RESEARCH PAPER

Preterm Labor and Delivery- Incidence, Risk Factors and Perinatal Outcomes in A Tertiary Centre (Neigrihms)

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ABSTRACT

Background: Preterm birth is a major public health problem and a leading cause of neonatal morbidity and mortality worldwide. Identification of risk factors and evaluation of neonatal outcomes are essential for developing effective preventive strategies, particularly in resource-limited settings.

Objectives: To determine the incidence of preterm labour and delivery and to evaluate associated risk factors and perinatal outcomes at a tertiary care centre in North-East India.

Methods: This hospital-based prospective observational study was conducted in the Department of Obstetrics and Gynaecology, NEIGRIHMS, Shillong, from January 2018 to July 2019. A total of 332 women with preterm labour and delivery were enrolled and followed up. Maternal demographic, obstetric, clinical, and neonatal data were collected using a structured proforma. Statistical analysis was performed using SPSS version 23.0. Associations were assessed using Chi-square test, Pearson correlation, and regression analysis, with $p<0.05$ considered statistically significant.

Results: Among 1,566 total deliveries during the study period, 332 were preterm deliveries, yielding an incidence of 21.2%, while the incidence of preterm labour was 12.5%. The mean maternal age was 27.58 ± 6.4 years, and the mean gestational age at delivery was 33.55 ± 2.3 weeks. Anaemia (38.6%) was the most common risk factor, followed by multifetal gestation (22.3%), oligohydramnios (11.4%), eclampsia (10.8%), and PPROM (10.2%). The mean birth weight of preterm neonates was 2.17 ± 0.58 kg, and 53.6% were low birth weight. Neonatal morbidity and mortality rates were 19.5% and 7.1%, respectively. Respiratory distress syndrome was the leading cause of neonatal morbidity and mortality. Increasing gestational age showed significant positive correlation with APGAR scores and significant negative correlation with neonatal morbidity, mortality, respiratory distress syndrome, and NICU admission rates ($p<0.001$). Maternal risk factors were significantly associated with adverse neonatal outcomes.

Conclusion: Preterm birth constitutes a substantial burden in the study population. Anaemia and multifetal gestation were the predominant risk factors, while respiratory distress syndrome was the leading neonatal complication. Early identification and management of high-risk pregnancies, along with strengthening antenatal and neonatal care services, may improve perinatal outcomes.

Keywords: Preterm birth, Preterm labour, Prematurity, Risk factors, Neonatal morbidity, Respiratory distress syndrome

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INTRODUCTION

Preterm birth, defined as delivery before 37 completed weeks of gestation, remains one of the most important contributors to neonatal morbidity and mortality worldwide. According to the World Health Organization (WHO), preterm labour refers to the onset of labour before 37 completed weeks of gestation or 259 days from the first day of the last menstrual period.[1] Globally, an estimated 15 million babies are born preterm every year, accounting for more than one in ten live births. Prematurity is the leading cause of death among children under five years of age, resulting in nearly one million deaths annually due to complications associated with preterm birth.[2]

India bears the highest burden of preterm births globally, contributing approximately 3.6 million preterm deliveries each year.[3] Despite substantial advances in obstetric

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management and neonatal intensive care, preterm birth continues to be a major public health challenge, particularly in developing countries. While survival of extremely preterm infants has improved considerably in high-income settings, neonatal salvage below 28 weeks of gestation remains difficult in many resource-limited regions. Consequently, prematurity continues to be a leading cause of perinatal and neonatal mortality and morbidity in developing nations.[4]

The consequences of prematurity extend beyond the neonatal period. Preterm infants are at increased risk of respiratory distress syndrome, neonatal jaundice, sepsis, feeding difficulties, and prolonged hospitalization. Furthermore, survivors may experience long-term neurodevelopmental impairments, including cerebral palsy, visual and hearing deficits, learning disabilities, and cognitive dysfunction.[5] The economic burden associated with intensive neonatal care and long-term rehabilitation further highlights the importance of preventing preterm birth and improving outcomes among affected infants.

