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Transcatheter treatment of atrial septal aneurysm associated with patent foramen ovale for prevention of recurrent paradoxical embolism: How to turn a procedure to a challenge

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Abstract
Patients with Atrial Septal Aneurysm (ASA) associated with Patent Foramen Oval (PFO) are at higher risk for recurrent paradoxical embolism compared to patients with PFO alone. The ASA may increase the PFO diameter due to the highly mobile atrial septal tissue, leading to a more frequent and wider opening of an otherwise small channel. Atrial septal aneurysm has been also considered a nidus for local thrombus formation with subsequent embolization. Transcatheter treatment of ASA associated with PFO is safe and effective in patients with paradoxical embolism. The procedure effectively abolishes right-to-left shunt and decreases atrial septal mobility. But, the procedure is not free of difficulties and complications. We report the case of a 48 years old man, with recurrent stroke, related to the presence of a PFO with a huge ASA, to show the difficulty of occlusion of this defect. The procedure was performed under general anesthesia to allow continuous multiplane transoesophageal imaging of the atrial septum and related structures. Stretched diameter of the PFO was determined by TOE measures. The availability of one type of occluder (Amplatzer PFO Occluder), the importance of the aneurysm, and the impact of the importance of aneurysm on the inconstant and variable size of the PFO may be causing difficulties during the procedure and turn the procedure to a challenge.

Keywords: atrial septal aneurysm, patent foramen ovale, paradoxical embolism, percutaneous intervention

Introduction

Atrial Septal Aneurysms (ASA) are localized, bulging malformations that protrude into the right or left atrium. Their prevalence in general population ranges from 1% in autopsy to 2.2% in trans esophageal echocardiographic (TEE) series [1]. Atrial Septal Aneurysm is rarely an isolated abnormality. It is frequently (50% to 89%) associated with a patent foramen ovale (PFO) [1, 2]. Patients with ASA + PFO are at higher risk for recurrent paradoxical embolism compared to patients with PFO alone [3]. Growing experience with new occlusion devices has allowed these patients to undergo percutaneous treatment [4, 5], But, the procedure is not free of difficulties and complications. We report the case of a 48 years old man, with recurrent stroke, related to the presence of a PFO with a huge ASA, to show the difficulty of occlusion of this defect.

2. Case report

We report a 48-year-old patient recently diagnosed with ASA associated with PFO. He has been admitted to our clinic for recurrent ischemic stroke assessment. Clinical examination has revealed systolic murmur at the left lower sternal border. There is no evidence of heart failure. Chest X-ray has shown a mild increased cardiothoracic ratio; also, the electrocardiogram has exposed a slight right axis deviation and RBBB.

Transthoracic echocardiography (TTE) examination has revealed a huge aneurysm of atrial septum and moderate enlarged right ventricle. ASA was defined as an interatrial septum of abnormal mobility with protrusion of the septum into the left or right atrium for more than 10 mm beyond baseline. Due to the presence of ASA, we decided to further investigate the atrial septum and to perform a Trans Oesophageal Echocardiography (TOE). Apart from confirming the abnormalities detected by transthoracic echocardiography, an interatrial shunt due to the presence of PFO was exposed by TOE. Quantification of the PFO shunt volume was determined by contrast injection.

