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LETTER TO THE EDITORS

Retrieval of an embolised occluder with an alligator forceps during staged paravalvular leakage closure

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Sirs:

A 54-year-old male with a history of three previous cardiac surgical interventions presented with progressive dyspnoea, NYHA Class IV and rapid weight gain of 15 kg during the last 10 weeks. In 2010, he underwent aortic valve replacement due to native valve endocarditis. Two years later he suffered from prosthetic valve endocarditis and a redo aortic valve replacement had to be performed. In 2017 the patient had recurrent prosthetic valve endocarditis this time involving the mitral valve. It was complicated by an aortic aneurysm with aortic valve regurgitation and severe mitral regurgitation. He underwent mitral valve replacement (Mosaic® 29 mm; Medtronic inc.) combined with re-redo aortic valve replacement (Carpentier-Edwards Perimount Magna Ease® 25 mm, Edwards Lifesciences), reconstruction of the aorto-mitral continuity and root replacement. His relevant comorbidities comprised of chronic obstructive pulmonary disease, chronic kidney disease stage 3, diabetes mellitus type 2 and ongoing alcohol and nicotine abuse. At presentation, his body weight was 117 kg and his height was 190 cm. He presented with hypotension (85/54 mmHg), a regular heart rate of 75/min, orthopnoea, a peripheral oxygen saturation of 91% without cyanosis and an elevated jugular vein pressure. On auscultation, he had a 3/6 systolic murmur in the 5th intercostal space of the medio-clavicular line radiating into the axilla and basal pulmonary rales. He presented with substantial lower leg edema.

An echocardiographic study revealed severe paravalvular leakage (PVL) of the mitral valve prosthesis caused by a large crescent defect (ESM 1 and 2 in the Online Resource; Fig. 1). An acute endocarditis was unlikely after transesophageal echocardiography, negative serum markers for infection and inflammation as well as negative blood cultures.

Current guidelines recommend surgery for operable patients with prosthetic heart valves with intractable hemolysis or heart failure due to severe prosthetic or paraprosthetic regurgitation (Recommendation IB). Percutaneous closure should be performed if surgical risks are high and anatomic features are suitable for catheter-based therapy (Recommendation IIaB [1]). Because of the very high risk of surgery, the heart team concluded that a percutaneous strategy was indicated potentially requiring a staged interventional procedure. Using 2D and 3D echocardiography the defect size was measured to be 7×16 mm with an area of 0.9 cm^2 (Fig. 1d, e). Via an antegrade transseptal approach [2], an Amplatzer Duct Occluder (16×8 mm) was successfully placed leaving a remaining moderate defect with paravalvular leakage on both sides of the occluder. As complete closure of the defect was not possible using only one device, a staged procedure was planned after risk–benefit analysis to reduce the chance of device dislocation. It remains a matter of speculation if complete PVL-closure in one session could have been successfully achieved utilizing a simultaneous or a sequential deployment technique without harming the patient [2]. Hemoglobin was 5.3 mmol/l and remained stable on day 3 after the procedure. Levels of lactate dehydrogenase and free-circulating hemoglobin were elevated. Whereas lactate dehydrogenase was rising after the procedure from 11.6 before to 30 µkat/l, free-circulating hemoglobin showed decreasing levels from 39.5 to 29 µmo/l on day 4 post-intervention. However, after discharge, the patient experienced increased hemolysis with symptomatic anemia leading to two hospital admissions with four blood transfusions and dyspnoea NYHA Class III. Therefore, the patient was scheduled for a second procedure after 3 months. The

