Endovascular management of acute critical ischemia secondary to blunt tibial artery injury

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We report a case of acute limb-threatening ischemia from blunt traumatic tibial arterial disruption managed with endoluminal techniques. An otherwise healthy 37-year-old man involved in a motorcycle crash sustained a compound fracture of his right tibia and fibula. Arterial insufficiency developed after surgical reduction of the orthopedic injuries that warranted selective angiography of the involved extremity. This demonstrated complete occlusion of the infragenicular circulation at the level of the ankle. Recanalization of the posterior tibial artery was achieved by using coronary balloon-expandable stents, thereby reestablishing in-line flow to the foot. Clinical and noninvasive surveillance at 2 years confirmed patency of the recanalized artery with the absence of any ischemic symptoms. Arterial reconstruction of the infrapopliteal arterial tree poses a formidable challenge in the setting of blunt trauma. Recent improvements in endovascular skills, endoluminal technology, and imaging capabilities have allowed percutaneous reconstruction of challenging arterial pathology. Endovascular treatment of blunt tibial injuries is an alternative to complex open reconstructions. These patients require close long-term postoperative surveillance because the durability of such a repair remains unknown. (J Vasc Surg 2006;44:1101-3.)

Blunt leg trauma with concomitant orthopedic and vascular injuries is associated with a high rate of limb loss; in fact, the major amputation rate after blunt tibial artery injuries has been reported to be as high as 38%. Furthermore, the risk of limb loss increases with the number of tibial vessels injured. Despite reports of the successful endoluminal management of arteriovenous fistulas in the setting of tibioperoneal arterial injuries, the endovascular treatment of traumatic infrapopliteal arterial disruption has, to our knowledge, been previously reported. We report a case of severe foot ischemia after blunt lower extremity trauma that was successfully managed by endovascular techniques.

CASE REPORT

A previously healthy 37-year-old man presented to our emergency department after being involved in a motorcycle crash. The patient was hemodynamically stable, with obvious deformities of his right lower extremity. A diagnosis of an open compound fracture of the distal tibia and fibula was made from the radiologic and clinical evaluation. A neurovascular exam of the injured limb documented palpable femoropopliteal pulses before orthopedic surgery.

The patient underwent open reduction with internal fixation of the distal fibula with closed intramedullary rodding of the tibial fracture. Approximately 4 hours postoperatively, the patient began complaining of severe right foot pain. Motor and sensory function of the foot was intact, but his foot was cold and mottled. A vascular surgical evaluation was requested.

On examination, he was found to have a palpable femoral and popliteal pulse with no audible pedal signals. Capillary refill was sluggish. Motor and sensory function of the foot remained intact. The patient was taken to the endovascular suite for suspected infrapopliteal arterial thrombosis. Under conscious sedation with local anesthesia, retrograde left femoral arterial access was gained by using a single wall entry needle. A 5F sheath was placed in the left common femoral artery, with subsequent selective catheterization of the right common iliac artery using a VS1 catheter (Cook, Bloomington, Ill).

Selective imaging of the right lower extremity demonstrated undiseased patency of the superficial femoral artery and popliteal artery. The origins of the anterior tibial artery, peroneal artery, and posterior tibial artery were all patent. However, there was evidence of abrupt occlusion of all three vessels approximately 5 cm above the level of the ankle. Although there was no angiography evidence of reconstitution of the anterior tibial artery and peroneal artery vessels below the ankle, the posterior tibial artery did reconstitute distally (Fig 1).

Intra-arterial nitroglycerin (200 μg) was administered to alleviate any potential vasospasm, but angiography did not document any improvement. Given the extensive associated tissue damage, lower extremity edema, orthopedic hardware, and the urgent need to reestablish arterial flow, we opted for a therapy through an endoluminal approach.

