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Intraoperative Type B Aortic Dissection During Total Arch Replacement

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ABSTRACT

Background: Intraoperative aortic dissection is an extremely serious complication that should be prevented whenever possible. When it does occur, it requires urgent clinical management.

Case presentation: We report the case of a 78-year-old man with Marfan syndrome who developed an intraoperative complicated type B aortic dissection with a distal anastomosis entry site during total arch replacement for a chronic dissection.

Conclusion: Performing immediate thoracic endovascular aortic repair, we were able to improve malperfusion to the lower extremities that occurred during total arch replacement.

INTRODUCTION

Intraoperative type B aortic dissection (TBAD) is an extremely rare complication during cardiac surgery. We report a case of immediate and lifesaving thoracic endovascular aortic repair (TEVAR) for a complicated TBAD that occurred intraoperatively during total arch replacement (TAR).

The patient gave his consent to publish clinical information pertaining to his case in a medical publication.

CASE REPORT

A 78-year-old man with Marfan syndrome presented to our hospital with a chronic DeBakey type II dissection. He denied having any prior symptoms, and his vital signs were stable. He had undergone a bio-Bentall procedure for annuloaortic ectasia and aortic valve regurgitation by another surgeon 6 years prior. The patient was followed up in the outpatient clinic, but he was reviewed in our department because of the ongoing enlargement of the aneurysm.

A contrast-enhanced computed tomography scan showed chronic DeBakey type II aortic dissection of the distal ascending aorta (beyond the prior Bentall) and the transverse aortic arch that was 60 mm in diameter. (Figure 1) There were no findings indicating dissection in the descending aorta. A transthoracic echocardiogram revealed no paravalvular leak at the aortic prosthetic valve and normal left ventricular function. We thought that the cause of the chronic dissection was the distal anastomosis site of his previous bio-Bentall procedure. We decided to perform an elective TAR after consultation with the patient to explain the risks and benefits of the surgery.

Surgery was performed via median sternotomy. First, the right femoral artery and femoral vein were exposed in anticipation of major bleeding during dissection of the adhesion. Then, cardiopulmonary bypass was established between the ascending aorta and right femoral vein, but since adequate drainage was not obtained, the SVC cannulation was added. Cardiac arrest was achieved by antegrade cardioplegia. When the bladder temperature reached 28°C, the circulation was arrested and selective antegrade cerebral perfusion started, which was trifurcated perfusion of the brachiocephalic left common carotid artery and left subclavian artery (LSCA). An open distal anastomosis was created using a 4-branched graft (Triplex 26 mm, Terumo Corporation, Tokyo, Japan) and sutured with 4-0 polypropylene horizontal mattress sutures with pledgets. Continuous 4-0 polypropylene sutures were then added. Circulation was restored from the lateral branch of the graft, and after suturing the central anastomosis, the three cervical branches were reconstructed. After removing the aortic cross-clamp, the patient successfully was weaned off cardiopulmonary bypass, and protamine was administered. However, we noticed that the arterial pressure in the left dorsalis pedis artery could not be recorded. Further, we were unable to record a left femoral arterial pulse. An intraoperative transesophageal echocardiogram (TEE) revealed an aortic dissection with an entry at the distal anastomosis site, resulting in true lumen compression. (Figure 2) Abdominal blood flow was confirmed by TEE, but lactate rose to 5.5 mmol/L. We diagnosed a complicated TBAD with a distal anastomosis entry site, which required urgent treatment.

We chose to perform TEVAR to expand the true lumen but found it difficult to secure the landing zone because the graft to the left subclavian artery was close to the distal suture line. Therefore, we performed a renewed anastomosis between the LSCA and another graft branch that had been used for systemic circulation. This allowed for a landing zone of approximately 3 cm, enabling us to deploy the stent and restore perfusion to his left lower extremity. (Figure 3)

