Suprasternal approach for implanting a microaxial left ventricular assist device in a failing Fontan patient with dextrocardia: A case report

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Received for publication Oct 4, 2023; revisions received Jan 31, 2024; accepted for publication Feb 7, 2024; available ahead of print Feb 17, 2024.

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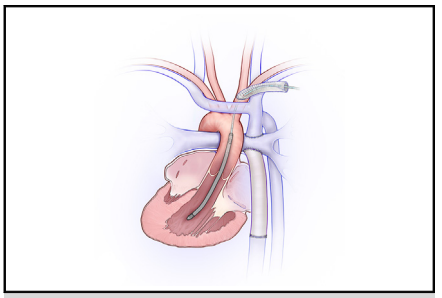
JTCVS Techniques 2024;24:174-6
2666-2507

https://doi.org/10.1016/j.xjtc.2024.02.007



Schematic demonstrating the final result of Impella 5.5 device after suprasternal access.

CENTRAL MESSAGE

Suprasternal exposure of the brachiocephalic trunk is an advantageous strategy for delivery of mechanical circulatory support in patients with complex adult congenital heart disease.

The prevalence of patients with congenital heart defects surviving to adulthood has given rise to the field of adult congenital heart disease (ACHD). The use of temporary mechanical circulatory support for these patients is an area of burgeoning interest. However, patients with ACHD are often plagued by diminutive peripheral vasculature. Additionally, for patients with cavopulmonary connections such as Fontan or bidirectional Glenn, the use of extracorporeal membrane oxygenation does not fully decompress the cavopulmonary circulation and has been described to lead to poor outcomes.[1] As such, nontraditional approaches to introduce ventricular assist devices may be necessary. In this case report, we describe the use of suprasternal exposure of the brachiocephalic trunk for graft implantation for delivery of the Impella 5.5 platform (Abiomed) in a failing Fontan patient with heterotaxy. Informed consent for inclusion of patient data was not obtained for this article because the original procedure was emergency and the patient subsequently was not consentable through their passing; institutional review board approval was not required.

CASE DESCRIPTION

The patient was a 24-year-old man with a history of heterotaxy syndrome with asplenia (A,D,D), dextrocardia, right sided aortic arch with mirror image branching, unbalanced complete atrioventricular canal with hypoplastic left ventricle, right ventricle aorta with pulmonary atresia, bilateral superior vena cavas with bridging innominate vein, and interrupted inferior vena cava with axygos continuation (Figure 1). He previously had been palliated with a Blalock-Taussig shunt followed by a bidirectional Glenn, and when finally fenestrated, extracardiac Fontan.

The patient was hospitalized twice during the month preceding operative intervention with hypoxia and cardiogenic shock secondary to possible myocarditis, and left against medical advice both times. He was readmitted to the cardiology service in cardiogenic shock from presumed myocarditis. Medical management was attempted without significant improvement. An intra-aortic balloon pump was placed, despite which his cardiac index was 0.8. Given these findings, he was taken to the operating room as an emergency case. Due to his dextrocardia and sharp angulation of the aberrant right subclavian artery, a left-sided approach was chosen. A left axillary cutdown was performed; however, the axillary artery was found to only be 3 to 4 mm in size, and was determined to be too small to accommodate an Impella 5.5 device.

A suprasternal approach was then taken to expose the innominate artery. The proximal left carotid and left subclavian arteries were circumferentially dissected and after

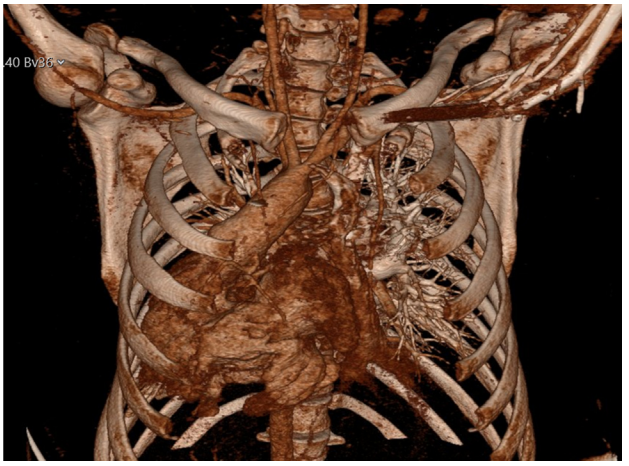


FIGURE 1. Three-dimensional reconstruction of the patient's thoracic anatomy with the sternum removed to allow for visualization of the vasculature.

appropriate heparinization, controlled (Figure 2). A longitudinal arteriotomy was made and a 10-mm polyethylene terephthalate graft was sewn on and tunneled out to the previously made left axillary incision. An Impella 5.5 device was then introduced successfully and positioned across the aortic valve with positioning confirmed by fluoroscopy and transesophageal echocardiography.

