

Maternal Cardiac Risk Factors and Their Association with Preterm Delivery – A Cross-sectional Study

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Abstract

Background:

Preterm birth is a major contributor to neonatal morbidity and mortality, especially in low- and middle-income countries like India. Emerging evidence suggests that maternal cardiac risk factors such as hypertension, diabetes, and obesity may play a role in increasing the risk of preterm delivery.

Aim:

To assess the association between maternal cardiac risk factors and preterm delivery in a tertiary care setting.

Methods:

A cross-sectional observational study was conducted among 150 pregnant women admitted for delivery. Maternal cardiac risk factors including hypertension, diabetes, obesity, family history of cardiovascular disease, and sedentary lifestyle were assessed using a structured proforma. The gestational age at delivery was noted, and statistical analysis was performed using Chi-square test, odds ratio (OR), and logistic regression.

Results:

The prevalence of preterm delivery was 36.7%. Hypertension ($p=0.001$), diabetes ($p=0.045$), and obesity ($p=0.030$) were significantly associated with preterm delivery. Logistic regression revealed hypertension as the only independent predictor (Adjusted OR: 3.92; 95% CI: 1.75–8.78). Family history and sedentary lifestyle were not statistically significant.

Conclusion:

Maternal hypertension, diabetes, and obesity are important risk factors for preterm birth, with hypertension being an independent predictor. Integrating cardiometabolic risk assessment into routine antenatal care is essential for early identification and prevention of preterm delivery.

Keywords:

Preterm birth, hypertension in pregnancy, gestational diabetes, maternal obesity, cardiac risk factors, antenatal care.

Introduction

Preterm birth, defined as the delivery of a baby before 37 completed weeks of gestation, is a major public health concern and the leading cause of neonatal mortality worldwide.

According to the World Health Organization (WHO), around 15 million babies are born preterm annually, and this number is rising in both developed and developing countries [1].

The complications of preterm birth are responsible for approximately 1 million deaths every year, making it the second most common cause of death in children under 5 years of age [2].

The burden of preterm birth is particularly high in low- and middle-income countries, with India alone accounting for 23.4% of global preterm births, the highest for any single

country [3]. Despite improvements in antenatal care and neonatal intensive care services, the rates of preterm births have remained high due to the multifactorial nature of its etiology.

Traditionally, factors such as multiple gestation, intrauterine infections, and uterine anomalies have been implicated in preterm labor. However, recent studies have highlighted the significance of maternal cardiac and metabolic risk factors as emerging contributors to preterm delivery. These include chronic hypertension, gestational hypertension, diabetes mellitus (both pregestational and gestational), obesity, sedentary lifestyle, and a family history of cardiovascular disease [4]. These factors not only affect the cardiovascular system of the mother but also influence uteroplacental blood flow, potentially leading to placental insufficiency and adverse perinatal outcomes. Hypertensive disorders of pregnancy are among the most common medical complications and are closely associated with preterm deliveries, either due to spontaneous onset of labor or iatrogenic indications for early delivery to prevent maternal and fetal morbidity [5]. Similarly, maternal diabetes, obesity, and dyslipidemia lead to chronic inflammation, endothelial dysfunction, and increased oxidative stress, which may trigger preterm labor or necessitate early delivery [6]. In India, the prevalence of non-communicable diseases among women of reproductive age is on the rise, fueled by urbanization, changing dietary habits, decreased physical activity, and increased stress. A large proportion of women remain undiagnosed or undertreated during pregnancy, thus elevating the risk of preterm birth and associated complications [7]. Despite this, data on the contribution of maternal cardiac risk factors to preterm labor in the Indian setting remains limited.

Given this background, the present study aims to explore the association between maternal cardiac risk factors and the occurrence of preterm delivery in a tertiary care setting.

Establishing such a link would enable early identification of at-risk mothers and help

formulate targeted antenatal interventions to reduce the burden of preterm birth and improve neonatal outcomes.

Aim:

To evaluate the association between maternal cardiac risk factors and the incidence of preterm delivery.

Objectives:

1. To identify the prevalence of cardiac risk factors (such as hypertension, diabetes, obesity, family history of heart disease) among pregnant women.
2. To determine the incidence of preterm delivery in women with and without cardiac risk factors.
3. To assess the strength of association between specific cardiac risk factors and preterm delivery.

Study Design:

Descriptive cross-sectional observational study.

Study Setting:

Department of Obstetrics and Gynecology, in collaboration with the Department of Cardiology, at a tertiary care teaching hospital.

Study Population: Pregnant women admitted for delivery (both term and preterm), in the labor room or antenatal ward of the hospital.

