

Maternal and fetal outcomes of labour in pregnancies with cardiac disease: a prospective observational study.

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Abstract

Objectives

To evaluate maternal and fetal outcomes of labour among pregnant women with cardiac disease and assess obstetric and cardiac complications during labour and the postpartum period

Methods

A prospective observational study was conducted among 50 pregnant women with cardiac disease admitted in labour at a tertiary care hospital in Karnataka, India. Participants underwent clinical, obstetric and cardiovascular assessment, including electrocardiography and two-dimensional echocardiography. Maternal cardiac and obstetric complications, mode of delivery, maternal outcomes and neonatal outcomes were recorded prospectively until discharge.

Results

Most women were aged 21–30 years (44, 88.0%), and 43 (86.0%) were in NYHA functional class I. Rheumatic heart disease was the commonest cardiac lesion (23, 46.0%), followed by congenital heart disease (14, 28.0%); mitral stenosis predominated among rheumatic lesions (19, 82.6%). Cardiac complications occurred in 2 (4.0%) women, comprising congestive cardiac failure and arrhythmia. Vaginal delivery was the commonest mode (24, 48.0%), followed by LSCS (15, 30.0%) and instrumental delivery (11, 22.0%). Preeclampsia (9, 18.0%) and intrauterine growth restriction (7, 14.0%) were the commonest obstetric complications. Maternal outcome was uneventful in 36 (72.0%), while 14 (28.0%) required HDU care. Among 51 newborns, 18 (35.3%) had birth weight <2.5 kg. There were 47 (94.0%) live births and 3 (6.0%) intrauterine deaths. NICU admission occurred in 12 (24.0%) and prematurity in 10 (20.0%) pregnancies.

Conclusion

Outcomes were generally favourable, but cardiac complications and adverse perinatal outcomes occurred, emphasizing risk stratification, individualized delivery planning and multidisciplinary maternal-fetal surveillance.

Recommendations

Early identification and risk stratification of pregnant women with cardiac disease should be emphasized. Individualized delivery planning, close maternal and fetal monitoring during labour and postpartum surveillance are recommended, particularly in high-risk women managed at centres with appropriate cardiac, obstetric, anaesthetic and neonatal facilities.

Keywords: Cardiac disease in pregnancy; maternal outcome; fetal outcome; rheumatic heart disease; labour.

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Introduction

Cardiac disease complicating pregnancy is an important cause of maternal and perinatal morbidity and mortality, particularly in developing countries [1]. Although improvements in diagnosis and treatment have allowed more women with congenital heart disease to reach reproductive age, rheumatic heart disease continues to contribute substantially to the burden of cardiac disease during pregnancy in developing regions [2]. Approximately 1% of pregnancies are affected by cardiac disease, and these

patients require careful antenatal assessment and coordinated obstetric and cardiac care [3].

Pregnancy produces significant cardiovascular adaptations, including increased blood volume, heart rate and cardiac output, which are generally well tolerated in women with normal cardiac function [4,5]. However, these changes may place considerable stress on women with underlying cardiac disease and can precipitate cardiac decompensation, arrhythmias, heart failure or other complications [6]. The haemodynamic stress becomes particularly important

during labour and the immediate postpartum period because of changes in cardiac preload and afterload associated with uterine contractions, blood loss and autotransfusion from the contracting uterus [7].

The outcome of pregnancy in women with cardiac disease depends on the type and severity of the cardiac lesion, maternal functional status and the presence of previous cardiac complications [8]. Increasing maternal functional class is associated with a higher risk of adverse maternal and fetal outcomes [9]. In addition to maternal complications, cardiac disease during pregnancy may be associated with fetal growth restriction, prematurity, low birth weight, fetal distress and perinatal morbidity or mortality. Appropriate antenatal surveillance, risk stratification and multidisciplinary management are therefore essential to optimize outcomes [10].

Despite advances in the management of cardiac disease during pregnancy, labour remains a critical period requiring careful monitoring and individualized management. Evaluation of maternal and fetal outcomes can help identify the common complications and factors associated with adverse outcomes in these high-risk pregnancies. Therefore, the present study was undertaken to determine the maternal and fetal outcomes of labour in pregnant women with cardiac disease and to assess the obstetric and medical complications occurring during labour.

