CASE REPORT

Persistence of the eustachian valve in secundum atrial septal defects: possible implications for cerebral embolism and transcatheter closure procedures

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Abstract

Transcatheter closure of large secundum atrial septal defects is now accepted clinical practice. With the introduction of easily applicable closure devices the indications for this procedure have been expanded to include the closure of patent foramen ovale after cerebral stroke of unknown origin. In some of these patients a persistent eustachian valve is present. The clinical relevance of this finding is still unclear. A 36 year old patient with a brainstem stroke of unknown origin and a secundum atrial septal defect in combination with a persisting prominent eustachian valve is reported. The potential role of the eustachian valve in the genesis of the stroke and the difficulties during transcatheter closure of the defect because of the persisting valve are discussed.
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Keywords: atrial septal defect; eustachian valve; stroke; transcatheter closure

During the past decade various percutaneous transcatheter closure devices for atrial septal defects (ASD) have been introduced in clinical practice.[1] Additionally, these devices are increasingly being used to close patent foramen ovale in patients with a cryptogenic stroke.[2 3] We report the case of a 36 year old man with an ASD and a persistent, prominent eustachian valve, who had suffered from a cryptogenic stroke.

Case report

A 36 year old male patient was referred to our hospital for percutaneous transcatheter occlusion of a secundum ASD, which had been diagnosed following a brainstem stroke. A left to right shunt volume of 30% had been measured at catheterisation and right heart pressures had been confirmed to be normal.

A device closure was performed under general anaesthesia. This was monitored by transoesophageal echocardiography (TOE). TOE showed the ASD to be located in the fossa ovalis. The large left to right shunt was confirmed by the washout phenomenon after application of echo-contrast medium. There was also a huge persisting eustachian valve floating in the right atrium (video 1, sequences 1 and 2). During the first echo-contrast bolus injection via a cubital vein this valve led to a visible separation of the superior caval vein inflow from the inferior caval vein inflow (video 2, sequence 1). Following placement of a guidewire via the ASD into the left atrium, the eustachian valve was noted to be trapped between the wire and the inferior rim of the ASD (video 1, sequence 3). This entrapment was still visible when the sizing balloon and the introducer sheath of the occluder device were advanced across the ASD over the guidewire (video 1, sequences 4 and 5). An Amplatzer

Video 1 Sequence (S) 1 to 9: Transoesophageal images of the implantation sequence of the Amplatzer septal occluder. S1: Findings before the intervention with a small atrial septal defect (ASD) of 8 mm and a prominent persisting eustachian valve. S2: Colour Doppler image of the left to right shunt via the ASD. S3: After the placement of the guidewire the rim of the eustachian valve was entrapped between the guidewire and the inferior rim of the ASD. S4: The sizing balloon also fixed the tip of the eustachian valve at the defect. S5: After the introducer sheath of the occluder was forwarded into the left atrium the eustachian valve was still trapped in the defect. S6: The left atrial disk was expanded without complications, but the eustachian valve still seemed to adhere to the occluder. S7: The right atrial disk was also deployed without complications. However, it was impossible to disconnect the occluder from the catheter. S8: After the occluder had been retracted into the sheath and the sheath had been removed from the ASD the eustachian valve was again floating free in the right atrium. S9: In a second try the occluder was implanted correctly and the eustachian valve was no longer fixed to the septum by the device.

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Video 2 S1: An echo-contrast bolus administration via the superior caval vein showed a washout phenomenon from the ASD in the right atrium and in addition the eustachian valve acted like a separator between the inferior and superior caval inflow of the venous blood. S2: After implantation of the occluder a second bolus injection of echo-contrast (this time via the inferior caval vein) showed that the blood was directed to the inferior part of the occluder before it was mixed with the blood from the superior caval vein.

septal occluder (11 mm) was then advanced via the sheath and the left atrial disk was expanded in the left atrium without complications (video 1, sequence 6). After expansion of the right atrial disk the eustachian valve became entangled with the occluder (video 1, sequence 7). At this point, it was impossible to disconnect the connecting cable of the device from the occluder. Therefore, the occluder was recovered by retracting it into the sheath. As soon as the sheath was withdrawn from the ASD the eustachian valve became free and was visualised floating in the right atrium (video 1, sequence 8). During a second attempt at closure the sheath was repositioned in the ASD, this time without entrapment of the eustachian valve, and the closure of the defect was completed without complications (video 1, sequence 9). A second echo-contrast bolus application (this time via the inferior caval vein) documented the absence of the right atrial washout phenomenon as an indirect sign of complete occlusion of the defect. Additionally, it was seen that the contrast enhanced blood from the inferior caval vein was directed by the eustachian valve to the inferior part of the occluder (video 2, sequence 2).

Discussion

Interventional closure of a patent foramen ovale is now technically feasible but the superiority of interventional strategies compared with anticoagulation in patients with cryptogenic stroke has not been shown.[4 5] In the present case TOE showed a prominent persisting eustachian valve in addition to confirming the presence of a secundum ASD. This eustachian valve was attached at the anterior rim of the inferior caval vein, floated free within the right atrial cavity, and prolapsed into the interatrial defect. Before transcatheter occlusion of the defect, administration of echo-contrast medium via the superior caval vein showed a distinct washout phenomenon indicating a significant left to right shunt, but as usual in such defects there was also a right to left component of the shunt. Furthermore, it was nicely shown that the eustachian valve somehow acted to partition the right atrial inflow and separated the flows from the inferior and superior caval veins. After the occluder was successfully implanted a second bolus of echo-contrast medium was given, this time via the femoral vein sheath of the device. Contrast inflow to the right atrium from the inferior caval vein and the eustachian valve towards the fossa ovalis was documented. We assume that this shows the persisting original fetal function of the eustachian valve, leading the oxygenated blood from the inferior caval vein to the foramen ovale. In our case this may have contributed to a paradoxical cerebral embolism.

A persisting eustachian valve in the absence of other structural heart diseases is believed to have no pathological importance.[6] However, there are several reports documenting cyanosis in patients with ASD without an increase in right heart pressures but in whom the ASD was associated with a prominent eustachian valve. This valve has thus been implicated as the possible source of the right to left shunt.[7] The findings in this case support the hypothesis that patients with a cryptogenic stroke and an ASD or patent foramen ovale combined with a prominent eustachian valve may benefit from interventional closure of the interatrial communication. One prior study reported a rate of approximately 60% (in a group of 120 consecutive necropsies) of a persisting eustachian valve in adults.[8] The potential relevance of the eustachian valve in the mechanism of paradoxical embolism can be shown by the contrast injection into the inferior caval vein. Additionally, this report shows the importance of TOE guidance to recognise, prevent, and treat complications during interventional closure of patent foramen ovale and ASD. There has been one recent report of a series of three patients showing the practicability of using a steerable ablation catheter to deflect the eustachian valve away from the interatrial septum during the procedure.[9]

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