Cardiac dysrhythmias after transcatheter closure of ASD with Amplatzer device

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Transcatheter closure of atrial septal defect (ASD) has been used as an alternative to open heart surgery. Although transcatheter closure of ASD with the Amplatzer septal occluder is a safe and feasible method in pediatric patients, there is little published data on arrhythmia analysis following transcatheter device closure of secundum ASD. We evaluated cardiac dysrhythmias with 24-hour ambulatory electrocardiographic (ECG) monitoring after transcatheter closure of ASD with Amplatzer device.

A total of 85 consecutive patients with ASD underwent transcatheter closure of secundum ASD with Amplatzer device between October 1998 and December 2003. The study involved 65 of these patients assessed by 24-hour ambulatory ECG monitoring. Seven patients were evaluated a second time by 24-hour monitorization.

During the procedure, transient complete atrioventricular (AV) block was seen in two patients. One of them returned to normal sinus rhythm in catheterization lab and the other returned to normal sinus rhythm in two hours. Transient junctional rhythm was observed in another patient during the device placement. Twenty-four hour ambulatory ECG monitoring was performed on all patients after a mean four-month period (1-12 months).

Holter recordings demonstrated rare supraventricular extrasystole in two patients, rare ventricular premature beats in two patients, and intermittent sinus arrest with sinus pause lasting <1.5 seconds in one patient, for a total of five patients (7.6%).

In conclusion, dysrhythmias after transcatheter device closure of secundum ASD with Amplatzer device are rare and benign. We need further long-term follow-up to evaluate late dysrhythmias after the transcatheter device closure of secundum ASD.

Key words: transcatheter closure of ASD, Amplatzer occluder, 24-hour ambulatory ECG monitoring, dysrhythmias.

Cardiac dysrhythmias after surgical closure of atrial septal defects (ASD) such as atrial reentrant tachycardia, atrial flutter or atrial fibrillation have been observed late after the procedure, even when performed at a young age[1,3].

Recently, transcatheter closure of ASD has been used as an alternative to open heart surgery[3]. Catheter-delivered devices to close ASDs have been successfully applied in humans in the last 25 years. Despite the many devices available and the new technology, most are not practical. The Amplatzer septal occluder was designed to overcome many of the limitations of earlier ASD occlusion devices[4,5]. The Amplatzer septal occluder is a self-expanding, self-centering double disk joined by a center stalk, which occludes the defect and adheres to the septal rims.

Transcatheter closure of ASD with the Amplatzer septal occluder is a safe and feasible method in pediatric patients. With the Amplatzer septal occluder, occlusion rate is high and rate of major complication

is low[6-8]. There is little published data on arrhythmia analysis following transcatheter device closure of secundum ASD. In this report, we assessed the cardiac dysrhythmias on 24-hour ambulatory electrocardiographic (ECG) monitoring after transcatheter closure of ASD with Amplatzer device.

Material and Methods

In our institution, 85 patients underwent transcatheter closure of secundum ASD with Amplatzer device between October 1998-December 2003. The diagnosis of ASD was established echocardiographically prior to the procedure in all patients. Family history of congenital heart disease and arrhythmia was recorded prior to procedure. The standard 12-lead electrocardiogram of patients before and after the procedure was analyzed. Sixty-five of them were evaluated by 24-hour ambulatory ECG monitoring after transcatheter ASD closure with Amplatzer device.

The procedure was performed using general anesthesia according to a previously described protocol[4,5]. All patients were evaluated with transthoracic echocardiography after the procedure at 1st day, 3rd month, and 12th month. All patients were placed on heparin (400 IU/kg/day) for 24 hours, followed by aspirin (3–5 mg/kg/day) for six months.

All patients had 24-hour ambulatory ECG monitoring using three-channel recording (Rozzin, version 3.6F, New York) on an outpatient basis at an average of four months after the transcatheter ASD closure. Patients completed a form to indicate their major activities during the 24-hour recording period. ECG analysis included heart rate, rhythm, ECG intervals, supraventricular ectopy (SVE), ventricular ectopy (VE), and atrioventricular (AV) block. The number of supraventricular premature beats (SVPB) and ventricular premature beats (VPB) per hour were calculated, based on the number of hours monitored.

