Reoperation for Prosthetic Valve Endocarditis in the Third Trimester of Pregnancy

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A pregnant 29-year-old woman underwent emergency aortic valve re-replacement for prosthetic valve endocarditis. Cesarean section was performed with the chest open ready for cannulation. Fears of uterine hemorrhage during systemic heparinization for cardiopulmonary bypass were unfounded, and both mother and the 28-week-gestation newborn recovered uneventfully. (Ann Thorac Surg 1992;53:263-5)

Surgical intervention for prosthetic valve endocarditis during pregnancy is complicated by the risks of cardiopulmonary bypass to the fetus as well as the technical problems of increased vascularity, bleeding tendencies, and the difficulties of reoperation through pericardial adhesions. Further, for prosthetic aortic valve replacement, sepsis or aneurysm formation in the annulus may necessitate prolonged manipulation to acquire secure valve implantation. A protracted operation is more likely to result in premature labor or fetal death even when full precautions are taken, including elevation of the right flank to displace the uterus from the inferior vena cava. Nowadays a fetus of 28 weeks' gestation has a good chance of survival. Open cardiac operation in the third trimester might therefore be best managed by cesarean section followed immediately by cardiac operation using conventional techniques without time constraint. The outstanding consideration is whether cardiopulmonary bypass can be carried out safely without uncontrollable bleeding from the uterine bed. We present a case report that illustrates our approach to the problem and review the literature relevant to cardiopulmonary bypass during pregnancy.

Case Report

A 26-year-old woman who had previously had three successful pregnancies despite critical aortic stenosis was referred for aortic valve replacement. A heavily calcified bicuspid valve was excised and replaced with a 23-mm Carpentier-Edwards porcine xenograft. The biological valve was used because she was to remarry and, despite advice to the contrary, wanted more children. Anticoagulants were therefore contraindicated. She was not an intravenous drug abuser.

Three years later and 24 weeks into her fourth pregnancy, the patient had malaise, fatigue, night sweats, and hematuria after dental treatment without antibiotic prophylaxis. Her condition worsened despite antibiotic treatment, and at 26 weeks she was admitted to the hospital. A new soft ejection systolic murmur was detected, and splinter hemorrhages were seen in the toes of the left foot. Blood cultures grew Streptococcus sanguis sensitive to gentamicin sulfate and benzylpenicillin, and these were prescribed directly. Two-dimensional echocardiography showed prolific vegetations, particularly on the ventricular side of the aortic prosthesis. One of them prolapsed into the valve ring during systole and partially obstructed its orifice. An outflow gradient of 140 mm Hg was recorded by Doppler echocardiography during systole, but there was no aortic regurgitation.

The management of this patient stimulated considerable debate among the cardiology, cardiac surgical, obstetric, and pediatric teams. The risks to be considered were coronary or cerebral embolism from the infected prosthesis versus loss of the child during a potentially difficult valve re-replacement or after cesarean section at 26 weeks. Fetal survival was considered secure if delivery could be postponed until 28 weeks, and accordingly, medical management with antibiotics and close observation by serial electrocardiograms and echocardiograms was undertaken for a further 2 weeks.

At 28 weeks the patient was taken to the operating theater for cesarean section, which was to be followed directly by aortic valve replacement. The patient was anesthetized and positioned supine on the operating table but with the right flank elevated to displace the uterus from the inferior vena cava. As rapid sternotomy through previous adhesions would prove difficult in the event of acute deterioration, the mediastinal reentry was undertaken first. The pericardial adhesions over the anterior surface of the heart were cleared so that pursestrings could be inserted into the aorta and right atrium in preparation for bypass.

At this stage, a routine and uneventful lower-segment cesarean section was performed, delivering a live male infant weighing 1.3 kg. The uterus was closed in two layers, with great care taken to achieve full hemostasis. Sterilization was carried out by tubal ligation, and ergonovine (ergometrine) was administered systemically. The abdominal wound was left open in case of hemorrhage during full heparinization and cardiopulmonary bypass with muscle relaxants.

