Operative Techniques in Thoracic and Cardiovascular Surgery

Classic Single-Patch Repair of Atrioventricular Septal Defects

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Early surgical outcomes after repair of atrioventricular septal defects have improved significantly over the last 60 years. Preservation of function of the left atrioventricular valve is of significant importance to achieve long-term results. For nearly 40 years, the classic, single-patch technique, as first described by Mayo Clinic investigators, has been our preferred method for repair (of atrioventricular septal defects). The single-patch reconstruction technique (described in this manuscript article), is teachable, reproducible, and reasonably durable. Our most recent 20-year experience (1995-2014) with more than 200 such repairs, and an operative mortality rate of 2.2%, is consistent with other contemporary outcomes. Left atrioventricular valve dysfunction remains the most common late, clinically notable issue.

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Introduction

The first successful repair of a complete atrioventricular septal defect (AVSD) was reported by Lillehei et al.[1] The patient was a "gravely ill" 15-month-old girl with pulmonary artery pressure of 90/50 mmHg. Controlled cross-circulation permitted a right atriotomy and direct viewing of the defect. The repair consisted of suturing the upper margin of the ventricular septum to the lower edge of the atrial septal defect. Interrupted silk stitches were placed through the "origin" of the common mitral tricuspid valve. Intracardiac repair was completed in "twelve and one-fourth minutes," and total cross-circulation time was 22 minutes. Catheterization and electrocardiogram at 4 months and again at 11 years following surgery demonstrated normal pulmonary artery pressures, no residual shunting, no valve regurgitation, and no heart conduction disturbance. The patient subsequently gave birth to 3 children.[2] Then, in 1966, Rastelli et al[3] published a landmark article on the anatomical variation within the complete forms of AVSDs. They studied 30 hearts with this malformation and described 3 distinct types of AVSDs based on the anatomy of the superior common AV valve leaflet and the extent and site of the interventricular communication. These new anatomical observations became an inspiration for the original single-patch repair, the details of which were reported from the Mayo Clinic by Rastelli et al.[4]

This initial (1955-1967) Mayo Clinic experience with repair of complete AVSDs included 38 patients, divided into 2 groups. The first 31 patients had repair before the Rastelli-Kirklin anatomical study and classification. These earliest repairs consisted of suturing the common AV superior and inferior leaflets to the crest of the ventricular septum using interrupted mattress sutures. The interatrial communication was closed with Ivalon sponge, Teflon patch material, or pericardium. Repair in the last 7 patients was based on the improved understanding of complete AVSD anatomy. These repairs consisted of creating an anterior mitral valve leaflet by attaching the common AV valve leaflets together using interrupted stitches. The septal defects were closed with a single patch of either autologous pericardium or Teflon. The technique of AV valve reconstruction described "splitting" the common superior and inferior valve leaflets (when necessary) from the free edge to the annulus, slightly to the pulmonary ventricular side of the midline, and then attaching the reconstructed leaflets to the septation patch. Hence, birth of the classic, single-patch repair of complete AVSDs.

Today, repair of complete AVSDs is typically accomplished at 3-6 months of age, but it may be required earlier if heart failure, for example, poor feeding, tachypnea, inadequate weight gain, or hepatomegaly, becomes difficult to control. Preoperative echocardiography is useful in assessing the morphology and competence of the common AV valve, the size and function of each of the 2 ventricles, the depth of the inlet "canal" ventricular septal defect, the

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extent of the primum atrial septal defect, and the presence of 1 or 2 left ventricle papillary muscles.

Operative Technique

The descriptions and illustrations here are in reference to a well-balanced Rastelli type C complete AVSD, as repaired at Loma Linda University Children's Hospital (Figs. 1-9) (Table).

Intraoperative transesophageal echocardiography is available for most infants. Residual intracardiac shunts are extremely unusual, whereas mild to moderate AV valve regurgitation is not uncommonly observed during early recovery. It is rare that AV valve regurgitation increases over time. Rather, the usual pattern is for gradual reduction or virtual elimination of AV valve regurgitation simply as a function of time, recovery, and ventricular remodeling. Intraoperative echocardiographic evidence of severe mitral regurgitation or the position of the regurgitant jet (central or along the septation patch) may stimulate a (very unusual) secondary "pump run" for additional suturing. AV valve stenosis has not been an issue for us with this method of repair.