Inclusion Criteria:

- Women with singleton pregnancies.
- Gestational age ≥ 28 weeks at the time of delivery.
- Women who give written informed consent.
- Women with or without cardiac risk factors.

Exclusion Criteria:

- Women with multiple gestation.
- Known congenital uterine anomalies.
- Women with medically indicated preterm delivery for fetal structural anomalies or chromosomal abnormalities.
- Women with known congenital heart disease or severe cardiac illness requiring tertiary cardiac care.

Sample Size:

Estimated using prevalence data from prior studies, assuming a prevalence of cardiac risk factors among pregnant women at 30%, with 95% confidence interval and 8% absolute precision. sample size: 150 participants.

Sampling Technique:

Consecutive sampling of all eligible and consenting women admitted for delivery during the study period.

Data Collection Tool:

A pre-tested, structured proforma will be used to collect the following information:

1. Sociodemographic Data:

- Age, Education, Socioeconomic status, Urban/Rural residence.

2. Obstetric History:

- Gravida, parity, abortions, Gestational age at delivery, Previous history of preterm births, Mode of delivery

3. Maternal Cardiac Risk Factors:

- **Hypertension:**

Chronic hypertension (diagnosed before pregnancy or before 20 weeks)

Gestational hypertension (diagnosed after 20 weeks without proteinuria)

- **Diabetes Mellitus:**

Pre-existing Type 2 DM

Gestational diabetes mellitus (based on GCT/OGTT results per IADPSG or DIPSI criteria)

- **Obesity:**

BMI ≥ 25 kg/m² (pre-pregnancy or first-trimester)

- **Family History of Cardiovascular Disease:**

First-degree relatives with ischemic heart disease or hypertension <60 years of age

- **Sedentary Lifestyle:**

Self-reported physical inactivity

- **Smoking or tobacco use:**

Active or passive exposure during pregnancy

4. Outcome Variable:

- **Gestational age at delivery:**

Preterm: <37 completed weeks

Term: ≥ 37 weeks

Statistical Analysis:

Data will be entered into MS Excel and analyzed using SPSS or equivalent statistical software. Frequency and percentage for categorical variables (e.g., presence of hypertension). Mean \pm standard deviation for continuous variables (e.g., age, BMI). Chi-square test or Fisher's exact test: To compare proportions between groups (e.g., preterm vs term deliveries among those with vs without cardiac risk factors). Odds ratio (OR) with 95% confidence interval: To estimate the strength of association. Binary logistic regression (if sample size permits): To assess independent predictors of preterm delivery adjusting for confounders A p-value <0.05 will be considered statistically significant.

Results

Total number of participants included in the study: 150 pregnant women

- Preterm deliveries (<37 weeks): 55 (36.7%)
- Term deliveries (≥ 37 weeks): 95 (63.3%)

Table 1: Sociodemographic Profile of Study Participants (n = 150)

Variable	Frequency (n)	Percentage (%)
Age < 25 years	42	28.0
Age ≥ 25 years	108	72.0
Rural residence	64	42.7
Urban residence	86	57.3
Lower socioeconomic class	51	34.0
Middle/Upper class	99	66.0

Interpretation:

Majority of the women were aged ≥25 years and belonged to urban and middle socioeconomic backgrounds.

Table 2: Prevalence of Maternal Cardiac Risk Factors (n = 150)

Risk Factor	Present (n)	%	Absent (n)	%
Hypertension (chronic/gestational)	36	24.0	114	76.0
Diabetes (GDM/Pre-existing)	28	18.7	122	81.3
BMI ≥25 kg/m ² (Obesity)	41	27.3	109	72.7
Family history of CVD	26	17.3	124	82.7
Sedentary lifestyle	46	30.7	104	69.3

Interpretation:

Obesity and hypertension were the most common cardiac risk factors among the participants.

Table 3: Association Between Cardiac Risk Factors and Preterm Delivery

Risk Factor	Preterm (n=55)	Term (n=95)	p-value	Significant?
Hypertension	22 (40.0%)	14 (14.7%)	0.001 **	Yes
Diabetes	15 (27.3%)	13 (13.7%)	0.045 *	Yes
Obesity (BMI \geq 25)	21 (38.2%)	20 (21.1%)	0.030 *	Yes
Family history of CVD	12 (21.8%)	14 (14.7%)	0.280	No
Sedentary lifestyle	20 (36.4%)	26 (27.4%)	0.240	No

Interpretation:

Hypertension, diabetes, and obesity were significantly associated with preterm delivery.

Family history and sedentary lifestyle were not statistically significant.

