A Rare Complication of TEVAR Performed for Complex Acute Stanford B Aortic Dissection

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Abstract

Management of aortic dissection with a novel endovascular technique known as thoracic endovascular aortic repair (TEVAR) paired with surgical debranching as a less invasive alternative to conventional repair has gained widespread acceptance. However, experience for complicated, Stanford type B dissection involving the aortic arch is still limited.

Keywords

- acute Stanford B aortic dissection
- TEVAR
- debranching

Introduction

Most surgeons still consider open repair of complex aortic arch pathologies by means of cardiopulmonary bypass and deep hypothermic circulatory arrest as state of the art, even though significant morbidity and mortality are associated with these.[1] Novel endovascular techniques such as thoracic endovascular aortic repair (TEVAR) coupled with surgical debranching as a potentially less invasive alternative treatment has gained popularity. With acceptable results regarding primary technical success and mortality and morbidity rates, these procedures have increasingly replaced open repair despite long-term experience is missing and a postprocedural stroke is still an issue.[1]

With TEVAR being considered for treatment of aortic dissection, penetrating ulcer, pseudoaneurysm, and aneurism even when involving the ascending aorta (proximal landing zone [PLZ] 0) or the arch (PLZ 1, 2),[2] more information about acute and/or chronic complications of this approach is required.

Case Presentation

We report the case of a 76-year-old woman with a decent overall health status, initially referred to our hospital for a large posttraumatic pleural effusion on her left side. Her past medical history included hypertension, diffuse coronary atherosclerosis, and atrial fibrillation, and she is currently under treatment with Coumadin. She received a right shoulder joint replacement 6 months ago, left hip replacement 2 years ago, and has a history of osteoporosis.

Thoracentesis was performed that showed bloody effusion. Additionally, an emergency computed tomography (CT) scan performed upon the patient's arrival revealed an acute Stanford type B aortic dissection with retrograde affliction/hematoma of the aortic arch (►**Fig. 1**).

She was rushed to our theater and due to relevant comorbidity, we opted for a hybrid aortic arch repair with initial debranching procedure (end-to-side Y-graft from ascending aorta with end-to-end anastomoses to brachiocephalic artery and left common carotid artery, left carotid-subclavian bypass) and TEVAR (PLZ 0, ►**Fig. 2**).

On admission to intensive care unit (ICU), the patient was ventilated and hemodynamically stabilized with low-to-moderate inotropic support. After successful extubation and an initially uneventful course, she developed respiratory distress and relevant blood loss through her indwelling chest tubes by postoperative day 3. An emergency CT scan confirmed progressing hemothorax, which we successfully treated by releasing a partly coagulated hematoma of roughly 500 mL through thoracoscopy. Six days later, the patient had to be resuscitated due to asystole. Emergent CT scan confirmed active bleeding in the mediocaudal region of the ascending aorta/bypass anastomoses and relevant pericardial effusion (►**Fig. 3A**). She was immediately taken to the operating room (OR) and extracorporeal bypass was initiated under cardiopulmonary resuscitation (CPR). We discovered active bleeding directly spurting above the ascending aortic anastomosis with the Y prosthesis, which appeared to be torn by the implanted stent (►**Fig. 3B**). Under hypothermia

