Intracardiac Operation in Seven Pregnant Women

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The outcome of open heart operations on pregnant women is not well documented. Between March 1985 and October 1988, 7 pregnant patients underwent valve replacement at Tygerberg Hospital. This included three redo operations and one double-valve replacement. The range of perfusion temperatures used during cardiopulmonary bypass was 28° to 33°C with aortic cross-clamp times of 53 to 121 minutes. One baby was stillborn, but the others were normally delivered at full term, and all the mothers survived. The stillborn baby was lost after the shortest procedure at the highest temperature during cardiopulmonary bypass.

(Ann Thorac Surg 1993;55:1172–4)

When an open heart operation is mandatory in a pregnant woman, the mother and baby can be adversely affected by the cardiopulmonary bypass process. Currently there is a 1% to 4% incidence of cardiac disease in pregnant women, 60 percent of which is rheumatic in origin [1]. In our present series, all 7 patients had rheumatic heart disease. Current practice in most centers is to use high-flow, normothermic, high-pressure cardiopulmonary bypass techniques to protect the fetus and the mother [2]. This series documents the procedures and outcome of open heart operation in 7 pregnant women carried out in an academic hospital over a period of 3 years. This is a large series compared with the documented information and provides outcomes for more than one technique and procedure.

Material and Methods

Between 1985 and 1988, 7 pregnant women with severe heart valve disease underwent open heart operation at Tygerberg Hospital. The mean age at operation was 27.4 years (range, 23 to 35 years). The mean gestation was 21.5 weeks (range, 16 to 30 weeks). Three patients had had a previous valve replacement, and 1 of them also had had a previous closed mitral valvotomy. One patient (patient 3) had two valve replacements during the same pregnancy, the first operation at 10 weeks' and the second at 16 weeks' gestation. Six patients had congestive heart failure, and 1 patient had bacterial endocarditis. All patients were treated conservatively but did not respond to treatment. One had mitral incompetence, 1 had mitral stenosis, 4 had mitral incompetence and stenosis, and 1 had aortic and mitral incompetence (Table 1).

Open heart operation was performed in a routine manner with one arterial cannula in the ascending aorta and two venous cannulas in the right atrium. A cardioplegia cannula was placed in the root of the aorta in 6 patients; in the patient with aortic incompetence, cold cardioplegia was infused directly into the coronary ostia. A standard dose of 1 L of St. Thomas' II solution was given after the aorta was cross-clamped and then 400 mL every 20 minutes. In all patients, the left ventricle was vented with a Foley catheter through the left atrium. St. Jude Medical valves were used in 5 patients and Carpentier-Edwards bioprostheses in 2. Ticron 2-0 interrupted stitches were used in all patients. No facilities for fetal monitoring were available during operation.

Perfusion during cardiopulmonary bypass was kept at a flow of 2.5 $L \cdot min^{-1} \cdot m^{-2}$ at a temperature of 30°C except during the double-valve replacement and one of the redo operations, where the temperature was kept at 28°C, and one mitral valve replacement at 33°C. The mean bypass time was 104 minutes (range, 66 to 148 minutes) and the mean aortic cross-clamp time, 78 minutes (range, 53 to 121 minutes).

All 5 patients with mechanical prostheses were put on a regimen of warfarin sodium until 4 weeks before the expected date of delivery. They were then hospitalized and given heparin sodium (5,000 units every 8 hours) subcutaneously.

Results

All the patients survived the operation and were discharged from the hospital after 10 days. One patient died of thalassemia 5 months after discharge. The disease was well controlled at the time of operation, and both she and the baby were discharged from the hospital in good condition. The other 6 patients are well with a mean follow-up of 57.2 months (range, 35 to 78 months). One baby was stillborn 24 hours after operation, but the other 6 were delivered normally at full term.

The patient who lost the baby was 27 years old, and the operation was done at 23 weeks' gestation. It was her first operation, and a Carpentier-Edwards bioprosthesis was

Accepted for publication Aug 21, 1992.

