The challenge of posttraumatic thrombus embolization from abdominal aortic aneurysm causing acute limb ischemia

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We report the first documented case of distal thromboembolism originating from an abdominal aortic aneurysm (AAA) after a blunt trauma. A 72-year-old man with a known 6.2 cm AAA was brought to our emergency department with signs of bilateral acute limb ischemia developing immediately after an accidental fall. The occlusion was confirmed at computed tomographic angiography, and the aneurysm showed a fragmentated/ulcerated mural thrombus, morphologically different as compared to the previous computed tomography (CT). A thromboembolectomy was performed and, after treatment of the ischemic complications, the aneurysm was repaired by open surgery. Embolization from aneurysms in the setting of a trauma is a challenge for the vascular surgeon, also because of its rare occurrence. We describe the management and discuss the operative strategy we opted for in this patient. (J Vasc Surg 2011;54:840-3.)

Acute limb ischemia due to embolization of mural thrombi is an unusual, but well-known presentation of aortic aneurysms, accounting for 5% of new diagnoses.[1] Only 2 cases[2] of arterial occlusion after a blunt trauma of an aneurysmatic aorta are reported in literature. We present the first case of a patient with a known AAA who developed acute bilateral limb ischemia after a thoracic blunt trauma showing radiologic findings attesting for intra-aneurysmal origin of the emboli. We discuss the management and treatment options of this condition.

CASE REPORT

A 72-year-old man was transported to our emergency department after a fall from 3 meters injuring the anterior thorax. During transportation, he started feeling severe pain at the buttock irradiating to the thighs and legs bilaterally. The patient was hemodynamically stable upon arrival. His medical history revealed oral anticoagulation for chronic atrial fibrillation, type-II diabetes, dyslipidemia, and a minor stroke 6 years before. For the last 2 years, he had been followed at another institution for a juxtarenal abdominal aortic aneurysm (AAA). The last computed tomography (CT) scan, 1 month before the event, measured an aortic diameter of 6.2 cm with 0.8-cm neck length and, at that time, the patient had been scheduled for repair.

Primary survey excluded common traumatic injury patterns. The abdomen presented a pulsatile mass consistent with the known AAA. Both legs were pale and cold with complete anesthesia and motor function loss beyond the middle third of the tibia. Femoral pulses were still palpable. Popliteal and pedal pulses were absent bilaterally. A thoracoabdominal CT-angiography was performed. Other possible sources of embolism and a (contained) rupture of the AAA could be excluded. The aneurysm diameter was unchanged as compared to the previous CT, but several new mural ulcerations and a mobile thrombus floating into the lumen were present (Fig 1). An abrupt occlusion at the distal segment of the right superficial femoral artery and at the left popliteal artery was seen without collaterals and without signs of atherosclerosis (Fig 2).

The patient underwent bilateral embolectomy through infragenicular incision according to Szilagy[3] in order to easily access the tibial vessels. Using Fogarty catheters, the infrapopliteal arteries were selectively cannulated and old thrombotic material was extracted both proximally and distally to the arteriotomies. At this time, angiography was postponed since pedal pulses promptly recovered. Ten hours later, the patient again developed bilateral leg pain, with increasing (>40 mm Hg) intra-compartmental pressures indicating a compartment syndrome of anterior compartments bilaterally and left posterior. After a two-incision four-compartment fasciotomy, a completion angiography showed residual embolic material in the left posterior tibial and dorsalis pedis arteries at the ankle. Stenting of posterior tibial artery (to treat a postembolectomy dissection) and concurrent thrombectomy plus angioplasty (to fragment the thrombus) of the dorsalis pedis artery were performed successfully. The patient's postoperative course was characterized by a deficit in dorsiflexion of the left foot (foot drop) due to left deep peroneal nerve palsy as a consequence of prolonged ischemic injury. The symptoms resolved spontaneously 1 month from the embolectomy. After 2 weeks of heparinization, we performed a classical open repair with a bifurcated Dacron prosthesis, previously clamping the iliac arteries before starting a careful aortic isolation. The inferior mesenteric artery, which was already occluded, needed no control. The proximal aorta was then clamped slightly infrarenal profiting from the 0.8-cm length of the neck. No further embolization occurred intraoperatively. The patient recovered well from the operation and could be discharged after 21 days in good general condition.

