The Heart Surgery Forum #2012-1102
16 (2), 2013 [Epub April 2013]
doi: 10.1532/HSF98.20121102

Online address: http://cardenjennings.metapress.com

Long-term Results of the Single-Patch Repair Technique for Sinus Venosus Atrial Septal Defects

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ABSTRACT

Background: Anomalous pulmonary venous drainage commonly accompanies sinus venosus atrial septal defects (SVASDs). Many techniques have been reported for avoiding postoperative complications, such as narrowing of the superior vena cava (SVC) or the pulmonary system, and arrhythmia. We perform a single V-Y pericardial patch plasty repair technique for SVASDs. The purpose of this study is to report on the long-term results of this surgical technique.

Methods: We retrospectively analyzed patients who had a diagnosis of ASD and who underwent their operations between 2000 and 2010 at the Gulhane Military Medical Academy Haydarpasa Training Hospital. Thirty-nine of the patients had an anomalous pulmonary return, and the single pericardial patch technique had been performed in 32 of these patients.

Results: The mean (±SD) postoperative extubation time was 5 ± 1.6 hours. The mean drainage volume was 384 ± 137 mL. All patients were discharged from the hospital at a mean of 4.6 ± 1.1 days after their operation and were prescribed anticoagulants for 3 months. No perioperative or late-term mortality was observed. Patients were followed up for 6 months to 2 years. There were no residual shunts and no stenosis-related findings in the pulmonary venous system or the SVC.

Conclusion: Use of the single pericardial patch plasty technique might lower complication rates in patients with SVASD, especially those who have not completed their growth.

INTRODUCTION

Sinus venosus atrial septal defects (SVASDs) constitute 4% to 11% of all ASDs and are commonly accompanied by total or partial anomalous pulmonary venous return (PAPVR) [Agrawal 1997; Attenhofer Jost 2005]. Many techniques have been reported for eliminating complications following SVASD repairs, such as narrowing of the superior vena cava (SVC) or pulmonary system, residual shunt, and arrhythmia. The purpose of this study was to investigate the long-term results of SVASD repair with a single pericardial patch technique.

Received August 24, 2012; accepted March 22, 2013.

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MATERIALS AND METHODS

We retrospectively analyzed patients who had a diagnosis of ASD and underwent their operations between 2000 and 2010 at the Gulhane Military Medical Academy Haydarpasa Training Hospital. Of the 421 patients who had undergone ASD operations, 39 had a right upper or mid pulmonary anomalous return. The mean (±SD) diameter of the defect was 2.6 ± 0.6 cm. Another type of ASD was present in 4 of the patients. The single pericardial patch technique had been performed on 32 of the patients. All patients were anticoagulated with warfarin until endothelization (for 3 months). We have postoperative echocardiographic follow-up results for 26 patients.

Surgical Techniques

The operation was performed in all patients via a median sternotomy after intubation and the initiation of general anesthesia. Properly sized patches were prepared during the pericardiotomy. Cardiopulmonary bypass was achieved via aortobicaval cannulation and with standard cardioplegia and moderate hypothermia. The SVC was cannulated selectively with an L cannule.

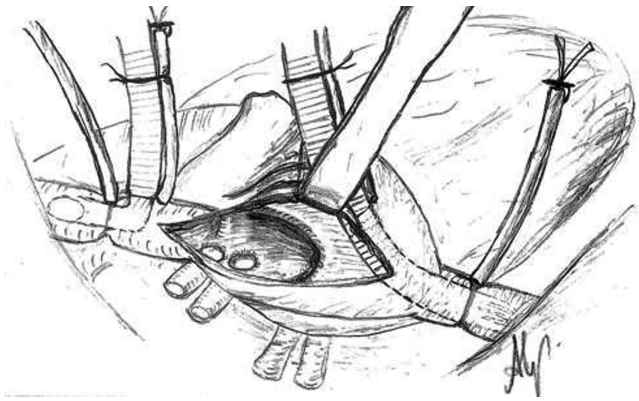

Figure 1. View of sinus venosus atrial septal defect after right atriotomy.

