Nuclear Medicine

Bone scintigraphy findings in calciphylaxis

John Raduka BS\textsuperscript{a}, Abhimanyu Aggarwal MD\textsuperscript{b}, Katherine Johnson\textsuperscript{c}, Kathy Byun MD\textsuperscript{b}, Anthony P. Trace MD, PhD\textsuperscript{b,*}

\textsuperscript{a} School of Medicine, Eastern Virginia Medical School, Norfolk, VA, USA
\textsuperscript{b} Department of Radiology, Eastern Virginia Medical School, P.O. Box 1980, Norfolk, VA, USA
\textsuperscript{c} College of Arts and Sciences, College of William and Mary, Williamsburg, VA, USA

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ABSTRACT

Calciphylaxis is a poorly understood condition involving vascular calcification and thrombosis that leads to skin necrosis. Unfortunately, a noninvasive definitive test for calciphylaxis does not currently exist, and diagnosis relies on clinical symptoms and risk factors. Imaging can help guide diagnosis of this rare disorder. We present a pathology-proven case of calciphylaxis and the corresponding imaging findings seen on bone scintigraphy.

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Introduction

Calciphylaxis is a poorly understood condition involving vascular calcification and thrombosis that leads to skin ischemia and eventual necrosis most commonly seen in patients with end-stage renal disease (ESRD) on dialysis [1]. The condition was first recognized in 1898 by Bryant and White in uremic patients and was later experimentally produced in nephrectomized rats [2,3]. The disease is associated with significant morbidity and mortality with a 1-year mortality rate as high as 80% in patients with skin ulceration [1]. Patient risk factors such as ESRD and hyperparathyroidism in conjunction with skin necrosis create a suspicion of calciphylaxis that can be supported with bone scintigraphy; skin biopsy can be used for definitive diagnosis [1,4]. This case report presents a patient with sepsis and ESRD who was initially diagnosed with calciphylaxis after bone scintigraphy.

Case presentation

A 40-year-old woman with a history of sickle cell anemia, ESRD, glucose-6-phosphate dehydrogenase deficiency, and hypertension presented with weakness, fatigue, and
shortness of breath. The patient was noncompliant and did not undergo dialysis during the previous 5 days. A complete blood count revealed leukocytosis (17.9 K/μL) with a left shift (93% neutrophils) and anemia (hemoglobin 3.7 g/dL, hematocrit 11.1%). A basic metabolic panel showed elevated glucose (216 mg/dL), blood urea nitrogen (72 mg/dL), and creatinine (12.0 mg/dL) levels. The patient was diagnosed with sepsis, volume overload, and severe anemia, and was started on triple antibiotic therapy, was transfused with 2 units of red blood cells, and resumed dialysis as an inpatient.

Physical examination showed skin necrosis, which, combined with her medical history, raised concern for osteomyelitis. A metastable Technetium-99 methyl diphosphonate (99m Tc-MDP) bone scan was performed. Angiographic–flow phase images showed asymmetric perfusion in the lower extremities, with the right greater than the left (Fig. 1). Immediate blood–pool phase images showed similar asymmetry in the lower extremity soft tissues with moderately increased activity at the right distal tibia (Fig. 2). Delayed images showed moderate-to-intense uptake related to superficial soft tissues of medial and lateral right calf muscles with moderate increased uptake at both ankles (Fig. 3). Prominent calvarial uptake with lack of visualization of the kidneys suggested a pattern of underlying metabolic bone disease, which was most likely hyperparathyroidism based on patient history (Fig. 4).

Discussion

Calciphylaxis is a rare, poorly understood condition involving vascular calcification and thrombosis that lead to skin ischemia and necrosis. Clinicians rely on patient risk factors and physical examination findings such as skin necrosis to raise the suspicion for calciphylaxis. Although there have been studies that show correlation of abnormal soft-tissue tracer uptake in bone scintigraphy with the diagnosis of calciphylaxis, the definitive role of imaging is not yet established [1,4,5].

Our patient’s history of ESRD, hyperparathyroidism, and skin necrosis was consistent with calciphylaxis. The pattern of soft-tissue uptake demonstrated on 99mTc-MDP bone scan supported the diagnosis. Wedge biopsy confirmed the diagnosis. Currently, skin biopsy is necessary to histopathologically confirm the diagnosis, but it is time consuming, invasive, and carries risks such as poor wound healing and infection. A reliable, noninvasive tool to help diagnose calciphylaxis to a high degree of certainty is obviously invaluable.

It is important to note that soft-tissue calcifications are a nonspecific radiographic finding and can be found in a multitude of diseases. Most commonly presenting as dystrophic calcifications with a prevalence of up to 98% [6]. Other causes of soft-tissue calcifications include tumoral calcinosis, autoimmune processes such as scleroderma and dermatomyositis, venous insufficiency, infections such as cysticercosis, and neoplasm such as osteosarcomas.

However, only a small subset of these diseases present with soft-tissue uptake on 99mTc-MDP bone scan as they are not all metabolically active and thus would not avidly bind Tc-99m MDP. These include tumoral calcinosis, myositis ossificans, osteosarcoma, and dermatomyositis [7]. The pattern of uptake on bone scan in correlation with the radiographic findings will help to differentiate the various etiologies. Tumoral calcinosis, myositis ossificans, and osteosarcoma would present as distinct areas of focal uptake, whereas dermatomyositis would show diffuse uptake. These differentials are important to consider when assessing soft-tissue uptake on 99mTc-MDP bone scan in patients presenting with calciphylaxis.

We present this case to strengthen the connection between patterns in bone scintigraphy and histopathologically confirmed calciphylaxis and to show that, although calciphylaxis has historically been a clinical diagnosis, imaging can play an important role. We believe the characteristic soft-tissue uptake seen in bone scintigraphy provides insight to a diagnosis of calciphylaxis through noninvasive imaging and with more research will be shown to be an effective tool in the diagnosis of this rare disease.
Fig. 2 – Metastable Technetium-99 methyl diphosphonate (99m Tc-MDP) bone scan immediate blood–pool phase images demonstrate asymmetric soft-tissue activity over the RT distal tibia. LT, left; MED, medial; RT, right.
Fig. 3 – Metastable Technetium-99 methyl diphosphonate (99m Tc-MDP) bone scan 3-hour blood–pool phase images demonstrate activity in the superficial soft tissues of the RT medial and lateral calf muscles. LT, left; MED, medial; RT, right.
Fig. 4 – Metastable Technetium-99 methyl diphosphonate (99m Tc-MDP) bone scan whole-body delayed-phase images demonstrate prominent calvarial uptake and nonvisualization of the kidneys, a metabolic pattern attributed to the patient’s hyperparathyroidism. LT, left; RT, right.

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