

Calcific Myonecrosis of the Calf Manifesting as an Enlarging Soft-Tissue Mass: Imaging Features

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Calcific myonecrosis is a rare late posttraumatic condition in which an entire single muscle is replaced by a fusiform mass with central liquefaction and peripheral calcification. Case reports [1–4] have described the clinical and plain radiographic features of calcific myonecrosis and have suggested compartmental syndrome as the underlying cause. We report an additional case and illustrate the imaging findings in two others, all with enlarging soft-tissue masses due to calcific myonecrosis. The radiologic features of calcific myonecrosis allow differentiation from other causes of enlarging soft-tissue masses, including neoplasm, abscess, and myositis ossificans.

Case Report

A 77-year-old man had a slowly enlarging painless mass anterolateral to the left tibia. No systemic signs or symptoms were present. He had had a fracture of the neck of the left fibula 52 years earlier, with no clinical evidence of compartmental syndrome. Numbness in the distribution of the common peroneal nerve and weakness of the left ankle with dorsiflexion and eversion were present immediately after the injury. Surgical exploration at that time showed complete transection of the common peroneal nerve; attempted nerve repair was unsuccessful.

Physical examination showed a fusiform, nontender, fluctuant mass in the anterior compartment of the left leg. Hypoesthesia was present in the distribution of the common peroneal nerve, with weakness on dorsiflexion and eversion of the ankle. Plain radiographs (Figs. 1A and 1B) showed a fusiform, peripherally calcified mass anterolateral to the left tibia with gravitational settling of calcifications inferiorly within the liquid center of the mass. CT scans at

the level of the upper tibia (Fig. 1C) obtained after administration of contrast material showed a nonenhancing, fusiform mass with peripheral calcification replacing the tibialis anterior muscle. The mass contained material with a central, homogeneous, intermediate density. No bone erosion or destruction was present.

Incisional biopsy showed yellow-brown pasty material and calcified debris. Histologic examination showed amorphous eosinophilic material and dense fibrocollagenous tissue with dystrophic calcification. No viable, malignant, or inflammatory cells were found. Cultures for bacteria, fungi, mycobacteria, and parasites were negative. Serum levels of calcium, phosphate, urea, and creatinine were normal. A chronic draining infection developed at the operative site after open incisional biopsy.

Discussion

Liquefaction and calcification of muscle is a rare delayed complication of trauma. The six previously reported [1–4] and three present cases of calcific myonecrosis occurred 26–64 years (mean, 42 years) after trauma. The sites of muscle involvement by calcific myonecrosis were the tibialis anterior (four patients, Figs. 1 and 2), both the tibialis anterior and peroneus longus (one patient, Fig. 3), and an unspecified muscle associated with an abnormality in the anterior compartment of the calf (four patients).

Calcific myonecrosis is clearly related to previous trauma. In the nine reported cases, the initial trauma was fracture of the fibular neck (one patient), fracture of the tibial and fibular necks (two patients), fracture of the femoral shaft (two patients), fracture of the femoral shaft with ischemic paralysis of the leg (three patients), and laceration of the femoral

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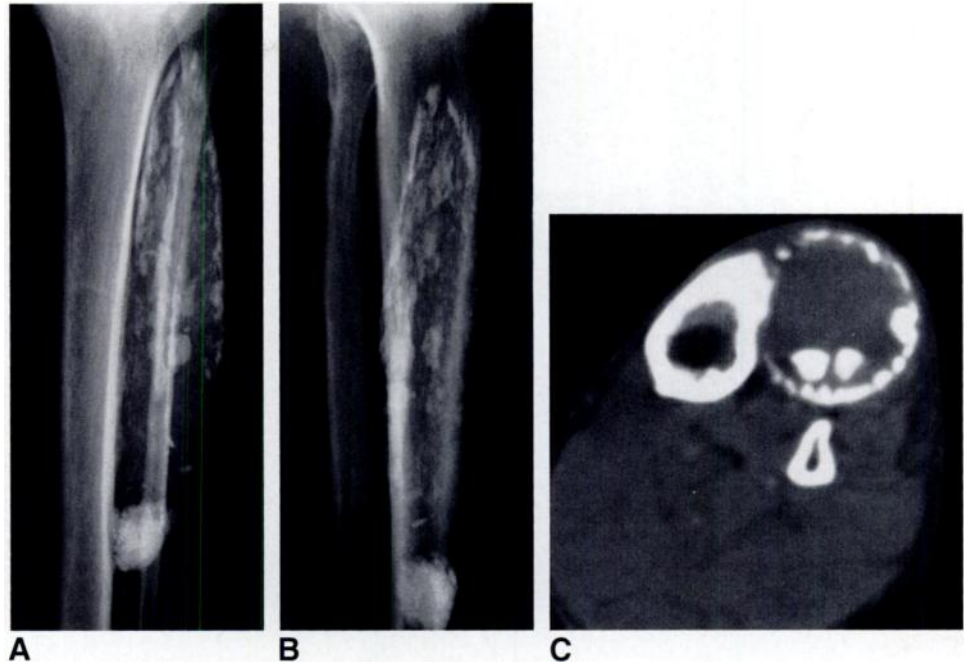
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Fig. 1.—77-year-old man with calcific myonecrosis of tibialis anterior muscle.