Postoperatively with the support of the Impella 5.5 device, he was weaned off of epinephrine, vasopressin, and norepinephrine, and supported only with milrinone. At P6 support with the Impella 5.5 device, he was sustained with a flow of 3.6 L/minute. Within 24 hours, his lactate level normalized. Unfortunately, on postoperative days 5 through 7 he developed multifocal pneumonia requiring reintubation with hypoxia and sepsis. Secondary to his overwhelming sepsis he developed multiorgan system dysfunction and died on postoperative day 14.

DISCUSSION

The population of patients with ACHD continues to grow, the field of cardiac surgery must be adept at multiple approaches to provide heart failure support platforms. Extracorporeal membrane oxygenation does not fully support these patients, and a ventricular assist device may be

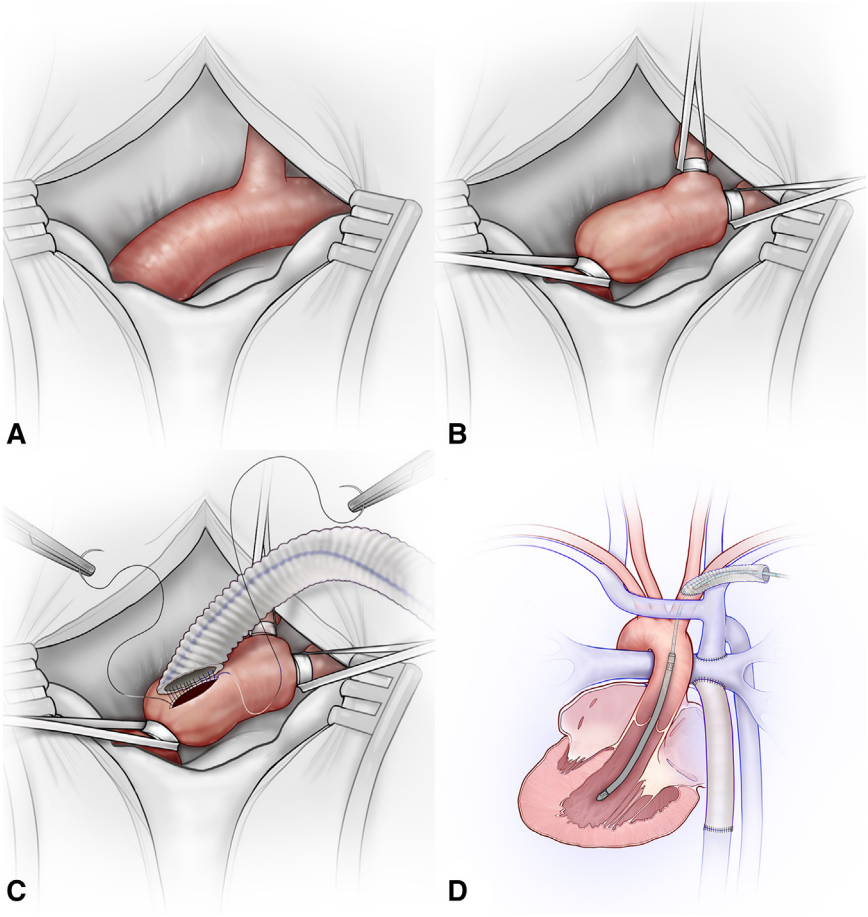


FIGURE 2. Suprasternal exposure of the innominate artery (A), followed by obtaining vascular control of branches (B). A 10-mm graft was then sewed onto the innominate (C) to create a conduit through which the Impella 5.5 device (Abiomed) was introduced and positioned across the aortic valve (D).

more effective in patients with cavopulmonary connections. Specifically, we are reporting a novel approach of delivering the Impella 5.5 platform via a suprasternal access to the base of a left-sided innominate artery in a patient with dextrocardia without splitting the sternum.

Several groups have published articles regarding the use of continuous flow ventricular assist devices in patients with ACHD.[2] For patients with peripheral vasculature not suitable for Impella 5.5 device insertion, implantation directly into the aorta or into the innominate artery have been described via hemi- or full sternotomy.[3,4] However, for many patients with ACHD, hemi- or full sternotomy is not a benign endeavor in the setting of multiple prior sternotomies. As such, it can be advantageous to access the proximal arch vessels without sternotomy.

To the best of our knowledge, no one has implanted an Impella 5.5 device via the suprasternal approach without sternotomy in a patient with dextrocardia. This approach is adapted from a previously published technique[5] for suprasternal control of the innominate artery without requiring sternotomy. Suprasternal incision followed by vertical retraction on the sternal notch allowed adequate working space and visualization of the arch vessels to obtain vascular control and sew on a 10-mm polyethylene polyester graft. Adaptation of this technique demonstrates how strategies utilized in the field of adult cardiac surgery can be modified and adapted for patients with ACHD requiring mechanical circulatory support.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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