Detection of Soft Tissue Tumors on Bone Scintigraphy: Report of Four Cases

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ABSTRACT

This paper presents four cases of abnormal soft tissue activity in the bone scan of patients with different lesions (lung inflammatory pseudotumor, pulmonary fibrosis, pulmonary metastatic osteosarcoma and metastatic hepatic carcinoma of colon).

Key words: Bone scan, Soft tissue, Tumors, Abnormal activity

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INTRODUCTION

In the bone scan in healthy people, the soft tissue structures readily visualized are usually the kidney and bladder. The soft tissue background is usually slight, especially in younger persons. Young people not only have good renal function and thereby excrete a large portion (40% to 50%) of the injected dose, resulting in efficient clearance of activity from soft tissue, but also have high blood flow and metabolic activity in bone. With aging, generalized soft tissue background often increases, presumably as a result of the reduction in bone metabolism, osseous blood flow, and decreasing renal function (1). The presence of abnormal activity in soft tissue usually is the result of increased blood flow, calcification, and irradiation, changes in endocrine function, tissue necrosis, or direct interaction with injected pharmaceuticals such as iron dextran. Tumors such as neuroblastoma, lymphoma, hemangioma, osteosarcoma and lung carcinoma occasionally exhibit soft tissue accumulation in bone

scintigraphy. Also soft tissue metastasis from colon, pancreas, ovary and etc can be seen in bone scanning (1). This paper presents four cases of abnormal soft tissue activity in the bone scan of patients with different lesions (lung inflammatory pseudotumor, pulmonary fibrosis, pulmonary metastatic osteosarcoma and metastatic hepatic carcinoma of colon).

CASE PRESENTATION

Case 1
Bilateral diffuse lung uptake on ^{99m}Tc-MDP bone scan due to pulmonary fibrosis

A 4 years old girl with Acute Lymphocytic Leukemia (ALL) was referred for a bone scan. She has not been previously treated for her disease. Increased activity in the right shoulder and lower lumbar spine were noted. Also bilateral diffuse lung uptake was noticed (Fig 1).

Case 2
^{99m}Tc-MDP uptake in the pulmonary inflammatory pseudotumor

A 13 years old girl with history of pulmonary surgery 2 years ago and histologically proven diagnosis of inflammatory pseudotumor. She was recently evaluated for weight loss & cough. Imaging (Chest-X ray, CT scan and sonography) revealed a mass lesion in the lower lobe of the left lung with evidence of cardiac and stomach extension. The bone scan revealed a zone of increased uptake in the left lung with involvement of adjacent ribs. Pulmonary surgery was again performed in this patient. Unfortunately she expired during post surgical period. The last pathological evaluation, confirm the original diagnosis of inflammatory pseudotumor (Fig 2).

Case 3
Diagnosis of metastatic osteosarcoma pulmonary lesions by bone scintigraphy

A 10 years old boy with history of right above knee amputation due to osteosarcoma one year ago was referred to our department. A bone scan was performed for possible skeletal metastasis. The scan revealed a zone of abnormal collection of activity in the right hemithorax most likely due to metastatic osteosarcoma. In the chest oblique view a soft tissue pulmonary mass was noted (Fig 3).

Case 4
^{99m}Tc-MDP hepatic uptake in metastatic lesion of colon carcinoma

A 66 years old female with previous history of colon resection due to colon cancer, was referred for bone scan for skeletal metastasis. She presented with a mass which was suspected to be a hemangioma on obdominal CT scan. This lesion was cold on RBC Scan, however, accumulation of ^{99m}Tc-MDP was observed in bone scintigraphy (Fig 4).

DISCUSSION

Pulmonary fibrosis can be caused by many conditions including chronic inflammatory processes (sarcoidosis, Wegners granulomatosis), infections, environmental agents (asbestose, silica, exposure to certain gases), exposure to ionizing radiation (radiation therapy), chronic conditions (lupus, rheumatoid arthritis), and certain medications. In some people, chronic pulmonary inflammation and fibrosis develop without an identifiable cause. Most of these people have a condition called idiopathic pulmonary fibrosis (IPF). There are some five million people worldwide within the age range from seven to eighties who are affected by this disease. Current research indicates that many infants are afflicted by pediatric interstitial lung disease. At this time there is limited data on prevalence of this condition in this age group.

In our first case the bone scan revealed involvement of both lungs due to pulmonary fibrosis in a 4 years old girl with ALL, while ^{99m}Tc–MDP is not normally accumulated in the region of lungs. Pulmonary inflammatory pseudotumor, known as a plasma cell granuloma, is an uncommon lesion with unidentified etiology.