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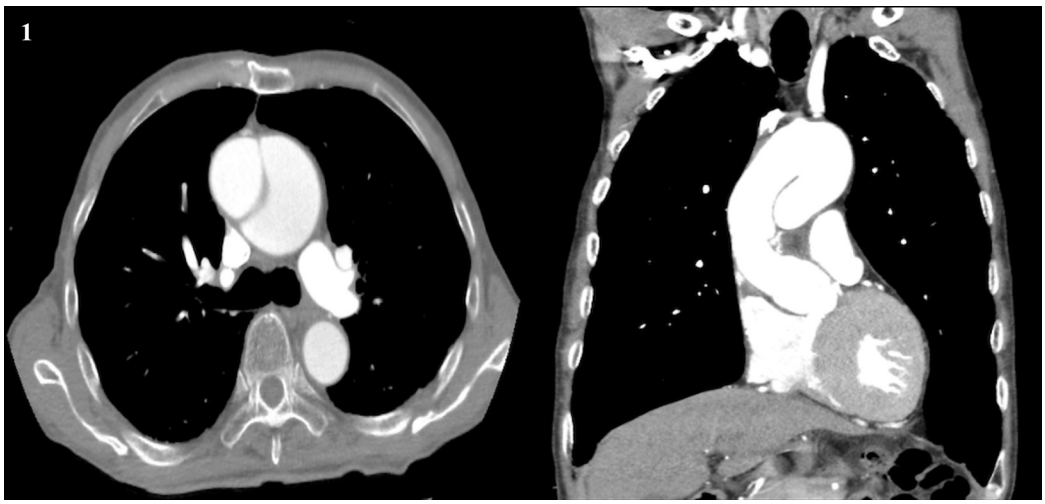

Figure 1. Preoperative contrast-enhanced computed tomography showing DeBakey type II aortic dissection with a diameter of 60 mm.

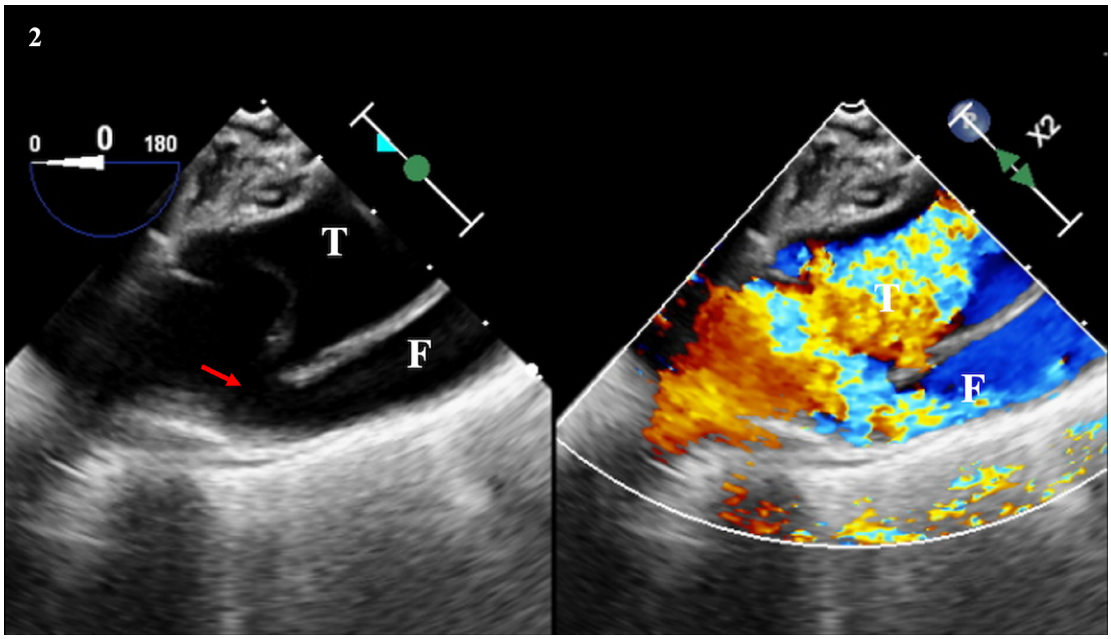

Figure 2. Intraoperative transesophageal echocardiography showing an aortic dissection from the distal anastomosis site. The red arrow shows the entry site. The blood flow in the false lumen is shown. F, false lumen, T, true lumen

Due in part to the preoperative severe chronic obstructive lung disease, tracheostomy was required at 3 weeks postoperatively. He subsequently developed pneumonia, urinary tract infection, and even bacteremia, which was treated with appropriate antibacterial agents. Follow-up CT scan during hospitalization showed no signs of graft infection. Owing to the extensive time required for rehabilitation, the patient was discharged from hospital 7 months after his surgery. He was able to walk unaided at discharge. However, 1 month later, the patient came to the hospital with a complaint of fever and was admitted with a diagnosis of graft infection and died the day after admission.

