

Pregnancy Complicated by Maternal Heart Disease: A Review of 281 Women

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Abstract

Objectives To study maternal heart disease in an Indian setting for: (1) different etiological factors, (2) different types of lesions, and (3) maternal and perinatal outcome.

Methods 281 women with heart disease who delivered ≥ 28 weeks of gestation at different teaching institutions (tertiary care centres) in India were studied.

Results Rheumatic heart disease ($n = 195$; 69.4 %) with isolated mitral stenosis ($n = 75$; 26.7 %) were the commonest. Septal defect ($n = 27$; 9.6 %) was the predominant lesion among the congenital heart disease ($n = 60$; 21.3 %) patients, whereas in the miscellaneous group ($n = 26$; 9.2 %), ischemic heart disease ($n = 10$; 3.6 %) was the leading cause. Multiple cardiac lesions were also diagnosed in 100 (35.58 %) women. In 87 (31 %) women, diagnosis was made first time in labor. Majority $n = 131$, (46.6 %) had spontaneous vaginal delivery and few ($n = 9$; 3.3 %) required induction of labor. Cardiac

complications were noted in 72 women (25.6 %). There were three (1.06 %) maternal deaths and perinatal mortality was 4 % ($n = 11$).

Conclusion In this study, rheumatic heart disease in pregnancy is still predominant though acquired cardiac lesions are rising. In rheumatic heart disease, mitral valve involvement was the commonest and multiple valve lesions were a major observation. Most common obstetric complication was small for gestation baby. Maternal morbidities in the unbooked women are high and congestive cardiac failure was the major cardiac complication.

Keywords Pregnancy · Heart disease · Types · Outcome

Introduction

Prevalence of heart disease in pregnancy vary from 0.3–3.5 % [1, 2]. In the presence of maternal heart disease, the circulatory changes of pregnancy may result in decompensation or death of mother or fetus. There are few studies available in India that are prospective, focused particularly on heart disease in pregnancy, and examined the populations managed at different institutions in different parts of country. To assess the outcomes of heart disease in pregnancy comprehensively in a contemporary cohort, we prospectively examined the frequency of pregnancy-related complications in Indian women with heart disease.

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Methods

This study was conducted by the committee for the “Medical Disorders in Pregnancy” of the Federation of Obstetrics and Gynaecological Societies of India (FOGSI) under the Chairmanship of the first author. The study prospectively enrolled 281 pregnant women with heart disease receiving care in five cardiac and obstetric-teaching hospitals across the country (Table 1). In each centre, we had a principal investigator, who was a member of this committee. All pregnant women with congenital or acquired cardiac lesions or those with cardiac arrhythmias referred to a participating center were eligible for enrollment. To be eligible for inclusion, patients in whom cardiac arrhythmia was the primary diagnosis must have had symptomatic sustained tachyarrhythmias or bradyarrhythmias requiring treatment before pregnancy. Women who were referred for termination of pregnancy were excluded. All centers received research ethics approval for this study, and the subjects gave informed consent.

A proforma was predesigned to gather the minimum but essential information regarding heart disease in pregnancy. Keeping in mind the limitation of resources, the proforma was made simple and brief. Baseline data recorded at the first prenatal visit included age, parity, gestational age, New York Heart Association (NYHA) functional class, co morbid conditions, prior cardiac events (for those who underwent cardiac intervention; only events after intervention were considered), cardiac lesions, prior surgery/interventions, cyanosis (oxygen saturation <90 %), medications, use of tobacco, educational status, thorough clinical examination including chest auscultation, 12-lead ECG, and transthoracic echocardiographic assessment of systemic (left) and venous (right) ventricular systolic function. Follow-up data were obtained from clinical visits during the second trimester, third trimester, peripartum period (onset of labor until hospital discharge), and at 6 weeks postpartum. Women were advised on the importance of rest, taking iron and folic acid supplementation, avoidance of infection, and early visit to the clinic if there is any deterioration of health condition. Women with NYHA classes I and II were admitted in the hospital at 36 weeks. Vaginal delivery was the aim. Cesarean section