Importantly, many complications associated with prematurity can be prevented through evidence-based and cost-effective interventions. Essential maternal and newborn care, administration of antenatal corticosteroids, kangaroo mother care, timely management of infections, and quality intrapartum and postnatal care have been shown to significantly improve survival and reduce morbidity among preterm newborns.[1] Therefore, identification of risk factors associated with preterm birth is essential for implementing preventive strategies and optimizing maternal and neonatal healthcare services.

Preterm birth is a multifactorial condition influenced by a complex interaction of maternal, fetal, obstetric, socioeconomic, and environmental factors. Numerous studies conducted worldwide have evaluated the incidence, determinants, and outcomes of preterm birth.[5,6] Similar studies from different regions of India have also reported varying incidence rates and risk factor profiles.[7–9] However, the epidemiology of preterm birth is known to differ across populations because of variations in ethnicity, socioeconomic status, healthcare accessibility, environmental exposures, and reproductive characteristics.[10]

The North-Eastern region of India possesses unique demographic and ethnic characteristics, and data regarding the incidence, risk factors, and neonatal outcomes of preterm birth remain limited. Therefore, findings from studies conducted in other parts of the country may not be directly applicable to this population. In view of the significant burden of prematurity, limited regional data, and the need for evidence-based preventive strategies, the present study was undertaken at a tertiary care centre in North-East India to determine the incidence of preterm labour and delivery, identify associated risk factors, and evaluate perinatal outcomes among preterm births. The findings of this study may contribute to improved risk identification, targeted interventions, and better maternal and neonatal healthcare planning in the region.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based prospective observational study was conducted in the Department of Obstetrics and Gynaecology, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), Shillong, Meghalaya, India, over a period of one and a half years from January 2018 to July 2019. Prior approval for the study was obtained from the Institutional Ethics Committee (IEC), NEIGRIHMS.

Study Population: The study included pregnant women presenting with preterm labour and admitted to the labour room of NEIGRIHMS during the study period.

Inclusion Criteria

All pregnant women in preterm labour from the period of viability up to 36 weeks and 6 days of gestation were included in the study.

Exclusion Criteria

- Pre-viable pregnancies presenting with uterine contractions.
- Gestational age ≥37 completed weeks.

Sample Size and Sampling Technique: The sample size was calculated using SPSS Sample Power software. Considering the prevalence of preterm labour in India to be 23% as reported by Uma et al. [9], the minimum required sample size at 95% confidence interval and 80% power was estimated to be 322 participants. Therefore, a minimum sample size of 322 women was planned for enrolment. Simple random sampling was employed for recruitment of eligible cases attending the labour room of NEIGRIHMS.

Study Procedure: All eligible women admitted with preterm labour were recruited and evaluated through detailed history taking, clinical examination, obstetric examination, and ultrasonography. Preterm labour and threatened preterm labour were diagnosed according to the American College of Obstetricians and Gynecologists (ACOG) 1997 criteria, defined as four uterine contractions within 20 minutes with or without cervical dilatation greater than 1 cm or cervical effacement of 80% or more. Rupture of membranes was diagnosed by sterile speculum examination. Detailed general, systemic, and obstetric examinations were performed with special emphasis on identifying conventional risk factors associated with preterm labour. Maternal haemoglobin levels were measured and recorded. Maternal risk factors and neonatal outcomes were documented and subsequently analysed.

Data Collection: Data were collected using both direct and indirect methods. Direct data collection involved biomedical measurements, including neonatal birth weight. Indirect data collection was carried out through structured interviews using a predesigned questionnaire. Maternal information included age, state of origin,

educational status, socioeconomic status, booking status, parity, interpregnancy interval, gestational age at delivery, previous history of preterm birth, previous history of abortion, multifetal gestation, haemoglobin level at admission, and the presence of maternal risk factors and comorbidities. Neonatal data included mode of delivery, birth weight, APGAR scores, neonatal morbidity, NICU admission, and neonatal mortality.

