THE DISABLED HEART AND PREGNANCY.

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Certain problems in regard to pregnancy and parturition arise when dealing with women handicapped by crippled hearts.

In the first place, advice may be sought concerning the advisability of marriage, or, if the patient has already ventured on matrimony, the question will naturally arise whether pregnancy should be contemplated and if so, how often.

Again, under what conditions should pregnancy be allowed to proceed to full term, and what circumstances justify termination of the pregnancy; and if it is decided to empty the uterus, which is the most satisfactory method?

Further, to what extent and by what means can the mother be helped during the stress of labour. Finally, there is the management of the patient after the birth of the child.

It is generally agreed that in women with crippled hearts the pregnancy must be looked upon as a complication of the cardiac condition and that they must be treated from the first as cardiacs.

The problem of their management is one for the physician rather than the obstetrician. Pregnancy and parturition are, in fact, an added load to the already handicapped myocardium. Not only is this true on mechanical grounds but the altered metabolism increases the demands on the heart.

Cardiac failure is the danger—a failure which may jeopardise life during pregnancy and parturition, or which may develop later during the period of lactation and leave the woman permanently in a lower category.

Classification of the Cardiac Lesion.

The American Heart Association have agreed on the following classification, and its use is to be recommended. The value of such a classification is obvious: statistics from various and diverse clinics have a greater significance when the standard of the cardiac condition of their clientele is clearly indicated.

Class 1. Patients with organic heart disease but free from any disability. No sign of congestive failure. No evidence of active disease.

Class 2. Patients with organic heart disease, unable to carry on their ordinary physical activities without discomfort.

(a) Activities slightly limited. Rarely, any congestive failure.

(b) Activities greatly limited. Some signs of congestive failure. Anginal pain or active disease.

Class 3. Symptoms of heart failure at rest. Marked congestive failure. Anginal pain or active infection.

Effect of Pregnancy on Heart and Circulation.

Pregnancy and labour are physiological events making some call on the cardiac reserve and even under normal conditions place the heart under strain. It is essential that we should fully appreciate the nature of this strain when considering the reaction of a crippled heart to pregnancy.

In what way is the circulation embarrassed?

- (1) The weight of the patient increases. The work of the heart varies directly with the weight of the individual.
- (2) The placenta, the large uterus, the growing breasts, all make extra demands on the maternal heart. The minute volume of blood is increased.
- (3) The large uterine tumour after the 6th month interferes with the movements of the diaphragm: there are changes in the shape of the chest: the circumference increases: the costal angle widens: the heart is pushed up and out. In later months the bases of the lungs are compressed and the vital capacity is lowered.
Pressure results—varicose veins, piles, œdema.
- (4) By an increased metabolic rate, which during the latter months of pregnancy is 30 per cent. higher than normal.

Many of these effects are more noticeable in the primigravida and there is a gradual increase in the difficulties and discomforts as pregnancy advances, the acme being about the 36th week.

Next comes the crucial test, the moment of deliverance, the great adventure of parturition.

Perfectly familiar as you are with the *three stages* I would ask you to visualise them in relation to the *Heart and Circulation*.

Stage 1. First, the period of dilatation. From the commencement of labour until the cervix is completely dilated. This stage does *not* put a severe strain on the heart, although the pains may cause a condition of *general* exhaustion, especially if the first stage is unduly prolonged. There is the added danger of prolonged nervous exhaustion with its damaging effect on the vasomotor tone.

Pain, fatigue, sleeplessness, and sometimes great apprehension, are the detrimental factors. If all is going well this stage should not be hurried.

Stage 2. The second stage is the important phase . . . the period of expulsion. **From complete dilatation of the cervix until the birth of the child.**

With each pain the patient braces her body, gets her feet against something solid, takes a deep inspiration, closes the glottis, and makes forcible straining movements with the abdominal and respiratory muscles, often accompanied by a grunt. Her face becomes congested and may be covered with sweat.

In cardiac patients, cyanosis is frequent. As the pain subsides, the glottis is opened and respiration re-established. During each pain the arterial blood pressure is raised and the heart quickens.

