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Original Research Article

Pregnancy Outcomes among Women with Cardiac Disease

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Abstract:
Background: Cardiovascular disease complicates approximately 1–4% of pregnancies and remains a significant cause of maternal morbidity and mortality worldwide, particularly in developing countries (Regitz-Zagrosek et al., 2018; Roos-Hesselink et al., 2019). Physiological cardiovascular changes during pregnancy may worsen pre-existing cardiac conditions, leading to adverse maternal and neonatal outcomes.
Objective: To determine the pregnancy outcomes among women with pre-existing cardiac disease presenting at a tertiary care hospital.
Methods: This descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynecology, Bolan Medical College/Hospital, Quetta, over six months. A total of 241 pregnant women aged 18–49 years with gestational age >28 weeks and documented pre-existing cardiac disease were enrolled using non-probability consecutive sampling. Maternal and neonatal outcomes were recorded and analyzed using SPSS version 25. Quantitative variables were expressed as mean ± SD, while qualitative variables were presented as frequency and percentage. Chi-square/Fisher's exact test was applied, with $p \leq 0.05$ considered statistically significant.
Results: The mean maternal age was 29.4 ± 5.8 years. Cesarean section was performed in 112 (46.5%) women. Preterm birth occurred in 58 (24.1%) cases, while low birth weight was observed in 64 (26.6%) neonates. NICU admission was required in 52 (21.6%) newborns. Low Apgar score (<7 at 5 minutes) was recorded in 39 (16.2%) cases, and fetal distress occurred in 44 (18.3%) deliveries. Postpartum hemorrhage was observed in 21 (8.7%) women, and 17 (7.1%) required maternal ICU admission. Maternal mortality was recorded in 6 (2.5%) cases, while neonatal mortality occurred in 9 (3.7%) neonates.
Conclusion: Pregnancy in women with pre-existing cardiac disease is associated with increased rates of cesarean delivery, preterm birth, low birth weight, NICU admission, and maternal complications. Early identification and multidisciplinary management are crucial to improving fetomaternal outcomes.

Keywords: Cardiac disease, pregnancy outcomes, maternal morbidity, neonatal outcomes, cesarean section.

INTRODUCTION

Cardiovascular disease (CVD) complicates approximately 1–4% of all pregnancies worldwide and remains a leading cause of indirect maternal mortality (Regitz-Zagrosek et al., 2018). Although overall maternal mortality has declined globally, the proportion of deaths attributable to cardiac disease has increased, particularly in developed countries where heart disease is now recognized as the primary indirect cause of maternal death (Alkema et al., 2016; MacDorman et al., 2020). This rising trend is largely attributed to improved survival of women with congenital heart disease (CHD), delayed

childbearing, and an increasing prevalence of acquired cardiac conditions such as ischemic heart disease and cardiomyopathy (Roos-Hesselink et al., 2019).

Pregnancy is associated with significant physiological adaptations in the cardiovascular system, including a 30–50% increase in blood volume, elevated cardiac output, and reduced systemic vascular resistance (Elkayam & Goland, 2021). While these changes are well tolerated in healthy women, they may precipitate clinical deterioration in those with pre-existing cardiac disease. Women with valvular heart disease, cardiomyopathies, arrhythmias, ischemic heart disease, or repaired and unrepaired congenital defects are at increased risk of complications such as heart failure, arrhythmias, thromboembolism, and maternal mortality (Siu et al., 2020). The hemodynamic burden peaks during the late second and third trimesters and in the immediate postpartum period, further increasing the likelihood of adverse events.

Risk stratification tools have been developed to estimate maternal cardiac risk during pregnancy. The Cardiac Disease in Pregnancy (CARPREG) risk index was among the earliest validated models and demonstrated that predictors such as prior cardiac events, reduced ventricular function, left heart obstruction, and poor functional class significantly increase maternal morbidity (Siu et al., 2001). More recently, the European Society of Cardiology (ESC) guidelines have recommended the modified World Health Organization (mWHO) classification to guide individualized risk assessment and multidisciplinary management (Regitz-Zagrosek et al., 2018). Despite these advancements in clinical assessment and management strategies, adverse maternal and neonatal outcomes remain substantial.

Large international registries have consistently reported higher rates of cesarean delivery, preterm birth, low birth weight, and neonatal intensive care unit (NICU) admissions among women with cardiac disease (Roos-Hesselink et al., 2019). The ESC Registry of Pregnancy and Cardiac Disease (ROPAC) reported that maternal cardiac events occurred in approximately 11% of pregnancies, with heart failure being the most common complication (Roos-Hesselink et al., 2019). Additionally, studies have shown increased risks of fetal growth restriction, low Apgar scores, and neonatal mortality in pregnancies complicated by maternal cardiac conditions (Siu et al., 2020; Liu et al., 2019). These findings highlight the dual burden of maternal and perinatal morbidity associated with cardiac disease in pregnancy.

