Negative results - Assisted circulation

Acute thrombosis of an abdominal aortic aneurysm following intra-aortic balloon pumping

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Abstract

Acute thrombosis of an abdominal aortic aneurysm is a rare but devastating surgical emergency. We present the first case of a patient with sudden thrombosis of an AAA delayed (more than 24 h) after removal of an intra-aortic balloon pump. Treatment options include open surgical repair, axillobifemoral grafting or endovascular aortic repair. The patient received an aorto-bifemoral graft. The associations between intra-aortic balloon pump counter-pulsation and abdominal aortic thrombosis are discussed.

Keywords: Aortic aneurysm; Thrombosis; Intra-aortic balloon pump

1. Introduction

Thrombosis of an abdominal aortic aneurysm (TAAA) is a rare surgical emergency. Although first described in 1959 [1], reports of TAAA in the literature are limited [2]. Successful revascularisation was described only two years after the first report [3]. Nevertheless, overall mortality still approximates fifty percent [2].

The use of intra-aortic balloon counter-pulsation (IABP) is frequently associated with vascular complications, either following insertion, during balloon counter-pulsation or after removal of the device [4–6]. Thrombosis of the abdominal aorta associated with IABP, however, is exceedingly rare.

We report a case of a patient with sudden complete thrombosis of an AAA delayed (more than 24 h) after removal of an intra-aortic balloon pump.

2. Case report

A 65-year-old male (71 kg; 176 cm) with several cardiovascular risk factors (smoking, impaired renal function and hypercholesterolemia) was admitted to our hospital with unstable angina pectoris. Coronary angiography demonstrated multivessel disease including a severe (70–90%) left main bifurcated lesion extending into the proximal left descending artery as well as severe (70–90%) narrowing of the right coronary artery. An 8 Fr intra-aortic balloon with 40 cc volume (Arrow*) was inserted percutaneously (Sel-dinger) through the right femoral artery. Balloon pumping was initiated at 1:1 ratio with 100% augmentation. The patient was started on low molecular weight heparin (nadroparin, 0.3 ml, twice daily). CABG surgery and postoperative course were uneventful except for a transient impairment of renal function. IABP weaning was initiated 24 h after arrival on the ICU unit (1:2 at 50% augmentation). Two hours prior to IABP removal, augmentation was reduced to 30%. The IABP was removed 48 h after surgery and nadroparin dose reduced (0.3 ml, once daily). The patient remained stable and was transferred from the intensive care unit to the regular ward.

Twenty-six hours after removal of the IABP the patient became extremely agitated. He complained of unbearable pain in his right lower extremity. On clinical examination, pulsations in the right leg were absent (peripheral pulses were present upon admission). Capillary refill and skin temperature of the lower extremities were unremarkable. Waking and waning paresis of both legs was present. Further clinical examination, including the abdomen, did not reveal any abnormal signs.

CT angiography of the abdominal aorta and iliac arteries demonstrated the presence of an occluded abdominal aneurysm, starting below the origin of the renal arteries. Small collaterals, originating from the superior mesenteric artery, maintained perfusion of the lower extremities (Fig. 1). A transverse section showed a maximal diameter of the aneurysm of 4.9 cm (Fig. 2). Urgent open surgical repair (aorto-bifemoral grafting) was performed. During the procedure, the presence of an infrarenal AAA, 6.5 cm in length and 5 cm in transverse diameter, containing fresh red thrombus was found. The patient recovered without any neurological sequelae and was discharged on the 22nd postoperative day.

3. Discussion

Thrombosis of the abdominal aorta is a rare complication of IABP. Two reports described partial thrombosis of the
Fig. 1. Computer tomographic contrast enhanced angiographic reconstruction of the abdominal arteries. The abdominal aorta is completely occluded below the origin of the renal arteries (arrowhead). A collateral from the superior mesenteric artery towards the left iliac artery is present (arrow).

abdominal aorta during IABP, resulting in occlusion of visceral and renal arteries. Neither patient survived [7, 8]. Baciewicz et al. were the first to document partial thrombosis of the abdominal aorta shortly after removal of the IABP by aortography, resulting in bilateral renal artery occlusion [9]. Only one previous case reported complete thrombosis of the abdominal aorta immediately following removal of the IABP [10].

