

Minimally invasive insertion of off-pump central extracorporeal membrane oxygenation

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In an attempt to minimize the morbidity associated with establishing mechanical support for the acutely failing right or left ventricle, minimally invasive techniques have been developed for the initiation of temporary mechanical support.¹ We illustrate a minimally invasive off pump technique for initiation of central extracorporeal membrane oxygenation (ECMO) using trans-apical insertion of an extracorporeal dual-lumen cannula (PROTEK Duo, TandemLife, Pittsburgh, PA).²

Technique

Initiation of central ECMO was established via a left mini-thoracotomy approach that allows for complete visualization and access to the anterior wall and apex of the left ventricle (LV). An intra-operative transesophageal echocardiogram (TEE) is used for localization of a cannulation site 2 cm anterolateral to the LV apex (Figure 1). The

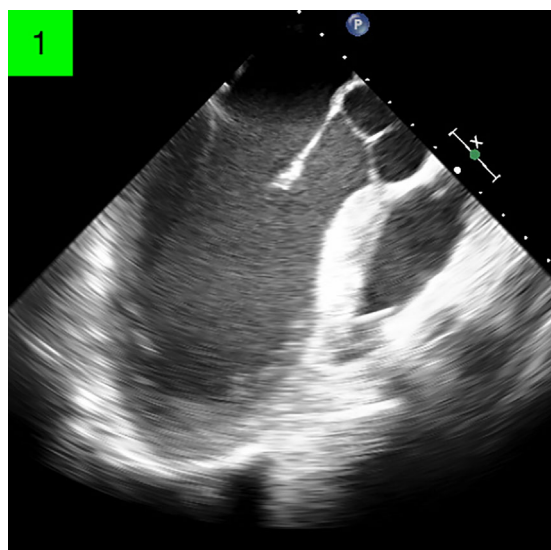


FIGURE 1 Intraoperative TEE demonstrates a dilated left ventricle prior to conversion to central ECMO. TEE was utilized for planning of cannulation site. ECMO, extracorporeal membrane oxygenation; TEE, transesophageal echocardiogram

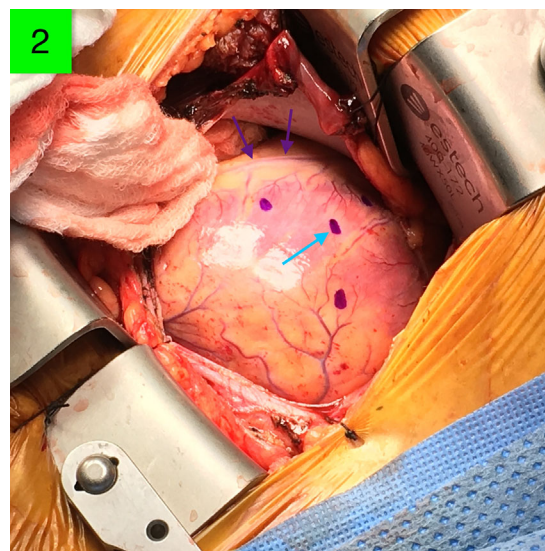


FIGURE 2 Pre-conversion planning demonstrating a dilated left ventricle with planning sites for purse string suture placement. Suture site for cannulation (blue arrow) is surrounded by three sites for planned anchoring. Left anterior descending artery (purple arrows) is helpful for anatomic localization



FIGURE 3 PROTEK Duo® dual-lumen cannula utilized for trans-apical access into the left ventricular apex

planned cannulation site is marked by an ink dot on the epicardium of the LV with three surrounding ink dots for the sights where pledgeted 3.0 prolene purse-string sutures are to be placed (Figure 2). Intraventricular access is obtained by placement of a cannulation needle into the center of the purse string placed at the cannulation site.

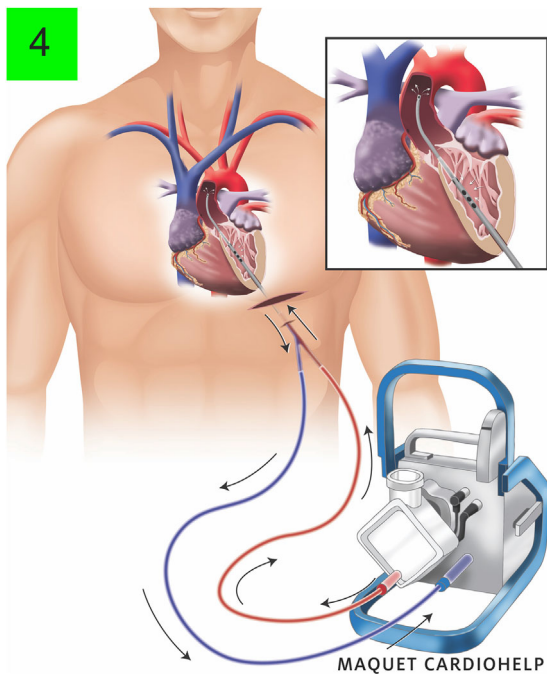


FIGURE 4 Diagram illustrating Oxy-LVAD. PROTEK Duo® cannula is trans-apically placed in LV with intake valves placed approximately 2 cm from the endocardium and outlet valves and cannula tip placed 2-3 cm distal to the aortic valve. The poorly oxygenated blood removed from the LV is circuited to an extracorporeal ECMO for oxygenation, and the oxygenated blood is circuited into the aortic root . ECMO, extracorporeal membrane oxygenation; LV, left ventricle

