

HEART DISEASE IN PREGNANCY

BASED ON A REVIEW OF 284 CASES SEEN AT THE MATERNITY HOSPITALS CONTROLLED BY THE UNIVERSITY OF CAPE TOWN

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There has been considerable improvement during recent years in antenatal care, blood transfusion techniques, antibiotics and operative obstetrics. The number of maternal deaths due to toxæmias of pregnancy, haemorrhage, sepsis and other obstetric complications has therefore fallen considerably. As a result, cardiac disease is today a far more important cause of maternal mortality and postpartum invalidism than it was, and in some series it has become one of the commonest causes.¹ In spite of this it has been shown that, in the light of our modern understanding of the disorder, proper management can reduce the mortality to zero.^{1,2} Accordingly, an analysis has been made of a large series of cases which were treated in our own institutions in Cape Town.

All the cases of cardiac disease associated with pregnancy which were seen in the 4-year period, 1953-1956, in the teaching maternity institutions controlled by the University of Cape Town, were analysed. During this period there were 30,980 deliveries. Among these, 284 patients were found to have a cardiac lesion; this represents an incidence of a little over 1%. The incidence reported in the literature varies from 0.45% to 3%.³⁻⁷ An analysis of the ages of the patients shows that the

TABLE I. AGE INCIDENCE

Age	No. of cases	%
Below 20	31	11
20 - 24	99	34.9
25 - 29	64	22.7
30 - 34	44	15.4
35 and over ..	46	16

commonest age incidence is between 20 and 24 years, followed by the 25-29 year age-group (Table I).

The findings in this series can be summarized as follows: total number of cases 284 (booked 217, unbooked 67); maternal mortality 8 (2.7%); stillbirths 12; neonatal deaths 6; undelivered foetuses 3; abortions (induced 4, spontaneous 5) 9; total foetal loss 30 (10.4%); number of viable babies 256; and mothers booked elsewhere 2.

GRADING ACCORDING TO DEGREE OF COMPENSATION

The cardiac functional capacity of each patient was assessed both on admission and on delivery. Patients were graded into 4 groups as recommended by the New York Heart Association.⁸

Grade I: Signs of organic heart disease are present but the patient is symptomless and has no limitation of activity.

Grade II: The patient has slight limitation on moderate activity.

Grade III: Definite limitation develops after any activity and signs of incipient failure are present.

Grade IV: There is complete limitation and signs of cardiac failure are present even at rest.

On admission 164 patients of the 284 in this series were assessed as being in Grade I, 67 in Grade II, 22 in

Grade III and 31 in Grade IV. At the time of delivery, 2 patients had been booked elsewhere for delivery, and 3 patients had died. Of the remaining 279 patients, 182 were now in Grade I, 68 were in Grade II, 19 were in Grade III and 10 were in Grade IV.

TYPE OF LESION

We consider it a most important aspect of the treatment to be in consultation with the Cardiac Clinic of Groote Schuur Hospital. All cases, as far as possible, are therefore thoroughly examined and diagnosed by a cardiologist. The lesions in the 284 patients in this series were as follows:

A. Rheumatic Heart Disease — 253 (89%)**1. Mitral Lesions**

(a) Pure mitral stenosis	147
(b) Pure mitral incompetence	13
(c) Mitral stenosis with other valvular lesions ..	71

These included the following associated lesions: mitral incompetence 33, aortic incompetence 22, aortic stenosis 7, aortic stenosis and incompetence 1, aortic stenosis with tricuspid stenosis and incompetence 1, aortic and mitral incompetence 4, and aortic stenosis and incompetence with mitral incompetence 3.

(d) Mitral incompetence with other valvular lesions	2
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These were: tricuspid incompetence 1, and aortic incompetence 1.

2. Aortic Lesions

(a) Pure aortic incompetence	9
(b) Pure aortic stenosis	7
(c) Aortic stenosis and incompetence	3

3. Acute Rheumatic Fever

One patient	1
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B. Congenital Heart Disease — 13 (4.6%)

1. Patent ductus arteriosus	4
2. Ventricular septal defect	3
3. Tetralogy of Fallot	3

These included the following: pure tetralogy of Fallot 1, with Blalock's operation 1, and with associated dextrocardia 1.

