International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 16; Issue: 7; July 2026
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Analysis of Maternal and Fetal Outcome in Preterm Labor

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DOI: https://doi.org/10.52403/ijhsr.20260707

ABSTRACT

Background and aims: Preterm birth remains one of the leading causes of neonatal morbidity and mortality worldwide and continues to impose a substantial burden on maternal health and healthcare systems. Early identification of risk factors and timely obstetric intervention are essential to improve fetomaternal outcomes. This study aimed to determine the prevalence of preterm birth, identify associated maternal and fetal risk factors, and compare maternal and neonatal outcomes between women with preterm and term deliveries at a tertiary care teaching hospital.

Methods: A hospital-based comparative case–control study was conducted in the Department of Obstetrics and Gynecology, KG Hospital and Postgraduate Medical Institute, Coimbatore, India, between November 2020 and July 2021. A total of 105 pregnant women with gestational age ≥28 weeks were enrolled, comprising 51 women with preterm birth (cases) and 54 women with term birth (controls). Sociodemographic characteristics, obstetric history, maternal and fetal risk factors, mode of delivery, maternal complications, and neonatal outcomes were prospectively recorded. Continuous variables were compared using independent *t*-test, while categorical variables were analyzed using Chi-square or Fisher's exact test. Odds ratios with 95% confidence intervals were calculated, and a p value <0.05 was considered statistically significant.

Results: The institutional prevalence of preterm birth was 17%, with late preterm birth (34–37 weeks) accounting for 76% of cases and medically indicated preterm birth representing 63% of all preterm deliveries. Hypertensive disorders of pregnancy (OR 4.68, 95% CI 1.22–17.89; p<0.05), fetal growth restriction (35% vs. 4%; p<0.001), oligohydramnios (33% vs. 7%; p<0.001), assisted conception, previous adverse obstetric history, and multiple pregnancy were significantly associated with preterm birth. Women with preterm delivery underwent cesarean section more frequently (59% vs. 31%; p<0.05). Preterm neonates had significantly lower birth weight (2.15±0.65 vs. 3.04±0.38 kg; p<0.001), lower 5-minute Apgar scores, higher NICU admission (53% vs. 4%; p<0.001), and increased neonatal complications including hyperbilirubinemia, respiratory distress syndrome, neonatal sepsis, and neonatal death.

Conclusion: Preterm birth remains a significant obstetric challenge, predominantly driven by medically indicated deliveries associated with hypertensive disorders, fetal growth restriction, oligohydramnios, and high-risk pregnancies. Strengthening antenatal surveillance, early risk stratification, timely referral, and evidence-based obstetric and neonatal interventions may

reduce preventable preterm births and improve maternal and neonatal outcomes.

Keywords: Preterm Birth; Pregnancy Complications; Pregnancy Outcome; Fetal Growth Restriction; Hypertension, Pregnancy-Induced; Intensive Care Units, Neonatal.

INTRODUCTION

Preterm birth, defined by the World Health Organization (WHO) as delivery before 37 completed weeks of gestation or before 259 days from the first day of the last menstrual period, remains a major global public health challenge. Of the approximately 130 million live births occurring worldwide each year, nearly 15 million are born preterm. Prematurity is a leading cause of neonatal morbidity and mortality and is associated with substantial long-term adverse health outcomes. India contributes significantly to the global burden of preterm births, with an estimated incidence of approximately 11%, accounting for nearly two-thirds of cases worldwide. Complications arising from preterm birth constitute the leading direct cause of neonatal mortality and the second most common cause of death among children under five years of age after pneumonia [1–3].

Preterm premature rupture of membranes (PPROM), spontaneous preterm labour with intact membranes, and medically indicated (iatrogenic) preterm delivery performed for maternal or foetal causes are the three general categories into which preterm births fall. The increasing global incidence of preterm birth is largely attributable to the rising frequency of medically indicated preterm deliveries, particularly in pregnancies complicated by hypertensive disorders and fetal growth restriction. In contrast, spontaneous preterm labor and PPROM, collectively termed spontaneous preterm births, are multifactorial syndromes associated with infection, inflammation, uteroplacental vascular disease, cervical insufficiency, uterine overdistension, and other complex pathophysiological mechanisms [4].

Preterm neonates are at increased risk of both short-term and long-term complications. Early neonatal morbidities include respiratory distress syndrome, necrotizing enterocolitis, retinopathy of prematurity, anemia of prematurity, neonatal jaundice, sepsis, feeding difficulties, and prolonged neonatal intensive care unit (NICU) admission. Survivors are also susceptible to long-term sequelae such as cerebral palsy, chronic lung disease, neurodevelopmental delay, intellectual disability, hearing impairment, and visual deficits. These complications impose a substantial emotional, social, and economic burden on affected families and healthcare systems because of prolonged hospitalization, intensive neonatal care, and lifelong medical and rehabilitative needs [5,6].