Results

A total of 85 consecutive patients with ASD underwent transcatheter closure of secundum ASD with Amplatzer device between October 1998-December 2003. The study involved 65 (36 female, 55%; 29 male, 45%) of the patients assessed by 24-hour ambulatory ECG monitoring after the transcatheter closure. Seven patients were evaluated a second time with this method. The age range of the 65 patients was 2 to 23 years (mean 7.4 years) and the weight range was 10.6 to 68 kg (mean 24.5 kg).

Ventricular tachycardia, originating from left ventricle, was present in an 18-year- old boy before ASD closure and had been successfully ablated before ASD closure. There were no rhythm abnormalities in ECG before the procedure.

On transthoracic echocardiography, defect size ranged from 6 to 22 mm (median 12). A secundum type ASD was present in 64 patients; one patient had two adjacent ASDs. Additionally, a small ventricular septal defect (VSD), patent ductus arteriosus (PDA) and aneurysm of the interatrial septum were each detected in one patient. On admission, one patient had first-degree mitral insufficiency.

During the procedure, Qp/Qs ranged from 1.15 to 5.8 (mean 2.04), mean pulmonary artery pressure was 10 to 30 mmHg (mean 17.9). Mean defect size was 16.8 mm (9-28 mm, median 18 mm) during the balloon sizing. Mean diameter of Amplatzer device used to close the ASD was 18.5 mm (10-26 mm, median 20 mm) and mean device/total septal diameter ratio was 1.51 (0.31-0.91, median 0.54). Mean procedure time was 53.7 minutes (25-120 min), and mean fluoroscopy time 11.1 minutes (5-33.2 minutes).

Transient complete AV block was seen in two patients after device placement. One of them returned to normal sinus rhythm in the catheterization lab and the other returned to normal sinus rhythm in two hours. Transient junctional rhythm was observed in another patient. Although small residual shunting was present in 50 patients (76%) immediately after the procedure, only three had small residual shunting on transthoracic echocardiography on the first day after the procedure.

There were no rhythm abnormalities in ECGs after ASD closure. Twenty-four hour ambulatory ECG monitoring was performed on all patients after a mean four-month period (1-12 months). The number of hours monitored ranged from 17.2 to 24.0 hours, with a mean of 21.8 hours. No change in baseline rhythm was noted during the monitorization. Holter recordings demonstrated rare SVPB (<03% of

total beats) in two patients (Fig. 1), rare VPB (<01% of total beats) in two patients (Fig. 2) and intermittent sinus arrest with sinus pause lasting <1.5 seconds was seen in one patient, for a total of five patients (7.6%). Twenty-four hour ambulatory ECG monitoring was performed twice in seven patients (average recording time: 22.3 hours). Five of seven of these Holter recordings were normal. We detected rare SVPB in two recordings in one patient. A comparison of the two revealed that the second recorded SVPB frequency (01% of total beats) was lower than in the previous recording (02% of total beats). Holter findings of one patient who had rare VPB were unchanged in the second 24-hour ambulatory ECG monitoring.

Discussion

Arrhythmias in ASD are frequent in elderly patients but less common in pediatric patients. There is, however, a high frequency of subclinical electrophysiologic abnormalities, including sinus node dysfunction, atrial arrhythmias, conduction delay, and AV block[1]. Congenital electrophysiological abnormalities of the sinus node or conduction system and factors such as increased volume loading or atrial distension have been attributed as supporting the development of sinus node dysfunction, atrial tachycardias, or AV conduction abnormalities[2,9]. Surgery might be the cause of electrophysiological damage to sinus nodal, atrial, or AV nodal tissue.