4. Pulmonary stenosis	2
5. Dextrocardia	1

C. Hypertensive Heart Disease — 11 (3.9%)

1. Essential hypertension	9
2. Acute toxæmia with pulmonary oedema	2

D. Other Miscellaneous Lesions — 7 (2.5%)

1. Toxic myocarditis	3
2. Heart block (2:1)	1
3. Aortic aneurysm	1
4. Paroxysmal tachycardia	1
5. Acute pulmonary oedema following anaesthesia	1

ANTENATAL CARE

Good antenatal care is of special importance in the management of the pregnant cardiac patient and is a

TABLE II. CASES IN WHICH PREGNANCY WAS TERMINATED

Age	Parity	Maturity	Lesion	Operation	Indication
36	3	14 weeks	Mitral stenosis and incompetence with hypertension	Hysterotomy	Previous cardiac failure and present HPT
24	3	12 weeks	Mitral stenosis and aortic incompetence	Hysterotomy and sterilization	In Grade IV failure
47	17	20 weeks	Hypertensive cardiac failure	Hysterotomy and sterilization	History of CCF and present HPT
24	6	9 weeks	Hypertensive cardiac failure	Hysterotomy and sterilization	History of CCF and present HPT

HPT=hypertension, CCF=congestive cardiac failure.

TABLE III. SPONTANEOUS ABORTIONS

Age	Parity	Maturity	Lesion	Grade on admission	Remarks
39	0	26 weeks	Hypertension	IV	Non-booked
20	0	20 weeks	Mitral stenosis	I	Booked
28	3	22 weeks	Aortic incompetence	III	Booked
37	9	20 weeks	Mitral stenosis	I	Booked
22	0	22 weeks	Mitral stenosis	IV	Booked. Abortion followed valvotomy

major factor in reducing the maternal and foetal mortality. The management programme in our institutions is carried out in the following way:

The patient's cardiac functional state is assessed by her response to exercise early in pregnancy. As much rest as possible is advised throughout pregnancy — at least 12 out of the 24 hours, including 2 hours in the afternoon. The amount of exercise permitted should fall just short of dyspnoea or tiredness and the patient is advised to lead a quiet life and not to go on holiday, etc. The patient is carefully examined every week, if possible. Early signs of failure are looked for. She is weighed and any excessive weight gain restricted. Patients also attend the Cardiac Clinic for consultation. The haemoglobin concentration is checked at short intervals. Any anaemia is vigorously treated for it can precipitate cardiac failure.

In this series, of the 67 non-booked patients, 4 (6%) were admitted with gross anaemia; of these, 3 had serious decompensation and 1 died. Among the 217 booked cases, only 2 (0.9%) (1 with a twin pregnancy) had a mild anaemia.

Respiratory infections (even a common cold) are treated seriously with complete bed rest because of the possibility of their causing cardiac failure. The teeth are carefully looked after to avoid subacute bacterial endocarditis. Protein foods, extra vitamins, and milk are encouraged and salt intake is restricted.

Pre-eclamptic toxæmia is even more carefully watched for than normally because of the extra load placed on the heart by the hypertension and fluid retention. In the non-booked group there were 8 (12%) cases of pre-eclamptic toxæmia, 2 of whom were admitted in Grade IV failure and 1 in Grade III; the patient in Grade III went into acute pulmonary oedema and her baby was stillborn. One other patient had to be delivered by Caesarean section after a failed induction; her baby was also stillborn. Among the booked cases there were 8 patients (3.7%) with pre-eclamptic toxæmia, 2 of whom had twin pregnancies. There were 4 stillbirths and 1 neonatal death, 1 of the pairs of twins surviving.

Any cases falling into Grades III or IV are admitted

to hospital and treated with absolute bed rest, restricted fluid intake, sedation, digitalization and diuretics. If possible, no obstetrical interference should be carried out until the cardiac failure has been controlled. Cardiac failure usually threatens about the 28th - 32nd week when the load on the circulation has reached its peak. All cardiac patients, therefore, are admitted during this period for re-assessment and bed rest. It will be noted that 5 (62%) of the deaths occurred in this period. A week before term all cases are admitted for rest and reassurance and to prevent the occurrence of any infection.

