

## What is the outcome of mother and child after percutaneous mitral valvuloplasty performed during pregnancy?

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### Mitral stenosis during pregnancy

Rheumatic heart failure is responsible for most of the cardiac complications during pregnancy. Mitral valve stenosis is nearly always of rheumatic origin and is the most common (90%) and important cardiac valvular problem during pregnancy<sup>1</sup>. The pressure gradient across the narrowed mitral valve may increase greatly during pregnancy because of the physiologic increase in heart rate (decreasing left ventricular diastolic filling time) and cardiac output. Mortality among pregnant women with severe disease can reach 5% and labour, delivery and the immediate puerperium appear to be the periods most at risk. In patients with persistent symptoms despite optimal medical therapy invasive treatment should therefore be considered. Percutaneous mitral valvuloplasty (PMV) has been shown to be a successful and safe procedure during pregnancy in experienced centres, and has become the first-choice interventional treatment if anatomically suitable valves are present resulting in a significant reduction in foetal and neonatal mortality. However, little is known about long-term follow-up results after PMV of pregnant women and cardiac catheterisation in the pregnant patient carries the risk of foetal radiation exposure. The long-term effects of radiation on the development of the babies remains a concern.

### Maternal and foetal outcome after PMV

The important study of Gamra et al in this issue, describes the outcome after balloon mitral commissurotomy during pregnancy for both mothers and babies<sup>2</sup>. In this well-performed, large study of 61 women with severe mitral stenosis and their 63 babies nearly complete information on follow-up was obtained during a period of 5 and a half years after ballooning. It is important to report the long-term outcome after PMV for the mothers and to investigate

the effects of radiation exposure for the babies. Of the mothers, all had uncomplicated PMV procedures. The outcome showed that one patient died at home following home delivery, and all others had uncomplicated deliveries, mostly vaginally. During follow-up only 4 patients needed mitral valve replacement and most of the women were in good functional class (NYHA 1 or 2). In the comparable study of Esteves et al, on 71 women with PMV during pregnancy, which was published last month, the short-term outcome was good for the mothers, but after a follow-up of 3 and a half year, the event-free survival was only 54%<sup>3</sup>. They concluded that PMV is safe and effective, both for the mother and for the foetus. However, although these 2 studies are the largest on this topic so far, still the number of patients is relatively small and not all questions are answered. To investigate the risk of need for surgery after a previous PMV, Zimmet et al, performed a retrospective analysis on 243 patients undergoing PMV at a single institution over a 14 year period. Fifty of these (21%) needed cardiac surgery at a median interval of 6 months after PMV and of these 9 (18%) had a procedure within 15 days<sup>4</sup>. So the need for surgery after PMV is not uncommon. Independent predictors of surgery after PMV were found to be severity of mitral regurgitation and a higher echo score. Indeed, surgery during pregnancy, brings great risks for the foetus and thus the presence of combined mitral regurgitation and a higher echo score define patients at higher risk for the need of subsequent surgery, where the decision to perform PMV or not should include these risks and the decision should be taken carefully.

The study of Gamra is especially valuable, because they studied the children, longitudinally, and data on weight, height and head circumference were obtained. They found no differences in comparison with the normal population. In addition, a standardised mental assessment of the children was performed. The outcome of this

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study showed that 16% of the children had an IQ less than 70. The statistical analysis showed no significant difference with the normal population. No predictors for low IQ, particularly with regard to the age at gestation and the fluoroscopy time, could be identified by univariate analysis. Also the study of Esteves described the physical outcome of the children and confirmed the results of Gamra et al, by finding normal growth and development.

## Radiation during pregnancy

The use of radiation during pregnancy evokes emotional responses both from the parents and from professionals. High doses of prenatal exposure to ionising radiation present an increased risk of prenatal death, malformation or impairment of mental development. Embryos and fetuses are more sensitive to radiation than adults or children. The effects of radiation on the foetus depend on the radiation dose and the gestational age at which exposure occurs. During the period from 8 to 25 weeks after conception, the central nervous system is particularly sensitive to radiation. Foetal doses in excess of about 100 mGy may result in a decrease in IQ. Between 8-15 weeks after conception, a foetal dose of 1000 mGy (1 Gy) reduces IQ by about 30 points with the risk of severe mental retardation being about 40%<sup>5</sup>. Substantially lower doses presents probably no increased risk, however, definite reassurance remains difficult. During cardiac catheterisation the mean radiation exposure to the unshielded abdomen is 1.5 mGy, and less than 20% of this reaches the foetus because of tissue attenuation. During PMV the radiation dose may be substantially higher. The study by Gamra gives us information on the mental development in the first 5 years of life; however, concern about the development of mental problems later in the live of these children is not completely solved. Finally, other side effects of radiation may appear later in life.

To reduce radiation exposure, several options are available. Shortening fluoroscopic time and delaying the procedure until at least the completion of the first trimester (period of major organogenesis) will minimize radiation effect. Insertion of the catheter by the subclavian route instead of the femoral eliminates direct foetal radiation. Furthermore, if it becomes necessary for a pregnant woman to undergo a PMV procedure during the first trimester, fluoroscopic imaging with an empty bladder delivers the lowest absorbed dose to the foetus. Contrary to popular belief, external shielding of the pelvis of the patient is of limited value. The radiation dose absorbed by the foetus without shielding was found to be < 3% higher than that with external shielding for all periods of gestation. Obviously, most of the foetal dose is attributable to scatter from the thorax of the mother.

A useful new tool in guiding PMV is performing the procedure with use of intracardiac echo, if necessary in combination with minimal radiation. Until now only transoesophageal echo investigation and transthoracic echo were available and both echo techniques have limitations. Transoesophageal echo, although permitting an optimal view, is not patient friendly and in case of a long procedure, narcosis of the patient is warranted. On the other hand transthoracic echo is patient friendly, but often does not allow optimal viewing of the position of the balloon catheter. Good positioning of the intracardiac catheter and manoeuvring of the balloon is mandatory for a good

result. Intracardiac echocardiography is easy to perform and, after a short learning curve, will offer optimal visualisation of the valve and position of the balloon catheter, without sedating the patient<sup>6,7</sup>. At this point the costs of the intracardiac echocatheter may be a limitation in its use. Development of re-usable catheters would be a major step forward.

The issue of radiation during pregnancy is not limited to the treatment of mitral stenosis, but does play a role also in other cardiac diseases like severe stenosis of the aortic valve, radiofrequency catheter ablation or an acute coronary syndrome occurring during pregnancy<sup>8</sup>. The incidence of an acute coronary syndrome during pregnancy is increasing, due to changes in life-style pattern of women, with habit's of more smoking, stress and overweight, in combination with a tendency towards delaying childbearing age. In patients with an acute coronary syndrome treatment with a percutaneous intervention may be warranted. The results of Gamra et al are encouraging in showing no dramatic effects of radiation on the physical or mental outcome in the first five years of the children who had radiation exposure during pregnancy. This is important because the other treatment option in patients with an acute coronary syndrome, thrombolytic therapy, has major limitations during pregnancy, with especially a high risk of bleeding. The results of Gamra therefore support the policy to perform a percutaneous intervention as first choice treatment also in these women.

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