Case Report

Balloon aortic valvotomy in pregnancy

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Introduction

Severe aortic stenosis in pregnancy has been known to have a high maternal and perinatal mortality, documented at 17 and 32%, respectively, in 1978. More recent reviews still indicate significant maternal morbidity and unfavourable fetal outcomes. Severe aortic stenosis with or without symptoms leads the table of ‘high maternal and fetal risk’ in valvular heart disease in pregnancy. We report the case of a woman with congenital aortic valve stenosis from a progressively stenotic congenital bicuspid aortic valve, successfully treated by balloon aortic valvotomy at the beginning of the second trimester.

Case report

A 36-year-old primigravida who had been working and studying overseas returned when she was 12 weeks pregnant. She was reassessed in the cardiology unit where she had been followed since the age of 8 years for a mildly stenotic congenital bicuspid aortic valve. The mean pressure gradient across the aortic valve on Doppler echocardiography measurements had ranged from 21 to 36 mmHg pressure up to the age of 33 years when she went overseas. Because the stenosis was only mild to moderate in severity, no intervention had been indicated and the patient was followed annually. On the last review, when the gradient was 36 mmHg pressure, possible pregnancy was discussed. Reassessment was advised before pregnancy was considered.

However, the patient returned 3 years later, in the first trimester of pregnancy, and was dyspnoeic. Her echocardiogram showed the bicuspid aortic valve domed in systole and there was thickening of the right coronary cusp. The peak gradient across the valve was 78 mmHg pressure with a mean gradient of 51 mmHg. The aortic valve area was 0.9 cm² and the indexed area was 0.57 cm²/m², indicating severe aortic stenosis. The ascending aorta was dilated and left ventricular contractility was vigorous with an ejection fraction of 64%. The left ventricular walls were not hypertrophied, with the interventricular septum measuring 9 mm and the posterior wall 8 mm.

It was considered that the patient would not tolerate pregnancy well with these haemodynamics and surgical valvotomy was discussed. Because cardiac surgery is known to carry a high risk to the fetus, the alternative balloon catheter aortic valvuloplasty was then scheduled. It was performed at 13 weeks gestation.

A lead apron was placed over the mother’s abdomen to shield the baby from radiation and a percutaneous approach via the right femoral artery was made. The aortic valve was difficult to cross retrogradely because the orifice of the bicuspid valve was eccentric as well as stenotic. When it was crossed with a guide wire, a 20 mm Cribier-Letac (Boston Scientific) balloon catheter was placed across the valve. However, there were concerns that the balloon was sitting distally in the mitral valve apparatus. If the balloon was inflated in that position, it could result in mitral valve rupture. An echocardiogram obtained in the catheter theatre confirmed mitral entrapment (Fig. 1) and the wire and balloon catheter were repositioned safely. Two sequential inflations of the balloon were successful in reducing the catheter measured peak gradient from 50 to 20 mmHg pressure. The mean gradient fell from 40 to 17 mmHg pressure. Total screening time was longer than anticipated at 53 min, with dose-area product (DAP) of 39.6 Gycm², but safety was ensured with correct positioning.

A follow-up echocardiogram showed the aortic valve area of 1.2 cm² with moderate aortic incompetence. At 20 weeks gestation, the patient left for France to be with her partner. In Paris, labour was induced at 39 weeks gestation. However, fetal heart rate decelerations occurred after contractions and she was delivered by caesarean section. The baby boy had the cord around his neck, but was normal and weighed 2.9 kg. After delivery, the mother developed pulmonary oedema, which resolved with intravenous diuretic therapy. Aortic valve replacement has been advised.

Discussion

Aortic stenosis is a dangerous cardiac lesion in pregnancy. Although the mother may be well compensated before conception, the increasing cardiac output through a fixed obstructive lesion often leads to serious compromise. Fortunately,

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severe aortic valve stenosis is uncommon in pregnancy because the congenital type has a male predominance and is usually treated in childhood. The rheumatic form is becoming less common and is also unusual in child-bearing years.4

When symptoms develop or when echocardiography indicates a significant lesion, intervention is required. Aortic valve replacement using cardiopulmonary bypass has a high incidence of fetal loss, which is still around 19%.5 Usually, the aim is to progress the pregnancy to a stage where the baby can be delivered prematurely by Caesarean section as the mother goes under anaesthesia for cardiopulmonary bypass and aortic valve replacement.

