Case report

# The Role of Bone Scintigraphy with Single-photon Emission Computed Tomography-computed Tomography in the Diagnosis and Evaluation of Calciphylaxis

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## Abstract

Calciphylaxis, also known as calcific uremic arteriolopathy, is an uncommon disease, typically found in patients with the end-stage renal disease. Pathophysiological features include small vessel vasculopathy with mural calcification, fibrosis, and thrombosis. The clinical presentation varies but often consists of the necrosis of skin and subcutaneous tissues, with or without visceral organ involvement due to small vessel vasculopathy. This condition has a significant morbidity and mortality, making accurate diagnosis imperative. We present a case of calciphylaxis investigated using planar bone scintigraphy and single-photon emission computed tomography-computed tomography (SPECT-CT). This case stresses the value of SPECT-CT to accurately localize the abnormal uptake in subcutaneous soft tissue microcalcifications and confirms the exact location and extent of pathology.

**Keywords:** Bone scan, calciphylaxis, heterotopic ossification, hybrid imaging, renal disease

## Case Report

A 26-year-old female with longstanding type 1 diabetes mellitus and end-stage renal disease managed with peritoneal dialysis was referred to our department. The patient had an erythematous rash and edema of the lower extremities of several weeks duration. Investigation with leg Doppler ultrasound for a suspected deep vein thrombosis was negative. She was subsequently referred for bone scintigraphy to assess for suspected extraosseous calcifications in the lower extremities.

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Extraosseous calcifications in patients with end-stage renal disease are a very common finding, with arterial calcifications reported in over 80% of patients on dialysis.[1-3] Arterial calcifications can occur at the level of the intima, where they are a manifestation of atherosclerosis or in the media. Calciphylaxis, also known as calcific uremic arteriolopathy, is a disorder associated with medial calcifications resulting in tissue ischemia and subcutaneous necrosis. As a result, subcutaneous calcifications are seen to occur in these patients. Calciphylaxis is an uncommon disease, occurring in <5% of dialysis patients[4] but carries a dismal prognosis, with the estimated 1-year survival rate below 50%,[5] with death occurring most frequently from infection.[6] In a retrospective series,[7] the most



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commonly affected site was the legs, affecting 60% of patients, followed by the abdomen and buttocks. Females are more commonly affected.[8]

In our case, three-phase bone scan revealed unremarkable blood flow (not shown) but increased soft tissue radiotracer uptake in the peripheral aspects of the lower calves/shins [Figure 1]. Delayed images showed abnormal, heterogeneous methylene diphosphonate (MDP) uptake of mild to moderate intensity in the soft tissues of both lower legs [Figure 2]. Similar findings have previously been described.[9-12]

Single-photon emission computed tomography-computed tomography (SPECT-CT) of the lower legs was performed [Figure 3] showing that the abnormal radiotracer uptake was confined to the subcutaneous tissues in a circumferential pattern), sparing the muscular compartments, in keeping with calciphylaxis. Increased activity was seen to extend from the mid or distal calf to the feet, bilaterally. The corresponding low-dose CT showed signs of soft tissue, microcalcification, and inflammation. Prominent vascular calcifications were noted, though not associated with increased MDP uptake. As well, MDP uptake was present in areas where calcifications were not discernible on CT.

## Conclusion

The differential diagnosis of calciphylaxis includes cellulitis, vasculitis, atherosclerosis, embolus, warfarin necrosis, fibrointimal hyperplasia, and early nephrogenic systemic fibrosis. Skin biopsies are frequently used to obtain the correct diagnosis with the most common histopathological finding consisting of calcifying panniculitis.[13] Comparison of bone scan findings with CT have previously been reported[14] but not the use of hybrid imaging, to the best of our knowledge.

Bone scan offers several advantages in the diagnostic workup of calciphylaxis including high sensitivity and the ability to survey the entire body. The sensitivity of bone scan for calciphylaxis has been reported to be as high as 97%.[15]

The addition of SPECT-CT to the exam allows for the precise localization of the affected soft tissue compartments and the extent of calcifications, identification of potentially necrotic tissue, and the assessment of disease activity. As compared to plain radiography, CT, and mammography, bone scan with SPECT-CT is unique in its ability to assess both the exact anatomical location and extent of the disease as well as the presence of active disease.

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### Conflicts of interest
There are no conflicts of interest.

**Figure 1:** The pool phase of a three-phase bone scan demonstrated diffusely increased soft tissue uptake in the soft tissues of the lower extremities, bilaterally

**Figure 2:** The delayed images of the bone scan showed abnormal, heterogeneous methylene diphosphonate uptake of mild to moderate intensity in the soft tissues of both lower legs (arrow)

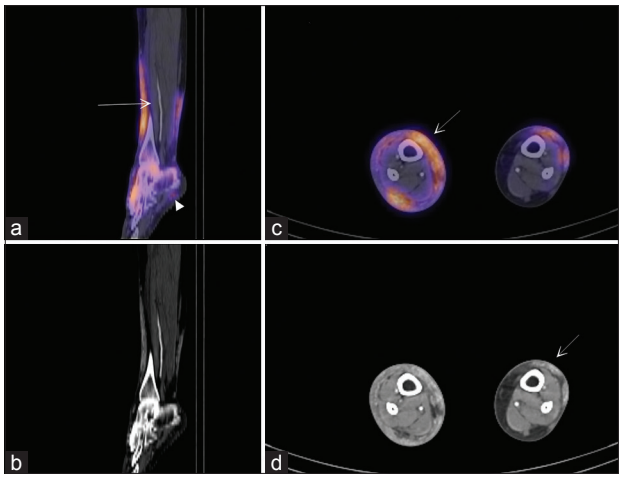


**Figure 3:** Single-photon emission computed tomography-computed tomography of the lower extremities with fused images in sagittal (a and b) and axial (c and d) cuts. The increased radiotracer uptake was seen to localize relatively superficially to the subcutaneous tissues in a circumferential pattern (c, arrow. An important finding was sparing of the muscular compartments, in keeping with calciphylaxis. The uptake was seen to extend from the mid or distal calf to the feet of both lower extremities. The corresponding low-dose computed tomography showed signs of soft tissue, microcalcification, and fat stranding, in keeping with inflammation (d, arrow). Prominent vascular calcifications were also present, and comparison to the single-photon emission computed tomography suggested not associated with increased methylene diphosphonate uptake (a, arrow). As well, methylene diphosphonate uptake was present in areas where calcifications were not discernible on computed tomography (a, arrowhead), suggesting future sites of calcification

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