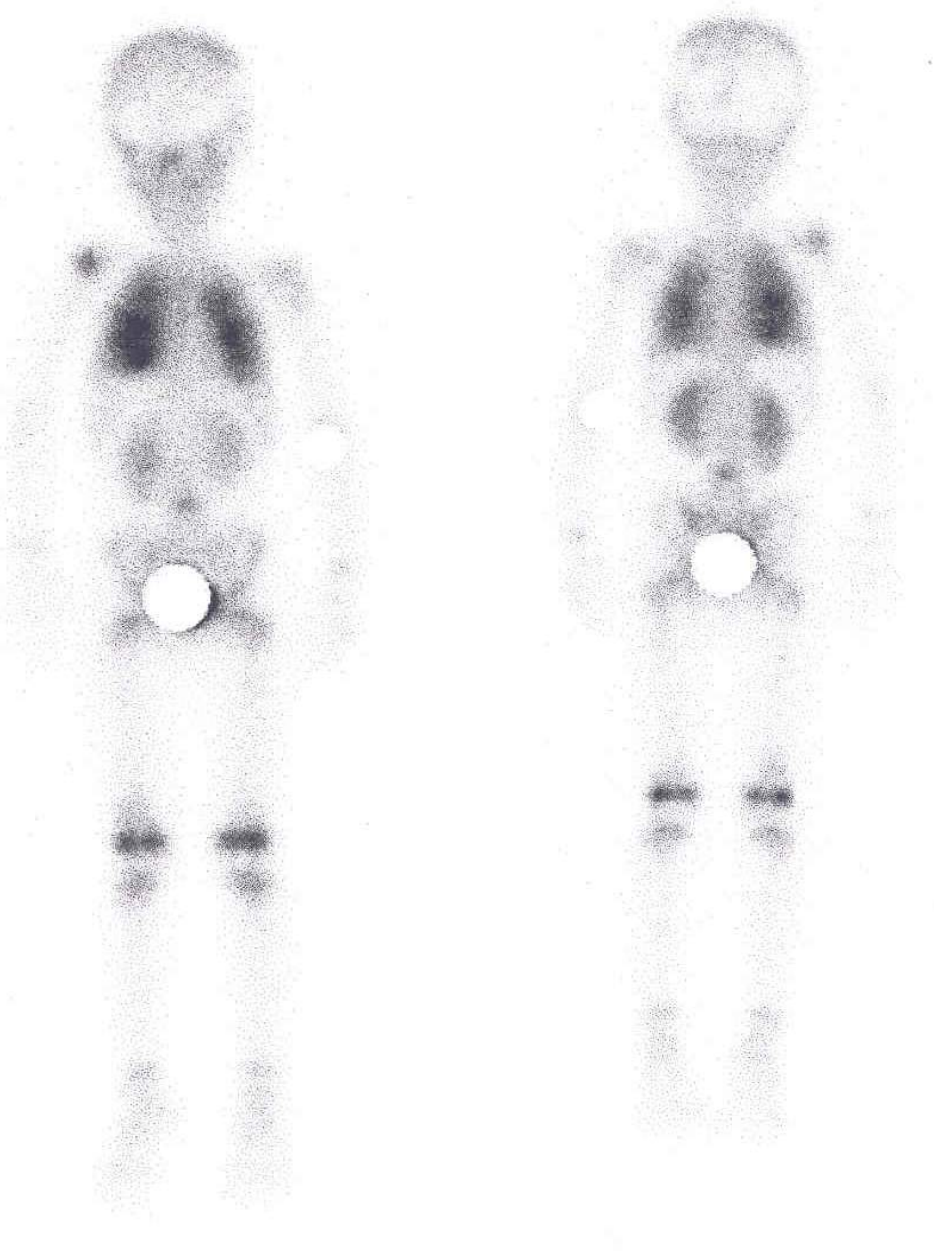

Fig 1- Bilateral diffuse lung uptake on ^{99m}Tc-MDP bone scan, due to pulmonary fibrosis.

