Endovascular treatment of an anastomotic outflow graft pseudoaneurysm of the descending aorta after implantation of a left ventricular assist device

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Abstract

Introduction: Outflow graft (OG) obstruction is a dangerous complication that may occur for various reasons after the implantation of the left ventricular assist device (LVAD).

Case Report: In this study, we describe the case of a 67-year-old patient on LVAD support who developed a late pseudoaneurysm of the OG anastomosis (to the descending aorta) causing OG stenosis at the level of the anastomosis. The patient was treated with a customized fenestrated endovascular stent graft placed into the descending aorta and stent implantation into the OG.

Keywords:
endovascular, LVAD, pseudoaneurysm, stenting

1 | INTRODUCTION

The outflow graft (OG) of left ventricular assist devices (LVAD) is usually anastomosed to the ascending aorta, but occasionally also to the descending aorta or its major branch.¹ Pseudoaneurysm formation of the vascular anastomosis is infrequently reported and may in some cases lead to OG obstruction causing heart failure, which may be treated by means of an intervention.²⁻⁴ We describe, for the first time, an obstruction of the OG due to a pseudoaneurysm of the OG anastomosis to the descending aorta. To prevent rupture of the pseudoaneurysm and further obstruction of the OG, a customized fenestrated stent graft was implanted into the descending aorta, followed by OG stenting.

2 | CASE REPORT

A 67-year-old male with ischemic cardiomyopathy (history of CABG 8 years ago) was admitted due to a significant deterioration in his physical condition, 2 years after implantation of an LVAD (HeartWare HVAD; Medtronic, Minneapolis, MN) with the OG placed into the descending aorta (due to adhesions following prior CABG surgery). The LVAD implantation was performed as destination therapy. During the diagnostic evaluation, the computed tomography angiography (CTA) showed a leak in the OG anastomosis, which had resulted in a pseudoaneurysm (Figure 1). The partially thrombosed pseudoaneurysm (50 mm in diameter) narrowed the lumen of the OG.

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(cross-sectional area [CSA] 0.58 cm\(^2\), reference: CSA 0.96 cm\(^2\)), causing an LVAD flow reduction of approx. 1 L/min. A positron emission tomography/computed tomography (PET-CT) showed no signs of infection.

After obtaining the patient's informed consent, interventional therapy was performed in the hybrid operating room under general anesthesia. On the basis of the CTA measurements, a self-expanding covered thoracic stent graft (E-vita Thoracic 3G 30/30/100 mm) and an

**FIGURE 1** Preoperative computed tomography angiography (CTA). A. CTA imaging as a curved multiplanar reformation reconstruction revealed an approx. 50 mm partially thrombosed pseudoaneurysm. The lumen of the pseudoaneurysm is been perfused via the aorta (blue arrow). B. Image of volume rendering technique showing the position of the pseudoaneurysm (red arrow) to the outflow graft. C. Positron emission tomography/computed tomography with radioactive Fluorine-18 image showing no signs of pathologically increased glucose metabolism in the pseudoaneurysm (yellow arrow)

**FIGURE 2** Stent preparation. A. E-vita Thoracic 3G 30 × 100-mm stent is exposed halfway from its deployment system; a 9-mm hole is cut into the wall. B. A tip of a flexible radiopaque guidewire was sewed around the aperture using 5-0 Prolene sutures. C. Completed 9-mm window with radiopaque ring. D. Fluoroscopy outside the body showing the position of the aperture in the stent (red arrow)
E-ventus 37 × 10-mm peripheral stent graft (both Jotec, Hechingen, Germany) were selected. In a first step, which was performed under sterile conditions on the back table, the thoracic stent graft was pulled halfway out of its deployment system and a 9-mm hole was cut into the middle segment. To make the aperture visible under fluoroscopy, the X-ray visible tip of a flexible guidewire was sewed around the hole using 5-0 Prolene sutures (Figure 2). The stent was then reinserted and irrigated with the antibiotic solution through the lumen of the deployment system.

In the next step, the thoracic stent was advanced into the descending aorta using a Super Stiff guidewire via percutaneous access in the right femoral artery. The stent was expanded halfway and the created window was positioned facing the OG anastomosis.

The right axillary artery was surgically exposed and an introducer (Cook, 75 cm, 7 Fr) was placed into the open part of the stent-graft. The guidewire was placed into the OG through the window of the stent-graft. The E-ventus 37 × 10-mm balloon-expandable covered stent was positioned inside the OG, connecting the window to the OG and securing the blood flow. Short LVAD stops were performed while positioning the stents to improve the accuracy of stent placement. After the thoracic stent was fully deployed and the OG stent was released, the LVAD flow increased from 4.3 to 5.3 L/min.

The postoperative course was uneventful. The control CTA confirmed an optimal position of the grafts and exclusion of the pseudoaneurysm (Figure 3). Additionally, no endoleak was observed after the procedure. The antplatelet/anticoagulant therapy after the procedure was left unchanged (acetylsalicylic acid, 100 mg/d and Coumadin with target INR of 2.5-3). The patient was discharged home on the ninth postoperative day with an improved physical condition. The postoperative follow-up period of 126 days was uneventful.

3 | DISCUSSION

This case demonstrates a well-known cause for new onset of heart failure in patients on LVAD support—obstruction of the OG. However, in our case the obstruction was caused by an unusual pseudoaneurysm formation of the OG anastomosis. We suspect that the

![Figure 3](https://example.com/figure3.jpg)

**FIGURE 3** Results. A,B, Intraoperative fluoroscopy showing the position of Eventus 37 × 10-mm stent in E-vita Thoracic 3G (red arrow). C, Axial computed tomography angiography imaging as a curved multiplanar reformation reconstruction demonstrating optimal stent position in the outflow graft (red arrow). D, Postoperative (volume rendering technique) image showing no perfusion of the pseudoaneurysm.
pseudoaneurysm was caused by minimal anastomotic insufficiency with subsequent bleeding under the adventitia. However, such a constellation is difficult to identify during surgery.

In our unusual case, an interventional approach with a fenestrated stent graft and placement of a stent branch into the OG was shown to be safe and effective. However, an infectious cause of the pseudoaneurysm formation should be ruled out by means of a clinical examination and PET-CT. In such a case, surgical replacement of the descending aorta by a homograft should be considered instead.

4 | CONCLUSION

In cases of LVAD OG obstruction due to a pseudoaneurysm formation, an endovascular approach to restore optimal blood flow is an effective alternative to surgery.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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