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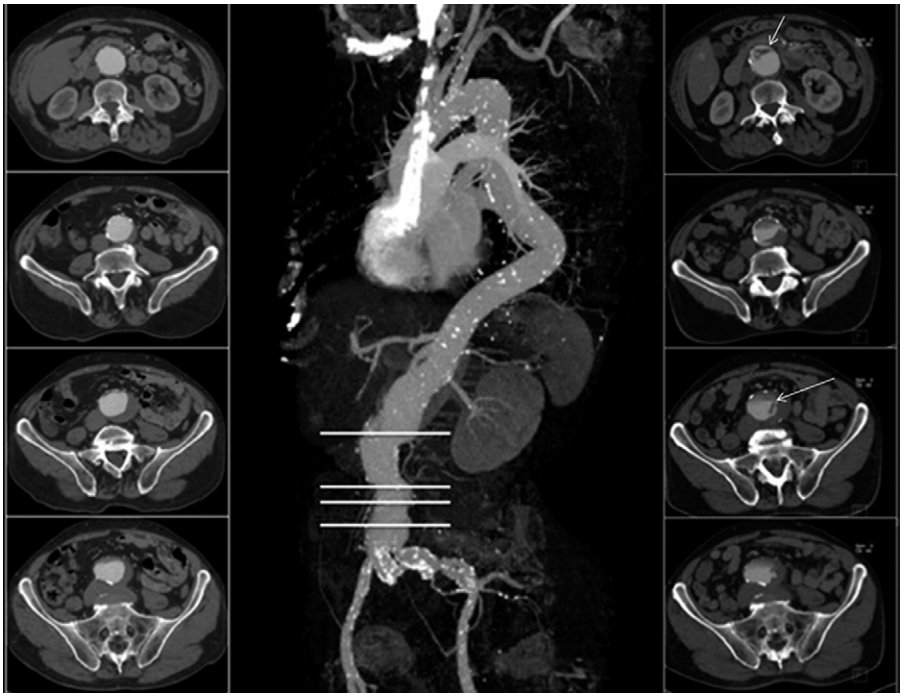

Fig 1. Computed tomography reconstruction of the entire aorta showing a juxtarenal aneurysm. On the sides are compared axial images 1 month before trauma **(left)** with the same scans after trauma **(right)**. The *white lines* define the levels of images. Irregular and ulcerated/mobile thrombus (*white arrows*) is present along the whole length of the aneurysm at several levels.

DISCUSSION

The traumatic dislodgement of debris from an aneurysmatic aorta is the result of a singular combination of variables. In the case we present, a thoracic contusion was the primum movens causing the disruption of forces holding the thrombus together.

It is known that atherosclerotic changes may be associated with a weakening of the intima, thus making these sites more susceptible to shear stress during a blunt trauma.[4] Second, transmission of longitudinal shock waves through the organs and through the aortic lumen, caused by a remote trauma, contributes to the fragmentation of the mural thrombus.[5]

In the literature, aortic disruption, aortic dissection, and traumatic aneurysm are most frequently reported as consequences of an abdominal blunt trauma[6] but rarely are they caused by a remote trauma. Hertzer[7] in 1977 and Beless et al[8] in 1990 documented, respectively, popliteal and iliac occlusion by migration of plaque fragments after abdominal nonpenetrating trauma. Ali et al[2] first reported left iliac and right femoral artery occlusion after seat belt constriction of a 4 cm AAA in a traffic accident. Although, in that note, the radiologic evidence of an aneurysmal source of the emboli was missing, since no previous imaging of the AAA was available. The CT scan on admission had showed completely regular clotted material along the aneurysm wall but also severe atherosclerosis at the level of the occlusion bilaterally. Therefore, a superimposed thrombosis as an effect of the blunt trauma could not be excluded.

In the report by Davison,[9] only the medicolegal aspects of fatal complications that occurred after suspicious embolization of an AAA after assault are dealt with.

Our case is unique because we could compare the altered morphology of the mural thrombus on the CT scan, and furthermore proves how demanding the management in an acute setting could be.

After resolution of the acute limb ischemia, in fact, concerns were raised about the potential for re-embolization of the ulcerated/mobile thrombus and consequently for the timing of aneurysm repair. Embolization of nonfloating and floating thrombi is actually reported in 12% and 75% of patients, respectively.[10] A prolonged anticoagulation therapy alone cannot prevent recurrent events,[11] although it may allow the thrombus to stabilize over time. On the other hand, the decision of an immediate exclusion of the aortic lesion should take into consideration the critical metabolic situation during the ischemic period, as well as the risk of provoking additional embolic events because of too early manipulation. The optimal timing for treatment of mobile thrombi needs to be defined.