Global surveillance data indicate a steady rise in the incidence of preterm birth over the past several decades. Analysis of reliable national data from 65 countries demonstrated an increasing trend in preterm births between 1990 and 2010 [3]. This rise has been attributed to multiple factors, including increasing maternal age, higher prevalence of maternal comorbidities such as diabetes mellitus and hypertensive disorders, greater use of assisted reproductive technologies leading to multiple gestations, and evolving obstetric practices, including an increase in medically indicated preterm deliveries and cesarean sections performed before term [4].

The WHO estimates that the prevalence of preterm birth ranges from 5% to 18% across 184 countries, highlighting its widespread global impact [3]. Countries such as the United States, India, Brazil, and Nigeria account for the largest absolute numbers of preterm births. In India, Shubhada *et al.* reported a prevalence of 15%, whereas Feresu *et al.* documented a prevalence of 16.8% in Zimbabwe [7,8]. Globally, preterm birth is the leading cause of mortality among children younger than five years and is

responsible for approximately 16% of all under-five deaths and nearly 35% of neonatal deaths [9]. Consequently, reducing the incidence of preterm birth and improving neonatal outcomes have become major priorities for national and international health organizations. Given the substantial burden of prematurity and the pivotal role of tertiary care centers in managing high-risk pregnancies, the present study was undertaken to determine the prevalence of preterm birth, identify associated maternal risk factors, and evaluate maternal and neonatal outcomes among women delivering preterm.

Aim and Objectives

Aim

The present study aimed to evaluate the maternal and fetal outcomes associated with preterm labor and to identify factors associated with preterm birth among women delivering at a tertiary care teaching hospital.

Primary Objective

- To investigate the epidemiology of preterm birth among women delivering at the study institution.

Secondary Objectives

- To determine the prevalence of preterm birth among antenatal women delivering at the study institution.
- To identify the sociodemographic and obstetric risk factors associated with preterm birth.
- To compare maternal outcomes between women with preterm and term deliveries.
- To compare neonatal outcomes between preterm and term deliveries.

MATERIAL AND METHODS

This comparative case–control study was conducted in the Department of Obstetrics and Gynecology, KG Hospital and Postgraduate Medical Institute, Coimbatore, Tamil Nadu, India, over a period of nine months from November 2020 to July 2021. The study population comprised pregnant women with gestational age greater than 28 weeks attending the antenatal and labor services of the institution. A total of 105 participants were enrolled, including 51 women with preterm births (cases) and 54 women with term births (controls).

The sample size was estimated using the formula for prevalence studies considering a 95% confidence level (Z = 1.96), an expected prevalence of 7%, and an absolute precision of 5%, which yielded a minimum sample size of 100 participants. To compensate for possible non-response and recording errors, the sample size was increased by 5%, resulting in a final target sample size of 105 participants.

Eligible participants included pregnant women with viable singleton or multiple pregnancies between 28 and 40 weeks of gestation. Women with intrauterine fetal demise or confirmed coronavirus disease 2019 (COVID-19) infection were excluded from the study.

Gestational age was determined using the first day of the last menstrual period calculated according to Naegele's formula or, when available, by first-trimester ultrasonography. Cases were defined as women who delivered before completing 37 weeks of gestation, whereas controls were women who delivered at or beyond 37 completed weeks of gestation. The prevalence of preterm birth during the study period was calculated as the total number of preterm live births divided by the total number of live births during the study period and expressed as a percentage.

A structured interview and clinical assessment were performed for all participants. Sociodemographic variables including maternal age, educational status, occupation, socioeconomic status, marital status, method of conception, and pre-pregnancy body mass index were recorded. Detailed obstetric history including gravidity, parity, previous abortions, previous preterm births, mode of previous delivery, and prior maternal and neonatal outcomes was obtained. Comprehensive

obstetric examination was performed to identify maternal risk factors including gestational hypertension, diabetes mellitus in pregnancy, fetal growth restriction, multiple pregnancy, oligohydramnios, genitourinary infections, anemia, and other chronic medical disorders complicating pregnancy.

Hypertensive disorders of pregnancy were defined as blood pressure ≥140/90 mmHg with or without proteinuria. Fetal growth restriction was defined as birth weight below the fifth percentile for gestational age. Diabetes in pregnancy was diagnosed according to the Diabetes in Pregnancy Study Group India (DIPSI) guidelines. All participants underwent ultrasonographic evaluation to determine estimated fetal weight, amniotic fluid index, and fetal presentation. Spontaneous labor was defined as cervical dilatation greater than 3 cm with more than 80% cervical effacement accompanied by documented regular uterine contractions.

