

Original Research Article

Maternal risk factors associated with preterm births in a tertiary care hospital

Rengashree V.*, Chidambaranathan S., Rajaselvan R., Kavipriya G.

Department of Paediatrics, Government Medical College and Hospital, Cuddalore District, Chidambaram, Tamil Nadu, India

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*Correspondence:

Dr. Rengashree V.,

E-mail: rengashree97@gmail.com

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ABSTRACT

Background: Preterm birth remains an important contributor to neonatal morbidity and mortality, particularly in tertiary care settings. Maternal medical and obstetric conditions play a major role in the occurrence of preterm delivery. This study was conducted to assess maternal risk factors associated with preterm births among preterm neonates admitted to a tertiary care neonatal unit.

Methods: This hospital-based observational study was conducted in the Neonatal Unit of Government Medical College and Hospital, Cuddalore (dt), Tamil Nadu, over a period of 12 months. Neonates delivered before 37 completed weeks of gestation were included. Data regarding gestational age, sex, maternal medical conditions and neonatal outcome were collected using a pretested proforma and analysed using descriptive statistics.

Results: A total of 156 preterm neonates were included during the study period. Late preterm (51.9%) neonates was common in this of the total study population. The most common maternal risk factors were hypothyroidism (21.8%), pregnancy-induced hypertension (20.5%), maternal anaemia (14.1%), pre-eclampsia (10.3%), and gestational diabetes/diabetes complicating pregnancy (10.3%). Among mothers with documented risk factors, 50.6% had one risk factor, 27.5% had two risk factors, 6.4% had three or more risk factors and 15.3% had no risk factors.

Conclusions: Maternal risk factors were commonly observed among preterm births, with thyroid dysfunction, hypertensive disorders, anaemia, and diabetes being important contributors. Strengthened antenatal screening, early risk identification, and timely referral may help reduce preterm birth-related morbidity.

Keywords: Preterm birth, Maternal risk factors, Hypothyroidism, Pregnancy-induced hypertension, Neonatal outcome

INTRODUCTION

Preterm birth, defined as birth occurring before 37 completed weeks of gestation, remains one of the major challenges in maternal and neonatal health.¹ It contributes substantially to neonatal morbidity, mortality, prolonged hospitalization, and long-term developmental impairment.² Although advances in obstetric care, neonatal resuscitation, antenatal corticosteroid use, surfactant therapy, and neonatal intensive care have improved survival, preterm neonates continue to remain biologically vulnerable because of immature respiratory,

metabolic, neurological, gastrointestinal, and immune systems.³ The burden is particularly important in low- and middle-income settings, where delayed antenatal identification of high-risk pregnancies and limited access to specialized neonatal care may worsen outcomes.⁴

Preterm birth is not a single disease entity but a multifactorial obstetric syndrome resulting from the interaction of maternal, fetal, placental, infectious, metabolic, and environmental factors.⁵ It may occur spontaneously following preterm labour or preterm premature rupture of membranes, or it may be medically

indicated due to maternal or fetal complications.⁶ Maternal disorders such as hypertensive disorders of pregnancy, anaemia, diabetes complicating pregnancy, thyroid disorders, urinary tract infection, antepartum haemorrhage, abnormal amniotic fluid volume, and obstetric complications have all been recognized as important contributors to early delivery.⁷ Identification of these risk factors is essential because several of them are potentially modifiable through timely antenatal screening, risk stratification, referral, and appropriate obstetric intervention.⁸

The clinical importance of maternal risk factors lies not only in their individual association with preterm birth but also in their cumulative effect.⁹ In routine clinical practice, pregnant women often present with more than one risk factor, such as anaemia with hypothyroidism, hypertensive disorders with fetal growth restriction, or diabetes with abnormal liquor volume.¹⁰ The coexistence of multiple maternal risk factors may reflect a higher-risk pregnancy profile and may influence the gestational age at delivery, neonatal birth weight, need for resuscitation, neonatal intensive care admission, and clinical outcome. Therefore, assessing the number of maternal risk factors in addition to identifying individual risk factors provides a more comprehensive understanding of the maternal background contributing to preterm births.¹¹

The classification of preterm neonates into extreme preterm, early preterm, moderate preterm, and late preterm categories is clinically relevant because morbidity and mortality vary considerably across gestational age groups.¹² Extreme and early preterm neonates are more likely to require advanced respiratory support, prolonged neonatal intensive care, and intensive supportive treatment, whereas late preterm neonates, despite being relatively mature, also remain at increased risk of respiratory distress, feeding difficulty, jaundice, sepsis, hypoglycaemia, and readmission^[13]. Studying maternal risk factors across gestational age categories may help identify whether certain maternal conditions are more frequently associated with earlier or later preterm delivery.¹⁴

