

Seven Years' Outcome of Simultaneous Surgical Treatment of Atrial Septal Defect and Atrial Flutter in 2 Children: Case Reports

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ABSTRACT

We describe 2 children who had long-standing type 1 atrial flutter and atrial septal defect. The simultaneous surgical treatment of these 2 conditions consisted of transmurular incision from the inferior edge of the septal defect to the tricuspid ring, transmurular incision from the medial-superior edge of the septal defect to the tricuspid ring, and closure of the septal defect with a bovine pericardial patch. There was no arrhythmia recurrence during a 7-year follow-up period.

INTRODUCTION

In diagnoses of supraventricular arrhythmias, severity is associated with embolic accidents, arrhythmogenic cardiomyopathy, and sudden death. This diagnosis has implications as severe in children, in addition to the restriction of physical activities and the chronic use of antiarrhythmic and anticoagulant drugs.

Radiofrequency catheter ablation has revolutionized the management of supraventricular tachyarrhythmias. Before the introduction of ablation, surgery was the sole alternative to clinical therapy. In children, especially infants and low-weight children, catheters with the appropriate dimensions are not always available. Therefore, when supraventricular tachyarrhythmias, more specifically atrial flutter, occur in association with congenital heart defects that need surgical correction, the treatment of the arrhythmia can be planned to be done in the same procedure [Guiraudon 1996; Yamauchi 1997; Theodoro 1998; Henglein 1999].

In common or uncommon type 1 atrial flutter, there is a zone of slow conduction, which is the narrowest part of the circuit. This region is bounded posteriorly by the inferior vena cava and eustachian ridge, and anteriorly by the tricuspid annulus. This region is presumed to be a critical zone in the reentrant circuit [Cauchemez 1996; Olgin 1996]. This

area is the target for ablation in the currently preferred electrophysiologically and anatomically guided approach [Cosio 1996; Feld 2000]. It is also known that the border of an atrial septal defect (ASD) forms a line of conduction barrier that protects the reentrant circuit [Feld 2000].

With this background, we report the simultaneous surgical treatment of type 1 common atrial flutter and ASD in 2 children.

CASE REPORTS

Patient 1, a 3-year-old boy weighing 12 kg, was admitted in New York Heart Association functional class II/III and with recurrent pneumonia. Over the previous months, he had experienced episodes of pallor and perspiration without loss of consciousness. A physical examination revealed a systolic murmur at the upper left sternal border, and the second heart sound was split widely and fixedly. The electrocardiogram exhibited common atrial flutter (Figure 1).

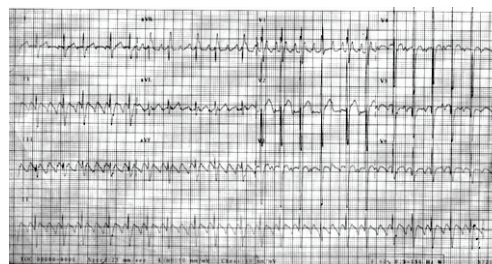


Figure 1. Electrocardiogram showing type 1 atrial flutter in patient 1.

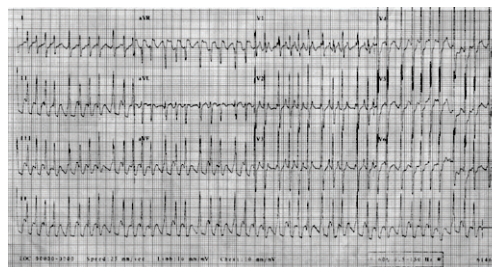


Figure 2. Electrocardiogram showing type 1 atrial flutter in patient 2.

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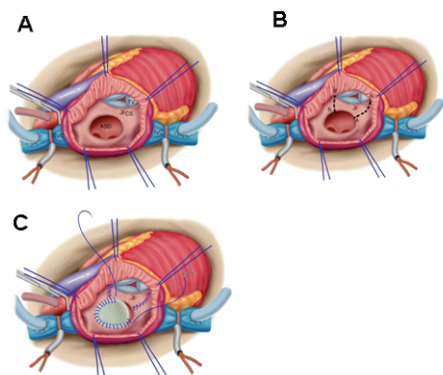


Figure 3. A, Surgical view from the right atriotomy. SVC indicates superior vena cava; IVC, inferior vena cava; CS, coronarian sinus; TV, tricuspid valve; ASD, atrial septal defect: interatrial communication. B, Dashed line from A to A' indicates transmurals incision from the inferior edge of the interatrial communication to the tricuspid ring, passing the tricuspid-caval isthmus; dashed line from B to B' indicates transmurals incision from the medial-superior edge of the interatrial communication to the tricuspid ring. C, Suture of atrial incisions: closing of the interatrial communication with a bovine pericardial flap.