Termination of Pregnancy

Therapeutic abortion is considered (a) in patients before the 20th week of pregnancy who remain in Grade III or IV without response to treatment, or (b) in patients with a history of previous cardiac failure where the cause is still present and is likely to recur.^{3,9}

Others express the view that there is never any indication for termination in women with heart disease, no matter how severe it is.¹⁰ The termination of pregnancy after the 12th week, however, requires an abdominal operation and, should therapeutic abortion be necessary, it must, if possible, be done before this time.

In the present series hysterotomy was performed on 4 (1.3%) cases, all unbooked patients. However, hypertension was the main indication in 3 of these. All 4 cases survived (Table II). There were many other patients in this series who were allowed to go to term, although they had cardiac compensation as poor as, or worse than, these 4.

Spontaneous Abortions

There were 5 (1.6%) spontaneous abortions in the series (Table III). In all, 3 of the 5 cases fell into the unfavourable Grades III or IV. The 5 abortions all occurred between the 20th and 26th weeks. This would seem to support the view that abortions are more common in the severe cardiac case. In the 284 cases reviewed, 46 (16%) women gave a history of one or more abortions. However, in 200 control cases, 51 (25.5%) women gave a similar history. On the whole, therefore, abortions appear less common among cardiac cases, one of the possible reasons being the better antenatal supervision they receive.

Results of Antenatal Supervision

The importance of antenatal supervision is illustrated very forcefully by an analysis of the results in the booked and non-booked cases. The maternal mortality was twice

TABLE IV. MATERNAL AND FOETAL MORTALITY IN BOOKED AND NON-BOOKED CASES

	Maternal deaths	Stillbirths	Neonatal deaths
Booked cases ..	5 (2.3%)	6 (2.8%)	3 (1.4%)
Non-booked cases ..	3 (4.5%)	6 (8.9%)	3 (4.5%)
Total ..	8	12	6

as high in non-booked patients. In addition, both the stillbirth and neonatal death rates were more than 3 times as high in this group (Table IV).

Tables V and VI demonstrate that at delivery 7.15% of the booked cases were in Grades III and IV, whereas

TABLE V. GRADING ON ADMISSION AND DELIVERY OF BOOKED CASES

Grade on admission	Number of cases	Grade on delivery	Number of cases
I	141	I	135
		II	3
		III	1
		IV	—
		Booked elsewhere	2
II	46	I	13
		II	32
		III	—
		IV	—
		Deaths	1 (in labour)
III	14	I	2
		II	7
		III	3
		IV	2
IV	16	I	3
		II	2
		III	5
		IV	4
		Deaths	2 (undelivered)

The patients who were in Grades III and IV on admission (30), represented 13.8% of the total, while those in Grades III and IV on delivery (15) were 7.15% of the total.

in the non-booked cases the corresponding figure was much higher (20.8%). On admission there was a similarly significant difference in the grading of the two groups (13.8% as against 34.3%).

LABOUR, DELIVERY AND THE PUERPERIUM

Management of the pregnant cardiac case in labour and at delivery in our institutions is as follows:

Patients are admitted to hospital for the week before term. Accurate pelvic assessment is done to ensure that spontaneous normal labour is possible. Liberal sedation is the rule throughout labour to alleviate any pain or apprehension. The usual drugs prescribed were morphine, gr. $\frac{1}{2}$, or pethidine, 100 mg.; these were repeated or followed by 'sodium amytal' or phenobarbitone if necessary. Penicillin, 500,000 i.u., was administered twice daily during labour as prophylaxis against subacute bacterial endocarditis. Digitalis folia or, if necessary, digoxin, are usually given to patients in Grades III or IV. These patients may also require aminophylline and oxygen. Venesection is

TABLE VI. GRADING ON ADMISSION AND DELIVERY OF NON-BOOKED CASES

Grade on admission	Number of cases	Grade on delivery	Number of cases
I	23	I	22
		II	—
		III	—
		IV	1
II	21	I	4
		II	17
		III	—
		IV	—
III	8	I	2
		II	2
		III	4
		IV	—
IV	15	I	1
		II	5
		III	6
		IV	3

The patients who were in Grades III and IV on admission (23) represented 34.3% of the total, while those in Grades III and IV on delivery (14) were 20.8% of the total.

occasionally performed as a last resort. Finally, strict attention is paid to nutrition and excretion.

