TECHNIQUE

Use of the reversed button device to treat an atrial septal aneurysm associated with a patent foramen ovale

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Abstract

An atrial septal aneurysm may be associated with a patent foramen ovale. When paradoxical emboli result, the shunt must be closed and the atrial septal aneurysm excised. A reversed buttoned occluder device was successfully used for the transcatheter treatment of this condition.

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An atrial septal aneurysm is a localised protrusion of the interatrial septum that usually involves the fossa ovalis. Usually it is a clinically silent condition that often is diagnosed incidentally on echocardiography.¹ However, it can cause atrial tachycardia, atrial thrombus formation, or systemic embolisation.¹⁻³ We report on a patient with repeated embolic episodes attributed to an atrial septal aneurysm with an associated patent foramen ovale in whom both these abnormalities were corrected by a transcatheter technique.

Case report

A 48 year old woman presented with a history of multiple episodes of cerebral and peripheral arterial embolism. The physical examination, chest x ray, and electrocardiogram were normal. Transthoracic echocardiography showed normal cardiac chambers and valves. No ventricular or atrial septal defects were seen but an aneurysm of the interatrial septum was noted. Transoesophageal echocardiography confirmed the aneurysm, which prolapsed into the left atrium (fig 1A) and right atrium (fig 1B) during the cardiac cycle. A contrast study using agitated saline showed a right to left shunt (fig 2) indicating a patent foramen ovale.

Because the patient's symptoms were attributable to the atrial septal aneurysm and in view of paradoxical emboli passing across the patent foramen ovale, we decided to close the defect with a 20 mm reversed buttoned occluder device. We used a modification of the previously described technique to place the buttoned occluder device.⁴ After giving antibiotic prophylaxis and 5000 IU of heparin intravenously, the patent foramen ovale was crossed with a multipurpose catheter. A 0.035 inch exchange guidewire was placed in the left superior pulmonary vein over which an 8F long sheath was positioned into the left atrium. The counteroccluder was advanced through this sheath into the left atrium and pulled back against the interatrial septum. The occluder was then advanced into the right atrium where it assumed its square shape.⁴ The occluder and the counteroccluder were then buttoned together (fig 3).

Figure 1 Transoesophageal echocardiogram showing an aneurysm of the interatrial septum (arrowheads) prolapsing into the left atrium (A) and the right atrium (B).

Figure 2 Contrast study showing a right to left shunt across the patent foramen ovale.

Figure 3 Reversed buttoned occluder device with the counteroccluder (arrows) in the left atrium and the occluder with its X-shaped skeleton (arrowheads) in the right atrium.

Figure 4 Transoesophageal echocardiogram showing the occluder (arrows) closely applied to the right atrial side of the interatrial septum. Note that the aneurysm has been obliterated and there is no prolapse of any part of the interatrial septum.

A transoesophageal echocardiogram after the procedure showed that the device was correctly placed over the interatrial septum (fig 4). The septal aneurysm was obliterated and a contrast study showed that the patent foramen ovale had been closed. The patient was given two more doses of antibiotic prophylaxis and was discharged the next morning on 100 mg of aspirin daily for 3 months. A follow up transthoracic echocardiogram 3 months later showed the device in a good position and no right to left shunt after intravenous injection of contrast medium. The patient refused a transoesophageal study. One year after placement of the device she was well and had not had any further episodes of systemic embolism.

Discussion

Aneurysms of the interatrial septum may occur as isolated abnormalities or in association with an atrial septal defect, patent foramen ovale, atrioventricular valve prolapse, left atrial hypertension, or congenital cardiac anomalies of the hypoplastic right heart type.^{15,6} Although such aneurysms are most commonly detected incidentally during echocardiography,¹ they may present as non-ejection clicks, atrial arrhythmia, atrial thrombi, embolic episodes, or rarely as a "tumour effect" leading to atrioventricular or pulmonary vein obstruction.^{1-3,7} Systemic emboli are attributed to right to left shunting through the commonly associated defect in the aneurysmal septum. Alternatively, even in the absence of such a defect, the wide prolapsing movements of the septum tends to cause embolisation of attached thrombotic material.⁷ Therapy ranges from watchful waiting for incidentally detected aneurysms to surgical correction if symptoms or an associated cardiac anomaly are present.

Atrial septal aneurysms in adults are often associated with an atrial septal defect or patent foramen ovale.¹⁸ Right to left shunting across the patent foramen ovale may occur during straining or a valsalva manoeuvre. This may lead to paradoxical emboli, as in our patient. The treatment of a patent foramen ovale associated with paradoxical emboli includes anticoagulation or surgical closure of the shunt. Recently, the availability of transcatheter closure devices has permitted these defects to be closed without resort to surgery.^{4,9,10}

The buttoned occluder device is made up of a square occluder made of polyurethane foam supported by an X-shaped wire skeleton.^{4,9} This is held in place against the interatrial septum by a counteroccluder which is a straight wire covered by polyurethane foam. Because in an atrial septal defect shunting is predominantly from left to right, the occluder device is deployed with the occluder positioned in the left atrium and the counteroccluder in the right atrium. This ensures that the occluder is held firmly against the

interatrial septum by the higher left atrial pressure. However, until endothelialisation closes of the defect completely, this arrangement can still allow right to left shunting when the right atrial pressure is increased (Valsalva manoeuvre).

In patients with a patent foramen ovale and history of paradoxical embolisation, the risk of even transient further right to left shunting is unacceptable because embolisation can occur before the device becomes fully endothelialised. Hence, in such a situation the reversed device is preferred. Here the occluder disc (which is the one responsible for closing the defect) is placed in the right atrium (instead of the left atrium as in the standard device) and the counter occluder in the left atrium. This results in better prevention of right to left shunting because any increase in right atrial pressure presses the occluder firmly against the interatrial septum. In our patient, the aneurysm of the interatrial septum was also repaired by this procedure, probably because the device buttressed the prolapsing portion of the interatrial septum.

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