SPCHS NEWSLETTER

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Contents:

SURGICAL TECHNIQUE: Hemi Mustard Procedure

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Preoperative Lines

Patient preparation is standard for any open-heart procedures. It is preferable to have short length central venous line inserted in the Right internal jugular vein since all of them will have a BD Glenn shunt along with Hemi Mustard as a part of the procedure. Arterial line is inserted either in the radial or femoral artery. Additional Femoral venous central line or at least one of the peripheral venous lines in the lower limb is very helpful to check the Hemi mustard baffle at the end of the procedure with agitated saline at the end of the procedure. Near infra-red spectroscopy (NIRS) monitoring is optional. Transesophageal echocardiogram (TEE) is a standard care in all patients.

CPB circuit

Standard CPB circuit with additional cardiotomy sucker in the CPB circuit is helpful. This additional cardiotomy circuit is very helpful to keep the field dry during the procedure since the hemi mustard procedure is done using fibrillatory arrest in our institute. We always do the pre-bypass ultrafiltration as routine and continue with conventional ultrafiltration during the entire procedure.

Myocardial Protection

Moderate Hypothermia with core temperature of 28 degree and Fibrillatory arrest is usual. Del Nido cardioplegia is preferred if needed to arrest the heart. Cardioplegia is given at 30ml/kg and repeated once in 60 minutes.

Surgical steps

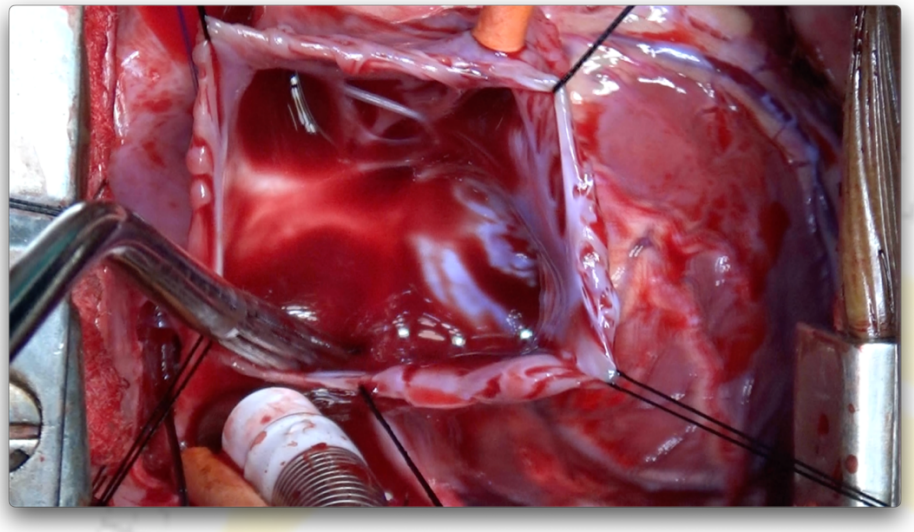
A standard median sternotomy is done. Sternum is retracted with standard chest wall retractor. The entire anterior portion of pericardium is harvested from just phrenic nerve on either side since we use pericardium for VSD closure and to make Ozaki valved conduit for patients undergoing Hemi Mustard and Rastelli procedure. Pericardial stay sutures are taken. General inspection of size of greater artery and their relationship, position of SVC, IVC, size of both atrial appendage and coronary artery anatomy is made. The harvested pericardium is fixed on a metal plate with silk sutures and getting cleaned and treated with 0.6% glutaraldehyde for 3-5 minutes. Aorta and main pulmonary arteries are dissected. The SVC was dissected to its entire length and azygos vein is divided. The IVC is dissected. Both cavae are looped with silk. After systemic heparinization, aorta is cannulated high near the origin of innominate artery. The SVC is cannulated very high near SVC- Innominate vein junction using metal tip right angle cannula and IVC was cannulated near the diaphragm. Cardiopulmonary bypass is then instituted, and the patient is cooled to 28 degree celsius on rectal temperature. During cooling, a left ventricular vent catheter is placed through the right upper pulmonary vein.

