CASE REPORT
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Unusual finding on bone scintigraphy: Cerebral 99m-tc mdp involvement

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Abstract

Unusual finding on bone scintigraphy: Cerebral 99m-tc mdp involvement

^{99m}Tc-MDP (99mTc-methylene diphosphonate) uptake in the brain parenchyma was observed in the scintigraphic imaging of a 56 years old male patient with renal cell carcinoma (RCC), who was referred to our clinic for metastasis screening due to widespread bone pain. Uptake of ^{99m}Tc-MDP in the brain parenchyma in bone scintigraphy is a rare finding. This case is presented to reveal the causes of cerebral 99mTc-MDP involvement.

Keywords: bone scintigraphy, ^{99m}Tc-MDP, serebrovascular event

INTRODUCTION

Bone scintigraphy is a frequently used examination in nuclear medicine applications. It is widely used to screen suspected bone metastases of various cancers due to its easy accessibility and low cost (1-4). In addition, osteoarticular infections (osteomyelitis, prosthetic infections, etc.), metabolic bone diseases and traumatic pathologies (stress fracture, pseudoarthrosis, etc.) are among the main clinical indications (5).

Technetium-99m (^{99m}Tc)-labeled diphosphonates, particularly ^{99m}Tc-methylene diphosphonate (MDP), are the most widely used radiopharmaceuticals in bone scintigraphy (1-4). Although the mechanism of uptake is not yet fully understood, diphosphonates bind to hydroxyapatite crystals on mineralized bone surfaces (1,6,7). A lesser part is bind to the organic matrix of bone, immature collagen tissue. High osteoblastic activity, characterized by local bone blood stream, increased permeability, increased bone surface area, and new bone formation, plays an active role in the uptake of phosphonates in bone tissue (8).

Extraosseous ^{99m}Tc-MDP uptake can also be observed in bone scintigraphy in such cases: benign or malignant soft tissue calcifications, hematomas, soft tissue infections and inflammations, etc . Although cerebrovascular events (CVE) are common in the population, brain parenchyma involvement is an unusual finding in bone scintigraphy (9). In our patient with RCC who underwent whole body bone scintigraphy for metastasis screening, activity involvement was observed in the brain parenchyma, and the reasons for this were tried to be explained with this case report.

CASE

A 56-year-old male patient with RCC was referred to our clinic for whole body bone scintigraphy due to widespread bone pain.

The patient was intravenously injected with 20 mCi (740 MBq) of ^{99m}Tc-MDP. After 3 hours, the whole body was scanned with a double-headed gamma camera with a low-energy and high-resolution collimator attached and integrated with a computed tomography (CT) device.

Slightly irregular increased ^{99m}Tc-MDP uptake in both sacroiliac regions and vertebral column in the scintigraphy examination was initially evaluated in favor of osteodegenerative changes. Except this, heterogeneous ^{99m}Tc-MDP uptake were observed in the mid-level of the left half of the neurocranium (Figure 1).

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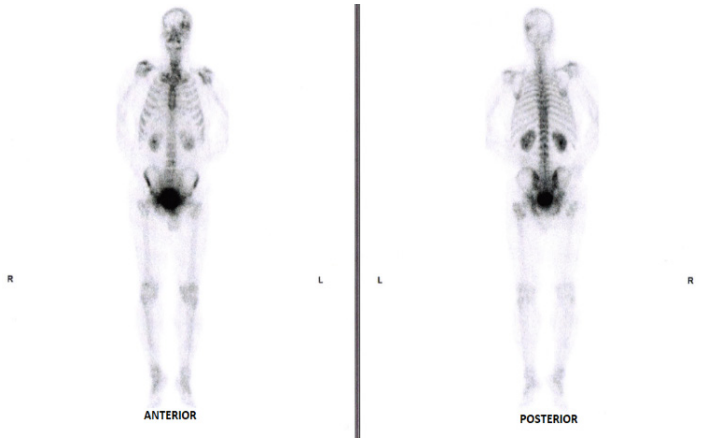

Figure 1. Patient's whole body bone scintigraphy, anterior and posterior images. Suspected ^{99m}Tc-MDP uptake was observed in the mid-level of the left half of the neurocranium. In addition, slightly increased ^{99m}Tc-MDP uptake was observed in both sacroiliac joints and vertebral column suggesting osteodegenerative changes. Activity distributions in other bones of the skeletal system were at normal range (Gaziantep University Faculty of Medicine, Department of Nuclear Medicine)

Because of this involvement, the patient underwent SPECT/CT hybrid imaging of the cranial region. In SPECT/CT imaging, it was understood that 99mTc-MDP uptake was not in the bone structure but in the left frontotemporal region within the brain parenchyma. In addition, heterogeneous density changes were observed in this area in CT sections (Figure 2).

When the patient's history was examined, it was learned that he had CVE about 2 weeks before the date of bone scintigraphy and angiography was performed for the left middle cerebral artery.

DISCUSSION

Bone scintigraphy is an examination with high sensitivity and low specificity. However, the morphological information provided by single-photon emission computed tomography (SPECT)/computed tomography (CT) hybrid systems greatly increased the specificity of the method.

