MITRAL VALVOTOMY DURING PREGNANCY

Eighteen Cases

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Mitral stenosis is especially common in women of child bearing age. Of our first 350 mitral valvotomies, 64 per cent. were women below the age of 45 and 18 of these women were pregnant.

There are several reports in the literature of the value of mitral valvotomy during pregnancy.^{6, 7, 8, 11, 12, 13, 20, 21, 25}

Organic heart disease, especially mitral stenosis, is one of the leading causes of maternal morbidity and mortality. Rheumatic heart disease accounts for 90 per cent. of pregnant cardiac patients and in 75 per cent. of these there is involvement of the mitral valve,⁴ usually with mitral stenosis.

The object of this communication is to present clinical details, criteria for selection of these cases, discussion about the optimum time for surgery, operative findings, immediate post-operative complications and correlation of operative findings with the post-operative progress.

Material

Eighteen patients are included in this series.

Age

Their ages range between 20 and 45 years.

TABLE I

20 to 25 years	25 to 30 years	30 to 40 years	40 to 45 years
4	6	7	1

Previous Pregnancies

There was one primipara and 17 multipara patients in this series. The number of previous pregnancies in multipara are shown in Table 2.

TABLE 2
Multipara

One	Two	Three	Four
9	3	3	2

Duration of Present Pregnancy

The length of gestation at the time of mitral valvotomy is indicated in weeks in Table 3.

TABLE 3

14 to 15 weeks	16 to 17 weeks	18 to 19 weeks	20 to 21 weeks	24 to 25 weeks	28 to 29 weeks
2	7	2	3	2	2

Duration of Follow-up

The duration of follow-up after mitral valvotomy or cardiomy is shown in Table 4.

TABLE 4

Over 4 years	Over 3 years	Over 2 years	Over 1 year
2	8	4	4

Clinical Assessment

Dyspnoea on exertion is a common complaint especially in the latter half of the pregnancy, but dyspnoea before the fourth month of pregnancy needs careful evaluation and is an ominous sign in a pregnant patient with mitral stenosis.

The limitation of activity due to dyspnoea and fatigue has been graded into four classes, I, II, III, IV (New York Heart Association Classification). We have graded our patients accordingly.

Dyspnoea during the present pregnancy was assessed and compared with the dyspnoea during the previous pregnancy in 17 multipara patients. The dyspnoea which is worse and progressive during the present pregnancy is an unfavourable sign.

1. Two patients who were placed in Class I during the previous pregnancy had deteriorated to Class III during the present pregnancy.

2. Ten patients who were placed in Class II during the previous pregnancy had deteriorated to Class III.

3. Four patients were placed in Class II during the present pregnancy and their classification was the same during the previous pregnancy. These four patients developed recurrent attacks of acute pulmonary oedema.

4. One patient was placed in Class II during the present pregnancy but she had a history of congestive cardiac failure during the previous pregnancy.

5. One primipara patient was placed in Class I. She developed an attack of acute pulmonary oedema.

The grading of dyspnoea is notoriously difficult. A patient in Class II may rapidly deteriorate to Class III in a month's time.

There were: 12 patients in Class III; 5 patients in Class II; one patient in Class I.

Paroxysmal Nocturnal Dyspnoea. There were 15 patients who complained of frequent attacks of paroxysmal nocturnal dyspnoea. Eleven patients were in Class III and four patients in Class II. Pseudo-paroxysmal-nocturnal dyspnoea can closely resemble attacks of true paroxysmal nocturnal dyspnoea. One of our patients had this symptom; though the nature of this was not realized until after the operation. At operation the valve was almost normal except for slight calcification around the medial commissure.

Haemoptysis. The cardiac and respiratory embarrassment of normal pregnancy never gives rise to haemoptysis. Haemoptysis in mitral stenosis is a sign of pulmonary hypertension. Eleven patients complained of frequent attacks of haemoptysis and two patients had one attack of massive haemoptysis each.