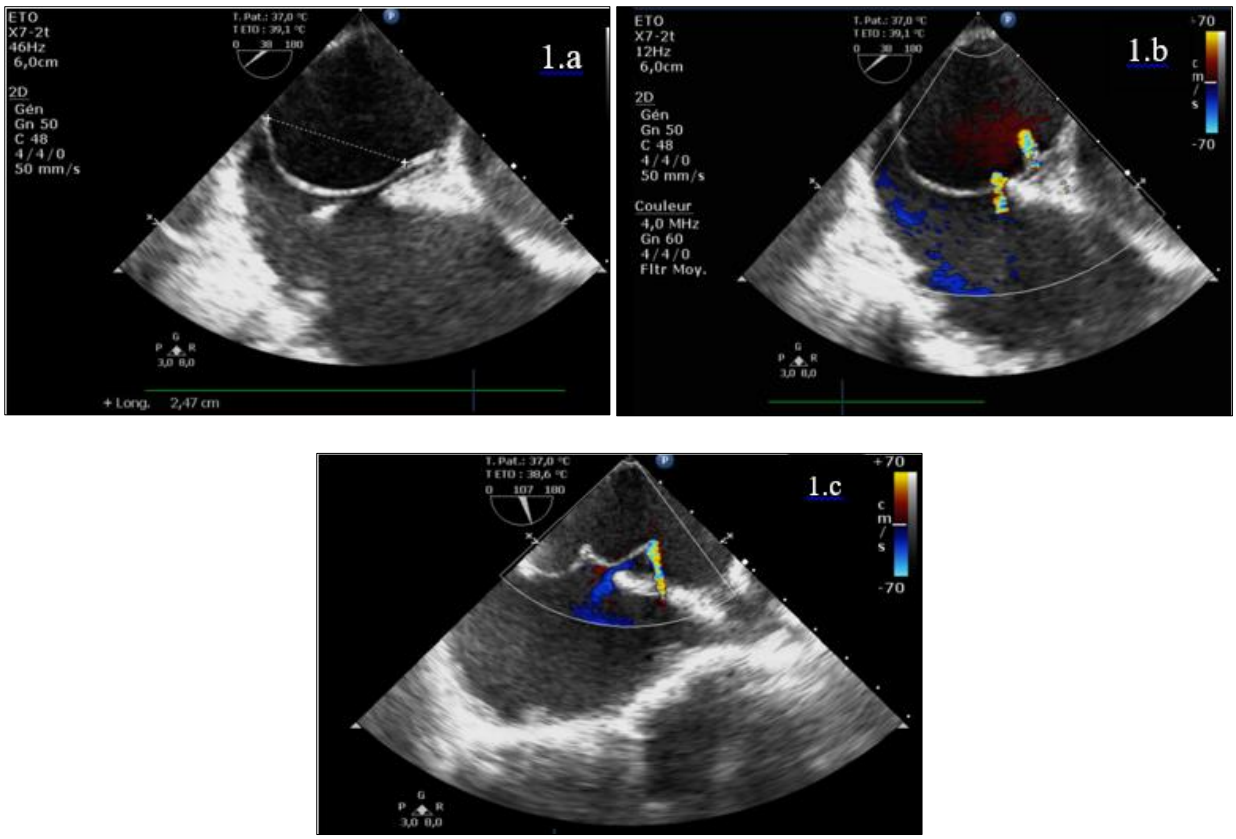

Fig 1 a, b, c: Atrial septa1 aneurysm with PFO bulging into the right atrium and into the left atrium

3. Cardiac catheterization

The procedure was performed under general anesthesia and Trans esophageal monitoring to allow continuous multi plane Trans esophageal imaging of the atrial septum and related structures. Stretched diameter of the PFO was determined by TOE measures.

We used Amplatzer PFO occluder. Venous access was gained via the right femoral vein and the PFO was passed using a 8F transseptal sheath. The Amplatzer PFO occluder device was screwed on to the delivery wire and compressed by withdrawing it into the loader. The compressed device was then introduced into the sheath and advanced across the atrial septum to the end of the long sheath. The left atrial retaining disc was then extruded.

The extruded disc and introducer sheath were then withdrawn as a single unit until resistance to further withdrawal was felt, which should be at the fossa ovalis.