Materials and methods

Study design

A prospective observational study was conducted among pregnant women with cardiac disease admitted in labour at the Department of Obstetrics and Gynecology, ESIC Medical College, PGIMSR and Model Hospital, Rajajinagar, Bengaluru, Karnataka, India. The study evaluated maternal and fetal outcomes during labour and the postpartum period. A total of 50 pregnant women with cardiac disease were included after obtaining written informed consent.

Study setting

The study was conducted at ESIC Medical College, PGIMSR and Model Hospital, Rajajinagar, Bengaluru, Karnataka, India, a tertiary-care teaching hospital providing obstetric, medical, cardiac, anaesthetic and neonatal services. The Department of Obstetrics and Gynecology manages routine and high-risk pregnancies, including women with medical and cardiac comorbidities, and provides intrapartum and postpartum care. Pregnant women requiring specialist cardiac evaluation and multidisciplinary

management were assessed and managed in coordination with the relevant departments.

Study duration

The study was conducted from 01/06/2025 to 31/12/2025.

Study population

Pregnant women admitted to the labour ward with a previously diagnosed cardiac disease or with clinical signs and symptoms suggestive of cardiac disease, subsequently confirmed by relevant investigations, were enrolled. Both booked and unbooked pregnant women were included. A structured proforma was used to record relevant demographic, clinical, obstetric, cardiac and neonatal information. Participants were followed from admission through labour and until maternal and neonatal discharge.

Study size

The sample size was calculated using the single-population proportion formula, $n = Z^2 p(1-p)/d^2$, where Z is the standard normal deviate at a 95% confidence level (1.96), p is the anticipated proportion (10%), and d is the allowable absolute precision (8.3%). Substituting these values, $n = (1.96)^2 \times 0.10 \times (1-0.10)/(0.083)^2 = 50.16$, which was rounded to 50 participants. Accordingly, a total of 50 eligible pregnant women with cardiac disease were included in the study after applying the predefined inclusion and exclusion criteria.

Clinical assessment

Detailed history regarding age, educational status, occupation, marital status, age at marriage, health awareness, antenatal care, number of antenatal visits and previous or current symptoms suggestive of cardiac disease was recorded. General physical examination, systemic examination, cardiovascular examination and obstetric examination were performed. Maternal vital parameters, including pulse rate, blood pressure, respiratory rate, temperature and oxygen saturation, were monitored. Per-abdominal and per-vaginal examinations were performed as clinically indicated.

Investigations

Routine investigations and cardiac evaluation included complete blood count, complete urine examination, blood grouping and Rh typing, bleeding time, clotting time, prothrombin time/INR, random blood sugar, VDRL, HBsAg, HIV testing, electrocardiography (ECG), two-

dimensional echocardiography (2D-Echo), chest radiography and obstetric ultrasonography.

Intrapartum monitoring and management

Once labour was established, fetal well-being was assessed using non-stress testing and pelvic assessment was performed. The progress of labour was monitored using the Friedman partograph. Maternal condition, uterine contractions, fetal heart rate, cervical effacement and dilatation, fetal head station and descent, colour of liquor, and evidence of caput or moulding were assessed periodically by abdominal and vaginal examination. Bishop score was assessed where appropriate. The mode of delivery, including spontaneous vaginal delivery, instrumental delivery or lower-segment caesarean section (LSCS), was determined according to obstetric and maternal indications.

Cardiac monitoring

Women were closely monitored throughout labour and the postpartum period for evidence of cardiac deterioration. Monitoring included pulse rate, blood pressure, oxygen saturation, respiratory status, chest auscultation and cardiovascular system examination. ECG and 2D-Echo were performed as clinically indicated. Routine antibiotic prophylaxis was administered according to institutional protocol, and maternal or obstetric complications were managed promptly. Both mother and newborn were kept under close observation during the intrapartum and postpartum periods.

Outcome measures

The primary outcomes were maternal and fetal outcomes of labour among pregnant women with cardiac disease. Maternal outcomes included mode of delivery, obstetric complications, cardiac complications during labour and the postpartum period, and maternal status at discharge. Fetal outcomes included birth weight, Apgar scores, neonatal complications and neonatal status at discharge. The association of maternal cardiac disease with obstetric and neonatal outcomes was also assessed.