Cardiopulmonary bypass was established with systemic cooling to 32°C. As soon as perfusion was started,
500 closed mitral valvotomies as early as 1965 showed a

Table 1 summarizes the reported experience of open

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Patients</th>
<th>Indication for Operation</th>
<th>Maternal Deaths</th>
<th>Fetal Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open mitral commissurotomy</td>
<td>33</td>
<td>CHF, 27*</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mitral valve replacement</td>
<td>29</td>
<td>CHF, 21; endocarditis, 1; thrombosed prosthesis, 7</td>
<td>1</td>
<td>6</td>
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<tr>
<td>Aortic valve replacement</td>
<td>15</td>
<td>Aortic stenosis, 9, endocarditis, 6</td>
<td>0</td>
<td>5</td>
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<tr>
<td>Pulmonary embolectomy</td>
<td>4</td>
<td>Shock, 4</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Closure of ASD or VSD</td>
<td>22</td>
<td>CHF, 8*</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Coronary bypass</td>
<td>4</td>
<td>Unstable angina, 4</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Myxoma removal</td>
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<tr>
<td>Repair of thoracic aorta</td>
<td>3</td>
<td>Leaking/ruptured aneurysm, 3</td>
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<td>0</td>
</tr>
<tr>
<td>Tetralogy of Fallot</td>
<td>1</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td></td>
<td>2 (1.7%)</td>
<td>20 (17.4%)</td>
</tr>
</tbody>
</table>

* Data in literature were incomplete.

ASD = atrial septal defect; CHF = congestive heart failure; VSD = ventricular septal defect.

the aortic cross-clamp was applied so that further manipulation would not disseminate fragile vegetations. The aortic root was opened and 1 L of cold potassium cardioplegia delivered directly into the coronary ostia. Inspection of the valve prosthesis showed it to be grossly infected, and on its removal from the annulus, the left ventricular outflow tract was found to be packed with vegetations. There was a subannular aortic root abscess between the left and right coronary cusps. All infected material was removed, and the valve was replaced with a size 11A Starr-Edwards prosthesis.

After systemic rewarming and reperfusion, the heart reverted to sinus rhythm spontaneously, and cardiopulmonary bypass was discontinued without difficulty. Thoracic and abdominal wounds were closed directly after heparin sodium reversal. The mother was transferred to the cardiac recovery area and extubated 1 hour later. She completed a course of antibiotics in the hospital over the next 4 weeks. The infant was transferred to the special-care baby unit and made satisfactory progress.

One year later, both mother and infant are in good health.

Comment

Table 1 summarizes the reported experience of open cardiac operations in pregnant patients. There have been many reports of fetal survival to term after cardiopulmonary bypass in the second and third trimesters of pregnancy [1]. It is generally accepted that closed mitral valvotomy and open heart procedures using cardiopulmonary bypass can be performed with very low risk to the mother. Collective reported experience [2–7] of more than 500 closed mitral valvotomies as early as 1965 showed a maternal mortality rate of less than 2% and a fetal mortality rate of less than 10%. Maternal mortality does not differ from that expected in the overall population according to the type of surgical procedure performed, and hence pregnancy should not influence the outcome in female patients requiring cardiac procedures. The review by Becker [8] of the experience of members of The Society of Thoracic Surgeons revealed only 1 maternal death in 68 operations with cardiopulmonary bypass, and that death occurred late and was due to hepatitis.

There have been no comprehensive experimental studies of the effects of cardiopulmonary bypass on the fetus. Theoretically, nonpulsatile perfusion, hyperoxygenation, heparinization, and prolonged hypotension could adversely affect both placenta and fetus. Fetal heart monitoring has shown dysrhythmias and bradycardia during perfusion [9]. Bradycardia occurs at the onset of bypass, a finding suggesting it is possibly related to hypothermia [9], and can be eliminated by an increase in perfusion rate. Thus high flow rates together with normothermic perfusion have reduced fetal risk during bypass. Intraoperative uterine monitoring shows the rewarming phase of bypass may promote uterine contractions and premature labor, particularly in mothers with advanced gestational age (between 26 and 35 weeks of pregnancy). These can be controlled by pharmacological inhibition, and this has been used successfully in 1 patient who went into labor during bypass [10].