was done only with clear obstetric indications. Similarly, labor induction was considered with most stringent obstetric indications. Intramuscular syntocinon was given following the completion of the second stage except in patients with heart failure. For patients who did not deliver at the recruiting hospital, follow-up data were obtained by reviewing discharge summaries from the obstetric centers and by contacting the physicians. Newborns of mothers with congenital heart disease were examined for inheritance of disease; pediatric echocardiography was performed in all infants with abnormal cardiac examinations.

Data analysis was confined to pregnancies that were not complicated by miscarriage (fetal loss before 28 weeks gestation) or voluntary termination of pregnancy. Cardiac, neonatal, and obstetric events were analyzed separately.

Results

A total of 281 pregnant women complicated by heart disease were seen. Baseline characteristics of all pregnancies are shown in Table 2. The principal cause of cardiac lesion was rheumatic heart disease (69 %) and congenital heart disease (21 %). The ratio of patients with congenital heart disease relative to patients with rheumatic heart disease was 1:3.2. 159 (61 %) patients were booked. Only 35 (12.5 %) women were in the age group of 30 years or above. In 194 (69 %) cases, heart disease was diagnosed during pregnancy. For the remainder 87 (31 %), diagnosis was made first time during the course of labor when admitted as emergency.

Among the women who had rheumatic heart disease, mitral stenosis constituting 75 (75/195; 38.5 %) cases was the most common lesion (Table 3). Multiple cardiac lesions were present in 100 (100/281; 35.58 %) pregnancies. Among the women with congenital cardiac disease, atrial septal defect was the most common constituting 15 (25 %) cases. In the miscellaneous group ischemic heart disease was the most common constituting 10 (38.5 %) cases (Table 3).

Majority of the women 131 (46.6 %) delivered vaginally with spontaneous onset of labor (Table 4). Only 9 women (3.3 %) required induction with intracervical PGE₂ gel because of postdates (4), IUGR (2), IUFD (2), and

Table 1 Distribution of cases according to the centre (*n* = 281)

Centre	Chief investigator	No. of cases
1. NRS Medical College & Hospital, Kolkata	Dr. H. Konar	122 (43.4 %)
2. Sri Ram Chandra Med. College, Chennai	Dr. J. V. Raghavan	97 (34.5 %)
3. JLN Hospital, Bhilai	Dr. P. Panigrahi	35 (12.5 %)
4. VSS Medical College, Sambalpur	Dr. G. Sahoo	15 (5.3 %)
5. AFMC, Pune	Dr. T. K. Bhattacharya	12 (4.3 %)
Total		281 (100 %)

Table 2 Baseline characteristics

Distribution of cases according to age (years)	
	No. (%)
Age (years)	
<20	27 (9.6 %)
20–24	122 (43.4 %)
25–29	97 (34.5 %)
≥30	35 (12.5 %)
Gravida	
G 1	124 (44.13 %)
G 2	101 (35.94 %)
G 3	52 (18.51 %)
G 4	2 (0.71 %)
G 5	2 (0.71 %)
Type of cardiac lesion	
A Rheumatic	195 (69.41 %)
B Congenital	60 (21.37 %)
C Miscellaneous	26 (9.22 %)
NYHA functional class	
I and II	234 (83.27 %)
III	43 (15.30 %)
IV	04 (0.14 %)
Gestational age at entry (weeks)	
<20	132 (46.97 %)
>20	149 (53.02 %)
Receiving cardiac medication	
None	41 (14.59 %)
Digoxin	142 (63.21 %)
Diuretic	184 (65.48 %)
Antiarrhythmic	15 (5.33 %)
Anticoagulants	19 (6.7 %)
Prior heart failure/TIA/stroke	9 (3.20 %)
Prior cardiac surgery	8 (2.84 %)

^a Some patient received more than one medication

pregnancy induced hypertension (1). All had safe vaginal delivery. Ninety three (33.0 %) women delivered by cesarean section because of obstetric reasons. During pregnancy, cardiac surgery was performed in twelve women. All suffered tight mitral stenosis with symptoms not controlled by medical management. All had transventricular closed mitral valvotomy and uneventful surgical outcome, and tolerated pregnancy well. Another eight women entered pregnancy with prior mitral valve replacement. All of them had anticoagulant (heparin or warfarin) therapy.

