

## HEART DISEASE IN PREGNANCY\*

THOMAS J. DRY, M.A., M.B., CH.B. (CAPE TOWN), M.S. (MINN.), F.A.C.P.

Cape Town

There are relatively few cardiac conditions today which might prevent a woman from bearing children. A maternal mortality rate among women with heart disease, which was approximately 60% some 80 years ago,<sup>1</sup> should, under reasonably favourable circumstances, be no more than 3% today.

This reduction in the danger inherent in pregnancy and childbearing can be attributed mostly to a better understanding of the various factors which constitute the physiological load of pregnancy, improved methods of preventing and treating cardiac failure and rhythm disturbances, and the introduction of cardiac surgery for a number of congenital and acquired cardiac lesions.

A certain number of congenital anomalies of the heart and great vessels are seldom compatible with life beyond infancy and childhood, and thus they are rarely encountered in women of childbearing age. Certain other anomalous conditions are amenable to surgical correction or improvement, and these conditions should already have received corrective treatment during or even before the patients are out of their teens. Specific reference is made to the closure of a patent ductus, the excision and repair of a coarctation of the aorta, resection of the involved section of lung in pulmonary arterio-venous fistula, valvotomy for pulmonic stenosis and closure of atrial and ventricular septal defects.

The most striking acquired cardiac condition related to pregnancy is mitral stenosis. Fully 85% of heart disease encountered during pregnancy is of rheumatic origin and mitral stenosis is present in two thirds of these. The ideal time for valvotomy for mitral stenosis, (unlike the congenital conditions already referred to), is not necessarily determined by the patient's age. This means that many women with mitral stenosis reach the childbearing age before their mitral disease has progressed to the point necessitating surgical intervention. It is generally agreed that mitral commissurotomy is unwarranted when performed prophylactically before the development of symptoms. The remaining patients with rheumatic heart disease are much less favourably placed with reference to pregnancy. The surgical treatment of mitral insufficiency and of aortic stenosis and aortic insufficiency remains unsatisfactory, but time will in all probability alter this situation.

## THE EVALUATION OF THE RISKS INVOLVED IN PREGNANCY

The assessment of the dangers of childbearing in the individual case centres around the evaluation of two physiologic entities, namely, the cardiac reserve (which one may look upon as credit value), and the total physiological load of pregnancy (which one may look upon as debit value).

*The cardiac reserve.* Cardiac reserve is a reflection of the ability to exercise without symptoms (dyspnoea). It has become customary to recognize 4 categories of patients in terms of cardiac reserve, and this is particularly applicable to mitral

stenosis: (1) Patients with the murmurs of mitral stenosis, but who are able to tolerate normal activity without dyspnoea, (2) patients who experience dyspnoea with normal activities, and in whom this limitation does not progress, (3) patients who experience dyspnoea with less than normal activities, and who show progression of symptoms, and (4) patients who experience dyspnoea without any activity.

The assessment of cardiac reserve in the individual patient should be postponed till she has received the maximum benefit of treatment. The condition of a woman may, for example, appear to be unfavourable when, in effect, she has been overworked, is anaemic, obese or hyperthyroid, or has ingested large amounts of salt. In these conditions appropriate measures may lead to a marked increase in her cardiac reserve.

When a patient, seen for the first time, is already pregnant the evaluation of the cardiac status is much more difficult than in the non-pregnant state. Under these conditions there is a tendency to err on the side of over-diagnosis of heart disease. Thus the increased blood flow of pregnancy over an only slightly roughened valve, may suggest stenosis; functional murmurs, spurious X-ray enlargement of the heart due to the higher level of the diaphragm, and minor electrocardiographic changes, might readily be interpreted as evidence of disease of greater severity than that actually existing; swelling of the ankles, dyspnoea and palpitation are commonly encountered in pregnant women with normal hearts.