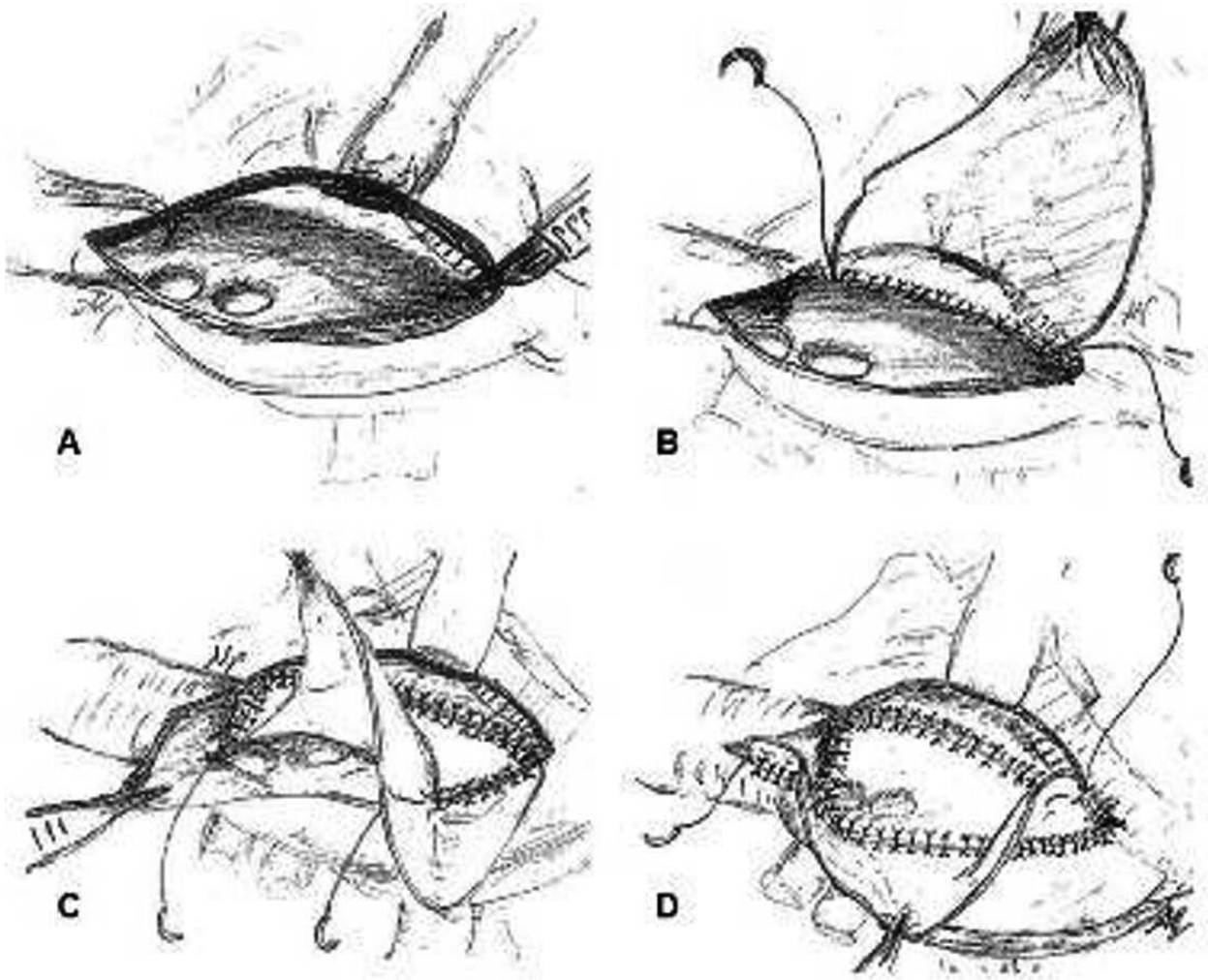

Figure 2. A, Expansion of the atrial septal defect. B, Suturing of the pericardial patch starting from the cavoatrial junction of the superomedial rim. C, Folding of the pericardial patch and suturing from the middle part to the inferomedial side of the atriotomy. D, Closing of the atriotomy with pericardial patch.