Acute Pulmonary Oedema. There were five patients who developed acute pulmonary oedema during their present pregnancy. Four of these patients had recurrent attacks of haemoptysis and paroxysmal nocturnal dyspnoea. The fifth patient was a 22-year-old primipara. Her heart was not enlarged. She was in sinus rhythm. She complained of slight breathlessness for the past two weeks. She suddenly developed an attack of acute pulmonary oedema, fortunately surviving the attack.

Cough. This was present in 16 cases. In a few cases the cough became worse on exertion and after going to bed.

Pulmonary Congestion and Bronchitis. Sixteen patients had recurrent attacks of bronchitis and 'colds.'

Congestive Cardiac Failure. Two patients developed congestive cardiac failure during the present pregnancy and one patient had a history of congestive cardiac failure during the previous pregnancy.

Peripheral Emboli. One patient gave a history of two episodes of peripheral embolism.

Operative Findings in 18 Patients

These patients were referred to us by various physicians, with a diagnosis of pure or predominant mitral stenosis. Six of these patients were suspected to have slight aortic regurgitation.

At operation: Fifteen patients were found to have pure or predominant mitral stenosis. One patient was found to have mitral stenosis and mitral incompetence; the mitral incompetence was thought to be equally important as the stenosis in producing the symptoms in this case. In one patient the predominant lesion was mitral incompetence. There was an almost normal valve except for slight calcification around the medial commissure in one other patient.

There is progressive acceleration of circulatory speed from the third to the ninth month. This acceleration of blood flow diminishes during the last few weeks before term.²⁴ Due to this increased velocity of blood flow the auscultatory signs of mitral stenosis become markedly augmented. Thus, a mild mitral stenosis in a non-pregnant patient may produce auscultatory signs of tight mitral stenosis during pregnancy, i.e. loud snapping first sound, long diastolic murmur with presystolic accentuation in the mitral area and a loud opening snap just internal to the apex beat.¹¹

Clinical Findings in 15 Patients with Pure or Predominant Mitral Stenosis

Radial pulse was of small volume in eight patients and full volume in seven patients. There was no relationship between the size of the mitral orifice and character of the pulse, but three patients who had severe pulmonary hypertension had a small volume pulse.

Jugular venous pulse—three patients with marked pulmonary hypertension had giant 'A' waves in the jugular venous pulse.

Blood pressure and pulse pressure were within normal limits in all the patients.

Apex beat was tapping in character in eight patients.

Parasternal heave and palpable P₂

1. There was marked parasternal heave with palpable P₂ in three patients.

2. There was moderate parasternal heave in 12 patients.

Diastolic thrill was palpable in all the patients.

First Sound in Mitral Area. In seven patients there was marked accentuation of the first sound. When the patient was placed in the left lateral position the *snap* was almost deafening in quality. The mitral orifice (before split) was: 0.5 cm. or

less, five cases; 1.0 cm., one case; 2.0 cm., one case.

In six patients the first sound was accentuated. The mitral orifice (before split) was: 0.5 cm., four cases; 1.0 cm., one case; 2.0 cm., one case.

In two patients the first sound was not accentuated. The mitral orifice (before split) was 1 cm. in diameter in both cases. The anterior lateral cusp was mobile, but one case had slight calcification around the medial commissure.

Opening snap was present in 13 cases. It was absent in two cases who did not have accentuated first sound in the mitral area.

Diastolic Murmur in Mitral Area. A long rumbling diastolic murmur with presystolic accentuation was present in 14 patients in sinus rhythm. The presystolic accentuation was absent in a patient with auricular fibrillation.

Systolic murmur in mitral area was heard in eight patients.

Soft in quality, four patients (no regurgitation was detected at operation). Mild systolic murmur in two patients (slight regurgitation was present at operation). Harsh, systolic murmur conducted to axillae in two cases (there was moderate 'blow back' in one case at operation).

Pulmonary Second Sound. This was accentuated in all cases. In three cases with marked pulmonary hypertension, the sound was narrowly split, with more accentuation of the second element.