In India, preterm birth continues to be an important public health concern because of the dual burden of maternal health problems and neonatal care challenges. Conditions such as maternal anaemia, hypertensive disorders of pregnancy, thyroid dysfunction, diabetes complicating pregnancy, infection, antepartum haemorrhage, and inadequate antenatal care remain commonly encountered in clinical settings.¹⁵ A tertiary care neonatal unit receives a wide spectrum of preterm neonates, including those born to mothers with multiple antenatal and obstetric complications. Hospital-based studies from such settings are useful for understanding the local pattern of maternal risk factors and for guiding preventive strategies within antenatal and perinatal care services.¹⁶

The present study was conducted to assess the maternal risk factors associated with preterm births among inborn preterm neonates admitted to a tertiary care neonatal unit. The study specifically describes the distribution of individual maternal risk factors and evaluates the maternal risk-factor burden according to gestational age category. By identifying both the common maternal risk factors and the pattern of single versus multiple risk-factor burden, the study aims to provide clinically useful evidence for strengthening antenatal screening, early risk identification, referral planning, and preventive obstetric care to reduce the burden of preterm births and improve neonatal outcomes.

Aim

Aim was to assess the maternal risk factors associated with preterm births among delivered at a tertiary care neonatal unit.

Objectives

Objectives were to assess the association between maternal risk-factor burden and gestational age category of preterm neonates, to describe the distribution of maternal risk factors among mothers who delivered preterm neonates and outcome of preterm neonates with respect to maternal risk factors.

METHODS

Study design and setting

This study was conducted as a hospital-based observational study in the Neonatal Unit of Government Medical College and Hospital, Cuddalore(dt), Tamil Nadu.

Study population

The study population comprised inborn preterm neonates delivered at less than 37 completed weeks of gestation were included during the study period. The study focused on neonates born preterm and their corresponding maternal clinical and obstetric risk factors.

Study duration

The study was conducted over a period of 12 months.

Inclusion and exclusion criteria

All inborn neonates delivered before 37 completed weeks of gestation, admitted to the neonatal unit during the study period, and whose caregivers provided written informed consent were included in the study. Neonates delivered at 37 or more completed weeks of gestation, outborn neonates, neonates with major congenital malformations, cases of intrauterine death, and neonates

whose caregivers declined consent were excluded from the study.

Study procedure

After obtaining written informed consent from caregivers, data were collected using a pretested semi-structured proforma. Maternal risk factors and clinical outcome were documented.

Gestational age was assessed as per modified Ballard's scoring and categorised as per gestational age category. Preterm birth was defined as birth occurring before 37 completed weeks of gestation. Extreme preterm was defined as birth before 28 completed weeks of gestation. Early preterm was defined as birth from 28 weeks to 31 weeks +six days. Moderate preterm was defined as birth from 32 weeks to 33 weeks +six days. Late preterm was defined as birth from 34 weeks to 36 weeks + six days. All enrolled neonates were monitored during their stay.

Maternal risk factors included any documented maternal medical, obstetric/pregnancy-related condition associated with the index pregnancy. Maternal risk-factor burden was defined as the number of documented risk factors present in the mother and was categorized as one risk factor, two risk factors, and three or more risk factors. Clinical outcome was categorized as discharged and expired. Ethical clearance was obtained from the institutional ethics committee of Government Medical College and Hospital, cuddalore(dt), before initiation of the study.

RESULTS

A total of 156 neonates as per inclusion criteria were included, classification of preterm neonates was made as shown below in Table 1.

Table 1: Distribution of preterm neonates according to gestational age category and sex.

Gestational age (in weeks)	Female	Male	Total, N (%)
Extreme preterm	3	2	5 (3.2)
Early preterm	18	19	37 (23.7)
Moderate preterm	16	17	33 (21.2)
Late preterm	35	46	81 (51.9)
Total	72	84	156 (100)

A total of 156 neonates were included during study period, of which late preterm neonates constituted the largest proportion (51.9%).

Risk factors

Neonates with risk factors were observed in the study as shown below Table 2.

Table 2: Distribution of maternal risk factors among preterm births.

