Indian Journal of Clinical Practice, Vol. 30, No. 11, April 2020

Fresh Look into Current Expanding Indications for Sutureless Repair for Total Anomalous Pulmonary Venous Return

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ABSTRACT

Total anomalous pulmonary venous return (TAPVR) has an incidence of about 5.9-7.1 per 1,00,000 live births. Sutureless repair is a safe and effective procedure to manage TAPVR. The sutureless technique with creation of neoatrium leads to less pulmonary venous obstruction postoperatively and less reoperation rates as well. This article provides an overview of sutureless repair for TAPVR.

Keywords: Sutureless technique, total anomalous pulmonary venous connection or return, classical TAPVC correction, pulmonary vein stenosis, pulmonary vein gradients, extracorporeal membrane oxygenation

Incidence of total anomalous pulmonary venous return (TAPVR) currently is about 5.9-7.1 in 1,00,000 live births.[1] In TAPVR, all the pulmonary veins connect to chambers other than left atrium (LA) necessitating an obligatory right to left shunt for survival. Pulmonary hypertension in situations with right-sided volume overload with oxygenated blood and pulmonary venous obstruction (PVO) at multiple levels are major contributory factors to mortality from the disease.[2,3] A drop in mortality has been noted in high volume centers from 15% to <3%. *In situ* pericardial tissue being used for neo LA creation by sutureless techniques has been increasingly appreciated as an excellent technique for recurrent pulmonary venous stenosis (PVS).[3,4] Safety has been reported by many current meta-analytical studies.[5]

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A meta-analysis of seven leading studies on mortality that compared the two surgical techniques – traditional repair versus sutureless techniques – showed no difference statistically in these two methods.[5] Here native pulmonary venous tissues do not have any suture lines. Reactive intimal proliferation is avoided maintaining optimal flow patterns. Gradients in pulmonary veins, especially after infracardiac type repairs, necessitate support with extracorporeal membrane oxygenation (ECMO) and anastomotic revision by conventional repair techniques.

Avoidance of distortion or narrowing, with optimal flow characteristics have been the two most attractive options with sutureless repair technique. Pulmonary vein scoring is generally done as follows:

PVS: 0 = no stenosis (mean gradient <2 mmHg); 1 = mild stenosis (mean gradient 2.0-6.9 mmHg); 2 = severe stenosis (mean gradient >7 mmHg) and 3 = complete occlusion. The sum of the individual pulmonary vein scores is then used as a subjective measure of the overall degree of PVS ranging from 0 (no stenosis) to a theoretic maximum score of 12.

Echocardiography should focus on right ventricular systolic pressure evaluation using the tricuspid regurgitant jet. Early diastolic velocity of the pulmonary regurgitant jet gives the mean pulmonary artery pressure. Left ventricular ejection fraction (LVEF) should also be measured. Indexed left atrial volume (LAVi) should be also measured. The collecting chamber is

included in the left atrial volumetric measurement post repair. Mean gradients of the individual pulmonary veins should also be calculated.

TECHNIQUE

Using standard cardiopulmonary bypass with bicaval cannulation, unroofing of the coronary sinus is done for cardiac TAPVR and further includes single- or two-sided atriopericardial connection, especially if there is associated vein to confluence orifice stenosis. In case of sutureless repair of infracardiac and supracardiac TAPVR, incisions are made in the venous confluence and then extended separately into both pulmonary veins separately for unobstructed flow. Small pulmonary venous confluences, as in infracardiac TAPVR require incisions into individual pulmonary veins. In sutureless repair atriopericardial anastomosis is fashioned using pericardium close to the pulmonary vein orifice to the pericardium. A neo LA is created allowing free flow of blood from pulmonary veins into LA. The interatrial communication is closed. Operative duration is more often linked to complexity in the anatomy than to type of repair in most cases in high volume centers. Early challenges are related to pulmonary hypertension and lung function while late morbidity is due to PVS. Even small pulmonary gradients can cause significant secondary pulmonary hypertension.

DISCUSSION

Though sutureless repair evolved for cases where ECMO could not be weaned off as salvage procedures, indications to use these are being more liberalized as more technical expertise is being attained in high volume centers. This technique can be safely and confidently applied for all infracardiac types, cardiac types with PVS and also for select cases of supracardiac types with pulmonary vein narrowing. In recent years, this sutureless technique, utilized also for the primary repair of TAPVR, has been expanded for use in patients who had preoperative PVO or were at risk of developing PVO.[6] Mortality figures exponentially rise in procedures for recurrent PVS.

Treatment procedures for recurrent PVS include medical therapy, inhaled nitric oxide, ECMO or surgical revision, or septostomy. In cases with diffuse proliferative fibrosis, the requirement of lung or heart-lung transplantation is a reality. Thrombosis, embolism, rupture, phrenic nerve injuries are points that necessitate discussion with this procedure. Integrity of the pleuropericardial junction is a crucial feature when this technique is adopted. Reoperation rates for PVO are less for sutureless techniques.[7]

CONCLUSIONS

Use of sutureless technique with creation of neoatrium results in less PVO postoperatively and less reoperation rates while having the same postoperative mortality as traditional repair, indicating that it is safe in experienced hands. Better and more complete visualization of pulmonary veins is provided by this technique and suture induced inflammation is completely eliminated. Wide opening ensures obstruction free drainage even with intimal fibroblastic proliferation that occurs later in the disease process naturally.

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