Right atriotomy

With fibrillary arrest without aortic cross clamping, Both caval tapes are tightened. Right atrium is opened, 0.5 to 1cm lateral to interatrial groove, starting from the right trial appendage all the up to RA-IVC caval junction. Both proximal and distal end of the right atrial incision is split transversely on either side for better exposure. The right atrial incision will almost look like obliquely placed capitol letter I. Multiple stay sutures are taken on both right atrial margin. Cardiotomy suckers is placed inside the right atrium. Separate cardiotomy sucker is placed on the coronary sinus in

order to keep the field dry. The anatomy of interior portion of right atrium, interatrial septum, location of coronary sinus, morphology of both AV valves were studied. Sometimes , leaving the IVC unsnared will help us to drain the venous drainage from right atrium if you doing the procedure under fibrillatory arrest

Picture 1 : Right atriotomy and Stay sutures

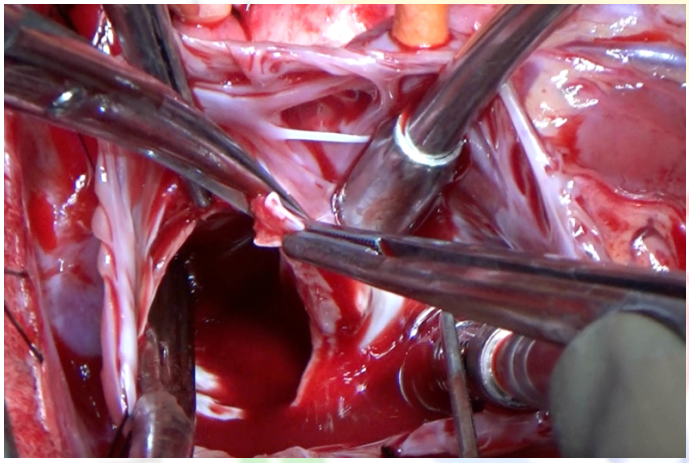


Atrial septectomy and Re- endothelialisation

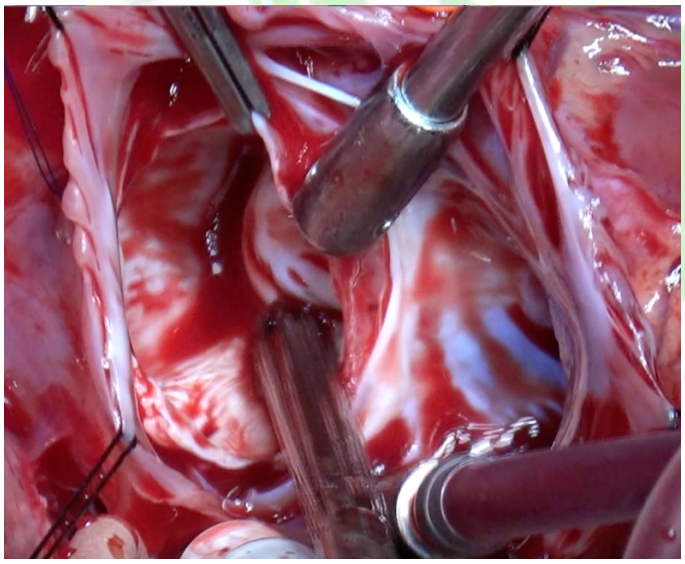
Aggressive Atrial septectomy is completed by excising the septum primum. Superior and inferior limbus of septum secundum along the ASD margins are thinned out aggressively. Excision of superior limbus can be very aggressive and can be done as close to the SVC orifice inside the right atrium. We should be careful about anatomical variation of sinus nodal artery. In similar way the tissue on the inside of interatrial groove can be very aggressively thinned. Coronary sinus will be split open (unroofed) in to the LA for at least one centimetre from its origin. Eustachian valve and all the trabculation near the IVC are removed. Creation of large Atrial septal defect is very crucial for unobstructed Hemi Mustard baffle. The margins of unroofed coronary sinus is reendothelised by approximating endocardium to endocardium on either side. In similar way, the ASD margins were reendothelialised by suturing the endocardium on either side of thinned out ASD margin. We prefer to use 6-0 prolene sutures in smaller children and 5-0 prolene in bigger children and we interlock all the sutures. The reendothelialising sutures usually starts near the right upper pulmonary vein and runs in a clock wise direction including SVC- RA junction, the right atrial margins near the mitral valve and all the way up to the medial end of unroofed coronary sinus. The another sutures starts near the right lower pulmonary vein and runs in a anti clock wise manner till the lateral edge of the unroofed coronary sinus. It is preferable to leave space in the right atrium while reendothelising the atrial margin between the right upper and right lower pulmonary veins since it can be used to enlarge right atrium if there is any pulmonary venous obstruction.