The Second Stage

All efforts on the part of the patient must be kept to a minimum, especially in the more serious grades. Where anaesthesia is necessary, gas and oxygen are used if cyanosis is present, otherwise a pudendal block, which is preferable, is done. This prevents pain and delay, especially in primigravidae, and allows for immediate episiotomy.³ It is often said that forceps should be applied as a routine in cardiac cases. In this series, however, forceps were only applied in 33 (10.4%) cases. Ten of these were in Grades III or IV. This would seem to bear out the theory that the second stage in these patients is short. Recent work

TABLE VII. TYPE OF DELIVERY IN RELATION TO GRADING

Grade	Spontaneous vertex	Forceps	Caesarean section	Arm and spontaneous vertex	Assisted breech	Spontaneous breech	Breech extraction	Hysterotomy	Spontaneous abortion	Born before arrival	Total
I	149	11	7	2	2	3	—	3	—	—	182
II	49	10	4	3	1	—	—	—	2	—	68
III	11	5	—	—	—	1	1	—	1	—	19
IV	2	3	1	—	—	—	—	—	2	1	10
Total	211	29	12	5	3	4	2	4	5	4	279*

* Apart from these 279 cases, 5 were undelivered.

on this subject, however, suggests that there is in fact no significant difference in the length of labour in cardiac cases and in normal women.¹¹ The methods of delivery are related to the functional grade at delivery in Table VII.

The Third Stage

This is managed as in any normal patient except that ergometrine is never given unless a severe postpartum haemorrhage occurs. The effect of ergometrine is to cause contraction of the myometrium, thereby forcing extra blood into the circulation and causing prolonged closure of the uterine arteriovenous shunt. Both these factors may put an extra strain on the heart.¹²

It is important to allow normal separation of the placenta; attempts at manual removal are liable to cause

TABLE VIII. MATERNAL DEATHS

Booked or non-booked	Age	Maturity	Grading		Delivery	Time of death	Lesion	Child
			Adm.	Del.				
1. Booked	23	32	IV	—	Undelivered	10 hrs. after admission	Mitral stenosis. Aortic incompetence	—
2. Booked	40	34	II	—	Undelivered	36 hrs. after admission	Mitral stenosis. Hypertension	—
3. Booked	26	32	IV	—	Undelivered	2 weeks after admission	Mitral stenosis	—
4. Non-booked	31	27	IV	IV	Internal version & breech extraction	At delivery	Mitral stenosis	Stillborn
5. Booked	30	32	IV	IV	Forceps	15 hrs. after delivery	Mitral & aortic stenosis	Still born
6. Non-booked	33	36	I	I	Caesarean section	2 weeks after delivery	Aortic aneurysm. Hypertension	Live
7. Booked	26	40	I	I	Forceps	Just after the third stage	Mitral & aortic stenosis	Live
8. Non-booked	40	40	I	IV	Caesarean section	6 hrs. after admission	Hypertension. Gross anaemia	Live

Adm. = on admission. Del. = on delivery.

fatal shock. This was fortunately necessary in only 1 case in the present series. As soon as the third stage is over the patients in the more serious Grades III and IV are propped up and morphine is administered. Lacerations or episiotomy incisions are sutured under local anaesthesia.

As always, the third stage is the most dangerous. There is a great danger of sudden collapse, the reason for which is not certain.¹³

Caesarean Section

Caesarean section occupies a limited but distinct place in the treatment of patients with heart disease. The operation is never done on cardiac grounds alone but only where a difficult labour is expected or is taking place, to save the mother undue shock or exhaustion.¹

Caesarean section was performed in 12 (4.2%) cases in this series. These figures are similar to those of MacRae's series where the incidence was 4%.¹ O'Driscoll *et al.*,¹⁴ however, performed the operation in only 0.7% of their cases.

