

# Metabolic Bone Superscan in Carcinoma Breast with Occult Graves' Disease: Looking Beyond Skeletal Metastases

## Abstract

Extrathyroidal manifestations of autoimmune thyroid disorders include thyroid-associated ophthalmopathy, thyroid dermopathy, and thyroid acropachy. Thyroid acropachy is an extreme manifestation of autoimmune thyroid disorder characterized by clubbing and swelling of fingers and toes, with or without periosteal reaction of the distal bones. We present a 50-year-old woman, posttreatment for carcinoma breast (6 years back) and referred for bone scan for generalized body ache. Bone scan findings resulting in detailed clinical evaluation prompted toward the suspicion of a thyroidal disease with ultimate diagnosis of Graves' disease.

**Keywords:** Metabolic bone disease, metabolic superscan, thyrotoxicosis

## Introduction

Metabolic superscan is a commonly encountered pattern of uptake of  $^{99m}\text{Tc}$ -methylene diphosphonate (MDP) in a host of metabolic bone diseases, including but not limited to osteomalacia, rickets, primary hyperparathyroidism, and chronic kidney disease. It is important to note that thyrotoxicosis may also present as a metabolic superscan pattern on a routine  $^{99m}\text{Tc}$ -MDP whole-body bone scan (WBBS) due to high bone turnover. This is especially important when the patient is referred for metastatic workup for a different etiology, and the finding of superscan pattern is incidental.

## Case Report

A 50-year-old woman, follow-up case of breast carcinoma, (post-surgery and chemoradiation) was under regular checkup for the past 6 years without any evidence of disease recurrence. However, for the past 5 months, she had begun to experience generalized body aches, associated with weight loss and breathlessness. On evaluation, her routine investigations were within normal limits, except for raised serum alkaline phosphatase (ALP) levels. It was noted that the ALP levels done before the onset of recent symptoms were within the normal limits. She was subsequently

referred for a  $^{99m}\text{Tc}$ -MDP WBBS as a part of the metastatic workup. WBBS [Figure 1] revealed increased cortical tracer uptake in the appendicular skeleton, especially in bilateral lower extremities, with suppressed soft-tissue tracer activity and decreased ratio of axial-to-appendicular tracer uptake. There was no evidence of any focal abnormal tracer activity seen in the WBBS.

Detailed history and clinical examination revealed that the patient was experiencing heat intolerance, tachycardia, and fine tremors and had developed slight prominence of both the eyes, in addition to significant weight loss and breathlessness. Consequently, with a suspicion of metabolic bone disease and thyroidal illness, a complete thyroid panel including T3, T4, thyroid-stimulating hormone levels, antithyroid peroxidase (TPO) antibody assay, and intact parathyroid hormone levels were obtained. The results were suggestive of a hyperthyroid state with the presence of anti-TPO antibodies, indicating Graves' disease.  $^{99m}\text{Tc}$ -pertechnetate thyroid scintigraphy [Figure 2] confirmed the findings. The parathyroid hormone was within the normal limits. Plain radiographs of bilateral lower extremities, feet, and hands were negative for periosteal reaction or focal bone destruction. There was no evidence of thyroid dermopathy in the present case.

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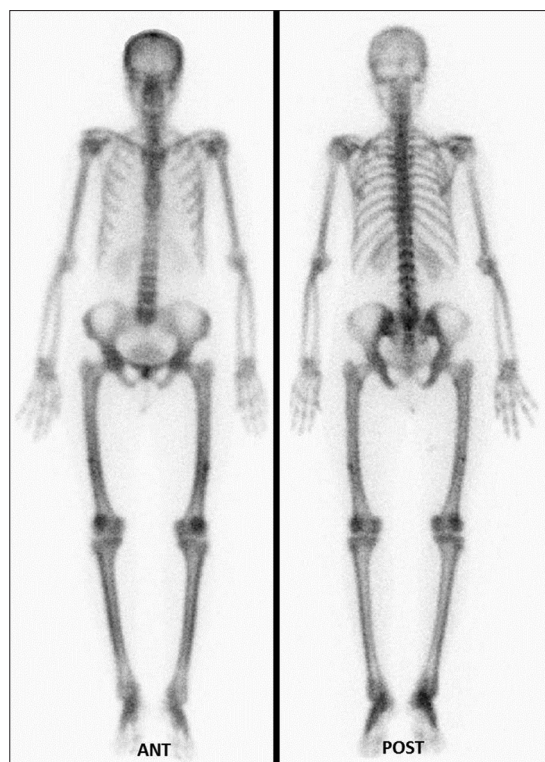
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**Figure 1:**  $^{99m}\text{Tc}$ -MDP whole-body bone scan in anterior and posterior projections, showing increased tracer uptake in the axial and appendicular skeleton, suggestive of metabolic superscan pattern

With a diagnosis of Graves' disease, the patient was prescribed carbimazole with a beta-blocker, which led to significant improvement in her symptoms and normalization of the thyroid profile.