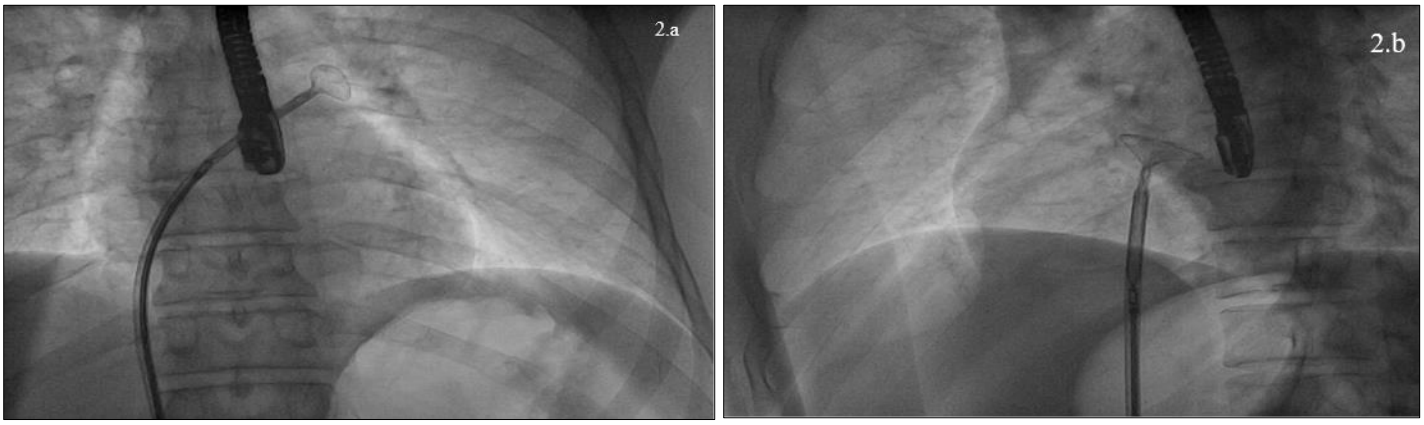

Fig 2: a and b Extrusion of the left atrial disc

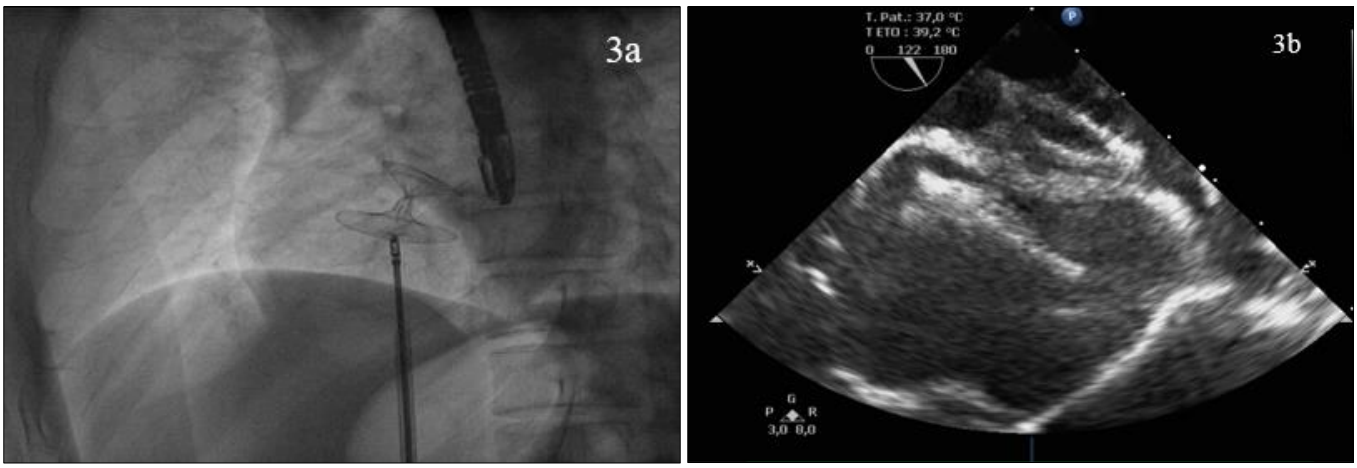

Fig 3 a and b: Extrusion of right atrial disc

While maintaining constant tension on the delivery wire the introducer sheath was peeled back to expand the rest of the ccluder. The position of the occluder was checked with transo esophageal echocardography before release. Care was taken to ensure the device did not protrude into related structures. The device was released from the delivery cable successfully. There were no acute complications.

