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Original Research Article

CORRELATION BETWEEN MATERNAL RISK FACTORS AND NEONATAL HYPERBILIRUBINEMIA

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ABSTRACT

Background: Neonatal hyperbilirubinemia is a common condition that may progress to serious complications if not identified early. Maternal factors, such as anaemia, thyroid disorders, and obstetric complications, can affect bilirubin levels in newborns. This study aimed to assess the correlation between maternal risk factors and neonatal hyperbilirubinemia. **Materials and Methods:** This cross-sectional study included 233 neonates (<15 days) admitted to a tertiary care NICU with elevated indirect bilirubin levels. The maternal variables recorded were age, parity, BMI, weight, height, and antenatal conditions, including anaemia, hypothyroidism, PIH, GDM, previous LSCS, blood group incompatibility, PROM, CPD, oligohydramnios, and foetal distress. The neonatal variables included gestational age, birth weight, gender, mode of delivery, and blood group. Data were analysed using descriptive statistics and expressed as frequencies and percentages. **Result:** Most mothers were aged 30–34 years (45%), multiparous (55%), and had a normal BMI (46%). Anaemia was the most frequent maternal risk factor (18%), followed by previous LSCS (15.87%), blood group incompatibility (7.72%), hypothyroidism (7.3%), and CPD (9.44%). Additional factors included PIH (5.15%), foetal distress (5.58%), GDM (3.43%), PROM (3.43%), and oligohydramnios (3.43%). Among the neonates, 142 (61%) were male, 131 (56%) were preterm, and 154 (66%) had low birth weight. A majority were delivered by LSCS (82%). The most common blood group was B+ (62%). **Conclusion:** Maternal factors, particularly anaemia, prior LSCS, CPD, hypothyroidism, and blood group incompatibility, were frequently associated with neonatal hyperbilirubinemia. Early identification of at-risk mothers may improve neonatal outcomes.

INTRODUCTION

Jaundice in newborns, marked by yellow colouration of the sclera and mucous membranes, occurs when unconjugated bilirubin levels rise, potentially leading to serious consequences such as kernicterus, hearing impairment, and cerebral palsy.[1] While physiological neonatal hyperbilirubinemia is expected and transient in many infants, the presence of specific maternal and neonatal risk factors can shift the condition from benign to pathological.[2]

Physiological jaundice typically appears in full-term infants around 24 hours after birth, peaks between 48 to 96 hours (2 to 3 days), and usually resolves by 2 to 3 weeks of age, but any deviation from that pattern or evidence of neurotoxicity marks pathological hyperbilirubinemia.[3] Multiple neonatal risk factors for hyperbilirubinemia, such as low birth weight, prematurity, male sex, and specific blood groups are well established.[4] Maternal factors are less clearly defined but remain important, with studies indicating roles for maternal–fetal blood group incompatibility, labour-related factors, and maternal conditions such as hypertension and diabetes.[5]

Maternal risk profiles, including maternal age, parity, weight, body mass index (BMI), anaemia, hypothyroidism, and pregnancy-induced hypertension, may indirectly affect neonatal bilirubin metabolism through their effects on foetal growth, liver maturity, feeding initiation, and haemolysis.[6]

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For example, maternal anaemia has been linked to low birth weight, which is a strong predictor of neonatal jaundice. Caesarean delivery, another significant maternal-obstetric factor, has also been associated with higher neonatal jaundice risk, possibly via delayed feeding, gut motility changes and altered colonisation of gut flora in the neonate.[7,8,9]

Despite the recognised neonatal factors, the specific correlation between detailed maternal risk factors, such as maternal height, weight, BMI, previous surgical history (e.g. LSCS), maternal thyroid status, and the onset of neonatal hyperbilirubinemia remains unexplored. A better understanding of this area may help identify high-risk neonates earlier and guide interventions, such as optimised feeding practices or monitoring in rural setups.

In view of the significant burden of neonatal hyperbilirubinemia, particularly in low-resource and rural settings where feeding practices may be suboptimal and breast milk availability is limited. The establishment of breast milk banks and improved maternal-neonatal care could mitigate the impact of these risks.[10] Therefore, this study aimed to assess the relationship between maternal risk factors and the development of hyperbilirubinemia in neonates.

MATERIALS AND METHODS

This cross-sectional study included 233 neonates with elevated indirect bilirubin levels in the Neonatal Intensive Care Unit of a tertiary care hospital. Ethical approval was obtained from the Institutional Ethics Committee, and informed consent was obtained from all participating mothers before data collection.

Inclusion Criteria

Neonates younger than 15 days of age, both term and preterm, who presented with increased indirect bilirubin levels. Mothers with complete information on maternal factors related to hyperbilirubinemia were included.

Exclusion Criteria

Newborns with congenital anomalies, neonates older than 28 days, and those with incomplete maternal or neonatal data, healthy newborns without hyperbilirubinemia and those whose mothers did not provide consent were excluded.

Methods: Data were collected using a structured form designed to gather maternal and neonatal variables. Maternal data included age, parity, number of pregnancies, weight during pregnancy, height, BMI. Information regarding maternal complications, such as anaemia, hypothyroidism, pregnancy-induced hypertension, gestational diabetes, blood group incompatibility, oligohydramnios, PROM, previous caesarean section, CPD, and other antenatal conditions, was recorded. Neonatal variables included birth weight, gestational age, gender, blood group, and mode of delivery. All neonates admitted with hyperbilirubinemia were monitored and routine clinical assessment in the neonatal intensive care unit and managed according to the standard care protocols.