Study Variables and Outcomes: The independent variables assessed in the study included maternal age at delivery, state of origin, socioeconomic and educational status, booking status, interpregnancy interval, parity, gestational age at delivery, previous history of preterm birth, previous history of abortion, multifetal gestation, and haemoglobin level at admission. The primary outcome measure was the incidence of preterm labour and delivery. Secondary outcomes included the identification of risk factors associated with preterm labour and delivery and the assessment of perinatal outcomes among preterm neonates.

Statistical Analysis: Data were entered into Microsoft Excel 2016 and analysed using Statistical Package for Social Sciences (SPSS) version 23.0.0.0 for Windows (64-bit edition). Descriptive statistics were used to summarize the study findings. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Bar charts and pie charts were generated using Microsoft Excel. Associations between variables were analysed using the Chi-square test. Pearson correlation analysis and regression analysis were performed wherever applicable. Odds ratios were calculated to assess the strength of associations. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 332 women with preterm labour and delivery were enrolled and followed up during the 18-month study period. Among 1,566 total deliveries conducted during the study period, 332 were preterm deliveries, yielding an incidence of preterm delivery of 21.2%. The incidence of preterm labour was 12.5% (196/1566).

The mean maternal age was 27.58 ±6.4 years (range: 16–48 years). Most participants belonged to the 25–29 years age group (25.3%). The majority were residents of Meghalaya (94.0%), belonged to the lower socioeconomic class (63.3%), and had primary-level education (49.7%) (Table 1).

Table 1. Sociodemographic Characteristics of the Study Population (N=332)

Variable		Frequency	Percentage (%)
Age Group (years)	<20	36	10.8
	20–24	82	24.7
	25–29	84	25.3
	30–34	73	22.0
	35–39	46	13.9
	≥40	11	3.3
Socioeconomic Status	Lower	210	63.3
	Middle	103	31.0
	Upper	19	5.7
Educational Status	Uneducated	13	3.9
	Primary (I–VIII)	165	49.7
	Secondary (IX–XII)	120	36.1
	Higher Education	34	10.2

Most women were primigravida (37.0%). The mean gestational age at delivery was 33.55 ±2.3 weeks, and the majority of preterm births occurred between 32 and 36 weeks of gestation (80.4%). More than half of the women were unbooked (56.9%). Singleton pregnancies accounted for 77.7% of deliveries (Table 2).

Table 2. Obstetric Characteristics of the Study Population (N=332)

Variable		Frequency	Percentage (%)
Parity	G1	123	37.0
	G2	78	23.5
	G3	40	12.0

	G4	29	8.7
	G5	22	6.6
	G6+	40	12.0
Gestational Age	28–31 weeks	65	19.6
	32–36 weeks	267	80.4
Booking Status	Booked	143	43.1
	Unbooked	189	56.9
Number of Fetuses	Singleton	258	77.7
	Multifetal	74	22.3

The mean interpregnancy interval was 1.28 ±1.4 years. The mean haemoglobin level at admission was 10.5 ±1.8 g/dL, with the highest proportion of women having haemoglobin levels between 8 and 10 g/dL (32.2%).

Overall, 79.8% of women had at least one identifiable risk factor associated with preterm delivery, whereas 20.2% were classified as idiopathic cases. Anaemia was the most common risk factor (38.6%), followed by multifetal gestation (22.3%), oligohydramnios (11.4%), eclampsia (10.8%), PPROM (10.2%), and fetal distress (10.2%) (Table 3).

Table 3. Major Risk Factors Associated with Preterm Delivery (N=332)

Risk Factor	Frequency	Percentage (%)
Anaemia	128	38.6
Multifetal gestation	74	22.3
Oligohydramnios	38	11.4
Eclampsia	36	10.8
PPROM	34	10.2
Fetal distress	34	10.2
Placenta previa	28	8.4
Hypertension	26	7.8
Malpresentation	26	7.8
Thyroid dysfunction	14	4.2
Idiopathic	67	20.2

The caesarean section rate among preterm deliveries was 47.9% (159/332), compared with 31.8% among term deliveries. Among preterm births, 52.1% were delivered vaginally. The mean birth weight of preterm neonates was 2.17 ±0.58 kg (range: 0.53–3.80 kg). The majority of neonates were classified as low birth weight (53.6%). Mean APGAR scores at 1 and 5 minutes were 7.29 ±1.51 and 8.46 ±1.35, respectively. Of the 332 deliveries, 329 resulted in live births and 3 were intrauterine fetal deaths.

