Case Report

Calciphylaxis on bone scan: correlation between molecular and cross-sectional findings

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\textbf{Introduction}

Calciphylaxis is a rare condition characterized by calcific uremic microangiopathy, a disease process in which extensive vascular calcifications are seen in the microvasculature, usually in the skin and subcutaneous fat. Systemic calciphylaxis refers to involvement of the visceral organs, such as the heart or the stomach. Calciphylaxis is reported in 1%-4% of patients with end-stage renal disease, and is occasionally seen with other disease processes such as multiple myeloma \cite{1}. We describe a case of calciphylaxis detected on technetium-99m methyl diphosphonate (Tc-99m MDP) bone scan with correlative cross-sectional imaging findings.

\textbf{Case report}

A 65-year-old male with long-term end-stage renal disease and diabetes presented with a long-term nonhealing ulcer of the right lower extremity and bilateral ankle pain of unclear etiology. A whole-body bone scan was obtained and demonstrated that diffuse increased soft tissue uptake thought to be contributed by delayed soft tissue clearance secondary to renal failure. However, there was asymmetric pronounced radiotracer deposition in the bilateral calves subcutaneous tissues more pronounced compared with the rest of the body soft tissue uptake (Fig. 1). Patient could not tolerate the single-photon emission computed tomography (CT) portion of the examination due to severe pain, so a low attenuation CT was obtained for further characterization of the planar images findings. CT images showed extensive subcutaneous and a few cutaneous calcifications corresponding to the areas of abnormal radiotracer uptake on bone scan (Fig. 2) pathognomonic for calciphylaxis in this patient with a classic presenting history of end-stage renal disease and nonhealing lower extremity ulcers. Skin punch biopsies of the right lateral calf and right shin were performed, and pathology showed ulcer with ischemic necrosis and underlying calcification of...
Fig. 1 – A 65-year-old male with end-stage renal disease (ESRD) and a long-term nonhealing ulcer of the right lower extremity. (A) Anterior and (B) posterior planar images demonstrate marked radiotracer uptake in the subcutaneous tissues of the lower extremities bilaterally, predominantly in the bilateral calves (arrows). There is faint activity in the diminutive bilateral kidneys (arrowheads) consistent with history of long-term renal failure. Incidental note of photopenia in the bilateral knees related to prior knee arthroplasties, and severe uptake in the left midfoot joints and to a lesser degree in the right midfoot joints secondary to degenerative changes.
arteries and subcutaneous fat, consistent with calciphylaxis. Prominent uptake within the midfoot joints corresponded to severe degenerative changes on CT (images not shown).

**Discussion**

Calciphylaxis represents extensive microangiopathy and small vessel calcifications with secondary progressive cutaneous necrosis. Other terms used to describe calciphylaxis include calcific uremic microangiopathy, calcifying panniculitis, or vascular calcification-cutaneous necrosis syndrome. The process occurs often in the lower extremities, with preservation of pulses. Less often, it affects the breasts, abdomen, and male genitalia. Calciphylaxis can be seen with primary, secondary, or tertiary hyperparathyroidism, and is associated with elevated calcium and phosphate levels, which exceed their solubility in blood causing them to deposit in vessels, which in turn leads to progressive vascular compromise in skin and subcutaneous fat, and less often in the muscles. Clinically, patients with calciphylaxis present with bilateral symmetric lesions, pruritus, pain, and tenderness [2].

On histopathology, diagnosis is made by demonstration of subcutaneous calcific arteriolopathy and calcific uremic arteriolopathy.

Tc-99m MDP bone scan is thought to be positive because of the presence of neo-osteogenesis within the soft tissues, as it detects osteoblastic activity by chemisorption to hydroxyapatite crystals in new forming bone [1]. Although a few prior case reports in the literature described calciphylaxis findings...
on bone scan, this is the first report to show correlative cross-sectional imaging findings [3,4]. For imaging differential diagnosis, other causes of delayed radiotracer clearance from soft tissues (such as renal failure, venous insufficiency) and of soft tissue calcification in the lower extremities (such as long-term venous thrombosis, diabetes, metastatic calcifications, scleroderma, dermatomyositis and other connective tissue disease syndromes, post-traumatic and neurologic injuries, and tumor calcinosis) should be considered. Considering the planar imaging findings are not specific, presenting clinical history (long-term nonhealing ulcers in the setting of end-stage renal failure) is usually a clue pointing in the direction of calciphylaxis.

There can be significant morbidity and mortality from the disease, most commonly resulting from septicemia due to impaired integrity of the epidermis and dermis. More than 50% of patients die (most commonly from sepsis) within 1 year of being diagnosed. Treatment depends on the etiology. In cases of primary hyperparathyroidism, treatment consists of surgical removal of the autonomous parathyroid gland. Other possible treatment options include sodium thiosulfate, bisphosphonates, and hyperbaric oxygen [2]. Radionuclide bone scan may be useful for diagnosis and for monitoring response to intravenous medication therapy such as sodium thiosulfate [5].

REFERENCES

[1] Magro CM, Simman R, Jackson S. Calciphylaxis: a review. J Am Col Certif Wound Spec 2010;2(4):66–72.
[2] Nigwekar SU, Kroshinsky D, Nazarian RM, Goverman J, Malhotra R, Jackson VA, et al. Calciphylaxis: risk factors, diagnosis, and treatment. Am J Kidney Dis 2015;66(1):133–46.
[3] Gripp MJ, Gagliardi JA. Calciphylaxis on technetium bone scan: two case reports. Radiol Case Rep 2007;2(2):30–2.
[4] Soni S, Leslie WD. Bone scan findings in metastatic calcification from calciphylaxis. Clin Nucl Med 2008;33(7):502–4.
[5] Paul S, Rabito CA, Vedak P, Nigwekar SU, Kroshinsky D. The role of bone scintigraphy in the diagnosis of calciphylaxis. JAMA Dermatol 2015.