In women with spontaneous preterm labor or PPROM, the timing of labor onset and rupture of membranes was documented. Speculum examination was performed to confirm PPROM, and high vaginal swabs obtained from the posterior fornix using sterile cotton swabs were immediately sent for microbiological culture. Per-vaginal examination was carried out to assess cervical dilatation and membrane status. Women diagnosed with PPROM received intravenous cefotaxime (1 g twice daily) according to the institutional management protocol. All women presenting with threatened preterm labor between 28 and 37 weeks of gestation received antenatal corticosteroid therapy with betamethasone for fetal lung maturation.

The mode of delivery was documented for all participants. Following delivery, all neonates were examined by a pediatrician, and birth weight and Apgar scores were recorded. Mothers and newborns were followed until hospital discharge. Maternal postpartum complications and immediate neonatal outcomes were documented. Neonates requiring admission to the neonatal intensive care unit (NICU) were followed throughout their NICU stay, and neonatal complications as well as factors associated with neonatal mortality were recorded.

Statistical Analysis

Continuous variables were summarized as mean ± standard deviation or median with interquartile range according to data distribution, while categorical variables were expressed as frequencies and percentages. Comparisons of continuous variables between cases and controls were performed using the independent samples *t*-test for normally distributed data. Associations between categorical variables were evaluated using the Chi-square test or Fisher's exact test. Odds ratios (ORs) with corresponding 95% confidence intervals were calculated to estimate the strength of association between potential risk factors and preterm birth. A two-sided p value <0.05 was considered statistically significant. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 16.0 (IBM Corp., Armonk, NY, USA).

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee and Scientific Committee of KG Hospital and Postgraduate Medical Institute. Written informed consent was obtained from all participants before enrollment, and the study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS

Cases are the patients who delivered before 37 weeks - 51 cases (49%), controls are the cases who have delivered after 37 weeks - 54 cases (51%) as shown in figure 1.

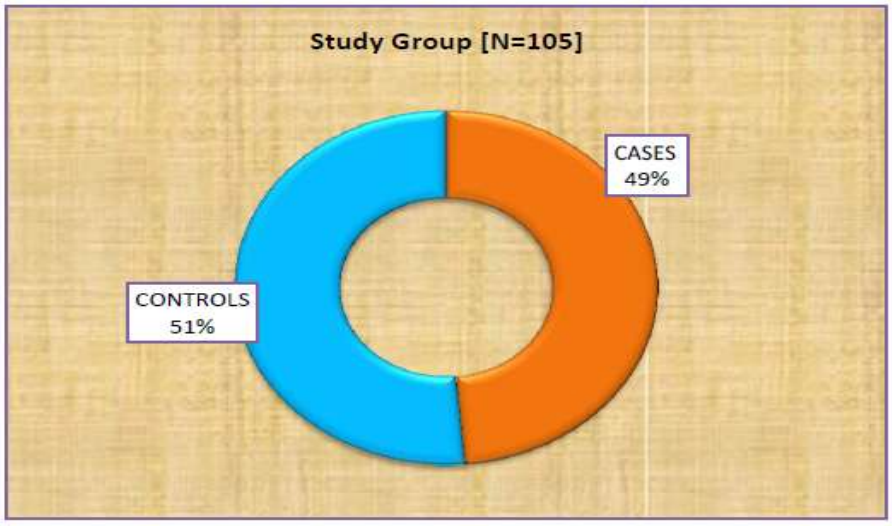

Figure 1: Distribution of Cases and Controls

Table 1 compares the baseline sociodemographic, anthropometric, and obstetric characteristics between the case (n=51) and control (n=54) groups. The majority of participants in both groups belonged to the 25–30-year age category (37% of cases and 46% of controls), with no statistically significant difference in age distribution between the groups (p>0.05). Educational status was also comparable, with undergraduate education being the most common level among cases (53%) and controls (39%) (p>0.05). Most participants in both groups belonged to the upper-middle socioeconomic class (63% in each group), and the occupational distribution was similar, with homemakers constituting the majority (71% of cases and 76% of controls) (p>0.05).

Body mass index showed comparable distributions between the groups, with normal BMI observed in approximately half of the participants (51% of cases and 57% of controls), followed by overweight and obesity, without a statistically significant difference (p>0.05). Blood group distribution was also similar, with O-positive being the predominant blood group in both cases (41%) and controls (46%) (p>0.05). Likewise, gravida distribution did not differ significantly between the groups, with primigravidae accounting for the largest proportion (45% vs. 56%; p>0.05).

