Pregnancy in patients with pulmonary autograft valve replacement

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Aim The purpose of this study is to determine the outcome and complications of pregnancy in women with pulmonary autograft valve replacement for aortic valve disease.

Methods and results The records of all women who had undergone pulmonary autograft valve replacement at the National Heart Hospital (now Royal Brompton Hospital) since 1968 were reviewed. From 1968 to 1993, 27 hospital survivors were female and among eight of them there were 14 pregnancies. All women were in Ability Index 1 at time of pregnancy with normal ventricular function, mild aortic regurgitation (six), mild pulmonary regurgitation (three) and mild pulmonary stenosis (two). None took anticoagulants. There was no maternal death, thromboembolic or haemorrhagic event or evidence of deterioration in valve function during pregnancy. Except for one woman (Ability Index 3) who developed dilated cardiomyopathy without aortic or pulmonary valve disease 6 months after delivery, the women remained in Ability Index 1 after pregnancy. There was no significant progression of aortic regurgitation (mild after seven pregnancies), pulmonary regurgitation (mild after six) or right-sided obstruction (mild after four). Reoperation for right-sided obstruction was carried out in two patients 4 and 7 years after a second pregnancy (9 and 15 years after the pulmonary autograft).

Conclusion No valve-related complications occurred during pregnancy and pregnancy appeared to have no effect on the function of the pulmonary valve autograft or the right-sided homograft. The pulmonary autograft is thus an ideal procedure for a young female needing aortic valve replacement.

Key Words: Aortic valve, pregnancy, pulmonary autograft.

Introduction

There is no agreement about the ideal heart valve replacement for aortic valve disease in women of childbearing age. Mechanical prostheses carry an increased risk of thromboembolism and complications related to anticoagulants. Bioprostheses have, especially in the young, a high rate of failure which may be accelerated by a pregnancy. Some authors even consider that women of child-bearing age with artificial heart valves should be advised against pregnancy. Ross described in 1967 the pulmonary autograft operation for aortic valve disease using the autologous pulmonary valve in the aortic position and an aortic valve homograft in the pulmonary position. The low operative mortality, low incidence of late valve dysfunction, low risk of thromboembolism and the absence of anticoagulants might make the pulmonary autograft an ideal operation for the young woman with severe aortic valve disease. This study reviews the outcome of pregnancy in women with pulmonary autograft operation to determine if valve-related complications occur during pregnancy and if pregnancy influences the function of the pulmonary autograft or the right-sided homograft.

Methods

The records of female patients who underwent pulmonary autograft valve replacement at the National Heart Hospital (now Royal Brompton Hospital) since 1968 were reviewed. Data were collated only in those who had a pregnancy after the pulmonary autograft operation. The clinical status (Ability Index and presence of valve dysfunction on physical examination), and echocardiographic and angiographic assessment before and after pregnancy were noted. The maternal complications during pregnancy, the need for reoperation during or following pregnancy and the fetal outcome were also evaluated. Details about operative procedure, early and late mortality, reoperations and
long-term complications in the cohort operated during the first two decades have already been published elsewhere.\textsuperscript{19-20}

**Patient population**

There were 131 hospital survivors (22 female) in the initial cohort (1968–1984) and five additional women had a pulmonary autograft between 1985 and 1993. Six patients were lost to follow-up. Eight of the 21 women had 14 pregnancies; three with one pregnancy, four with two and one with three. The initial diagnosis was: aortic stenosis (three), aortic regurgitation (three) with two secondary to rheumatic heart disease and aortic regurgitation with subaortic ventricular septal defect (two). Endocarditis precipitated the procedure in two patients. Patients were aged from 12 to 27 years (mean = 21.5) at the time of operation. Previous operations (three) included aortic valvotomy 7 and 9 years before and aortic valve replacement with a homograft 12 years earlier. Age at conception was from 21 to 40 years (mean = 28). The interval between the operation and first pregnancy ranged from 1 to 21 years (mean = 5.6). All women were in Ability Index 1 before pregnancy. Echocardiographic or angiographic evaluation preceded seven pregnancies and demonstrated mild aortic regurgitation (six), mild right-sided valve regurgitation (three) and mild right-sided valve stenosis (two). The clinical examination was reported normal before the other seven pregnancies. No patient took anticoagulants or other medication. The follow-up period after the last pregnancy ranged from 1 to 23 years (mean = 9.7), and after pulmonary autograft from 8 to 28 years (mean = 19.2).