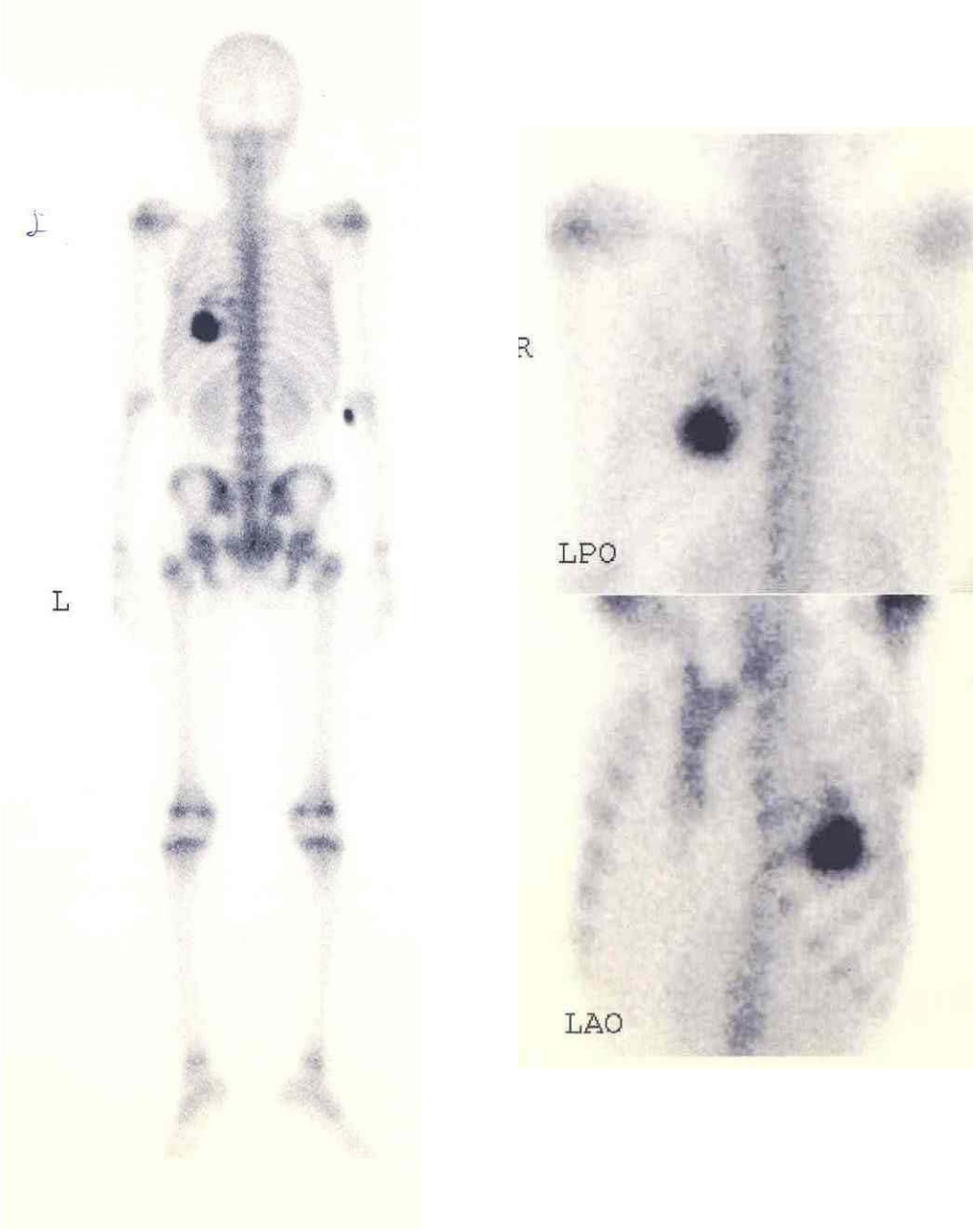

Fig 2- ^{99m}Tc-MDP uptake in the pulmonary inflammatory pseudotumor.