Prolongation of this stage may cause very great physical exhaustion, and it is agreed that in cardiac patients every unnecessary minute being a danger should be avoided.

Stage 3. From the birth of the child to the birth of the placenta. Following the evacuation of the uterus there is a sudden drop in the blood pressure. The patient may collapse.

Such is the task which the heart has to meet.

It is obvious, then, that pregnancy and labour throw a definite strain on the heart, a strain which may be very great if labour is unduly prolonged. The reserves are called upon and if they are unequal to the strain, cardiac failure appears, often with startling suddenness, especially during labour itself.

The patient with valvular disease faces labour with an already diminished reserve and in this lies the danger.

We must remember:—

- (1) That in valvular disease of the heart, rheumatic in origin, the myocardium is probably damaged as well as the valves.
- (2) That in mitral stenosis, the commonest type of lesion:—
 - (a) the output of blood per minute is considerably diminished, probably to not more than 2 to 5 litres.
 - (b) there is persistent engorgement of the alveolar walls and an engorged alveolar wall is inelastic.
 - (c) there is frequently emphysema, especially in the old standing cases, with the inevitable dependence of the heart on the free movement of the diaphragm.
- (3) That auricular fibrillation is a grave handicap to any heart and a very serious additional load in pregnancy and labour. This is probably the most disastrous of all the cardiac disabilities, in regard to labour.

Bearing these facts in mind it is clear that there is in the pregnant woman an increased liability to cardiac failure, and it is this liability which has to be met and diminished by careful supervision and treatment.

Cardiac failure may develop gradually but more often its onset is sudden and is due to:—(1) undue effort or over-exertion; or (2) some toxic illness such as influenza, tonsillitis, bronchitis, rheumatism, uræmia; or, (3), the sudden onset of auricular fibrillation.

Manifestations of Cardiac Embarrassment.

Cardiac failure may manifest itself at any time during the pregnancy, either before labour, during the stress of parturition, or post-partum.

We must, therefore, in every pregnant cardiac, be on the alert from the first for any early sign of failure, such as **dyspnœa**, which in a mild degree is usually a feature of the last month or two of every pregnancy: but in cardiac cases it appears sooner especially in those with emphysema. It may become excessive, preventing recumbency and interfering with sleep.

Pain is not a common sign but there may be an ache over the cardiac thrust, especially when the heart is large and overacting.

Oedema of the bases of the lungs is another suggestive indication and one of importance. We should, therefore, watch the bases carefully.

A **steady increase in pulse-rate** should arouse one's suspicions, though hyperthyroidism must be borne in mind: and progressive venous engorgement and cyanosis are both clear indications of moment.

The extent and severity of these symptoms must be our guide in the management of the patients. Pregnant women with damaged hearts must be treated primarily as *cardiacs*, and the pregnancy viewed simply as an added burden to be lightened or terminated as the conditions demand, and as evidences of cardiac failure manifest themselves.

Frequency of Heart Disease Complicating Pregnancy.

On looking into the literature we find a remarkable agreement.

Firstly, it is usually accepted that only a little over 1 per cent. of pregnant women suffer from valvular disease. This means that in any individual practice the number of such patients must be small, but this very fact may increase the anxiety of the practitioner.

In the Liverpool Maternity Hospital during the years 1926 to 1934, the incidence of heart cases among the total admissions has been 1.8 per cent., and in Walton Infirmary during 1935, in the women delivered of child or foetus, the proportion of those with crippled hearts was 1.27 per cent.

The valvular disease is almost entirely rheumatic in origin and mitral stenosis is the dominant lesion.

Dame Louise McIlroy of the Royal Free Hospital gives:—

77% Mitral stenosis	}	=92.5%
15.5% Mitral and aortic		

This was in a series of 200 crippled hearts.

Carr and Hamilton of Boston, in 472 pregnant cardiacs (rheumatic in origin) give:—

77% Mitral stenosis	}	=90%
13% Mitral and aortic		

And in 289 consecutive cases in the Liverpool Maternity Hospital:—

74.1% Mitral stenosis	}	=90.2%
16.1% Mitral and aortic		

My figures for Walton are as follows:—

67 patients, cardiacs, with pregnancy and parturition, from the beginning of September, 1934, to the present date—March, 1936:

Nature of cardiac disease.