If symptoms and decompensation begin in early pregnancy, they will only worsen with the normal increasing cardiac output of pregnancy, putting the mother’s life at risk. Therefore, the alternative intervention is balloon aortic valvotomy. This was first reported during pregnancy in 19886 and there has been limited published experience since that time with a few case reports8–11 (Table 1). There have been no fetal deaths in these selected cases.

The concern with such a cardiac catheter procedure is the risk of radiation to the fetus and the long-term risk of genetic damage or cancer. These risks are small, but have to be balanced against the alternative larger risk to the mother and fetus.12

The present patient had added technical challenges that did prolong the exposure to radiation. Her bicuspid aortic valve opened eccentrically and was difficult to cross retrogradely with a guide wire. When it was crossed, the wire and balloon catheter were directed preferentially to a position that resulted in entanglement in the mitral valve apparatus. This was proven by echocardiography in the catheter theatre. It has been reported previously that when a balloon was inflated in such a case, it caused rupture of the mitral valve attachments, leading to acute mitral regurgitation and the need for emergency mitral valve replacement.13 This complication was avoided in the present patient at the expense of fluoroscopy time to get the position correct. The use of echocardiography did improve safety and reduce fluoroscopy.

Previous reports have given variable modes of delivery after balloon valvuloplasty, including vaginal, forceps and Caesarean section. Our patient’s Caesarean section was related to fetal distress, but the mother did develop pulmonary oedema.

Balloon valvotomy must still be regarded as a palliative procedure. It is indicated in adults with senile calcific aortic stenosis who are not candidates for surgical replacement. It may also be considered as a ‘bridge to surgery’ in selected patients, such as those with cardiogenic shock or those who require emergency non-cardiac surgery.14 In children, it is useful in gaining years of growth and development before an eventual aortic valve replacement. Our patient was advised to undergo valvular replacement because of post-partum pulmonary oedema and aortic incompetence in a calcified aortic valve. However, the procedure of balloon aortic valvotomy did allow a satisfactory pregnancy with a safe delivery of the infant. Therefore, there is still an indication for this procedure in pregnancy.15

Table 1 Reported cases of balloon aortic valvotomy in pregnancy

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age (years)</th>
<th>Mother Cause of aortic stenosis</th>
<th>Gestation (weeks)</th>
<th>Cardiac catheter Gradient (mmHg)</th>
<th>X-ray time (min)</th>
<th>Gestation (weeks)</th>
<th>Delivery Method</th>
<th>Birth weight (kg)</th>
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<tbody>
<tr>
<td>McIvor6</td>
<td>19</td>
<td>Congenital</td>
<td>14</td>
<td>64→32</td>
<td>29</td>
<td>39</td>
<td>Vaginal</td>
<td>2.9</td>
</tr>
<tr>
<td>Angel et al.7</td>
<td>17</td>
<td>Congenital</td>
<td>20</td>
<td>133→68</td>
<td>20</td>
<td>40</td>
<td>Forceps</td>
<td>3.5</td>
</tr>
<tr>
<td>Savas et al.8</td>
<td>22</td>
<td>Rheumatic</td>
<td>22</td>
<td>45→22</td>
<td>46 (triple valve)</td>
<td>36</td>
<td>Vaginal</td>
<td>N/A</td>
</tr>
<tr>
<td>Banning et al.9</td>
<td>26</td>
<td>Congenital</td>
<td>14</td>
<td>128→50</td>
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<td>41</td>
<td>Caesarean</td>
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<tr>
<td>Banning et al.9</td>
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<td>Congenital</td>
<td>16</td>
<td>123→60</td>
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<td>36</td>
<td>Caesarean</td>
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<td>Lao et al.10</td>
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<td>16</td>
<td>122→42</td>
<td>N/A</td>
<td>38</td>
<td>Forceps</td>
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<td>Rheumatic</td>
<td>26</td>
<td>145→41</td>
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<td>38</td>
<td>Vaginal</td>
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<td>Present study</td>
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<td>13</td>
<td>50→20</td>
<td>53</td>
<td>39</td>
<td>Caesarean</td>
<td>2.9</td>
</tr>
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References