Data collection and follow-up

Details regarding labour, delivery, maternal complications, mode of delivery and neonatal outcomes were recorded prospectively. Newborns were assessed for birth weight, Apgar score and complications and were followed until discharge. Mothers were counselled regarding

contraception, pregnancy spacing and the importance of regular cardiac and obstetric follow-up.

Inclusion criteria

All pregnant women in labour, whether booked or unbooked, with a diagnosed cardiac disease or clinical features suggestive of cardiac disease confirmed by appropriate investigations were included.

Exclusion criteria

Pregnant women whose symptoms or signs were determined to be physiological changes of pregnancy or were attributable to non-cardiac medical conditions such as anaemia or hyperthyroidism, without evidence of cardiac disease, were excluded.

Bias: Potential selection bias was minimized by including consecutive eligible pregnant women admitted in labour during the study period, irrespective of whether they were booked or unbooked. Information bias was minimized by using a structured data-collection proforma and recording clinical, cardiac, obstetric and neonatal findings prospectively. Maternal and neonatal outcomes were documented using predefined clinical parameters and followed until hospital discharge. The same eligibility criteria and outcome definitions were applied to all participants.

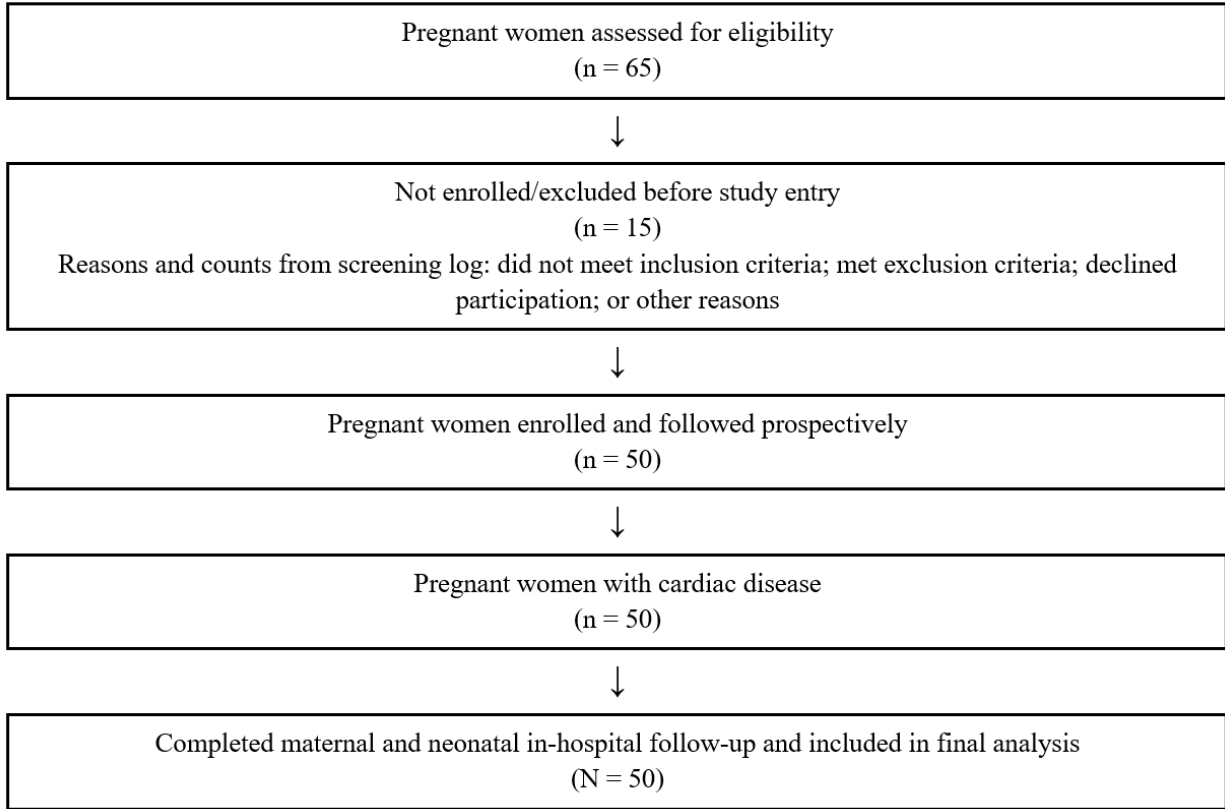
Ethical considerations

Ethical clearance was obtained from the Institutional Ethics Committee of ESIC Medical College, PGIMS and Model Hospital, Rajajinagar, Bengaluru, Karnataka, India, before commencement of the study. The study received ethical approval on 01/03/2025, with ethical clearance number 023/2025. Written informed consent was obtained from all participants. Confidentiality and privacy of participant information were maintained throughout the study.