DISCUSSION

Intraoperative aortic dissection is an extremely rare complication during cardiac surgery, with an incidence of 0.16% [Still 1992]. The areas of aortic cannulation, cross-clamping, partial-occlusion clamping, proximal anastomosis, and direct aortic injury have been reported as dissection sites [Still 1992]. The literature on descending aorta dissection suggests that the jet created by the aortic cannula or intimal injury during intra-aortic balloon pump insertion may create an entry site [Ishikawa 2014; Varghese 2002]. In this case, dissection probably occurred from the distal anastomosis site, as shown by

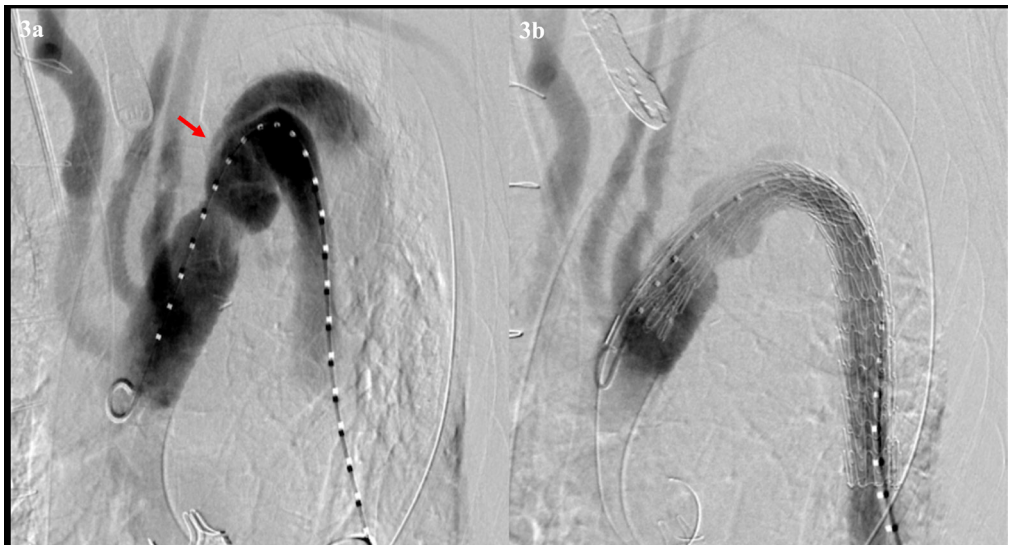

Figure 3. A) Aortography showing an aortic dissection from the distal anastomosis site. The red arrow shows the entry at the site of greatest curvature. B) A stent graft was deployed, and the true lumen was enlarged. The stent did not interfere with blood flow to the left subclavian artery.

the TEE. Such dissections are rarely experienced in practice, but we could not identify any similar cases in the literature. Therefore, we believe there is a need for this report.

Patients with cystic medial necrosis, longstanding hypertension, or advanced atherosclerosis of the aortic wall have been reported to be more prone to intraoperative aortic intimal injury [Murphy 1983]. In the present case, the patient had Marfan syndrome, and the consequent vulnerability of his blood vessels to intraoperative aortic intimal injury was anticipated preoperatively. In addition, since we determined that the cause of the chronic DeBakey type II dissection was the distal anastomosis site of his previous surgery, we performed distal anastomosis with increased caution. Specifically, our hospital usually performs only continuous sutures for distal anastomosis of aortic aneurysms, but we performed vertical mattress sutures using pledgets with the deepest attention. In addition, since the anastomosis site was so deep, we added a continuous suture to prevent bleeding. However, an aortic dissection with an anastomotic entry did still occur, indicating that this strategy needs to be revised. For patients with high vascular vulnerability, the use of the frozen elephant trunk technique along with TAR may be a viable option. In addition, using a Teflon felt sandwich technique on any anastomosis that is amenable to it can be a valuable option for patients with a predisposition to dissection formation such as a Marfan patient. We also thought that the additional continuous sutures used to prevent bleeding resulted in increased stress on the aorta and should not have been used.

The use of TEVAR for acute complicated TBAD has been proven to be an excellent treatment strategy [Stelzmueller 2019]. However, we encountered several problems with this approach. It was difficult to secure the landing zone because the side branch of the graft to the LSCA was close to the entry site. Therefore, we quickly re-anastomosed the LSCA with another side branch that had been connected to the pump cannula. This enabled us to secure a landing zone of approximately 3 cm in length. However, for patients with such vascular vulnerabilities, it would have been better to place the head vessel branches approximately 3 cm proximal to the distal anastomosis site to ensure a proximal landing zone for future TEVAR procedures.

Malperfusion due to intraoperative dissection did not appear to have directly contributed to the patient's death, however, prolonged operative time with additional TEVER may have been one factor that delayed postoperative recovery. While it is possible to perform the remedial procedures we have described above, efforts must be required to avoid intraoperative dissection.

In conclusion, distal anastomosis in patients with vascular vulnerabilities, such as Marfan syndrome, may cause TBAD during TAR. Future studies should examine further improvements to the surgical techniques used for distal anastomosis.

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