Mitral stenosis	...	...	51	} = 17.8%
Mitral reg. V.D.H.	...	...	5	
Mitral stenosis and aortic reg.			9	
Aortic reg. and mit. reg.	...		1	
Sub. acute inf. endocarditis			1	
			<hr/> 67 <hr/>	

Classification of 64 in which class was noted:—

		P	M	
Class I.	23	11	12	} 50 or 78% being in either Class I or Class IIA.
Class II.A	27	7	20	
Class II.B	9	4	5	
Class III.	5	2	3	
Primiparæ 25		Multiparæ 42.		

Two deaths: (1) Subacute Infective Endocarditis.

(2) Advanced mitral stenosis. Slight puckering aortic cusps, death the day after delivery.

There was only one patient with auricular fibrillation, and one Cæsarian in the series.

It is well known that the average case of chronic valvular disease (Class I and Class II.A) tolerates pregnancy comfortably and generally nothing more is required than supervision and pilotage. In the Walton figures, 78 per cent. belonged either to Class I or Class IIA.

Indications for Terminating Pregnancy.

If the cardiac reserve is good the advisability of terminating pregnancy does not arise except on obstetric grounds.

When, however, severe cardiac failure exists we are faced with the necessity of deciding whether the pregnancy is to be terminated and which of various methods should be employed. If it is clear that intervention is imperative, an attempt must first be made to restore compensation and the uterus emptied only when the reserve power of the heart has been augmented. For the stress of labour is likely to prove fatal to a woman whose decompensated heart is struggling with difficulty to maintain the circulation.

In the earlier months, cardiac failure which refuses to respond to treatment justifies immediate intervention, especially if there be persistent retching and vomiting. But if the pregnancy has existed for more than three months then it is wiser to defer interference until towards the end of pregnancy.

The following cases exemplify some of the difficulties met with.

Case 1.

An example of the type of patient in which early termination of pregnancy is indicated.

Aged 22. Primigravida. Advanced mitral stenosis. Early emptying of the uterus.

I saw this patient on *February 8th, 1923.*

She could not walk, even slowly, without dyspnoea—much worse the last two months. She belonged to Group 3. Had been married four months.

A delicate fragile creature with typical mitral facies and some œdema of the ankles.

Large heart: old standing lesion.

Heart rate 120 per minute, fundamental rhythm normal. Pulse very small in volume.

It was obvious that pregnancy and parturition would prove a serious risk, probably disastrous.

At the 10th week, under an anæsthetic, the os was dilated and the ovum was removed with forceps and curette.

She took the anæsthetic well and gave no trouble.

She was warned against further pregnancy.

Case 2.

Patient aged 31 years. 3 Para. 1922.

Advanced mitral stenosis. Forceps delivery to shorten 2nd stage.

She had tolerated pregnancy well but labour was prolonged owing to early rupture of the membranes.

First stage lasted 18 hours.

Heart rate increased from 100 to 138, pulse steady and full.

Dyspnoea and orthopnoea and some cyanosis towards the end with marked venous engorgement.

No advance of the head during the first hour of the 2nd stage.

Forceps applied under ether. $\frac{1}{2}$ hour strong pulling.

Extreme maternal cyanosis and venous engorgement during the operation.

Pulse 150 per minute.

Almost instant relief after delivery.

Post-natal condition satisfactory.

Child 9 lbs. 3 ozs. Born dead.

5th Pregnancy. 22nd May, 1924. Another large child born dead.

Labour induced . . . bougies.

During 2nd stage, dyspnoea, cyanosis, mental distress.

Morphia gr. 1/6th.

Forceps delivery owing to difficult presentation.

Ether anæsthesia well borne.

History of 6th and last pregnancy.

7th May, 1927, collapsed owing to sudden onset of auricular fibrillation and acute heart failure. Heart rate 140.

Orthopnoea, intense cyanosis, universal râles in chest.

