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Deployed but not irretrievable: A novel surgical off-pump technique for parachute device extraction

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Dear Editor,

Techniques of surgical ventricular reconstruction (SVR) in patients with dilated left ventricles or ventricular aneurysms were initially widely supported, as effective treatments in the advanced stages of heart failure (HF), on the basis of promising early trial data [1]. It was intuitively expected that with surgical LV volume reduction and the correction of maladaptive LV geometric changes, an improvement in cardiac function could be achieved. Despite the initial reported success of these techniques, in recent times there has been considerable debate regarding the optimal surgical technique for this approach and the ideal patients that are likely to benefit [2].

These perpetual challenges, alongside the limited availability of cardiac transplantation, have kindled a considerable interest in the development of percutaneous strategies to treat patients with refractory HF [3]. One such strategy is to partition the akinetic/aneurysmal segment of the left ventricle to enable left ventricular cavity reduction, improved left ventricular geometry and facilitated forward blood flow [4]. The Parachute® device (Cardiokinetix, Inc., Menlo Park, CA) achieves left ventricular restoration by this means and is formed by a foot contacting the LV wall, a nitinol frame and anchoring tines that engage the left ventricular wall to exclude the aneurysmal segment. Suitability and sizing of the device is made by cardiac computed tomography, whilst the delivery of the system to the apex is guided by peri-procedural fluoroscopy and intraprocedural echocardiography. Using this approach, procedural success has been reported to be high with a deployment success rate reported to be in excess of 95% [5].

In the reported case, we present a novel surgical off-pump technique to extract a Parachute device from a patient who developed unheralded chest pain and shortness of breath following implantation. Also, we explore the utility of multimodality imaging in this case and the specific technical considerations required to facilitate a successful extraction.

A 63-year-old man with severe left ventricular systolic dysfunction (EF 25%) and a left ventricular aneurysm secondary to a myocardial infarction in 1998 presented to our heart failure services with deteriorating symptoms. Despite optimal medial therapy, cardiac resynchronisation therapy and coronary revascularisation, he remained in NYHA Class III with an exercise tolerance of 100 yards. The patient was considered a candidate for a Parachute device and was referred for an ECG-gated cardiac computed tomographic (CT) scan. This confirmed Parachute device suitability and provided the required patient specific sizing of the device (Fig. 1).

The Parachute device was implanted under local anaesthesia at the LV apex under fluoroscopic guidance via the right femoral artery without immediate complication. One day later, the patient experienced acute chest pain and worsening shortness of breath. An echocardiogram confirmed suboptimal positioning of the Parachute device with the foot of the device at the mid inferolateral wall with the tines directed towards the anteroseptum. There was restriction of the posterior mitral leaflet and new moderate mitral regurgitation (Fig. 2a–d). A cardiac CT scan confirmed the misalignment by 70°–90° as compared to the original CT core lab report of the device (Fig. 2e–h). Given the patient's symptoms, new mitral regurgitation and potential for further intracardiac damage, a decision was made for Parachute device extraction.

In deciding the optimal strategy for extraction patient specific factors, surgical and anaesthetic risk, and the mechanical properties of the device were considered. Information provided by Cardiokinetix indicated that the majority of prior extractions of the Parachute device