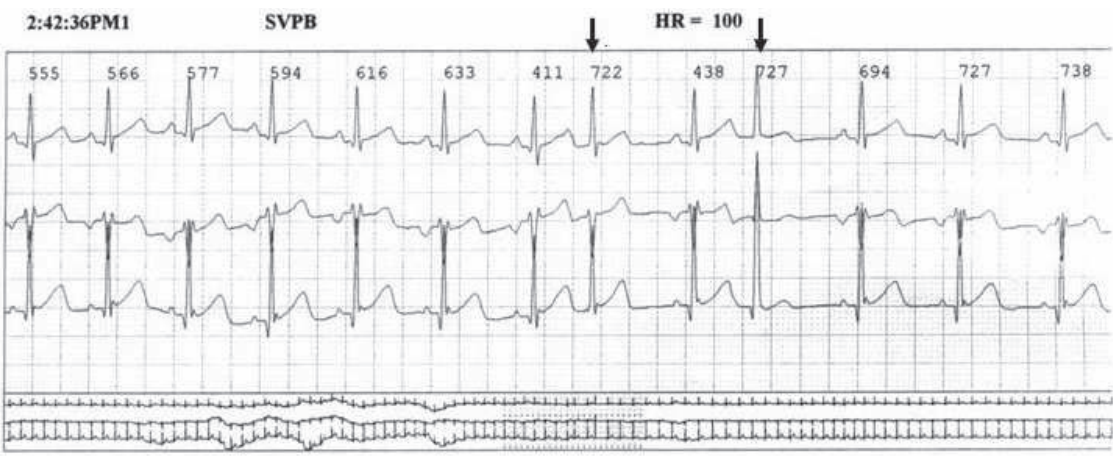

Fig. 1. ECG strip from Holter monitorization obtained after transcatheter closure of ASD in a seven-year-old girl shows supraventricular premature beats.

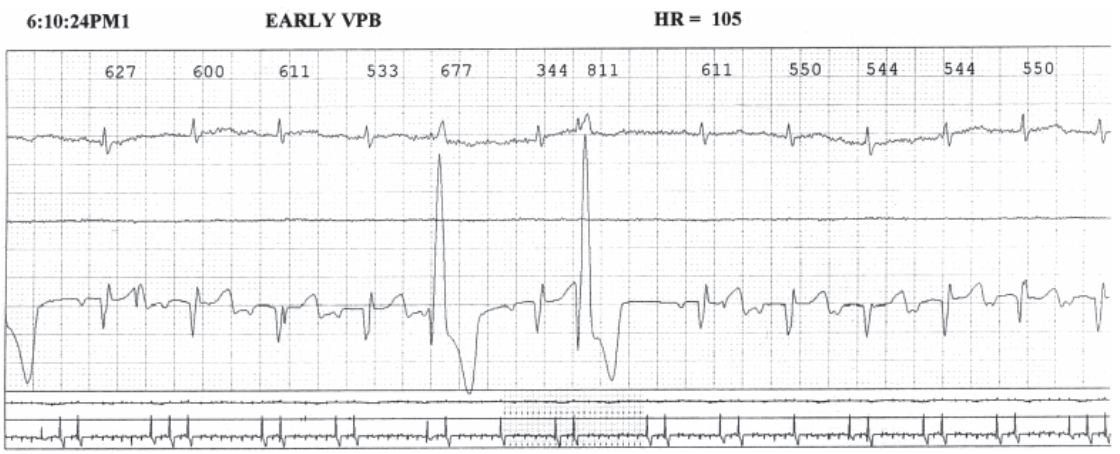

Fig. 2. ECG strip from Holter monitorization obtained after transcatheter closure of ASD in a five-year-old boy shows ventricular premature beats.

Preoperative and late onset atrial fibrillation or flutter occurs more frequently as the age at surgical repair increases[3].

Amplatzer transcatheter closure of secundum ASD has advanced over the last decade and is a viable alternative to surgical repair[4]. Device closure of ASD involves a shorter hospital stay, carries less cost than surgical closure and avoids some of the potential risks of cardiac surgery[10]. Although the Amplatzer septal occluder for transcatheter closure of ASD is a safe and feasible method in pediatric patients, there is little published data on arrhythmia analysis following transcatheter device closure of secundum ASD. Hill et al.[11] demonstrated that ambulatory Holter monitoring analysis immediately following transcatheter closure of ASD with Amplatzer device is associated with a small but statistically significant increase in SVPB, including nonsustained supraventricular tachycardia (SVT). They concluded that increased supraventricular premature beat was not due to residual shunt but perhaps to device placement.

