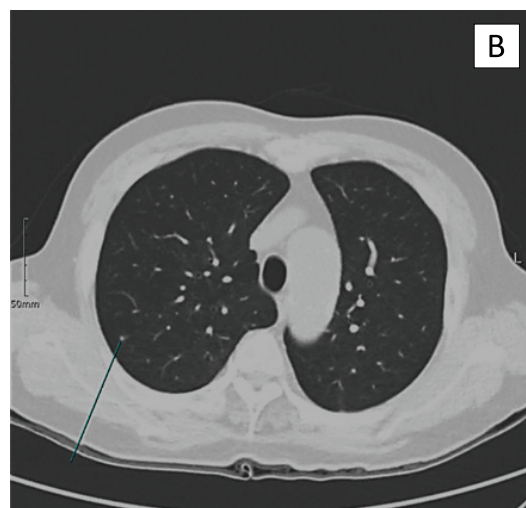
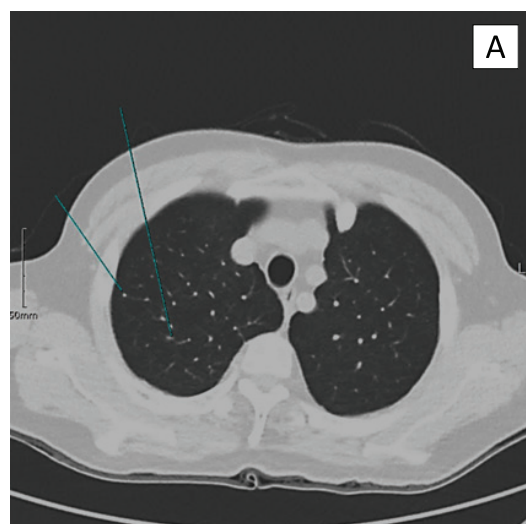


Figure 3. Axial lungs CT scan. (A) Two tiny nodules in the right upper lung; (B) One tiny nodule also in the right upper lung(B), mentioned as a benign lesion.

DISCUSSION

In cancer patients, diffuse pulmonary uptake may result from metastasis, which is triggered by a variety of causes, including increased regional blood flow permeability, altered regional extracellular fluid dynamics, raised tissue calcium concentration, and tumor necrosis [7]. Cross-sectional imaging is typically quite good at identifying nodules or numerous lesions with the suspicion of metastasis. In this case, neither a chest X-ray nor a CT scan revealed any suspicious nodules that may have indicated metastasis or cancer.

Pulmonary uptake in a bone scan also plays a part in lung infection. There have been reports of hydroxyapatite crystals in the mitochondria of some necrotic tissues in pulmonary tuberculosis patients. Mycobacteria-induced lung parenchymal injury resulted in an increase in calcium-binding capacity and Tc-99m MDP chemisorption [2]. There was no evidence of a mycobacterial tuberculosis pattern in our case's imaging, and there was no prior infection with or treatment for tuberculosis in this patient's history.

Renal failure may lead to diffused pulmonary uptake. One well-known consequence of end-stage renal failure is soft-tissue calcification. The etiology is that intermittent alkalosis favors the deposition of calcium salts, chronic acidosis leaks calcium from bone, hyperparathyroidism tends to cause intracellular hypercalcemia also bone resorption, and low glomerular filtration rate can result in hyperphosphatemia and an elevated calcium-phosphorus product [5]. However, on the day of the bone scan examination, the patient's creatinine, calcium, and phosphate levels were all within normal ranges despite a history of chronic renal failure.

Amyloidosis may also be indicated due to the patient's advanced age, history of chronic renal failure, recurrent AF, and postural dizziness [8–10]. If we look attentively at bone scan, the heart also showed a slight increase, though it was less pronounced than in the ribs. According to a study, cardiac uptake of bone scintigraphic agents is linked to high pulmonary uptake if amyloidosis is the cause of the cardiac uptake. This can indicate pulmonary involvement. Then, a potential explanation is that a relatively high concentration of amyloid deposits may be linked to the uptake in the lungs [6,11,12]. It is widely observed that amyloidosis and cancer are linked. In AL amyloidosis and endocrine peptide-related amyloidosis, the overproduction of amyloid precursor proteins or peptides by tumors has been proposed as the mechanism, whereas in FAP- and SSA-related amyloidosis, chronic stimulation or inflammation is thought to be the cause of the malignant transformation [13]. We suggest that amyloidosis may have been the cause in this case situation. However, the board decided against further investigation until the patient complained or showed clinical symptoms.

CONCLUSIONS

Tc-99m MDP may play a role in evaluating amyloidosis involvement in uncommon places such as the lung if this patient is positively diagnosed with amyloidosis. Future research should focus on analyzing diagnostic options in the patient's condition in this situation. Our recommendation for better cardiac amyloidosis diagnostic performance, further testing with Tc-99m pyrophosphate (PYP) or Tc-99m dicarboxypropane diphosphonate (DPD) is indicated. To confirm that it is still unrelated to renal failure, parathyroid hormone (PTH) should also be assessed.

DECLARATIONS

Competing of Interest

The authors declare no competing interest in this study.

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