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0003-4975/93/$6.00

Table 1. Summary of Cardiac Procedures Done on 7 Pregnant Patients

Variable	Patient No.						
	1	2	3	4	5	6	7
Date	3/30/87	3/4/85	9/18/86	8/20/85	7/4/88	3/1/85	10/4/88
Age (y)	30	23	26	35	27	24	27
Previous operation	MVR, 1975	. . .	MVR, 7/20/86	. . .	. . .	. . .	CMV, 1979; MVR, 1981
Pathology	MS	AI, MI	MI, MS	MI, MS	MI, MS	MI	MS, MI
Symptoms	CHF	CHF	CHF	CHF	CHF	SBE	CHF
Gestation (wk)	24	18	16	22	23	30	18
Operation performed	MVR, SJM 31 mm	AVR + MVR, SJM 31 + 23 mm	MVR, CE 31 mm	MVR, SJM 33 mm	MVR, CE 31 mm	MVR, SJM 31 mm	MVR, SJM 29 mm
Fetus	Normal	Normal	Normal	Normal	Stillborn	Normal	Normal
Cardiopulmonary bypass time (min)	86	148	127	85	66	110	104
Aortic clamp time (min)	55	121	89	64	53	93	70
Cardiopulmonary bypass temperature (°C)	30	28	30	30	33	30	28

AI = aortic incompetence; AVR = aortic valve replacement; CE = Carpentier-Edwards bioprosthesis; CHF = congestive heart failure; CMV = closed mitral valvotomy; MI = mitral incompetence; MS = mitral stenosis; MVR = mitral valve replacement; SBE = subacute bacterial endocarditis; SJM = St. Jude Medical heart valve.

implanted in the mitral position. The cross-clamp time was 53 minutes and the bypass time, 66 minutes. This baby had a normal heart rate before the operation, but no heart beat could be detected after the operation.

Comment

Cardiac operations during pregnancy can be performed with a fair deal of safety for both mother and baby. A survey of The Society of Thoracic Surgeons showed only one maternal death in 68 procedures requiring cardiopulmonary bypass and a fetal survival of more than 80% [2]. Bernal [3] reviewed the literature in 1986 and collected only 45 cases with sufficient information on diagnosis, procedure, and outcome for mother and fetus over a 27-year period. One maternal and nine fetal deaths were reported in this group.

At present, it is our policy to use biological valves in young women without children, although early calcification and breakdown of these valves are accelerated in younger patients [4, 5]. In 5 patients, we used mechanical valves because these patients had one or more children and decided preoperatively to be sterilized after delivery. The choice of a mechanical valve did not influence the morbidity or mortality of the mothers or infants.

At our institution, the current practice of using warfarin postoperatively with a prothrombin ratio between 2.0 and 4.0 (international normalized ratio) and switching to subcutaneous heparin, 5,000 units every 8 hours, 4 weeks before the expected date of delivery seems safe and effective. We noted no maternal or fetal complications caused by warfarin or heparin in this series. Conversion to heparin 4 weeks before delivery prevented neonatal intracranial hemorrhage, as reported by Salazar and colleagues [6].

Theoretically, cardiopulmonary bypass with nonpulsatile flow, total heparinization, and hyperoxygenation could affect the placenta and fetus adversely, but in our study, no deleterious effects could be identified. Only 1 baby was lost, and that occurred after the shortest procedure with the highest temperature (33°C) in the series.

Our current practice is to use high flow (minimum of $2.5\ L \cdot min^{-1} \cdot m^{-2}$) throughout bypass and to try to keep mean blood pressure greater than 70 mm Hg. This flow is never reduced but must be increased if the mean blood pressure drops to less than 70 mm Hg. The patient is fully heparinized, and the activated clotting time is kept greater than 400 seconds. The mean temperature is maintained at 32°C. It is, however, probably safest for the fetus to use high-flow, normothermic, high-pressure perfusion during cardiopulmonary bypass to prevent possible bradycardia, arrhythmias, and increased uterine contractions.

Continuous fetal monitoring during operation is probably of value to adjust the flow during bypass if bradycardia occurs [7, 8]. In 3 patients operated on recently, fetal monitoring was used. No episodes of bradycardia occurred using the high-flow, high-temperature cardiopulmonary bypass methods described in this report. These patients are not included in this series because they have not yet delivered their babies.

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The American Board of Thoracic Surgery began its recertification process in 1984. Diplomates interested in participating in this examination should maintain a documented list of the operations they performed during the year prior to application for recertification. This practice review should consist of 1 year's consecutive major operative experiences. (If more than 100 cases occur in 1 year, only 100 need to be listed.) They should also keep a record of their attendance at approved postgraduate medical education activities for the 2 years prior to application. A minimum of 100 hours of approved CME activity is required.

In place of a cognitive examination, candidates for recertification will be required to complete both the general thoracic and cardiac portions of the SESATS V syllabus (Self-Education/Self-Assessment in Thoracic Surgery). It is not necessary for candidates to purchase SESATS V booklets prior to applying for recertification. SESATS V booklets will be forwarded to candidates after their applications have been accepted.

Diplomates whose 10-year certificates will expire in 1996 may begin the recertification process in 1994. This new certificate will be dated 10 years from the time of expiration of the original certificate. Recertification is also open to any diplomate with an unlimited certificate and will in no way affect the validity of the original certificate.

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