Table 4. Neonatal Outcomes Among Preterm Deliveries

Outcome	Value
Live births	329
IUFD	3
Mean birth weight (kg)	2.17 ± 0.58
Low birth weight (%)	53.6
APGAR score at 1 min	7.29 ± 1.51
APGAR score at 5 min	8.46 ± 1.35
Neonatal morbidity (%)	19.5

Neonatal mortality (%)	7.1

Respiratory distress syndrome (RDS) was the leading cause of neonatal morbidity (17.6%) and also the most common cause of neonatal mortality. Increasing gestational age was associated with significantly higher APGAR scores at both 1 minute ($r = 0.389$, $p < 0.001$) and 5 minutes ($r = 0.421$, $p < 0.001$). Conversely, gestational age demonstrated significant negative correlations with neonatal morbidity, mortality, RDS, and NICU admission rates (Table 5).

Table 5. Correlation of Gestational Age with Neonatal Outcomes

Variable	Correlation Coefficient (r)	r^2	p-value
Neonatal morbidity	-0.231	0.054	<0.0001
Neonatal mortality	-0.316	0.100	<0.0001
RDS	-0.356	0.127	<0.0001
NICU admission	-0.464	0.215	<0.0001

The presence of maternal risk factors was significantly associated with increased caesarean section rates, neonatal morbidity, neonatal mortality, NICU admissions, and respiratory distress syndrome. Women with identifiable maternal risk factors had 2.4 times higher odds of caesarean delivery, 3.17 times higher odds of neonatal morbidity, 2.84 times higher odds of NICU admission, and 4.54 times higher odds of neonatal respiratory distress syndrome (Table 6).

Table 6. Association of Maternal Risk Factors with Pregnancy Outcomes

Outcome	Odds Ratio	p-value
Caesarean section	2.40	0.004
Neonatal morbidity	3.17	0.012
Neonatal mortality	Significant	0.049
NICU admission	2.84	<0.001
Respiratory distress syndrome	4.54	<0.001

Socioeconomic status was significantly associated with maternal anaemia ($p=0.023$) and the presence of maternal risk factors ($p=0.041$). Lower socioeconomic groups demonstrated a higher prevalence of anaemia and pregnancy-related risk factors. Pregnancy-induced hypertension was significantly associated with caesarean section ($p=0.010$), NICU admission ($p=0.007$), and respiratory distress syndrome ($p=0.009$). Similarly, fetal growth restriction was significantly associated with increased neonatal morbidity ($p=0.012$) and respiratory distress syndrome ($p=0.023$).

DISCUSSION

The present prospective observational study was conducted to determine the incidence, risk factors, and neonatal outcomes of preterm labour and delivery in a tertiary care centre in North-East India.

The incidence of preterm delivery in the present study was 21.2%, while the incidence of preterm labour was 12.5%. These findings are comparable to those reported by Uma et al. and Begum et al., who documented incidence rates of approximately 23%.[9,11] The relatively high incidence observed in our study may be attributed to the tertiary referral nature of the institution, where complicated pregnancies are frequently managed.

The mean maternal age was 27.58 ±6.4 years, with the highest proportion of preterm deliveries occurring among women aged 25–29 years. Most participants belonged to the lower socioeconomic class and had primary-level education. Similar observations have been reported by Begum et al., who found that lower socioeconomic status and poor educational attainment were associated with preterm birth.[11] More than half of the women in our study were unbooked, indicating inadequate antenatal care utilization, which may contribute to adverse pregnancy outcomes.

Primigravidae constituted the largest proportion of preterm deliveries (37.0%). Although some studies have reported an increased risk of prematurity with higher parity, our findings suggest a greater burden among women with lower parity.[12,13] A significant negative correlation between parity and maternal haemoglobin was also observed, indicating that increasing parity may adversely affect maternal nutritional status.

