A Case with Non-Small Cell Cancer in the Left Lung Diagnosed Following Observation of Bilateral Diffuse Lung Uptake of Tc-99m-MDP on Bone Scintigraphy

Kemik Sintigrafisinde Bilateral Akciğerlerde Difüz Tc-99m-MDP Tutulumunun Gözlenmesinin Ardından Sol Akciğerden Küçük Hücreli Dışı Karsinom Tanısı Alan Bir Olgu

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ABSTRACT Extraskeletal accumulation of Technetium-99m methylene diphosphonate (^{99m}Tc-MDP) can be seen in bone scintigraphy both in benign and malignant lesions. In malignant lesions, this phenomenon is usually associated with microscopic calcifications due to the abnormal calcium metabolism, and occurs most frequently in the lungs. In this case report, we present a patient with a non-small lung cancer diagnosed following observation of incidental bilateral lung MDP accumulation in bone scintigraphy. Therefore, the tracer distribution in the soft tissues needs to be carefully examined on bone scans and any unexpected visible soft tissue activity should be stated on the scintigraphy report.

Key Words: Radionuclide imaging; carcinoma, non-small-cell lung; positron-emission tomography

ÖZET Kemik sintigrafisinde iskelet sistemi dışı Teknesyum-99m metilen difosfonat (MDP) tutulumları hem benign hem de malign hadiselerde izlenebilmektedir. Malign hadiselerde bu durum anormal kalsiyum metabolizması nedeniyle oluşan mikroskobik kalsifikasyonlarla ilişkilidir ve en sık akciğerlerde meydana gelir. Bu olgu sunumunda, kemik sintigrafisinde bilateral akciğerlerinde rastlantısal aktivite birikimi saptanan ve daha sonradan küçük hücreli dışı akciğer kanseri tanısı alan bir hastamızı bildirdik. Dolayısıyla, kemik sintigrafilerinde yumuşak dokulardaki aktivite dağılımı dikkatle değerlendirilmelidir ve görülebilir düzeyde beklenmeyen bir iskelet dışı aktivite tutulumu saptandığında, bu durum sintigrafi raporunda vurgulanmalıdır.

Anahtar Kelimeler: Radyonüklit görüntüleme; karsinom, küçük hücreli olmayan; pozitron emisyon tomografi

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Bone scintigraphy with Technetium-99m labeled diphosphonate (^{99m}Tc-MDP) is a useful imaging method for the evaluation of bone diseases, because of its accessibility, reasonable cost and ability to show the entire skeletal system.[1,2] Soft tissue accumulation of ^{99m}Tc-MDP compounds can be seen in a variety of benign and malignant lesions (Table 1).[3-5] It is well known that several factors lead to either focal or diffuse lung accumulation of MDP in the lungs, including abnormal calcium metabolism, increased vascular permeability or altered binding the activity by tissue, hormone or enzyme receptors that can be triggered by different benign and malignant processes.[6,7]

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TABLE 1: Extraosseous activity uptake on Tc-99m MDP bone scintigraphy.[8]

Technical Reasons:	Inadequate radiopharmaceutical preparation, colloid formation, free pertechnetate, urine contamination
Malignancies:	Breast and lung carcinoma, multiple myeloma, lymphoma, metastases (colon, stomach, esophagus, bladder, ovary, neuroblastoma, endometrium, melanoma), malignant ascites and pleural effusion
Myocutaneous:	Myositis ossificans, polymyositis, calcinosis cutis, calcific tendonitis
Amyloid:	Deposits in the P-component
Infarction:	Myocardial, skeletal muscle
Hypercalcemia:	In metastatic calcific deposits resulting from primary and secondary hyperparathyroidism, carcinomas, multiple myeloma and dystrophic calcifications
Inflammation:	Polymyositis, cardioversion
Other:	Chemotheraphy, radiotheraphy

CASE REPORT

A 57-year-old male patient was admitted to Nuclear Medicine clinic for bone scintigraphy. He had been suffering from low back pain and cough for at least 2 months.

A whole-body-bone scintigraphy with ^{99m}Tc-MDP was performed to evaluate the entire skeletal system. Bone scan was obtained using a dual head gamma camera **(E-Cam; Siemens** Medical Systems, Germany) with a high resolution, low-energy collimators. Three hours following intravenous administration of 740 MBq ^{99m}Tc MDP and subsequent oral hydration, anterior-posterior whole-body scan was obtained. Bone scan revealed increased focal osteoblastic activity in the bilateral knees, associated with degenerative changes. Anterior-posterior whole body images showed no other pathological skeletal uptake. However extraosseous heterogeneous and diffuse activity uptake was seen in both of lung parenchyma and mediastinum (Figure 1). In the scintigraphy report, it was recommended to evaluate lung parenchyma and mediastinal uptake with radiological imaging methods such as X-ray or computed tomography (CT). The thorax CT performed after the bone scan revealed a mass lesion in the upper lobe of the left lung and bilateral lymph nodes in the mediastinum. After that, a needle biopsy from the left lung mass was performed and diagnosis of squamous lung cancer was obtained by pathological examination.