Condition controlled by morphia, venesection and intravenous strophanthin.

9th May. Heart rate 96 per minute.

26th May. Spinal anæsthesia by Mr. Wilson (stovaine).
Cæsarian section and sterilization.
Uneventful recovery.

12th June, 1927. Heart showed normal rhythm: walking about without discomfort.

The following case is an example of the type of case in which Cæsarian section is indicated to prevent any additional strain on the heart.

Case 3.

Patient aged 35. Primigravida.

Old standing advanced mitral stenosis. Normal Rhythm.

For three years, cough and dyspnœa on walking or climbing stairs.

Was a singer by profession but 15 months ago stopped singing and got married—or should I say got married and stopped singing!

Admitted December 19th, 1922. Obviously belonging to Class III.

Her distress (dyspnœa) was so great by August (? 4 to 5 months' pregnant) that she was compelled to remain in bed.

This, together with a tendency to rapid heart action justified Cæsarian section, which was performed by Mr. Leith Murray, 15th January, 1923.

She was sterilized at the same time.

Baby 7½ lbs. Full term, judging from child. Supposed to be 38 to 37 weeks.

Mother's condition satisfactory.

The existence of auricular fibrillation does not in itself justify interference until specific treatment with digitalis has failed after a full trial. The fibrillating heart tolerates pregnancy and labour better than one would expect if the patient is carefully treated throughout the pregnancy and parturition, but the further history of such patients is dismal reading.

In my first series of 50 consecutive cases published in the *Lancet* of 1928, there were five patients in whom auricular fibrillation was present, with one death—a death not due to the cardiac condition but to an associated grave kidney disease. In this woman induction was performed at 36 weeks and the patient died of uræmia.

In the remaining four cases, labour was normal, precipitate in one and premature in another. All were patients suffering from advanced mitral stenosis, and had had the advantage of careful supervision and treatment during the later months of pregnancy.

In one of the four, full doses of digitalis had steadied the heart and everything was progressing favourably until the patient went home for 9 days and ceased taking her medicine. She returned to the Maternity Hospital with the onset of labour and in great distress, heart rate about 130 to 150 per minute. In this patient great benefit was derived from the intravenous injection of strophthanthin which acted with sufficient rapidity to control the heart before the onset of the strenuous second stage.

The outlook in patients suffering from auricular fibrillation depends, therefore, upon the response to rest with full digitalization and the careful supervision of the terminal months of pregnancy. When this is adequate the immediate outlook is good but the remote outlook is anything but satisfactory.

This was stressed by Mackenzie who reported six cases: all but one of these were dead in two years.

As soon as the child is viable any sign of progressive cardiac failure which refuses to benefit from rest and digitalis justifies intervention. This raises the question of the best method of terminating pregnancy.

It is not easy to determine the relative value of induction and Cæsarian section, and each case has to be decided on its merits, the aim being to empty the uterus with the least strain to the mother's heart.

Induction in the latter months, especially in a primigravida, is not necessarily easier than normal labour: and it is often unduly prolonged, there is more uncertainty, the anæsthetic may have to be repeated and it is without doubt a greater psychological strain. Other things being equal, one expects a normal spontaneous labour to be more speedy and efficient than an induced labour, for it is the terminal event precipitated by a summation of normally co-ordinated physiological processes.

If the cardiac condition of the patient is so serious that intervention is indicated, then Cæsarian section subjects the patient to much less strain than an induced labour. It is possible that an exception might be made in the case of a multipara in whom the baby is small and who has a history of easy rapid deliveries. With a Cæsarian section, the heart is saved from the strain of the second stage of labour with its obvious risks, and incidentally it affords an opportunity for sterilization.

If the necessity for terminating pregnancy is not urgent, then the Cæsarian can with advantage be delayed until after the onset of labour. In fact, the reaction of the patient to the first stage may be the deciding factor. A cardiac patient sometimes drifts very rapidly and unexpectedly into distress during this stage. It is then one realizes the advantage of having the patient in hospital so that the Cæsarian can be started without delay.

