

A novel technique for microaxial left ventricular assist device insertion via transcervical transcarotid approach



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The ability of the Impella 5.5 (Abiomed) to offload the left ventricle (LV) and its potential for flexibility in implantation demonstrate its remarkable utility as periprocedural support for high-risk surgical cases. Herein, we describe a novel transcervical transcarotid Impella insertion, avoiding central cannulation in a situation in which the axillary artery could not be used. Institutional review board approval was not required for this study; the need for informed written consent was also waived.

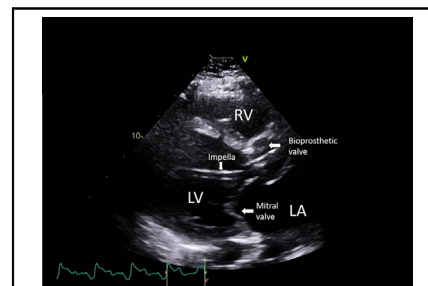
CASE REPORT

A 61-year-old male patient with longstanding heart failure was admitted with acute-on-chronic exacerbation of his valvular cardiomyopathy. He had severe aortic insufficiency with a reduced ejection fraction in 2016 for which he underwent an aortic valve replacement (AVR) with a 27-mm Trifecta pericardial tissue valve (Abbott).

Right heart catheterization revealed a cardiac index of 1.7 L/min/m², 29 mm Hg pulmonary capillary wedge pressure, and 42 mm Hg mean pulmonary artery (PA) pressure. Due to his small stature (1.63 m, 74 kg) and axillary artery diameter of 5 mm, he underwent an axillary intra-aortic balloon pump placement as bridge to transplantation. Subsequently elevated PA pressures and unfavorable blood type O led to the decision to increase his support to Impella 5.5 as a bridge to decision contingent on his PA pressures.

Given hostile sternal anatomy on computed tomography, recent pneumonia, small axillary diameter, and favorable carotid artery diameter of 6.5 mm, we proceeded with a transcervical transcarotid Impella insertion using transesophageal echocardiogram and fluoroscopy through the existing tissue AVR.

In the operating room, the intra-aortic balloon pump was removed from its axillary position. A neck incision was made 1 cm above the sternal notch on the anterior sternocleidomastoid (Figure 1). Heparin was administered to achieve an activated clotting time >250 seconds. Lacking



Transthoracic echocardiogram showing Impella 5.5 placement in left ventricle.

CENTRAL MESSAGE

Transcervical transcarotid Impella 5.5 insertion is a viable option for full circulatory support and left ventricular offloading to provide periprocedural support in high-risk cases.

a preoperative computed tomography scan of the head and neck due to the patient's acute-on-chronic renal insufficiency, a test occlusion of the carotid was performed using vessel loops proximal and distal to the common carotid artery with bilateral cerebral near infrared spectroscopy oximeters. Oximetry revealed no measurable drop in cerebral saturation, and saturation remained near baseline for the remainder of the case. A 10-mm graft was tunneled laterally in the supraclavicular region and vessel loops tightened for proximal and distal control with subsequent end to side anastomosis of the graft to the right carotid with a 5-0 PROLENE suture. The patient was placed in steep Trendelenburg position and the graft deaired by loosening the proximal vessel loop while maintaining tension on the distal vessel loop. A vascular clamp was applied to the graft, the Impella sheath was introduced and secured using the manufacturer's clips, and the side port of the sheath was deaired in usual surgical fashion. The Impella device was then placed using techniques previously discussed¹ with GLI-DEWIRE (Terumo) as the initial method to cross the tissue AVR and obtain access into the LV cavity. An angled pigtail (Cordis) was sed to exchange to a stiff wire (Abbott



FIGURE 1. The right cervical incision at the medial border of the sternocleidomastoid is shown both postoperatively and intraoperatively (*) with anastomosis to right carotid artery. The graft tunnel exit site in the supraclavicular region (+) as well as previous sternotomy for aortic valve replacement (^) are additionally present.

Vascular), and the Impella device was introduced into the LV (Figure 2).

Impella was started at a minimal flow of P2 and uptitrated to a flow between 2.5 and 3.5 L/min, and the patient was extubated in the operating room with fully intact neurologic examination. His recovery consisted of continued elevation of his PA pressures despite optimal off-loading of the LV, inotrope support for the right ventricle, and diuresis. As a result, he was implanted with a durable left-ventricular assist device on day 8 of support.

