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Simultaneous Double Clipping Delivery Guide Strategy for Treatment of Severe Coaptation Failure in Functional Mitral Regurgitation

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We report on a novel treatment strategy using two clip delivery systems (CDS) simultaneously, after double transseptal puncture, for treatment of severe functional mitral regurgitation. Both CDS were used to titrate for an optimal result in a patient with a severe coaptation gap of both mitral leaflets. The patient was successfully treated with two MitraClips. Thus, even a contraindication for MitraClip can be overcome with a more complex double guide intervention.

Keywords MitraClip • Severe mitral regurgitation • Coaptation failure • Transseptal puncture • Simultaneous double clipping approach • Haemodynamics

Introduction

There is intensive debate on whether patients should be treated with the MitraClip device only in accordance with the EVEREST criteria or not [1]. Nevertheless complex anatomies may preclude adherence to the instructions for use (IFU) to obtain procedural success. In this regard, the alternative strategy ''zipping by clipping'' has been proposed for patients with severe functional mitral regurgitation and little coaptation [2]. With this approach, several clips are sequentially implanted, with the first being placed either in the medial or lateral commissure followed by a second or third clip. Having closed the mitral orifice at one side, an improved coaptation of the leaflets within the centre of the mitral valve may facilitate targeting the main area of mitral regurgitation. The major limitation of that approach is the risk of valvular distortion, leading to persistent mitral regurgitation with jet fragmentation after sequential clip deployment. Thus, the simultaneous use of a two-clip delivery system, i.e. double CDS approach (dCDS) might be an appealing concept, since device optimisation can be obtained at all times until the clips are completely deployed. Moreover, this approach gives the operator the possibility to close a severe coaptation gap with sequential closing and opening manoeuvers of both clips. That means, having performed a successful grasp with the first clip (remaining attached to the CDS), the second clip can be placed more easily next to the first clip due to an improved coaptation. Now the first clip can be reopened and a better leaflet insertion can be obtained (''mitral titration''). This manoeuver can be repeated several times until a sufficient result is achieved.

Case report: To prove this concept, a patient with severe functional mitral regurgitation (FMR) was chosen for treatment with the dCDS-approach at our institution.

PMH: A 77 year-old male patient was referred for a MitraClip procedure to our centre. The patient suffered from severe shortness of breath on slight physical exertion (NYHA 3) and he complained about dizziness. Routine transoesophageal examination discovered severe functional mitral regurgitation (see Figure 1), but the anatomy was judged to be too complex for a standard MitraClip procedure. Laboratory testing

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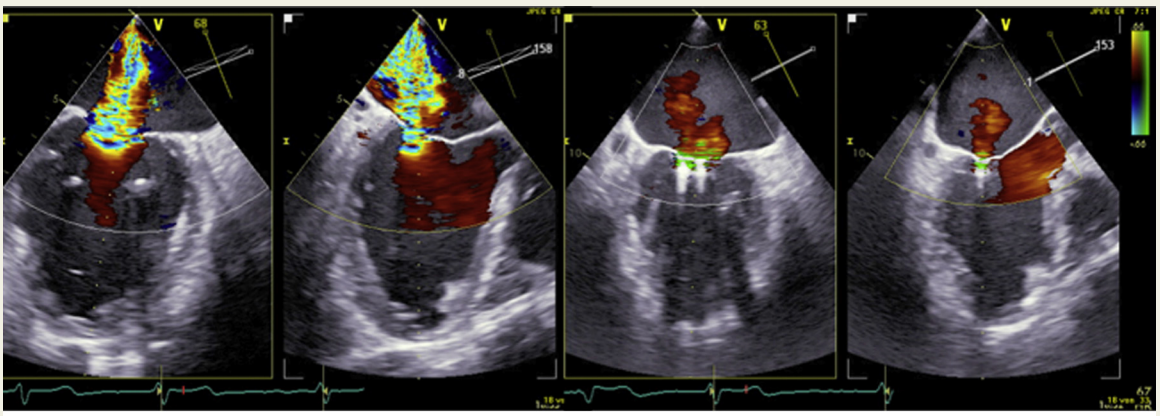