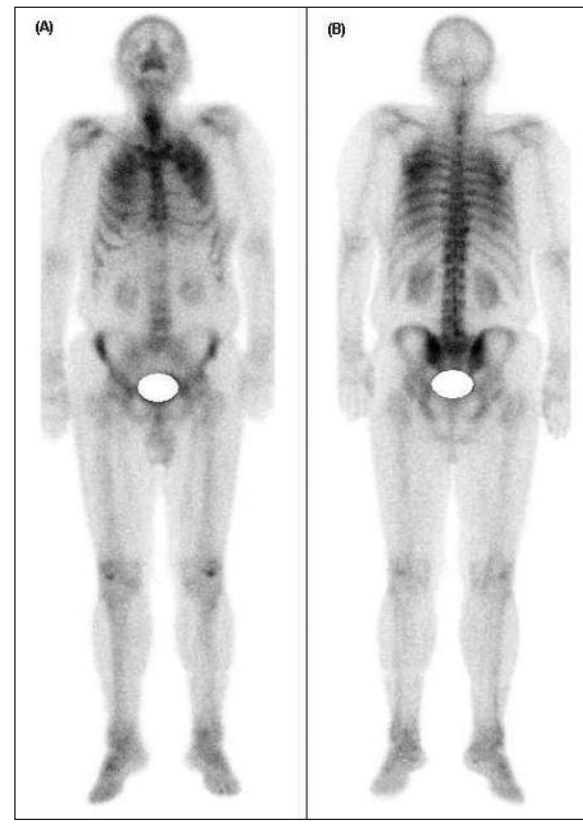


FIGURE 1: Anterior **(A)** posterior **(B)** whole-body-bone scintigraphy, three hours following intravenous administration of 740 MBq (20mCi). 99mTc-MDP bone scans showed bilateral heterogenous lung and mediastinal accumulation.

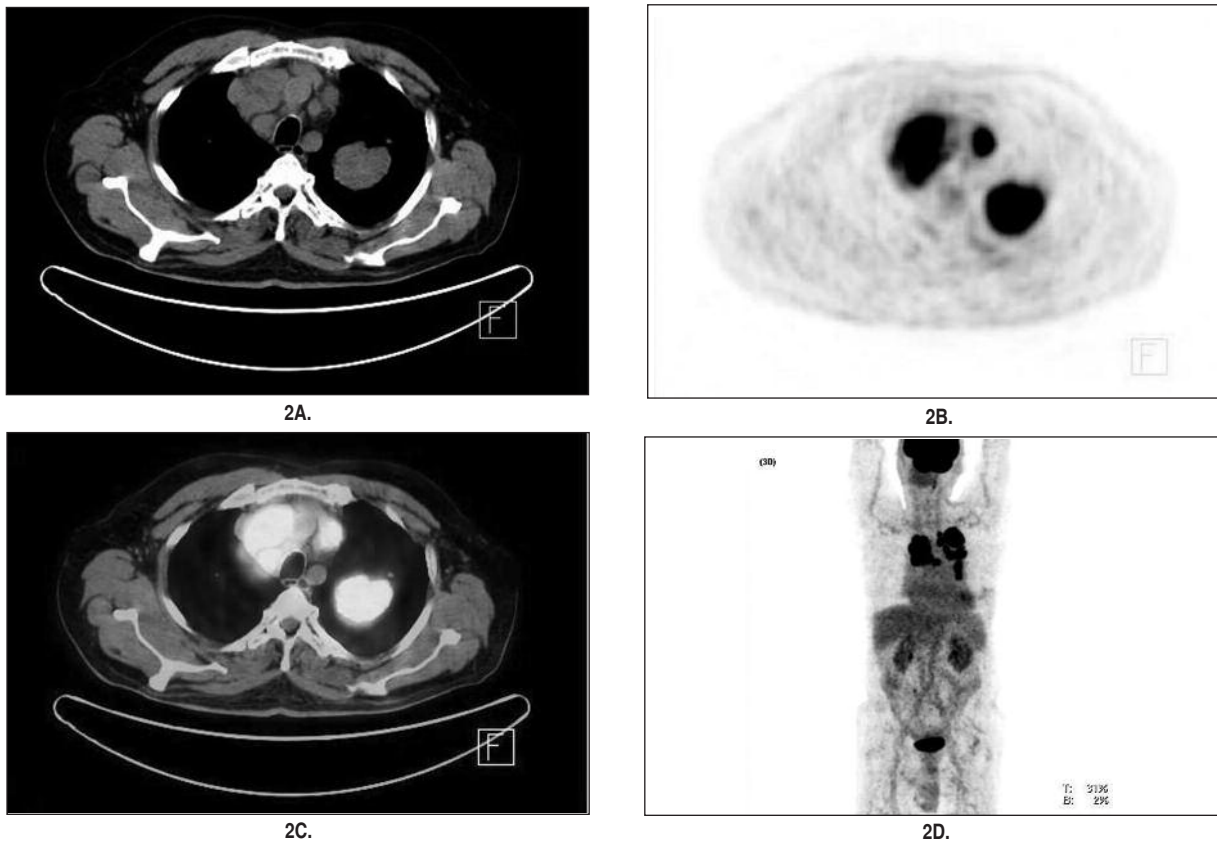
The patient was also admitted to Nuclear Medicine clinic for Positron Emission Tomography/Computed Tomography (PET/CT) imaging for lung cancer staging. For PET/CT examination, 525 MBq of ^{18}F-FDG was intravenously injected after eight hours of fasting period. Following one hour of waiting time in a silent room, patient was imaged using an integrated PET/CT camera with a LSO

