

# Describing The Use of Two Hybrid Prostheses in The Staged Surgical Repair of Aortic Dissection

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## Case report

**Keywords:** Aortic dissection, thoracoabdominal aorta, TEVAR, Hybrid prostheses

**Posted Date:** September 17th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-835587/v1>

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# Abstract

**Background**-Reconstruction of the thoracoabdominal aorta after dissection (Stanford Type A with extension into descending aorta) has limited surgical options. Described here is a novel technique for the staged surgical repair of the thoracoabdominal aorta after reconstruction of the ascending aorta with aortic arch using a hybrid prosthesis.

**Case presentation**- The thoracoabdominal aorta is accessed via a lateral thoracotomy. After a left-left bypass to perfuse the descending aorta, the proximal end of the prosthesis is anastomosed to the proximal aorta and distal end of the new prosthesis is then inserted into the true lumen of the descending aorta and the stent is deployed.

**Conclusion**-Using this technique, operative time is reduced with accurate reconstructions of the anatomy.

## Background

The Frozen Elephant Trunk technique is a well-established treatment for aortic dissections (Stanford Type A) involving the aortic arch and descending aorta. The Thoraflex™ Hybrid prosthesis (VASCUTEK Ltd. Inchinnan, Renfrewshire, Scotland), consisting of a proximal flexible conduit and a distal self-expanding covered stent, has consistently shown positive results in the treatment of these conditions<sup>1</sup>. Some cases may also present a reentry too distal to be closed off by the stent of the prosthesis<sup>2</sup>, due to the underlying pathology, or selection of a shorter stent to avoid spinal cord injury. This may lead to a progression of the aneurysm leading to an increased risk of rupture, or in some cases, a true lumen collapse. These cases warrant the reconstruction of the thoracoabdominal aorta. The following is a description of such a staged reconstruction using the Thoraflex™ Hybrid Ante-Flo™ device, performed in two patients with residual dissection of the thoracoabdominal aorta (residual DeBakey I) with significant diameter progression, after previously undergoing the Frozen Elephant Trunk procedure for aortic dissection.

## Case Presentation

Two patients, who initially presented with aortic dissection classified as Stanford Type A/DeBakey I, which involved the aortic arch and descending aorta, progressing up to the femoral arteries. On follow up, a rapid progression of pathology with continued perfusion of the false lumen was observed in both patients. The length of the stent prosthesis is calculated from the preoperative CT scan to avoid occlusion of the abdominal branches. During anaesthesia induction, the patient is intubated using a dual lumen endotracheal tube to allow the left lung to collapse after thoracotomy. With the patient in the right lateral position, an incision is taken along the 5<sup>th</sup>/6<sup>th</sup> left intercostal space from the anterior axillary line to the scapular line. The aorta is prepared distal to the inlying stent. The left atrium is prepared for cannulation. After clamping the stent, the aorta is divided at the distal end of the stent and the distal end of the new prosthesis is then inserted into the true lumen of the descending aorta and the stent is deployed. Following this, a left-left bypass is achieved via the left atrium using a one-stage venous

cannula, and blood is returned using the perfusion arm of the prosthesis with the proximal aorta clamped. The collar of the prosthesis is sutured proximally to the aorta near the inlying previous stent. The use of a collard prosthesis allows for easier suturing to the intima, ensuring continued perfusion via the true lumen. The patient is weaned from the left-left bypass and the aortic clamp is released. Air is removed via the perfusion arm of the prosthesis, which is then oversewn after the procedure is complete.

## Discussion And Conclusion

The Thoraflex™ Hybrid Prosthesis is commonly used on the proximal aorta in patients with aortic aneurysm and aortic dissection (Stanford Type A). Of the two patients treated with this procedure, the first patient underwent a supracoronary aortic replacement with the Frozen Elephant Trunk procedure and needed treatment of the thoraco-abdominal aorta due to progressive true lumen collapse as a result of continued perfusion of the false lumen and symptoms related to reduced perfusion of the abdominal organs. The 3-D reconstruction of the CT-angiography of this patient before and after replacement of the thoracoabdominal aorta is included in the figure above. The second patient, who had Loeys-Dietz syndrome, first underwent a Bentall procedure with a mechanical aortic valve, then the Frozen Elephant Trunk procedure to replace the aortic arch and proximal descending aorta. Due to the underlying disease and progression of the aneurysm with continued perfusion of the false lumen, the distal descending aorta (thoracoabdominal aorta) needed treatment. In both cases, continued false lumen perfusion, risk of rupture due to rapid progression of the aortic aneurysm, difficult anatomy for reconstruction using endovascular techniques were the reasons for selection of this procedure.

Though TEVAR was considered in both patients, it was not feasible due to difficulty in establishing reliable vascular access, as well as a narrow landing zone in the progressive aneurysm of the descending aorta. A TEVAR extension alone would not have sufficiently excluded the proximal descending aorta from retrograde perfusion.

During the procedure, the stent portion of the prosthesis is inserted manually under direct vision of the landing zone. This prevents the occurrence of distal stent graft-induced new entry. As both cases presented with chronic dissection, where the occurrence of iatrogenic re-entry has been shown to occur more frequently<sup>3</sup>, a surgical approach may provide a significant advantage over endovascular approach in this area. Furthermore, this technique is faster and technically easier than using a tube graft to reconstruct the descending aorta up to/ just beyond the diaphragm.

There were no neurological complications in both cases, although this technique should not inherently affect the occurrence of such complications, as compared to other procedures on the thoracoabdominal aorta and may require further evaluation.