However, booking status differed significantly between the study groups (p<0.05). A significantly higher proportion of controls were booked cases (93%) compared with cases (78%), whereas referred cases were more frequent among cases (22%) than controls (7%). Overall, except for booking status, the two groups were well matched with respect to baseline demographic and obstetric characteristics, minimizing the likelihood of confounding due to these variables.

Table 1. Comparison of Baseline Sociodemographic and Obstetric Characteristics Between Cases and Controls

Variable	Category	Cases (n=51)	%	Controls (n=54)	%	P value
Age (years)	18–20	5	10	5	10	>0.05
	>20–25	12	23	12	22	
	>25–30	19	37	25	46	
	>30–35	12	24	8	15	
	>35–40	3	6	4	7	
Education	School	8	16	14	26	>0.05
	Undergraduate	27	53	21	39	
	Postgraduate	16	31	19	35	

Socioeconomic status	Lower middle	14	27	18	33	>0.05
	Upper middle	32	63	34	63	
	Upper	5	10	2	4	
Occupation	Homemaker	36	71	41	76	>0.05
	Professional	15	29	13	24	
BMI	Normal	26	51	31	57	>0.05
	Overweight	18	35	16	30	
	Obesity	7	14	7	13	
Booking status	Booked	40	78	50	93	**<0.05**
	Referred	11	22	4	7	
Blood group	O+	21	41	25	46	>0.05
	A+	11	22	9	17	
	A−	1	2	1	2	
	B+	13	25	16	30	
	B−	3	6	0	0	
	AB+	2	4	3	5	
Gravida	Primi	23	45	30	56	>0.05
	Gravida 2	17	33	16	30	
	Gravida 3	8	16	5	9	
	Gravida 4	3	6	2	4	
	Gravida 5	0	0	1	1	

Table 2 compares the obstetric characteristics of the case and control groups. As expected, all women in the control group delivered at term (>37 weeks), whereas the preterm group comprised 6% early preterm (28–32 weeks), 18% moderate preterm (>32–34 weeks), and 76% late preterm (34–37 weeks), indicating that late preterm births constituted the majority of preterm deliveries.

Among multiparous women, the distribution of interpregnancy interval was comparable between the two groups, with no statistically significant difference ($p>0.05$). Most women had an interpregnancy interval of more than two years, suggesting that birth spacing was not associated with preterm birth in the present study.

Past obstetric history differed significantly between cases and controls ($p<0.05$). Women in the case group had higher proportions of previous lower segment cesarean section (10%), previous miscarriage (20%), and previous preterm birth (4%), whereas these conditions were absent or less frequent among controls, indicating that an adverse obstetric history the study groups. may increase the risk of subsequent preterm delivery.

The method of conception also demonstrated a statistically significant association with preterm birth ($p<0.05$). Conception following fertility treatment was observed more frequently among cases (18%) than controls (6%), whereas spontaneous conception predominated in both groups (82% vs. 94%), suggesting an increased likelihood of preterm birth among pregnancies conceived with treatment.

Regarding the type of pregnancy, singleton pregnancies accounted for the majority of both groups (88% of cases and 100% of controls), while all multiple (twin) pregnancies were observed exclusively in the case group (12%). As this variable was presented descriptively, no statistical comparison was performed. Overall, these findings suggest that adverse obstetric history and conception following fertility treatment were significantly associated with preterm birth, whereas interpregnancy interval was not significantly different between the study groups.

Table 2. Comparison of Obstetric Characteristics Between Cases and Controls

Variable	Category	Cases (n=51)	%	Controls (n=54)	%	p value
Gestational age (weeks)	28–32	3	6	0	0	—
	>32–34	9	18	0	0	
	34–37	39	76	0	0	
	>37	0	0	54	100	
Interpregnancy interval*	≤2 years	7	14	4	7	>0.05
	>2–5 years	8	16	10	19	
	>5 years	5	10	6	11	
Past obstetric history	Normal delivery	11	22	19	35	**<0.05**
	LSCS	5	10	0	0	
	Miscarriage	10	20	5	9	
	Previous preterm birth	2	4	0	0	
Method of conception	Spontaneous conception	42	82	51	94	**<0.05**
	Conceived with treatment	9	18	3	6	
Type of pregnancy	Singleton	45	88	54	100	—
	Multiple (Twins)	6	12	0	0	

***Interpregnancy interval analysis was performed only among multiparous women (Cases = 20; Controls = 20).**

Table 3 compares the maternal and fetal risk factors between the case and control groups. Among maternal risk factors, gestational diabetes mellitus was observed in 37% of cases and 28% of controls; however, this difference was not statistically significant (OR=1.544, 95% CI: 0.678–3.515; p>0.05). Hypertension was significantly more common among cases than controls (22% vs. 6%), with hypertensive women having approximately 4.7-fold higher odds of preterm birth (OR=4.675, 95% CI: 1.221–17.890; p<0.05). The prevalence of hypothyroidism, anemia, antiphospholipid antibody (APLA) syndrome, fibroid uterus, urinary tract infection, and other maternal comorbidities did not differ significantly between the two groups (all p>0.05), despite higher odds observed for some conditions.