Conclusion

Thus, every pregnant patient with pure mitral stenosis may not necessarily have a loud first sound nor an opening snap. The constant finding was a long rumbling diastolic murmur with presystolic accentuation. The presystolic accentuation was absent in one patient with auricular fibrillation.

Predominant mitral incompetence, one case. (Mitral orifice was 2.5 cm. in diameter.) Mitral stenosis with severe mitral incompetence, one case. The mitral incompetence was thought to be as important as stenosis in producing her symptoms. Mitral orifice (before split) was 2 cm. in diameter. Both patients had a loud first sound, a long rumbling diastolic murmur with presystolic accentuation and a localized harsh systolic murmur in the mitral area.

The patient with an almost normal valve had a loud first sound, long rumbling diastolic murmur with presystolic accentuation and a localized harsh systolic murmur in the mitral area. She had congestive cardiac failure during the previous pregnancy, which might have been a congested circulatory state²¹ (Eichna *et al.*, 1954).

Criteria for Advising Surgery

These cases were referred to us by seven different physicians and the criteria they used for advising surgery are listed below.

Acute Pulmonary Oedema (5 cases). The development of attacks of pulmonary oedema is a serious complication. Morgan Jones (1951) considers acute pulmonary oedema to be one of the leading causes of death during pregnancy. A situation of utmost gravity arises if the attacks of pulmonary oedema are not controlled by adequate medical measures.¹⁴

(i) One patient was a young primipara. She had complained of dyspnoea for two weeks before she suddenly developed an acute attack of pulmonary oedema. She fortunately survived this attack.

(ii) Four patients had recurrent attacks of acute pulmonary oedema which were not controlled by adequate medical measures.

Class III Disability. The 12 patients in this group were all multipara and their disability had become worse during the present pregnancy.

Congestive Cardiac Failure. Two patients developed congestive cardiac failure during the present pregnancy and one patient had had congestive cardiac failure during the previous pregnancy. A patient who failed during the previous pregnancy will certainly do so during the present pregnancy.

Auricular Fibrillation. When auricular fibrillation supervenes it usually occurs during the last stage of rheumatic heart disease. The maternal mortality in pregnant patients with auricular fibrillation is 31.5 per cent. The one patient in this group also had class III disability.

Optimum Time for Mitral Valvotomy

Pregnancy imposes an additional load on the heart.^{2, 3, 4, 24} There is gradual increase in the cardiac output from the 12th to the 36th week of gestation. By that time the cardiac output is about 50 per cent. above normal. The blood volume also increases and by the 36th week it is about 50 per cent. above the non-pregnant state. After the 36th week of gestation there is gradual decrease in the cardiac output and the blood volume. Thus it would be hardly necessary to operate after the 36th week when 'lightening of the burden has occurred.' This rule of thumb cannot be applied to every case. O'Connell and Mulachy (1955) have reported successful mitral valvotomy at full term for threatened pulmonary oedema.

There is general agreement that mitral valvotomy should be carried out early in pregnancy to give the heart its best chance before the maximum load of pregnancy is reached.

The length of gestation, in our cases, at the time of mitral valvotomy is shown in Table 3.

Operation

The following points were noted at operation:

1. The diameter of the mitral orifice before the valve was split.
2. Valvular calcification.
3. Mobility of the antero-medial cusp of the mitral valve.
4. *Regurgitation*. The degree of the mitral incompetence was estimated from the stream of regurgitant flow of blood felt by the tip of the index finger. It was slight, moderate or severe, according to the amount of blow back.
5. The diameter of the mitral orifice after completion of the split.

The diameter of the mitral orifice before the valve was split: 0.5 cm. or less, nine cases; 1 cm. or less, four cases; 2 cm. or less, three cases; over 2.5 cm., one case; over 3 cm., one case.

Diameter of mitral orifice after mitral valvotomy:

3 cms. or over	2.5 cms. or over	1 cm. or over	Less than 1 cm.
12	3	Nil	1

One patient had an almost normal valve; one patient had predominant mitral incompetence.