A and B, Anteroposterior (A) and lateral (B) radiographs show a fusiform mass with plaque-like peripheral calcifications. Calcifications are most numerous in inferior pole of lesion because of gravitational settling within liquid center of mass.

C, Axial contrast-enhanced CT scan shows a peripherally calcified mass replacing tibialis anterior muscle.



artery (due to gunshot wound) with ischemic myonecrosis (one patient).

Both compartmental syndrome [4] and ischemia [1–3] have been suggested as the primary cause of calcific myonecrosis. In three of the nine reported cases, clinical evidence of increased pressure within the muscle compartment was reported. Evidence of muscle ischemia involving the entire leg was reported in four cases; however, calcific myonecrosis subsequently developed in a single muscle. No evidence of compartmental syndrome or muscle ischemia was present in our three cases.

Calcific myonecrosis appears to be associated with peripheral nerve injury. Transection of the common peroneal nerve was surgically proved in one of our cases and was diagnosed on the basis of clinical findings in the other two cases. In the six cases previously reported, numbness in the lateral leg and dorsal foot was described; however, the cause and location of nerve damage was localized to the common peroneal nerve in only one case. The common peroneal nerve is the most commonly injured nerve in the lower limb, because of its superficial position [5]. Interestingly, all reported cases of calcific myonecrosis have involved muscles innervated by the common peroneal nerve. Although the pathogenesis of calcific myonecrosis is not completely understood, we think that peripheral nerve injury is an important factor.

The radiologic findings of a fusiform mass with plaque-like peripheral calcifications replacing a calf muscle were present in all cases in our series and in the previously reported cases [1–4]. In our experience, this appearance is specific for calcific myonecrosis. Other causes of calcified soft-tissue masses in the calf include myositis ossificans, calcified soft-tissue neoplasms, dystrophic calcification associated with chronic hematoma or abscess, polymyositis, and dermatomyositis. Myositis ossificans typically shows zonation, with pro-

duction of osseous tissue beginning in the periphery of the lesion and progressing centrally [6]. By 6 weeks after the initial injury, the lesion is usually completely ossified. The radiologic features of calcific myonecrosis that allow distinction from myositis ossificans are the lack of central calcifications, the amorphous plaque-like peripheral calcifications (as compared with the mature trabeculated and lamellar bone seen in myositis ossificans), and the liquid center of the lesion. The



Fig. 2.—67-year-old man with calcific myonecrosis of tibialis anterior muscle. Anteroposterior radiograph shows a fusiform mass with peripheral plaque-like calcifications in expected location of tibialis anterior muscle.

