Emergency Redo Mitral Valve Replacement in a Pregnant Woman at Third Trimester — Case Report and Literature Review —

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Pregnancy carries significant physiological changes that demand more cardiac output, so structural cardiac disease can cause life-threatening complications. A woman had rheumatic mitral stenosis and underwent mitral valve replacement (MVR) with bioprosthesis 8 years prior to admission. She presented with dyspnea and leg edema at 30 weeks of gestation. Severe mitral stenosis caused by xenograft failure was noted on echocardiography. Management was conservative until a sudden onset of hemodynamic compromise requiring emergency redo MVR under normothermic cardiopulmonary bypass with intra-aortic balloon pump. Monitoring of fetal heartbeat and uterine contractions showed no significant abnormalities and the woman gave birth to a full-term baby by Cesarean section with postoperative warfarin therapy. (Circ J 2008; 72: 1715–1717)

Key Words: Bioprosthesis; Cardiopulmonary bypass; Intra-aortic balloon pump; Pregnancy; Redo mitral surgery

Cardiac disease can affect any age group, but because of the increased workload of cardiovascular system, women of gestational age are at risk of deterioration of structural heart diseases. Although cardiac operations in pregnancy have been successfully performed, most physicians and patients prefer to be conservative to avoid uncertain maternal or fetal risks. Urgent or emergency cardiac surgery is sometimes inevitable. We present a case of pregnancy complicated by bioprosthesis failure.

Case Report

A 34-year-old woman with a history of rheumatic heart disease had undergone mitral valve replacement (MVR) with a xenograft 8 years prior to the present admission. She had become pregnant without medical consultation in advance. Echocardiography in the first trimester revealed a normal bioprosthesis and good left ventricular function, but after 20 weeks of gestation she developed progressive shortness of breath. Mitral stenosis with a mitral valve area of 1.2 cm² was noted. Diuretics and digitalis were given, but bilateral pleural effusion developed at 30 weeks of gestation and she was admitted for management of congestive heart failure. Complete bed rest and intensive monitoring of hemodynamics and fetal heart beats were prescribed. However, she experienced sudden onset diaphoresis, loss of consciousness, and hypotension after an episode of tachycardia. Endotracheal intubation was performed for cardiogenic shock and respiratory failure. After informed consent was obtained, emergency redo MVR with a mechanical prosthesis (St Jude HP 29-mm) was performed. There were severe sclerotic changes of the 3 leaflets of the xenograft with limited opening (Fig 1). In order to maintain pulsatile blood flow, an intra-aortic balloon pump (IABP) was used during cardiopulmonary bypass (CPB). Fetal cardiac activity was monitored with an external ultrasound transducer and uterine contraction was also monitored. Episodes of transient bradycardia resolved after increasing the CPB flow. The CPB and cross-clamp times were 81 min and 33 min, respectively. Flow during normothermic CPB ranged from 2.4 to 2.6 L·min⁻¹·m⁻². The patient tolerated the procedure well and was discharged 12 days after the operation. She subsequently gave birth to a full-term baby at 37 weeks of gestation by Cesarean section. Both the mother and child were doing well 4 years after the operation.

Discussion

Pregnancy significantly increases the cardiac workload and carries risks for women with severe structural heart diseases. Till now, there has been a substantial risk of fetal death if cardiac operation under CPB is required, so open heart surgery during pregnancy has been advised only in extreme conditions. Emergency and redo operations carry significant surgical risks even under mechanical circulatory support. CPB is associated with a maternal mortality rate of 3–15% which is similar to that of the nonpregnant female. However, fetal mortality remains at 20–33%, with an average of 19% over the past 25 years.¹–³ The feto-maternal outcome varies according to the timing of operation, gestational age, maternal status, type of procedure, perfusion protocol, and pharmaceutical therapy.⁴ The use of vasoactive drugs,
age, kind of surgery, reoperation, and functional class play a role in maternal mortality. Similarly, maternal age more than 35 years, functional class, reoperation, emergency surgery, type of myocardial protection, and ischemic time contributed to fetal death.6,5

