

## Bone Scan in Evaluation of Bone Viability in Severe Frostbite of the Hand

### Abstract

A 39-year-old male presented to the emergency department (ED) with frostbite to the fingers of both hands. In the ED, he received warm baths, acetylsalicylic acid, clopidogrel, and heparin. A three-phase bone scintigraphy with technetium-99m-methylene diphosphonate revealed absent radiotracer uptake in distal phalanges of both hands. The patient received acetylsalicylic acid, clopidogrel and wound care for the next 5 days and made an excellent recovery with satisfactory wound healing in both hands. Early rapid rewarming and reperfusion can improve the prognosis significantly and therefore bone scan done within first 1–2 days may give spurious results.

**Keywords:** Bone scan, cold thermal injury, frostbite, hand

A visually impaired 39-year-old male was brought to the emergency department (ED) with frostbite to the fingers of both hands. The patient was found in a disoriented state outside his house in frigid temperatures after being out there for at least one and a half to possibly 4 h. The patient had a known history of poorly controlled type 1 diabetes, end-stage renal disease, congestive heart failure, hypertension, and polysubstance abuse. In the ED, within the first 24 h after the frostbite, the patient received warm water baths, acetylsalicylic acid, and clopidogrel. Perfusion into the fingers was preserved in both the hands but with delayed capillary refill time. Gray to light purple discoloration, particularly in the distal phalanges of both hands and marked blistering on the right hand beginning at about the level of the proximal phalanx were noted [Figure 1]. The examination of his forearms and wrists was unremarkable.

A three-phase bone scintigraphy with technetium-99m-methylene diphosphonate (<sup>99m</sup>Tc MDP) was done immediately following the rewarming of the hands. It revealed absent radiotracer uptake in all the distal phalanges of the right hand and second to fourth distal phalanges of the left hand [Figure 1]. In view of multiple comorbidities, the patient was not started on an aggressive treatment with tissue plasminogen activator (tPA). The patient received heparin for 48 h. After that, he

was continued on acetylsalicylic acid, clopidogrel and wound care for the next 5 days. He made an excellent recovery with improved motor function and satisfactory wound healing in both hands [Figure 1].

Frostbite is defined as tissue injury resulting from prolonged exposure of tissue to temperature below its freezing point.<sup>[1]</sup> Frostbite injuries usually involve the hands and feet.<sup>[2]</sup> Many coexisting conditions present in this reported case can also predispose to frostbite such as illicit drug use and disease such as diabetes mellitus.<sup>[3]</sup> Clinically, frostbite injuries are divided into superficial (first and second degrees) or deep (third and fourth degrees).<sup>[4,5]</sup> First-degree frostbite presents with erythema and mild edema. Second degree presents with erythema, substantial edema and clear or milky fluid-filled blister. Third degree has hemorrhagic blisters with severe edema. Fourth degree can show blue-gray mottled appearance with eventual gangrene and extensive necrosis.<sup>[4-6]</sup>

Early radiological investigations with angiography can provide vital information on vessel patency, identify potential targets for thrombolysis, and monitor response to thrombolytics.<sup>[7]</sup> Rapid rewarming using warm baths, and early reperfusion with peripheral vasodilators, heparin, tPA are the mainstay of treatment. To minimize tissue damage, the treatment must be started within the first 24 h.<sup>[7]</sup> For further potential surgical management, it is crucial to assess the depth of

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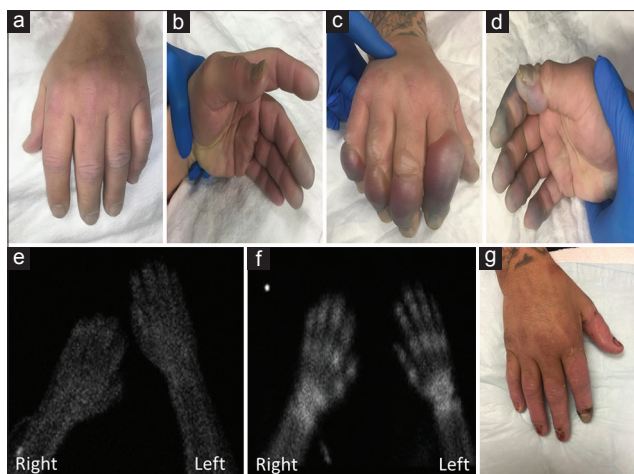
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**Figure 1:** Day 0 (a-f) swollen fingers with skin erythema, blue-gray discoloration of distal phalanges and large blisters (a and b - left hand, c and d - right hand). Technetium-99m-methylene diphosphonate three-phase bone scan revealed absent radiotracer uptake in the second to fifth distal phalanges of the right hand on blood pool (e) and delayed phase planar images (f). Day 14 (g - right hand) showing wound healing with re-epithelization of dorsal aspect of fingers

injury, which can be difficult to determine clinically. Multiphase bone scintigraphy using Tc-99m MDP is an excellent tool to assess bone viability. It can be used to establish the depth of injury and to provide early prognostic evaluation including the bone perfusion and demarcation of viable from necrotic bone tissue.<sup>[7-9]</sup> The scan should be performed 2–4 days after the original injury. The early treatment can lead to marked improvement in the perfusion and therefore bone scan done too early can give a false level of demarcation between viable and necrotic tissue, as seen in this case.

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### Conflicts of interest

There are no conflicts of interest.

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