Acute Heart Failure after Percutaneous Pulmonary Valve (Melody® Valve) Implantation

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BACKGROUND/METHODS

Percutaneous pulmonary valve implantation (PPVI) using the Melody® valve has recently gained FDA approval for relief of pulmonary conduit regurgitation or stenosis in certain clinical situations. We present a case of a 38 year old male with pre-existing left ventricular (LV) diastolic dysfunction who developed acute heart failure after PPVI for relief of pulmonary conduit stenosis.

Table 1. Hemodynamics before and after PPVI

<table>
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<th>06/2009</th>
<th>08/2010</th>
<th>09/2010</th>
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<tbody>
<tr>
<td>RA mean</td>
<td>10</td>
<td>16</td>
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<tr>
<td>RV systolic</td>
<td>66</td>
<td>69</td>
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<td>RVEDP</td>
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<tr>
<td>PA systolic</td>
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</tr>
<tr>
<td>PA wedge</td>
<td>15</td>
<td>20</td>
<td>--</td>
</tr>
<tr>
<td>LV systolic</td>
<td>109</td>
<td>100</td>
<td>--</td>
</tr>
<tr>
<td>LVEDP</td>
<td>17</td>
<td>26</td>
<td>--</td>
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<tr>
<td>CI</td>
<td>2.4</td>
<td>2.5</td>
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</table>

All pressures are in mmHg. RA = right atrium; RV = right ventricle; EDP = end diastolic pressure; PA = pulmonary artery; LV = left ventricle; CI = cardiac index (L/min/m²).

CASE HISTORY

A 38 year old male with a history of congenital subaortic stenosis status-post Ross procedure presented with right ventricle (RV) to pulmonary artery (PA) conduit obstruction and symptoms of increasing fatigue and dyspnea on exertion. Echocardiogram revealed moderate RV to PA conduit obstruction, with a maximum instantaneous gradient of 58 mmHg and mean gradient of 35 mmHg. There was mild pulmonary regurgitation. Mitral inflow and tissue Doppler velocities suggested severely elevated LV filling pressure.

INTERVENTION

Hemodynamic measurements prior to valve implantation showed an RV to PA peak systolic gradient of 39 mmHg. RV end diastolic pressure was 20 mmHg; LV end-diastolic pressure was 26 mmHg. Coronary angiography performed with high-pressure balloon dilation of the conduit showed no coronary artery compression. The Melody® valve (Medtronic, Minneapolis, MN) was implanted and dilated to 22 mm. Subsequent RV to PA peak systolic gradient was 17 mmHg (Table 1).

RE-ADMISSION

Three weeks later, he was re-admitted with progressive symptoms of dyspnea and tachycardia. Exam findings included crackles at the lung bases, increased jugular venous distention, hepatomegaly and lower extremity edema. Chest x-ray showed bilateral pleural effusions and pulmonary edema. Echocardiogram showed only a mild gradient across the Melody® valve.

Coronary compression was suggested by CT angiography (Figure 1), but ruled out by selective coronary angiography (Figure 2). However, LV end diastolic pressure measured at the time of coronary angiography was 45 mmHg (Table 1).

After aggressive diuresis his symptoms improved. At latest follow up, he was being treated with afterload reduction and high doses of diuretic as an outpatient for persistent symptoms.

DISCUSSION

This case illustrates a previously unreported side effect of Melody® valve placement—acute elevation in left ventricular filling pressure due to increased LV preload in a patient with pre-existing diastolic dysfunction. We suggest that the relief of RV outflow tract obstruction and competency of the pulmonary valve improved right heart output sufficiently to provide increased pulmonary venous return and increased LV preload. Such a physiologic mechanism is similar to the increased LV preload experienced after secondum atrial septal defect closure, which has been reported in conjunction with left heart failure and increased LV filling pressure.

CONCLUSIONS

1. Relief of RV outflow obstruction with percutaneous pulmonary valve implantation increases left ventricular preload
2. Individuals with abnormal LV diastolic filling and RV outflow obstruction may be at risk of diastolic heart failure after relief of RV outflow obstruction.

REFERENCES


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