Although case reports and collective reviews suggest that fetal mortality has become progressively less likely during cardiopulmonary bypass, prolonged valve operations still carry considerable risk. We have had experience with an intrauterine death during aortic valve replacement in a patient in the third trimester, despite the use of normothermic pulsatile perfusion with high flow rates in an attempt to preserve the fetus. Subsequent spontaneous abortion with profound hemorrhage also endangered the life of the mother. This adverse outcome was not reported, and the predominance of successful cases in the literature may reflect a general tendency not to report unsuccessful efforts.

When urgent open cardiac operation is required during
the first or second trimester, there is little option other than to try to preserve the fetus. We have found no relationship between gestational age and mortality in reported cases, but congenital malformations were found at delivery in 3 infants whose mothers had undergone cardiopulmonary bypass during the first trimester. The optimum time for elective cardiac operation, however, is certainly outside of pregnancy, and we now consider it safer to deliver a fetus at 28 weeks or more rather than to risk bypass. Unlike 10 years ago, today neonatal pediatric intensive care is highly sophisticated, and the majority of these infants can be expected to survive.

Our literature search showed the fetal death rate was 17.4% for cases involving cardiopulmonary bypass (see Table 1). There were 6 fetal deaths among 29 patients who underwent mitral valve replacement during pregnancy. Of particular interest was thrombosis of mechanical mitral prostheses, which may follow a change in anticoagulant therapy from warfarin sodium to heparin sodium. Of 7 patients with valve thrombosis, 4 continued pregnancies to term after replacement, though 1 surviving infant had mild hydrocephalus. One fetus spontaneously aborted 3 days after operation, and 2 patients with a pregnancy of more than 35 weeks required urgent cesarean section, secondary to hemodynamic deterioration in the mother with fetal distress. The delivery was carried out before valve replacement in 1 patient and intraoperatively in the second; both infants survived. In another patient operated on for complications of mitral valve endocarditis, spontaneous abortion with fetal death occurred during the first postoperative day.

Aortic valve replacement also carries a major risk for the fetus. Of 9 patients requiring elective valve replacement for critical aortic stenosis, only 5 continued their pregnancy to term. As with our unpublished case, spontaneous abortion occurred within 3 days of operation in the other 4. Six patients underwent valve replacement for complications of native aortic valve endocarditis. One patient, whose term was unspecified but who was late in the third trimester, underwent cesarean section before valve replacement, and both mother and infant survived. There was 1 fetal death in the remaining 5 patients.

Infective endocarditis in itself does not appear to adversely affect the fetus. We know of 1 other patient who underwent cesarean section at 36 weeks' gestation before cardiopulmonary bypass for endocarditis (personal communication). The mother was in cardiogenic shock with a thrombosed and infected mitral disc valve, but both mother and infant survived.

The principle concern in the case of our patient was the potential for uterine hemorrhage during cardiopulmonary bypass after the cesarean section had been performed. There is little recorded experience with cesarean section in the peribypass state. Martin and associates [11] performed cesarean section for fetal distress during cardiopulmonary bypass with survival of both mother and child. We had intended to pursue this course in our patient whose fetus died but were misled by the intraoperative fetal monitoring.

Our experience, reinforced by these additional cases, leads us to conclude that for pregnancies of 28 weeks or more, cesarean section can be undertaken safely before bypass without risk of subsequent uterine hemorrhage. This seems preferable to attempting to preserve the fetus during bypass in the face of a reported fetal mortality rate of 17.4%, and we believe this option should be taken in preference to exposing the fetus to the risks of cardiopulmonary bypass.

References