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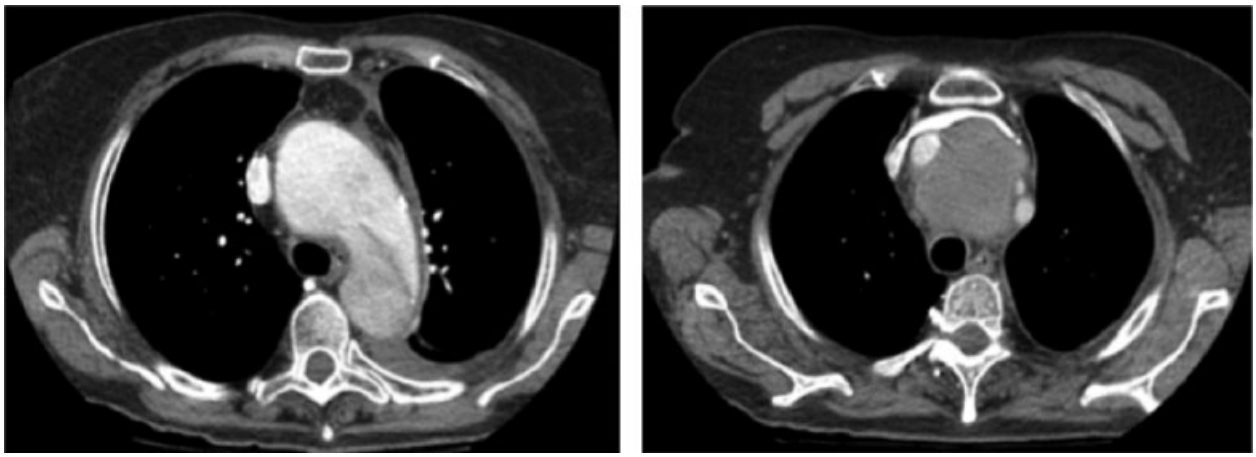

Fig. 1 Acute type B aortic dissection with retrograde affliction of the aortic arch.

(28°C) and antegrade cerebral perfusion via the bypass graft, the supracommissural ascending aorta was replaced with a Dacron prosthesis, which in turn was anastomosed to the stent graft excluding the rigid metal struts. Bypasses to the carotid arteries were reanastomosed in an end-to-side technique (►**Fig. 4A**). After the procedure, the patient was transferred to ICU and hemodynamically stabilized with moderate inotropic support. Her further course was complicated by acute renal failure requiring hemodialysis, which could be discontinued down the line, and respiratory failure necessitating tube tracheostomy. Six weeks later, her general condition was vastly improved and she could be discharged in good overall health without major neurological complications. A control CT scan after 6 months confirmed patency of all anastomoses (►**Fig. 4C**).

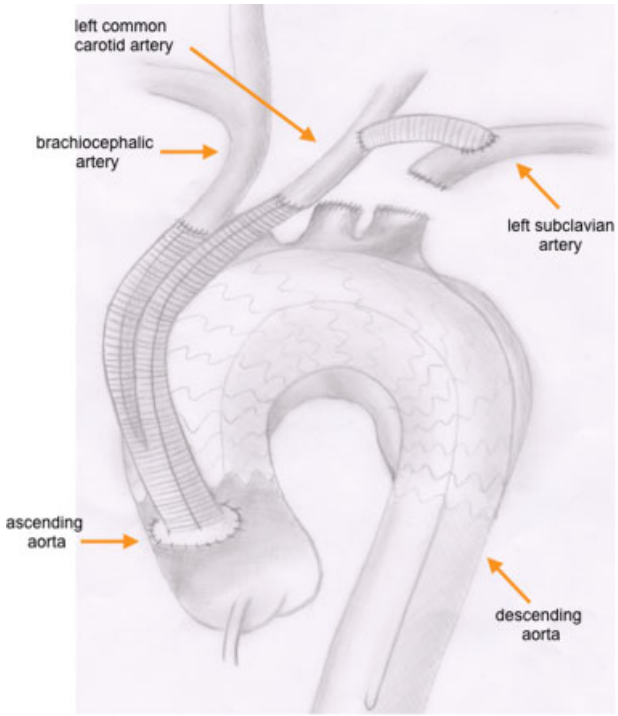

Fig. 2 Hybrid aortic arch repair with initial debranching procedure. End-to-side Y-graft from ascending aorta, end-to-end anastomoses to brachiocephalic artery and left common carotid artery; extraanatomic left carotidsubclavian bypass; and thoracic endovascular aortic repair (TEVAR, proximal landing zone [PLZ] 0).

