Compartment syndrome of the foot associated with a delayed presentation of acute limb ischemia

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Compartment syndrome of the leg is a well-recognized complication known to follow urgent revascularization done for acute limb ischemia, but compartment syndrome of the foot has not been reported after the ischemia-reperfusion sequence. Herein we report a case of foot fasciotomy done for compartment syndrome that occurred after urgent revascularization. We suggest that foot fasciotomies should be considered in particular circumstances of acute lower leg ischemia, such as infrapopliteal thromboembolic events, prolonged ischemia, and persistent or worsening foot symptoms that follow revascularization and calf fasciotomies. (J Vasc Surg 2016;63:819-22.)

Compartment syndrome is a complication known to follow urgent revascularization done for acute limb ischemia and is widely recognized to occur in the leg, forearm, and hand compartments as a result of the ischemia-reperfusion sequence.[1,2] Compartment syndrome of the foot has been described only in the setting of trauma[3] but has not been reported after the ischemia-reperfusion that occurs in the setting of acute limb ischemia. Herein we report a case of fasciotomy of the foot done for compartment syndrome that occurred after urgent revascularization. Written informed consent for the use of photography for publication was obtained from the patient. Consistent with our institution's policy on case reporting, Institutional Review Board approval was not obtained.

CASE REPORT

An 80-year-old man presented to our hospital. He previously had no limitations in walking. He had a known history of diabetes mellitus, atrial fibrillation, congestive heart failure (ejection fraction of 40%-45%), and stage 2 chronic kidney disease. Before admission, he noted the acute onset of left foot pain, weakness, and decreased sensation. Noticing some initial (although limited) improvement, he assumed the symptoms would resolve. He therefore sought medical attention only 10 days after the initial onset of the symptoms because he experienced a lack of resolution that severely impaired his walking ability.

At the time of this delayed presentation, the left foot was notable for pallor. Objective weakness and sensory impairment were noted in the foot and calf. Venous waveforms were noted at the level of the ankle, but no arterial signals could be found with a continuous-wave Doppler probe.

Fogarty catheter thromboembolectomy was performed through the common femoral and distal popliteal arteries; soft, dark red-appearing thrombus was retrieved from the common femoral, proximal superficial femoral, deep femoral, and distal popliteal arteries. The catheter did not pass through the distal superficial femoral artery/proximal popliteal artery or through the posterior tibial or peroneal arteries. To ensure adequate revascularization, a femoropopliteal bypass was done using polytetrafluoroethylene tunneled in an anatomic fashion. A two-incision, four-compartment leg fasciotomy was performed to the level of the distal calf. Completion angiography demonstrated in-line flow through the bypass, the anterior tibial artery, and the dorsalis pedis artery in the foot.

Early after this initial operation, his leg and foot symptoms had improved, but they worsened significantly again by day 3. The patient had reported severe and progressively worsening pain in the dorsum of the foot. Examination was notable for only mild swelling of the dorsum of the foot (Fig 1) but significant tenderness. Pain and limited range of motion were noted with passive movement of the toes and ankle. He did not have significant calf swelling or tenderness.

He was urgently returned to the operating room. The fasciotomy incisions in the anterior and medial compartments were extended to near the level of the extensor retinaculum tendon of the ankle. A five-incision foot fasciotomy[4,5] (Fig 1) was performed to open and to inspect 9 of the 10 compartments of the foot (all except the calcaneal compartment). The dorsal, lateral, and several interosseus compartments had significant soft tissue swelling as noted. The muscles in the interosseous compartments were pale and edematous but contracted with electrocautery. The muscle of the medial and both central compartments appeared viable.

The patient's left lower extremity function improved significantly after this operation. Specifically, pain during active and passive movement was significantly decreased. Both sensation and strength improved significantly. He was able to ambulate with a four-point walker before discharge on postoperative day 17. He received negative pressure wound therapy dressings for the calf wounds and gauze dressings for the foot wounds.

He has been seen at regular intervals in our outpatient clinic. The sensation in his left foot improved to near baseline. Strength and range of motion also further improved. All foot incisions healed by secondary intent within 2 months. Massive swelling of

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Fig 1. Five incisions used to release 9 of the 10 compartments of the left foot. These consist of two incisions on the dorsum of the foot (parallel to the second and fourth metatarsals; *left panel*) to release the dorsal compartment and four interosseous compartments; one on the plantar aspect of the foot (parallel to the third metatarsal; *middle panel*) to release the superficial and deep central compartments; and one incision each on the medial and lateral aspects of the forefoot (parallel to the glabrous skin borders of first and fifth metatarsals; *upper* and *lower right panels*) to release the medial and lateral compartments, respectively.

the foot persisted for about 2 months but was improved by the third month (Fig 2). He has been offered split-thickness skin grafting to re-epithelialize small residual calf wounds but has refused. He remains fully ambulatory with use of a cane and returned to his part-time work as a construction supervisor. He remained well at last follow-up 5 months after surgery.

DISCUSSION

Compartment syndrome is a well-recognized complication of the ischemia-reperfusion sequence that follows revascularization for acute limb ischemia. Vascular surgeons are familiar with the recognition and management of compartment syndrome of the calf. Compartment syndrome of the hand and the importance of fasciotomy incisions there have long been recognized to follow ischemia-reperfusion.[1,2] Despite being analogous to compartment syndrome of the hand, compartment syndrome of the foot has been reported only after various forms of trauma[3,6,7] and never in the setting of acute limb ischemia.

The natural history of untreated or unrecognized foot compartment syndrome is poor, resulting in Volkmann ischemic contractures and significantly impaired foot function.[8] After performing detailed late follow-up evaluations (average of approximately 2 years after the initial injury), Rosenthal et al[9] identified untreated trauma-related compartment syndrome in 10% of a group of patients with calcaneal fractures. Persistent complications of untreated compartment syndrome in the foot included persistent pain (both with activity and at rest), impaired sensation, muscle atrophy, and claw toe deformity. Grading of residual foot function was significantly worse in patients who had untreated foot compartment syndrome than in those who did not.[9]

On the basis of the clinical presentation after revascularization with calf fasciotomy incisions and the significant swelling seen in the dorsal and lateral compartments of the foot on foot fasciotomy, the patient described here seems to have had clear evidence of compartment syndrome in the dorsal and lateral compartments. The incisions achieved complete secondary wound closure with local wound care only, with the plantar and medial incisions (those without significant swelling) healing the fastest.

Ten compartments of the foot have been described (Fig 3). These are the medial compartment, the lateral compartment, the superficial and deep central compartments, the dorsal compartment, the calcaneal compartment,

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