Among fetal risk factors, both fetal growth restriction (FGR) and oligohydramnios showed highly significant associations with preterm birth. FGR was present in 35% of cases compared with only 4% of controls (OR=0.071, 95% CI: 0.015–0.324; p<0.001), while oligohydramnios occurred in 33% of cases and 7% of controls (OR=0.160, 95% CI: 0.049–0.517; p<0.001). In contrast, polyhydramnios was uncommon in both groups (2% each) and showed no statistically significant association with preterm birth (OR=0.943, 95% CI: 0.057–15.493; p>0.05).

Overall, hypertension emerged as the only maternal risk factor significantly associated with preterm birth, whereas fetal growth restriction and oligohydramnios were the strongest fetal risk factors identified in the present study. These findings underscore the importance of close antenatal surveillance for maternal hypertensive disorders and fetal growth abnormalities to facilitate early identification and management of pregnancies at increased risk of preterm delivery.

Table 3. Comparison of Maternal and Fetal Risk Factors Between Cases and Controls

Risk Factor	Cases (n=51)	%	Controls (n=54)	%	Odds Ratio (95% CI)	p value
Maternal Risk Factors						
Gestational diabetes mellitus (GDM)	19	37	15	28	1.544 (0.678–3.515)	>0.05
Hypertension	11	22	3	6	4.675 (1.221–17.890)	**<0.05**
Hypothyroidism	7	14	8	15	0.915 (0.306–2.773)	>0.05

Anemia	12	24	14	26	0.879 (0.361–2.137)	>0.05
APLA syndrome	2	4	0	0	5.500 (0.257–11.7)	>0.05
Fibroid uterus	1	2	0	0	3.238 (0.129–81.314)	>0.05
Urinary tract infection (UTI)	3	6	1	2	3.312 (0.332–32.929)	>0.05
Others	11	22	5	9	2.695 (0.864–8.398)	>0.05
Fetal Risk Factors						
Fetal growth restriction (FGR)	18	35	2	4	0.071 (0.015–0.324)	**<0.001**
Oligohydramnios	17	33	4	7	0.160 (0.049–0.517)	**<0.001**
Polyhydramnios	1	2	1	2	0.943 (0.057–15.493)	>0.05

Table 4 compares the mode of delivery, postpartum complications, and neonatal characteristics between the case and control groups. A statistically significant difference was observed in the mode of delivery between the two groups ($p<0.05$). Cesarean section (LSCS) was the predominant mode of delivery among cases, accounting for 59% of deliveries, compared with 31% among controls. In contrast, normal vaginal delivery was more common in the control group (69%) than in the case group (41%), indicating that women with preterm labor were significantly more likely to undergo cesarean delivery.

Postpartum complications were infrequent in both groups. Post-dural puncture headache occurred in 4% of women in each group, fever was reported in 4% of cases and 2% of controls, and episiotomy hematoma was observed only in one case (2%). None of these postpartum complications differed significantly between the two groups (all $p>0.05$), suggesting comparable maternal postpartum outcomes irrespective of gestational age at delivery.

A statistically significant difference was observed in neonatal birth weight distribution ($p<0.05$). Among neonates born to cases, 14% had very low birth weight (<1.5 kg), 65% had low birth weight (1.5–2.5 kg), and only 21% weighed more than 2.5 kg at birth. In contrast, the majority of neonates in the control group (94%) had a birth weight greater than 2.5 kg, while only 6% had low birth weight and none had very low birth weight. These findings highlight the strong association between preterm birth and reduced neonatal birth weight.

The distribution of neonatal gender was comparable between the two groups, with male infants accounting for 52% of births in the case group and 63% in the control group, whereas female infants constituted 48% and 37%, respectively. No statistically significant difference was observed in neonatal gender distribution ($p>0.05$). Overall, the findings demonstrate that preterm birth was significantly associated with a higher rate of cesarean delivery and lower birth weight, whereas postpartum maternal complications and neonatal gender distribution remained comparable between cases and controls.