Statistical analysis

Data were entered, tabulated and analysed using SPSS software, version 18.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, while continuous variables were summarised using appropriate descriptive statistics. Associations between categorical variables were assessed using the chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant.

Figure 1; Participant flow through the study



Results

The study included 50 pregnant women with cardiac disease. The majority were aged 21–30 years (44 [88.0%]), followed by women aged <20 years (3 [6.0%]) and >31

years (3 [6.0%]). Regarding gestational age, 26 (52.0%) women were at term (37–40 weeks), 16 (32.0%) were preterm (<37 weeks), and 8 (16.0%) were post-term (>40 weeks). Primiparous and multiparous women were equally represented, with 25 (50.0%) each. (Table 1)

Table 1: Baseline Characteristics of the Study Population (N = 50)

Characteristic	n (%)
Age group (years)	
<20	3 (6.0)
21–30	44 (88.0)
>31	3 (6.0)
Gestational age (weeks)	
<37	16 (32.0)
37–40	26 (52.0)
>40	8 (16.0)
Parity	
Primiparous	25 (50.0)
Multiparous	25 (50.0)
Total	50 (100.0)

Note. Values are presented as number (percentage). Percentages are calculated using the total study population (N = 50).

Most women belonged to NYHA functional class I (43 [86.0%]), while 5 (10.0%) were in class II and 2 (4.0%)

were in class III. None of the women were classified as NYHA class IV. (Table 2)

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Table 2: Distribution According to New York Heart Association Functional Class (N = 50)

NYHA functional class	n (%)
Class I	43 (86.0)
Class II	5 (10.0)
Class III	2 (4.0)
Class IV	0 (0.0)
Total	50 (100.0)

Note. Values are presented as number (percentage). NYHA = New York Heart Association.

Rheumatic heart disease was the most common cardiac condition, observed in 23 (46.0%) women, followed by

congenital heart disease in 14 (28.0%). Mitral valve prolapse was present in 5 (10.0%), cardiomyopathy in 3 (6.0%), peripartum cardiomyopathy and dextrocardia in 2 (4.0%) each, and other cardiac lesions in 2 (4.0%) women. (Table 3)

Table 3: Distribution of Maternal Cardiac Lesions (N = 50)

Cardiac lesion	n (%)
Rheumatic heart disease	23 (46.0)
Congenital heart disease	14 (28.0)
Mitral valve prolapse	5 (10.0)
Cardiomyopathy	3 (6.0)
Peripartum cardiomyopathy	2 (4.0)
Dextrocardia	2 (4.0)
Other cardiac lesions	2 (4.0)

Note. Values are presented as number (percentage). Percentages are based on the total study population (N = 50).

Among women with rheumatic heart disease, mitral stenosis was the predominant lesion, present in 19 (82.6%) women, followed by mitral regurgitation in 13 (56.5%). Pulmonary

hypertension was documented in 4 (17.4%), aortic regurgitation in 2 (8.7%), and tricuspid regurgitation in 1 (4.3%) woman. Some women had more than one valvular lesion. (Table 4)

Table 4: Distribution of Rheumatic Heart Disease Lesions (n = 23)

RHD lesion	n (%)
Mitral stenosis	19 (82.6)
Mitral regurgitation	13 (56.5)
Tricuspid regurgitation	1 (4.3)
Aortic regurgitation	2 (8.7)
Pulmonary hypertension	4 (17.4)

Note. Values are presented as number (percentage) among women with rheumatic heart disease (n = 23). Percentages exceed 100% because some participants had more than one valvular lesion. RHD = rheumatic heart disease.