We grouped these patients into 'unfavourable' and 'favourable' groups from the findings at operation.

Unfavourable Group. There were three cases in the unfavourable group.

1. Predominant mitral incompetence with heavy calcification of the valve. The valve orifice was over 2.5 cm. There was marked calcification and the calcium was heaped up in friable lumps around the commissures. It was not considered safe to attempt valvotomy.

2. Severe mitral incompetence with mitral stenosis. The mitral orifice was enlarged from 2 cm. to over 3 cm.

3. The commissures could neither be adequately fractured with a finger nor cut with knife. The mitral orifice was 0.3 cm. in diameter and was enlarged to 0.75 cm.

Favourable Group (14 cases).

1. Eleven cases: the diameter of the mitral orifice was over 3 cm. and no incompetence was detected after the completion of valvotomy. The valve cusps were mobile.

2. Three cases: the diameter of the mitral orifice after splitting the valve was over 2.5 cm., though there was a trace of incompetence at the end of the operation. The valve cusps were mobile.

Normal Valve. One patient had an almost normal mitral valve. The diameter of mitral orifice was over 3 cm., the valve cusps were mobile. There was slight calcification along the medial commissure. She had a minimal lesion of the mitral valve and a history of congestive cardiac failure during the previous pregnancy. It is probable she had a circulatory congestive state (Eichna *et al.*, 1954) during the previous pregnancy and it had very little to do with the minimal lesion of the mitral valve.

Follow-up

Unfavourable Group

The patient who had predominant mitral incompetence had to be readmitted one month after the valvotomy and she aborted at 24 weeks. After this she steadily improved. The second patient in whom mitral incompetence was considered to be as important as mitral stenosis in producing her symptoms, did not by any means have a smooth antenatal period. She had to be maintained on a strict medical regime to keep her free of pulmonary congestion and had to be hospitalized early before the delivery. She underwent a normal labour at full period but in the immediate post-partum period she developed congestive cardiac failure and responded well to the usual medical treatment. The third patient who had a mitral orifice less than 0.5 cm. which could not be enlarged beyond 0.75 cm. had a rather stormy antenatal period. She had to be hospitalized one month after valvotomy with congestive cardiac failure. She went into labour at full term and only very strict medical regime kept her just free of trouble. These two patients in the unfavourable group would certainly seem to support those who maintain that most women would do well without valvotomy if medical supervision was adequate, but such a regime entails considerable worry to the patient and the attending physician.

Favourable Group (14 cases)

All the patients in this group had a smooth antenatal period. One patient aborted at four weeks after the valvotomy. The remaining 13 patients went through their pregnancies without giving undue anxiety and there was no maternal or foetal mortality. Two of these patients have gone through further pregnancy each without any complication.

Eleven patients (mitral orifice after split over 3 cm. and mobile cusps) have maintained 'excellent' progress and three patients (mitral orifice after split over 2.5 cm. slight calcification and trace of incompetence) have also maintained 'good' progress.

	Pure mitral stenosis	Mitral stenosis and mitral incompetence	Predominant incompetence	Almost normal
Without calcification	11*	*2 slight incompetence *1 marked incompetence		
With calcification	*2 slight calcification		†1 heavy calcification	*1 slight calcification

*Valve cusps mobile.

†Valve cusps rigid.

The Risk of Mitral Valvotomy

Mortality

All patients survived the operation. Mitral valvotomy can be safely carried out during pregnancy without undue harm to the mother or the foetus.

Morbidity

Cerebral Embolism. One patient had a left cerebral embolism at the time of operation and developed right hemiplegia with aphasia. She gradually recovered from this and the remainder of her pregnancy has been uneventful. She has undergone a subsequent pregnancy without any complications.

Tracheo-bronchial Secretions and Collapse of Lung. Three patients had marked difficulty in bringing up their sputum and one patient developed collapse of the left lower lobe. Their distress was relieved by bronchoscopic aspiration of the bronchial tree.