Table 4. Comparison of Mode of Delivery, Postpartum Complications, and Neonatal Characteristics Between Cases and Controls

Variable	Category	Cases	%	Controls	%	Significance
Mode of delivery *(n=51 vs. 54)*	Normal vaginal delivery	21	41	37	69	**<0.05**
	LSCS	30	59	17	31	
Postpartum complications *(n=51 vs. 54)*	Post-dural puncture headache	2	4	2	4	>0.05
	Fever	2	4	1	2	
	Episiotomy hematoma	1	2	0	0	
Birth weight (kg) *(Cases: n=58 babies; Controls: n=54 babies)*	<1.5	8	14	0	0	**<0.05**
	1.5–2.5	38	65	3	6	
	>2.5	12	21	51	94	
Baby gender *(Cases: n=58 babies; Controls: n=54 babies)*	Male	30	52	34	63	>0.05
	Female	28	48	20	37	

There was no statistically significant difference in APGAR scores at 1 minute but at 5 minutes 6% babies had APGAR scores of 7 vs 2% in control group 20% had 8 score compared to 4% in control group indicating a statistically significant difference between two groups at 5 minutes (table 5). 53% of infants born preterm required NICU admission whereas only 4% required admission in control group. There was statistically significant difference ($p<0.001$) between both groups for NICU admission.

Table 5. Comparison of APGAR Score in Both Cases and Controls

Study Group					
	Cases	**%**	**Controls**	**%**	**Significance**
APGAR 1 minute					
5	1	2%	2	4%	>0.05
6	3	6%	2	4%	
7	10	20%	2	4%	
8	37	73%	46	85%	
9	0	0%	1	2%	
10	0	0%	1	2%	
APGAR 5 minute					
7	3	6%	1	2%	
8	10	20%	2	4%	
9	13	25%	18	33%	<0.05
10	25	49%	33	61%	

The most common neonatal complication encountered in preterm group was neonatal hyperbilirubinemia - 16% compared to only 2% in term group. Incidence of respiratory distress was 10% in preterm group compared to term group where there was no complication of RDS. 4 infants (8%) had neonatal sepsis attributed to PPROM in mother whereas no incidence of neonatal sepsis in term group. 2 cases of NND both were cases of severe preeclampsia with FGR with severe prematurity (table 6).

Table 6. Neonatal Complications in Both Cases and Controls

Study group				
Neonatal complication	**Cases**	**%**	**Controls**	**%**
LBW	3	6%	0	0%
Neonatal hyperbilirubinemia	8	16%	1	2%
RDS	5	10%	0	0%
SEPSIS	4	8%	0	0%
preterm care	2	4%	0	0%
NND	2	4%	0	0%
OTHERS	6	12%	4	7%
cried after resuscitation	1	2%	1	2%

Table 7 compares the mean maternal and neonatal characteristics between the case and control groups. The mean maternal age was comparable between cases (27.35 ± 4.82 years) and controls (27.19 ± 4.80 years), with an overall mean age of 27.27 ± 4.78 years. No statistically significant difference was observed between the two groups ($p>0.05$), indicating that maternal age was well matched.

A highly statistically significant difference was observed in neonatal birth weight ($p<0.001$). The mean birth weight among neonates in the case group was 2.15 ± 0.65 kg, which was substantially lower than that of the control group (3.04 ± 0.38 kg). The overall mean birth weight of the study population was 2.61 ± 0.69 kg, reflecting the expected reduction in birth weight associated with preterm delivery.

The mean APGAR score at 1 minute was comparable between cases (7.63 ± 0.69) and controls (7.83 ± 0.77), with no statistically significant difference ($p>0.05$). However, by 5 minutes, neonates in the control group demonstrated significantly higher APGAR scores than those in the case group (9.54 ± 0.67 vs. 9.18 ± 0.95; $p<0.05$), suggesting better early neonatal adaptation among term infants despite generally satisfactory APGAR scores in both groups.

The duration of maternal hospital stay was significantly longer among cases than controls (7.18 ± 4.71 vs. 5.13 ± 1.72 days; $p<0.01$). The overall mean hospital stay was 6.12 ± 3.64 days, indicating that women delivering preterm required prolonged hospitalization, likely because of increased maternal and neonatal monitoring and the need for additional obstetric and neonatal care.

Overall, while maternal age was comparable between the groups, preterm birth was associated with significantly lower neonatal birth weight, lower 5-minute APGAR scores, and a longer duration of maternal hospitalization. These findings emphasize the greater healthcare utilization and neonatal vulnerability associated with preterm deliveries.

