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CASE REPORT
Other

Late presentation of left atrial appendage erosion and perforation by an Amplatzer™ Amulet™ closure device: a case report

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Background Percutaneous left atrial appendage (LAA) closure may reduce the risk of cardioembolic stroke in patients with non-valvular atrial fibrillation. Given the prophylactic nature of the procedure, identifying and managing complications are paramount.

Case summary A 73-year-old man presented 14 months after percutaneous LAA closure with syncope and acute pericardial tamponade which required surgical exploration and haemostasis; the most temporally remote account of this complication albeit amongst very few case reports. Tissue erosion by the Amplatzer™ Amulet™ LAA closure device (Abbott, Plymouth, MN, USA) was noted at two separate anatomical locations, corresponding to the device disc and lobe, which has not been described previously.

Discussion This case report highlights the anatomical relationship between the LAA and its surrounding structures, and the importance of recognizing the risk of late device erosion.

Keywords Left atrial appendage closure • Late complication • Erosion • Perforation • Case report

Learning points

- Erosion or perforation of a device through the left atrial wall/left atrial appendage (LAA) wall can cause serious late complications of LAA closure and the incidence is unknown.
- The presentation of pericardial effusion and or tamponade in a patient with a remote history of LAA closure warrants evaluation for erosion, and surgical haemostasis appears appropriate.

Introduction

Percutaneous left atrial appendage (LAA) closure may reduce the risk of cardioembolic stroke in the setting of non-valvular atrial fibrillation (AF). The procedure has found particular clinical relevance among patients with a contraindication for long-term oral anticoagulant therapy. The procedure appears well tolerated with infrequent long-term complications noted.[1,2] We report a case which, 14 months after device implantation, presented with pericardial tamponade caused by tissue erosion corresponding to both the disc and the lobe of an Amplatzer™ Amulet™ LAA closure device (Abbott, Plymouth, MN, USA), requiring surgical exploration and haemostasis.

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Timeline

Time	Event
Day 0	Index procedure and discharge
Intervening time	Asymptomatic
14 months	Urgent presentation with pericardial tamponade
	Computed tomography diagnosis
	Surgical exploration and haemostasis
	Discharge from hospital at 7 days
Present day	No recurrence of pericardial effusion

Case presentation

A 73-year-old man presented with permanent AF, arterial hypertension, pulmonary embolism, alcohol dependence, and previous bleeding gastric ulcer (CHADSVASC stroke risk score: 3; HAS-BLED bleeding risk score: 3). Cardiovascular examination revealed normal heart sounds with blood pressure of 138/75 mmHg. Laboratory tests were within normal range. Due to concerns about bleeding risk and medication adherence, percutaneous LAA closure was requested. Pre-procedural cardiac computed tomography (CT) imaging revealed a mildly dilated left atrium and classical windsock-shaped LAA with orifice diameter 20.3 mm × 29.3 mm and a landing zone of 20.0 mm × 22.3 mm diameter at 10 mm depth (*Figure 1A–C*). Based on these CT measurements, a 25-mm Amulet™ device was selected—aiming for 10–20% compression of the Amulet™ lobe—and implanted in an uncomplicated procedure. Fluoroscopy revealed a well-positioned device with a compression of 10–20% (*Figure 1D and E*). Intracardiac echocardiography was used to guide the transseptal puncture and device positioning and showed an appropriate device position without peri-device leak. Three months after the procedure, routine cardiac CT imaging revealed a satisfactory location of the Amulet™ device with partial retraction of the disc into the LAA at the posterior edge; however, there was complete occlusion of the LAA without any contrast leakage into the LAA (*Figure 1F–I*). The patient was discharged home with aspirin as single-antiplatelet therapy indefinitely.

At 14 months post-procedure, the patient presented with acute severe shortness of breath and syncope. Cardiovascular examination revealed severe hypotension of 55/30 mmHg with reduced heart sounds and the patient was found to have pericardial tamponade. Medication included aspirin but no other antithrombotic medication. Cardiac CT imaging revealed no immediate cause for the effusion. Surgical exploration revealed fresh blood in the pericardium with fresh oozing from the posterior aspect of the LAA adjacent to the Amulet™ disc as well as erosion on the main pulmonary artery (PA) adjacent to the lobe of the Amulet™ device. *Figure 2* shows a 3D model of this patient's LAA with a 25-mm Amulet™ device implanted in the same position. Surgical extraction of the LAA device was deemed too high risk due to tissue adhesion. Both eroded locations were patched with Tachosil™ (Nycomed, Linz, Austria), a surgical haemostatic agent that consists of an equine collagen patch coated with human fibrinogen and thrombin. The Amulet™ device remained in situ and the patient made a good clinical recovery, receiving aspirin long-term antiplatelet therapy on discharge. At 6-month follow-up no further pericardial fluid was noted.