Despite the early ECG changes, Hessling et al.[12] demonstrated that cardiac dysrhythmias on Holter monitoring in pediatric patients before and one year after transcatheter ASD closure with the ASO device are rare and benign. In that study Holter electrocardiograms were performed before and one year after the procedure in 23 pediatric patients. Analysis of the Holter monitoring before the intervention showed regular sinus rhythm in 20 patients and sinus rhythm with intermittent atrial rhythm in three patients. SVPB were detected in one patient, and a ventricular couplet was present in one patient. One year after the intervention showed sinus rhythm in 18 patients and sinus rhythm with intermittent atrial rhythm in five patients.

The number of patients involved in our study was higher than in a previous study, but our results were similar. During the procedure, transient complete AV block was seen in two patients. One of them returned to normal sinus rhythm in the catheterization lab and the other returned to normal sinus rhythm in two hours. Transient junctional rhythm was observed in another patient during the device placement. We observed rhythm abnormalities on Holter monitorization in only five patients as relatively benign problems. All of these dysrhythmias were benign and no treatment was required.

In conclusion, dysrhythmias after transcatheter device closure of secundum ASD with Amplatzer device are rare and benign. We need further long-term follow-up to evaluate late dysrhythmias after the transcatheter device closure of secundum ASD.

REFERENCES

1. Greenstein R, Naaz G, Armstrong WF. Usefulness of electrocardiographic abnormalities for the detection of atrial septal defect in adults. Am J Cardiol 2001; 88: 1054-1056.
2. Conraads V, Moulijn AC, Vrints CJ. Atrial arrhythmia in atrial septal defect. N Engl J Med 1999; 341: 540-541.
3. Bink-Bolkens MT, Meuzelaar AC, Vrints CJ. Atrial arrhythmia after repair of secundum atrial septal defect. The influence of surgical modification. Am Heart J 1988; 115: 629-633.
4. Masura J, Gavora P, Formanek A, Hijazi ZM. Transcatheter closure of secundum atrial septal defects using the self-centering Amplatzer septal occluder: initial human experience. Cathet Cardiovasc Diagn 1997; 42: 388-393.
5. Chan KC, Godman MJ, Walsh K, Wilson N, Redington A, Gibbs JL. Transcatheter closure of atrial septal defect and interatrial communications with a new self-expanding nitinol double disc device (Amplatzer septal occluder): multicenter UK experience. Heart 1999; 82: 300-306.
6. Faella HJ, Sciegata AM, Alonso JL, Jmelnitsky L. ASD closure with Amplatzer device. J Interven Cardiol 2003; 16: 393-397.
7. Fischer G, Kramer HH, Stieh J, Harding P, Jung O. Transcatheter closure of secundum atrial septal defects with the new self-centering Amplatzer septal occluder. Eur Heart J 1999; 20: 541-549.
8. Bilgic A, Celiker A, Ozkutlu S, Ayabakan C, Karagoz T, Ocal T. Transcatheter closure of secundum atrial septal defects, a ventricular septal defect, and a patent arterial duct. Turk J Pediatr 2001; 43: 12-18.
9. Mantovan P, Gatzuolis MA, Pedrocco A, et al. Supraventricular arrhythmia before and after surgical closure of atrial septal defects: spectrum, prognosis and management. Europace 2003; 5: 133-138.
10. Hughes ML, Maskell G, Goh TH, Wilkinson JL. Prospective comparison of costs and short term health outcomes of surgical versus device closure of atrial septal defect in children. Heart 2002; 88: 67-70.
11. Hill SL, Berul CI, Patel HT, et al. Early ECG abnormalities associated with transcatheter closure of atrial septal defects using the Amplatzer (R) septal occluder. J Interv Card Electrophysiol 2000; 4: 469-474.
12. Hessling G, Hyca S, Brockmeier K, Ulmer HE. Cardiac dysrhythmias in pediatric patients before and 1 year after transcatheter closure of atrial septal defects using the Amplatzer septal occluder. Pediatr Cardiol 2003; 24: 259–262.