Equally, sufficient evidence is missing on what should be the proper operative technique for AAAs with mobile/ulcerated thrombus. Several authors[12–17] have reported positive endovascular experience with the endovascular

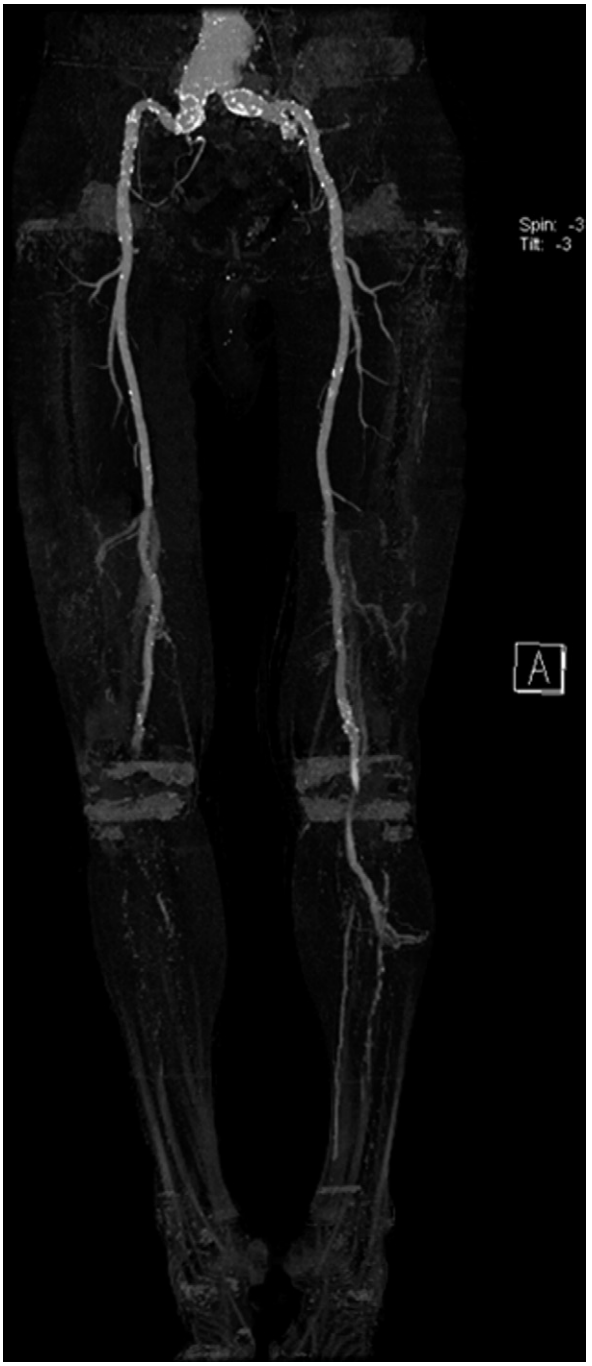

Fig 2. Computed tomography angiography–maximum intensity projections reconstruction demonstrating bilateral occlusion at the femoropopliteal artery junction.

treatment of unstable thoracic aortic thrombi. In the field of abdominal aorta, Zhang et al[18] recently described simultaneous endovascular treatment of thoracic and abdominal mobile thrombi, using the large size introducer sheaths to prevent distal embolization. Likewise, successful exclusion of a pedunculated thrombus of the infrarenal aorta could be obtained by using balloon occlusion of the contralateral iliac artery.[19] In our case, a minimally invasive approach could not be proposed as a safe solution for a juxtarenal aneurysm with menacing mobile thrombi. Previous clamping of iliac vessels (and visceral if needed) is hence pivotal in order to prevent embolic transit during aortic isolation.

In conclusion, the rare occurrence of a posttraumatic unstable ulcerated AAA with limb threatening ischemia poses a series of challenges. Resolution of the limb ischemia, treatment of concomitant traumatic injuries, and timing of the aneurysm repair are the main issues. A balance of risks and benefits of early or delayed treatment should be found, according to the patient's condition. Based on the literature, there are good chances of succeeding an uneventful endovascular exclusion of the aneurysm without extra risk whenever the criteria for endovascular aneurysm repair are met. In all other cases, open repair can be safely performed if distal control is first obtained.

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