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Case Report

A Challenging Case of Endovascular Repair of a Thoracic Aortic Rupture

Amine Fikani[1*], Fadi Farhat[2], Antoine Millon[1]

[1]*Department of Vascular Surgery, Claude Bernard University, Villeurbanne, France*

[2]*Department of Cardiac Surgery, Claude Bernard University, Villeurbanne, France*

ABSTRACT

Endovascular procedures are currently treating more complex cases. In this report, we present the case of a complex aortic rupture in a patient with a type B aortic dissection. We describe step by step the procedure and we describe other alternative surgical and endovascular techniques. We believe that as collective experience grows, endovascular treatment limits can be pushed to replace surgery in more complex cases.

Keywords: Aortic dissection; Aortic rupture; Endovascular; TEVAR; Frozen elephant trunk

INTRODUCTION

Endovascular surgery has become the mainstay for the management of aortic pathologies. With the improvement in technology and the increment of worldwide experience, more complex cases are being eligible for endovascular repair.

Thoracic aortic rupture is a life-threatening condition that demands immediate and precise intervention [1]. Among the various treatment options, endovascular repair has emerged as a less invasive alternative to open surgery, offering potential benefits in terms of reduced morbidity and mortality. However, the procedure is not without its challenges, particularly when faced with complex anatomical variations, hemodynamic instability or delayed presentation. This report details a particularly challenging case of endovascular repair for a thoracic aortic rupture, highlighting the technical difficulties encountered, the strategies employed to overcome these obstacles and the critical decision-making processes that ultimately led to a successful outcome [2].

CASE PRESENTATION

A 60-year-old man presented for severe acute back pain. Eight years ago, he had a history of ascending aortic replacement for an extensive type A aortic dissection. Surgery was complicated by lower limb ischemia treated with aorto-iliac stenting. He had then a Frozen Elephant Trunk (FET) surgery a year ago for an arch aneurysm [3].

On admission, CT scan showed an aneurysm of the descending thoracic aorta of 10 cm originating just below the FET endoprosthesis. The aneurysm was associated with pleural effusion. There was no visceral malperfusion. The aorto-iliac stent was deployed inside the false lumen which was perfused by reentries inside the renal arteries. There were no re-entries inside the aortic lumen at the abdominal level. There was no dissection of the iliac and femoral arteries (Figure 1).

Figure 1: Pre-operative CT scan: Aortic rupture (*), aorto-iliac stent (black star), false lumen (black arrow), true lumen (white arrow).

An endovascular approach was decided. Under general anesthesia, through a femoral puncture, a 6Fr introducer was inserted. Catheterization of the true lumen was complex. Using a BER2 catheter, a standard Terumo guidewire was pushed through the stent mesh inside the true lumen. The orifice was

Correspondence to: Amine Fikani, Department of Vascular Surgery, Claude Bernard University, Villeurbanne, France; E-mail: aminefikani@gmail.com

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then dilated progressively with an 8 mm, 10 mm and 12 mm balloon. A Lunderquist guidewire was then inserted and placed inside the ascending aorta. A 20Fr dryseal flex introducer sheath (GORE®) was passed through the stent mesh. A 28 mm GORE® TAG® Conformable stent graft was deployed inside the FET to the level of the celiac trunk. Finally, a 14 mm × 30 mm sinus excel stent was deployed inside the mesh of the aorto-iliac stent to preserve a communication between the true and the false lumen (Figure 2).

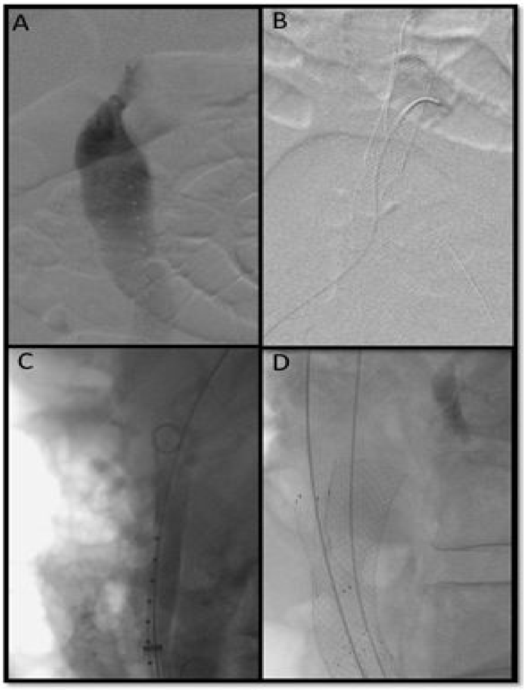

Figure 2: Procedure A) Aortography through the aorto-iliac steng injecting the false lumen; B) Ber2 catheter inside the stent mesh; C) Pig-tail catheter and lunderquist inside the true lumen; D) Stent between true lumen and aorto-iliac stent.

