Case reports

Combined percutaneous pulmonary valvuloplasty and patent foramen ovale closure in an adult with recurrent transient ischemic attacks

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We report the case of a 60-year-old man with a history of recurrent transient ischemic attacks, effort syncope, cyanosis, erythrocytosis and a systolic murmur. Echocardiography and catheterization showed severe pulmonary stenosis and a patent foramen ovale with a right-to-left shunt. The patient was submitted to combined percutaneous pulmonary valvuloplasty and patent foramen ovale closure using the Amplatzer device.

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Case report

A 60-year-old man was referred to our Department for effort dyspnea (NYHA functional class II) and the finding of a systolic murmur. He also complained of effort syncope and suffered from recurrent transient ischemic attacks. Cerebral magnetic resonance imaging revealed multiple ischemic lacunae at the frontal and parieto-occipital levels, with smooth carotid vessels at echo-Doppler evaluation. The ECG showed right atrial enlargement and incomplete right bundle branch block. Transthoracic echocardiography (TTE) showed pulmonary stenosis with a maximum systolic pulmonary valve gradient of 86 mmHg (mean gradient 48 mmHg), right ventricular hypertrophy and right atrial enlargement. Transesophageal echocardiography (TEE) showed a patent foramen ovale (PFO) with significant left atrial filling after intravenous injection of contrast medium (Levovist®, Schering, Berlin, Germany) (Fig. 1). Cardiac catheterization confirmed pulmonary valve stenosis (peak gradient

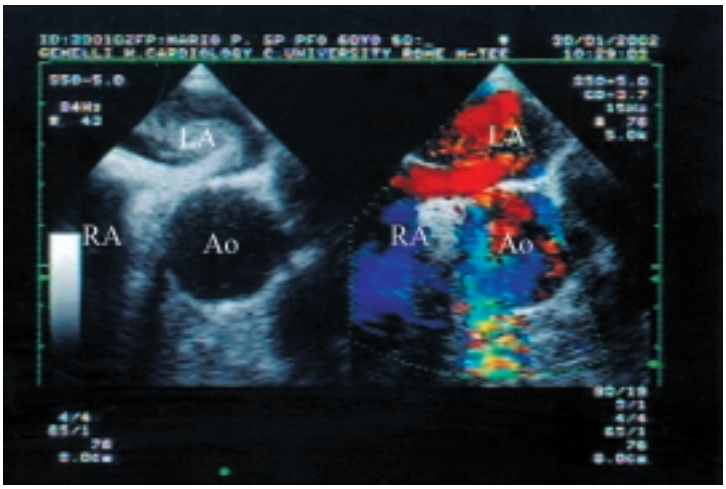

Figure 1. *Transesophageal echocardiography after contrast injection* (left) *and with color Doppler imaging* (right), *showing a patent foramen ovale with a right-to-left shunt. Ao = aorta; LA = left atrium; RA = right atrium.*

120 mmHg) with marked post-stenotic dilation of the pulmonary artery and a PFO with a significant right-to-left shunt (pulmonary venous blood oxygen saturation 95.6%; left atrial blood oxygen saturation 83.8%); the coronary arteries were angiographically normal. Blood analysis showed arterial hypoxemia (arterial blood oxygen saturation 86.9%) with erythrocytosis (hemoglobin 17.9 g/dl, hematocrit 54%).

Procedure. After the insertion, under local anesthesia, of a 5F pigtail scaling catheter (PBN Medical, Stenlose, Denmark) into the right side of the heart through the right femoral vein, right ventriculography was performed in the left lateral view and the diameter of the annulus of the pulmonary valve was measured (Fig. 2). The pulmonary valve was crossed with a diagnostic multipurpose catheter (Boston Scientific Scimed, Maple Grove, MN, USA) and a super-stiff 0.035" J-tipped exchange wire (Amplatz, Boston Scientific Corporation, Watertown, MA, USA) was positioned distally into the left pulmonary artery. A 22 × 40 mm VACS-2 balloon (Osypka, Rheinfelden-Herten, Germany) was positioned across the valve (balloon to annulus ratio 1.1) and inflated repeatedly (Figs. 3 and 4) until the disappearance of the central waste in the fully inflated balloon. Infundibular constriction was managed by propranolol 4 mg i.v. and, at the end of the procedure, the peak gradient dropped from 120 to 25 mmHg and the right ventricular systolic pressure dropped from 157 to 57 mmHg.

Immediately after completion of pulmonary valvuloplasty, PFO closure was performed using a 25 mm Amplatzer device (AGA Medical, Minneapolis, MN, USA) (Fig. 5), during sedation with propofol i.v. and under TEE monitoring. Levovist® injection into the right atrium after device delivery confirmed the complete suppression of the right-to-left shunt (Fig. 6). Femoral hemostasis was achieved by manual compression. The total procedure and fluoroscopy times were 134 and 21 min respectively. Two days following these procedures, TTE control confirmed the absence of any residual in-