*The total physiological load of pregnancy.* The physiological changes which occur during normal pregnancy have been accurately documented. The pulse rate increases by 10-12 beats per minute at rest and considerably more with effort than in the same woman when she is not pregnant; cardiac output increases by 40-50%; total oxygen consumption by 15-18% and the blood volume increases by 30-50%. These changes occur early in the second trimester and except for oxygen consumption, start to return towards normal during the last 2 months of gestation. The pregnant woman normally hyperventilates, and, contrary to expectation, vital capacity is actually increased during pregnancy.

To this metabolic load, which is inseparable from the pregnant state and thus to a very large extent unalterable, must be added the cardiac work necessary to maintain life, cardiac work imposed by activity, by emotional stress, by intercurrent infections, by anaemia, obesity and by sodium intake and retention, a group of factors which can individually be modified by appropriate measures. Reduction in salt intake will also diminish blood volume to some extent.

One of the important haemodynamic phenomena in regard to mitral stenosis is that any increase in cardiac rate results in a diminished flow through the mitral orifice; this in turn causes, first a rise in left atrial pressure, and second a drop in cardiac output. The rise in left atrial pressure is already augmented by increased blood volume, so that the tendency for pulmonary congestion, acute pulmonary oedema and haemoptysis increases as pregnancy advances to the eighth month of gestation.

\* A paper presented at the Third Congress of the South African Society of Obstetricians and Gynaecologists, Pretoria, August 1958.

The combined effects of prescribing more rest, allaying mental stress, of treating intercurrent infections with appropriate antibiotics, of prescribing iron for anaemia, of reducing weight by dietary measures, and of limiting sodium intake, may maintain a level of cardiac reserve which will keep the patient in a state of compensation throughout pregnancy.

The critical periods are (a) from the third to the eighth month, after which the metabolic load lessens, (b) labour itself, and (c) the immediate post-partum period.

The first evidences of cardiac failure require prompt treatment, which should include bed rest, digitalization and sodium restriction, in addition to other measures already enumerated, where they are indicated. When cardiac failure remains uncontrollable in patients with mitral insufficiency or aortic disease, we must accept defeat and advise therapeutic abortion to save the mother's life. In the majority of cases in this category, cardiac failure will have occurred by the end of the first trimester. Should medical measures fail in the patient with mitral stenosis and those congenital anomalies amenable to surgery, one must choose between therapeutic abortion and surgical treatment.

The success with which women can be carried to term by conservative medical measures is attested by a number of reports. For example Burwell<sup>2</sup> reports a maternal mortality of 3 out of 298 pregnancies, a foetal and neonatal death rate of 18% and therapeutic abortion rate of about 10%; during a 6-year period however, the number of therapeutic abortions dropped to 3%. Furthermore, according to a survey made by Miller and Metcalfe<sup>3</sup> there is no evidence that pregnancy, once completed successfully, has accelerated the course of heart disease. O'Driscoll, Barry and Drury's<sup>4</sup> record, to quote another example, is equally convincing of the effectiveness of conservative treatment. In 298 pregnancies complicated by rheumatic heart disease, one mother died before the end of the puerperium, 13 viable infants did not survive the neonatal period, mitral commissurotomy was performed on only 3 occasions, no caesarean section or induction of labour was performed for heart disease, and no therapeutic abortion was performed.

#### SURGICAL TREATMENT

What now is the case for definitive surgical treatment during pregnancy? Most of the data concern mitral stenosis, but the same underlying principles are valid for congenital cardiac lesions for which definitive surgical treatment is possible. The only reliable answer to this question can be found in the practical experience from many medical centres. Many reports are indeed available,<sup>5-13</sup> but most of the earlier reports were concerned with small numbers of patients operated on at various stages during pregnancy. The figures are impressive enough. One of the larger series is that of Kaufman and Ruble,<sup>14</sup> who report (a) on 93 mitral commissurotomies with 3 maternal deaths: 85 babies were delivered in this group. (b) 22 patients who had closure of a patent ductus with no maternal mortality and only one miscarriage one month following surgery.

It is of interest to note that mitral valvotomy has been successfully performed at any stage of pregnancy, though it is generally agreed that surgery is preferably applied towards the end of the first trimester, when the pregnancy is more secure and the danger of producing congenital anomalies is

less. In one instance mitral valvotomy was carried out 10 hours before delivery. While one might ponder over the wisdom of such a decision, it nevertheless was successful in this case.