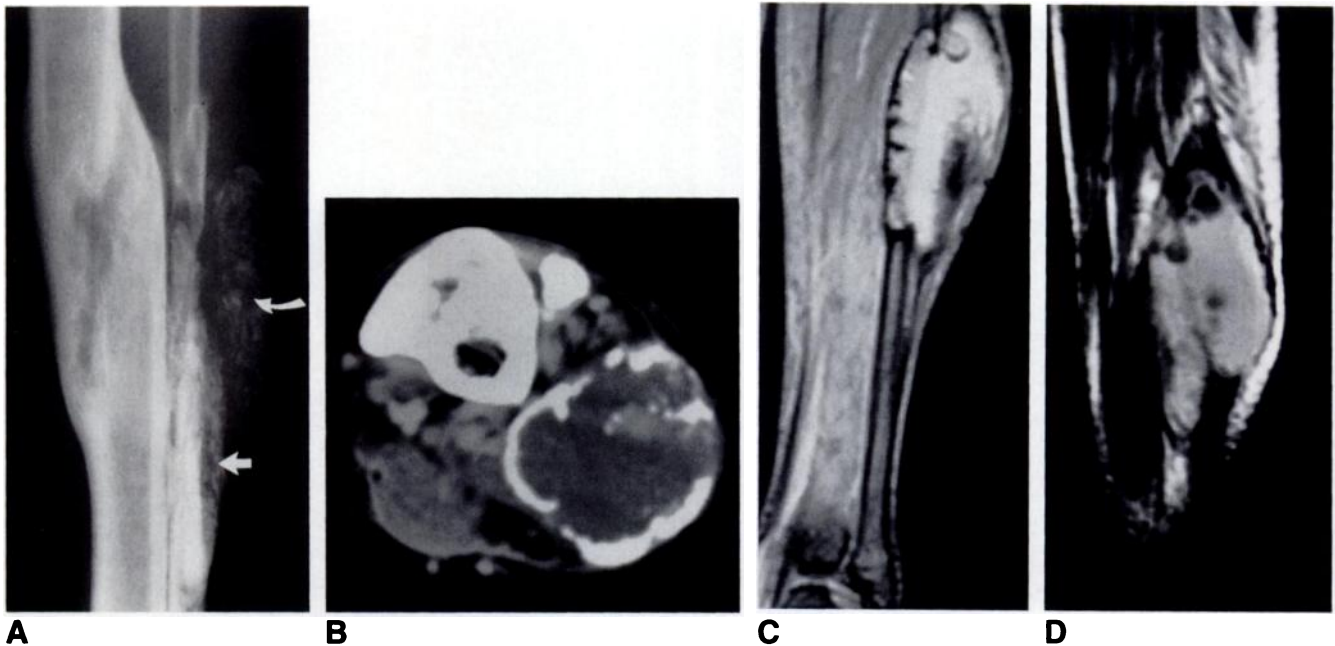


Fig. 3.—56-year-old man with calcific myonecrosis of tibialis anterior and peroneus longus muscles.

A, Lateral radiograph shows peripherally calcified fusiform masses replacing tibialis anterior (*straight arrow*) and peroneus longus (*curved arrow*) muscles.

B, Axial CT scan shows a peripherally calcified mass with a low-attenuation liquid center.

C and D, Coronal 1.5-T gradient-echo (800/20, 30° flip angle, **C**) and sagittal spin-echo (500/20, **D**) MR images show homogeneous intermediate signal intensity in center of mass, representing fluid. Foci of low signal at periphery of mass represent calcifications.

MR features of chronic myositis ossificans include inhomogeneous areas of high signal intensity on T1-weighted images that correspond histologically to the presence of marrow fat between mature bone trabeculae [7]. In contrast, MR images in a case of calcific myonecrosis showed homogeneous intermediate signal intensity within the liquid center of the lesion (Figs. 2C and 2D). Calcification may occur within a chronic muscle hematoma or abscess; however, involvement of a single entire muscle has not been reported. Calcified soft-tissue neoplasms, such as parosteal osteosarcoma, typically appear more aggressive, have nonperipheral calcifications, and are not confined to a single muscle. Liquefaction of the center of a calcified soft-tissue neoplasm is unusual.

Dermatomyositis and polymyositis are systemic diseases with diffuse involvement. Radiologically, subcutaneous calcification is most common. Larger calcification may occur intermuscularly or most characteristically in the intermuscular fascia. Localized involvement of a single muscle would exclude these conditions [8].

Radiologic recognition of calcific myonecrosis is important in order to provide appropriate treatment of the patient. Open excision should be avoided, if possible. In three of nine reported cases, chronic infection with sinus formation resulted from open surgical procedures [3, 4]. One reported case required below-knee amputation for control of refractory soft-tissue infection. The characteristic radiologic appearance of this lesion, combined with a history of previous trauma and

peripheral nerve damage, should allow a confident diagnosis and obviate surgical biopsy or excision.

We conclude that calcific myonecrosis is an uncommon late complication of trauma that may manifest as an enlarging calcified soft-tissue mass. The patient has a history of previous trauma, often with nerve injury. The typical radiologic findings are a fusiform mass replacing a calf muscle, with peripheral plaque-like calcifications and a liquid center. Appropriate treatment depends on radiologic recognition of this lesion, as the clinical features may suggest an enlarging soft-tissue neoplasm or infection.

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