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Letter to the Editor

Partial clip detachment and posterior mitral leaflet perforation after mitraclip implantation

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Dear Editor,

A 64-year-old woman with a history of essential hypertension, left ventricular systolic dysfunction, chronic obstructive pulmonary disease, and recurrent flash pulmonary edema despite adequate pharmacological therapy was admitted to our hospital for acute decompensated heart failure. Transthoracic echocardiography (TTE) showed a reduced left ventricular ejection fraction (36%), severe mitral regurgitation (MR) (effective regurgitant orifice area of 33 mm^2 in mesosystole) and elevated pulmonary artery systolic pressure (55 mmHg). The patient was treated with high-dose intravenous furosemide and non-invasive ventilation. After improvement of her clinical condition, conventional two-dimensional transesophageal echocardiography (TEE) and coronary angiography were planned to establish the etiology of cardiomyopathy and MR, to localize the origin of the regurgitant jet and to assess mitral valve (MV) anatomy. TEE with midesophageal intercommissural (at 60°) and left ventricular outflow tract (at 120°) views revealed a central jet involving the A2-P2 scallops due to symmetric leaflet tethering. The vena contracta was estimated to be 7 mm, and no additional regurgitant jets were visualized. Several parameters that need to be measured for planning MitraClip (MC) (Abbott Vascular, Menlo Park, CA, USA) implantation were also calculated, including tenting area, coaptation depth (11 mm), coaptation length (3.1 mm) and the distance from the fossa ovalis to leaflet coaptation (48 mm). In addition, an estimate of MV area (5.27 cm^2) was obtained from the transgastric view. No significant coronary stenosis was observed on coronary angiography. The patient was judged to have severe functional MR by the local "heart team", including a clinical and interventional cardiologist, an echocardiographer and a cardiac surgeon, and was considered to be amenable to percutaneous treatment because of high surgical risk and patient's preference. After successful transseptal puncture, a MC device was implanted with standard technique under conventional TEE monitoring. The leaflets were grasped by the clip with residual moderate regurgitation. However, given the relatively high transmitral gradient (5.6 mmHg) and the risk for worsening stenosis, a second clip was not implanted. Two months later the patient was readmitted for fatigue and reduced effort tolerance with clinical signs of heart failure. TTE showed recurrence of severe MR due to single leaflet clip attachment to the anterior mitral leaflet (see movies 1 and 2). TEE confirmed partial clip detachment. Additionally, color flow mapping revealed a flow convergence area on the posterior mitral leaflet (Fig. 1), suggesting leaflet perforation that was confirmed by real-time three-dimensional (3D) acquisition (General ElectricVivid E9; GE Vingmed ultrasound —Horten, Norway. Fig. 2; see also movies 3 and 4). Surgical MV replacement was proposed but the patient refused.

Moderate to severe MR is a common finding in patients with congestive heart failure, occurring approximately in one third of cases [1]. According to guideline criteria [2], MV surgery is considered the standard treatment for patients with severe MR. However, almost half of patients with heart failure and severe MR are at high risk and are denied surgery because of coexisting comorbidities, advanced left ventricular systolic dysfunction, or old age [3]. MC implantation has rapidly emerged as an alternative treatment option for patients with severe MR who are not amenable to MV surgery. The Endovascular Valve Edge-to-Edge Repair Study (EVEREST I) was the first clinical trial to enroll predominantly patients with degenerative MR, and demonstrated that MC implantation is safe and feasible, with a significant reduction in MR grade (<2+) observed in 74% of cases [4]. At long-term follow-up, 90.1% of patients were free from death and 76.3% were free from MV surgery; clip detachment was reported in 9% of cases [4]. Of the 32 patients enrolled in the EVEREST II trial undergoing post-clip MV surgery, in 10 cases the indication was partial clip detachment detected procedurally, at discharge, at 30 days and 12 months of follow-up in 3, 1, 5 and 1 patients, respectively [5]. Surgical MV repair or replacement was required in 8 and 2 patients, respectively, but the overall rate of 5% in

