Dilatation of a restrictive interatrial communication using a balloon angioplasty catheter

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Balloon atrioseptostomy is a life-saving procedure palliating certain congenital heart defects like transposition of the great arteries, right or left atrioventricular valve atresia, hypoplastic left heart syndrome, and pulmonary hypertension. Occasionally the Rashkind balloon septostomy technique may be ineffective in creating an adequate interatrial communication. We performed balloon dilatation of a restricted atrial septal defect using a balloon angioplasty catheter in a three-month-old infant.

Key words: atrioseptostomy, balloon dilatation, transposition of the great arteries.

The survival of infants with certain congenital cardiac defects depends on the presence of an adequate interatrial communication[1]. Balloon atrial septostomy is one of the most commonly performed palliative procedures for neonates[2,3]. Occasionally, an adequate communication at the atrial level is present at birth but becomes restrictive with increasing age, and a communication then has to be made. The Rashkind balloon septostomy is usually successful in neonates, but may be ineffective in older children with a thickened atrial septum[1,4]. Blade atrial septostomy may be an alternative for such patients; however, it has its limitations[1,4,5]. Technically it is harder to perform and may have increased risk of complications. We performed balloon dilatation of a restricted atrial septal defect in a three-month-old infant.

Case Report

A three-month-old female infant was referred to our hospital. She had cyanosis since birth. On admission she had tachycardia (156/min) and tachypnea (52/min). Her blood pressure was 90/45 mmHg. She had hepatomegaly, palpated 4 cm below the costal margin. The first and second heart sounds were normal; a systolic ejection murmur of grade 1 was heard at the second left intercostal area. All the pulses were symmetrically palpated, including the femoral pulses. The other physical examination findings were normal.

On telecardiogram the cardiothoracic ratio was 56 percent with a narrow base of the cardiac silhouette. Pulmonary vascular markings appeared normal. The electrocardiography revealed right axis deviation (+10°) and right ventricular hypertrophy. The white blood cell count, hemoglobin and arterial oxygen saturation were 9,200/mm^3, 16.7 g/dl, and 29 percent, respectively.

The transthoracic echocardiography revealed transposition of the great arteries with a small patent foramen ovale. There was no patent ductus arteriosus or ventricular septal defect. A balloon atrial septostomy was performed via the right femoral vein with fluoroscopic guidance. Initially a 5F Nu-med Z-5' ® balloon atrioseptostomy catheter was used for the procedure. The balloon was inflated with a maximum 2 ml saline in the left atrium and was retracted to the right atrium. The oxygen saturation of the right ventricle before and after this procedure was 29 and 38 percent, respectively. The small increment in the oxygen saturation suggested insufficient mixture at the atrial level after the balloon atrial septostomy. Therefore, we inflated a Tayshack balloon angioplasty catheter of 7x3 mm twice at the interatrial septal level (Fig. 1). The oxygen saturation increased to 54 percent. On the transthoracic echocardiography, 7 mm of atrial septal defect was measured after the procedure. The patient is now clinically well awaiting an atrial switch operation.

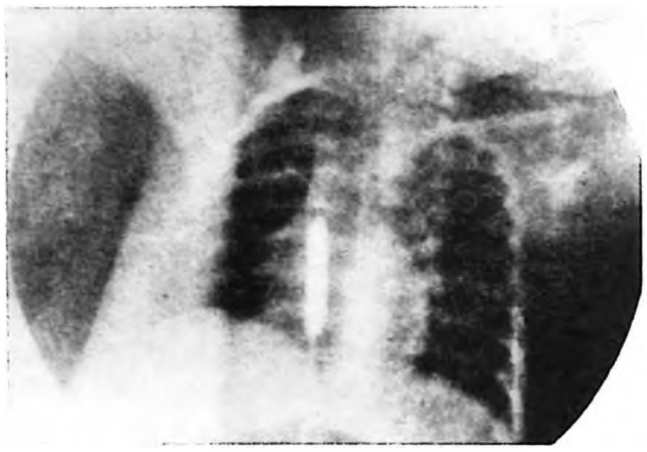

Fig. 1. Dilatation of the atrial septum using balloon angioplasty catheter.

