Thoracoabdominal aneurysm causing functional mitral valve stenosis after total arch replacement

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Abstract

Large thoracic and thoracoabdominal aneurysms may compress adjacent mediastinal structures. We present a case of a large thoracoabdominal aneurysm compressing the left atrium and leading to functional mitral valve stenosis after total aortic arch repair, requiring urgent open thoracoabdominal aneurysm repair.

Keywords: Thoracoabdominal aneurysm, symptomatic aneurysm, cardiac compression

Introduction

The indication for surgical repair in patients with thoracoabdominal aortic aneurysms mainly depends on aneurysm size but repair is also recommended in patients with symptoms, as these may represent acute aortic expansion and therefore imminent rupture [1]. We report on a patient with compression of the left atrium by a thoracoabdominal aneurysm after total arch repair, requiring urgent open aneurysm repair.

Case Report

A 72-year-old man presented with exertional dyspnea and chest pain. He had a history of ascending aortic repair due to type A (DeBakey I) aortic dissection fifteen years prior, with no imaging surveillance for ten years. Further comorbidities were arterial hypertension, mild chronic anemia and right kidney atrophy with almost normal renal function due to previous dissection. There was no evidence of a connective tissue disorder. Contrast-enhanced computed tomography (CT) revealed a complex post-dissection thoracoabdominal aneurysm with a maximum diameter of 90 mm at the level of the descending thoracic aorta (Figure 1), 57 mm at the level of the abdominal aorta and a 50 mm aneurysm of the brachiocephalic trunk. The aortic root was 56 mm and moderate aortic valve insufficiency was present. Transthoracic echocardiography and cardiac CT revealed compression of the left atrium by the descending aortic aneurysm crossing the spine from left to right, while left ventricular function was preserved (Video 1). Pre-operative work-up for coronary artery and pulmonary disease was unremarkable.

As a first stage, aortic root and total aortic arch replacement with a conventional elephant trunk procedure (30 mm graft, length of elephant trunk 80 mm) was performed via median sternotomy. On the fifth postoperative day, the patient developed respiratory failure with severe pulmonary edema. His hemodynamic state deteriorated within hours. Echocardiography revealed compression of the left atrium by the descending aortic

aneurysm leading to severe functional mitral valve stenosis (Video 2). Bronchoscopy showed a 50-70% stenosis of both lower lobe bronchi due to external compression. The patient was reintubated and emergency redo sternotomy was performed with temporary stabilization of the patient. Norepinephrine doses were initially reduced but needed to be increased again (0.135 µg/kg/min). Due to unchanged echocardiographic findings despite the open chest, the decision to advance with the 2nd stage of thoracoabdominal aneurysm repair was taken. The procedure was performed the next day via a left thoraco-phreno-lumbotomy (keeping the sternum open with a retractor) with replacement of the aorta from the elephant trunk to the superior mesenteric artery (28 mm graft). The descending aortic aneurysm showed a small area of blood imbibition at the level of the left atrium (Figure 2).

Postoperatively, hemodynamics improved and the chest was closed on the fourth postoperative day. Recovery was complicated by renal failure with temporary hemodialysis, prolonged ventilator weaning, a non-disabling stroke and critical illness polyneuropathy. No ischemic spinal cord injury was found by magnetic resonance imaging. After 77 days, including 22 days on the intensive care unit, the patient was transferred to a rehabilitation facility. He has recovered well, is able to walk with one stick and regained good functional ability (modified Rankin scale 1).

Discussion

In the present case of a symptomatic thoracoabdominal aneurysm, the initial symptoms of the patient (exertional dyspnea, chest pain) correlated with the compression of left atrium by the aneurysm shown on preoperative imaging. These symptoms were inconsistent and never hemodynamically compromising. A few cases with a similar presentation, including heart failure, have been reported [2, 3, 4, 5]. The unexpected finding in our patient was that compression of the left atrium worsened after the first stage procedure. The resulting functional mitral valve stenosis lead to underfilling of the left ventricle and made the

hemodynamic instability very difficult to treat. Urgent interdisciplinary decision-making was required to abandon the plan of a more delayed 2nd stage procedure and to proceed with thoracoabdominal repair. It remains unclear whether the first procedure shifted intrathoracic anatomical structures and therefore increased the external pressure on the heart. The intraoperative finding of a small area of blood imbibition in the aneurysm wall at the level of the left atrium may also suggest recent acute expansion of the aneurysm, possibly contributing to increased compression. Due to the critical patient condition, no cross-sectional imaging was obtained between surgeries and thus, an increase in diameter was not documented. A similar case with manifestation of heart failure due to left atrial compression by a descending aortic aneurysm four weeks after a first stage procedure has been reported by Gandhi et al [5]. However, their patient died due to aneurysm rupture while awaiting second stage repair.

In this patient, endovascular repair of the aneurysm was not considered due to the lack of a distal landing zone and kinking of the aorta. Furthermore, a rapid relieve of the compression was necessary, which would not have been achieved by endovascular means. A single stage approach with aortic arch and thoracoabdominal aortic repair using a hemi-clamshell incision was not considered feasible, as performing the distal anastomosis beyond the mid-descending aorta is difficult and there was no segment of the aorta above the diaphragm suitable for an anastomosis.

Conclusion

In patients with a thoracoabdominal aneurysm presenting with severe compressive symptoms, aneurysm repair should be considered without delay.

Figure and video legends

Figure 1: CT angiography of the thoracoabdominal aortic aneurysm; (A) axial; (B) sagittal; (C) coronal plane; (D) 3D reconstruction of the heart

Figure 2: small area of blood imbibition in the aneurysm wall adjacent to the left atrium (arrow)

Video 1: preoperative CT with 3D reconstruction of the heart, demonstrating compression of the left atrium by the descending aortic aneurysm

Video 2: transthoracic echocardiography five days after the 1st stage procedure showing functional mitral valve stenosis; (A) aortic aneurysm; (*) left atrium; (**) left ventricle

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