Majority of the women, 225 (80 %), in this study, were within their second pregnancy (Table 2). In this study, 165 (58.7 %) babies born weighed ≥ 2.5 kg (Table 4). Perinatal mortality in the study was 4 %. There was no baby born with congenital heart disease (Table 4). The major

complications that were encountered during the management of these 281 pregnancies are shown in the Table 4. The predominant problem was the heart failure found in 21 (7.4 %) women. Sixty nine (24.55 %) women suffered due to varied cardiac morbidities (cardiac failure-21, arrhythmias-15, embolism-1, bacterial endocarditis-1, CVA-1, and change in NYHA $\geq 2 = 18$ and urgent cardiac intervention 12). There were three maternal deaths in this study. All these three women were unbooked, seen first time in labor as an emergency. They suffered from the complications of cardiac failure, pulmonary edema, anemia and infection.

Discussion

Our study provides a contemporary assessment of maternal and neonatal complications associated in women with heart disease in pregnancy. This study shows that rheumatic heart disease is still predominant and cardiac lesion and cardiac complication rate was high (21 %). As the study was multicentric and all centers had a wide catchment area, study population may be more representative of total population at risk.

It is estimated that 0.3 and 3.5 % of all pregnancies are complicated by heart disease and it accounts for 15 % of pregnancy-related mortality [3]. Teaching institutes in our country, being referral centers, may not reflect the actual prevalence of this medical disorder in pregnancy. It is an important cause of maternal mortality in India [4]. Heart disease in pregnancy has re-emerged as one of the leading causes of maternal mortality.

Although the incidence of cardiac abnormalities in pregnancy as a group has remained more or less unchanged, the relative contribution of the different causes of heart disease diagnosed during pregnancy varies with the study population and study period. Our study shows rheumatic heart disease is three times more common than congenital heart disease, and mitral stenosis was the predominant lesion. These observations are in agreement with other Indian studies [5, 6]. However, the incidence of rheumatic heart disease in developed countries has been greatly reduced by the widespread use of antibiotics effective against the streptococcal bacterium which causes rheumatic fever. Thus, our study indirectly indicates inadequate or no treatment of girls suffering from streptococcal infection in their childhood and adolescence.

Murmurs are commonly heard during pregnancy due to the haemodynamic changes. Echocardiography is rarely necessary in pregnant women with murmurs [7]. However, in our cases, echocardiography was done routinely. Thirty five percent (35.58 %) of cases in our study suffered multiple cardiac lesions. Echocardiography was helpful for early and accurate evaluation of cardiac status.

Table 3 Types of cardiac lesions ($n = 281$)

Type	No. (%)
(A) Rheumatic	
MS	75 (38.5)
MR	22 (11.3)
MS + MR	15 (7.7)
MS + PAH	13 (6.6)
MS + MR + PAH	13 (6.6)
MR + AR	10 (5.1)
AR	10 (5.1)
AS + AR + MR	6 (3.1)
TR + MR + PAH	6 (3.1)
MS + AR	6 (3.1)
MR + PAH	3 (1.6)
MR + MS + AR	3 (1.6)
AS + AR	3 (1.6)
MS + AS	2 (1)
MS + AR + PAH	2 (1)
MS + AF	2 (1)
MS + AS + PAH	2 (1)
TR	2 (1)
Total	195 (100)
(B) Congenital	
ASD	15 (25)
VSD	12 (20)
TOF	11 (18.4)
PDA	7 (11.7)
MVP	7 (11.7)
ASD + PAH	2 (3.3)
PS	2 (3.3)
Dextrocardia	2 (3.3)
CHCM	2 (3.3)
Total	60 (100)
(C) Miscellaneous	
IHD	10 (38.5)
Arrhythmia	6 (23.1)
AF	3 (11.5)
DCM	4 (15.4)
PAH	3 (11.5)
Total	26 (100)