Perioperative management of pregnant women for cardiac surgery and CPB should take the well-being of both mother and fetus into consideration. CPB during pregnancy has been studied for years. Assad et al conducted an animal experiment and concluded that decreased placental flow and pressure with CPB may result in impaired placental perfusion and respiratory gas exchange, which were worsened by hypothermia.7 Pomini et al8 reviewed 69 reports of cardiac operations during pregnancy from 1958 to 1992. Embryofetal mortality was 24% and 0% in the hypothermic and normothermic groups, respectively, and pump flow and mean arterial pressure during CPB seemed to be the most important factors influencing fetal oxygenation. However, a recent study by Pardi et al showed that deep hypothermic CPB in pregnant ewes was associated with irreversible changes in fetal cardiovascular parameters, blood gases, and acid–base balance and, therefore, with fetal survival.9 Sakagushi et al reported their surgery for acute type A aortic dissection in 4 pregnant patients with Marfan syndrome. Three had live births before undergoing deep hypothermic circulatory arrest, but the other patient who underwent surgical correction with the fetus in utero had a miscarriage.10 However, successful use of deep hypothermic circulatory arrest in pregnancy has been reported for a woman at 21 weeks of gestation who had a ruptured aortic arch aneurysm. Both the mother and fetus survived, and a normal baby was delivered at the 39th week of gestation.11

Fetal circulation during CPB has not been well elucidated. High-flow, high-pressure, normothermic CPB for the shortest time possible is best for maintaining placental autoregulation. Champsaur et al12 report that pulsatile flow for 30 min of CPB in a fetal lamb preparation temporarily prevented the progressive hypoxemia observed under steady-flow bypass. Individual organ blood flow, including that of the placenta, was significantly higher under pulsatile bypass. Pulsatility may become a valuable adjunct to overcoming placental dysfunction observed during experimental fetal cardiac surgery. Nonpulsatile CPB may not be able to meet the demands of the fetoplacental circulation because of the alteration in uterine artery flow velocity13 whereas there has been successful use of pulsatile perfusion in cardiac surgery during pregnancy14 which was the reason for our choice of this in the present case. Wilcox et al15 reported their experience of using IABP with CPB in 2 gravid patients. In the first case, the IABP was inserted in an attempt to improve uterine perfusion and relieve a profound fetal bradycardia. In the second case, IABP was used electively to provide pulsatile flow. Both cases had good outcomes. Therefore, we used IABP in advance to improve the fetal outcome in the patient presented here.

In addition to refining the CPB strategy, fetal heart rate monitoring is essential for early detection and management. Bradycardia is the most frequent fetal response to CPB, most likely because of hypoperfusion, and is usually reversible by increasing the perfusion. Uterine contraction monitoring is also essential for early control because contractions are associated with significant fetal loss.2

Bioprosthetic valves are usually considered the most suitable devices for using in women of childbearing age because anticoagulants can be avoided, although it was considered that pregnancy might favor calcification of porcine xenografts, leading to bioprosthetic failure.16,17 However, recent evidence shows that it does not increase structural deterioration or reduce the survival of bioprosthetic valves.20,21

For women in the third trimester to have cardiac operations, emergency Cesarean section is advocated because the estimated fetal risks are high during CPB. Emergency valve replacement immediately following Cesarean section has been reported.18,19 Some less invasive interventions have been successful in pregnant women with severe heart disease; for example, percutaneous transluminal balloon dilatation of the native mitral valve stenosis is a safe and effective alternative to mitral surgery in pregnancy.22 Thrombolytic therapy with streptokinase for prosthetic valve thrombosis during the first trimester in a pregnant woman resulted in the delivery of a normal healthy child at 9 months’ gestation.23 Nevertheless, surgical replacement is still the only effective way of treating xenograft failure.

In conclusion, pregnancy in women with underlying heart diseases is still associated with considerable morbidity and mortality rates. Maternal morbidity in the form of heart failure, atrial fibrillation, valve thrombosis, thromboembolism, bleeding complications and non-functioning prostheses
is 2.9%, 5.8%, 2.9%, 2.9%, 11.7% and 2.9%, respectively\textsuperscript{24} Counseling for pregnancy, strict prenatal care and early risk stratification during gestation are fundamental measures for improving the outcome of pregnancy in women with heart disease\textsuperscript{25} Meticulous fetal/uterine monitoring and continuous refining of CPB strategies will provide the best outcome of cardiac surgery during pregnancy.

References