The 2-dimensional color Doppler echocardiogram revealed a 10-mm ostium secundum ASD, moderate right atrial and ventricular enlargement, and an estimated pulmonary artery systolic pressure of 40 mm Hg. The frontal chest radiograph showed cardiomegaly and increased pulmonary blood flow.

Patient 2, a 14-month-old girl weighing 6 kg and receiving amiodarone therapy, was admitted with electrocardiographically documented common atrial flutter that had existed since she was born (Figure 2). She had undergone an attempt at chemical and electrical cardioversion without a response. A physical examination revealed a systolic murmur at the upper left sternal border, and the second heart sound was split widely and fixedly. The 2-dimensional color Doppler echocardiogram showed a 22-mm ostium secundum ASD, moderate left and right atrial enlargement, and moderate right ventricular enlargement. The pulmonary artery systolic pressure was estimated at approximately 30 mm Hg. A frontal chest radiograph revealed cardiomegaly and increased pulmonary vascular markings.

Surgical Aspects

Cardiopulmonary bypass was instituted with standard cannulation of the ascending aorta and direct cannulation of the superior and inferior vena cavae. The right atrium was opened, and the anatomy was carefully inspected. A transmurals incision beginning at the inferior edge of the ASD and continuing to the tricuspid valve ring was performed to target the tricuspid valve–inferior vena cava isthmus. Another transmurals incision from the medial-superior edge of the ASD to the tricuspid valve ring was also performed (Figures 3A and 3B). Incision closure was made with a running suture of 5-0 polypropylene, and the ASD was closed with a bovine pericardium patch (Figure 3C). No cryoablations were performed.



Figure 4. Seven-year postoperative follow-up. Electrocardiogram of normal sinus rhythm in patient 1.



Figure 5. Seven-year postoperative follow-up. Electrocardiogram of normal sinus rhythm in patient 2.

RESULTS

At the end of cardiopulmonary bypass, sinus rhythm was observed. The immediate postoperative period was uneventful. The patients remain asymptomatic with no medications. There was no recurrence of arrhythmia during 7 years of follow-up. In both patients, the 2-dimensional color Doppler echocardiogram shows normal cardiac dimensions and performance, and the electrocardiogram reveals normal sinus rhythm (Figures 4 and 5).

DISCUSSION

Atrial flutter in infants has been reported to be difficult to treat and poorly tolerated when it is associated with congenital heart diseases. The chance of sudden death is 4 times higher, because of the risk of an accelerated ventricular response and ventricular fibrillation [Dunnigan 1985; Garson 1985; Doniger 2006]. Potential serious complications include embolic stroke and, more rarely, tachycardia-induced cardiomyopathy. Atrial flutter is a type of arrhythmia that is resistant to pharmacologic suppression. Our second patient had been undergoing amiodarone treatment with no change in ventricular rates. This child also underwent attempts at chemical and electrical cardioversion without success.

An association between atrial flutter and congenital heart defects increases morbidity. Even with defects of moderate severity, such as ASD, patients can develop cardiac failure [Theodoro 1998]. In our first patient, the communication was 10 mm, and the dilatation of the right chambers was

moderate. Nevertheless, the child showed symptoms of heart failure and a low tolerance to physical activities.

The occurrence of an atrial flutter following correction of an ASD is well known. The suture lines and scars are thought to work as artificial barriers protecting the reentrant circuit. Even in percutaneous treatment with placement of prostheses, however, this arrhythmia can occur [John 2007], reinforcing the importance of the ASD edge as a protection line to circuit. Even if flutter develops postoperatively, the cavotricuspid isthmus approach plays a leading role in the remission of arrhythmia [Chan 2000; Mandapati 2003].

Radiofrequency ablation is the most elected treatment for supraventricular tachyarrhythmias, but in children, it is often necessary to wait until the child attains the ideal weight and height before performing the procedure [John 2007]. In our patients, there was significant morbidity from the association of a surgically approachable anatomic defect with an arrhythmia whose substrate was well defined in the architecture of the right atrium.

On the basis of these concepts, surgical transmural lesions were produced to interrupt the reentrant circuit, concomitant with the procedure that corrected the septal defect. The conventional right atrial access enabled ample visualization of the edges of the communication, tricuspid ring, and cavotricuspid isthmus, the structures involved in type 1 atrial flutter.

CONCLUSION

We conclude that children with type 1 atrial flutter and an ASD can undergo simultaneous surgical treatment of both conditions, as we have done, with good prospects for a total cure. The long-term follow-up, 7 years, showed satisfactory outcomes. We believe that in association with congenital heart defects that need surgical correction, surgical treatment of atrial flutter, as we have proposed, must always be considered.

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