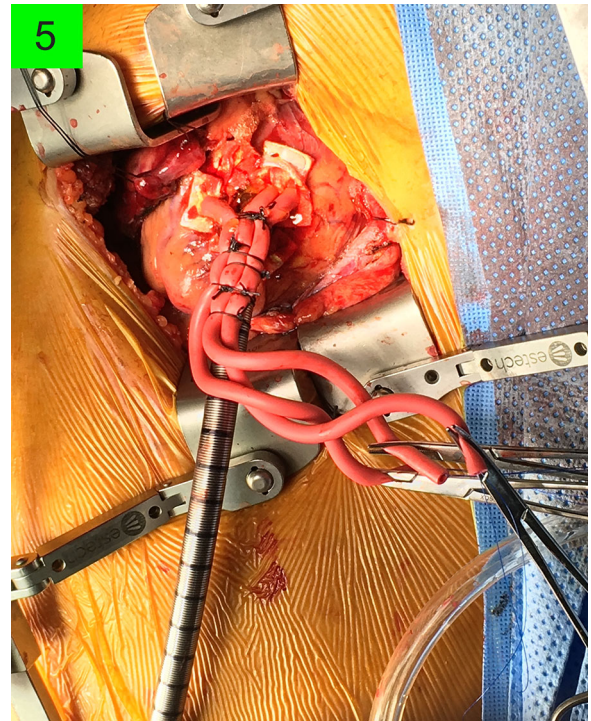


FIGURE 5 PROTEK Duo® cannula in situ after trans-apical insertion into the planned cannulation site. The three surrounding pledgetted suture sites are visible with pledgets and Rommell surgical tubing providing support and anchoring of the cannula. Bioglue® is used to strengthen the cannulation site

Subsequently, a 0.032 Cook wire (Cook Medical, Bloomington, IN) is inserted into the cannulation site until the wire is visualized in the ascending aorta on the TEE. A 31-French PROTEK Duo® cannula is guided into the cannulation site over the Cook wire using a Seldinger technique (Figure 3). Trans-apical placement of the PROTEK Duo® cannula establishes a site of intracardiac blood exchange with the

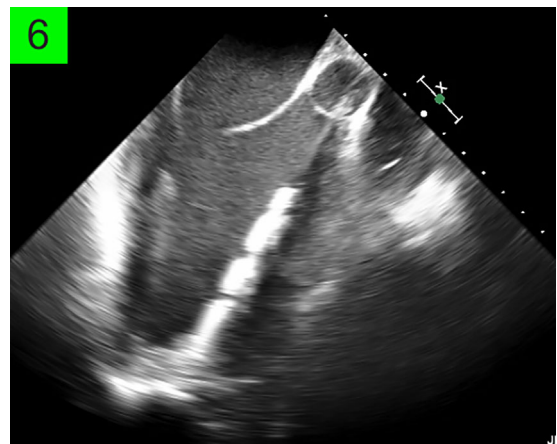


FIGURE 6 Intraoperative TEE demonstrating successful placement of the PROTEK Duo® cannula within the left heart with inlets positioned centrally within the left ventricular chamber and outflow inlets positioned in the aortic root, above the aortic valve. TEE, transesophageal echocardiogram

intake ports of the cannula located approximately 1 cm from the LV endocardium, and the outlet ports and cannula tips extending 2-3 cm above the aortic valve (Figure 4). Blood is then cycled through the cannula with flows achieving 4.5 L/min via an extracorporeal membrane oxygenator and pump (Maquet Cardiohelp ECMO circuit, Getinge Group, Rastatt, AG). After the successful placement of the cannula, it is anchored and supported by the placement of three pledgeted prolene purse-string sutures, secured with Rommell's, and tied to the PROTEK Duo[®] cannula (Figure 5).

A post-operative TEE confirmed successful placement of the left ventricular assist device with the PROTEK Duo[®] cannula identified two centimeters into the left-ventricular cavity from the endomyocardium with outflow across the aortic valve two to three centimeters into the ascending aorta (Figure 6). In this patient, ECMO was discontinued 72 h after its insertion. After removing the PROTEK Duo[®] cannula and tubing, we placed a Gore-Tex (W. L. Gore & Associates, Inc., Newark, DE) neopericardial reconstruction over the left ventricular apex.

CONFLICTS OF INTEREST

All authors have no potential conflicts of interest, and nothing to disclose with regard to commercial support.

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How to cite this article: Avery R, Yu S, Rao P, Wong R, Khalpey Z. Minimally invasive insertion of off-pump central extracorporeal membrane oxygenation. *J Card Surg.* 2017;32:738-740.

<https://doi.org/10.1111/jocs.13208>

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