

Caval isolation with balloon catheters within venous cannulas in cardiac surgery



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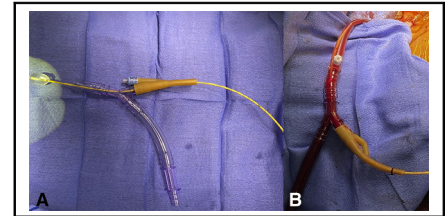
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(A) Y connector with balloon catheter; (B) SVC cannula with a balloon catheter inside.

CENTRAL MESSAGE

We report a new technique to occlude the cavae from within by inserting balloon catheters within venous cannulae, thus avoiding caval dissection.

See Commentary on page 65.

Video clip is available online.

Isolation and occlusion of the venae cavae can be challenging in redo operations. Herein, we describe a simple technique of caval occlusion that minimizes dissection of the venae cavae.

CASE REPORT

A 47-year-old female heart transplant recipient with severe tricuspid valve regurgitation required surgical repair

and possible replacement. Because of the close proximity of the aorta to the sternum, we elected to use the right thoracotomy approach. We also anticipated severe adhesion between the aorta and the superior vena cava (SVC); therefore, we prepared for an alternate method of caval occlusion.

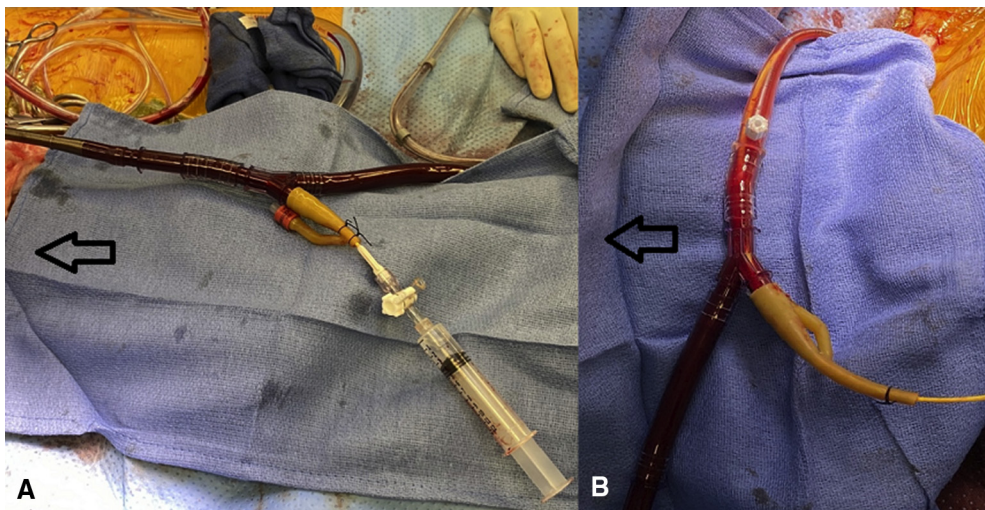
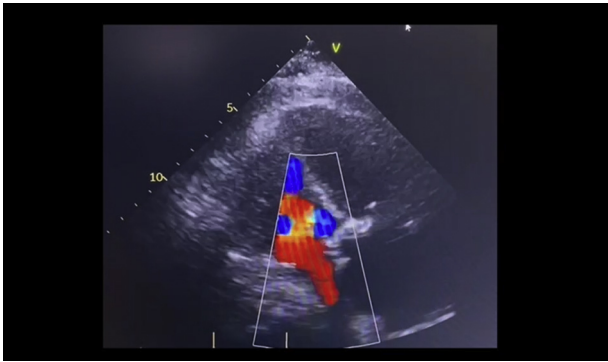


FIGURE 1. Fogarty catheters inside the right common femoral (A) and right internal jugular (B) venous cannulas. Arrows point to the direction of the patient's head.



VIDEO 1. Video of the operative details. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00035-9/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00035-9/fulltext).

