DOI: https://doi.org/10.3329/cardio.v13i1.50570

Case Report

Atrial Septal Stenting - A Lifesaving Procedure: First Case Report from Bangladesh

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Key words: *TAPVD, ASD, CHD, Atrial Septal stenting, Balloon septostomy.*

Abstract:

Certain congenital heart defects require the creation of an unrestrictive atrial septal defect (ASD) secundum to achieve adequate atrial mixing to improve systemic oxygen saturation by placing septal stent. We reported a case of 7-month-old child who was presented with shock like state with marked desaturation. He was diagnosed as a case of mixed total anomalous pulmonary venous return with restricted closing ASD secundum. We performed atrial septal stenting as a palliative procedure for saving the life. Creation or enlargement of ASD in infants using nonconventional transcatheter techniques is feasible, safe, and effective when usual technique fails or not suitable. After the procedure systemic saturation improved and patient became hemodynamically stable and there after rerouting of pulmonary veins to left atrium with ASD closure and removal of stent done by open heart surgery and send him home safely.

(Cardiovasc. j. 2020; 13(1): 86-91)

Introduction:

An unrestrictive atrial septal defect (ASD) is necessary for a number of congenital heart defects, to reduce atrial hypertension, to maintain systemic cardiac output, or to achieve adequate atrial mixing to afford stable systemic oxygen saturation. Infants who have a restrictive ASD can rapidly develop hemodynamic instability like transposition of great arteries or total anomalous pulmonary venous return, tricuspid atresia. There are several transcatheter techniques for enlarging or creating an ASD, including balloon atrial septostomy, blade atrial septostomy with or without subsequent balloon septostomy, and static balloon dilation.[1–5] However, beyond the neonatal period, the atrial septum gets thicker and becomes vulnerable to tears during balloon septostomy. Blade septostomy has been introduced in cases in which balloon septostomy fails, but this procedure presents significant risks.[6] Static and cutting balloons have also been used to enlarge interatrial communications, also with uncertain results.[5] However, there are some isolated or combined situations in which these techniques may be technically impossible, difûcult, risky, or ineffective such as a thick or intact septum, a small left atrium(LA), a small baby, occluded femoral veins, absence of the hepatic portion of the inferior venae cava (IVC), or unavailability of an adequate size Park blade. Stenting of the atrial septum has been introduced to achieve a reliable interatrial communication which is lifesaving bridging palliative procedure.[7,8,9] We had performed atrial septal stenting in an emergency basis where a seven-month-old boy presented with shock due to low cardiac output due to almost closing restrictive ASD in mixed total anomalous pulmonary venous return (TAPVR). After stent implantation hemodynamic condition improved and 10 days later total surgical correction done, and patient was discharged after 11nth post-operative days of surgery. He came for follow up (one and three month after surgery) and there was no complication.

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Case report:

Seven month male child (weight 5.5 kg) diagnosed as a case of mixed TAPVR admitted for medical management with respiratory distress in the Pediatric cardiology department, National heart foundation hospital and research institute who shortly developed cardiogenic shock like state with feeble pulse, effort breathing, deep cyanosis (SPO2= 32%), cold clammy periphery and low blood pressure (55/35 mm Hg), on auscultation faint ejection systolic murmur in 2nd left intercostal area. It was an emergency state but surgery was not possible as because operation theater was busy with scheduled ongoing cases, so we had to find out the way to rescue the baby. We managed with IV fluid and inotropes then intubated him and rushed to take him to cardiac catheterization laboratory. Detailed transthoracic echo was done before admission which showed mixed type of TAPVR, right sided(upper and lower) and left lower pulmonary veins formed a confluence at the posterior aspect of left atrium and draining into coronary sinus to right atrium & left upper pulmonary vein forming a vertical vein & draining to SVC to RA, left sided chamber was small with severe pulmonary hypertension with closing restrictive ASD(1X2mm) with right to left shunt with thickened Inter atrial septum (IAS). This thick IAS was not suitable for conventional balloon septostomy or dilatation and left atrium was too small to take suitable septectomy blade (Park blade) and also not available in our lab so we planned to do inter atrial septal stenting.