Among the 14 women with congenital heart disease, Ebstein anomaly was the most frequently documented

lesion (4 [28.6%]), followed by atrial septal defect (3 [21.4%]), ventricular septal defect and tetralogy of Fallot (2

[14.3%] each), while ASD with pulmonary stenosis, ASD with pulmonary hypertension, and bicuspid aortic valve were present in 1 (7.1%) woman each. (Table 5)

Table 5: Distribution of Congenital Heart Disease Lesions (n = 14)

Congenital heart lesion	n (%)
Atrial septal defect	3 (21.4)
ASD with pulmonary stenosis	1 (7.1)
ASD with pulmonary hypertension	1 (7.1)
Ventricular septal defect	2 (14.3)
Bicuspid aortic valve	1 (7.1)
Ebstein anomaly	4 (28.6)
Tetralogy of Fallot	2 (14.3)
Total	14 (100.0)

Note. Values are presented as number (percentage) among women with congenital heart disease (n = 14). ASD = atrial septal defect.

while the remaining 48 (96.0%) women had no documented cardiac complications. No case of infective endocarditis was reported. (Table 6)

Cardiac complications during the study period were observed in 2 (4.0%) women. Congestive cardiac failure occurred in 1 (2.0%) woman and arrhythmia in 1 (2.0%),

Table 6: Maternal Cardiac Complications (N = 50)

Cardiac complication	n (%)
No cardiac complication	48 (96.0)
Congestive cardiac failure	1 (2.0)
Arrhythmia	1 (2.0)
Total	50 (100.0)

Note. Values are presented as number (percentage). Percentages are based on the total study population (N = 50).

Vaginal delivery was the most common mode of delivery, occurring in 24 (48.0%) women, followed by LSCS in 15 (30.0%) and instrumental vaginal delivery in 11 (22.0%) women. (Table 7)

Table 7: Mode of Delivery (N = 50)

Mode of delivery	n (%)
Vaginal delivery	24 (48.0)
Instrumental vaginal delivery	11 (22.0)
LSCS	15 (30.0)
Total	50 (100.0)

Note. Values are presented as number (percentage). LSCS = lower-segment caesarean section.

Among the documented obstetric complications, preeclampsia was the most frequent (9 [18.0%]), followed

by intrauterine growth restriction (7 [14.0%]) and anaemia (6 [12.0%]). Breech presentation and previous LSCS were observed in 4 (8.0%) women each, while PROM occurred in 3 (6.0%) and oligohydramnios in 1 (2.0%) woman. (Table 8)

Table 8: Obstetric Complications (N = 50)

Obstetric complication	n (%)
Preeclampsia	9 (18.0)

Intrauterine growth restriction	7 (14.0)
Anaemia	6 (12.0)
Breech presentation	4 (8.0)
Previous LSCS	4 (8.0)
PROM	3 (6.0)
Oligohydramnios	1 (2.0)

Note. Values are presented as number (percentage). Percentages are based on the total study population (N = 50). LSCS = lower-segment caesarean section; PROM = premature rupture of membranes.

The maternal outcome was uneventful in 36 (72.0%) women, whereas 14 (28.0%) required care in the high-dependency unit. (Table 9)

Table 9: Maternal Outcome (N = 50)

Maternal outcome	n (%)
Uneventful	36 (72.0)
HDU care	14 (28.0)
Total	50 (100.0)

Note. Values are presented as number (percentage). HDU = high-dependency unit.

Among the 51 newborns, 33 (64.7%) had a birth weight of ≥ 2.5 kg, while 18 (35.3%) were classified as low birth weight (< 2.5 kg). (Table 10)

Table 10: Neonatal Birth Weight (n = 51)

Birth weight	n (%)
< 2.5 kg	18 (35.3)
≥ 2.5 kg	33 (64.7)
Total	51 (100.0)

Note. Values are presented as number (percentage). Birth weight was assessed among 51 newborns.

growth restriction was documented in 7 (14.0%) pregnancies, NICU admission was required in 12 (24.0%), prematurity occurred in 10 (20.0%), and congenital heart disease was identified in 1 (2.0%) newborn. (Table 11)

Of the 50 pregnancies, 47 (94.0%) resulted in live births and 3 (6.0%) resulted in intrauterine death. Intrauterine

Table 11: Perinatal and Neonatal Outcomes (N = 50)

Perinatal/neonatal outcome	n (%)
Live birth	47 (94.0)
Intrauterine death	3 (6.0)
Intrauterine growth restriction	7 (14.0)
NICU admission	12 (24.0)
Prematurity	10 (20.0)
Congenital heart disease	1 (2.0)

Note. Values are presented as number (percentage). Percentages are based on the total number of pregnancies (N = 50). NICU = neonatal intensive care unit.