A 5F Ansel 1 (Cook) crossover sheath was advanced to the right proximal superficial femoral artery. Systemic anticoagulation with heparin was achieved to maintain an activated clotting time of >250 seconds. A 4F catheter was placed over a hydrophilic guidewire and positioned immediately proximal to the posterior tibial occlusion. The guidewire was subsequently exchanged for a 0.014-inch Spartacore wire (Guidant, Menlo Park, Calif), which was used to cross the disrupted segment of the posterior tibial artery. The lesion was initially dilated with a 2-mm × 20-mm Maverick coronary balloon (Boston Scientific, Natick, Mass) without an adequate reconstitution of flow.
Three Express (Boston Scientific) coronary stents (2.5-mm × 28-mm, 2.5-mm × 12-mm, and 2.5-mm × 8-mm) were then deployed within the disrupted segment.

Completion angiography documented successful recanalization of the posterior tibial artery with continuous flow to the foot. There was no evidence of residual hemodynamically significant stenosis or arterial dissection (Fig 2). Systemic anticoagulation was not actively reversed. The arterial puncture site was hemostatically secured with a closure device (Angio-Seal, St. Jude Medical, St. Paul, Minn). Clopidogrel (300 mg) was administered immediately after the procedure. The patient was not systemically anticoagulated postoperatively.

His postoperative course was uneventful. A vascular exam confirmed the presence of a palpable posterior tibial pulse with audible biphasic dorsalis pedis Doppler signal. His ischemic rest pain had resolved. The patient was discharged to a rehabilitation facility on postoperative day 3 with aspirin at 81 mg and clopidogrel at 75 mg daily; however, he has not been complaint with their use.

The patient has been monitored for 2 years postprocedurally with clinical exams and serial duplex ultrasound studies. No clinical evidence of acute or chronic ischemia has been noted during the postoperative follow-up. The intravascular stents remain patent without any evidence of hemodynamically significant stenoses (Fig 3).

**DISCUSSION**

Blunt tibial artery injury carries a higher risk for limb loss than injuries sustained from penetrating trauma; in fact, blunt injury, a pulseless extremity, need for arterial repair, tibial arterial injury, and multiple long-bone fractures were predictors of amputation. Moniz et al reported a major amputation rate after tibial artery injuries of 38%. The risk of limb loss increases with the number of tibial arteries injured.

The management of acute limb-threatening ischemia after blunt arterial trauma has typically been achieved with open revascularization of the affected arterial tree; however, open reconstruction in the setting of recent trauma and after orthopedic reconstruction is fraught with obstacles. Operative difficulty arises from lower extremity edema, the presence of operative hardware, and the presence of vasospasm in the injured vessels. Advancements in endovascular expertise, endoluminal technology, and imaging capabilities have enabled technically successful treatment of the peripheral arterial tree. Such a minimally invasive approach may permit revascularization of the traumatized lower extremity while avoiding the obstacles of open repair.
Endovascular techniques have been used successfully for arterial disruption of vessels that are difficult to access surgically, such as the subclavian and carotid arteries. Furthermore, early experience with endoluminal stent-graft treatment of post-traumatic false aneurysms and arteriovenous fistulae have been encouraging. Despite the reports of successful endovascular management of traumatic arteriovenous fistulae and several reports documenting technically successful management of traumatic lower extremity arterial injuries, the treatment of distal tibial arterial injuries via percutaneous techniques has not, to our knowledge, been previously reported.

The patient presented was at high risk for limb loss because of the number of arteries injured and the presence of concomitant orthopedic fractures. Endoluminal treatment of this lesion permitted revascularization of a tibial vessel from a site remote from prior trauma, thereby minimizing the risk for iatrogenic neurovascular injury. In addition, because the diagnosis of acute limb ischemia in the trauma setting is often delayed, urgent revascularization is necessary for limb salvage. In this case, the diagnosis of limb ischemia was delayed by 4 hours. An endovascular approach allowed prompt identification of the injury with reconstitution of flow within 90 minutes.

Beyond the technical feasibility of such an approach, concern persists regarding the durability of such a repair. Clearly, level I prospective, randomized data will not be available demonstrating equivalency or superiority of endovascular therapy compared with open revascularization. It is thus imperative to survey these patients for evidence of ischemia or restenosis during follow-up. We initially attempted an endovascular approach to serve as a bridge to more definitive open revascularization. Fortuitously, this patient has not demonstrated any evidence of restenosis.

REFERENCES