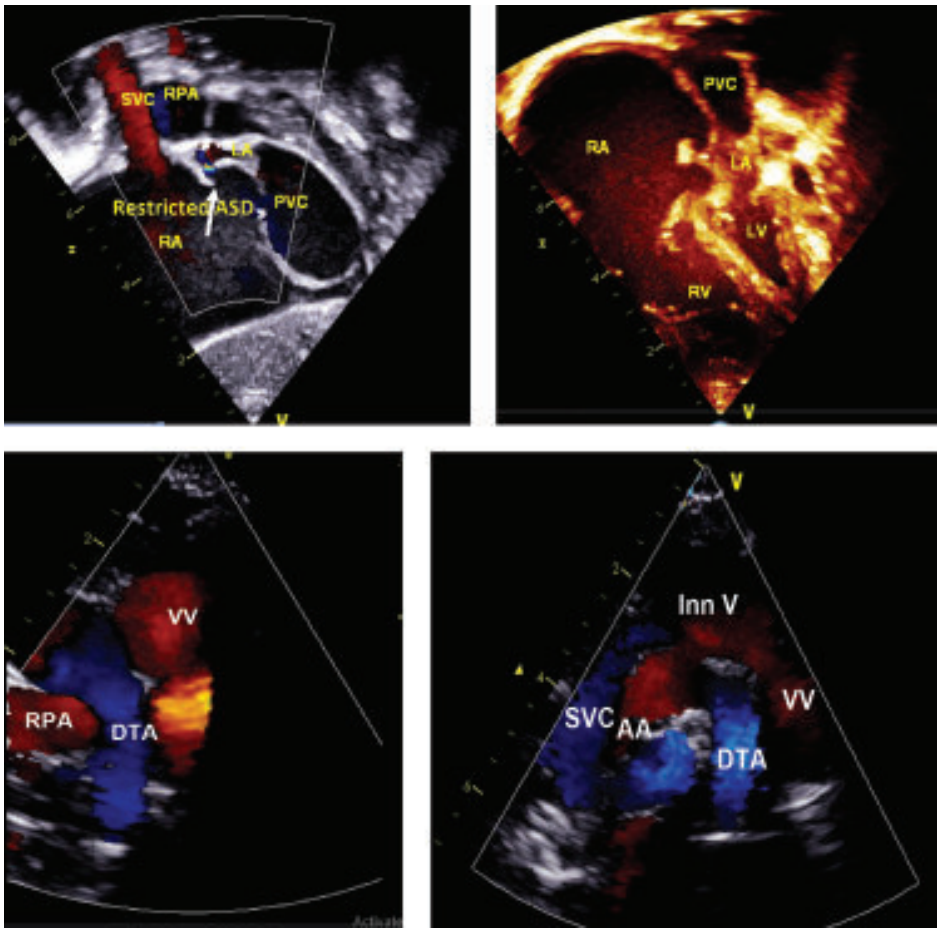

Fig.-1: *Dilated RA- RV & SVC with small LA & LV. Closing restrictive ASD with R-L shunt. Three PV draining to dilated CS to RA, LUPV draining to VV to SVC to RA.(RA=Right atrium, RV= Right Ventricle, SVC=Superior venae cava, LA=Left atrium, LV= Left Ventricle, CS= Coronary sinus, LUPV= Left upper pulmonary vein, VV=Vertical vein, Inn V=Innominate vein, RPA= Right pulmonary artery, AA=Ascending aorta, DTA=descending thoracic aorta, PVC= Pulmonary venous confluence))*

We had seen this patient prior to this visit (one weak) and routine electrocardiography (ECG), chest X-Ray, echocardiography and CT angiogram was performed earlier and planning for surgery. ECG showed right axis with right ventricular forces and CXR suggested cardiomegaly with increased pulmonary flow.

CT angiogram showed left upper pulmonary vein (LUPV) draining to left sided vertical vein which then draining to innominate vein & then to superior vena cava and other left sided and right sided pulmonary veins forming a confluence which draining to coronary sinus.

Fig.2: CXR anterior-posterior view showed cardiomegaly with increased pulmonary blood flow.