Picture 2 : Beginning of atrial septectomy (Excision of Septum primum)

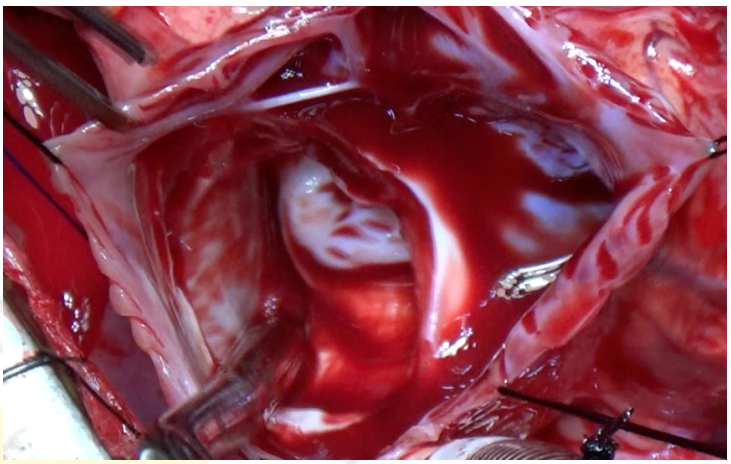
Picture 3



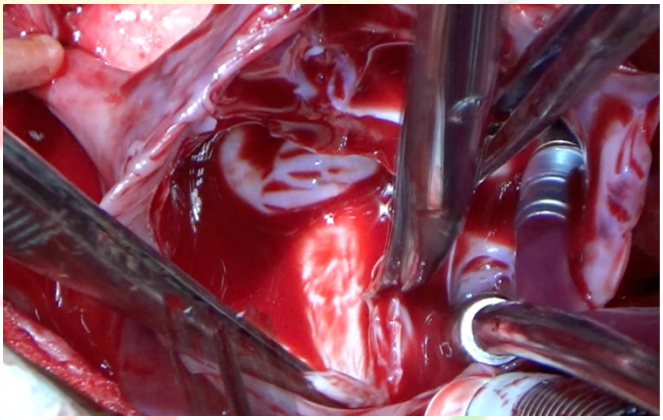
Picture 4 : Complete excision of septum Primum



