

When Echocardiography Fails, Intravascular Ultrasound as an Alternative for Adequate Graft Patency in Hybrid Elephant Trunk Surgery

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ABSTRACT

Aortic pathology is a common cardiovascular disease in the US. Transesophageal Echocardiogram is an invaluable imaging modality in the management of aortic pathology in perioperative setting. Intravascular ultrasound can assess coronary obstruction during coronary interventions and can be used in endovascular aneurysm repair. A 54-year-old male underwent Hybrid Elephant Trunk Surgery, for complex open aorta repair. There was functional confirmation graft patency via the femoral arterial line tracing, there was surgical confirmation via visual and physical inspection of graft, but there was lacking anatomical confirmation. Epi-aortic ultrasound reassured the graft patency at level of the arch. However, transesophageal echocardiogram was not reassuring for adequate anatomical confirmation of patency. Intravascular ultrasound was used for anatomical confirmation of graft patency and position. This technology provides real time graft patency and is a great tool in open aorta reconstruction surgery.

Keywords: Aorta surgery, elephant trunk surgery, intravascular ultrasonography, transesophageal echocardiography

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INTRODUCTION

Aortic pathology comprises a significant portion of cardiovascular disease in the US population. Aortic dissection and aneurysm of the aorta are significantly prevalent to about five cases per 100,000 inhabitants.^[1] Transesophageal echocardiogram (TEE) is an invaluable imaging modality in the management of aortic pathology in a perioperative setting.^[2] Intravascular ultrasound (IVUS) is a catheter-based technology that consists of a cylindrical ultrasonic transducer on the distal end, providing real-time images of blood vessels.^[3] It can be an alternative or

complement to surface ultrasound to diagnose and guide the treatment of complex vascular pathology.^[4,5] Herein, we report the utilization of IVUS for anatomical confirmation of graft patency during an open aorta reconstruction case where TEE views were not adequate.

CASE PRESENTATION

A 54-year-old male with uncontrolled hypertension and poly-substance abuse presented with DeBakey Type-I acute aortic dissection and underwent emergent supracoronary

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ascending aorta replacement with #28 Gelweave® graft. Surgery was successful and he had no immediate complications. The arch and descending dissection was not repaired in this first stage. Unfortunately, he was lost to follow-up and was readmitted 96 days later with sudden onset of back pain and hypertensive emergency. Imaging showed progressive dilation of the aortic arch and descending aorta, requiring a hybrid elephant trunk reconstruction of the aorta. He had a carotid subclavian bypass a week before the open surgery.

The procedure was done under general anesthesia. Left brachial and right femoral arterial lines were placed for hemodynamic monitoring. The right axillary artery was used for arterial cannulation. After redo sternotomy, inferior vena cava (IVC) and superior vena cava (SVC) were cannulated. Cardiopulmonary bypass was initiated followed by deep hypothermic circulatory arrest with antegrade cerebral perfusion. The arch was transected between the innominate artery and the carotid artery. The carotid artery was transected, the stump was over sewed, and the subclavian artery was ligated. Through the left femoral artery, a 34-mm Gore CTAG stent graft was deployed, covering the orifice of the left carotid and left subclavian artery. This Gore CTAG graft was utilized as a frozen elephant trunk. The distal anastomosis was then done, followed by innominate artery reconstruction and reperfusion of the lower body. The carotid artery reconstruction was done, followed by rewarming and proximal anastomosis to the surgical graft.

Graft patency was confirmed functionally with a normal femoral artery line tracing. Surgical patency was confirmed via a visual and physical inspection of graft, but there was no anatomical confirmation of graft patency particularly on the descending segments of the aorta. Epiaortic echocardiographic view reassured the graft patency at the arch [Figure 1]. However, TEE views [Figure 2] were not reassuring for adequate anatomical confirmation of the descending aorta graft patency. IVUS was utilized, entering the graft (at the level of the distal arch) after a small 16 fr size incision was done, the probe entered proximally and then it was moved distally, to confirm and ensure the position and patency of the elephant trunk graft [Figure 3]. The patient had a complete recovery and was discharged from the hospital on postoperative day 14.