Discussion

Peri-procedural LAA perforation and pericardial effusion or PA injury at the time of LAA closure is well documented and caused by direct trauma of the LAA and/or surrounding structures by the delivery catheter or closure device.[2,3] Late erosive complications provoked by LAA closure devices have an alternative pathology and are likely to be caused by local pressure exerted on surrounding tissues by the device. The incidence of these late complications is not described and only few reports exist.

In this context, the close anatomical relationship between the LAA and the main PA has been previously highlighted with particular relevance to LAA device-related complications.[4] Wang *et al.*[5] reported a case of main PA erosion and acute pericardial tamponade 6 months after Amulet™ LAA closure device implantation, which was managed in a similar fashion to the case described in this report. In addition, Sepahpour *et al.*[6] reported a case of PA erosion by a Watchman™ LAA closure device (Boston Scientific, Boston, MA, USA), resulting in pericardial tamponade and death at 16 days post-procedure. In a broader context, an Italian registry of Amplatzer™ Cardiac Plug (St. Jude Medical/Abbott, Plymouth, MN, USA) cases reported a mean follow-up period of 680 days for 134 patients post-device insertion; no late complications including perforation or erosion were observed with all patients having appropriate investigation to exclude late device-related complications or pericardial tamponade.[1] A larger registry of the Amplatzer™ Amulet™ device reported a 1.2% rate of peri-procedural tamponade, including one case of PA rupture. A death rate of 1.4% between 7 days and 3 months was observed but unknown if specifically device related.[7] Importantly, cases of late device-related complication resulting in death where no post-mortem examination is performed will result in an underestimation of LAA closure complications.

This case report describes the most temporally remote case of device erosion following percutaneous LAA closure. It is also the first identification of LAA erosion and perforation caused by the Amulet™ disc that was partially retracted into the LAA, being adjacent to the left upper pulmonary vein (*Figure 2*). It is possible that retraction of the disc into the LAA caused excessive local pressure at the edge of the Amulet™ disc. However, a previous study comparing 93 Amulet™ cases with the disc retracted into the LAA vs. 76 cases with the Amulet™ disc covering the LAA ostium did not provide any evidence for a difference in the occurrence of safety and efficacy endpoints between both groups.[8] Still, as Amulet™ disc retraction has also been reported to increase the risk of device-related thrombus,[9] it is generally recommended—and attempted—to obtain a complete