MS mitral stenosis, MR mitral regurgitation, PAH pulmonary artery hypertension, AS aortic stenosis, AF atrial fibrillation, ASD atrial septal defect, VSD ventricular septal defect, TOF tetralogy of fallot, PDA patent ductus arteriosus, AR aortic regurgitation, MVP mitral valve prolapse, PS pulmonary stenosis, IHD ischemic heart disease, DCM dilated cardiomyopathy, CHCM congenital hypertrophic cardiomyopathy

Cardiac failure is a major complication in pregnancy and is often associated with maternal death (Table 4). In this study, most cases had cardiac failure during labor, 5

women required intensive care monitoring, and 12 of them were unbooked and were seen first time in labor. Three women in this group were further complicated with anemia, and infection, and they died. We therefore emphasize the preventive aspect of cardiac complications in pregnancy, labor, or puerperium with early detection.

Most of the women with heart disease in pregnancy go into spontaneous labor and deliver vaginally. Majority of the neonates had either average or less than average birth weight (Table 4). Induction of labor is not generally indicated. However, in a well-selected case, induction of labor may be considered when the situation so arises. Induction of labor with PGE₂ intracervical gel has been found safe and effective in this study. In a well-selected case of cardiac disease, induction of labor is not associated with more maternal or neonatal complications [8]. We believe that our favorable outcome was attributable to the joint management of all our women by the obstetric as well as cardiologist team. All these women were categorized as NYHA Class I.

In this study, 12 patients underwent TVMC during pregnancy and 8 women entered pregnancy with prosthetic valves. Any form of cardiac surgery during pregnancy is avoided unless the cases are refractory to medical treatment. However, we observed significant improvement of symptoms in these cases which underwent TVMC in the second trimester for tight mitral stenosis. Balloon valvuloplasty is less invasive and is equally safe and effective during pregnancy. In this series, the outcome of surgery was good for both the women and the babies.

Majority of pregnancies complicated by heart disease in this study had uneventful course with a favorable outcome for both the mother and the baby. Mortality in women with heart disease during pregnancy is high when complicated with infective endocarditis. This certainly calls for every preventive measure for the women at risk in our setup. In this study, all women received prophylactic antibiotics against bacterial endocarditis. However, the working party of the British Society for Antimicrobial Chemotherapy recommends prophylaxis only in very high risk women, such as those with prosthetic heart valves or previous endocarditis [9]. We feel that in our setup in India, anti-bacterial endocarditis prophylaxis should be given as a routine to all women with heart disease in pregnancy.

Women with prosthetic heart valves or with left atrial vegetations were given anticoagulant therapy to reduce the risk of thromboembolic complications. We did not face any difficulty in managing women with heparin (SC) during the first trimester and last 2 weeks of pregnancy and using warfarin during the rest of pregnancy and puerperium. All women breast fed their children as the routine use of anticoagulants in therapeutic doses during puerperium is not a contraindication of breast feeding.

Table 4 Maternal and perinatal outcomes

Maternal cardiac event (at least one of the following)	
Cardiac failure	21 (7.4 %)
Sustained arrhythmia requiring therapy	15 (05.33 %)
Embolism	01 (0.3 %)
Bacterial endocarditis	01 (0.3 %)
Cerebrovascular accident	01 (0.3 %)
Cardiac death	03 (1.1 %)
Change in NYHA class ≥ 2	18 (06.40 %)
Need for urgent invasive intervention	12 (04.27 %)
Obstetric event (at least one of the following)	
Pre eclampsia	04 (01.4250)
Post partum hemorrhage	02 (0.7 %)
Non cardiac maternal death	0
Mode of delivery	
SVD	131 (46.6 %)
Induced labor	09 (03.20 %)
LSCS	93 (33.0 %)
Instrumental delivery	48 (17.0 %)
Neonatal event	
Small for gestational age	114 (42.18 %)
Intra uterine fetal death	02
Neonatal death	11 (4.04 %) (SB = 5; ND = 6)
Congenital heart disease of newborn	0