The mean birth weight was 2.52 ± 0.70 kg. The mean Apgar score was 5.98 ± 1.99 at 1 minute and increased to 7.76 ± 2.17 at 5 minutes. (Table 12)

Table 12: Neonatal Parameters

Parameter	M ± SD
Mean birth weight (kg)	2.52 ± 0.70
Mean 1-minute Apgar score	5.98 ± 1.99
Mean 5-minute Apgar score	7.76 ± 2.17

Note. Values are presented as mean ± standard deviation (SD). Apgar = Appearance, Pulse, Grimace, Activity, and Respiration.

Discussion

The present study evaluated 50 pregnancies complicated by cardiac disease. Most women were aged 21–30 years (88.0%), with equal representation of primiparous and

multiparous women. The majority were in NYHA class I (86.0%), while only 4.0% were in class III and none were in class IV, indicating predominantly preserved functional status. The importance of functional status is supported by the CARPREG study, which identified NYHA class >II or cyanosis as a predictor of maternal cardiac events. Similar favourable outcomes among women with lower NYHA classes have been reported by Subbaiah et al. [11].

Rheumatic heart disease was the predominant cardiac lesion (46.0%), followed by congenital heart disease (28.0%), with mitral stenosis being the commonest rheumatic lesion (82.6%). This pattern reflects the continuing burden of rheumatic heart disease in developing countries. Subbaiah et al. similarly reported rheumatic heart disease as the predominant cardiac lesion in pregnancy [11], while a systematic review from South Asia also demonstrated a substantial burden of rheumatic heart disease among pregnant women [12]. The predominance of mitral stenosis is clinically relevant because the increased blood volume and cardiac output of pregnancy can worsen transmittal obstruction and precipitate cardiac symptoms [13].

Cardiac complications occurred in 2 (4.0%) women, comprising one case each of congestive cardiac failure and arrhythmia. No maternal cardiac death or infective endocarditis was documented. The relatively low complication rate may be related to the predominance of women with NYHA class I disease and close intrapartum monitoring. Larger studies involving more severe cardiac disease have reported higher complication rates, including heart failure and arrhythmias [14]. Therefore, the favourable findings in the present study should be interpreted in the context of the small sample size and predominantly low-risk functional status.

Vaginal delivery was the commonest mode of delivery (48.0%), followed by LSCS (30.0%) and instrumental

vaginal delivery (22.0%). Cardiac disease alone is generally not an indication for caesarean delivery, and the route of delivery should be individualized according to the cardiac lesion, maternal functional status, obstetric indications and fetal condition. Previous studies have similarly demonstrated that vaginal delivery is feasible in a substantial proportion of women with cardiac disease [11,15].

Preeclampsia (18.0%), IUGR (14.0%) and anaemia (12.0%) were the most frequent obstetric complications. The increased occurrence of fetal growth restriction and other adverse outcomes may be related to impaired maternal cardiovascular function and uteroplacental perfusion. A systematic review of rheumatic heart disease in pregnancy reported increased risks of preterm birth, low birth weight and IUGR, particularly with more severe maternal cardiac disease [13]. Similar adverse maternal and neonatal outcomes have been reported with increasing severity of congenital heart disease [16].

Maternal outcome was uneventful in 36 (72.0%) women, while 14 (28.0%) required HDU care. The need for higher-level monitoring emphasizes the importance of close observation during labour and particularly the early postpartum period, when rapid haemodynamic changes may precipitate cardiac deterioration. Contemporary evidence from the CARPREG II study also supports individualized risk assessment and multidisciplinary management of pregnant women with cardiac disease [14].

Perinatal outcome was generally favourable, with 47 (94.0%) live births; however, prematurity (20.0%), IUGR (14.0%) and NICU admission (24.0%) were observed, along with three intrauterine deaths. The mean birth weight was 2.52 ± 0.70 kg, while mean Apgar scores were 5.98 ± 1.99 at 1 minute and 7.76 ± 2.17 at 5 minutes. These findings are consistent with previous evidence demonstrating increased risks of prematurity, fetal growth restriction and neonatal morbidity in pregnancies complicated by maternal cardiac disease [13,16].

