Letter to the Editor

Left ventricular partitioning device in a patient with chronic heart failure: Short-term clinical follow-up

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The increase in left ventricular (LV) volume after a myocardial infarction is a component of the remodelling process and is associated with a poor clinical outcome. Hence, the current management strategy for ischemic LV dysfunction has been aimed to reverse the remodelling process (i.e., reduction of LV volume and improved ejection fraction) by medical therapy. Although major breakthroughs have been made in the medical treatment of these patients, the LV remodelling and the syndrome of heart failure continue to progress despite optimal medical therapy. Therefore, a search for therapies with mechanisms of action other than neurohormonal antagonism seems justified.

A novel heart catheter-based procedure has been developed. The Parachute™ Ventricular Partitioning Device (Parachute™) is deployed percutaneously in the left ventricle in patients with antero-apical regional wall motion abnormalities after a myocardial infarction (MI) to partition the ventricle and segregate the dysfunctional region. This technique has been tested in experimental and small pilot studies where the partition the ventricle and segregate the dysfunctional region. This technique has been tested in experimental and small pilot studies where the Parachute™ results were safe and effective in the short term. We present in this case report with 3 and 6 month follow up, Int J Cardiol (2012), doi:10.1016/j.ijcard.2012.06.130

The patient was screened first according to echocardiographic criteria: (I) EF<40%, (II) LV dilatation (LVEDD>56 mm and LVEDS>38 mm), (III) antero-apical regional wall motion abnormalities (akinet/dyskinetic), (IV) LV apex diameter (LVAD) = 4.5×5 cm. Secondly, according to 3D-Cardiac-CT (LV architecture, geometry, and trabeculation).

Echocardiography revealed a dilated LV (65 mm) with antero-apical wall motion abnormalities, no apical thrombus, and calculated LV ejection fraction (EF) of 27% (by Simpson biplane formula). End systolic volume index (ESVI) was 76.8 mL/m². LVAD was (4.5×5 cm) (Fig. 1A). A 3D Cardiac-CT demonstrated an appropriate architecture and geometry with trabeculation of the LV (Fig. 2A). To determine the functional status we assessed NYHA classification and the standard 6 min walk test by two independent and blinded cardiologist before and 3 months after device implantation. Additionally, testing of the change in quality of life was performed using Minnesota Living with Heart Failure Questionnaire. Potential active coronary ischemia was ruled out by coronary angiography.

The first experience in the world with a percutaneous implantation of a short foot Parachute™ was uneventful. The implantation was performed under local anaesthesia via the right femoral artery. The collapsed implant was attached to the delivery catheter, and advanced retrogradely through the guide catheter across the aortic valve and positioned in the LV apex. A echocardiography was performed to assess the appropriate positioning. The device was expanded using compliant balloon dilatation.

A control echocardiography demonstrated that the Parachute™ was positioned at the apex, with no residual leak between the walls of the LV and the device. LV end-diastolic pressure decreased immediately from 16 to 12 mmHg. The total procedure time was 62 min, and fluoroscopy time was 10 min. The post-implantation course was uneventful, and the patient was discharged after 2 days. The patient was discharged on aspirin, fooniprir, carvedilol, hydrochlorothiazide, and simvastatin, with the addition of low-dose warfarin (target international normalized ratio of 2.0) for 3 months.

There was an increase of global LVEF, whereas a decrease of LVEDV and LVESV at 3 and 6 months after the Parachute™ implantation as compared to baseline. Moreover, we found decrease of NYHA class and NT-ProBNP 3 and 6 months after implantation compared to

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Furthermore, a significant improvement of 6 min walk test and quality of life were observed 3 and 6 months after device implantation compared to baseline (Table 1).

On discharge and 3 months after the Parachute™ implantation control echocardiographic and 3D-Cardiac-CT examinations showed that implant was in good position and there was no leakage between static and dynamic LV chamber (Figs. 1A and 2B). ECG at rest, on exercise, and 24-h Holter ECG revealed no rhythm disturbances at any time point. There was no inflammatory response or myocardial reaction (white blood cell count, CRP, CPK) on discharge, and 3–6 months after the Parachute™ implantation. Serum creatinine and blood urea nitrogen did not show changes at 24 h following procedure or at discharge compared to baseline values.

Although several surgical approaches have been advocated in patients with dilated LV, including partial left ventriculectomy (Batista procedure), cardiomyoplasty, and surgical ventricular remodelling (Dor procedure), only the latter is frequently used with acceptable short and long-term effects on mortality and morbidity. Perioperative mortality is still higher than 5%, and the overall 5-year survival is less than 70%.

The Parachute™ is delivered percutaneously from the femoral artery using standard techniques for left heart catheterization without open heart surgery. Pre-clinical studies in an animal model of MI have demonstrated that the Parachute™ implant has beneficial effects on cardiac function [1]. In a recently published clinical pilot study, the implant was successfully implanted in 15 of 18 (83%) patients with significant favourable effect on LV function [2].

In this case report we discuss, for the first time, a screening procedure including echocardiographic and 3D Cardiac-CT, before implantation. The same methodology can be employed at follow-up. We confirm an improvement in LVEF% and clinical status, as proposed by Sagic et al. [2]. Moreover, we report an improvement in quality of life and NT-ProBNP values 3 and 6 months after implantation.

In conclusion, the combination between percutaneous LV volume reduction by the Parachute™ implantation and standard medical therapy may be an important option to consider in the treatment of patients with antero-apical wall motion abnormalities. Moreover, there is a need for adequate screening of potential candidates for the Parachute™ implantation. In this context, specific echocardiographic and 3D-Cardiac-CT criteria may serve as tools for a timely selection of candidates.

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The authors of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology [3].

References


Table 1
Cardiac function, clinical functional status parameters at baseline, 3 and 6 months after Parachute™ implantation.

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<th>Baseline</th>
<th>3 months after Parachute™ implantation</th>
<th>6 months after Parachute™ implantation</th>
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<tbody>
<tr>
<td>LVEF (%)</td>
<td>27</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>LVEDV (ml)</td>
<td>220</td>
<td>190</td>
<td>185</td>
</tr>
<tr>
<td>LVESV (ml)</td>
<td>154</td>
<td>131</td>
<td>132</td>
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<tr>
<td>NYHA classification</td>
<td>III</td>
<td>I-II</td>
<td>I-II</td>
</tr>
<tr>
<td>NT-ProBNP (pg/ml)</td>
<td>850</td>
<td>620</td>
<td>625</td>
</tr>
<tr>
<td>6 min walk test (m)</td>
<td>220</td>
<td>800</td>
<td>980</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>29</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
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Global left ventricular ejection fraction (LVEF), end-diastolic volume (LVEDV), end-systolic volume (LVESV), New York Heart Association (NYHA), N-terminal pro brain natriuretic peptide (NT-ProBNP).

Fig. 2. (A) LV dilatation with antero-apical regional wall motion abnormalities (pre-parachute implantation). (B) Parachute device (post-parachute implantation) in 3D cardiac CT.