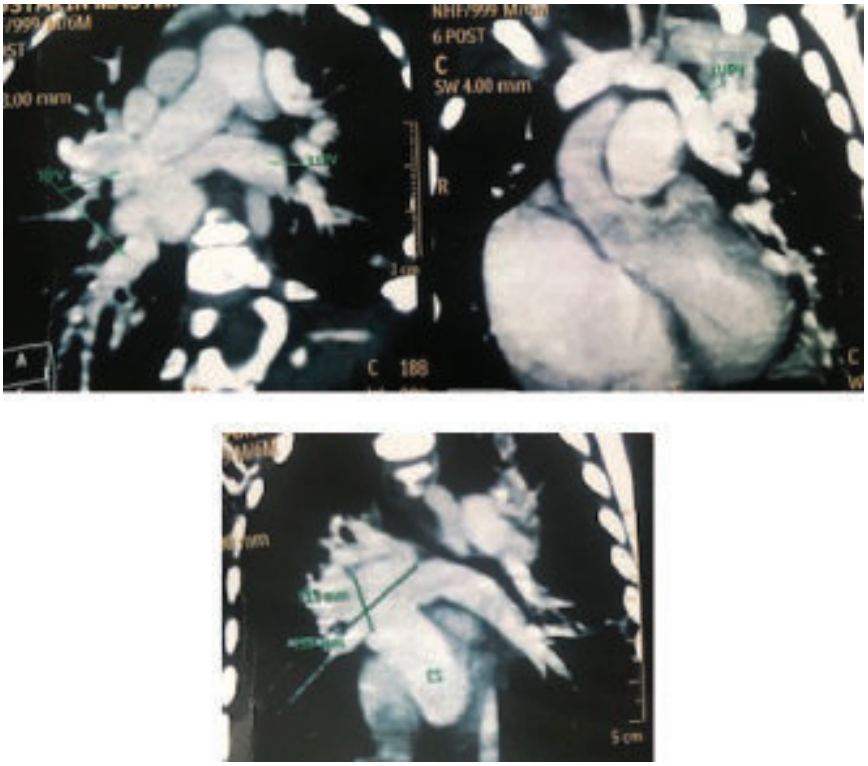

Fig.-3: *CT angiogram showing left upper pulmonary vein (LUPV) draining to vertical vein to innominate vein to superior vena cava and other three pulmonary veins forming a confluence which draining to coronary sinus.*

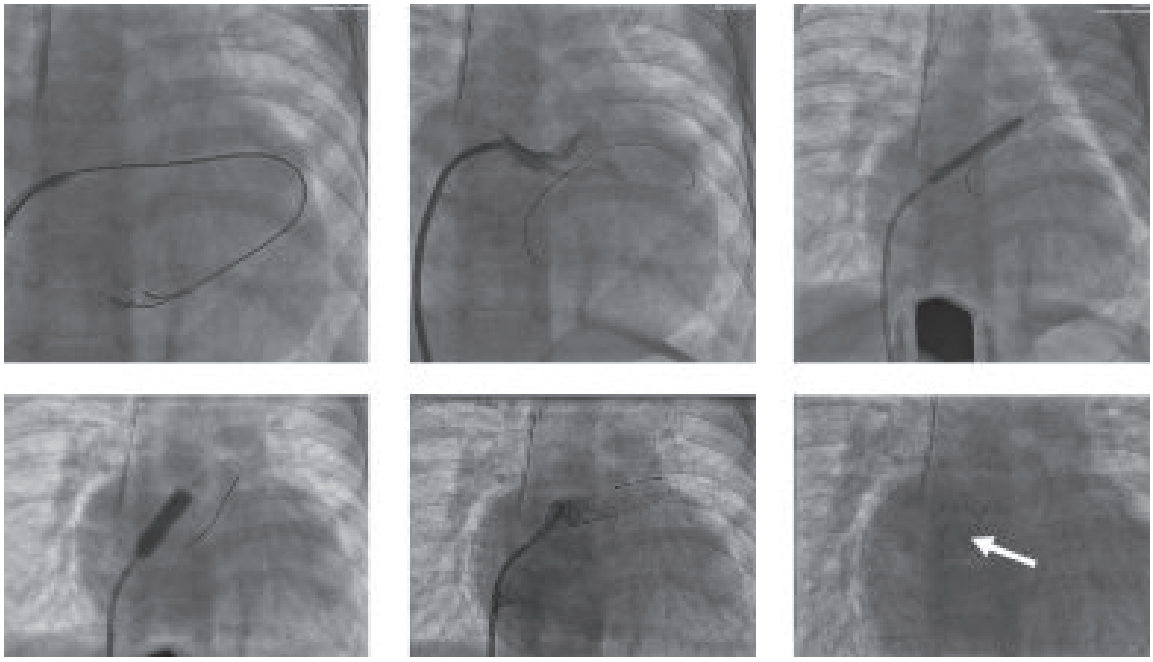

Fig.-4: *Cardiac catheterization showed placement of stent at restrictive ASD level.*