The clinical presentation is helpful in discriminating between a partial and a complete thrombosis of the abdominal aorta. Symptoms accompanying a partial thrombosis of the aorta depend on whether side branches, such as mesenteric or renal arteries are completely occluded. In contrast, the clinical presentation of a complete TAAA is acute with severe pain in both legs, mottling of the skin below the umbilicus and paresis, paralysis and paraesthesia of the lower extremities. Clinical signs include absent pulsations in the legs and skin coolness. The diagnosis in this case was somewhat obscured due to the presence of collateral arteries from the superior mesenteric artery towards the iliac arteries. Although arterial pulsations were absent, perfusion was sufficient to prevent cyanosis and to maintain normal capillary refill.

Complete TAAA is a surgical emergency. Several treatment options have been described in the literature, including open surgical repair with aortic tube or bifurcated grafts [2, 3, 10], axillobifemoral grafting [2] or endovascular aortic repair [11]. No randomised trials have been performed so far. Given the low prevalence of TAAA, such trials are not likely ever to be performed. In this case, we preferred the open aortic repair. In case of high cardiac and/or pulmonary risk, axillobifemoral grafting can be considered a potential alternative. Only one case of endovascular repair of an TAAA has been reported so far [11]. Until more evidence is available, we consider this not to be first choice.

Several putative causative mechanisms of TAAA have been proposed [12], including occlusive iliac artery disease leading to aneurysm outflow obstruction, local additional trauma to a pre-existent abdominal aortic aneurysm with sudden dislodgment of a mural thrombus, an embolism from cardiac or proximal aortic origin, hypotension or a temporary low flow state. IABP interferes with most of these factors. Firstly, the use of IABP may indeed cause increased vascular resistance in case of local narrowing of the abdominal aorta. However, if this was the case, thrombosis would have occurred during counter-pulsation. Secondly, IABP can cause local trauma to the abdominal aorta, not only during placement and removal, but during balloon pulsation as well, especially in the presence of an atheromatous aorta [13]. Tierney et al. have performed an interesting ex vivo study using cadaveric intact human aorta specimens [14]. They demonstrated that atheromatous plaques can be disrupted not only by direct contact with the balloon, but by the generated pressure waves as well. Thirdly, IABP has been described to be associated with thoracic aortic thrombosis [15], which may cause distal occlusions due to embolism. Finally, low cardiac output is one of the indications for IABP placement. Reduced cardiac output after weaning of IABP support can result in low flow conditions. In our patient this was not the case.

It is of interest to note that, in both the patient in the report of Sakakibara et al. [10] and in our patient, an abdominal aneurysm was present. These two cases represent the only reports of complete TAAA in association with IABP. This suggests that presence of an abdominal aneurysm is critical to develop a complete TAAA after initiation of thrombosis. Given the different lag time between removal of the IABP device and occurrence of thrombosis, the triggering event, however, may be different.
Perhaps the most intriguing question is whether this complication could have been prevented. Some advocate to screen patients before (elective) surgery [4], others advocate to routinely perform abdominal ultrasound prior to IABP insertion [10]. However, IABP placement is done according to stringent criteria, resulting in a high benefit–risk ratio. Furthermore, IABP insertion is frequently performed immediately following invasive procedures, including coronary angiography or cardiac surgery. Abdominal ultrasound in between such an invasive procedure and placement of an IABP is not always feasible and could potentially delay urgent placement of an IABP. Finally, the number of reported cases of TAAA associated with the use of IABP counterpulsation is extremely low. To our knowledge this is the first report to describe acute thrombosis of an abdominal aortic aneurysm (TAAA) delayed after removal of an IABP. We do not consider abdominal ultrasound a prerequisite for placement of an IABP. However, in case the clinical examination is indicative of the presence of an abdominal aneurysm in advance, we perform abdominal ultrasound to confirm the clinical suspicion of an abdominal aneurysm.

In conclusion, TAAA associated with IABP counterpulsation is an exceedingly rare complication. Nevertheless, a high index of suspicion is warranted in case of acute onset of lower limb pain and lower limb neurological signs associated with the usage of IABP counterpulsation.

References