**Pre-operative obstetric history**

Two women (one with aortic stenosis, one with aortic regurgitation) had a miscarriage before the operation and one of them also had three uncomplicated terminations on medical advice.

**Women with no pregnancy**

The basic diagnosis of the thirteen women who did not experience a pregnancy after the pulmonary autograft were aortic stenosis (eleven) with two secondary to rheumatic valve disease, and aortic regurgitation secondary to rheumatic valve disease (two) with one operation precipitated by endocarditis. Two patients had an aortic valvotomy 4 and 18 years earlier. Age at the time of the pulmonary autograft was significantly higher in this group compared to women with a pregnancy (30.4 ± 9.5 vs 21.5 ± 5.1; \(P=0.01\)). A woman with mild to moderate aortic stenosis had two uncomplicated pregnancies 9 and 6 years before her pulmonary autograft. Another had a termination on medical advice because of significant aortic stenosis 3 years before the autograft. None had significant residual defect to preclude a pregnancy after the autograft.

**Results**

**Maternal outcome**

The eight patients had 14 uneventful pregnancies. There was no maternal death, no thromboembolic or haemorrhagic complications, no evidence of deterioration in valve function during or within the first year after pregnancy. Seven women remained in Ability Index 1 after 13 pregnancies, and only one pregnancy was followed by a deterioration in the patient's Ability Index (Ability Index = 3). A 27-year-old woman, who had an aortic valve and root replacement with a homograft at the age of 12 years followed by a pulmonary autograft valve replacement at age 24 years, presented with progressive dyspnoea 6 months after delivery. The echocardiographic evaluation showed a normal left ventricle and mild aortic regurgitation before pregnancy and revealed 6 months after delivery a moderately enlarged left ventricle (end-diastolic diameter = 59 mm, end-systolic diameter = 47 mm) with diffuse poor systolic function and no significant aortic valve disease. The angiographic assessment confirmed the absence of significant aortic or pulmonary valve disease. There was no coronary artery disease. She was treated with angiotensin converting enzyme inhibitors and her condition improved a little (Ability Index 2).

Echocardiographic or angiographic assessment were performed after nine pregnancies and showed mild aortic regurgitation (seven), mild pulmonary regurgitation (six) and mild pulmonary stenosis (four). The physical examination was normal after the other five pregnancies. Overall, there was no significant progression of aortic regurgitation or right-sided lesions during or within a year after pregnancy.

**Obstetric history and fetal outcome**

The eight women had 14 full-term normal deliveries (vaginal (five), caesarean section (four), no information (five)). The mean birth weight was 3.2 kg (seven cases). There was no congenital heart disease in the offspring, but there was neonatal death in a 9-day-old baby with spina bifida and hydrocephalus.

**Maternal evolution**

Right-sided obstruction occurred in two patients 4 and 7 years after a second pregnancy (9 and 15 years after the pulmonary autograft valve replacement). A fascial tube containing an unsupported fascial valve was initially used in one patient and a freeze dried aortic
homograft in the other. Acute endocarditis on the pulmonary valve complicated by pulmonary emboli was present in one. They both underwent reoperation to replace the valve with an aortic homograft without complications. One of these two patients also needed a double valve replacement for severe aortic and pulmonary regurgitation 16 years after the second operation (25 years after the initial procedure). The other six women were free of significant aortic and pulmonary valve disease 8 to 26 years (mean = 16.5) after the pulmonary autograft.

