Case Report

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Hybrid Approach to Repair Type A Aortic Dissection

Combined Endovascular Superior Mesenteric Artery Stenting and Bentall Procedure

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Abstract

A Stanford Type A aortic dissection is a life-threatening surgical emergency that requires emergent surgery. The mortality after repair is high especially if the aortic dissection is complicated by visceral or peripheral malperfusion. We describe a case of a male patient who presented with an aortic dissection involving the ascending aorta, aortic arch, descending thoracic aorta, and the abdominal aorta down to the iliac bifurcation. The dissection also involved the visceral and renal arteries with evidence of superior mesenteric artery (SMA) occlusion. Successful outcome was achieved by endovascular stenting of the patient's SMA, followed by a Bentall procedure. To the best of our knowledge this is the first case report in the English literature of SMA stenting followed by a Bentall procedure to treat acute Type A aortic dissection complicated by SMA occlusion.

Key Words

Type A aortic dissection · Bentall procedure · Superior mesenteric artery · Stent graft

Introduction

A Stanford Type A aortic dissection is a life-threatening surgical emergency that requires emergent surgery. The mortality after repair has been reported as high as 30% [1], although most recent series demonstrate mortality in the 10-16% range [2,3] after surgical repair. Approximately 25% of aortic dissections have evidence of peripheral malperfusion at presentation [4]. In cases of visceral malperfusion syndrome, particularly involving the superior mesenteric artery (SMA), the operative mortality is significantly increased [5]. Without intervention in acute Type A aortic dissection, early death occurs in 30% of patients by 24 hours and 93% at 1 month as a result of malperfusion syndromes, or cardiac complications or rupture [6]. Type A aortic dissection is complicated by visceral malperfusion in 16-33% of cases [4–7].

Case Report

A 55-year-old gentleman who is diabetic, hypertensive, and a heavy smoker presented to the emergency department of his local hospital with sudden severe neck pain that started 3 h earlier. The pain radiated to his back and was associated with sweating, nausea, and vomiting. A computed tomography (CT) scan of the chest and abdomen was performed which showed an aortic dissection involving the ascending aorta, aortic arch, descending thoracic aorta, and the abdominal aorta down to the iliac bifurcation (Fig. 1A and 1B). The dissection also involved the visceral and renal arteries with evidence of SMA occlusion (Fig. 1C).

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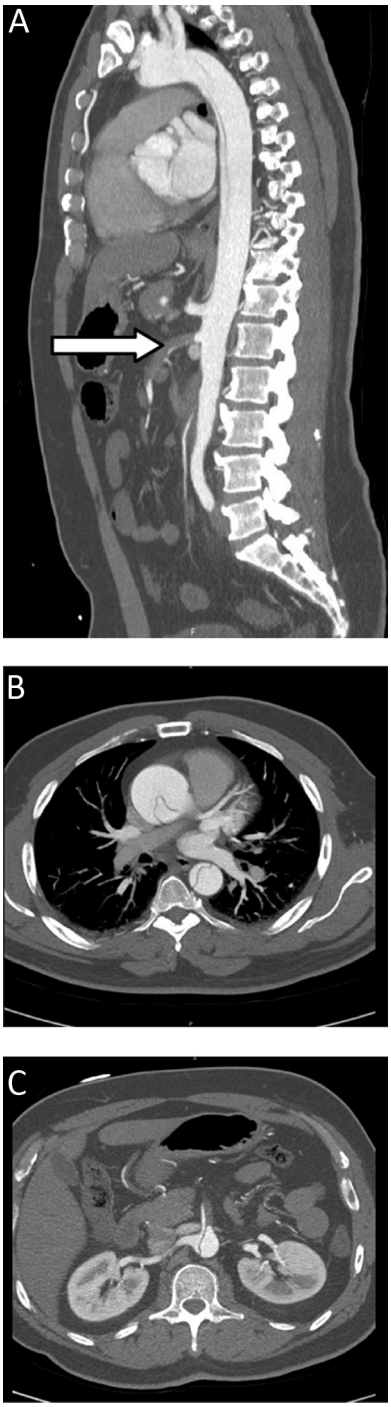

Figure 1. Computed tomography. A. Preoperative sagittal view showing Type A aortic dissection. B. Axial view showing intimal flap involving the aortic root extending to the descending aorta. C. Axial view showing aortic intimal flap extension to SMA (**arrow**).