Pre-term birth and low birth weight babies are known as the major neonatal complications in women with heart disease in pregnancy. Perinatal outcome was more dependent on severity of symptoms during pregnancy rather than the duration and type of heart disease [3]. 114 (42.2 %) babies in this study weighed <2.5 kg. These neonates also run the risk of inheriting congenital heart disease. Overall, the risk of such inheritance is quoted to be 3–5 % compared to 1 % risk in general population [10]. In our study, we have not observed any such inherited neonatal heart disease though 21.3 % women in this study suffered from congenital type of cardiac lesions.

Warfarin embryopathy has been quoted at 5–10 % when used in the first trimester [9]. Five of eight women with mechanical prosthetic valves used warfarin who conceived inadvertently during the period of follow-up. By the time they were first seen in the clinic, all were in their second trimester. None of these neonates had any congenital malformations. It appears to us that low dose of warfarin (3–4 mg a day) may not have a very high fetal risk as the earlier studies had shown. The fetal risk from warfarin is dose dependent. A dose more than 5 mg is associated with the increased risk of teratogenesis, miscarriage, and still birth [11]. Follow-up study of children whose mothers had

warfarin during pregnancy had been revealed [10]. Recommendation of using some form of heparin with the onset of conception appears theoretically sound. Unfortunately, conception cannot be planned with precision all the time and the price to pay for not using any form of anticoagulant is valve thrombosis and embolism. Therefore, there is no ideal solution to this problem. The risk of warfarin embryopathy certainly seems to be uncommon even when it was used in the first trimester [11]. However, further controlled studies are needed to document the safety of the use of low dose warfarin through out pregnancy. Bio-prosthetic valves are not associated with any such increased risk.

All the three maternal deaths were in women with unsupervised pregnancy and emergency admissions in labor with complications. We emphasize pre-pregnancy diagnosis, counseling, appropriate referral, routine antenatal supervision, and delivery at an equipped centre to improve the pregnancy outcome for both the mother and the baby. Cardiac failure is a serious complication and often leads to maternal death. We therefore stress the need to monitor cardiac patients for early detection and management of heart failure throughout the course of pregnancy, labor, and puerperium.

There is a gradual rise in the incidence of acquired cardiac disease in pregnancy all over the world [3]. This is also observed in this study. Ischemic heart disease, arrhythmia, and cardiomyopathy are seen more frequently during pregnancy. It may be due to increased association of medical disorders like obesity, diabetes, hypertension, and stress during pregnancy. Increased maternal age is also a known risk factor. Rheumatic heart disease is still the predominant one in this country though [6].

Maternal mortality in this study is comparable to another recent study in India [6]. However, high cardiac morbidities (20.3 %) observed in this study should not be ignored. However, such magnitude of maternal mortality and morbidity are not unexpected when 31 % of women were seen first time in labor as emergency. Therefore, there is further scope for the reduction of maternal mortality and morbidity, provided diagnosis is made prenatally and women are supervised continually.

In the present study, we felt the need of cardiac auscultation as a routine, besides obstetric examination to all women in the antenatal clinic. Any clinical diagnosis or suspicion of cardiac disease should be confirmed by a cardiologist. Similarly, general physicians should be careful to make cardiac auscultation as a routine for any girl or woman in the clinic, considering its long-term implications in relation to pregnancy, labor, and health. On early detection, surgical corrections especially with congenital heart disease may be done so that the women enter pregnancy safely and tolerate pregnancy well.

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