Figure 1 a and b) Transoesophageal echocardiography displaying significant mitral regurgitation before mitral clipping (left panel). After implantation of two MitraClips mitral regurgitation is significantly reduced (right panel).

showed normal troponin levels and a markedly elevated Nt-proBNP. Coronary angiography showed significant coronary three-vessel disease with patent coronary arterial bypass grafts (CABG) to all three coronaries. Due to several comorbidities (COPD, severe pulmonary hypertension, peripheral artery disease, a reduced LVEF of 38%) resulting in a high surgical risk (logEUROscore 39.8%; STS risk of mortality 8.7%) a MitraClip approach was chosen within the HEART team as the preferred treatment option. The patient was scheduled for a MitraClip procedure with the option to use the dCDS-strategy and gave written informed consent for this novel approach. Due to a significant coaptation failure (see Figures 2a and 2b; complete P2 and A2 segment with a coaptation gap of 11 mm, coaptation depth 5 mm) the first puncture was performed in the posterior aspect of the fossa ovale, with an estimated distance of 4.2 cm above the mitral coaptation gap. After administration of 10.000 IU heparin, the first CDS was introduced. The first clip was oriented using 3D TEE to the lateral border of the A2/P2 segment, with precise perpendicularity to the line of coaptation. After two grasps we were able to obtain some insertion of both leaflets inside both clip arms and the clip was almost completely closed. Due to persistent mitral regurgitation we decided to continue with the dCDS-strategy. The second transseptal puncture was performed via a left femoral vein access, slightly anterior to the first puncture site (4.3 cm above the coaptation gap). Subsequently, the second CDS was advanced across the septum, while the first CDS was kept connected to the first MitraClip. Unfortunately, with this anterior puncture we were not able to steer the second CDS to the medial border of the A2/P2 segment of the mitral valve, since the first guide was clearly obstructing the path to that particular mitral location (even after steering the second CDS across the first CDS to the posterior site). Thus, we decided to reopen the first clip and to relocate it to the medial site of the mitral valve. After a successful grasp with the first CDS, we observed some reduction of mitral regurgitation (but far from being acceptable). Following that, the second CDS was placed into the lateral aspect of the A2/P2 segment and with a single grasp, we found a significant reduction of mitral regurgitation (grade 1+). Despite the fact that the 3D-TEE confirmed a broad tissue bridge on both sides of the A2 and P2 segment (see figure 2c), with an insignificant mean transmitral gradient of 3 mmHg (CW-doppler), we decided to reopen the medial MitraClip to obtain a better result. After re-grasping at that particular site, the mitral regurgitation was further reduced (see figure 1b, 3, 4) and both Clips were sequentially deployed. While both guides remained in the left atrium, right heart catheterisation revealed a satisfactory increase in cardiac output (CO before: 3.3 L/min; CO after dCDS: 6.1 L/min) and a dramatic decrease of the left atrial pressure (v-wave before: 48 mmHg; 1 Clip: 29 mmHg; after dCDS: 13 mmHg, see figure 4). The improved haemodynamics was substantiated by a decrease in pulmonary arterial pressure (systolic PAP before: 52 mmHg; systolic PAP after dCSD: 45 mmHg) as well as pulmonary capillary wedge pressure (PCWP before: 25 mmHg; PCWP after dCSD: 19 mmHg). Thereafter, both guides were carefully removed from the left atrium and a significant left-to-right shunt was ruled out (Qp/Qs = 1.13). Both peripheral 24F puncture sites were closed with a Perclose® (Abbott Vascular) and the patient was quickly extubated and transferred to the peripheral ward. The following day, the patient reported an immediate improvement (NYHA class II) and he was discharged at day 3 after the procedure on clopidogrel (75 mg) and aspirin (100 mg) for four weeks. At 30 days follow-up, the patient presented himself in a persistent improved clinical state (NYHA class II) and echocardiography revealed a mild residual MR with a continuously small transmitral gradient (3 mmHg).

Discussion

This is the first report demonstrating the feasibility of a more complex dCDS- based strategy, to treat a patient with severe