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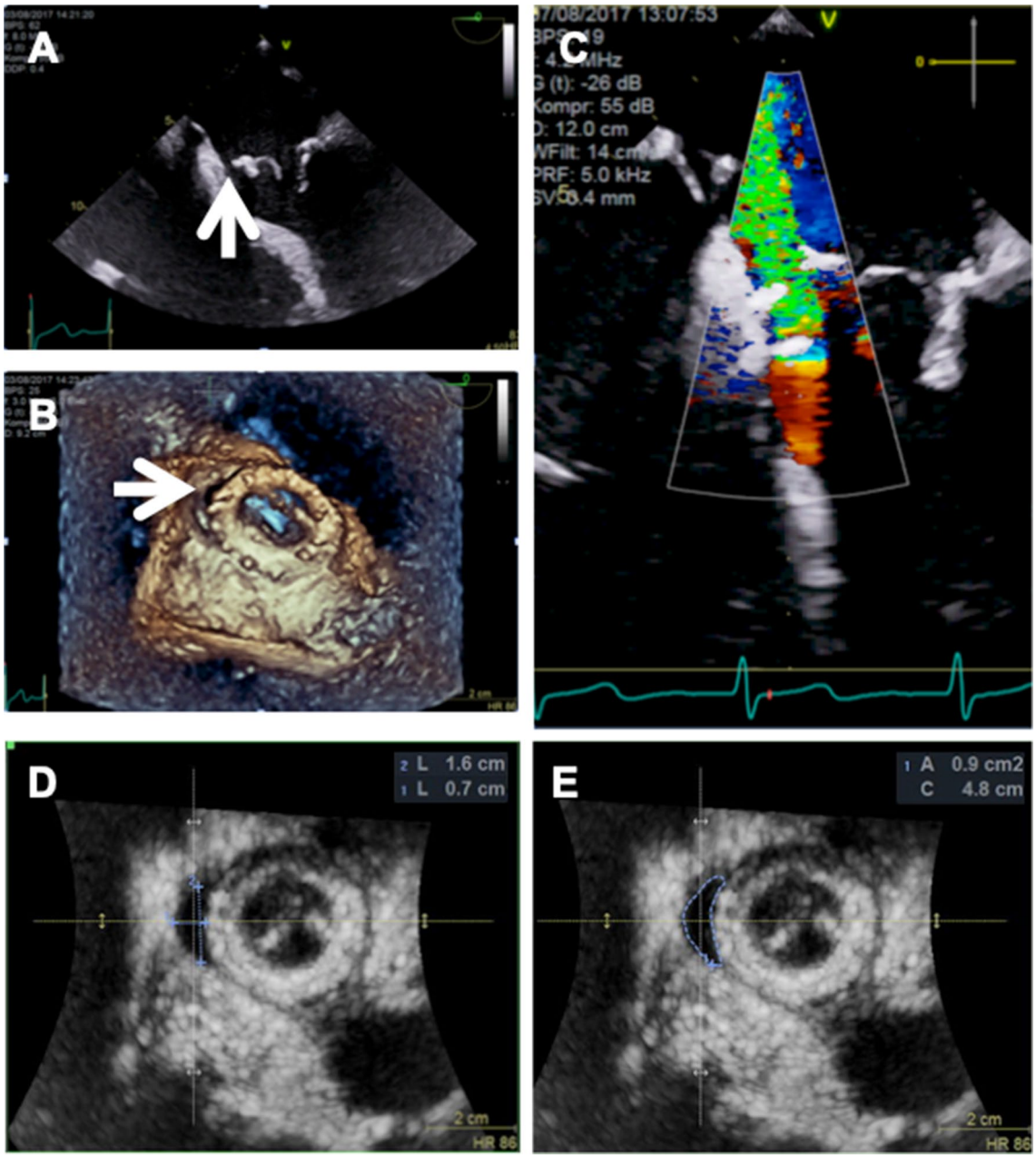

Fig. 1 **a** 2D echo of the mitral valve, the white arrow is indicating the paravalvular defect. **b** 3D echo demonstrating the crescent defect (white arrow). **c** Color Doppler echo showing a severe paravalvular leakage due to a large paramitral defect. **d** 2D reconstruction of the mitral annulus from a 3D data set measuring the length and width of the defect. **e** 2D reconstruction of the mitral annulus from a 3D data set sizing the area of the defect

interventional strategy was to implant at least one occluder on both sides of the Amplatzer Duct Occluder. After successful placement of an Amplatzer Vascular Plug 3 (14 × 5 mm), the defect was passed again to place a second plug. During advancement of a 5-French Judkins right diagnostic catheter through the defect, the Amplatzer Duct Occluder dislocated and embolised into the descending aorta (ESM 3, 4 and 5 in the Online Resource). The Amplatzer Vascular Plug 3 stayed in place. The dislocated occluder (Fig. 2a) was successfully retrieved with an alligator forceps (MTW Endoskopie Manufaktur; Fig. 2b) via a 14-French Cook sheath sitting telescopically in an 18 French Cook Sheath (Fig. 2c). A second Amplatzer Vascular Plug 3 (14 × 5 mm) was inserted successfully beside the first one with a very good result on echocardiography (ESM 6, 7 and 8 in the Online Resource; Fig. 3). The puncture site was closed with 2 ProGlide sutures (Perclose ProGlide®; Abbott). A central facial palsy was diagnosed after the intervention. The MRI scan revealed