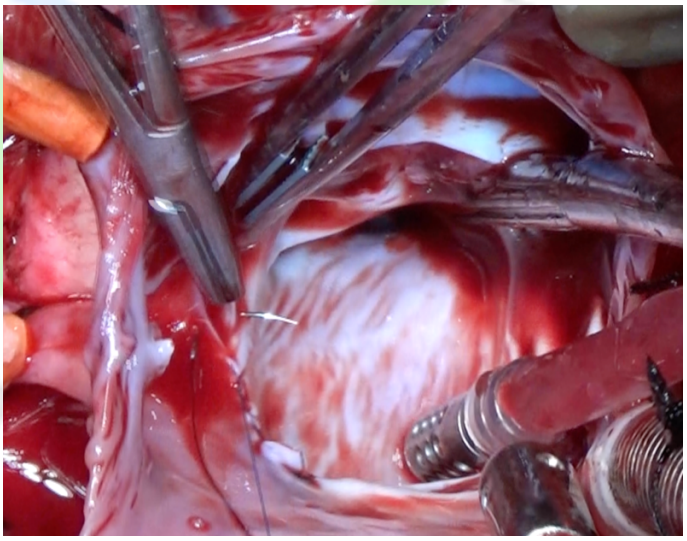
Picture 5: Excision of superior limbus



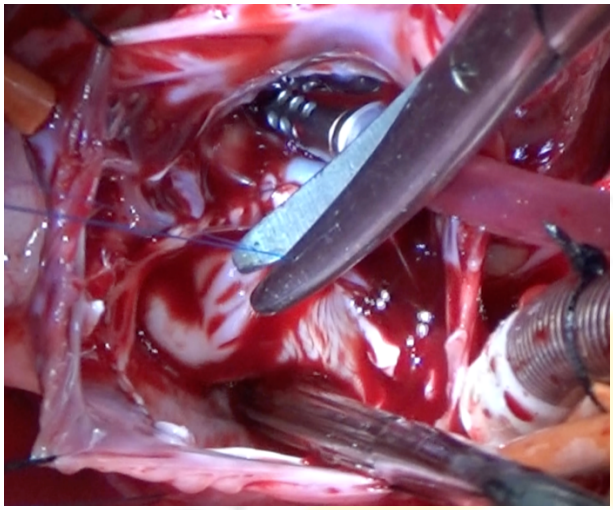
Picture 6: Unroofing the coronary sinus



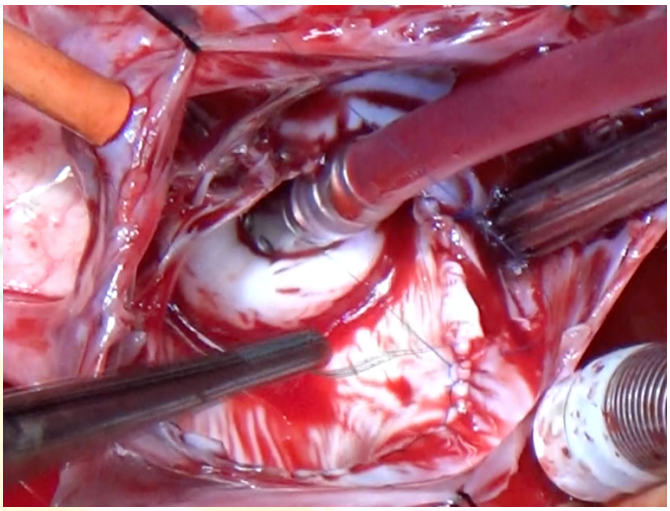
Picture 7a : Anterior re endothelialisation



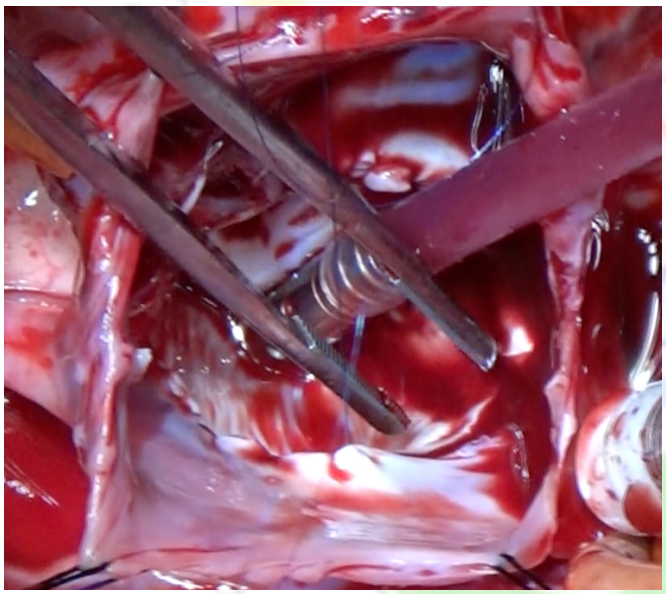
Picture 7b : Completion of suture line lines till the unroofed coronary sinus