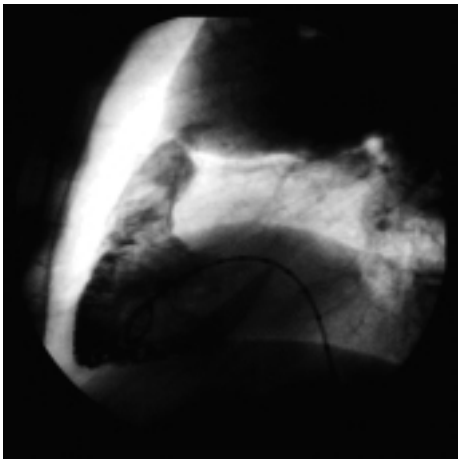

Figure 2. *Right ventriculography in the left lateral view.*

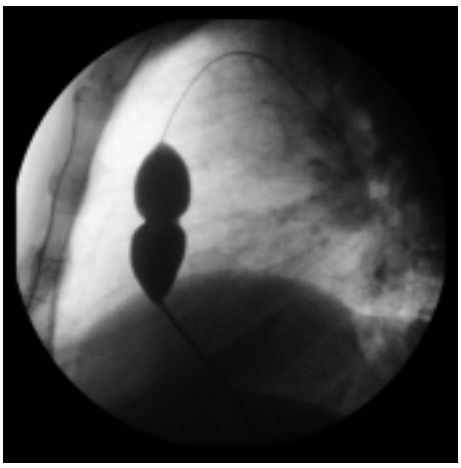

Figure 3. *Balloon inflation across the pulmonary valve (note the waste in the balloon body).*

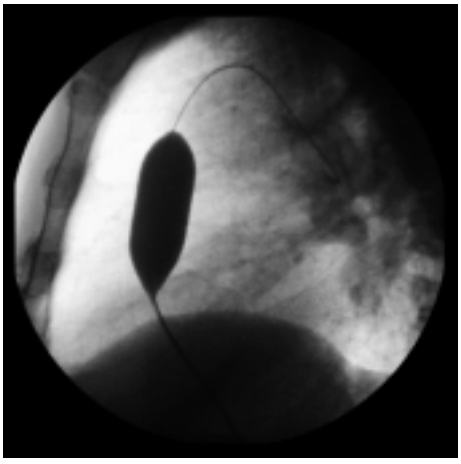

Figure 4. *Fully inflated balloon across the pulmonary valve.*

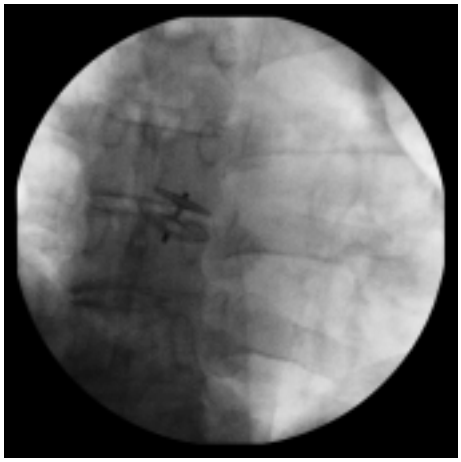

Figure 5. *Radiographic appearance of the Amplatzer device after deployment.*

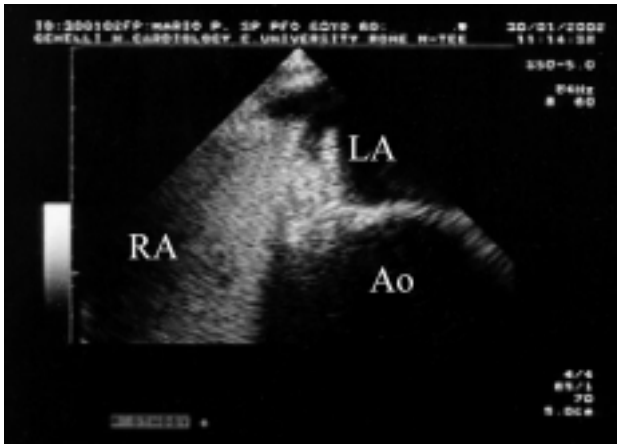

Figure 6. *Post-procedural transesophageal echocardiography after contrast injection, showing the correct positioning of the device and complete suppression of the right-to-left shunt as confirmed by the absence of left atrial opacities. Abbreviations as in figure 1.*

tracardiac shunt and a residual maximum pulmonary valve gradient of 15 mmHg. The patient was discharged on aspirin therapy (300 mg daily for 6 months).

Discussion

To the best of our knowledge, this is the first case report of simultaneous pulmonary valvuloplasty and PFO closure in a patient with documented cerebral paradoxical embolism. Indeed, although the association between pulmonary valve stenosis and an atrial septal defect with a left-to-right shunt is not rare[1,2], the concomitance of severe pulmonary stenosis and a PFO with a right-to-left shunt has not been frequently reported. In our case, pulmonary stenosis and the PFO acted synergistically to expose the patient to a high risk of paradoxical embolism, further enhanced by the blood hyperviscosity. Thus, the decision to perform both procedures during the same operative session was made in order to not only correct the congenital abnormalities but also to minimize the risk of future embolic events.

Percutaneous balloon valvuloplasty is considered the first-line treatment for congenital pulmonary stenosis both in children and in adults[3]. Of note, in adults the improvement is maintained over the long term, whereas children have a substantial risk of restenosis. Compared to surgical valvulotomy, percutaneous balloon valvuloplasty is associated with less psychological trauma[4], lower morbidity and mortality[5] and with a shorter hospital stay.

Percutaneous PFO occlusion was recently shown to be an effective and promising technique for the prevention of recurrent ischemic thromboembolism in patients with this congenital defect[6]. Although studies comparing the surgical and medical approaches are still lacking, it is noteworthy that the presence of a residual defect strongly predicts recurrent events[6]. Although PFO closure without general anesthesia and TEE is feasible, we chose to perform TEE with contrast injection in order to verify the correct positioning of the device during the procedure and to confirm complete shunt suppression.

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