Discussion

In recent years, a continuous shift from conventional surgery toward endovascular repair is observable in aortic surgery, and novel branched endografts or hybrid procedures even allow for endoluminal therapy of the aortic arch.[3] At present, optimal treatment of complex pathologies involving the aortic arch remains controversial. Refined neuroprotective strategies like antegrade cerebral perfusion and more moderate temperatures (e.g., 28°C) for circulatory arrest help to improve the outcome in open arch repair, with major complications such as stroke and death dropping below 5%.[3,4] These numbers hold up even in patients undergoing surgery for type A dissection, redo procedures, and extended arch repair.[3,5] Patel and coworkers identified independent predictors of early mortality like advanced age, prolonged bypass times, and impaired ejection fraction in open surgery.[3] Together with independent predictors of late mortality, such as prolonged lower body circulatory arrest times and increasing creatinine values, these variables might help in selecting patients better suited for endoluminal repair. Since first described by Volodos et al in the late 1980s,[4,6] endovascular aortic repair continuously evolved and has been extended to the PLZ 0 classification by Ishimaru, which corresponds to the ascending aorta.[2] To obtain a suitable PLZ 0 for a vascular stent, a surgical debranchment of the supraaortic vessels is mandatory. It generally consists of a revascularization of the brachiocephalic trunk and left common carotid artery from the ascending aorta through a Y-graft via median sternotomy. A complete debranching of the arch allows for a longer PLZ with lower incidence of endoleak. We were presented with an acute Type B dissection with retrograde affliction of the arch and opted for a hybrid approach due to the relevant comorbidity of our patient. After complete debranching with the adjunct of a left-sided carotidsublcavian bypass, TEVAR with PLZ 0 was performed. In accordance with

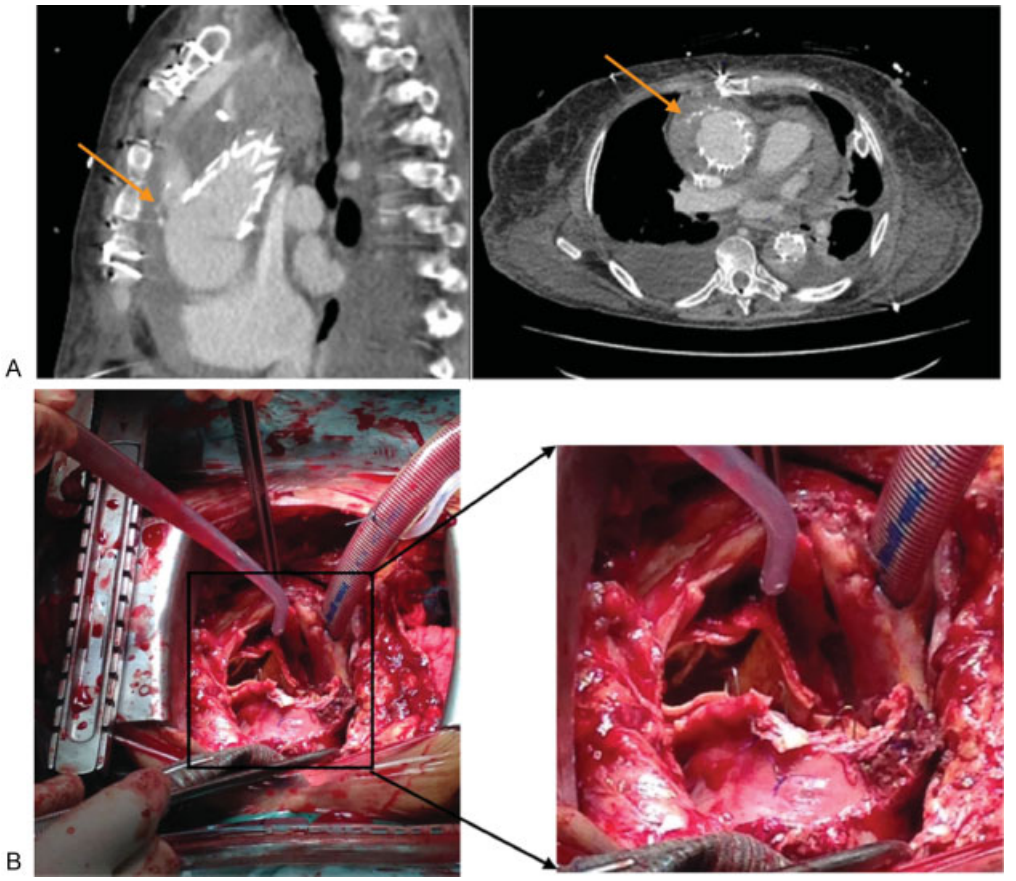

Fig. 3 Computed tomography (CT) scan confirming active bleeding (**A**). Intraoperative findings of ascending aorta tear and active bleeding (**B**).