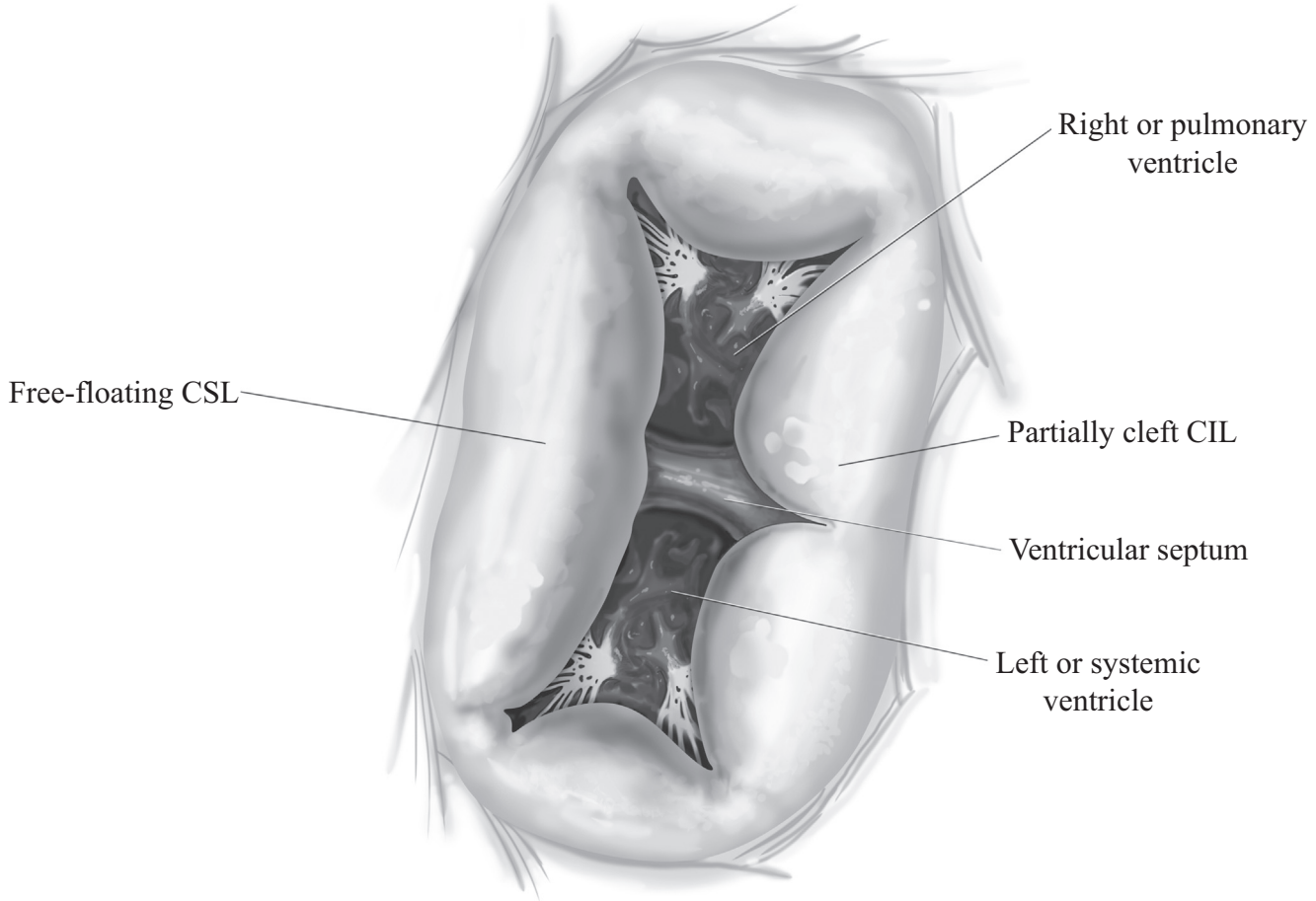

Figure 1 The type C anomaly is characterized by a superior atrioventricular leaflet that overrides or is "common" to both the ventricles. The leaflet is unattached to the arc of the ventricular septum, and it is without natural cleavage. An atrioventricular valve anatomy typical of Rastelli type C category. The classification is based on the profile of the common superior leaflet, shown here without attachments to the ventricular septum, and without a naturally occurring central "cleft." CSL = common superior leaflet; CIL = common inferior leaflet.