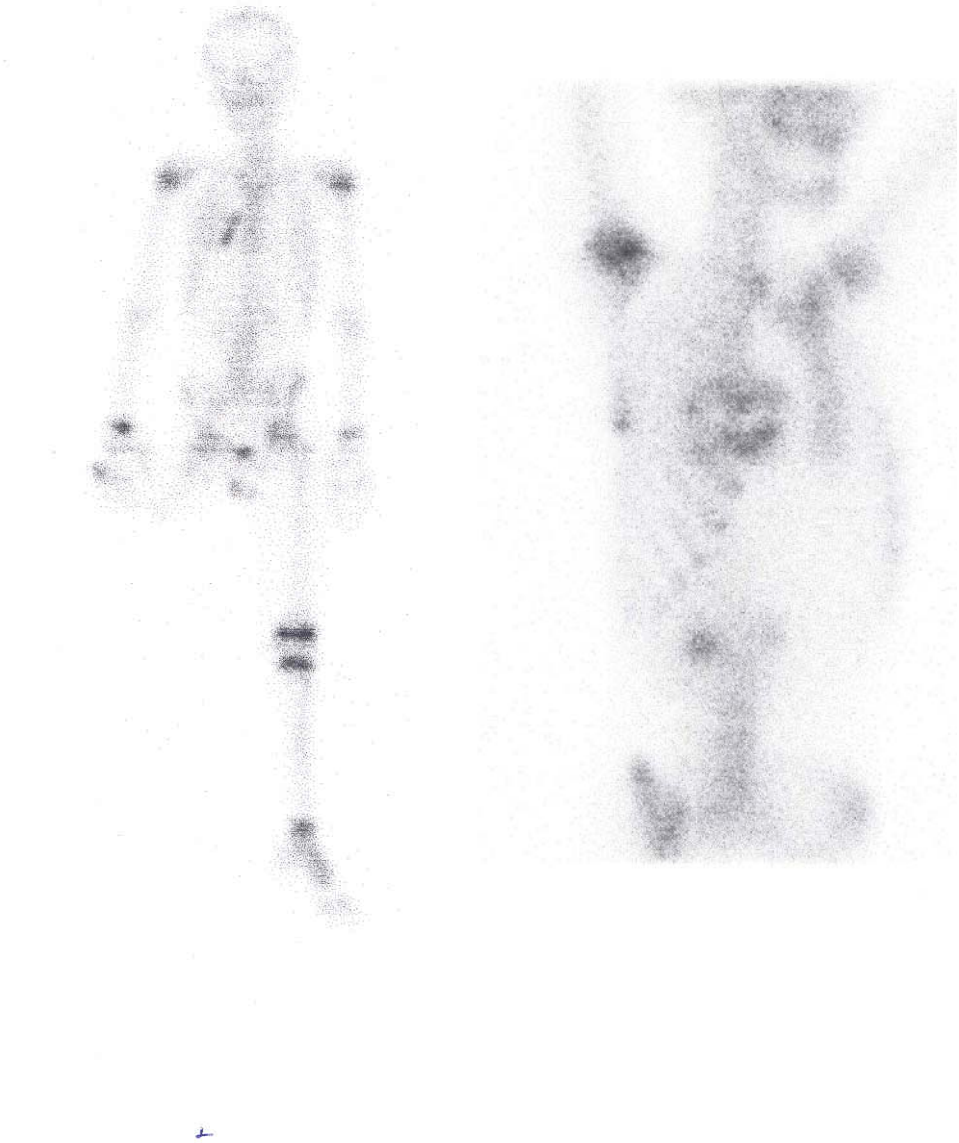

Fig 3- Osteosarcoma pulmonary metastasis in bone scintigraphy.