Arrhythmia. One patient who was in sinus rhythm before the operation developed auricular fibrillation in the immediate post-operative period. She spontaneously reverted to normal rhythm about eight weeks later.

Post-pericardiotomy Syndrome. One patient has complained of persistent praecordial pain since the operation.

Discussion

There is still a considerable difference of opinion concerning the value of mitral valvotomy during pregnancy. Burnwell and Metcalfe (1954) consider valvotomy more hazardous during pregnancy. Laake (1954) reached the conclusion that the number of patients with heart disease who have serious trouble during their pregnancies is small. Eichna *et al.* (1954) have described circulatory congestion simulating congestive cardiac failure in non-cardiac pregnant patients. The majority of pregnant patients with mitral stenosis can be kept free of trouble with adequate medical measures, but the first 24 to 72 hours after delivery is another danger period when cardiac decompensation can develop with great rapidity.

Several reports of valvotomy performed during

pregnancy have appeared (Brock, 1952; Cooley and Chapman, 1952; Logan and Turner, 1952; Watt *et al.*, 1954; O'Connell and Mulachy, 1955; Glover *et al.*, 1955; Bailey and Bolton, 1956; Marshall and Pantridge, 1957). From the accumulated experience of these authors combined with our own experience, we are convinced that mitral valvotomy has an important place in the treatment of mitral stenosis during pregnancy. A situation of the utmost gravity arises if pulmonary congestion and pulmonary oedema¹⁴ are not controlled by adequate medical measures. Mitral valvotomy in such patients definitely diminishes the mortality. It appears to us that there is very small risk attached to mitral valvotomy during pregnancy and by relieving the obstruction we are carrying out a logical and sensible treatment, besides, direct palpation of the valve gives us reliable information which can be useful if we have to advise sterilization at a later date.

Summary

Exploration of the mitral valve was carried out in 18 pregnant patients with mitral stenosis. From the operative findings, three patients were placed in the 'unfavourable group,' and 14 patients in the 'favourable group,' and one patient had an almost normal valve.

It is concluded that operative risk is no greater during pregnancy than in the non-pregnant state. Mitral valvotomy is the only logical method of treating the obstruction at the mitral orifice and if technically successful it considerably reduces the risk to the mother and the foetus.

Addendum

Case II in the unfavourable group has since died.

It is a pleasure to thank Miss M. Pandergaust and Miss Eunice Baker for careful case records and their help in completing this paper.

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Sealy (1953) points out in some detail the indications for surgical treatment of coarctation. He states that it has its uses, particularly as a prophylactic measure to prevent rupture, cardiac failure, endocarditis or cerebral catastrophes. He discusses the use of grafts and anastomoses, emphasising that over the age of 30 it is rather a hazardous procedure.

Finally, there is a report by Gross (1951) of 19 cases of coarctation treated by homologous grafts. In this series 80 per cent. of the patients had the blood pressure restored to normal, a fact which so far has been observed in the present case.

Summary

A case report of a patient suffering from subarachnoid haemorrhage and coarctation of the aorta, treated successfully by aortic homograft, is presented.

The apparent rarity of such a remarkable sequence of events is indicated.

Some attempt has been made to show the importance of discovering the exact cause of hypertension in the younger patient at the earliest age whenever possible (the gap of 10 years, between 1943 and 1953 in this case being noted), and the modes of presentation of these cases are described,

particularly in relation to cerebro-vascular catastrophes.

Early diagnosis and recognition of the condition is stressed, and this is shown vitally to affect the prognosis.

The value of an artery bank being available for the use of thoracic surgeons dealing with these cases is emphasised.

Acknowledgments

I wish to thank Dr. H. Alstead for his kind permission to publish this case, and Mr. J. K. B. Waddington for the use of his account of the operation. I am grateful to Dr. E. N. Chamberlain for his helpful, constructive criticism in the preparation of this paper.

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* These articles have not been quoted in the text. Each one of these articles is a classical contribution to this branch of medicine.