A striking feature among patients who had mitral valvotomy performed during pregnancy is the low morbidity and low mortality rate in the immediate post-partum period. This can be a very critical phase for the cardiac patient, and carries a maternal mortality rate of 7-10% in unoperated patients with mitral stenosis. This point alone would further strengthen the case for valvotomy and for other surgical procedures during pregnancy, where indicated. Furthermore, no one can ignore the danger of therapeutic abortion in early pregnancy, and more especially the danger of hysterectomy after the first trimester.

#### SUMMARY AND CONCLUSIONS

Women with organic heart disease should not lightly be denied the privilege of childbearing. If they fall in the functional categories 1 or 2 they can usually be carried to term by conservative medical management. When they fall in categories 3 and 4 this may still pertain, but will require skilled and more rigid medical care from the very early months of pregnancy. The situation in general has been eased, however, by the advent of cardiac surgery. Ideally, a woman with mitral stenosis (categories 3 and 4) should have had a valvotomy before she becomes pregnant, and in the future this will no doubt become a standard procedure. The same applies to other cardiac conditions amenable to surgery. In fact, the pregnant state can be ignored and surgical treatment carried out when the usual indications for surgical intervention present themselves. Actually, experience has shown that surgical treatment can be carried out at any stage of pregnancy, but since most haemodynamic changes of pregnancy become significant early in the second trimester, postponement is seldom warranted. Needless to say, strict medical treatment is imperative before surgical interference is entertained. Therapeutic abortion should then never be considered, except when medical measures have failed and where no other opportunity or method exists whereby amelioration of the cardiac reserve can be brought about. This is especially true since the termination of pregnancy, in itself, carries an appreciable risk. Finally the lowered maternal-mortality rate in the immediate post-partum period in women who have had a valvotomy during pregnancy, further strengthens the case for surgical intervention in preference to therapeutic abortion or undue delay in carrying out surgical treatment.

As a closing thought, however, it is worthy of note that it has been the experience in many quarters that conservative measures, based on a knowledge of the haemodynamics of pregnancy and on the improved methods of treating cardiac failure, are sometimes highly successful when for one reason or another surgical treatment cannot be resorted to.

#### REFERENCES

1. MacDonald, A. (1878): *The Bearings of Chronic Disease of the Heart upon Pregnancy, Parturition and Childbed*. London: Churchill.
2. Burwell, C. S. (1958): *J. Amer. Med. Assoc.*, **166**, 153.
3. Miller, M. M. and Metcalfe, J. (1956): *Circulation*, **13**, 481.
4. O'Driscoll, M. K., Barry, A. P. and Drury, M. L. (1957): *Brit. Med. J.*, **2**, 1090.
5. Glover, R. P., McDowell, D. E., O'Neill, T. J. E. and Janton, O. H. (1955): *J. Amer. Med. Assoc.*, **158**, 895.
6. Cooley, D. A. and Chapman, D. W. (1952): *Ibid.*, **150**, 1113.

7. Burwell, C. S. and Ramsey, L. H. (1953): *Trans. Assoc. Amer. Phycns.*, **66**, 303.
8. Harston, A. P. B. (1954): *J. Obstet Gynaec. Brit. Emp.*, **61**, 382.
9. Brock, R. C. (1952): *Proc. Roy. Soc. Med.*, **45**, 338.
10. Logan, A. and Turner, R. W. D. (1952): *Lancet*, **1**, 1286.
11. Watt, G. L., Bigelow, W. G. and Greenwood, W. F. (1956): *Amer. J. Obstet. Gynec.*, **67**, 275.
12. Mendelson, C. L. (1957): *Surg. Clin. N. Amer.*, **37**, 321.
13. Dellepiane, G. (1958): *Minerva Med. (Torino)*, **49**, 1.
14. Kaufman, J. M. and Ruble, P. E. (1958): *Ann. Intern. Med.*, **48**, 1157.