BALLOON DILATION OF A RESTRICTIVE INTERATRIAL COMMUNICATION IN A TWO-MONTH-OLD INFANT WITH MITRAL ATRESIA

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THE RASHKIND TECHNIQUE is the standard procedure for enlarging an interatrial communication in infants with complex cyanotic congenital heart disease. However, there are major limitations to the procedure in patients with a thick interatrial septum. For these patients, blade atrial sept ostomy is an alternative procedure.

We describe a case of a sick, 50-day-old infant with mitral atresia who required an urgent atrial septostomy. The small size left atrial cavity precluded the use of blade septostomy. We dilated the atrial septum with a standard angioplasty balloon catheter. Balloon dilation was performed with a 10-mm diameter balloon catheter inflated at maximal diameter for a 10-second period. After dilation, there was an increase of the arterial saturation from 10% to 80% as well as an increase of the left-to-right flow as judged by color Doppler.

At two-months follow-up, the patient was clinically well and Doppler echocardiographic studies demonstrated the persistence of the iatrogenic atrial septal defect.

Case Report

A 50-day-old male infant was referred to us from another hospital with a history of recurrent episodes of lung infection. On arrival the infant was in a critical condition with marked respiratory distress. He was cyanotic in 100% inspired oxygen, and his heart rate was 150 beats/min with weak peripheral pulses. The precordial examination revealed a right ventricular heave. The second heart sound was accentuated, and there was a grade 3/6 ejection systolic murmur along the left sternal border. The liver was palpable 5 cm below the right costal margin. The arterial blood gases while the infant is in 100% oxygen showed marked acidosis and severe hypoxia (pH, 7.17; Pco2, 8.9; Po2 3.86; HC03; 24.7; BE, -4.9; FIO2, 10%). A twelve-lead electrocardiogram revealed sinus rhythm, a heart rate of 150 beats/min, right-axis deviation, and right ventricular hypertrophy. The chest x-ray showed normal abdominal situs, levocardia, marked cardiomegaly, increased pulmonary vascular markings, and evidence for pulmonary venous congestion.

Echocardiography revealed levocardia, atrial situs solitus, and left aortic arch. The pulmonary veins were draining into a small left atrium, with an atretic mitral valve with single ventricle and dextro-malposition of the great arteries. The interatrial septum was thick and a small foramen ovale was seen. The color-flow Doppler study showed a high velocity jet suggestive of restricted flow across the atrial defect.

Because of the acidosis with high Pco2 values and the critical condition, the infant was intubated and taken for cardiac catheterization and angiography for emergency balloon atrial septostomy. In view of the infant's critical state, only an incomplete hemodynamic assessment was obtained (Table 1). A left atrial angiogram was performed in the anteroposterior and lateral projections.

This confirmed the echocardiographic diagnosis along with the restrictive foramen ovale (Figures 1A, IB). Rashkind balloon atrial septostomy was then performed, with the balloon inflated to a volume of 4 cm. Following the procedure there was still
an elevated pressure in the left atrium compared with the right, and the patient remained desaturated at 20% as measured by pulse oximetry.

![Image](https://example.com/image1.png)

**Figure 1.** Left atrial angiogram in the anteroposterior projection before balloon dilation of the foramen ovale. The dye fills the left atrium (A). On a delayed image, because of the restrictive foramen ovale, the pulmonary veins are opacified retrogradely (B). LA = left atrium, PV = pulmonary vein.

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<tr>
<td>RA pressure (mm Hg)</td>
<td>a7, v8</td>
<td>a8, v7</td>
<td>a5, v4</td>
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<tr>
<td>Oxygen SAT</td>
<td>10%</td>
<td>10%</td>
<td>80%</td>
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<tr>
<td>LA pressure (mm Hg)</td>
<td>a7, v13</td>
<td>a8, v14</td>
<td>a6, v8</td>
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The table shows the changes in oxygen saturation and right and left atrial pressures during and after the procedure. BAS = balloon septostomy; BALDIL = after-balloon dilatation; RA = right atrium; SAT = saturation; LA = left atrium; a, v = pressure waves in the atria.

A repeat echo-Doppler study showed no significant improvement. It was then decided to perform a balloon dilation of the restrictive persistent foramen ovale using a 10-mm diameter balloon on a 7-French shaft angioplasty catheter with a length of 2 cm. A 0.35-in (9-mm) exchange guidewire was positioned into the left upper pulmonary vein. The angioplasty catheter was then advanced over the guidewire, making sure that the catheter tip was free in the left atrium and not in the pulmonary vein. The balloon catheter was inflated at maximal pressure for a 10-second period. A repeat left atrial angiogram following the procedure showed significant improvement (Figures 2A, 2B). Repeat echo-Doppler study showed better flow across the atrial septum (Figures 3A, 3B, 3C). The systemic saturation rose from 10% to
Figure 2. Left atrial angiogram in the anteroposterior projection after balloon dilation of the foramen ovale. The dye opacifies the left atrium (A) and egresses immediately into the right atrium (B). There is no pulmonary venous congestion. LA = left atrium; RA = right atrium.

80% while in 100% oxygen. The baby was extubated the following day and discharged home seven days later. Echocardiographic study at that time showed an excellent mixing at the atrial level. At two-months follow-up, the patient was clinically well.

Discussion

Infants with complex congenital heart diseases may require initial palliation with the creation of an atrial septal defect. This decompresses the left atrium, improves mixing, and increases pulmonary blood flow in patients with mitral atresia. Rashkind balloon atrial septostomy is the procedure of choice when infants present early.2 However, the procedure may not be successful in infants over one month of age because of a thick atrial septum.2 Park et al, in 1978, introduced blade septectomy as a therapeutic alternative to balloon septostomy for patients with a thick atrial septum.3
In this case, it was felt that the small-size left atrial cavity precluded the use of blade septostomy. We were encouraged by the original report of balloon dilation of the interatrial septal defect in a child with transposition of the great arteries. Following the failure of balloon atrial septostomy, we were able to dilate the persistent foramen ovale using a commercially available balloon angioplasty catheter. Serial echocardiograms at discharge and at two-months follow-up showed persistence of the interatrial communication. We believe that balloon dilation of the thick interatrial septum may be a therapeutic alternative to blade septostomy in children with mitral atresia and a small left atrial cavity.

References