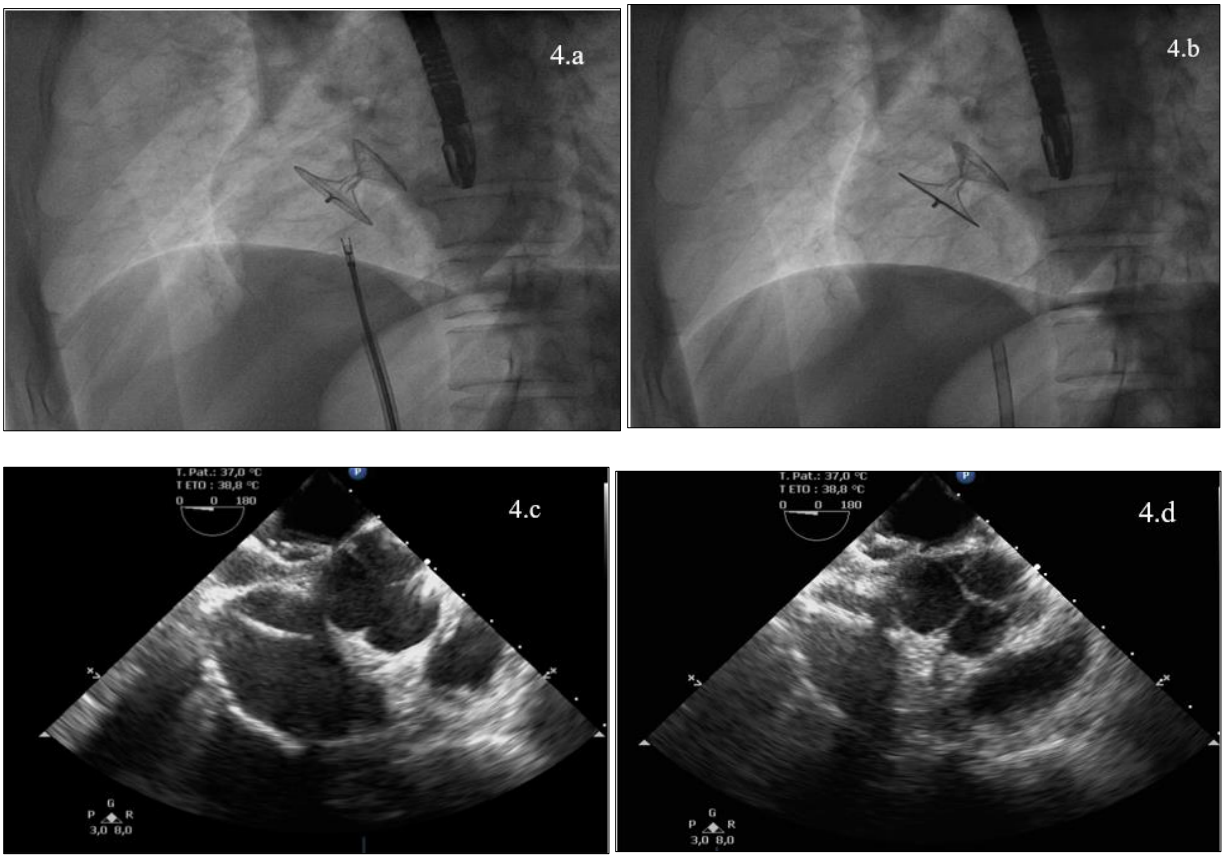

Fig 4 a-b-c and d: dispatching of the PFO occluder and TOE control of related structures

The availability of one type of occluder (amplatzer PFO occluder), the importance of the aneurysm, and the impact of the importance of aneurysm on the inconstant and variable size of the PFO have been causing difficulties during the procedure and have turned the procedure to a challenge.

The patient was anticoagulated at the time of the procedure with heparin and had received aspirin 300 mg per day for three months in order to prevent excessive thrombus formation on the device. Follow up echocardiography with color flow mapping was performed before discharge to ensure maintenance of position. We defined primary success as echocardiographic absence of residual shunt at discharge. Noninvasive clinical follow-up was carried out at 1, 3, 6, and 12 months post-treatment and yearly thereafter.

4. Discussion

The Patent Foramen Ovale and aneurysmal interatrial septum are being increasingly incriminated in cerebral thromboembolism and neurological decompression illness. Patients with Atrial Septal Aneurysm (ASA) associated with Patent Foramen Ovale (PFO) are at higher risk for stroke and stroke recurrence compared to patients with PFO alone. ASA may increase the PFO diameter due to the highly mobile atrial septal tissue, leading to a more frequent and wider opening of an otherwise small channel. The mechanisms implied in embolic episodes in patients with atrial septal aneurysm are related with the right-left passage through the PFO, or the formation of thrombus in the aneurysm itself, as long as ASA has been considered a nidus for local thrombus formation with subsequent embolization. Patients with a first ischemic embolism have a 15% risk of a second event in a 4 years period

Even when they receive aspirin [6]. Mechanical closure of the defect seems a logical alternative therapy.

patients with the coexistence of an ASA+PFO obtain a special benefit from percutaneous closure of PFO compared to patients with PFO alone, which might be explained by reduction of atrial septal mobility resulting from stabilization of the redundant atrial septal tissue between the device discs and closure of the larger PFO opening associated with an ASA.

Many reports [7–8] have shown transcatheter treatment of patients with cryptogenic stroke and PFO alone to be feasible using a variety of trans-septal occlusion devices. But few available studies have investigated the safety and long-term efficacy of transcatheter treatment of ASA associated with PFO. This studies demonstrated that transcatheter treatment of ASA associated with PFO is safe and procedural success and complication rates are similar to patients with PFO alone. Also, the additional presence of an ASA does not adversely affect elimination of right-to-left shunt compared with PFO alone and is not associated with an increased incidence of recurrent thromboembolic events [9, 10].

We believe that when managing PFO associated with ASA, operators should focus on closing the PFO and not on stabilizing the aneurysm. This will directly reduce residual shunts and therefore should translate into reduced recurrent embolic events. We often notice that, by achieving PFO closure with a well-conformed device, the septal excursion is also reduced.

The coexistence of ASA poses obvious technical challenges in percutaneous treatment of the symptomatic PFO. In specific, a large ASA can frequently distort the PFO opening so that it lies eccentrically with respect to the ASA and oval fossa. In such cases, complete ASA coverage is accomplished only by a large device or with one approximating the length of the interatrial septum, a strategy carrying the inherent risks associated with large sized device. Indeed, the implantation of large devices of 30 mm or more, if exceeding the length of the interatrial septum, have been correlated with mid-and long-term complications including increased frequencies of arrhythmias, device thrombosis, aortic and atrial erosions, and residual shunt [11].

5. Conclusion

PFOs with an associated atrial septal aneurysm can be closed with different devices available. Interventional PFO closure in patients with ASA poses obvious technical challenges, but still safe. There seems to be no additional risks compared with patients without atrial septal aneurysm.

6. Conflicts of Interest

The authors declare that they have no conflicts of interest.

7. Acknowledgments

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