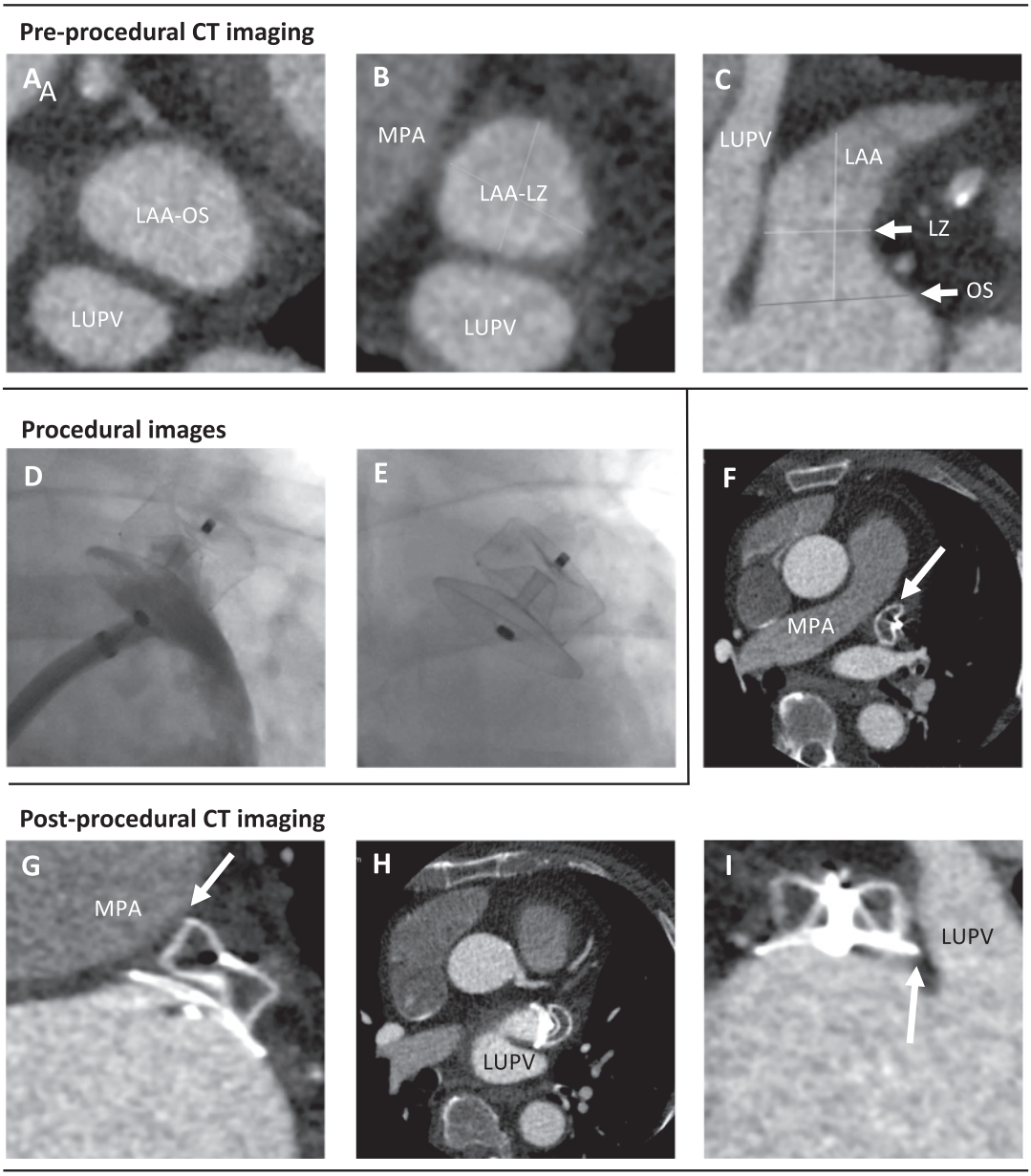

Figure 1 (*A–C*) Pre-procedural cardiac CT imaging showing (*A*) LAA ostium of 20.3 mm × 29.3 mm and proximity to left upper pulmonary vein (LUPV), (*B*) LAA closure device landing zone of 20.0 mm × 22.3 mm showing proximity to main pulmonary artery (MPA), (*C*) LAA longitudinal view with position of LAA ostium (OS), landing zone (LZ), and LAA depth of 30 mm. (*D* and *E*) Fluoroscopic device deployment with 10–20% lobe compression. (*F–I*) Post-procedural CT imaging showing (*F*, *G*) close proximity of Amulet™ lobe (arrow) to main pulmonary artery (MPA), (*H*, *I*) close proximity of Amulet™ disc to the left upper pulmonary vein (LUPV) and adjacent pericardial reflection (arrow). CT, computed tomography; LAA, left atrial appendage.

coverage of the LAA ostium with the Amulet™ disc. A deep implantation as well as undersizing of the Amulet™ disc in relation to the LAA ostium carries the risk of disc retraction.

Erosion of the main PA at the level of the Amulet™ lobe, or its stabilizing wires was also noted. Hence, close proximity of the predefined LAA landing zone and the PA should be considered before the procedure. Cardiac CT imaging with multiplanar reconstruction is an ideal imaging modality to screen for anatomical interactions—this is now systematically done at our institution. In case of close proximity of the LAA landing zone and PA, LAA closure devices with short or no anchoring hooks, LAA ligation, or no procedure could be considered, and excessive device