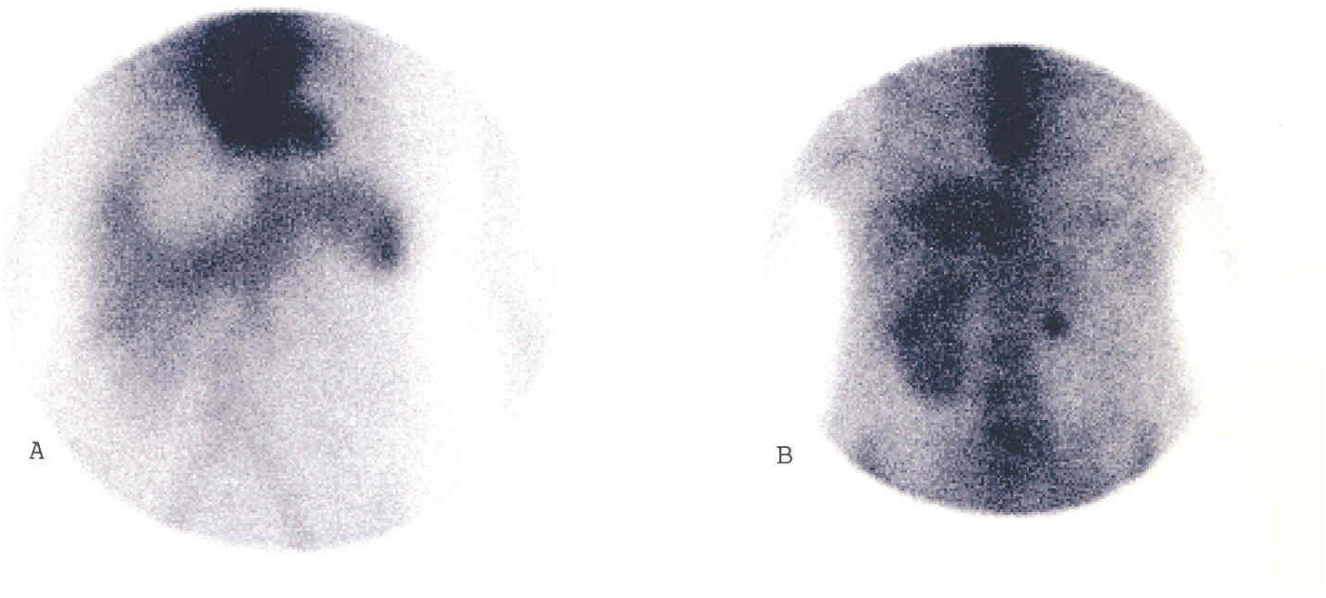

Fig 4- A: Liver cold defect in ^{99m}Tc RBC scan. B: ^{99m}Tc-MDP uptake in liver metastasis of colon carcinoma.

Early relapse with multiple lung nodules or other organ involvement is extremely rare (2). These lesions of the lung are rare benign tumors which are in fact, nonneoplastic unregulated growth of inflammatory cells. Occasionally, aggressive forms are seen. Umiker and Iverson recognized this entity for the first time and named it "postinflammatory tumors of the lung". The lung and airways are involved in the majority of cases. Mediastinum, thoracic lymph nodes, and other structures are rarely affected. Inflammatory pseudotumors have been also called histiocytoma, plasma cell granuloma, xanthoma, xanthogranuloma, fibroxanthoma, mast cell granuloma, and pseudolymphoma because of proliferation of other cell types. Inflammatory pseudotumors may mimic lung carcinoma and pose diagnostic and therapeutic difficulties.These are the most common primary lung tumors in children and should be kept in mind in differential diagnosis of every SPN or lung mass (3). An inflammatory pseudotumor is a relatively uncommon neoplasm. There has been a report by Bahadory et al. of patients under 16 years of age developing inflammatory pseudotumors, most frequently as primary tumor-like lesions in the lung. The incidence of disease is reported between 0.04% to 0.7% in different papers (2).

The heart, stomach, breast, and pleura are sometimes reported to be involved. Fever and clubbing have been reported and generally disappear after resection of the lesion. Bronchoscopy and cytological examinations of the sputum are often normal. Most pseudotumors are seen in the periphery of the lungs as SPN or a mass. Sometimes, calcification, cavity formation, and hilar lymphadenopathy may be seen. Pleural effusions typically small and ipsilateral could be found in up to 13% of cases.

Multiple or bilateral nodules are rarely seen in the lung. Locally invasive forms of the inflammatory pseudotumors have been described by many pathologists. Invasion of the surrounding tissues is present in these varieties and patients are often symptomatic. They may develop fever, dyspnea, fatigue, chest pain, and weight loss. Such cases often require more extensive excisions. Recurrence after resections, as has been the case in our patient is rare (3). Osteosarcoma is the most common primary

malignant tumor of bone. Osteosarcoma accounts for approximately 20% (one fifth) of all primary sarcomas of bone. The frequent site of skeletal involvement (50%) is located in the knee region. The peak incidence is during the second or third decade of life, with a little higher rate in males; 1.3: 1. There is a second peak in the sixth decade. Metastasis is frequent and is observed in approximately 80% of patients after surgical excision.

The most frequent sites of metastases are the lungs and liver. The recommended approach for evaluation of patients with osteosarcoma involves plain radiographs, bone scintigraphy to detect metastasis and MRI to stablish the extent of the primary lesion. Bone scans can also depict soft – tissue metastatic lesions before they appear on a chest radiograph. However, CT has the highest sensitivity for detection of pulmonary metastatic lesions (4-6).

In our third case pulmonary metastasis was observed as areas of increased tracer accumulation. Excluding cancer of the skin, colorectal carcinoma is the second most common malignancy in all parts of the world. Colorectal carcinoma is the most common malignancy of the GI tract.

The incidence is similar in men and women. The most common site of distant metastasis is the liver. The risk of hepatic metastasis increases with tumor size & tumor grade. The lung and bone are also sites of hematogeneous spread. Liver metastasis can be evaluated by sonography, CT, PET or CEA scan (7-8).

Accumulation of bone seeking agents in metastatic lesions of colon carcinoma especially in the liver is a well known finding (1). In our last patient, this observation against a negative RBC scan, was highly in favor of lesion in the liver.

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