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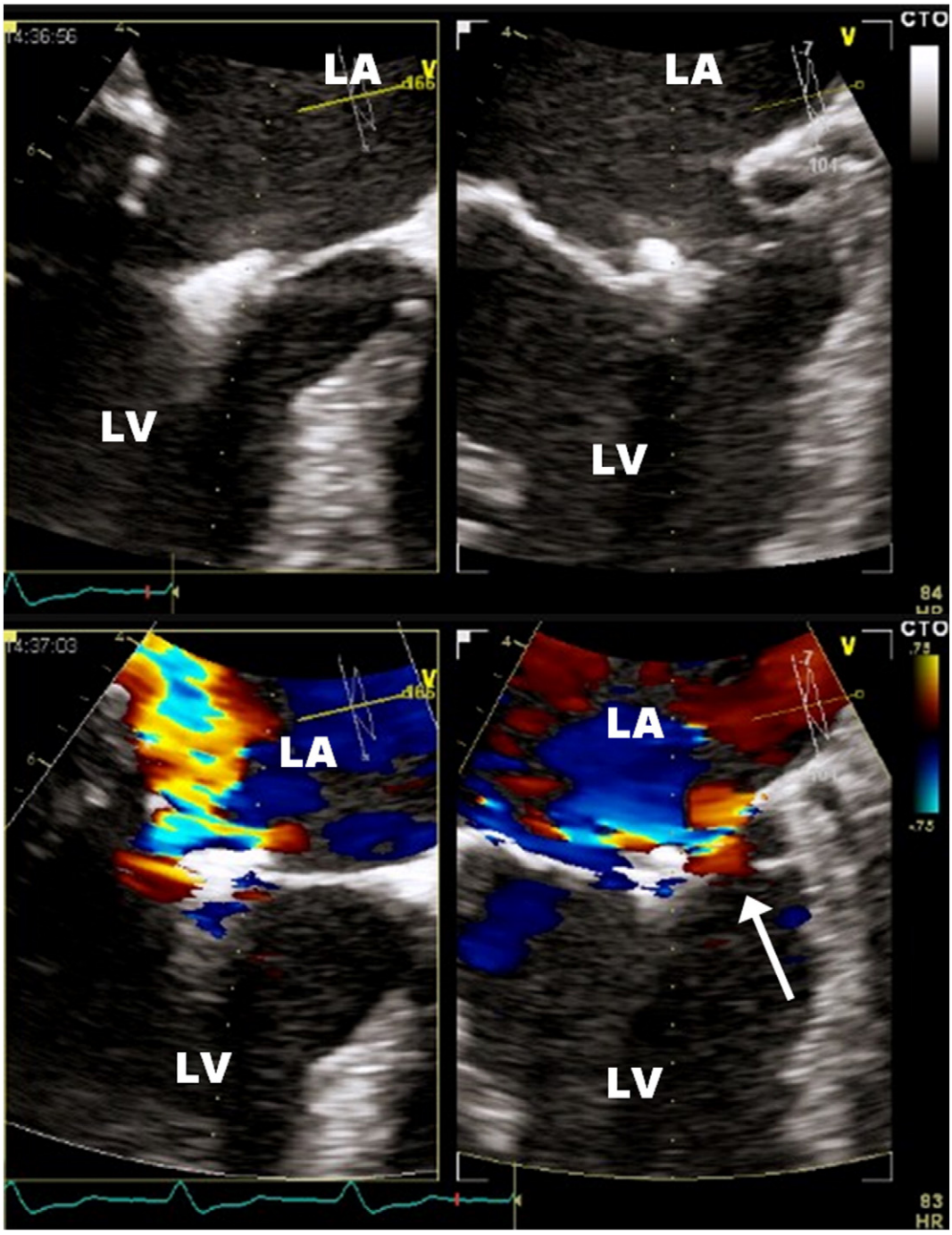

Fig. 1. Upper panels: transesophageal echocardiography (orthogonal view) showing single leaflet attachment of the MitraClip on the anterior mitral leaflet (see dotted arrows). Lower panels: color flow mapping in the same section as the upper panels. A flow convergence area (see solid arrow) can be appreciated in correspondence of the perforation of the posterior mitral leaflet. AML = anterior mitral leaflet; LA = left atrium; and LV = left ventricle.

the EVEREST II trial represents early experience with the novel MC device [6]. Preliminary data from EVEREST II REALISM indicate an even lower rate of single leaflet attachment, probably related to the higher level of procedure experience by individual operators [7].

Rudolph et al. reported clip detachment in 2 of 96 patients as a periprocedural complication that was remedied by placing an additional clip [8]. Recently, Maisano et al. published the one-year follow-up results of the ACCESS-EU prospective multicenter nonrandomized post-approval study that confirmed the efficacy of the procedure in high-risk elderly patients mainly affected by functional MR [9]. Single leaflet MC attachment was reported in 4.8% of cases despite no device embolization.

Braun et al. reported 4 cases of single leaflet device attachment in 47 patients undergoing two-dimensional TEE intraprocedural monitoring and none in 40 patients monitored with 3D TEE [10]. The authors stressed the value of the additional use of 3D acquisition to conventional biplane TEE approach to avoid the occurrence of this complication.

Intraprocedural assessment of device attachment prior to clip release is crucial for achieving both a good immediate goal (i.e., reduced regurgitant volume) and durability of device anchoring. Partial MC detachment is usually due to asymmetric grasping or inadequate leaflet capture within the clip [11]. It is likely that in our case the use of conventional imaging did not allow us to assess clip anchoring adequately. As already emphasized by other authors, 3D TEE has the peculiar ability