## Discussion

Thyroid acropachy is the least common but an extreme manifestation of autoimmune thyroid disease. Thyroid acropachy is characterized by clubbing and soft-tissue swelling of fingers and toes. In a series of 40 patients with thyroid acropachy followed at Mayo Clinic by Fatourehchi *et al.*, over a period of 26 years, majority (88%) had clubbing of fingernails and toes, swelling, and tightness of skin of fingers and toes with or without clubbing in 20%, and 10% of patients had pain in distal small joints, soft-tissue swelling, and subperiosteal reaction as seen on radiographs or WBBS. The authors reported that periosteal reaction in thyroid acropachy did not occur in the long bones of forearm or the legs unlike that in pulmonary osteoarthropathy. Of 40 patients, only one, with marked lower extremity pain, had an increased uptake in the cortical areas of both femur and tibias on WBBS. The extremity pain completely resolved after treatment with carbimazole for 3 months, indicating that pain and the resultant increased tracer uptake on WBBS were due to thyroid acropachy.<sup>[1]</sup>

A similar finding was reported by Reddy *et al.* in a 43-year-old woman with thyrotoxicosis. The woman was a previously diagnosed case of hyperthyroidism and



**Figure 2:**  $^{99m}\text{Tc}$ -pertechnetate thyroid scan showing increased tracer uptake in both lobes of the enlarged thyroid gland with suppressed salivary gland tracer uptake, suggestive of diffuse toxic goiter

underwent a bone scan in view of raised ALP levels. The bone scan findings were suggestive of a metabolic bone disease with increased tracer uptake, especially in the bilateral lower limb bones. However, this case report illustrated the bone scan findings in a previously known patient of hyperthyroidism.<sup>[2]</sup>

Hyperthyroidism increases the bone turnover and thus shortens the bone remodeling cycle. This is reflected by periosteal reaction and raised ALP levels.<sup>[3,4]</sup> The pattern of metabolic superscan includes prominent calvarial and sternal uptake, increased uptake in the appendicular skeleton, faint visualization of the kidneys, and reduced soft-tissue tracer activity. A varying combination of these features may be present in a given scintigraphy image depending on the disease status.

The metabolic superscan pattern was reported in 27 of 30 patients of Graves' disease by Kotb *et al.* in a prospective study with the distinct pattern of increased tracer uptake in the appendicular skeleton, especially in the bilateral lower extremities.<sup>[5]</sup>

Two extrathyroidal manifestations, i.e., thyroid dermopathy and acropachy, are indicators of severe autoimmune disease and in severe form of ophthalmopathy. Acropachy is present in extreme forms of dermopathy and may present with clubbing and swelling of fingers and toes with or without periosteal reaction of the distal bones. Acropachy may rarely also present with articular manifestation of distal joints. Thyroid acropachy is almost always associated with dermopathy and ophthalmopathy, although an isolated case of acropachy without dermopathy has been reported.<sup>[1]</sup>

Seigel in his case report on thyroid acropachy and its evaluation with  $^{99m}\text{Tc}$ -pyrophosphate scan gave three important scintigraphic findings to point the diagnosis toward thyroid acropachy. First, the uptake pattern in thyroid acropachy usually involves hands and wrists in

comparison to long bones in hypertrophic pulmonary osteoarthropathy. Next, the tracer uptake in the hand is selectively increased in the diaphyseal region. Finally, there is increased tracer uptake in the area of pretibial myxedema, which is frequently associated.<sup>[6]</sup>

The involvement of skeletal system has been previously reported as a part of the paraneoplastic syndrome. Carcinoma polyarthrititis and hypertrophic pulmonary osteoarthropathy are features of skeletal involvement without metastases in carcinoma breast and lung, respectively.<sup>[7]</sup>

The present case highlights that the primary detection of a thyroidal illness may even be helped by a <sup>99m</sup>Tc-MDP bone scan when the above-mentioned WBBS findings are kept in mind. In this case, the metabolic pattern of bone scan in addition to thyromegaly on the clinical examination prompted toward obtaining the thyroid function tests and finally revealing Graves' disease which could be managed appropriately.

#### 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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