DISCUSSION

IVUS can assess coronary obstruction during coronary interventions^[3] and can be used in endovascular aneurysm

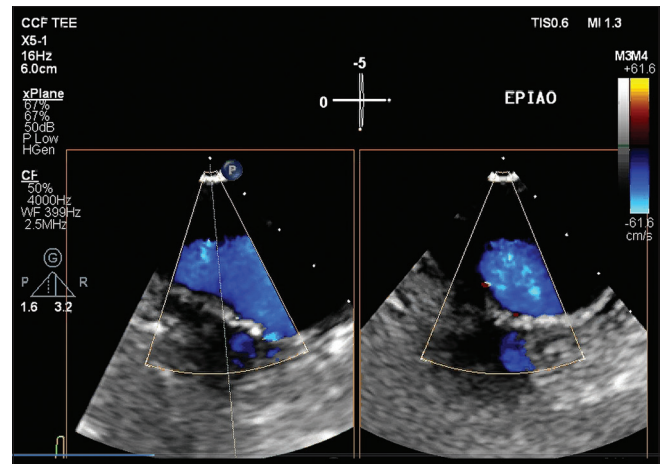


Figure 1: Epiaortic echocardiography using Multiplane and Color Flow Doppler. Demonstrates systolic flow in the graft at the arch level and presence of color artifact in the suture line and wall

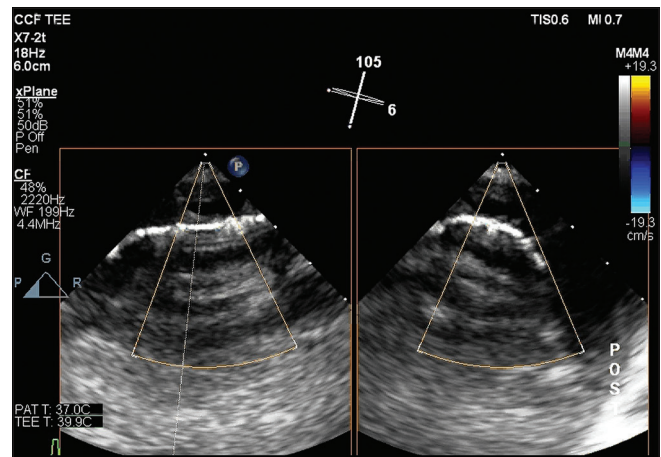


Figure 2: Transesophageal echocardiogram (TEE), the short axis of the descending aorta and aortic graft, using Color Flow Doppler and Multiplane. Demonstrates poor definition of flow within the graft material. Inadequate demarcation of graft lumen and position of graft material within the descending aorta. Poor visualization of anatomical structures

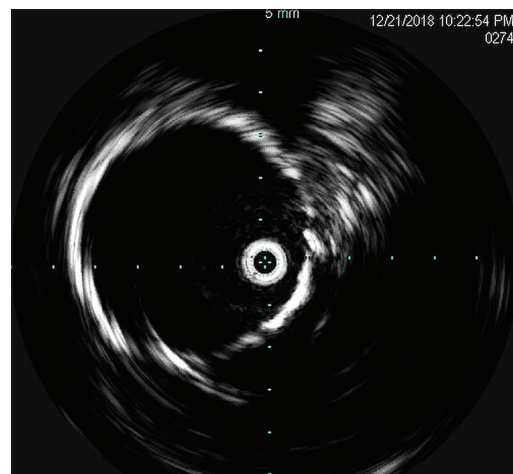


Figure 3: Intravascular ultrasound (IVUS), placed intra graft in the neo-descending aorta. Demonstrates adequate wall anatomy and normal luminal/tubular structure within the elephant trunk graft while moving IVUS probe distally

repair.^[4,5] There is no report of its use in open aortic surgery to confirm the patency of the aortic graft. TEE is routinely used intraoperatively for anatomical confirmation of aorta graft patency.^[2] However, when TEE views are not adequate, IVUS can be used for anatomical confirmation of graft patency. IVUS provides real-time graft patency and is a great tool in both open and hybrid aorta reconstruction surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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