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Case Report

Midterm Outcome of Patch Augmentation Valvuloplasty Using Porcine Small Intestine Submucosa Extracellular Matrix in a Child

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Abstract

Most structural congenital heart diseases require prosthetic material for complete repair. We report on a satisfactory mid-term outcome of a right atrioventricular valvuloplasty (patch augmentation) using a small-intestine-submucosa extracellular matrix patch.

Keywords: Patch Augmentation; Heart Diseases; Right Atrioventricular Valve (RAVV)

Introduction

Porcine small intestine submucosa extracellular matrix (SIS-ECM) is a biological acellular material [1], which has been used in various surgical procedures [2-4]. Atrioventricular valve regurgitation is a rare but possible late complication after AV septal defect repair [3]. In particular, right atrioventricular valve (RAVV) regurgitation is less frequent and usually treated by means of annulo-plasty. However, a leaflet patch augmentation may be useful to optimize valve competence. Several materials can be used to perform leaflet augmentation. Although autologous pericardial patch is commonly used, the SIS-ECM patch has shown good midterms results when used for tricuspidal anterior leaflet augmentation [4-6] or even tricuspid reconstruction [7]. We report on the late functional outcome of a SIS-ECM patch augmentation valvuloplasty in a child after AV septal defect repair. The review of medical records of the patient was approved by the hospital committee for clinical investigation. Informed consent for observational follow up was obtained prior to surgery from the patient or their parents or legal guardian at the time of first operation.

Case Report

A 2-months-old Caucasian male with complete AV septal defect, Down syndrome and previous intraventricular hemorrhage, underwent double patch repair at 3.5 months. At discharge, he presented with a small residual ventricular septal defect (VSD), and a mild-moderate RAVV regurgitation. Six months later, the patient was admitted for severe cyanosis and bradycardia. A laringoscopy showed ab-extrinseco pulsating tracheal compression from the aorta. Transthoracic 2D echocardiography showed severe RAVV regurgitation, with severe right atrium dilatation, and a mild residual VSD, and was scheduled for reoperation.

At 11 months of age, he underwent reoperation through median re-sternotomy with standard bicaval cardiopulmonary bypass. On surgical inspection, the septal leaflet of the RAVV was fibrotic,

thickened, retracted and immobilized, while the anterior leaflet was normal. The right atrium was dilated. A 3 mm residual posterior VSD below the septal leaflet was closed with 3 single interrupted pledgeted stiches. The RAVV was repaired by augmenting the anterior leaflet with a SIS-ECM patch (inclusion technique, Figure 1). The anterior leaflet was partially detached from the annular attachment, along its length; a SIS-ECM patch was cut into an oval shape and sutured using a running 7/0 polipropylene suture. Then, we added an anterior De Vega annuloplasty, using 6/0 polipropilene suture, tied on a 13 mm hegar. An additional anteroseptal commissural plasty (using U stitch) completed the repair, which resulted to be effective at saline test, showing a competent valve. Last, we made a reductive atrioplasty and we performed an aortopexy, using 3 interrupted stitch pulling the aorta anteriorly and reducing the compression of the aorta on the trachea, with subsequent increase of the airway lumen. A post procedural intraoperative bronchoscopy confirmed the effectiveness of the procedure, with no residual airway obstruction.

Figure 1: The right AV valve was repaired by augmenting the anterior leaflet with a SIS-ECM patch (inclusion tecnique): A) after the anterior leaflet was partially detached from the annular attachment, along its length, B) a SIS-ECM patch was cut into an oval shape and sutured using a running 7/0 polipropylene suture. C) Then, we added an anterior De Vega pledgeted annuloplasty, using 6/0 polipropilene suture (interrupted dotted line).

The child was discharged home after 18 days, with uncomplicated postoperative course. Transthoracic echocardiography before discharge showed mild RAVV regurgitation, residual mild right atrium dilatation, no residual VSD, normal biventricular function (Figure 2).

Figure 2: 3D view of the atrioventricular valves from the atria. LAVV: left atrioventricular valve, RAVV: right atrioventricular valve; Ao: Aorta.

Six years after reoperation, the patient required a permanent pacemaker implantation for a complete AV block. Transthoracic echocardiogram showed a mild RAVV regurgitation, with a mean inflow gradient of 6 mmHg (Supplemental Video 1). Noticeably, the anterior leaflet was thin and mobile, with no apparent calcification (Supplemental Video 2). The patient was discharged home in good conditions after an uncomplicated postoperative course after DDD pacemaker implantation.

Supplemental Video 1: Color Doppler of right atrioventricular valve. The valve presented a mild stenosis and a mild regurgitation. Mean diastolic gradient was 3 mmHg.

Supplemental Video 2: 3D view of the atrioventricular valves from an atrial view. Left atrioventricular valve is on the right side of the screen.

Comment

Complete repair of congenital heart disease often requires use of prosthetic material. However, commonly used prosthetic materials can't grow with the patient, often calcify, and may contribute to increase the risk of reoperation. The SIS-ECM patch has been showed to be a pliable material, which is avoid calcification [5-7]. Also, it has been postulated that when surrounded by the patient's vital tissue, it may be more durable [5]. In such a case, the biological patch acts as a framework for the patient's own progenitor cells allowing the deposition of vital and healthy tissue, and the tissue may grow around the patch as the patient does [5,6].

We herein describe a good long term clinical outcome in a case of RAVV repair performed using a SIS ECM patch for the "inclusion technique" (Figure 1). The advantage of this technique may be that the leaflet tissue is augmented with a SIS-ECM patch, and the native AV valve tissue is preserved around the prosthetic patch. This may allow a para-physiological growth of the leaflet, and possibly avoid or postpone the use of prosthetic valve, reducing the need for multiple reoperations. In fact, 6 years after surgery, 3D-ecocardiography has showed a satisfactory leaflet coaptation with mild regurgitation and transvalvular gradient, and a mobile leaflet. In addition, the lack of calcification which has been demonstrated for SIS ECM [5,6] may increase late durability of the valve leaflet and possibly delay consistently valve replacement.

Conclusion

Our experience suggests that use of SIS-ECM patch for an inclusion technique may be effective for leaflet valve reconstruction in children to avoid the drawbacks of prosthetic valves and reduce incidence of reoperations in childhood.

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