Extraosseous ^{99m}Tc-MDP involvement in bone scintigraphy can be seen in benign or malignant soft tissue calcification areas. Such formations of the calcium deposits in soft tissue can be a result of conditions that cause dystrophic calcification as in ectopic osteoblastic activity, metastatic calcification, osteoid formation in some tumors, excess ions such as iron and magnesium to which calcium binds, hypoxemia or amyloid. Metastatic calcification occurs when diphosphonates precipitate in the tissues in case of hypercalcemia. It is often seen with increased secretion of parathormone (PTH), bone destruction or vitamin D

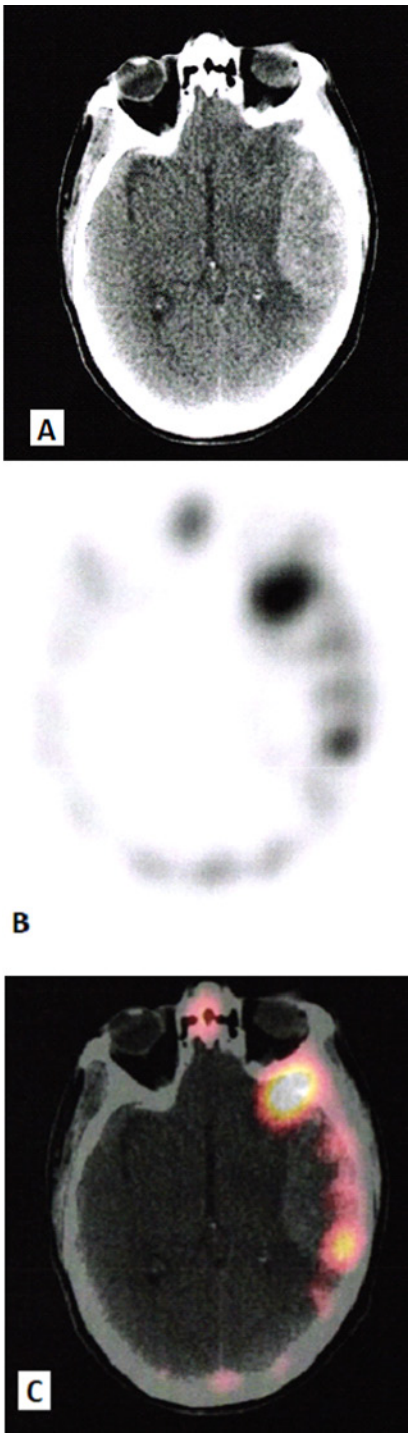

Figure 2. Cranial images of the patient: Transaxial CT (A), Transaxial SPECT (B), Transaxial SPECT/CT (C) fusion images show increased 99mTc-MDP uptake in the heterogeneous area of the brain parenchyma in the area matching the left frontotemporal region (Gaziantep University Faculty of Medicine, Department of Nuclear Medicine)

metabolism disorders. Diphosphonate uptake is observed especially in organs with high pH values such as kidneys and lungs. Dystrophic calcification, on the other hand, refers to the accumulation of calcium in the tissue due to trauma, ischemia, or cellular necrosis, while serum calcium and phosphate levels are normal. Diphosphonate uptake due to

infarction in the heart, brain or muscle tissue is an example of this (8,10).

^{99m}Tc-MDP also accumulates in ischemic tissues due to intracellular calcium accumulation resulting from cell membrane damage and protein denaturation (11). Although CVE is a common disease, brain parenchyma involvement in bone scintigraphy is an unusual finding in these cases. Moreover, in addition to microcalcification or bleeding, disruption of the blood-brain barrier is one of the main factors affecting this involvement. It has been stated that this abnormal appearance in the brain parenchyma may return to normal approximately 4 months after the infarction (9).

In this case, ^{99m}Tc-MDP uptake in the brain parenchyma as a rarely seen extraosseous involvement in whole body bone scintigraphy was presented. In the case with a history of CVE, it was thought that ^{99m}Tc MDP uptake in the brain parenchyma was caused by intracellular calcium accumulation due to cell membrane damage and, more likely, the disruption of the blood-brain barrier due to CVE.

In addition, this case showed us the importance of detailed and accurate history of the patient in bone scintigraphy, and the high efficiency of SPECT/CT imaging for diagnosis.

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Peer-Review

Both externally and internally peer reviewed.

Conflict of Interest

The authors declare that they have no conflict of interests regarding content of this article.

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Previously Report

The authors declared that some part of this study was presented as a poster at "20th National Anatomy Congress" held in İstanbul, entitled "Kadavra Boyun Bölgesinde Aksesuar Kas".

Ethical Declaration

The authors declare that informed consent was obtained from the participant for the conduct of this study and that the rules of the Declaration of Helsinki were followed.

Authorship Contributions

Concept: SG, MÖ, GA, NO, Design: SG, MÖ, GA, Supervising: SG, NO, Financing and equipment: -, Data collection and entry: SG, MÖ, Analysis and interpretation: SG, MÖ, Literature search: SG, MÖ, Writing: SG, MÖ, Critical review: SG

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