In low- and middle-income countries, including Pakistan, the burden may be amplified due to delayed diagnosis, limited access to specialized cardiac services, and inadequate antenatal surveillance. Rheumatic heart disease continues to contribute significantly to maternal morbidity in South Asian populations (Javaid et al., 2020). Moreover, local data evaluating pregnancy outcomes among women with pre-existing cardiac disease remain limited, restricting the development of context-specific clinical guidelines.

Given the increasing prevalence of cardiac disease among women of reproductive age and its substantial contribution to adverse fetomaternal outcomes, there is a pressing need to assess pregnancy outcomes in affected women within local healthcare settings. Identifying the frequency and pattern of maternal and neonatal complications will facilitate improved risk stratification, targeted interventions, and multidisciplinary management strategies. Therefore, this study aims to determine the pregnancy outcomes among women with pre-existing cardiac disease presenting at a tertiary care hospital.

LITERATURE REVIEW

Cardiovascular disease (CVD) during pregnancy has emerged as a significant contributor to maternal and neonatal morbidity and mortality worldwide. The global prevalence of cardiac disease in pregnancy ranges between 1% and 4%, with variations depending on geographic location and the burden of rheumatic and congenital heart disease (Regitz-Zagrosek et al., 2018). In high-income countries, congenital heart disease (CHD) constitutes the majority of cases due to improved survival into reproductive age, whereas rheumatic heart disease remains more prevalent in low- and middle-income countries (Roos-Hesselink et al., 2019).

Globally, maternal mortality has declined substantially; however, the relative proportion of deaths caused by cardiovascular disease has increased (Alkema et al., 2016). In developed countries, heart disease has become the leading indirect cause of maternal death (MacDorman et al., 2020). The physiological changes of pregnancy—including increased plasma volume, cardiac output, and heart rate—can exacerbate underlying cardiac pathology, resulting in decompensation, arrhythmias, or heart failure (Elkayam & Goland, 2021). These changes are particularly hazardous in women with reduced ventricular function, pulmonary hypertension, severe valvular lesions, or prior cardiac events.

Several large-scale studies have examined maternal cardiac complications in pregnancy. The CARPREG study demonstrated that women with prior cardiac events, baseline New York Heart Association (NYHA) class III/IV symptoms, left heart obstruction, or reduced ejection fraction had significantly higher rates of maternal cardiac complications (Siu et al., 2001). Subsequent validation studies confirmed that maternal cardiac event rates ranged between 10%

and 20% in high-risk populations (Siu et al., 2020). The development of the modified World Health Organization (mWHO) classification further improved risk stratification and clinical decision-making (Regitz-Zagrosek et al., 2018).

The European Society of Cardiology (ESC) Registry of Pregnancy and Cardiac Disease (ROPAC), one of the largest international registries, reported maternal cardiac events in approximately 11% of pregnancies, with heart failure being the most frequent complication (Roos-Hesselink et al., 2019). Maternal mortality in the registry was approximately 0.6%, though higher rates were observed in women with cardiomyopathies and pulmonary hypertension. Additionally, cesarean section rates exceeded 40%, reflecting increased obstetric intervention in this high-risk population (Roos-Hesselink et al., 2019).

Neonatal outcomes are also significantly affected by maternal cardiac disease. Studies have consistently shown increased rates of preterm birth, low birth weight, fetal growth restriction, and neonatal intensive care unit (NICU) admission among affected pregnancies (Siu et al., 2020). Liu et al. (2019) reported that adverse neonatal outcomes were more common in women with moderate to severe cardiac lesions compared to those with mild disease. Preterm birth rates in women with cardiac disease have been reported to range from 15% to 30%, significantly higher than in the general obstetric population (Roos-Hesselink et al., 2019).

Low birth weight and intrauterine growth restriction are thought to result from compromised uteroplacental perfusion secondary to maternal cardiac dysfunction (Elkayam & Goland, 2021). Furthermore, low Apgar scores and neonatal mortality have been associated with severe maternal cardiac conditions, particularly when maternal hemodynamic instability occurs during labor and delivery (Siu et al., 2020). These findings underscore the importance of multidisciplinary care involving obstetricians, cardiologists, anesthesiologists, and neonatologists.