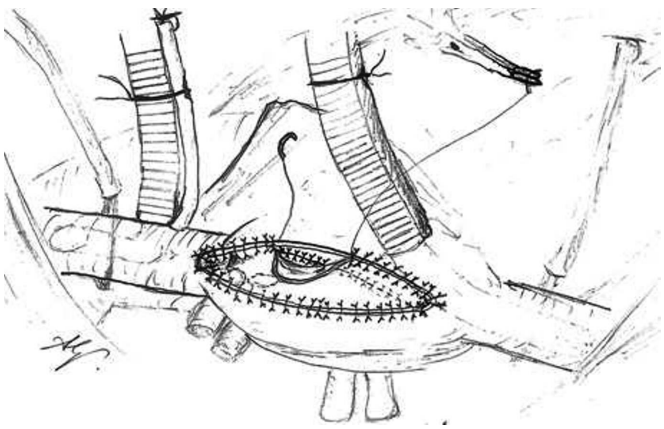

Figure 3. Postoperative view of the pericardial patch and right atrium.

The atriotomy incision is advanced vertically, starting from the medial part of cavoatrial junction toward the inferior vena cava cannule (before the right pulmonary artery) (Figure 1). If the diameter of the ASD is smaller than 2 cm, the defect is expanded (Figure 2A). The pericardial patch is sutured clockwise, starting from the cavoatrial junction of the superomedial rim (Figure 2B). The patch is folded after the lateral side of the defect is sutured. The suture line is to be moved from the inferior of the defect toward the inferomedial side of the atriotomy. A V-shaped notch is cut on the pericardial patch to eliminate the obstruction of the SVC. The lower part of the V and the middle segment of the patch are sutured to inferomedial side of the atriotomy, leaving the pulmonary veins on the left side of the atrium (Figure 2C). The lungs are ventilated, the deairing process is carried out, and the sutures are tied. Then, the remainder of the patch is folded backwards and sutured to both the cavatomy and the unattached side of the atrium in a superolateral fashion to provide an expansion to the SVC orifice (Figures 2D and 3).

RESULTS

The mean postoperative time to extubation was 5 ± 1.6 hours. The mean drainage volume was 384 ± 137 mL. Patients were transferred to the clinic on the first postoperative day. No perioperative or late-term mortality was observed. One patient developed an atrioventricular block that regressed on the sixth postoperative day. All patients were discharged at a mean of 4.6 ± 1.1 days after their operation, and anticoagulants were prescribed. The patients were followed up for 6 months to 2 years. The results of echocardiographic examinations were normal. No residual ASD has been observed. No stenosis-related findings were observed, either in the pulmonary venous system or in the SVC.

DISCUSSION

ASD is a congenital heart disease that once diagnosed should be treated when the patient is in the preschool years. Although small ASDs can be repaired with primary sutures, large defects require a patch to divert the flow of the pulmonary veins to the left atrium. Avoiding long-term complications requires careful selection of the type and size of the patch for young patients, because they have not completed their growth. The pathology in a typical SVASD is that the wall separating the right pulmonary artery from the SVC and the pulmonary artery is absent. Inefficient or ineffective treatment of a SVASD may lead to sinus node dysfunction, residual shunt, or an obstruction in the pulmonary veins and SVC. The main goal of the treatment should be to cover the shunt without causing an obstruction in the SVC or the pulmonary veins, or without causing arrhythmia. Therefore, different surgical techniques have been reported, such as an incision starting from the cavoatrial junction, patching with right atrium (RA) tissue, the Warden procedure, covering the ASD and the atrium with 2 separate patches, or covering the ASD and the RA with a single patch [Kouchoukos 2003; Iyer 2007]. In particular, the caval incision is commonly covered with a patch to avoid narrowing of the SVC.

When the ASD is located in the superior septum with a PAPVR, extreme traction is needed to perform a classic right atriotomy. During the surgery, excessive traction on the retractor may cause edema, especially on the sinus node, and may lead to atrial arrhythmia in the postoperative period.

The frequency of sinoatrial node injury following SVASD repair has been reported as 3.8% to 4.4% [Agrawal 1997]. The incision performed at the SVC-RA junction can damage the sinoatrial node, causing permanent sinus node dysfunction. The incision, starting from the RA appendix and continuing toward the medial wall of the SVC, is distant from the sinoatrial node lateral to the SVC-RA junction, yet it has the potential to damage the nodal artery if the artery passes through the medial. A direct approach to the defect would surely eliminate the risk of traction damage, because it would not require extreme retraction [Agrawal 1997]. An incision made across the cavoatrial junction may harm the sinoatrial node; nevertheless, it may lead to arrhythmia caused by fibrosis. Sinus node dysfunction is rarely seen with the Warden procedure [Stewart 2007]. Arrhythmia following the incision is mostly temporary and persists in 3.8% to 9.2% of cases.