Expert opinion is steadily veering towards Cæsarian section as the better method of emptying the uterus . . . although I was interested to note that Mr. Eardly Holland considers a well managed delivery, even in severely decompensated cases, better than a Cæsarian section. (Royal Socy. of Medicine. October, 1931.) My impression is that induction is to be advised as the wiser course in the first three months, and a Cæsarian section performed when there is a clear indication that from any cause labour is likely to be long and difficult and the viability of the child is in question.

Induction is much safer in the earlier months of pregnancy. In the later, it is recommended—not to obviate the risks of labour, but on account of the risks of continuance of the pregnancy.

I have been interested to observe in the different clinics the varying attitude towards Cæsarian section in patients with crippled hearts.

For example, in the Royal Free Hospital, there were only 5 Cæsarian sections in 200 patients with cardiac disease = $2\frac{1}{2}$ per cent. Whereas in Boston, 101 of 500 such patients were subjected to Cæsarian section, that is 20 per cent.

There is undoubtedly an increasing belief in the value of this method and this is well demonstrated by the figures of the Liverpool Maternity Hospital where the percentage has steadily risen since 1926 and it is now higher than the Boston figure.

In 1926.	1 in 23	=	4.5%	} For the last five years over 25%.
1927.	5 in 32	=	16.0%	
1928.	3 in 38	=	$7\frac{1}{2}$ %	
1929.	4 in 47	=	$8\frac{1}{2}$ %	
1930.	12 in 45	=	$26\frac{1}{2}$ %	
1931.	9 in 33	=	27%	
1932.	10 in 32	=	31%	
1933.	8 in 29	=	$27\frac{1}{2}$ %	}
1934.	11 in 36	=	30%	

In Walton, on the other hand, there was only one Cæsarian in 67 consecutive cases of cardiac disease.

The best general anæsthetic is ether or ethanesal as a vapour warmed by a Shipway's apparatus and accompanied by oxygen, or gas and oxygen.

To what extent do Pregnancy and Parturition cause permanent damage?

The answer is, I think, less than one would expect. It is remarkable how satisfactorily most cardiac patients progress for a time after labour is past, if they have been carefully piloted through the difficulties and adequately treated, but there is occasionally a tendency to slow progressive failure at a later date. This tendency is most marked in patients suffering from advanced mitral disease with auricular fibrillation.

Unassisted labour at full term in a decompensated heart, even if the patient survives, will probably leave the heart permanently less adequate and with a depleted reserve. She passes into a lower category.

Patients with advanced aortic regurgitation are especially liable to suffer, but moderate grades of aortic regurgitation with a good myocardium tolerate labour well.

Since there is a risk of permanent depreciation, great care should be taken during the puerperium to enable the heart to recover before returning to the ordinary stress of life. Some degree of supervision is essential.

Anæmia should receive prompt and adequate treatment, and fibrillation demands digitalis.

One danger is that of an increase of weight in the patient. This is a definite handicap to a damaged heart and obesity must be prevented or treated.

In my experience there is no objection to lactation, in fact the patients appear to do better when fulfilling their normal functions in this respect. However, if the patient is greatly distressed by cardiac failure or general weakness, she should not be allowed to bend forward to suckle the child, but the child should be held to the breast by a nurse or propped on a pillow.

Treatment.

Treatment may be summarised in a few words. **Pregnant women with diseased hearts must be regarded primarily as cardiac patients.** They must be under regular medical supervision throughout and the first indication of cardiac failure noted.

Among the poor, an ante-natal Home and a Rest Home are of the greatest value.

The reserve power of the heart must be increased by graduated exercise, by *adequate rest*, and by symptomatic treatment.

Dyspepsia, flatulency, constipation, **insomnia**, anæmia, bronchitis, and other discomforts, must be remedied. Severe bouts of coughing are particularly detrimental. Tachycardia is sometimes a distressing symptom during the 4th and 5th months. This is probably due to hyperthyroidism and not evidence of cardiac failure. Give iodine.

If there is **auricular fibrillation** it must be controlled with digitalis and the optimum dose found and maintained.