Caesarean section should not be lightly undertaken for it has been found that in Grade III or IV patients undergoing the operation the mortality rate is 12%.^{15,16} The only Grade IV case on which a Caesarean section was done in this series died a few hours later.

The anaesthetic used was usually gas and oxygen with triline or ether. Provided that the anaesthetist is skilled there is little risk with inhalation anaesthesia; cardiac patients stand it satisfactorily unless they are in failure. Thiopentone sodium must be avoided at all costs since it may cause a disastrous drop in blood pressure.¹⁷ The same applies to spinal anaesthetics which may result in hypotension followed by deficient coronary circulation and interference with respiration.¹⁸ Sterilization was performed on 5 of the cases undergoing Caesarean section. It cannot be held that the necessity of a sterilization is an argument in favour of doing a Caesarean section, for there are other much safer methods of sterilization. Even in cases of severe decompensation, statistical evidence has shown that vaginal delivery is safer than Caesarean section.¹⁵

The Puerperium

The first 12-18 hours following delivery is a most dangerous time for the cardiac patient. This is borne out by the fact that 3 (26%) of the deaths in this series occurred in this period. The explanation of this is not yet clear. Treatment, therefore, is as follows:

Adequate sedation is given for the first few days. The patient must have strict bed rest for at least 14 days or until all signs of failure, if present, are gone. Grade I and II patients may be allowed up a little earlier. Breast feeding is not permitted in Grades III and IV. Careful observation is important, and a number of complications should be specially watched for. These include puerperal infections, pneumonia or atelectasis, deep-vein thrombosis and subacute bacterial endocarditis. As far as possible these should be prevented by prophylactic penicillin, breathing exercises and leg movements. Cradles may be used for the legs but pillows under the knees are prohibited.

Subacute bacterial endocarditis occurred in only 1 (0.3%) patient in the postpartum period. She made a complete recovery.

MATERNAL DEATHS

There were 8 (2.8%) maternal deaths in the series. The incidence reported in the literature varies from 0% to 7.8%.^{1,2,19,5,20} The main data relating to these 8 cases are set out in Table VIII. An analysis of the 8 cases reveals a number of important points. In 6 of them congestive cardiac failure or pulmonary oedema was the cause of death. Haig and Gilchrist²⁰ also found these causes in 75% of the deaths in their series. Of the other 2 deaths 1 was due to rupture of an aortic aneurysm; the other followed the administration of an anaesthetic in a Grade I cardiac patient with moderate toxæmia. In the 4-year period 1953-1956, 69 maternal deaths occurred in the institutions under review. Cardiac disease therefore accounted for 11.7%. This is similar to the figures quoted by MacRae.¹

Three of the 8 patients who died were non-booked cases. However, only 2 (cases 3 and 5) can be said to have received reasonable antenatal care. The other booked cases either absconded or started their attendance very late. This is unquestionable evidence of the importance of adequate antenatal care.

Finally it will be noted that, of the patients who died, all except cases 7 and 8 died or were delivered during the 28th-32nd week period. This again illustrates the need for special supervision at this time.

SUMMARY AND CONCLUSIONS

A review of 284 cases of heart disease in pregnancy seen in the institutions under the control of the University of Cape Town in the years 1953-1956 is given.

These 284 cases were just under 1% of all admissions.

The great importance of antenatal supervision is emphasized. This is borne out, *inter alia*, by the fact that the maternal mortality was twice as high and the foetal mortality 3 times as high in non-booked patients.

The incidence of the various types of lesions occurring in the series is considered in detail.

The management throughout pregnancy and in labour, delivery, and the puerperium is outlined. The methods of delivery are presented and emphasis is given to the place of forceps delivery and Caesarean section.

The 8 maternal deaths in this series are analysed and discussed. It is pointed out that only 2 received reasonable antenatal care and that the majority of deaths occurred about the 28th - 32nd week of pregnancy.

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