

Case Report

Use of Pericardial Patch Conduit in Bidirectional Glenn Shunt: An Innovative Technique

Kazi Shariful Islam, Shahriar Moinuddin, Ankan Kumar Paul, Masud Alam

Dept. of Cardiac surgery, NICVD, Dhaka

Abstract:

Key words:
Pericardium,
Bidirectional
Glenn shunt,
Congenital heart
disease.

Bidirectional Glenn Shunt is a palliative procedure in single ventricle or hypoplastic right ventricle, tricuspid atresia and pulmonary stenosis complex where definitive repair is not feasible as well as an intermediate step of Fontan procedure. It is done by anastomosing superior venacava with right pulmonary artery or conduit can be used. We were forced to do the anastomosis between superior venacava and left pulmonary artery using a conduit as anatomy wasn't favorable. Due to unavailability of any recognized conduits we used autologous pericardium and created a conduit with it to carry out anastomosis. Post-operative results were satisfactory.

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Introduction:

The bidirectional Glenn shunt (BDG) is an operation to divert systemic venous return from the superior vena cava (SVC) directly to both lungs through the right pulmonary artery (RPA), bypassing a right ventricle (RV) that may be hypoplastic or absent. It is a Cavo pulmonary connection that provides excellent palliation in complicated malformations associated with low pulmonary blood flow, low pulmonary arterial (PA) pressure, and low pulmonary vascular resistance. Patients with low systemic arterial oxygen saturation (SaO₂) get benefitted as the effective pulmonary blood flow is increased without any increase in total pulmonary blood flow which improves the saturation. It can also relieve the volume load of the single functional ventricle and improve the geometric structure of the ventricle.^{1,2,3} This procedure can be done with or without cardiopulmonary bypass (CPB). It can be considered both as an intermediate step and as part of the procedure of total right heart bypass in case of single ventricle, tricuspid atresia or pulmonary stenosis (PS) complex.⁴ Use of homograft conduits has been described in patients undergoing the extracardiac Fontan operation to

route the inferior vena cava (IVC) to the PA.^{5,6} Even a homograft conduit to connect the SVC to the RPA in a patient with a functionally univentricular heart where corrective repair was impossible was also reported. We are presenting a case where we were forced to use autologous pericardial conduit to connect the SVC to LPA.

Case Report:

A 12 year old boy presented to us with progressive dyspnea and central cyanosis and failure to thrive since childhood. His arterial saturation was 68% in room air. On echocardiography double outlet right ventricle (DORV) was diagnosed with large nonrestrictive, non-committed ventricular septal defect (VSD) and PS. His main pulmonary artery (MPA), RPA and LPA was of fair size. As definitive correction wasn't feasible BDG was planned. CPB was established and it was seen that SVC was unusually rotated and deviated to the left from its usual location. It was impossible to anastomose it with the RPA. So anastomosis with LPA was planned. Azygous vein was ligated and separated. SVC was transected and atrial end closed. Surprisingly the length was even short for anastomosing with LPA. As no conduit was

Address of Correspondence: Dr. Shahriar Moinuddin, Dept. of Cardiac Surgery, NICVD, Dhaka, Bangladesh. shahriar.cmc@gmail.com

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available at that time, a pericardial patch was taken and it was rolled to make a tube and sutured with 5-0 polypropylene to make it a conduit. Then end to end anastomosis with SVC and end to side anastomosis with LPA did with 5-0 polypropylene. [Fig 1] Post-operative recovery was uneventful. Saturation increased to 84%. He was discharged on 9th post-operative day (POD). Follow up after 7 days, 1 month and 3 months revealed increased saturation up to 86% in room air and functional improvement of quality of life.

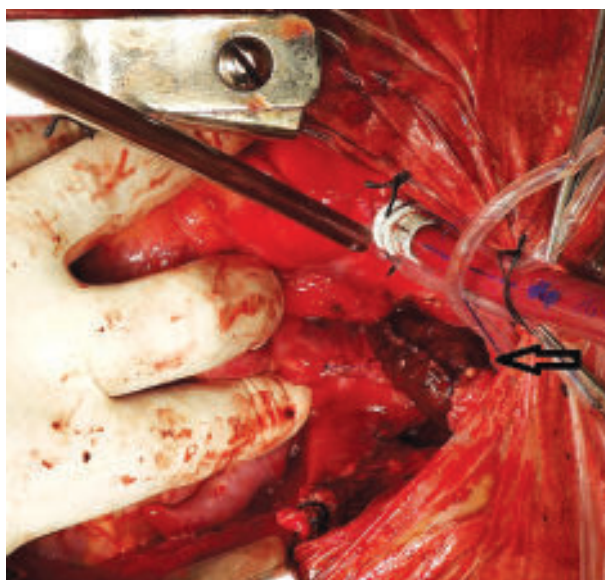


Fig 1: Conduit created with pericardial patch (arrow).

Discussion:

The original cavopulmonary, or Glenn, shunt has been used to palliate a variety of congenital heart lesions with excellent relief of cyanosis. Glenn was able to report a collected series of 537 cases by 1966.^{8,9} Advantages of this cavo-pulmonary shunt over the systemic artery-pulmonary artery shunts were recognized as (1) no increase in workload of the left side of the heart, (2) no late pulmonary vascular obstructive disease in the right lung, (3) shunting of venous blood rather than an arteriovenous admixture, and (4) decrease in the volume of blood flow through the right atrium.¹⁰ Although the classic Glenn shunt has been recognized as effective for long-term palliation, the success of the Fontan approach in treatment of tricuspid atresia and univentricular heart further decreased the need for permanent shunt palliation

and led to the concept of shunt staging toward an ultimate Fontan repair.^{11,12} So BDG is chosen as a palliative procedure in cases where Fontan or any definitive repair is not possible, or as an intermediate step of Fontan procedure. Our case was DORV with non-committed, non-restrictive VSD with PS. As definitive procedure was not possible, age of the patient was 12 years and PA size was fare, BDG was planned.

BDG is usually done by anastomosing SVC with RPA in end to side manner.⁷ Here SVC was anastomosed with LPA as SVC was unusually rotated and deviated towards left and was away from the RPA, close to the LPA. Upon separating the SVC from its cardiac end it was realized that the length was inadequate to anastomose it to the LPA. Using aortic homograft in Fontan procedure to anastomose the IVC to RPA is a recognized procedure. Even there is a case report stating the use of aortic homograft in creating BDG between SVC and RPA as in that case there was TAPVC to azygous vein and to save it SVC was transected a lot superiorly. As a result, the length was inadequate.⁷ Pericardial patch is used in Norwood procedure to reconstruct the aortic arch which is usually bovine pericardium.¹³ As aortic homograft wasn't available at that time we thought of using pericardium. Bovine pericardium wasn't available either, so we thought of using glutaraldehyde treated autologous pericardium. A conduit was created by rolling and suturing the pericardium with 5-0 polypropylene and it was anastomosed with SVC in an end to end manner and with LPA in an end to side fashion. It was actually an effective method as weaning was done without any difficulty and post-operative result is satisfactory. In a country like us where maximum patient are poor and resources are limited this innovative idea can be a good technique in difficult times. This is the first time someone used this technique, as using an autologous pericardial patch to perform BDG has not been reported yet to our knowledge.

Conclusion: In conclusion autologous pericardium can be used as a conduit in different scenario. Its availability, lower cost, and possible immunologic advantages make it an attractive alternative to allograft material.

Conflict of Interest - None.

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