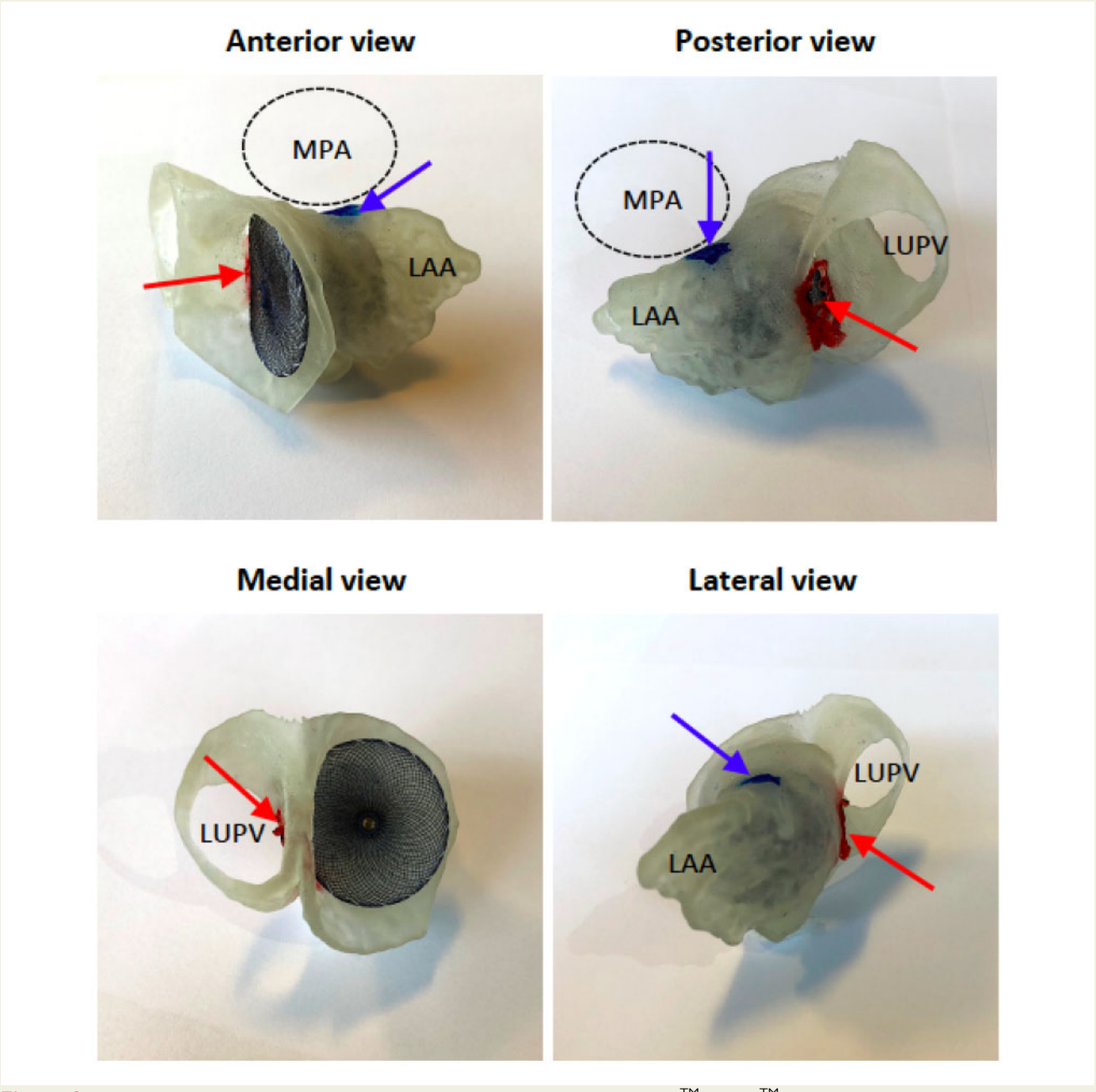

Figure 2 3D printed left atrial appendage (LAA) model showing the patient's Amplatzer™ Amulet™ device position in relation to surrounding anatomical structures. The erosion of the main pulmonary artery (MPA) adjacent to the device lobe is indicated in blue with blue arrow. The erosion of the left upper pulmonary vein (LUPV) adjacent to the device disc is indicated in red with red arrow.

oversizing should be avoided. In addition, using patient-specific LAA 3D models to simulate LAA device deployment may reveal important anatomical interactions that are not otherwise predicted on cardiac CT and/or echocardiography.

In conclusion, device erosion seems an infrequent complication of LAA closure but can occur late, and vigilance is advised. Careful procedural planning and execution may also help to obtain satisfactory LAA closure without excessive compression on surrounding anatomical locations and avoiding retraction of the occlusive device disc into the LAA. The authors suggest a potential role of pre-procedural CT imaging to guide LAA closure device selection in cases where the PA is particularly close to the LAA.

Lead author biography

Ben Wilkins is structural cardiac interventional fellow at Rigshospitalet, Copenhagen, Denmark, with interest in left atrial appendage closure, valvular heart disease and coronary intervention.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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