Table 7. Comparison of Mean Maternal and Neonatal Characteristics Between Cases and Controls

Parameter	Study Group	Mean ± SD	95% CI	Minimum	Maximum	Significance
Maternal age (years)	Cases	27.35 ± 4.82	26.00–28.71	18	38	>0.05
	Controls	27.19 ± 4.80	25.88–28.49	19	40	
	Total	27.27 ± 4.78	26.34–28.19	18	40	
Birth weight (kg)	Cases	2.15 ± 0.65	1.97–2.34	0.64	4.00	**<0.001**
	Controls	3.04 ± 0.38	2.93–3.14	2.34	3.83	
	Total	2.61 ± 0.69	2.47–2.74	0.64	4.00	
APGAR score at 1 minute	Cases	7.63 ± 0.69	7.43–7.82	5	8	>0.05
	Controls	7.83 ± 0.77	7.62–8.04	5	10	
APGAR score at 5 minutes	Cases	9.18 ± 0.95	8.91–9.44	7	10	**<0.05**
	Controls	9.54 ± 0.67	9.36–9.72	7	10	
Maternal hospital stay (days)	Cases	7.18 ± 4.71	5.85–8.50	3	28	**<0.01**
	Controls	5.13 ± 1.72	4.66–5.60	2	9	
	Total	6.12 ± 3.64	5.42–6.83	2	28	

Among total preterm births 63% were indicated preterm births, 20% due to PPROM and 18% due to spontaneous preterm labor without rupture of membranes.

Among 20% cases of PPROM 2% had UTI and 2% had vaginitis- Escherichia coli. Raised white blood cells count among 10%, raised CRP and ESR in 16% women of PPROM indicating an inflammatory reaction attributing to PPROM.

DISCUSSION

The present hospital-based case–control study evaluated maternal risk factors, obstetric characteristics, and neonatal outcomes associated with preterm birth. The prevalence of preterm birth was 17%, comparable to the global estimate of 5–18% reported by the WHO [2] and previous studies by Feresu SA et al [8], Shubhada SA et al [7], Wagura P et al [10], Temu TB et al [11], Bekele I et al [12], and Jamal S et al [13]. The findings suggest that although antenatal care has improved, medically indicated preterm births continue to increase because of better obstetric surveillance, assisted reproductive techniques, and high-risk pregnancies.

Maternal age, education, occupation, socioeconomic status, and prepregnancy body mass index were not significantly associated with preterm birth, consistent with Wagura P et al [10] and Bayingana et

al [15]. In contrast, Jamal S et al [13] and Bangal VB et al [14] reported associations with maternal age and socioeconomic status. These differences may reflect improved antenatal surveillance and differences in study populations. Referral from peripheral centers was significantly more common among women with preterm birth, similar to Shrestha et al [16], reflecting the role of the institution as a tertiary referral center managing complicated pregnancies including hypertensive disorders, fetal growth restriction (FGR), and oligohydramnios.

Maternal blood group was not associated with preterm birth, unlike the findings of Al-Abdi SY et al [17]. Primigravidity predominated among women with preterm births, although previous studies have reported conflicting findings regarding the association between parity and preterm birth [11,18].

Late preterm birth (34–37 weeks) constituted the largest proportion of preterm deliveries, similar to Jamal S et al [13]. Nearly two-thirds of preterm births were medically indicated rather than spontaneous, consistent with Henderson JJ et al [19] and Bangal VB et al [14]. Improved antenatal care, infection management, and progesterone prophylaxis according to FIGO recommendations [20] may explain the relatively lower frequency of spontaneous preterm labor and PPROM.

Hypertensive disorders of pregnancy were strongly associated with preterm birth, supporting previous studies [11,21,22]. FGR complicated approximately one-third of preterm pregnancies, similar to Carreno CA et al [23]. Multiple pregnancy and assisted conception also significantly increased the risk of preterm birth, consistent with Temu TB et al [11] and Goldenberg RL et al [4]. Interpregnancy interval was not associated with preterm birth, unlike Conde-Agudelo A et al [24]. However, previous abortion and previous preterm birth significantly increased recurrence risk, corroborating findings by Temu TB et al [11], Mercer BM et al [25], and Mahande MJ et al [26]. Although urinary tract infection and maternal anemia were not statistically significant, both showed increased odds of preterm birth, supporting earlier reports [11,27,28]. These observations reinforce the role of inflammation and maternal nutritional status in the pathogenesis of preterm birth.

Cesarean delivery was significantly more frequent among women with preterm birth because of associated obstetric complications [11]. Neonatal morbidity was considerably higher, with increased NICU admission, respiratory distress, neonatal jaundice, sepsis, feeding intolerance, prolonged hospitalization, and low birth weight, consistent with Lubow JM et al [29] and Leone A et al [30]. Routine antenatal corticosteroid administration may have reduced respiratory morbidity. Although the 1-minute Apgar score was similar, low 5-minute Apgar scores were significantly more common among preterm neonates, consistent with Maghsoudlou S et al [31]. Birth weight was substantially lower among preterm infants, comparable to Shrestha S et al [16]. Male neonates were slightly more common among preterm births, similar to Temu TB et al [11]. Neonatal mortality remained relatively low compared with previous reports [13,14], probably because most infants were late preterm and benefited from comprehensive NICU care.