Maternal risk factors	N	Percentages (%)
Hypothyroidism	34	21.8
Pregnancy-induced hypertension	32	20.5
Maternal anaemia	22	14.1
Pre-eclampsia	16	10.3
GDM or diabetes complicating pregnancy	16	10.3
Teenage primi	13	8.3
Oligohydramnios	13	8.3
Rh negative pregnancy	12	7.7
Underweight	11	7.1
Antepartum haemorrhage	7	4.5
Urinary tract infection	5	3.2
Obese	4	2.6
Eclampsia	4	2.6
Previous LSCS	4	2.6
Polyhydramnios	3	1.9
Vulvovaginitis	3	1.9
Overweight	3	1.9
Hyperthyroidism	2	1.3
Elderly primi	1	0.6
Clinical chorioamnionitis	1	0.6
HIV	1	0.6

Hypothyroidism was the most common maternal risk factor observed among preterm births, present in 21.8% of cases, followed by other risk factors.

Other common risk factors included pre-eclampsia, gestational diabetes/diabetes complicating pregnancy, teenage primi, oligohydramnios, and Rh-negative pregnancy. Since more than one risk factor could be present in same mother, the percentages do not add up to 100%.

Risk factor burden

Association between number of maternal risk factors and preterm delivery is shown in Table 3.

This indicates that, among preterm births, mothers with one documented risk factor were more commonly observed than those with multiple risk factors. However, mother with ≥ 3 risk factors had a relatively higher proportion of preterm births, suggesting that multiple maternal risk factors increase incidence of premature deliveries.

Outcome

Association between number of maternal risk factors as well as the neonatal outcome is shown in the Table 4 below.

Table 3: Association between maternal risk-factor burden and gestational age category of preterm neonates.

Maternal risk-factor burden	Extreme preterm	Early preterm	Moderate preterm	Late preterm	Total, N (%)
Mother with no risk factor	1	7	8	8	24 (15.3)
Mother with 1 risk factor	3	14	13	49	79 (50.6)
Mother with 2 risk factors	1	14	11	17	43 (27.5)
Mother with ≥ 3 risk factors	0	2	1	7	10 (6.4)
Total	5	37	33	81	156 (100)

Table 4: Association between maternal risk-factor burden and neonatal clinical outcome.

Maternal risk-factor burden	Discharged	Expired	Total, N (%)
Mother with no risk factor	23	1	24 (15.3)
Mother with 1 risk factor	77	2	79 (50.6)
Mother with 2 risk factors	40	3	43 (27.5)
Mother with ≥ 3 risk factors	8	2	10 (6.4)
Total	148	8	132 (100.0)

Neonatal mortality increased with increasing maternal risk factor burden with the highest mortality observed among mothers with ≥ 3 risk factors, suggesting that neonatal mortality increased with more number of maternal risk factors.

DISCUSSION

In the current study, late preterm neonates constituted the largest proportion of preterm births, accounting for 51.9% of cases, followed by early preterm neonates at 23.7%, moderate preterm neonates at 21.2%, and extreme preterm neonates at 3.2%. Male neonates were slightly more common than female neonates. This finding is comparable with Choudhury et al who reported that late preterm neonates formed the majority of their cohort, accounting for 60.14% of preterm births, with a male predominance of 64.49%.¹¹ Similarly, Vuppu and Iragamreddy studied late preterm neonates admitted to a tertiary care NICU and emphasized that this group forms a clinically important and vulnerable segment of preterm births.¹⁰ In contrast, Vasavi et al reported that early preterm neonates formed a larger proportion than late preterm neonates in their SNCU-based study, which may be due to differences in referral pattern, admission policy, and inclusion of more severely ill preterm neonates.¹² Overall, the findings of the present study support the observation that late preterm neonates constitute a major proportion of preterm admissions, although the distribution may vary according to healthcare setting and referral characteristics.

Hypothyroidism was the most common maternal risk factor among preterm births, observed in 21.8% of cases, followed by pregnancy-induced hypertension in 20.5% and maternal anaemia in 14.1%. Other important risk factors included pre-eclampsia, gestational diabetes or diabetes complicating pregnancy, teenage primi, oligohydramnios, Rh negative pregnancy, antepartum

haemorrhage, urinary tract infection, eclampsia, previous LSCS, polyhydramnios, vulvovaginitis, hyperthyroidism, obesity, elderly primi, clinical chorioamnionitis, and HIV. The pattern of risk factors in the present study is broadly consistent with Acharya and Poudel, who reported anaemia, teenage pregnancy, antepartum haemorrhage, urinary tract infection, and pregnancy-induced hypertension as important maternal risk factors associated with preterm birth.¹⁶ Mohapatra et al similarly observed that premature rupture of membranes, anaemia, intrauterine growth restriction, preeclampsia, and eclampsia were common adverse pregnancy conditions among preterm births.¹⁴ Choudhury et al reported bad obstetric history, PROM/PPROM, multiple gestation, abnormal liquor volume, IVF conception, and pre-eclampsia/eclampsia as prominent maternal risk factors in their preterm cohort.¹¹ Compared with these studies, the present study showed a higher representation of thyroid disorders, particularly hypothyroidism, which may reflect local antenatal screening patterns, regional disease burden, or improved detection of thyroid dysfunction during pregnancy.

