Case Report

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SVC cannulation in Total Anomalous Pulmonary Venous Connections repair surgery using a vent catheter

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Abstract

A baby of 10 days with obstructive infracardiac TAPVC was planned for surgery and underwent Cardiopulmonary bypass. A Medtronic 10Fr vent catheter was used to cannulate SVC instead of regular cannula i.e. an angled venous wire-reinforced cannula for upper body venous drainage.

Introduction

Total anomalous pulmonary venous connection (TAPVC) (1) typically presents in the very young and often requires early surgical intervention. Surgical correction of TAPVC has become increasingly successful; this success has been attributed to early and accurate diagnosis, improvement in surgical techniques, better myocardial protection as well as improved postoperative care of these sick infants.

Case report

A 10 days male baby weighing 2.6kg diagnosed with obstructive infracardiac TAPVC(2) at level of Ductus venous (2.6mm) of cyanotic etiology with severe pulmonary artery hypertension (PAH), non-restrictive OS-ASD (RL), and right ventricular volume overload (RVVO) with Middle pulmonary veins draining into common chamber forming a good sized vent. He was clinically evaluated and planned for surgery. Surgical strategy involved Creation of anastomosis between LA and Common pulmonary venous chamber, Disconnection of common pulmonary venous chamber from the systemic venous circuit and Closure of atrial septal defect.

Infracardiac TAPVC

Circuit planning

Based on requirement routine CPB circuit was used which includes a venous reservoir with integrated oxygenator and heat exchanger (Baby RX-05) with custom tubing pack of arterial and venous loops of 1/4inches and suction tubing with connectors of required size.

(Kindly describe the priming protocol adopted for the procedure)

Strategy

Based on the requirements circuit was assembled, primed, de-bubbled circulated properly and the AV loop line divided for cannulation. Heparin 300 U/kg IV was administered before arterial cannulation with a target ACT (measured after 3 min) of more than 480 seconds. During arterial cannulation, systolic pressure was restricted to90–100 mm Hg to reduce the risk of aortic dissection. The aortic cannulation was performed first to provide volume resuscitation in case of hypotension associated with venous cannulation. Once the aortic cannula is connected to the tubing, line pressure is checked to rule out dissection Ascending Aorta was cannulatedwith 6 Fr DLP aortic cannula. Cannulae connect the patient's blood to the circuit and hence to the CPB machine. They are made of polyvinylchloride (PVC) with wire reinforced to prevent obstruction due to kinking. Venous cannulae: single-stage cannulae are used during most open-heart surgeries, where two cannulae are inserted into the superior and inferior vena cava and joined by a Y-piece. Dual-stage cannulae are used for most closed-heart procedures, where a single cannula is inserted into the right atrium. Drainage occurs through gravity Vacuum applied to the reservoir allows the use of smaller cannulae and tubing, thus decreasing the circuit. Bicaval cannulation (3) (4) was performed, cannulating SVC and IVC separately, vacuum applied for adequate venous drainage. For cardioplegia delivery Romson's5Fr coronary catheter was used. Vent catheter of 10Fr size was used for venting the heart.

The Problem

As the patient was 2.6 kg infant there was difficulty in cannulating SVC (5) with 12Fr angled venous cannula, smallest available venous cannula in our institute. It was small in size much lesser than 4mm in diameter. So we thought of something else to provide better surgical view without hampering the proper flows and drainage .Hence an alternative solution had to implement without compromising optimal venous drainage.