The patient was transferred to our institution for further management. On arrival to our coronary care unit (CCU) he was hypertensive at 180/110 mm Hg and still in pain. He was also complaining of pain and tenderness involving his upper abdomen. There were absent pulsations in his left upper limb and left femoral arteries. Cardiac auscultation revealed a soft early diastolic murmur at the aortic area. He received intravenous nitroglycerin and beta-blockers to control his blood pressure. He underwent a transesophageal echocardiogram (TEE) which confirmed dissection of the aorta from the level of the aortic root and involving the right coronary artery, and extending into the aortic arch and descending aorta. The TEE also showed an intimal tear in the ascending aorta above the sino-tubular junction. The aortic root was dilated at 4.5 cm and the ascending aorta was 5 cm in diameter. Due to the nature of the static obstruction of the SMA and the onset of abdominal pain and slight abdominal tenderness, it was decided to begin by opening the SMA with a stent before performing the Bentall procedure to prevent the occurrence of bowel ischemia with its high mortality. The SMA was successfully opened in the catheterization laboratory by a vascular surgeon through a right femoral artery access under general anesthesia. The patient received a covered 6 × 40 mm self-expandable stent (Fig. 2A and 2C), a Nitinol stent from Cordis Corp. (Bridgewater, New Jersey). The time between patient arrival to our hospital and stenting the SMA was 3 h. Then, the patient was transferred directly to the operating room for repair of the aortic dissection by a Bentall procedure (Carbomedics size 23 mm valve, graft diameter 26 mm, model cp-023, Sorin Medica, Milan, Italy; Fig. 2B). The distal extent of resection was proximal to the innominate artery. The operation was successful and the patient had a smooth postoperative course. All pulses in both upper and lower extremities were present postoperatively. The patient was discharged home after 1 week in a good general condition. The fate of the false lumen was still present and not fully thrombosed. The patient was followed at the outpatient clinic and was doing well 1 year after this operation.

Discussion

Acute Type A aortic dissection is a life-threatening condition. The primary goal of early surgery is to minimize morbidity and mortality by preventing or reversing end-organ malperfusion. However, when systemic or visceral malperfusion is already occurring and complicates the condition, a strategy of address-

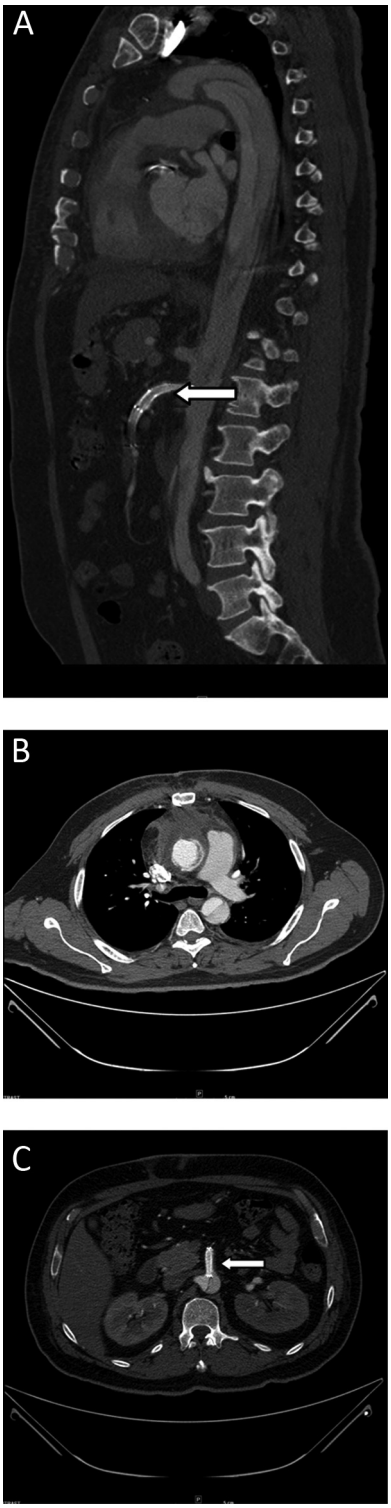

Figure 2. A and B. Computed tomography taken 10 days post-repair (A) and showing ascending aorta replacement with valved conduit (B). Note the stent in superior mesenteric artery (SMA). C. Axial view showing the stent in SMA (**arrow**).

ing the visceral complications first might be life saving [8].