based full ring PET scanner, which is consist of a 6-slice CT gantry (Siemens Biograph 6, IL, USA). The CT portion of imaging was performed without an intravenous contrast, and was essentially used for defining attenuation correction on PET emission data and better anatomic localization of PET findings. PET/CT images showed a mass with intense FDG accumulation in the left upper lung as well as bilateral conglomerated lymphadenopathies in the mediastinum. Maximum standardized uptake value (SUVmax) of the primary tumor was calculated as 16,5 (Figure 2).

DISCUSSION

Radionuclide imaging with ^{99m}Tc-MDP bone scintigraphy is a common Nuclear Medicine procedure to evaluate the entire skeletal system.[9] Extraosseous uptake of the tracer can be seen in bone scintigraphy due to a variety of factors including technical mistakes (such as inadequate radiopharmaceutical preparation, extravasation from injection site), aluminum toxicity, long-term hemodialysis, malignancies, amyloidosis, metastases, infarction, hypercalcemia, inflammation, chemotherapy or radiotherapy.[10]

Malignant and benign lung lesions may demonstrate a considerable MDP uptake most probably due to presence of microscopic calcifications and an abnormal calcium metabolism.[11] Castaigne et al. reported that tumor uptake of MDP involved tissues, with areas of necrosis being prone to pathologic calcifications and heteroplastic bone formation.[12] Garty and Edith showed extraosseous accumulation of MDP in a benign intrapulmonary calcified focus.[13] Akhzari and Daemi showed lung MDP uptake in the pulmonary inflammatory pseudotumor and lung metastasis of osteosarcoma with bone scintigraphy.[14] Lin et al. showed in-



2A. 2B. 2C. 2D.

FİGURE 2: Axial CT **(A)**, PET **(B)**, Fusion **(C)** and Maximum intensity projection **(D)** FDG PET/CT images showed intense FDG accumulation in a mass in upper lobe of the left lung and bilateral conglomerated lymph nodes in the mediastinum.

creased MDP uptake in the hemithorax associated with an acute radiation effect.[15] In our case report, a slightly increased MDP accumulation within the tumor bed is seen, as expected. However, it is interestingly associated with diffusely raised uptake of the tracer throughout extratumoral lung parenchyma. This finding might be related to some tumor-triggered mechanisms such as altered vascular permeability, acceleration of calcium metabolism, capillary permeability and increase in the calcium levels in ischemic lung tissues. Hwang et al. reported that visceral uptake of Tc-99m MDP and unusual extraosseous accumulation can be seen in primary hyperparathyroidism.[16] Unfortunately, we were not able to exclude any possible underlying systemic diseases such as primary or secondary hyperparathyroidism that may cause hypercalcemia and diffuse lung uptake of MDP in this particular case who was referred from another medical center.

CONCLUSION

In conclusion, extraosseous MDP uptake in the thorax can be seen in bone scintigraphy and may be related to lung cancer, particularly if it is focal. Therefore, extraosseous tracer accumulation in the bone scintigraphy should be carefully examined and should be stated in the scintigraphy report.

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