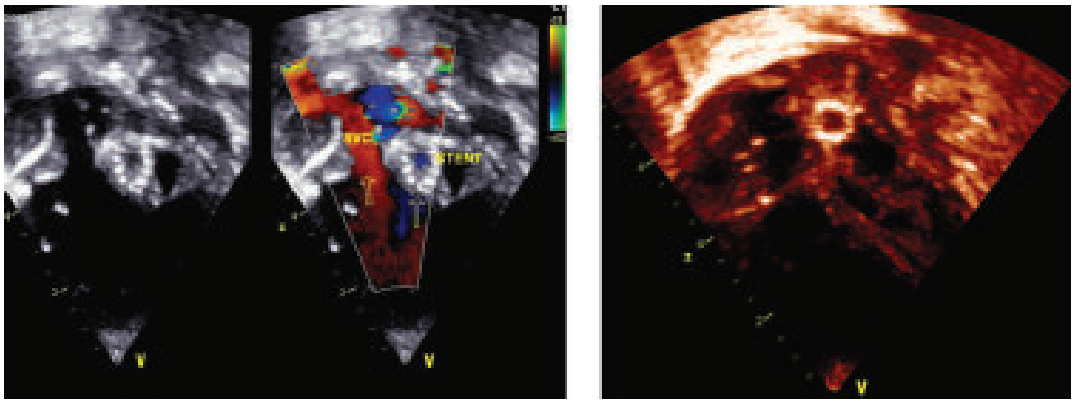

Fig.-5: *Post procedure Transthoracic echo (TTE)- subcostal window (bicaval & four chamber view) showing good flow through septal stent with good flow through SVC & RUPV. (SVC=Superior vena cava, RUPV=Right upper pulmonary vein)*

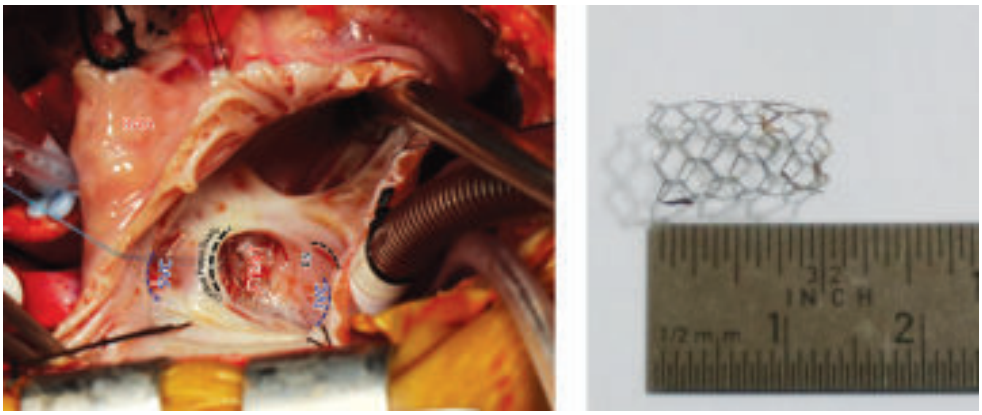

Fig.-6: *Surgical view showing stent at Inter atrial septum. (SVC=Superior vena cava, IVC=Inferior vena cava, RAA= Right atrial appendage, CS= Coronary sinus)*