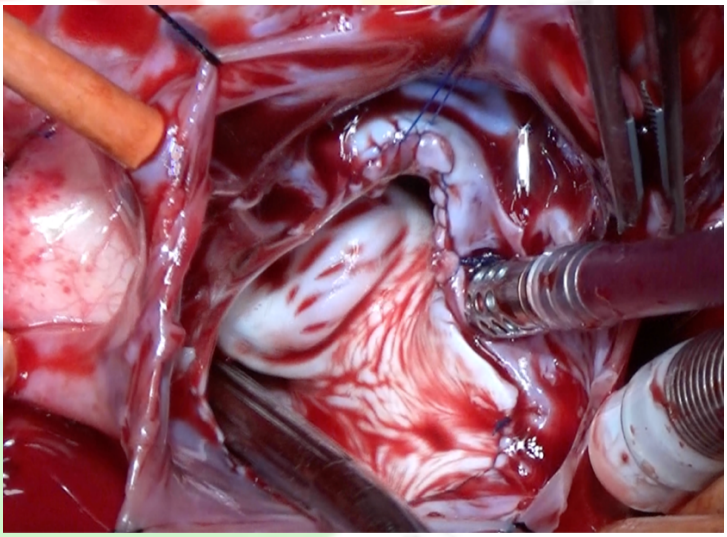
Picture 8b : Posterior sutureline till the coronary sinus



Picture8 a : Posterior re-ednothelisation



8c : Complete endothilum to endothelium approximation with traction suture

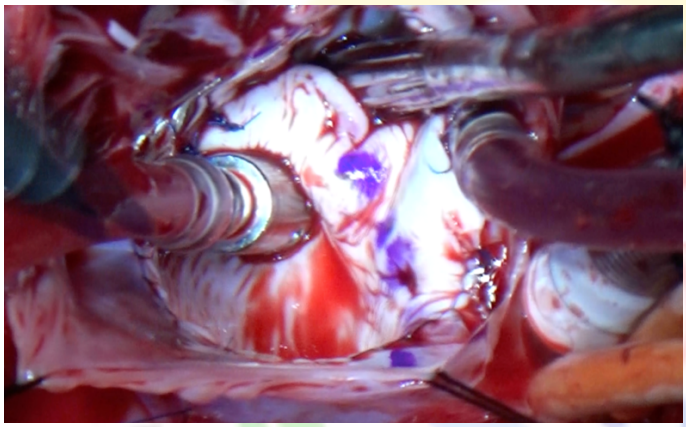


Hemi Mustard baffle reconstruction

Inspect the anatomy of tricuspid valve, left atrial appendage , left and right sided pulmonary venous opening after atrial septectomy. Place additional traction sutures along the atrial margin for better visualisation of anatomy. Ask assistant to use regular VSD retractor underneath the atrial margin for better exposure of Tricuspid valve. Take a silk thread and measure the distance from superior most aspect of tricuspid valve annulus till the IVC orifice on inner side of right atrium. Our preferred patch material is usually a native treated pericardium or bovine pericardium. The size of the patch will be usually about 8 x 6 cm in size. After carefully looking in to the left and right pulmonary veins, we start suturing the posterior layer of Hemi-Mustard baffle into the floor of left atrium about a centimetre from the tricuspid annulus. The posterior layer is sutured just inferior to left atrial appendage but anterior to the left pulmonary veins. The left atrial appendage will be usually included in to the hemimustard baffle. The posterior suture line will be extended in to floor of left atrium up to the floor of IVC rim by staying just lateral to the right sided pulmonary venous opening. The