Table 4: Odds of Preterm Delivery in Women With Cardiac Risk Factors

Risk Factor	Odds Ratio (OR)	95% CI	p-value
Hypertension	4.17	1.91 – 9.11	0.0003 **
Diabetes	2.39	1.02 – 5.60	0.044 *
Obesity (BMI \geq 25)	2.28	1.08 – 4.80	0.030 *
Family history of CVD	1.62	0.66 – 4.01	0.289
Sedentary lifestyle	1.52	0.74 – 3.11	0.252

Interpretation: Women with hypertension had more than 4 times higher odds of preterm delivery. Diabetes and obesity also significantly increased the odds, while other factors were not statistically significant.

Table 5: Binary Logistic Regression for Independent Predictors of Preterm Delivery

Variable	Adjusted OR	95% CI	p-value
Hypertension	3.92	1.75 – 8.78	0.001 **
Diabetes	2.11	0.89 – 5.02	0.088
Obesity (BMI \geq 25)	1.98	0.91 – 4.30	0.085
Age \geq 25 years	1.21	0.59 – 2.48	0.600
Socioeconomic class	1.10	0.53 – 2.31	0.790

Interpretation:

After adjusting for confounders, hypertension remained a statistically significant independent predictor of preterm delivery. Other factors such as diabetes and obesity showed a trend toward significance but did not reach the threshold.

Discussion

This cross-sectional study aimed to determine the association between maternal cardiac risk factors and preterm delivery. Our findings demonstrated that hypertension, diabetes mellitus, and obesity were significantly associated with preterm delivery, while factors such as family

history of cardiovascular disease and sedentary lifestyle did not show a statistically significant association.

The overall preterm delivery rate observed in our study was 36.7%, which is higher than the national average reported in India (~13%) but consistent with hospital-based studies from tertiary centers that handle high-risk pregnancies [8]. This discrepancy is likely due to the referral pattern and inclusion of medically complicated pregnancies. Hypertensive disorders, particularly gestational hypertension and preeclampsia, were strongly associated with preterm delivery in our study ($p = 0.001$), with an odds ratio of 4.17 in univariate analysis and remaining independently significant in multivariate logistic regression. This aligns with multiple studies that have shown hypertension to be one of the leading medical causes of iatrogenic or spontaneous preterm labor due to its effect on uteroplacental blood flow and endothelial dysfunction [9,10].

Similarly, women with diabetes mellitus, including gestational diabetes, had a significantly increased risk of preterm birth (OR 2.39, $p = 0.045$). Hyperglycemia in pregnancy has been linked to systemic inflammation and oxidative stress, which can contribute to premature rupture of membranes and placental dysfunction [11]. A study by Yogeve et al. also noted that poorly controlled GDM increases the risk of both spontaneous and indicated preterm deliveries [12]. Obesity (BMI ≥ 25 kg/m²) was another significant risk factor in our study, with nearly 38% of obese women delivering preterm. This finding is supported by a large cohort study by Crane et al., which found a dose-dependent relationship between maternal BMI and risk of preterm birth, likely due to inflammatory cytokines and hormonal imbalances affecting the pregnancy milieu [13]. Although family history of cardiovascular disease and sedentary lifestyle were more frequent among women with preterm delivery, these associations did not reach statistical significance in our cohort. This could be due to

underreporting, subjective assessment, or a smaller sample size limiting the power to detect such associations [14]. Interestingly, multivariate analysis confirmed hypertension as the only independent predictor, suggesting that the impact of other factors like obesity and diabetes may be mediated through or compounded by hypertension. This highlights the importance of early screening and management of blood pressure during antenatal care, which can potentially reduce the risk of preterm delivery [15].

From a public health perspective, the rising trend of non-communicable diseases among women of reproductive age in India, especially in urban and peri-urban areas, underscores the need for integration of cardiometabolic screening into routine antenatal services [16]. Preventive strategies including diet modification, physical activity, early detection of hypertension and diabetes, and targeted follow-up can help reduce the burden of preterm births linked to these modifiable risk factors.

Conclusion

This study highlights a significant association between maternal cardiac risk factors—particularly hypertension, diabetes mellitus, and obesity—and the occurrence of preterm delivery. Among these, hypertension emerged as an independent predictor even after adjusting for confounders. The findings underscore the growing influence of non-communicable diseases on obstetric outcomes in India and the need for early detection and management of cardiovascular risk factors during antenatal care. Strengthening maternal screening programs and incorporating cardiometabolic assessments as part of routine pregnancy care can aid in reducing the burden of preterm births and improving maternal and neonatal health outcomes.

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