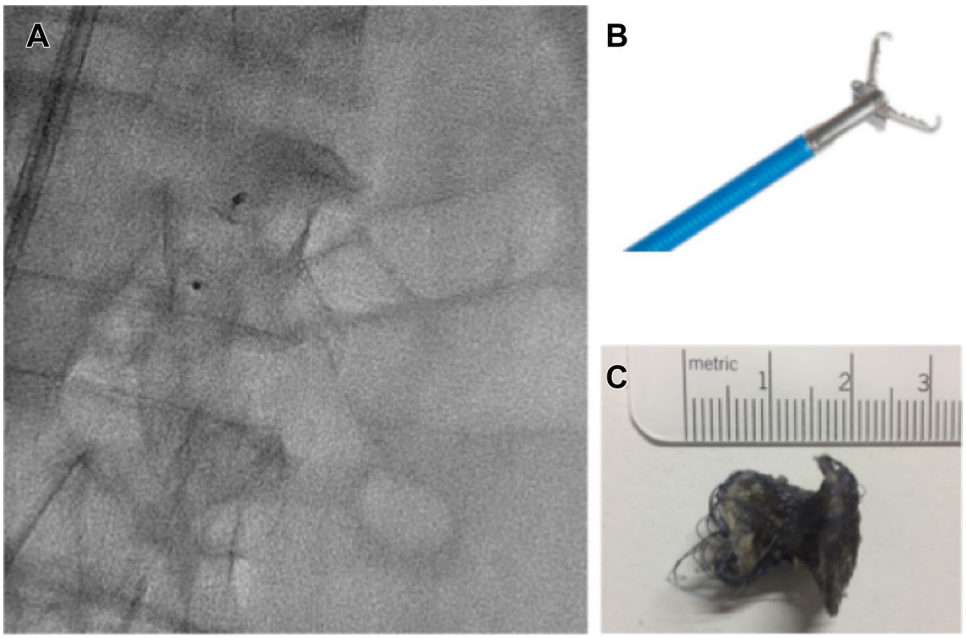

Fig. 2 **a** Fluoroscopic view of the Amplatzer Duct Occluder after embolisation to the descending aorta. **b** Alligator forceps (MTW Endoskopie Manufaktur). **c** Retrieved Amplatzer Duct Occluder via 14F/18F Cook sheath

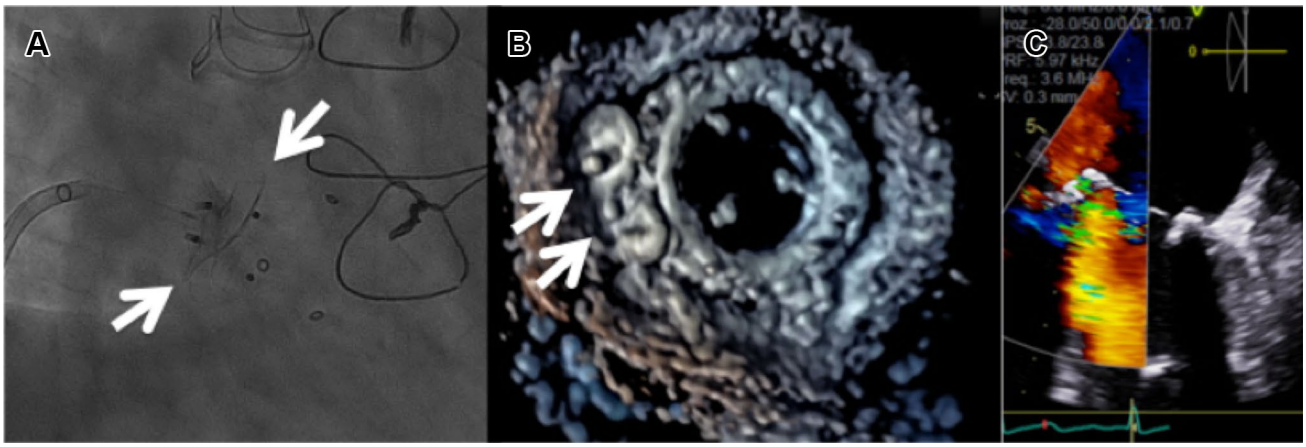

Fig. 3 **a** Fluoroscopic view of the placement of the second Amplatzer Vascular Plug 3 (white arrows indicating both occluders). **b** 3D echo after detaching the second occluder (white arrows indicating both occluders). **c** Color Doppler echo showing a significant reduction of paravalvular leakage

multiple small lesions in cerebellar, frontal and temporo-occipital locations. The neurologic symptoms improved after 2 days. Echocardiographic control revealed a stable result with mild PVL. Hemolysis reduced immediately after intervention, dyspnoea was reduced to NYHA Class II. The patient was discharged home without compromising neurological deficits. In subsequent outpatient controls, the patient described no breathlessness on exertion at all, his quality of life improved tremendously. This result is well in line with published case series of the current literature [3, 4].

In summary, PVL closure with multiple devices is feasible even in large defects. However, a staged procedure does not prevent device dislocation. In case of embolisation, using an alligator forceps in telescopic technique facilitates device retrieval. Care has to be taken to avoid relevant peri-procedural cerebral embolism.

Compliance with ethical standards

Conflict of interest Ingo Dähnert is a proctor for Abbott Amplatzer Occlusion devices.

Informed consent The author/s 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.

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