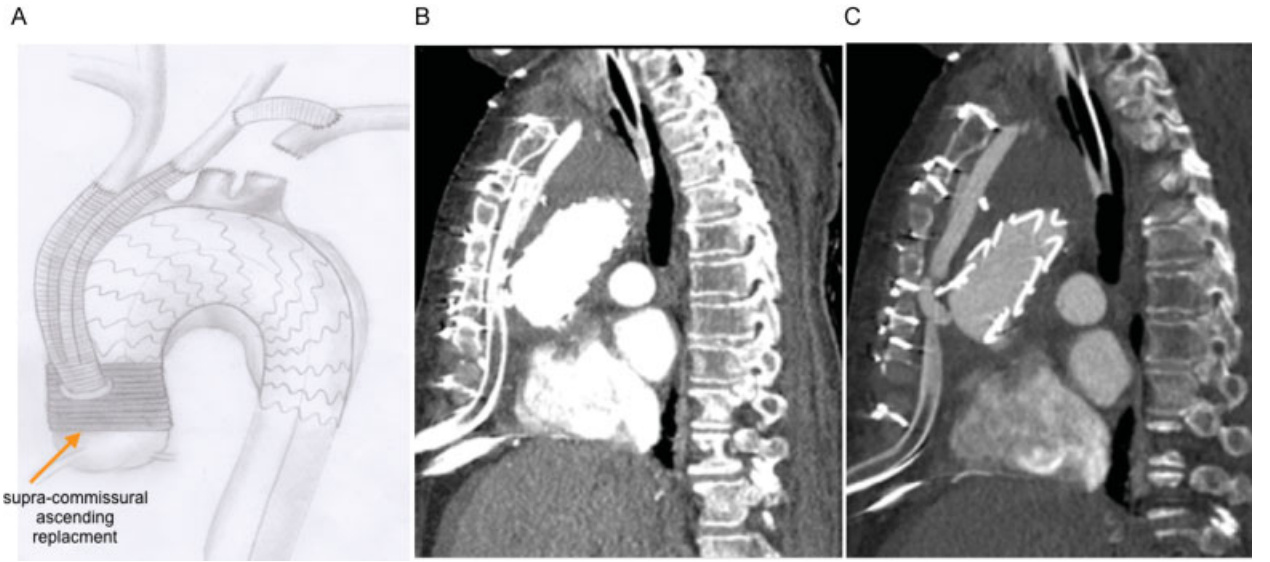

Fig. 4 Redo surgery with replacement of the supracommissural ascending aorta with a Dacron prosthesis, which was anastomosed to the stent graft excluding the rigid metal struts. Antegrade cerebral perfusion via the Y-graft. Reanastomosis of the Y-graft to the aortic prosthesis in end-to-side technique (**A**). Control computed tomography (CT) scan after 5 days (**B**) and 6 months (**C**).

the data of Canaud, who had a technical success rate of 100% in high-risk patients undergoing this procedure,[7] the initial course was uneventful and no endoleak developed. Even though intraoperative or late aortic rupture as severe complications of this procedure is known to occur, especially in patients treated for acute dissection,[8] this is, to our knowledge, the first report of a late stent-related perforation of the ascending aorta. This leads us to share concerns expressed by other groups about device's conformability to the curved shape of the aortic arch or the device's ability to withstand

increased aortic wall stress.[4] Interestingly, our conventional aortic repair initiated under CPR was feasible without incurring severe neurological complications, with the caveat of our patient having a long and tedious further course.

Endoluminal procedures have developed at an astonishing pace and certainly constitute the future of vascular surgery. However, at this point, we still tend to favor conventional aortic arch repair, which we consider the gold standard for complex pathologies.

Conclusion

Despite being widely considered as a less invasive and less dangerous alternative to conventional aortic repair, TEVAR still has relevant risks, especially in the treatment of pathologies of the aortic arch. Further experience with this technique is required prior to routine implementation.

Conflict of Interests
The authors have no conflict of interests to declare.

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