The possible persistence of residual false lumen in the untouched distal aorta after repair can increase the risk of death [9]. Ascending aortic graft, followed by endovascular stenting of the arch and of the descending and thoracic aortic segments [9] or elephant trunk technique [10] are two therapeutic options to deal with the false lumen and hence open dynamic peripheral and visceral arterial occlusions.

Two major issues should be considered in acute dissections associated with peripheral ischemia. One is deciding which lesion should be treated first (i.e., the proximal aorta or the visceral organ), and the other is the mechanism of occlusion of peripheral arteries. A primary aortic surgery has an increased risk of bowel infarction, which frequently leads to patient mortality, and a primary visceral revascularization might delay the proximal aortic repair.

Percutaneous management of ischemic complications in patients with Type B aortic dissection is well established. Vedantham's et al. [11] retrospective review of Washington University's interventional radiology database identified 11 patients with acute Type B aortic dissection who underwent 13 endovascular procedures to attempt revascularization of 23 ischemic vascular territories (4 mesenteric, 11 renal, 8 lower extremities). Percutaneous interventions included balloon fenestration (4 patients), aortic true lumen stent placement (3 patients), and branch vessel stent placement (8 patients).

Slonim et al. [12], at Stanford, reviewed 22 patients who underwent percutaneous treatment for peripheral ischemic complications of 12 Type A (five acute, seven chronic) and 10 Type B (nine acute, one chronic) aortic dissections. All five patients with an acute dissection underwent surgical repair of the ascending aorta before undergoing the endovascular procedure. In four of these five patients the endovascular procedure was performed within 24 h of the operation, and in the fifth patient it was performed 10 days after the operation.

In our case, after diagnosis and stabilization of the patient, management was done by stenting the superior mesenteric artery first, followed by the Bentall operation. This choice was taken because the patient was stable and also because of his abdominal pain and tenderness with impending bowel ischemia and because of the nature of the SMA occlusion, which was static, with lower chance of reopening after proximal aorta repair.

Conclusion

We describe a case of successful management of an acute Type A aortic dissection and SMA occlusion and beginning bowel ischemia treated with endovascular stenting of the SMA, followed by a Bentall procedure.

Conflict of Interest

The authors have no conflict of interest relevant to this publication.

Comment on this Article or Ask a Question

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EDITOR'S QUESTIONS

1. Why did you sample only the outer layer in your dissection patients? We know the dissection occurs in mid-media. Why not sample and examine the inner layer as well?

We are primarily interested in what drives aortic dilatation after aortic dissection has occurred. We focused on the outer wall of the false lumen because this is the region primarily responsible for aneurysm expansion and rupture in patients with dissection, and the region that would be the target for pharmacologic treatment designed to prevent dilatation after dissection. Changes involving the inner dissecting membrane (or dissection "flap") would have limited clinical relevance in chronic dissection.

In our case, after diagnosis and stabilization of the patient, management was done by stenting of the superior mesenteric artery first, followed by a Bentall operation. This choice was taken because the patient was stable and also because of his abdominal pain and tenderness with impending bowel ischemia and because of the nature of the SMA occlusion, which was static with a lower chance of reopening after proximal aorta repair.

During aortic dissection, the true lumen can be compromised in several ways, including compression, resulting in malperfusion syndrome. Other examples include dynamic obstruction by intima invagination, or static collapse of the aortic true lumen, and dynamic or static occlusion of one or more vital side branches.

With surgical repair of the dissected thoracic aorta, nearly 90% of peripheral pulse deficits can be reversed. However, patients with mesenteric or renal ischemia do not fare as well. The mortality rate of patients with renal ischemia is 50% to 70% and as high as 87% in mesenteric ischemia [1–3].

There appears to be a role for stent graft placement in treatment of static or dynamic obstruction of aortic branch arteries. Static obstruction of a branch can be overcome by placing endovascular stents across the vessel origin, and dynamic obstruction can be relieved by stents in the aortic true lumen with or without additional balloon fenestration [4].

Due to the nature of the static obstruction of SMA, and the start of abdominal pain and the slight abdominal tenderness, it was decided to begin with opening the SMA by a stent before performing the Bentall procedure to prevent the occurrence of bowel ischemia with its high mortality.

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