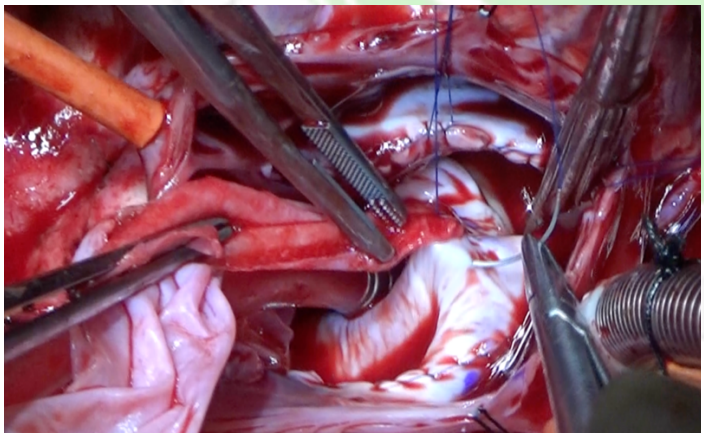
anterior layer of Hemi-Mustard is completed by suturing the pericardium along the margins of the left atrial appendage including the entire annulus of the tricuspid valve into the edge of the interatrial septal margin. Anterior layer of Hemi Mustard will be encircling the unroofed coronary sinus all the way to inferior vena cave orifice. Now complete hemi mustard by joining both anterior and posterior suture line by going around the IVC orifice and thereby encircling the IVC anteriorly. The sutures can go in and outside of right atrium where the IVC enter the RA in order to avoid any purse-string effect. The baffle was tested to look for any leak by clamping the IVC venous cannula. The patch can be plicated in the middle if the baffle is too redundant. With venous cannula clamped, you can also asses the Pulmonary veinous opening. If there is any suspicion about the pulmonary venous drainage, then split the right atrium in the space between both right sided pulmonary veins and place small pericardial patch to augment the pulmonary venous patch. Now the right atrium can be closed either primarily or with use of small pericardial patch near the IVC-RA junction.

Picture 9a : Markings for Posterior suture line of Hemimustard

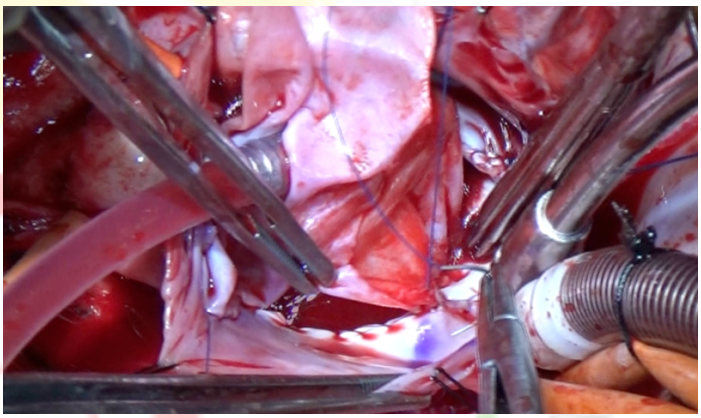


Picture 9A , B AND C : Beginning and completion of posterior Hemi mustard suture lines