Another disadvantage could be that of leaving a potentially perfused false lumen at the level of the second hybrid prosthesis stent graft. However, if a re-entry at the expected level can be ruled out pre-operatively, as was the case with the patients treated, the chances of this are minimal.

Though not performed in the cases presented, this procedure has the potential of being combined with reconstructions of the abdominal aorta when required.

This procedure shows that the descending aorta including the transition to the abdominal part of the aorta can be treated using the Thoraflex™ Hybrid Ante-Flo™ prosthesis. The inflow of the left-left bypass can easily be achieved by using the perfusion arm of the prosthesis without the need for additional vascular access. Using this technique, operative time is reduced with accurate reconstructions of the anatomy.

## List Of Abbreviations

TEVAR

Thoracic endovascular aortic repair

CT

Computer tomography

3D

Three dimensional

## Declarations

**Ethics approval and consent to participate-** was waived due to the descriptive and retrospective nature of the report.

**Consent for publication-**not applicable

**Availability of data and materials-**not applicable

**Competing interests-**the authors declare that they have no competing interests

**Funding-**No payment or services were accepted from a third party (government, commercial, private foundation, etc.) for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc)

**Authors' contributions-** Prof. Weyand, Dr. Tander: planning and performing the procedure. Dr. Harig, Pathare: Assisted during the procedure, writing the case report.

**Acknowledgements-**Not applicable

**Authors' information (optional)-**refer to title page

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## Figures

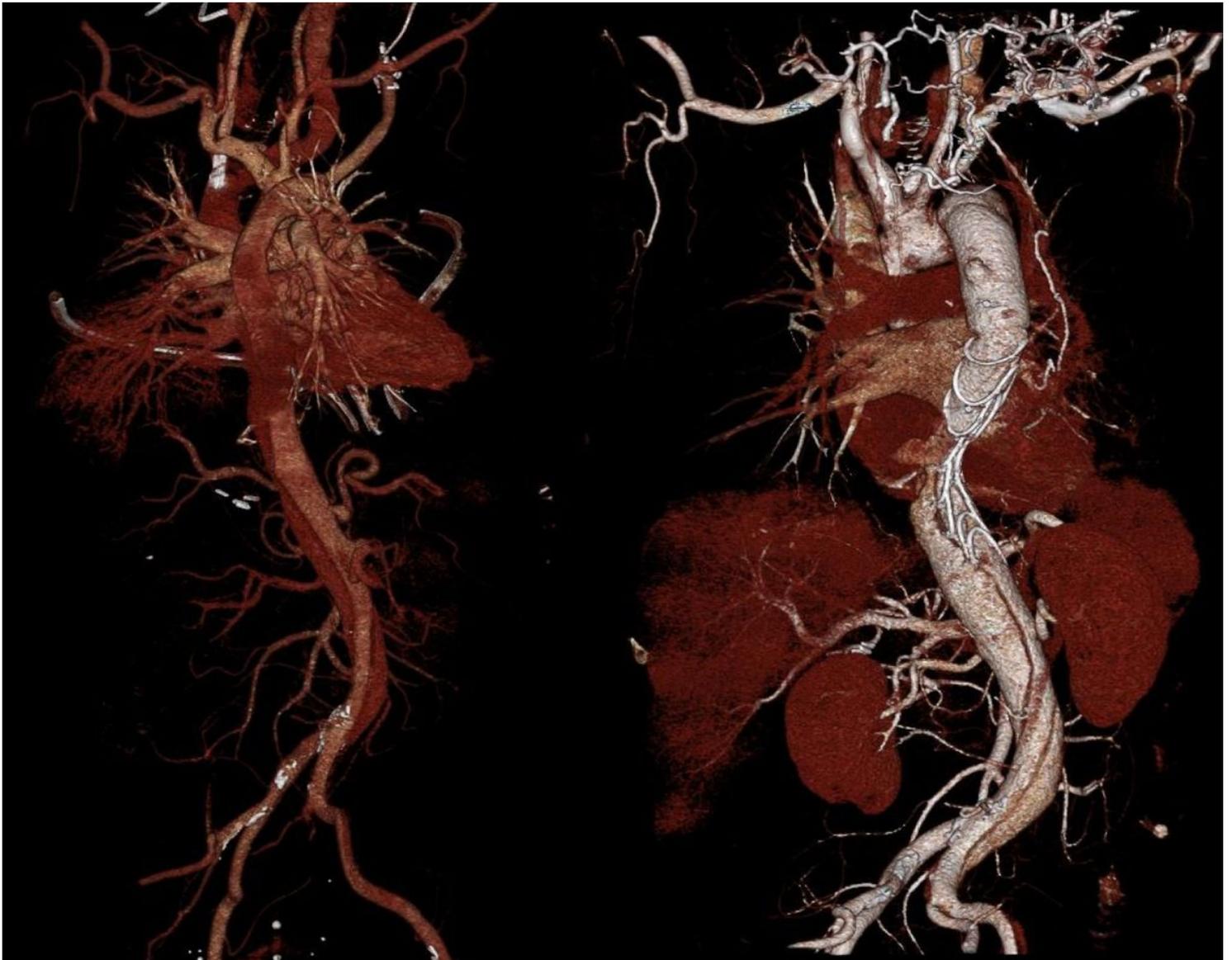


Figure 1

The figure shows the 3D reconstruction of the descending Aorta after replacement of the ascending aorta (left) showing the true and false lumen of the remaining dissection. After reconstruction with a hybrid prosthesis (right) the stent lies in the true lumen.