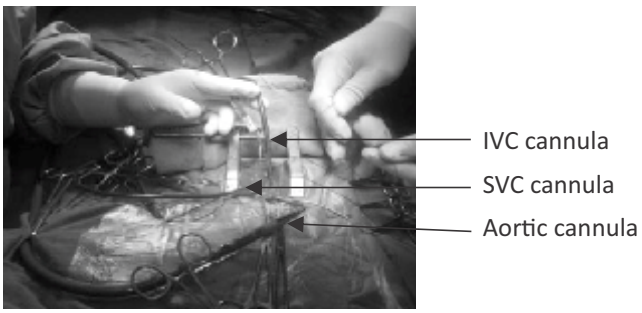
The Solution

It was then decided to use a Medtronic DLP vent of 10Fr to cannulate the SVC. Firstly, on Cardio-pulmonary bypass was initiated with single IVC cannula, following which SVC was cannulated with vent catheter. We observed that unimpeded upper body venous drainage providing good dry field for surgery. Full CPB was instituted and ventilation is discontinued.

Total bypass time was 90minutes and aortic cross clamp time was 52 minutes. Blood-crystalloid cardioplegia in 4:1 parts i.e St. Thomas cardioplegia was administered at rate of 30-35ml/kg body weight for 3 minutes (total 90ml dose) and also a second half potassium dose was given after 36 minutes of first cardioplegia dose administration . Normothermia was maintained throughout the surgery. VAVD was not instituted to maintain adequate venous drainage. SVC was draining adequately via 10Fr vent catheter.

Post-operatively also there was no complications after weaning off from CPB. After shifting in ICU patient was extubated within 24 hours. And kept under observation for 3-4 days in ICU itself and then shifted to ward.

Fig3- the above image shows aorta cannulated with 08Fr Biomedicus cannula and SVC cannulated with 10Fr vent catheter and IVC being cannulated with a straight venous cannula and snugged.



Discussion

The selection of cannula and cannulation technique is one of the main component of cardiopulmonary bypass. Selection of drainage cannula as well as return cannula can be done according to body weight, C.O, vessel anatomy as well as compatibility of surgeon specially about either angled cannula or straight cannula, but the appropriate venous drainage and adequate pump flow through return cannula should not be compromised to protect vital organs of the body during cardiopulmonary bypass. Although 1/3rd part of venous drainage comes through SVC however, congestion in SVC drainage may cause cerebral damage and impact on surgical outcome. Moreover, if a smaller sized wire-reinforced venous cannula or vent catheter would be available it could be more better as it prevents accidentally kinking of venous cannula and improves venous drainage.

Conclusion

Using of 10Fr vent catheter for SVC cannulation was a good alternative but avilability of a small sized venous cannnula with wire enforcement would be more better as there was risk of kinking of vent during surgery. Also if vent would be available with wire enforcement it would be more safer. Other features of vent and venous cannula are comparable like presence of multiple pores at the site of entry, etc.

References

1. http://www.heart.org/en/health-topics/congenital-heart-defects/about-congenital-heart-defects/total-anomalous-pulmonary-venous-connection-tapvc
2. https://www.chop.edu/conditions-diseases/total-anomalous-pulmonary-venous-return-tapvr
3. Hessel EA, Edmunds LH. Perfusion systems. In: Cohn LH, Edmunds LH , eds. Cardiac surgery in the adult. 2nd ed. New York, NY: McGraw-Hill, 2003; 317-338.
4. Hessel EA. Cardiopulmonary bypass equipment. In: Estafanous FG, Barash PG, Reves JG, eds. Cardiac anesthesia: principles and clinical practice. 2nd ed. Philadelphia, Pa: Lippincott Williams & Wilkins, 2001; 335-386.
5. https://books.google.co.in/books?id=M5sbCxd5cioC&pg=PA176&lpg=PA176&dq=difficulty+in+cannulation+of+svc&source=bl&ots=G6Sh_oxmqy&sig=kFOlP1AMa7SjQ5m6LuWzrJ9tQkY&hl=en&sa=X&ved=2ahUKEwiegNmHtPfdAhUHMo8KHdgjCooQ6AEwD3oECAAQAQ#v=onepage&q=difficulty%20in%20cannulation%20of%20svc&f=false
6. Manjula Sarkar and Vishal Prabhu, Indian J Anaesth. 2017 Sep; 61(9): 760-767.