Safe Heart Flush Technique During Recovery From Donors After Circulatory Death

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Abstract

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DCD Heart Recovery

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Abstract

For donation after circulatory death, procurement is performed after the heart has arrested. This technique has been employed and adopted by clinicians to overcome the shortage of available hearts for transplant. Warm ischemia time plays a pivotal role in the survival outcome of the heart recipients. We describe a fast and safe technique to flush the heart during recovery from circulatory death donors in order to shorten the warm ischemia time.

Key Words

Circulatory death, Warm ischemia time, Cardiac arrest

Introduction

In 1967, Christian Bernard performed the first heart transplant using donation after circulatory death (DCD) technique.[1] However, after the definition of brain death was established, donation after brain death (DBD) has dominated. The growing discrepancy between the available heart donors and the number of patients awaiting heart transplant motivated surgeons to extend the acceptance criteria for DBD hearts and re-explore DCD.[2] Warm ischemia time has pivotal impact on the recipients' survival who received hearts from DCD donors.[3] We have reported successful utilization of the Foley catheter to flush the lungs during recovery from donors after circulatory death with some modifications in both the technique and preparation of the Foley catheter.[4]

We describe a fast and safe technique to flush the heart during recovery from DCD donors to shorten the warm ischemia time using a modified Foley catheter.

Technique

The institutional review board approval was exempted as it falls outside its scope, and donor consent was obtained.

We describe a simple technique to insert and secure the preservation solution delivery catheter into the ascending aorta during heart procurement from DCD donors. This technique enables us to start flushing the heart with the preservation solution within 3 minutes from skin incision. Moreover, this technique secures the cannula to the ascending aorta without placing a purse-string suture. We use a 14-Fr. 2-way Foley catheter instead of using the regular cardioplegia catheter to flush the heart. The Foley catheter is prepared on the back table by applying several layers of wound closure tapes (Steri-strips^{TM}, 3M, Minneapolis, MN, USA) around the catheter shaft about 3 mm from the balloon (Fig. 1). These Steri-strips layers prevent the catheter from advancing into the lumen of the aorta and it alleviates any leak. We check the balloon integrity and flush the catheter before use. A 5-cc syringe is filled with sterile saline solution and connected to the inflation port of the balloon. The Foley catheter lumen is connected to the preservation solution tubing. The tubing system is carefully deaired before cannulation. A fine-tip forceps (tonsil forceps) is applied to the tip of the Foley catheter. After opening the chest and exposing the ascending aorta, the aortic cross clamp is applied to the ascending aorta and a 5-mm long transvers incision is made on the ascending aorta just proximal to the clamp. With the attached tonsil forceps, the tip of the Foley catheter is inserted into the aortic lumen and the assistant inflates the balloon. Heart perfusion is initiated, and the inferior vena cava (IVC) is vented (Fig. 2, video). The left ventricle (LV) is vented, and the heart is cooled in standard fashion.

Comment

This technique enables us to start flushing the heart within 3 minutes of skin incision. We have successfully used this technique in all the 12 DCD heart transplants with good outcome (all the recipients are doing well with normal graft function). Moreover, in this technique, the assistant is not required to support the Foley with his hands. Instead, his hands will be free to assist the surgeon with venting of the IVC and the LV. During the 2 dry-run procurements, we tried to use the regular cardioplegia catheter. The catheter dislodged from the aorta during perfusion which wasted time and preservation solution. The process of reinserting the cannula into the aorta was cumbersome given the pericardial cavity was full of blood and fluids. We apply the aortic cross-clamp before inserting the Foley catheter into the aorta to avoid incidental clamping the soft Foley catheter tip.

Warm ischemia time has a detrimental effect on the survival outcome of DCD heart transplantation. Sánchez-Cámara et al.[3]conducted a study to determine the impact of warm ischemia time on human cardiomyocytes function and viability. They concluded that myocardial contractility and cellular viability are significantly affected during the 10 minutes after cardiac arrest. The time interval before cardiac arrest during which life support therapy (LST) was withdrawn did not have a significant impact on heart function provided

that the LST withdrawal time interval was < 20 min. Given the 5-minute stand-off period mandated by most institutions, Sánchez-Cámara et al.[3] recommended the heart to be perfused within 5 minutes from skin incision. This includes the time required to collect about 1500 cc of donor blood in the DPP technique. Our technique demonstrates how preparation of a simple Foley catheter can mitigate the deleterious effect of warm ischemia time on the myocardial viability and contractility.

Conclusion

We believe utilizing a Foley catheter in perfusing the heart during recovery from DCD donors is an efficient and fast technique to shorten the warm ischemia time

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Figure legends

Fig. 1: Photo shows preparation of the Foley catheter on the back table

Fig. 2: Intra-operative photo shows the Foley catheter inserted into the aorta during perfusion

Video: Intra-operative video demonstrates the Foley catheter inserted into the aortic lumen during perfusion