The mean gestational age at delivery was 33.55 ±2.3 weeks, and most preterm births occurred between 32 and 36 weeks of gestation. Increasing gestational age was significantly associated with higher APGAR scores and lower neonatal morbidity, mortality, respiratory distress syndrome (RDS), and NICU admission rates. Similar positive correlations between gestational age and neonatal outcomes have been reported by Demmouche et al.[14]

Anaemia was the most common risk factor identified in the present study, affecting 38.6% of women. Arafa et al. also reported maternal haemoglobin as an important predictor of prematurity.[15] Multifetal gestation was the second most common risk factor, followed by oligohydramnios, eclampsia, PPROM, and fetal distress. Nearly one-fifth of cases were idiopathic, highlighting the multifactorial nature of preterm labour.

The caesarean section rate among preterm deliveries was significantly higher than among term deliveries (47.9% vs. 31.8%). This finding is likely related to the higher prevalence of maternal and fetal complications requiring operative delivery in preterm pregnancies. The mean birth weight of preterm neonates was 2.17 ±0.58 kg, and more than half were low birth weight. Neonatal morbidity was observed in 19.5% of live births, while neonatal mortality was 7.1%. Respiratory distress syndrome was the leading cause of both morbidity and mortality. Similar findings have been reported in previous studies of preterm neonates, where respiratory complications accounted for the majority of adverse outcomes.[16,17]

Maternal risk factors were significantly associated with adverse neonatal outcomes. Women with identifiable risk factors had significantly higher rates of caesarean delivery, neonatal morbidity, NICU admission, and respiratory distress syndrome. Pregnancy-induced hypertension was significantly associated with caesarean section, NICU admission, and respiratory distress syndrome, while fetal growth restriction was associated with increased neonatal morbidity and respiratory complications.

The present study demonstrates a substantial burden of preterm birth in the study population. Anaemia, multifetal gestation, hypertensive disorders, and other maternal complications were important contributors to preterm delivery and adverse neonatal outcomes. Strengthening antenatal care services, early identification of high-risk pregnancies, and timely neonatal interventions may help reduce the burden of prematurity and improve perinatal outcomes in this region.

CONCLUSION

Preterm birth remains a significant contributor to neonatal morbidity and mortality in the study population. The incidence of preterm delivery in the present study was 21.2%, highlighting the substantial burden of prematurity in this tertiary care setting. Anaemia was the most common maternal risk factor, followed by multifetal gestation, oligohydramnios, hypertensive disorders, and PPROM. Most preterm births occurred in the late preterm period. Neonatal outcomes were strongly influenced by gestational age. Increasing gestational age was associated with improved APGAR scores and reduced neonatal morbidity, mortality, respiratory distress syndrome, and NICU admissions. Respiratory distress syndrome emerged as the leading cause of both neonatal morbidity and mortality. Maternal risk factors were significantly associated with adverse neonatal outcomes, including increased rates of caesarean delivery, neonatal morbidity, NICU admission, and respiratory complications. Strengthening antenatal care services, improving maternal nutrition, early identification of high-risk pregnancies, and timely obstetric and neonatal interventions may help reduce the burden of preterm birth and improve perinatal outcomes in this region.

Implications for Practice

The findings of the present study emphasize the importance of strengthening antenatal, natal, and postnatal care services for the prevention and management of preterm birth. Early identification of maternal risk factors, timely referral, and adherence to recommended evidence-based interventions may improve neonatal outcomes. Community-level initiatives aimed at increasing antenatal care utilization and maternal awareness, particularly among lower socioeconomic groups, may help reduce the incidence of preterm birth in the region.

DECLARATIONS

Ethical Approval: The study was approved by the Institutional Ethics Committee, NEIGRIHMS, Shillong. Written informed consent was obtained from all participants.

Consent to Participate: Written informed consent was obtained from all study participants prior to enrolment.

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Conflict of Interest: The authors declare no conflict of interest.

Authors' Contributions: All authors contributed to study conception, data collection, analysis, manuscript preparation, and approval of the final manuscript.

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Data Availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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