In South Asian countries, including Pakistan, rheumatic heart disease remains a significant contributor to maternal cardiac morbidity. Javaid et al. (2020) reported that maternal mortality among pregnant women with pre-existing cardiovascular disease was approximately 6%, with notable rates of fetal loss and preterm delivery. Limited access to specialized cardiac services, delayed referrals, and suboptimal antenatal monitoring may contribute to poorer outcomes in resource-limited settings.

Despite growing international evidence, local data evaluating pregnancy outcomes among women with cardiac disease remain scarce. Most available studies are conducted in tertiary care centers and may not reflect the broader population. Moreover, variations in healthcare infrastructure, socioeconomic factors, and access to multidisciplinary management influence maternal and neonatal outcomes.

Given the increasing burden of cardiac disease in women of reproductive age and its established association with adverse fetomaternal outcomes, there is a critical need for context-specific research. Evaluating pregnancy outcomes in women with pre-existing cardiac disease at the local level will provide essential data to guide clinical practice, improve risk stratification, and develop evidence-based management protocols aimed at reducing maternal and neonatal morbidity and mortality.

METHODOLOGY:

Study Design and Setting

This descriptive cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Bolan Medical College/Hospital, Quetta. The study duration was six months following approval of the research synopsis from the institutional ethical committee and relevant authorities.

Study Population

The study population comprised pregnant women diagnosed with pre-existing cardiac disease who presented for antenatal care or delivery at the study setting during the data collection period.

Sample Size

The sample size was calculated using the WHO sample size calculator by taking the expected frequency of maternal mortality among women with cardiovascular disease as 6%, a margin of error of 3%, and a 95% confidence interval. The calculated sample size was 241 participants.

Sampling Technique

Non-probability consecutive sampling was used. All eligible women meeting the inclusion criteria during the study period were enrolled until the required sample size was achieved.

Inclusion Criteria

- Women aged 18–49 years
- Gestational age greater than 28 weeks
- Diagnosed with pre-existing cardiac disease (including arrhythmias, ischemic heart disease, heart failure, valvular heart disease, or congenital heart disease)
- Irrespective of parity, gravida, or booking status

Exclusion Criteria

- Women who developed cardiac disease during pregnancy
- Multiple gestations
- Women with gestational diabetes mellitus
- Women with pregnancy-induced hypertension

These exclusions were applied to minimize confounding factors that could independently influence pregnancy outcomes.

Operational Definitions

Cardiac disease was defined as documented history of cardiovascular disease diagnosed prior to pregnancy, confirmed through clinical history and medical records.

Pregnancy outcomes were assessed within 24 hours postpartum and included:

- Mode of delivery: Vaginal delivery or cesarean section
- Postpartum hemorrhage (PPH): Blood loss ≥500 mL within 24 hours of delivery
- Maternal ICU admission: Admission to intensive care unit after delivery
- Maternal mortality: Death during pregnancy or within 24 hours postpartum
- Low birth weight: Neonatal weight <2,500 grams
- Low Apgar score: Apgar score <7 at 5 minutes
- Fetal distress: Fetal heart rate <110 or >160 beats per minute
- NICU admission: Neonatal admission within the first 28 days of life
- Neonatal mortality: Death within 28 days after birth

Data Collection Procedure

After obtaining ethical approval, eligible patients were identified during antenatal visits or labor admission. Written informed consent was obtained prior to enrollment. Baseline demographic and obstetric information including maternal age, residence, education level, gravida, parity, gestational age, height, weight, and body mass index (BMI) were recorded using a structured proforma.

All enrolled participants were followed until 24 hours postpartum for assessment of maternal and neonatal outcomes. Neonatal parameters such as birth weight and Apgar scores at 1 and 5 minutes were recorded immediately after delivery. Clinical findings and outcome variables were extracted from hospital medical records.

Data Analysis

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25.

Quantitative variables (maternal age, gestational age, BMI, birth weight, and Apgar score) were presented as mean ± standard deviation or median with interquartile range depending on normality assessment.

Qualitative variables (mode of delivery, PPH, ICU admission, maternal mortality, low birth weight, NICU admission, fetal distress, neonatal mortality, and preterm birth) were expressed as frequencies and percentages.

Effect modifiers such as maternal age, residence, education, BMI, parity, and gravida were controlled through stratification. Post-stratification Chi-square test or Fisher's exact test was applied where appropriate. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 241 pregnant women with pre-existing cardiac disease were included in the study. The mean maternal age was 29.4 ± 5.8 years (range: 18–44 years).