DISCUSSION

Temporary mechanical circulatory support has gained popularity in its versatility as a bridge to recovery, bridge to definitive therapy, or bridge to life-ending decision-making.² The Impella 5.5 is a surgically placed temporary mechanical circulatory support that requires an 8- to 10-mm graft designed for approach from upper extremity vessels. More than 12,000 have been implanted since introduction to the market in 2019. The Impella 5.5 has gained popularity to its utility in directly offloading the LV, remote monitoring capabilities, ability to provide real-time hemodynamics of the LV end-diastolic pressure, and relative freedom from hemolysis.³

Although the Impella 5.5's main use has been in heart failure and cardiogenic shock, it has gained momentum as periprocedural support in high-risk surgical cases.⁴ We describe a novel implantation technique in a situation requiring hemodynamic support without the need for an invasive central

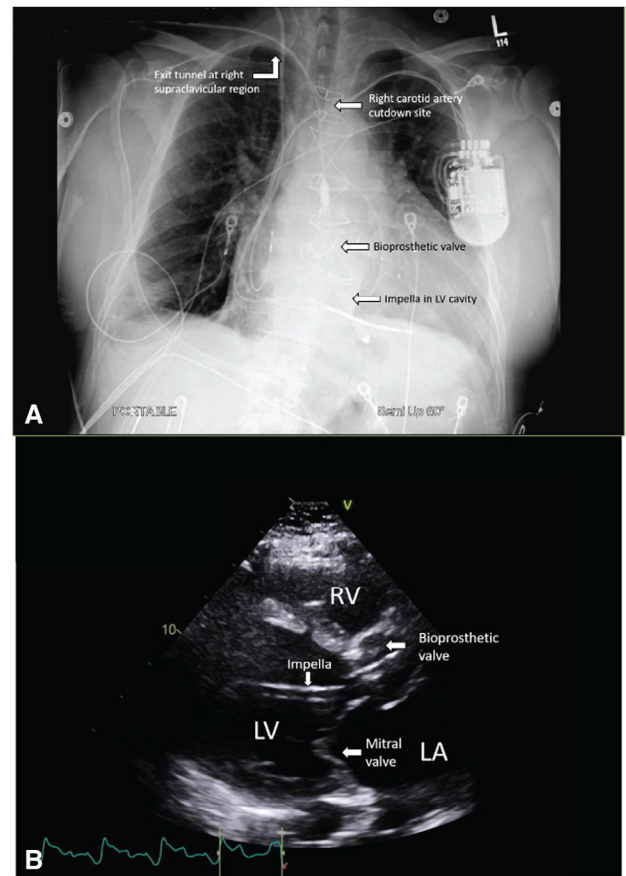


FIGURE 2. Radiograph of the chest (A) and transthoracic echocardiography image (B) from postoperative day 1 showing Impella 5.5 placement in left ventricle. LV, Left ventricle; RV, right ventricle; LA, left atrium.

strategy. This approach has been described with Impella 5.0 as a temporizing measure for patients in cardiogenic shock.⁵

Careful cerebral oximetry monitoring allowed us to successfully use this technique for temporary periprocedural support. This technique is a viable last resort maneuver in the armamentarium of surgeons who treat heart failure with the need for temporary support. Further discussion is provided in Appendix E1.

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 or reviewing 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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APPENDIX E1

Anatomic Considerations

Our patient's axillary artery diameter of 5 mm was below our minimum recommendation of 7 mm and was deemed inadequate for Impella 5.5 implantation. His common carotid artery diameter of 6.5 mm was adequate; we recommend a minimum carotid artery diameter of 6 mm for safe transcarotid Impella 5.5 implantation without compromising blood flow to the brain.

Anticoagulation Strategy

Heparin was administered to achieve an activated clotting time >250 seconds during wire and device

manipulation and placement. Subsequently, systemic heparin was used, and heparin was additionally used as a purge system for the Impella 5.5. To prevent embolization during explantation, proximal and distal control of the carotid artery was obtained using vessel loops. The distal end was lifted as the device was removed. After explantation, the proximal end was subsequently lifted to allow the vessel to back-bleed and flush debris as the distal vessel loop was gently released.