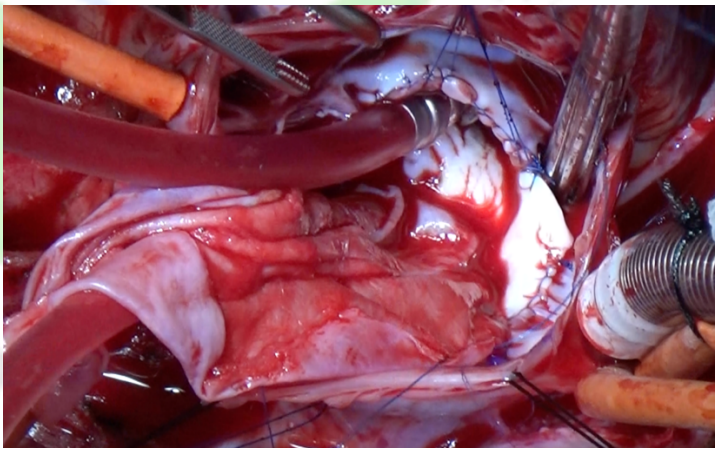
9a



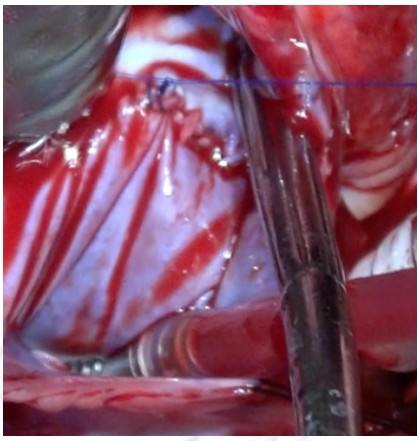
9b



9c



Picture 10 : Completion Hemi Mustard



Post procedure assessment of Baffle

TEE is very helpful in assessing the hemi mustard pathway if you have an experienced anaesthetist or a cardiologist. Use agitated saline and inject in to the femoral venous line to detect any baffle leak under the TEE guidance. Pulmonary venous pathway can be very well assessed with help of TEE .

Post-operative care

It is always mandatory to place peritoneal catheter at the end of the procedure and instruct the ICU team to watch for excessive peritoneal drainage. If any excessive drainage warrants repeat Echo or cath study to rule out baffle obstruction. Always check the liver enzymes in 12-24 hours after surgery.

ADVANTAGE

This hemi-Mustard strategy has been reported to have multiple following theoretical benefits compared to a full atrial switch; 1) it avoids suture lines in the sinus node area. Data from Senning and Mustard series demonstrate a late incidence of sinus node dysfunction in excess of 60%, 2) the technique shortens cross-clamp time, 3) it eliminates the possibility of superior vena cava baffle obstruction or leaks, 4) it prolongs the longevity of the right ventricle to pulmonary artery conduits used in the Rastelli repair, 5) it simplifies the procedure in patients with dextroposition or other positional abnormalities.

DISADVANTAGE

Several drawbacks such as the limited transvenous access for pacing, long-term moderate elevation of the SVC pressure, need for a competent pulmonary valve, and high incidence of chylothorax or pleural effusion

CASE REPORT:

Unexpected coronary artery grafting in a redo tetralogy of Fallot : Report of a case

Nilanjan Dutta, Debasis Das, Narayana Superspeciality Hospital, Kolkata

A 7 years old girl , 22 kg weight,was operated in the month of May, 2023 for Total correction and LPA plasty for Tetralogy of Fallot. The post-operative course was uneventful and she was discharged uneventfully. All her follow-up echocardiograms were acceptable. After 6 months, the patient came back in our OPD with 5 mm residual VSD, severe TR, severe LPA origin stenosis and biventricular dysfunction. There was no antecedent history suggestive of infective endocarditis.

After short medical optimization, she was taken for redo surgery. After redo-sternotomy, the patient was put on single cannula bypass. The main right coronary artery (RCA) got accidentally injured during the dissection in the atrio-ventricular groove region which was densely adherent to the pericardium near IVC. On closer inspection, it was realized that the mid Right Coronary Artery (RCA)was completely transected in the mid portion. We dissected the distal end of RCA from the pericardium. IVC was cannulated and patient was put on full CPB.