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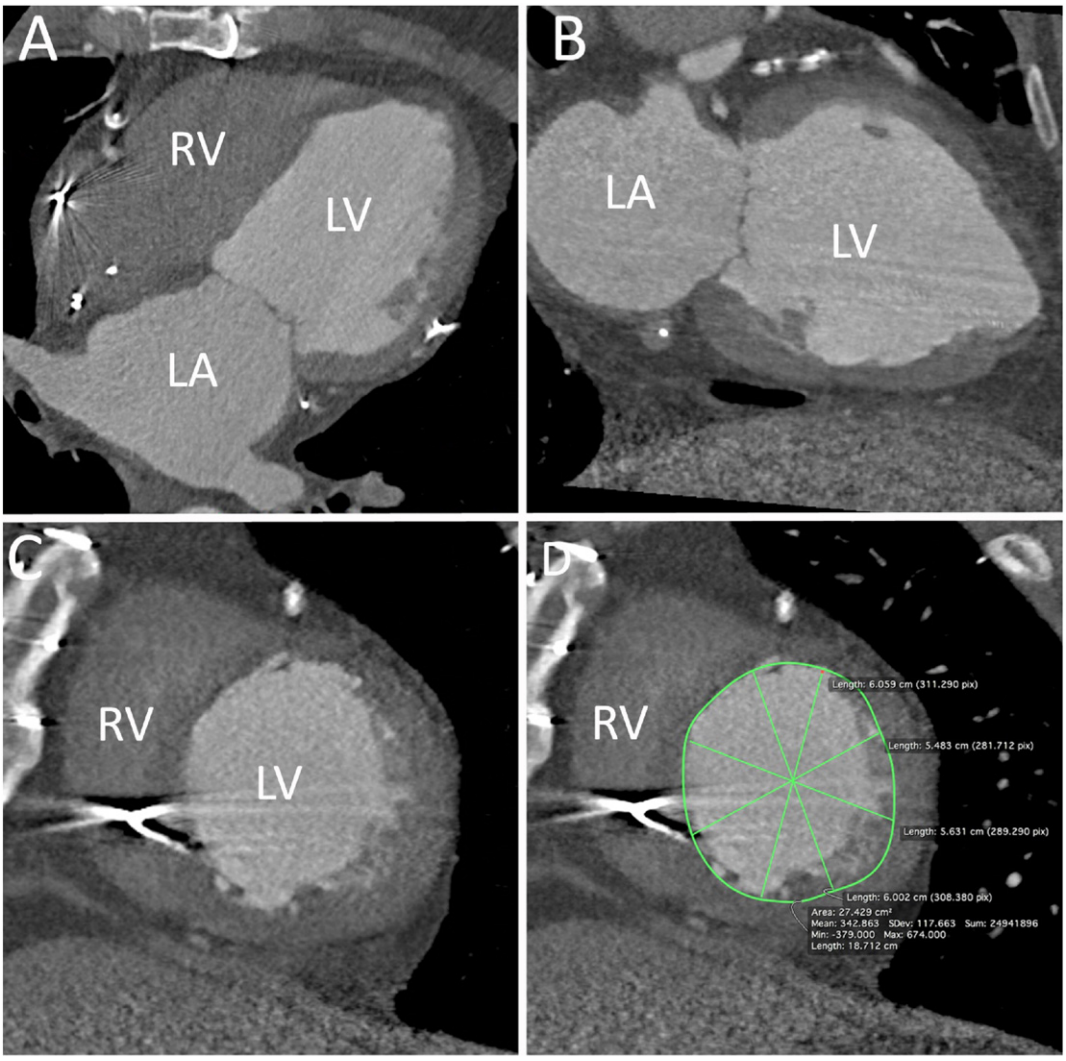

Fig. 1. Multidetector computed tomography pre-parachute device implantation. (A–D) Evaluation of the left ventricle at end systole to determine suitability and sizing for a Parachute device implant. (A) The 4-chamber view, (B) the 2-chamber view with a left ventricular apical aneurysm, (C) the short axis view at the base of the papillary muscles and (D) the measurements made for sizing of a Parachute device. LA denotes left atrium, LV—left ventricle and RV right ventricle.

were to facilitate left ventricular assist device implantation. In these cases, the Parachute device was extracted during general anaesthesia, a mid line sternotomy and a transapical mode of extraction. In the current case, owing to prior coronary artery bypass grafting, a retrosternal mammary artery course and the orientation of the device, this approach was deemed to be not feasible.

The procedure was performed in a hybrid theatre under general anaesthesia with 3D transesophageal echocardiography (3D-TEE)

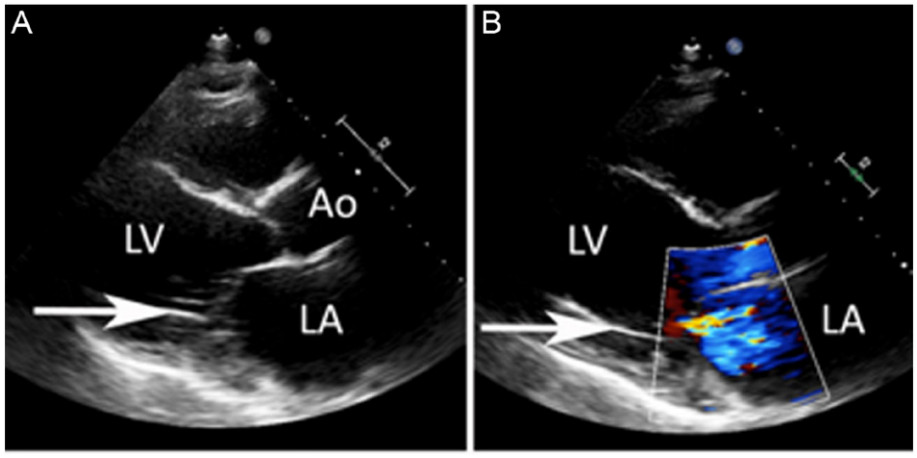

Fig. 2. (1) Transthoracic echocardiogram 2 days following Parachute device implantation. (A) The parasternal long axis view with the tines of the Parachute device impinging upon the posterior mitral valve leaflet (white arrow). (B) A resultant moderate centrally directed jet of mitral regurgitation.