Although Iyer and colleagues have reported that double-patch repair has been more successful in avoiding the possibility of pulmonary venous obstruction, the double-patch approach increases the risk of sinus node dysfunction, which can be as high as 55% [Iyer 2007; Stewart 2007]. Stewart et al. have not observed a significant rate of either SVC or pulmonary venous obstruction and have reported that the risk of sinoatrial node injury is lower (Stewart 2007). A single oval patch is folded like the wings of a butterfly. The posterior wing is used to separate the pulmonary vein and the SVC so that the pulmonary veins are on the posterior of the patch and the SVC is on the anterior of the patch. The anterior wing of the patch is used to enlarge the terminal cava. This approach avoids both sinus node dysfunction and SVC or pulmonary venous obstruction.

During an SVASD repair, a single patch can be used to cover both the defect and the right atriotomy. This is achieved by using half of the pericardial patch prepared from the vertical incision performed on the lateral SVC to cover the SVASD so that the flow of the pulmonary vein ostia is on the left atrium. The patch is sutured to the lateral side of the SVC medially; the remainder is used to cover the right atriotomy [Ohmi 1988]. In adult patients, Dacron grafts could be used, because of its flexibility and tensile potential. Victor and colleagues have reported the use of a single Dacron patch in the shape of a butterfly wing in patients from different age groups [Victor 1995]. In our clinic, we prefer to use a single patch acquired from the pericardium in ASD cases that are accompanied by PAPVR. In this technique, the patch used for repair of the septal defect should be properly sized. If the patch is too small, pulmonary vein ostia can be obstructed; if it is too big, the patch may cause outward swelling toward the vena cava and thereby cause obstruction. To avoid an obstruction in the cavoatrial junction where the patch is folded, we make a 2-cm incision in the middle of the pericardial patch so that the tension on the patch is reduced.

Checking the pulmonary veins with transesophageal echocardiography and measuring the gradient are a very important step in the operation before cardiopulmonary bypass is stopped. All procedures are performed routinely under transesophageal echocardiographic guidance. No patient required a second cardiopulmonary bypass. The operation is then brought to an end.

SVASD repair with a single pericardial patch not only reduces the incidence of arrhythmias and prevents residual ASD development but also prevents SVC and pulmonary venous obstructions. This technique is especially important for patients who have not completed their growth, because the pericardial tissue has the potential to grow. The retrospective nature of this study and the fact that the results were produced in the absence of a control group are limitations of this study. The results, however, are encouraging for surgeons who are considering the use of a single-patch technique for SVASD repair.

REFERENCES

Agrawal SK, Khanna SK, Tampe D. 1997. Sinus venosus atrial septal defects: surgical follow-up. Eur J Cardiothorac Surg 11:455-7.

Attenhofer Jost CH, Connolly HM, Danielson GK, et al. 2005. Sinus venosus atrial septal defect: long-term postoperative outcome for 115 patients. Circulation 112:1953-8.

Iyer AP, Somanrema K, Pathak S, et al. 2007. Comparative study of single- and double-patch techniques for sinus venosus atrial septal defect with partial anomalous pulmonary venous connection. J Thorac Cardiovasc Surg 133:656-9.

Kouchoukos NT, Blackstone EH, Doty DB, Hanley FL, Karp R, eds. 2003. Atrial septal defect and partial anomalous pulmonary venous connection. Kirklin/Barratt-Boyes cardiac surgery. 3rd ed. Philadelphia: Churchill Livingstone. p 715-52.

Ohmi M, Mohri H. 1988. A single pericardial patch technique for repair of partial anomalous pulmonary venous drainage associated with sinus venosus atrial septal defect. Ann Thorac Surg 46:360-1.

Stewart RD, Kelle AM, Backer CL, Young L, Mavroudis C. 2007. Evolving surgical strategy for sinus venosus atrial septal defect: effect on sinus node function and late venous obstruction. Ann Thorac Surg 84:1651-5.

Victor S, Nayak VM. 1995. Transcaval repair of sinus venosus defect. Using a butterfly-shaped patch. Tex Heart Inst J 22:304-7.