**Evolution of women with no pregnancy**

The follow-up period after the pulmonary autograft ranged from 6–22 years (mean = 16) in this group. Seven patients were completely asymptomatic, in Ability Index 1, and with minimal aortic or pulmonary regurgitation 6–22 years later. Right-sided obstruction occurred in three patients 5 to 21 years later; one had unsuccessful right-sided valve dilatation followed by valve replacement with an aortic homograft; the other two had an uncomplicated valve replacement with an aortic homograft. Significant aortic regurgitation occurred in two by 10 and 15 years; one had a successful aortic valve replacement with a St. Jude prosthesis and in the other an attempt was made to repair the aortic valve, followed 6 months later by an aortic valve replacement with a Carpentier–Edwards prosthesis. She died a few days post-operatively in heart failure. A 58-year-old woman who presented 12 years after the autograft with bacterial endocarditis and severe mitral regurgitation, had urgent mitral valve replacement and coronary artery by-pass grafts and died 3 years later in congestive heart failure.

**Discussion**

Pregnancy after prosthetic valve replacement exposes the mother and the fetus to a high rate of complications related to thromboembolic or haemorrhagic events[1–5,7]. The need for anticoagulants carries a significant risk of fetal and neonatal morbidity[3–8]. In contrast, bioprostheses (porcine valves) are associated with a decreased risk of thromboembolism or complications related to anticoagulants, but the accelerated rate of tissue valve degeneration in young patients, especially during pregnancy, limits their usefulness[9,10]. There is little information about pregnancy in patients with homografts[9] and even if those few data are encouraging, homografts are not universally available. There is no information about pregnancy in patients with pulmonary autograft valve replacement.

The pulmonary autograft operation is based on the premise that the pulmonary valve is anatomically identical to the aortic valve and is thus viable with a potential for permanence. Pregnancy appeared to have no effect on the function of the pulmonary autograft valve or the right-sided homograft. There was no significant increase in aortic regurgitation or right-sided lesions and there were no maternal complications during or after pregnancy. It is difficult to explain the deterioration in ventricular function in the patient with a dilated cardiomyopathy unrelated to aortic or pulmonary valve dysfunction. It was perhaps a reflection of myocardial damage after two major procedures which worsened with the haemodynamic load of pregnancy. It could also be a post-partum cardiomyopathy. Her condition has remained stable for 5 years after pregnancy on angiotensin converting enzyme inhibitors. Although several of these women were pregnant at a time when echocardiographic technology was not routinely available, accurate clinical findings were recorded in notes enabling the conclusion that there was no significant clinical progression of aortic or pulmonary valve disease, and seven of eight women remained asymptomatic after 13 pregnancies. Although the numbers are small, there was no congenital heart disease in the offspring. There were, however, only six women with congenital heart disease, two having rheumatic valve disease. As no women was on anticoagulants, the fetal morbidity was low.

In the long-term, two patients needed replacement of the right-sided homograft 9 and 15 years after the initial pulmonary autograft operation. The progression of right-sided obstruction did not appear to be accelerated in pregnancy as it occurred 4 and 7 years after a second pregnancy. Right-sided obstruction also occurred in three women who did not experience a pregnancy, 5 to 21 years after the pulmonary autograft. Matsuik et al.[20] reported a 12.8% reoperation rate on the right ventricular outflow tract by 15–20 years and the rate reached 75% in patients with valved conduits constructed from autologous fascia lata. Replacement of the right-sided homograft is inevitable, but as to whether it will be required before or after 20 years is unpredictable[14,15,19–21].

Since most young women who need aortic valve replacement may wish to have children, this factor must be considered when choosing the type of valve to be used. The pulmonary autograft operation is now recognised as a safe procedure in experienced hands with low operative mortality and excellent long-term results. It appears not to be affected adversely by pregnancy, or to have any deleterious effect on outcome of pregnancy. The response to the right-sided homograft is similar. Thus, provided the surgeon is experienced, pulmonary autograft valve replacement is an ideal operation for a young woman of child-bearing age with severe aortic valve disease.

**References**


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1662 A. Dore and J. Somerville