Among mothers with documented risk factors, 59.8% had one risk factor, 32.6% had two risk factors, and 7.6% had three or more risk factors. Late preterm birth was the most common gestational age category across all risk-factor burden groups. These findings indicate that even a single documented maternal risk factor may be frequently associated with preterm delivery, while a smaller proportion of mothers had multiple coexisting risk factors. This observation is supported by Fernandes et al., who emphasized that preterm labour is associated with several sociodemographic, obstetric, and clinical factors, suggesting that risk may accumulate across different maternal domains.¹³ Acharya and Poudel also reported multiple maternal risk factors among preterm neonates, including inadequate antenatal visits, primi gravidity, PPRM, urinary tract infection, anaemia, teenage

pregnancy, antepartum haemorrhage, and pregnancy-induced hypertension.¹⁶ Choudhury et al similarly documented several overlapping maternal risk factors, including bad obstetric history, PROM/PPROM, multiple gestation, abnormal liquor volume, IVF conception, and pre-eclampsia/eclampsia.¹¹ Mitrogiannis et al in an umbrella review, further reinforced that preterm birth is a complex multifactorial syndrome, where multiple maternal and obstetric exposures may contribute to early delivery.⁹ Thus, the present finding on risk-factor burden adds clinical value by showing that maternal risk assessment should not stop with identifying individual risk factors, but should also consider the cumulative number of risk factors present in the same pregnancy.

Most neonates born to mothers with documented risk factors were discharged after treatment. Among mothers with no risk factor, 23 were discharged and 1 expired. Among mothers with one risk factor, 77 neonates were discharged and 2 were expired. Among mothers with two risk factors, 40 neonates were discharged and 3 were expired. 2 mortality was observed among neonates born to mothers with three or more risk factors, suggesting that higher maternal risk-factor burden may be associated with poorer neonatal outcome; however, this finding should be interpreted cautiously due to the small number of cases in this subgroup. Choudhury et al reported an overall mortality rate of 4.34% among preterm neonates, with higher mortality among neonates born before 32 weeks of gestation, emphasizing the influence of gestational maturity on outcome.¹¹ Vasavi et al observed that mortality was significantly higher among out born neonates compared with inborn neonates, and respiratory distress syndrome and sepsis were major causes of death.¹² Mohapatra et al reported neonatal death in 9.21% of preterm infants, with birth asphyxia being the most common cause, and also observed that preeclampsia, intrauterine growth restriction, and caesarean section were more frequent among medically indicated preterm births.¹⁴ Acharya and Poudel found that mortality was higher among extremely to very preterm neonates than among moderate to late preterm neonates, with neonatal sepsis, hyaline membrane disease, and birth asphyxia as leading causes of death.¹⁶ Compared with these studies, the present study showed a favourable overall discharge pattern, but the occurrence of mortality among mothers with three or more risk factors highlights the need for close antenatal surveillance and early neonatal preparedness when multiple maternal risk factors coexist.

Limitations

Multicentric studies need to be done to find out maternal risk factors and outcome of preterm delivery.

CONCLUSION

The present study found that preterm births were associated with a wide range of maternal risk factors, with hypothyroidism, pregnancy-induced hypertension,

maternal anaemia, pre-eclampsia, and gestational diabetes/diabetes complicating pregnancy being the most commonly observed conditions. Late preterm neonates constituted the largest proportion of preterm births, and mothers with one documented risk factor formed the largest risk-factor burden group, followed by those with two risk factors and three or more risk factors. The findings indicate that maternal medical and obstetric complications continue to play an important role in preterm deliveries and should be actively identified during antenatal care.

Strengthening antenatal screening and risk stratification is essential to reduce the burden of preterm births. Pregnant women should be routinely evaluated for thyroid disorders, hypertensive disorders, anaemia, diabetes, urinary tract infection, abnormal liquor volume, and antepartum haemorrhage. Mothers with multiple risk factors require closer follow-up, timely referral, planned delivery in facilities with neonatal intensive care support, and coordinated obstetric–neonatal preparedness. Early identification and appropriate management of maternal risk factors may help reduce preterm birth-related morbidity and improve neonatal outcomes.

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