Table 1: Baseline Sociodemographic and Obstetric Characteristics (n = 241)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–25	68	28.2
26–35	121	50.2
>35	52	21.6
Residence		
Urban	132	54.8
Rural	109	45.2
Education Level		
Illiterate	74	30.7
Primary	63	26.1
Secondary	59	24.5
Intermediate & Above	45	18.7
Parity		
Primiparous	83	34.4
Multiparous	158	65.6
Mean Gestational Age (weeks)	36.8 ± 2.4	—
Mean BMI (kg/m²)	27.1 ± 3.9	—

Table 2: Mode of Delivery and Maternal Outcomes (n = 241)

Outcome	Frequency (n)	Percentage (%)
Vaginal Delivery	129	53.5
Cesarean Section	112	46.5
Postpartum Hemorrhage	21	8.7
Maternal ICU Admission	17	7.1
Maternal Mortality	6	2.5

Cesarean section was performed in 46.5% of cases. Postpartum hemorrhage occurred in 8.7% of women, while 7.1% required ICU admission. Maternal mortality was observed in 2.5% of cases.

Table 3: Neonatal Outcomes (n = 241)

Outcome	Frequency (n)	Percentage (%)
Preterm Birth (<37 weeks)	58	24.1
Low Birth Weight (<2500g)	64	26.6
Fetal Distress	44	18.3
Low Apgar Score (<7 at 5 min)	39	16.2
NICU Admission	52	21.6
Neonatal Mortality	9	3.7

Preterm birth occurred in 24.1% of cases, while 26.6% of neonates had low birth weight. NICU admission was required in 21.6% of newborns, and neonatal mortality was recorded in 3.7%.

Table 4: Association of Maternal Age with Adverse Maternal Outcomes

Maternal Age	ICU Admission n (%)	PPH n (%)	p-value
≤30 years (n=139)	6 (4.3%)	7 (5.0%)	
>30 years (n=102)	11 (10.8%)	14 (13.7%)	0.032*

Women aged >30 years showed significantly higher rates of maternal complications compared to younger women (p = 0.032).

Table 5: Association of BMI with Neonatal Outcomes

BMI Category	Preterm Birth n (%)	Low Birth Weight n (%)	p-value
<25 kg/m² (n=89)	14 (15.7%)	16 (18.0%)	
≥25 kg/m² (n=152)	44 (28.9%)	48 (31.6%)	0.018*

Higher BMI was significantly associated with increased rates of preterm birth and low birth weight (p = 0.018).

Summary of Key Findings

- Cesarean section rate: **46.5%**
- Preterm birth: **24.1%**
- Low birth weight: **26.6%**
- NICU admission: **21.6%**
- Maternal mortality: **2.5%**
- Neonatal mortality: **3.7%**
- Significant associations observed with maternal age and BMI.

DISCUSSION

This study aimed to determine pregnancy outcomes among women with pre-existing cardiac disease presenting at a tertiary care hospital. The findings demonstrate that maternal cardiac disease is associated with considerable maternal and neonatal morbidity, including increased rates of cesarean delivery, preterm birth, low birth weight, NICU admission, and maternal complications. These findings are consistent with existing international literature highlighting the high-risk nature of pregnancy in women with cardiac conditions.

In the present study, the cesarean section rate was 46.5%. This finding aligns with data from the European Society of Cardiology Registry of Pregnancy and Cardiac Disease (ROPAC), which reported cesarean delivery rates exceeding 40% among women with structural or ischemic heart disease (Roos-Hesselink et al., 2019). Higher cesarean rates in this population are often attributed to obstetric or cardiac indications, including maternal hemodynamic instability, fetal distress, or physician preference to avoid prolonged labor. Although vaginal delivery is generally recommended for most cardiac patients when feasible, clinical judgment frequently leads to operative delivery in high-risk cases (Regitz-Zagrosek et al., 2018).

Preterm birth was observed in 24.1% of pregnancies in this study. This rate is considerably higher than that reported in the general obstetric population, where preterm birth typically ranges between 8% and 12%. Similar findings have been documented in prior studies, with preterm delivery rates ranging from 15% to 30% among women with cardiac disease (Siu et al., 2020; Roos-Hesselink et al., 2019). The increased incidence of preterm birth may be attributed to maternal hemodynamic compromise, placental insufficiency, or medically indicated early delivery due to maternal deterioration.

Low birth weight was observed in 26.6% of neonates. This is consistent with previous evidence suggesting impaired uteroplacental perfusion secondary to maternal cardiac dysfunction as a potential mechanism (Elkayam & Goland, 2021). Studies have reported that compromised maternal cardiac output may limit adequate fetal growth, leading to intrauterine growth restriction and low birth weight (Liu et al., 2019). The coexistence of preterm birth further contributes to this outcome.

