Aneurysmal Bulging of the Interatrial Septum in a Newborn Infant with Arteriovenous Fistula and Congestive Heart Failure*

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Aneurysmal bulging of the interatrial septum into the left atrium is usually associated with obstructive rightsided lesions in newborn infants. We report aneurysmal bulging resulting from sustained, high blood flow during intrauterine life due to an intrathoracic arteriovenous fistula.

Reports of aneurysms of the interatrial septum in infancy have usually been associated with hypoplastic right heart syndrome and tricuspid atresia. Aneurysms of the septum primum in older children and adults have been reported in reviews of necropsy findings and in case reports of significant elevations of left atrial pressure in two patients with elevated left ventricular pressures. We report a newborn infant with congestive heart failure due to arteriovenous fistula between the left subclavian artery and innominate vein who, because of the extremely high flow and elevated right atrial pressures, demonstrated aneurysmal bulging of the interatrial septum on M-mode and 2D echocardiograms.

CASE REPORT

A one-day-old white boy born after an uneventful gestation and delivery was noted to have a harsh, long, almost continuous grade 4/6 murmur maximally in the region between the sternoclavicular joints. Chest radiograms showed an "hourglass" configuration of the cardiac silhouette, cardiomegaly, and increased pulmonary vascular markings (Fig 1). The electrocardiogram showed right axis deviation, right atrial and right ventricular enlargement. Echocardiographic studies were performed using both M-mode and 2-dimensional sector scans.

The M-mode echocardiogram revealed increased enddiastolic diameters in the right and left ventricles and left atrium. A linear echo could be seen about 1 cm anterior to the posterior wall of the left atrium (Fig 2) and an echo-free space could be seen closely applied to the posterior left ventricular wall consistent with the echo of the descending aorta. The two-dimensional echocardiogram revealed an aneurysmal bulge of the interatrial septum from the right atrium into the left atrium (Fig 3). Cardiac catheterization and angiography demonstrated an arteriovenous fistula between the left subclavian artery and innominate vein. Saturations in the innominate vein, superior vena cava and right atrium were greater than 90 percent, and the mean pressure in the right atrium was 18 mm Hg. A patent ductus arteriosus with bidirectional shunting was also demonstrated. The A-V fistula and FDA were treated successfully surgically and the patient was discharged in good condition on the 11th day of life.

DISCUSSION

The presence of a linear echo using M-mode in the left atrium has been reported in normal subjects as

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Figure 1. Chest roentgenogram showing cardiomegaly, the peculiar "hourglass" configuration of the heart, and the vascular engorgement.
Aneurysmal bulging of interatrial septum (Sapira, Caste)

Figure 2. M-mode echocardiogram through the aortic root (AO) and left atrium (LA). A clearly defined echo of the interatrial septum (IAS) can be seen 1 cm anterior to the left atrial posterior wall (LAPW). The LA/AO ratio is increased consistent with a large shunt.

Figure 3A (upper) and B (lower). Long axis apical view showing protrusion of the interatrial septum (IAS) into the left atrium (LA). LV=left ventricle, RV=right ventricle.

representing the insertion of the pulmonary veins into the left atrium, the dividing septum in cor triatriatum, the ring in supravalvular stenosing ring of the left atrium, and atrial septal aneurysms in the hypoplastic right heart syndrome and tricuspid atresia. The linear echo in the left atrium has also been associated with total anomalous pulmonary venous return to the coronary sinus. In this patient, the size of the left atrium was compatible with the diagnosis of either supravalvular mitral stenosis or cor triatriatum. The fact that the linear echo was within the left atrium and the size of the left atrium was normal, made the possibility of supracardiac total anomalous pulmonary venous return seem unlikely even though the chest radiograph showed an “hourglass or snowman” configuration of the cardiac silhouette. The association of generalized cardiomegaly, especially the end-diastolic dimensions of both ventricles and atria, with approximation of the descending aorta to the left ventricular posterior wall, has been associated with arteriovenous malformations in the head and liver, as well as interrupted aorta and cardiomyopathy.

The early reports of M-mode echocardiographic findings in aneurysms of the interatrial septum were suggestive but not conclusive of the diagnosis. With the advent of two-dimensional echocardiography, the ability to visualize the interatrial septum has improved markedly and Gondi and Nanda have reported two cases. Until this report, those congenital malformations producing aneurysms or aneurysmal bulging of the interatrial septum were hypoplastic right ventricle with intact interventricular septum, tricuspid atresia or severe regurgitation of an A-V valve. In the adult population a review of necropsy cases showed 16 aneurysms in 1578 cases, all of whom were reported to be asymptomatic from the aneurysm standpoint and had normal intraatrial pressures. Gondi and Nanda reported one patient with tight aortic stenosis and mild aortic regurgitation, but did not comment on intraatrial pressures. It would appear that in congenital heart disease, elevated intraatrial pressures can result in bulging of the interatrial septum into the atrium that has a lower pressure. In the case we are reporting, the very high flow and elevated right atrial mean pressure...
(18 mm Hg) produced the bulging septum and the abnormal echocardiographic findings.

Because of the improved ability to visualize the inter-atrial septum, the 2-dimensional echocardiographic study was the significant factor in excluding every other diagnosis. An aneurysmal bulge of the interatrial septum into the left atrium in a structurally normal heart in a newborn infant should suggest a high-flow lesion such as an arteriovenous malformation.

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Pacemaker System Failure Secondary to Air Entrapment within the Pulse Generator Pocket*
A Complication of Subclavian Venipuncture for Lead Placement

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Air entrapment within the pulse generator pocket may produce pacemaker system malfunction if the anodal contact plate becomes insulated by the accumulation of air. Unipolar pulse generators are predisposed to this complication. We describe a pacemaker-dependent patient who, early after implantation, experienced pacemaker system failure as a complication of subclavian venipuncture. This patient had an unsuspected pneumothorax that progressed to subcutaneous air entrapment within the pulse generator pocket. Management of this previously unreported complication of subclavian venipuncture is rapid, noninvasive and effective. With the growing use of subclavian venipuncture technique for lead placement one should avoid the predisposing factors that can lead to subcutaneous air entrapment.

The insertion of permanent endocardial pacing lead electrode systems utilizing a modification of the Seldinger technique for subclavian venipuncture with a peel-away introducer has been described by Littleford et al. and others. Since March 1979, this has been our technique of choice for transvenous lead implantation, because of the low incidence of complications while providing less surgical trauma, decreased operative time, and a reliable vein site for more than 95 percent of all patients receiving single or dual-chamber pacing systems. However, various potential complications of the subclavian venipuncture technique must be recognized, treated, and avoided. For this reason, "air entrapment," a previously unreported complication of the subclavian venipuncture technique, is described. Air entrapment secondary to other factors (failure to evacuate air from the generator pocket at the time of closure, and pocket infection with gas-producing bacteria) has been previously reported as an unusual cause of pacemaker system malfunction.

Pacemaker system failure due to air entrapment is limited to unipolar pacing modes and occurs when subcutaneous air is entrapped within the pulse generator pocket, resulting in insulation of the unipolar anodal plate (indifferent electrode) from the subcutaneous tissue.

CASE REPORT

On November 7, 1979, a 77-year-old pacemaker-dependent man with symptomatic complete heart block had his second pacemaker operation within a two-year period. His current pacing system consisted of a nine-year-old bipolar

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