Rest is essential, more especially in the four to six weeks before labour, and if the symptoms of cardiac failure do not yield to treatment the advisability of terminating the pregnancy will have to be considered.

Special attention should be paid to any pyrexial illness, because a toxic condition will further damage the handicapped heart; and during convalescence from such illness prolonged rest in bed is the first and most important factor in the building up of the cardiac reserve.

If there is frank failure of compensation in the earlier months of pregnancy the uterus will have to be emptied and induction, if considered the wiser method of approach, should never be attempted until compensation has been restored as far as possible by rest and drugs.

The aim during labour is to lessen nervous and physical exhaustion, especially during the first stage, and to diminish the physical strain of the second stage.

Light anæsthesia is helpful during the second stage, and narcotics are also valuable. They reduce the voluntary effort.

Dr. Minnitt's apparatus of gas and oxygen has proved most helpful.

When full dilatation has been reached an immediate resort to instrumental help is essential. If cyanosis is present, an inhalation of oxygen and 5% carbon-dioxide is useful. When acute pulmonary oedema is present, an immediate hypodermic injection of morphia is indicated.

In conditions of collapse, cardiazol and coramine should be given intramuscularly.

We have yet to consider when pregnancy may be considered dangerous or unjustifiable.

In my experience, there has been far too great a tendency to veto marriage in the presence of some cardiac abnormality, often when there is nothing more serious than premature beats, or a cardio-respiratory bruit.

When considering this question it is well to remember that marriage does not necessarily entail pregnancy.

Experience has shown that the majority of women suffering from valvular disease in whom the cardiac reserve is good, and who have never suffered a cardiac breakdown, are quite capable of passing through pregnancy and parturition without any great danger, and they are surely entitled to the risk of one confinement. It is generally agreed that pregnancy is an advantage to most women, a consummation devoutly to be wished, and the delights of motherhood should, whenever possible, be allowed to cardiac patients. If uncertain, give the woman the benefit of the doubt and then watch her carefully from the beginning to the end, being prepared to intervene if necessary.

The risks are said to be doubled after the age of 35.

Pregnancy in a healthy woman is in itself a risk and this is admittedly increased in the presence of heart disease, but it is one which many women of Class I and Class IIA are prepared to take in order to have a child and given constant supervision the risk is then not unreasonable.

In multiparæ a knowledge of the manner in which the previous pregnancy was tolerated is an excellent guide. In them, more particularly if the last delivery was satisfactory, the presence of early mitral stenosis or even aortic regurgitation, the occurrence of premature beats or the existence of cardiac pain and tenderness over the cardiac thrust, do not justify an absolute veto on a further pregnancy. So long as the cardiac reserve is good, so long as the response is satisfactory and there is no undue enlargement of the heart, the presence of valvular disease is no bar to marriage or pregnancy.

When, however, there is a clear history of congestive cardiac failure and distress during a previous pregnancy, and it is known that following the labour, the convalescence was unduly prolonged then a definite veto must be given.

The same opinion is justifiable in cases presenting auricular fibrillation: or, advanced mitral stenosis as shown by a large heart, a long diastolic bruit, and small cardiac reserve: or, advanced aortic regurgitation with a big heart, Corrigan's pulse, and defective reserve.

It is, however, the borderland cases that present the greatest difficulty. In them, any abnormality in the pelvis likely to prolong labour becomes of great importance and pulmonary complications add to the danger.

There is just one other point which deserves emphasis. Sometimes the patient is morbidly apprehensive in regard to a possible pregnancy and her fears may be so real and dominant that they cannot be dispelled. There is first the fear of the risk of labour itself, and in addition the fear that she will not be strong enough to look after her baby. Sympathetic handling can do much to help such a woman, and therefore a pregnant woman who is aware of her cardiac disability should be reassured not only during her pregnancy but also during the first stage of labour. Too often, the risks are unduly stressed and her pregnancy is overclouded by fear and apprehension.

The necessity for careful supervision must be emphasised and the importance of rest and sensible behaviour discussed with her quite freely, but she must be cheered on her way. A woman needs a stout heart for the great adventure of creation.