6 Fr short sheath was placed in the left femoral vein; A 20-gauge cannula was placed in the left femoral artery (RFA) for arterial pressure monitoring and blood gas sampling. Patient received Heparin (75 units/kg) to keep an activated clotting time above 250 seconds. We performed right atrial graphy through 6 Fr right Judkins guiding catheter by hand injection prior stent implantation to delineate restricted ASD. We crossed restrictive ASD through two wires, first Terumo (0.035") and then Grand slam percutaneous transluminal coronary angioplasty (PTCA) (0.014") wire and both were placed in left atrium. We predilate restricted ASD by coronary balloon(4x30mm) over PTCA wire. A low profile, balloon premounted Nephro *C* renal stent (7x15 mm) was placed across the restricted ASD over the PTCA wire and inflated at 12 ATM. During stent positioning we performed RA graphy through the sidearm of the venous sheath and after confirming the secure position we deployed the stent. We took two sample through arterial line and pre procedure arterial blood gas (ABG) analysis showed severe metabolic acidosis (PH=7.1) and pre stent spo2-42%, and post procedure ABG showed mild metabolic acidosis (PH=7.25) with spo2-86%. We performed post procedure TTE which showed good flow through septal stent. We shifted the baby to ICU. After stent implant, the patients received aspirin (approximately 5 mg/kg/ day) to prevent thrombus formation and checked ACT intermittently in ICU. The baby was extubated on 2nd day of procedure and surgery was done after 10 days when the child became stable. Surgery done shortly because of severe pulmonary hypertension due to pulmonary oedema from obstruction. Rerouting of pulmonary veins to LA done along with stent removal and ASD closure. Stenting in restrictive ASD is a lifesaving palliative durable procedure in shock like state, trial of other usual procedure might not be successful in a seven-month-old boy where IAS thickened rather it can endanger the life. So, we had to choose a definite shunt to achieve good mixing as well establish a good cardiac output to survive in a critical state. This was a temporary bridging therapy before definite surgical treatment.

Discussion:

Interatrial shunting through an atrial septal defect is vital in certain conditions in pediatric cardiology. Transposition physiology and left- or right-sided obstructive lesions (hypoplastic left heart or tricuspid atresia or total anomalous pulmonary venous return) are the major examples that need sufficient blood flow through the atrial septal defect, so creating or enlarging an interatrial communication may be required in these pathologies.[10,11] There are several procedures to create or enlarge interatrial communication like balloon septostomy or dilatation, blade septostomy, static balloon septostomy or inter atrial stent. Standard balloon septostomy seems to be less effective and even hazardous because of the thickened IAS, small LA, and the posteriorly placed ASD in our case. Blade septostomy also has several limitations and hazards because of the smallish size of the LA. Static balloon septostomy, even preceded by cutting balloon septostomy, may relieve the trans atrial gradient initially but does not seem to promote a durable unrestrictive ASD and also, we don't have that balloon on that time also. As such, stenting the IAS is recommended when it is thick enough.[12] Potential hazards associated with this procedure include: stent embolization; stent malposition with impingement on the superior vena cava, right pulmonary veins, or tricuspid or mitral valves; atrial perforation; and thrombus formation. Intra vascular stents used to treat vascular stenoses (where a stenotic vessel will usually have sufûcient length to anchor a stent adequately), stent implantation across the atrial septum leaves a stent unsupported by tissue on either side of the septum, leading to a potentially higher risk of stent embolization. Therefore, various techniques to prevent stent embolization during atrial septal stenting have been reported, typically including some mechanism aimed at creating a constriction within the center of the stent in the expected location of apposition against the atrial septum, while allowing the ends to become over expanded (i.e., resulting in a so-called "dog-bone" or" bow tie" shaped stent).[13] Pre-mounted stents are always preferred to avoid stent embolization. These stents are firmly mounted on low profile balloons in a very secure manner.[14] Another most feared complication of atrial stenting is thrombus formation. Some authors use oral anticoagulants for prevention of potentially lethal thrombotic stent occlusion, most of the clinicians use aspirin alone at antithrombotic

doses.[15,16] We used intravenous heparin for 24 hours and continued with oral aspirin at antithrombotic doses. So atrial septal stenting seems to provide a long-lasting, nonrestrictive atrial communication and should be taken into consideration interventional procedure in cases where conventional treatment fail.

Conclusion:

Our Patient presented beyond the neonatal period at 7 months with mixed TAPVC with restrictive ASD, which was a life-threatening condition. He presented with shock and surgery was not possible, so we took the challenge and placed pre mounted stent to increase cardiac output and increase inter circulatory mixing. Creation or enlargement of ASD in infants using new nonconventional transcatheter techniques which is a lifesaving procedure and suggest reliable, safe, and effective.

Conflict of Interest - None.

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