Post-operative CT scanner showed a stable diameter of the thoracic aorta. The false lumen was completely thrombosed at the thoracic level. There was a persistent perfusion of the false lumen at the abdominal level, through a reentry inside the right renal artery. There was no visceral or lower limb malperfusion (Figure 3).

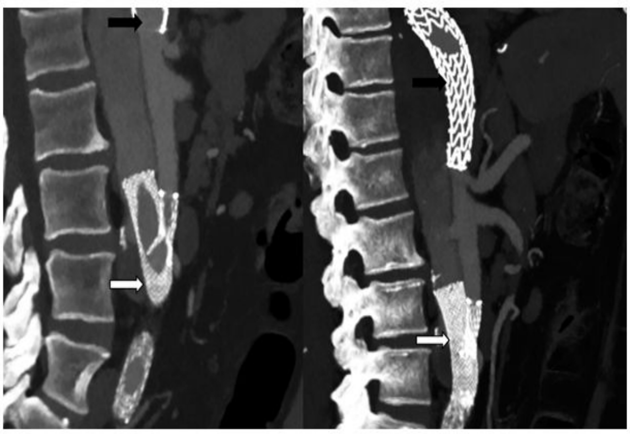

Figure 3: Post-operative Ct scan: Thoracic endoprosthesis (black arrow), aorto-iliac stenting (white arrow).

Post-operative course was uneventful and the patient was discharged at day 5. A written informed consent for publication was obtained [4].

Challenges in endovascular repair

The primary challenges in this case included:

Anatomical considerations: The rupture was located in a segment of the aorta with significant angulation, making it difficult to achieve a stable landing zone for the endograft. Additionally, the patient had a relatively short proximal neck, increasing the risk of endoleak [5].

Hemodynamic instability: The patient's unstable condition required rapid intervention, which limited the time available for preoperative planning and necessitated immediate intraoperative decision-making.

Device selection: Choosing the appropriate endograft was challenging due to the combination of the patient's aortic anatomy and the need for a device that could be deployed quickly and accurately in the emergency setting [6].

RESULTS AND DISCUSSION

Endovascular management of aortic pathologies have become a routine procedure. Advancement in technology and increasement of worldwide experience have broadened the spectrum of patients with complex aortic pathologies eligible for endovascular intervention.

In our case, the main difficulty was the access to the true lumen inside the aorta to deploy the endoprosthesis. We decided to access the true lumen through the mesh of the stent. The intervention was done under general anesthesia because we could not predict beforehand the complexity and the outcome of the procedure. Clearly, this procedure could have be done under local anesthesia [7].

Other alternatives access sites would have included a left ventricular/transapical approach which allows insertion of larger endovascular delivery systems and more precise placement of stents. Major complications of this access site are aortic valve regurgitation, intra-operative ventricular fibrillation, stroke, failure to exclude the aneurysm, retrograde aortic dissection and aortoesophageal/bronchial fistula. Transcaval technique may be used to deliver large profile devices into the abdominal aorta. A nitinol cardiac occluder device is then utilized to achieve tract closure. One of the major difficulties for this technique in our case is to be able to identify on the CT scan the cavo-aortic site to access the true lumen inside the aorta. Finally, there are few reports for TEVAR through trans axillary or trans carotid approach.

Surgery in our case would have been also challenging. It would require a large thoracoabdominal incision, cross-clamping or endo-clamping of the FET, replacement of the thoracic aorta (to the level of celiac trunk) and probably fenestration of the abdominal aorta [8].

CONCLUSION

In this report, we described the procedure of an endovascular management of a complex aortic pathology. As collective experience grows, endovascular treatment limits can be pushed further to replace surgery in complex cases involving endovascular repair of a thoracic aortic rupture, it is evident that the procedure, while complex, offers a viable alternative to open surgery, particularly in high-risk patients. The case underscores the importance of meticulous preoperative planning, the use of advanced imaging techniques and a multidisciplinary approach to manage complications that may arise during and after the procedure. Although endovascular repair presents its challenges, especially in anatomically difficult cases, it remains a life-saving option with potential for favorable outcomes when executed with precision and expertise. Continued advancements in endovascular technology and technique will likely further enhance the success rates and expand the applicability of this minimally invasive approach.

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