The right internal jugular vein was cannulated percutaneously with a 20-French (Fr) cannula (OptiSite arterial cannula, Edwards Lifesciences) that was positioned at 2 cm above the SVC–right atrial junction. This cannula was connected to a Y connector (NovoSci Corp) with one limb connecting to the cardiopulmonary bypass system. Via the other limb, a 7-Fr Fogarty balloon embolectomy catheter (Edwards Lifesciences) was introduced into the lumen of the venous cannula via a custom-made connector from an 18-Fr Foley catheter (Bard Medical) (Figure 1). The Fogarty catheter was advanced to the SVC and positioned at the SVC–right atrial junction, under transesophageal echocardiography guidance (Video 1). The right common femoral vein was cannulated with a 25-Fr venous cannula (Maquet Cardiopulmonary GmbH) and, in a similar fashion, another Y connector and Fogarty circuit was prepared (Figure 1). Because the femoral artery was small, an 8-mm Dacron graft was anastomosed to the right

common femoral artery for arterial cannulation. After initiation of cardiopulmonary bypass, the Fogarty balloons were inflated with saline to occlude the SVC and IVC before a right atriotomy was made (Figure 2). The aorta was not clamped. A repair on the tricuspid valve was attempted but was not satisfactory due to thickened and retracted leaflets, therefore the valve was replaced with a bioprosthetic valve (29-mm Carpentier-Edwards PERIMOUNT Magna Mitral Ease; Edwards Lifesciences). After closing the right atriotomy, we deflated the Fogarty catheters and weaned the patient off cardiopulmonary bypass. The patient's postoperative course was uneventful. The institutional review board granted an exception for this case report on February 9, 2021. The patient provided written informed consent before surgery, allowing for the use of clinical data.

DISCUSSION

We report a novel technique of intraluminal occlusion of the venae cavae during cardiac surgery that requires no dissection of the cavae. Intraluminal occlusion of the venae cavae has been described previously.^{1,2} Pfannmüller and colleagues¹ described a technique in which Fogarty catheters were inserted into the SVC and inferior vena cava via the left internal jugular and left common femoral veins and directed into the right atrium alongside with the venous cannulas, which were inserted in the right corresponding veins, to occlude the SVC and inferior vena cava, respectively. Compared with ours, this technique is more time-consuming and requires 4 accessible venous entry sites.

Intraluminal control of the cavae minimizes the dissection and isolation of these vessels in redo cases, or in right thoracotomy approach where the cavae are less accessible. In general, occlusion of both the superior and inferior venae

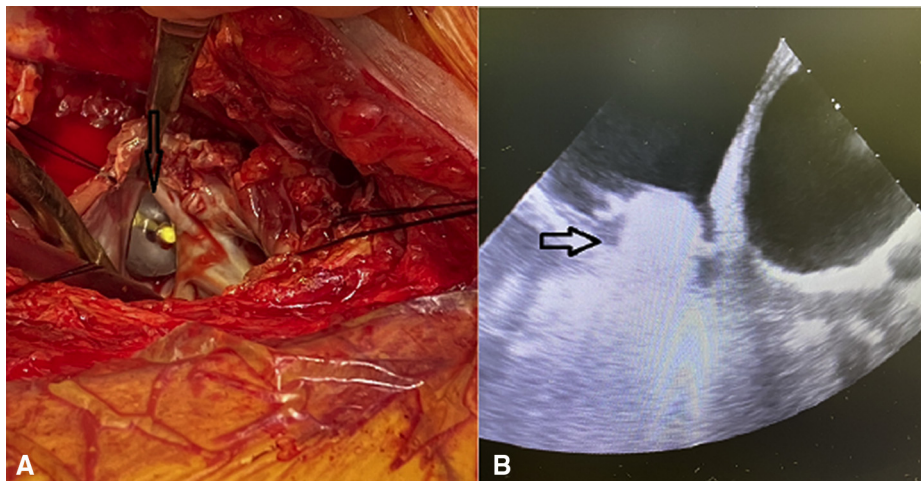


FIGURE 2. Intraoperative photograph (A) and transesophageal echocardiographic image (B) of the inflated Fogarty balloon catheter (arrows) occluding the SVC at the SVC–right atrial junction. SVC, Superior vena cava.

cavae is needed to prevent air entry into the venous system while operating on right heart structures; however, successful operation without IVC occlusion has also been reported.³

The Fogarty balloon catheters are available in different lengths, balloon sizes, and shapes; therefore, surgeons can select the one that is suitable for their patients. Echocardiography or computed tomography can measure caval diameters to help select the appropriate balloon size. Furthermore, with our technique, exchanging the catheter to a different size can be accomplished with ease. This

simple technique is useful for redo operations via either sternotomy or minimally invasive right thoracotomy approach.

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