Maternal morbidity was comparable between groups, consistent with SS Mohan et al [32], reflecting effective multidisciplinary management. Nevertheless, women with preterm birth required longer hospitalization because of neonatal intensive care needs.

The findings of the present study further emphasize the importance of evidence-based antenatal surveillance, individualized risk assessment, and multidisciplinary obstetric and neonatal care. Collectively, these observations are consistent with previous literature demonstrating that timely diagnosis of maternal complications and appropriate neonatal support substantially improve perinatal outcomes while reducing

preventable morbidity.

Overall, the findings of this study underscore that preterm birth remains a significant obstetric challenge with considerable neonatal morbidity. Early identification and effective management of hypertensive disorders of pregnancy, gestational diabetes mellitus, fetal growth restriction, oligohydramnios, maternal anemia, and multiple pregnancy, together with regular antenatal surveillance and timely referral of high-risk pregnancies to tertiary care centers with well-equipped NICU facilities, are essential strategies for reducing the incidence of medically indicated preterm birth and improving both maternal and neonatal outcomes.

Strengths and Limitations

The strengths of the present study include its comprehensive evaluation of maternal, obstetric, and neonatal outcomes associated with preterm birth and the identification of several modifiable obstetric risk factors, including hypertensive disorders, fetal growth restriction, oligohydramnios, gestational diabetes mellitus, and multiple pregnancy. The relatively low neonatal mortality despite considerable neonatal morbidity further highlights the importance of timely referral and availability of quality neonatal intensive care. However, several limitations should be acknowledged. This was a single-center hospital-based study conducted in a tertiary referral institution, which may limit the generalizability of the findings to the wider population because of referral bias. In addition, extremely preterm pregnancies before 28 weeks of gestation were not included, potentially underestimating the burden of severe prematurity.

CONCLUSION

Preterm birth remains a major obstetric challenge and continues to impose a substantial burden on maternal, neonatal, and healthcare outcomes. In the present study, the prevalence of preterm birth was 17%, which is comparable with previously reported estimates. Sociodemographic characteristics, including maternal age, educational status, occupation, socioeconomic status, prepregnancy body mass index, and blood group, were not significantly associated with the occurrence of preterm birth. The majority of preterm deliveries were late preterm births (34–37 weeks of gestation), with medically indicated preterm birth representing the predominant subtype, followed by preterm premature rupture of membranes (PPROM) and spontaneous preterm labor. Hypertensive disorders of pregnancy, including chronic hypertension, gestational hypertension, and preeclampsia, together with fetal growth restriction, oligohydramnios, and multiple pregnancies, were identified as the principal obstetric risk factors for preterm birth. Additional contributors included gestational diabetes mellitus, urinary tract infection, fibroid uterus, and antiphospholipid antibody positivity, while infection and inflammation appeared to play an important etiological role in pregnancies complicated by PPROM. The findings suggest that a substantial proportion of provider-initiated preterm births may be preventable through early identification of high-risk pregnancies and timely evidence-based interventions. Appropriate antenatal strategies, including low-dose aspirin prophylaxis for women at high risk of preeclampsia, anticoagulant therapy when indicated for autoimmune disorders, and routine screening and prompt treatment of genital and urinary tract infections, may help reduce the incidence of medically indicated preterm birth, PPROM, and spontaneous preterm labor. Women with preterm birth were more likely to undergo cesarean delivery, reflecting the higher prevalence of maternal and fetal complications requiring early obstetric intervention.

Preterm neonates experienced substantially higher morbidity, with increased rates of low birth weight, neonatal hyperbilirubinemia, respiratory distress syndrome, neonatal sepsis, hypoglycemia,

and neonatal intensive care unit admission compared with term infants. Although referred high-risk pregnancies had a greater incidence of preterm birth, favorable fetomaternal outcomes were achieved through timely referral and comprehensive multidisciplinary care in a tertiary care setting with well-equipped neonatal intensive care facilities. These findings underscore the importance of early pregnancy registration, regular antenatal surveillance, risk stratification, and timely referral of high-risk pregnancies to specialized centers. Furthermore, implementation of established evidence-based interventions, including antenatal corticosteroids, magnesium sulphate for fetal neuroprotection, and Kangaroo Mother Care for eligible preterm infants, should be strengthened to improve neonatal survival and reduce long-term morbidity. Collectively, these measures have the potential to improve fetomaternal outcomes while reducing the long-term healthcare burden associated with preterm birth.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Vidyashree, Prathima, Sumitra Sangavi, Bhavani. Analysis of maternal and fetal outcome in preterm labor. *Int J Health Sci Res.* 2026; 16(7):59-73. DOI: *https://doi.org/10.52403/ijhsr.20260707*

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