One newborn had congenital heart disease, highlighting the importance of fetal cardiac assessment in pregnancies complicated by maternal congenital heart disease. Maternal congenital heart disease is associated with an increased risk of congenital heart disease in offspring, supporting targeted fetal echocardiographic assessment when indicated. Overall, the present study demonstrates that favourable maternal and

fetal outcomes are achievable with predominantly good maternal functional status, appropriate surveillance and multidisciplinary care. However, the occurrence of cardiac complications, HDU admissions, prematurity, IUGR and intrauterine death emphasizes the need for early risk assessment and individualized antenatal, intrapartum and postpartum management.

Generalizability

The findings should be interpreted in the context of the single-centre design and relatively small sample size. The study population predominantly comprised women with NYHA class I disease, and therefore the findings may not be directly generalizable to women with severe cardiac dysfunction or complex cardiac lesions. Nevertheless, the study provides clinically relevant information regarding maternal and fetal outcomes of cardiac disease in a tertiary-care setting and supports the importance of multidisciplinary management and vigilant intrapartum and postpartum monitoring.

Conclusion

Pregnancy complicated by cardiac disease can have favourable maternal and fetal outcomes when women are appropriately risk-stratified and receive timely multidisciplinary care. In the present study, most women had preserved functional status, with NYHA class I being predominant, and rheumatic heart disease was the most common cardiac lesion. Although the majority of women had an uneventful maternal outcome, cardiac complications and the need for HDU care were observed in a proportion of patients. Adverse perinatal outcomes, including prematurity, intrauterine growth restriction, NICU admission and intrauterine death, were also documented. These findings highlight the importance of early identification of cardiac disease, assessment of functional status, careful intrapartum monitoring and close postpartum surveillance to optimize maternal and fetal outcomes.

Limitations

The study was conducted at a single tertiary-care centre and included a relatively small sample size of 50 pregnancies, which limits the generalizability of the findings. The study population was predominantly composed of women with NYHA class I disease; consequently, women with severe cardiac dysfunction or complex cardiac lesions were underrepresented, and the findings do not adequately reflect outcomes in these high-risk groups. The observational study design limits the ability to establish causal relationships between specific cardiac lesions and maternal or fetal outcomes. Furthermore, detailed long-term maternal and

neonatal follow-up after hospital discharge was not undertaken.

Recommendations

Pregnant women with known or suspected cardiac disease should undergo early cardiovascular assessment and appropriate risk stratification during pregnancy. Regular antenatal follow-up with assessment of NYHA functional status, cardiac function and obstetric and fetal well-being should be emphasized. Delivery planning should be individualized according to the underlying cardiac lesion, maternal functional status and obstetric indications, with multidisciplinary involvement of obstetricians, cardiologists, anaesthesiologists and neonatologists where appropriate. Vigilant monitoring during labour and the early postpartum period is particularly important because of the potential for acute haemodynamic changes and cardiac decompensation. Women with significant cardiac disease should preferably deliver at centres equipped to provide high-dependency maternal care and appropriate neonatal support.

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Conflict of Interest

The authors declare no conflict of interest.

Data Availability

The data supporting the findings of this study are available upon reasonable request from the corresponding author, subject to applicable institutional and ethical requirements.

Author Contributions

Dr. Keerti Shivaputrappa contributed to conceptualization, study design, methodology, investigation, and supervision. Dr. Swetha K. M. contributed to participant recruitment, investigation, data collection, data curation, and validation. Dr. Sonia H. contributed to formal analysis, interpretation of findings, literature synthesis, and preparation of the original manuscript draft. All authors contributed to critical revision of the manuscript, approved the final version for submission, and agreed to be accountable for the integrity and accuracy of the work.

List of Abbreviations:

2D-Echo, two-dimensional echocardiography; **ASD**, atrial septal defect; **BAV**, bicuspid aortic valve; **CHD**, congenital heart disease; **CCF**, congestive cardiac failure; **ECG**, electrocardiography; **HDU**, high-dependency unit; **IUGR**, intrauterine growth restriction; **IUD**, intrauterine death; **LSCS**, lower-segment caesarean section; **NICU**, neonatal intensive care unit; **NYHA**, New York Heart Association; **PPCM**, peripartum cardiomyopathy; **PROM**, premature rupture of membranes; **RHD**, rheumatic heart disease; **VSD**, ventricular septal defect.

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