Discussion

Many patients with certain forms of congenital heart defects require an adequate interatrial communication for survival. The transposition of the great arteries usually presents in the neonatal period, and a balloon atrial septostomy is life saving for these patients. However, some patients, as in the case presented here, may need this procedure after the neonatal period. There are other congenital heart diseases that usually present after the neonatal period, namely right or left atrioventricular valve atresia. Recently, an atrial septostomy has been used to palliate infants with hypoplastic left heart syndrome and older patients with primary pulmonary hypertension[1,6]. Rashkind balloon atrial septostomy procedure may not be successful for many patients, especially beyond the neonatal period. Even when the balloon septostomy is performed in the neonatal period, progressive restriction of the interatrial communication often develops[7]. These patients have been palliated surgically with Blalock-Hanlon atrial septectomy or non-surgically with Park's blade septostomy procedure for many years. Both techniques may be quite hazardous for a critically ill neonate or infant. Furthermore, not all the cardiologists are familiar with the blade atrial septostomy procedure.

There is limited experience in literature regarding balloon dilatation of the atrial septal defect; therefore, comparing the effectiveness as well as the security of this procedure with blade septostomy is not possible. In all the cases presented in the literature so far, this procedure was very successful without many serious complications[1,6,8-11]. Creating a large interatrial defect through a small introducer sheath (5-6 F) is a clear advantage of this procedure. Any palliation achieved may be of short duration, which may also be a restriction of other procedures. Mitchell et al.[8] showed that stationary angioplasty balloon atrial septostomy is effective in producing interatrial communications which remained patent for four to 14 weeks in animals. Although experimental studies in animals have demonstrated that balloon dilatation of the atrial septum produced defects within the fossa ovalis without causing tears that extended to the adjacent septum, excessive tearing of the atrial septum beyond the fossa ovalis is a possible risk, especially when large balloons are used for small infants.

Balloon dilatation of an atrial septal defect is a procedure that is safe and easy to perform. It is an alternative technique that can produce larger atrial defects than the Rashkind balloon atrial septostomy procedure. Further reports of clinical experience are needed to determine the efficacy and safety of this procedure in relation to blade septostomy.

REFERENCES

1. Webber SA, Culham JA, Sandor GG, Patterson MW. Balloon dilatation of restrictive interatrial communications in congenital heart disease. Br Heart J 1991; 65: 346-348.
2. Hijazi ZM, Geggel RL, Aronovitz MJ, Marx GR, Rhodes J, Fulton DR. A new low profile balloon atrial septostomy catheter: initial animal and clinical experience. J Invasive Cardiol 1994; 6: 209-212.
3. Bilgiç A. Balon atrial septostomi'nin Hacettepe Çocuk Hastanesi'nde uygulaması ve sonuçları. Çocuk Sağlığı ve Hastalıkları Dergisi 1982; 25: 13-22.
4. Park SC, Zuberbuhler JR, Neches WH, Lenox CC, Zoltun RA. A new atrial septostomy technique. Cathet Cardiovasc Diagn 1975; 1: 195-201.
5. Çeliker A, Bilgiç A, Alehan D, Özkutlu S, Özer S. Blade atrial septostomy: experience with 18 patients. Turk J Pediatr 1996; 38: 459-466.
6. Mullins CE, Latson LA, Neches WH, Colvin EV, Kan J. Balloon dilatation of miscellaneous lesions: results of Valvuloplasty and Angioplasty of Congenital Anomalies Registry. Am J Cardiol 1990; 65: 802-803.
7. Perry SB, Lang P, Keane JF, Jonas RA, Sanders SP, Lock JE. Creation and maintenance of an adequate interatrial communication in left atrioventricular valve atresia or stenosis. Am J Cardiol 1986; 58: 622-626.

8. Mitchell SE, Anderson JH, Swindle MM, Strandberg JD, Kan J. Atrial septostomy: stationary angioplasty balloon technique-experimental work and preliminary clinical applications. Pediatr Cardiol 1994; 15: 1-7.
9. Mitchell SE, Kan JS, Anderson JH, White RI, Swindle MM. Atrial septostomy: stationary angioplasty balloon technique (abstract). Paediatr Res 1986; 20: 173A.
10. Shrivastava S, Radhakrishnan S, Dev V, Singh LS, Rajani M. Balloon dilatation of atrial septum in complete transposition of great artery-a new technique. Indian Heart J 1987; 39: 298-300.
11. Hausknecht MJ, Sims RE, Nihill MR, Cashion WR. Successful palliation of primary pulmonary hypertension by atrial septostomy. Am J Cardiol 1990; 65: 1045-1046.