NICU admission was required in 21.6% of neonates, while 16.2% had a low Apgar score at 5 minutes. These findings are comparable to those reported by Siu et al. (2020), who demonstrated higher rates of neonatal complications among women with moderate to severe cardiac lesions. Fetal distress, recorded in 18.3% of deliveries in the current study, may reflect compromised placental perfusion or intrapartum maternal instability. Neonatal mortality was observed in 3.7% of cases, which, although lower than some regional reports, remains clinically significant.

Maternal complications were also notable. Postpartum hemorrhage occurred in 8.7% of women, and 7.1% required ICU admission. Hemodynamic instability during delivery and the postpartum period may exacerbate cardiac dysfunction, increasing the need for critical care monitoring (Elkayam & Goland, 2021). Maternal mortality was recorded in 2.5% of cases. While this rate is lower than some regional studies reporting maternal mortality up to 6% (Javaid et al., 2020), it remains substantially higher than rates observed in the general obstetric population.

Stratified analysis demonstrated a significant association between maternal age greater than 30 years and adverse maternal outcomes. Advanced maternal age is known to be associated with increased cardiovascular risk and reduced physiological reserve, potentially compounding the burden of underlying cardiac disease (MacDorman et al., 2020). Additionally, higher BMI was significantly associated with preterm birth and low birth weight. Obesity may further increase cardiovascular workload, exacerbate cardiac dysfunction, and contribute to placental insufficiency.

The findings of this study reinforce the importance of early risk stratification and multidisciplinary care. Current guidelines emphasize the role of coordinated management involving obstetricians, cardiologists, anesthesiologists, and neonatologists in improving outcomes (Regitz-Zagrosek et al., 2018). Timely referral to tertiary care centers, careful intrapartum monitoring, and individualized delivery planning are critical components of care for this high-risk population.

This study provides valuable local data on pregnancy outcomes among women with cardiac disease. However, certain limitations should be acknowledged. The cross-sectional design limits causal inference. Additionally, as the study was conducted at a single tertiary care center, the findings may not be generalizable to all healthcare settings. Future multicenter studies with larger sample sizes and stratification by specific cardiac diagnoses would further strengthen the evidence base.

In conclusion, pregnancy in women with pre-existing cardiac disease is associated with significantly increased maternal and neonatal complications. Higher rates of cesarean delivery, preterm birth, low birth weight, NICU admission, and maternal morbidity highlight the need for vigilant antenatal surveillance and multidisciplinary management. Strengthening early detection and standardized care protocols may substantially improve fetomaternal outcomes in this vulnerable population.

CONCLUSION:

The present study evaluated pregnancy outcomes among women with pre-existing cardiac disease at a tertiary care hospital and demonstrated a significant burden of maternal and neonatal complications. Women with cardiac disease experienced high rates of cesarean section (46.5%), preterm birth (24.1%), low birth weight (26.6%), NICU admission (21.6%), and maternal ICU admission (7.1%). Maternal mortality (2.5%) and neonatal mortality (3.7%) further highlight the serious implications of cardiac disease during pregnancy.

The findings confirm that pregnancy in women with pre-existing cardiac conditions remains a high-risk clinical situation, particularly in resource-limited settings. Physiological cardiovascular changes during pregnancy may precipitate decompensation, leading to adverse maternal and fetal outcomes. Advanced maternal age and higher body mass index were significantly associated with increased complications, emphasizing the importance of individualized risk assessment.

Overall, this study underscores the need for early identification, structured risk stratification, and multidisciplinary management to improve fetomaternal outcomes in women with cardiac disease.

RECOMMENDATIONS

1. **Early Risk Stratification:** All women with known cardiac disease should undergo preconception counseling and early antenatal cardiac evaluation to assess pregnancy-related risks.
2. **Multidisciplinary Care Approach:** Management should involve a coordinated team including obstetricians, cardiologists, anesthesiologists, and neonatologists to ensure comprehensive care throughout pregnancy and delivery.
3. **Delivery Planning at Tertiary Care Centers:** High-risk patients should be referred to tertiary care hospitals equipped with intensive care and neonatal facilities to manage potential complications effectively.
4. **Enhanced Antenatal Surveillance:** Regular monitoring of maternal cardiac status and fetal

growth should be implemented to detect early signs of decomposition or fetal compromise.

5. **Development of Local Clinical Guidelines:** Institution-specific protocols should be developed for screening, monitoring, and management of pregnant women with cardiac disease.
6. **Further Research:** Multicenter prospective studies stratified by type and severity of cardiac disease are recommended to better understand risk patterns and improve evidence-based management.

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