An autologous SVG was harvested from left leg. The vein graft was anastomosed into distal RCA with 7/0 prolene.

Antegrade del Nido cardioplegia was given through root and graft. Residual VSD was closed with a small separate patch. An intraoperative stent was placed in LPA and dilated till 10 mm (as the LPA had undergone augmentation previously also and has stenosed).Anteriorly, LPA was reconstructed with bovine pericardium. Aortic clamp was released and heart started beating.

After deairing , the cardioplegia cannula was removed and the proximal anastomosis of the venous graft was placed in the same place with 6/0 prolene. We came off with moderate doses of inotropes. Epicardial echo showed moderate LV dysfunction. The patient had significant pre-operative significant biventricular dysfunction and so the graft patency assessment with CT coronary angiogram was deferred to 3 months in follow up period. She was extubated on POD 1, made an uneventful recovery and was discharged on post-operative day 5. An gentle redundancy was kept in the venous graft for anticipated future growth of the heart.

A timely recognition of a catastrophic event saved the patient. We plan to assess the graft patency by CT coronary angiogram at 3 month follow up.

Image 1: ***Reversed SVG anastomosed to distal RCA, proximal cut end is retracted with prolene.***

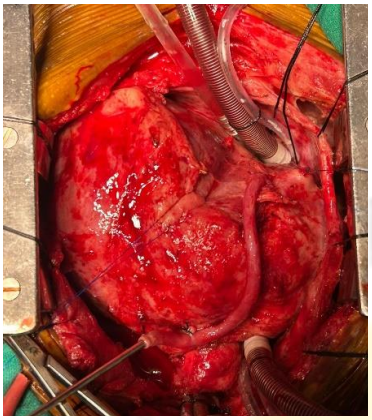


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Image 2: ***Completed anastomosis***

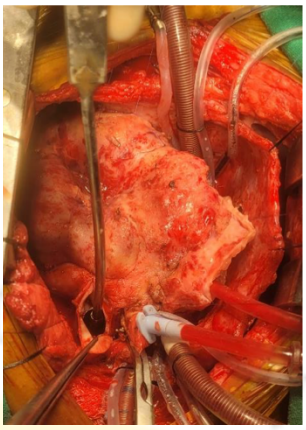

Image 3: ***Intraoperative stent in LPA***

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1. **IYER, K.S. (2023)** ***Dr. Sadasivam Oration IACTSCON 2012, YouTube.*** **Available at: https://youtu.be/o3TjLMDgHOU DOI :https://doi.org/10.5281/zenodo.8127773**
2. **SHARMA, R. (2022)** ***Straight from the heart*****, Available at https://youtu.be/8ApEgqXNFVcDOI: https://doi.org/10.5281/zenodo.8127863**
3. **IYER, K.S. (2023)** ***AATS MEETING PRESENTATION 2 patch AVSD repair, YouTube.*** **Available at: https://youtu.be/IrRgzO_gZHM DOI: https://doi.org/10.5281/zenodo.8127741**
4. **IYER, K.S. (2023)** ***DEFINING LIMITS OF BIVENTRICULAR REPAIR : A REALITY CHECK, YouTube.*** **Available at: https://youtu.be/OEeCMI1R7O8 DOI:https://doi.org/10.5281/zenodo.8127779**
5. **IYER, K.S. (2023)** ***The late TGA IVS what strategy and when*****, Available at: https://youtu.be/JuVqY6NuSVo DOI: https://doi.org/10.5281/zenodo.8127854**

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1.KAUSHAL, S. (2023) ***MITRAL ARCADE REPAIR*****, Available at: https://youtu.be/IB81OKJrbY8 https://doi.org/10.5281/zenodo.8138137**

2. SADASIVAM, V (2023) TWO PATCH REPAIR OF COMPLETE AVSD, Available at: https://www.youtube.com/watch?v=rklGzbw-9Cc https://doi.org/10.5281/zenodo.10369298