Phototherapy was provided as required, and the bilirubin levels were monitored until discharge. This study did not involve any interventions beyond standard medical care. The purpose of data collection was to identify patterns and associations between maternal characteristics and the occurrence of jaundice in neonates.

Statistical Analysis: All data were entered into Microsoft Excel for processing and analysed using descriptive statistics. All data were summarised as frequencies and percentages.

RESULTS

Most were aged 30–34 years 106 (45%) and multiparous 127 (55%). Normal BMI was most common 106 (46%), followed by overweight 63 (27%) and obese 40 (17%). The highest maternal weight group was 51–55 kg 54 (23%). Most mothers had a height of 151–155 cm 70 (30%) or 156–160 cm 69 (30%). [Table 1]

Table 1: Maternal demographic and anthropometric characteristics

Maternal variable	Category	n (%)
Maternal age (years)	18–24	13 (6%)
	25–29	62 (27%)
	30–34	106 (45%)
	35–39	52 (22%)
Parity	Primi	106 (45%)
	Multipara	127 (55%)
BMI	<18.5	24 (10%)
	18.5–24.9	106 (46%)
	25–29.9	63 (27%)
	>30	40 (17%)
Maternal weight (kg)	41–45	48 (21%)
	46–50	40 (17%)
	51–55	54 (23%)
	56–60	40 (17%)
	61–65	22 (9%)
	66–70	14 (6%)
	71–75	6 (3%)
	76–80	6 (3%)

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	81–85	3 (1%)
Maternal height (cm)	141–145	22 (9%)
	146–150	51 (22%)
	151–155	70 (30%)
	156–160	69 (30%)
	161–165	14 (6%)
	166–170	7 (3%)

Anaemia was the most common maternal risk factor 42 (18.03%), followed by previous LSCS 37 (15.87%), blood group incompatibility 18 (7.72%), hypothyroidism 17 (7.3%), and CPD 22 (9.44%). Other noted factors included fetal distress 13 (5.58%), PIH 12 (5.15%), GDM 8 (3.43%), PROM 8 (3.43%), oligohydramnios 8 (3.43%), and meconium-stained liquor 4 (1.72%), whereas several conditions occurred rarely (<1%). A total of 29 (12.45%) mothers had no risk factors. [Table 2]

Table 2: Distribution of maternal risk factors

Maternal risk factors	n (%)
Anaemia	42 (18.03%)
Antenatal hypoxia	2 (0.86%)
CPD	22 (9.44%)
GDM	8 (3.43%)
Hypothyroidism	17 (7.3%)
Induction failure	2 (0.86%)
Meconium-stained liquor	4 (1.72%)
PIH	12 (5.15%)
Postdated pregnancy	1 (0.43%)
PROM	8 (3.43%)
Rh incompatibility	2 (0.86%)
Abruptio placenta	1 (0.43%)
Fetal distress	13 (5.58%)
No risk factors	29 (12.45%)
Non-progressive labour	1 (0.43%)
Non-reactive CTG	2 (0.86%)
Oligohydramnios	8 (3.43%)
Placenta previa	1 (0.43%)
Previous LSCS	37 (15.87%)
Previous stillbirth	1 (0.43%)
Scar tenderness	2 (0.86%)
Blood group incompatibility	18 (7.72%)

Most of the neonates were male 142 (61%). Over half were born preterm (<37 weeks) 131 (56%), while 88 (38%) were term. Low birth weight (<2.5 kg) was common 154 (66%). The majority of them were delivered by LSCS 190 (82%). The most frequent blood group was B+ 145 (62%), followed by A+ 48 (21%). [Table 3]

Table 3: Distribution of neonatal characteristics

Neonatal variable	Category	n (%)
Gender	Male	142 (61%)
	Female	91 (39%)
Gestational age (weeks)	<37	131 (56%)
	37–42	88 (38%)
	>42	14 (6%)
Birth weight (kg)	<2.5	154 (66%)
	2.5–3.5	15 (6%)
	>3.5	64 (28%)
Mode of delivery	NVD	43 (18%)
	LSCS	190 (82%)
Blood group	A+	48 (21%)
	B+	145 (62%)
	AB+	20 (9%)
	O+	16 (7%)
	B–	3 (1%)

DISCUSSION

This study aimed to assess the association between maternal risk factors and neonatal hyperbilirubinemia. The findings showed that maternal anaemia, previous LSCS, blood group incompatibility, hypothyroidism, and CPD were the most frequent contributors. Most affected neonates were male, preterm, had low birth weight, and were delivered by caesarean section. This highlight that both maternal conditions and obstetric factors are increasing the risk of neonatal jaundice.

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In our study, most mothers were in their early thirties, with fewer in the younger age groups. Over half of the women had previous pregnancies. Many had a normal BMI, whereas some were overweight or obese. Overall, their weight and height mostly fell within the average adult ranges, indicating generally normal or slightly high BMI profiles. Similarly, He et al. reported a comparable age distribution, with most mothers between 30–34 years (39.82%) and 25–29 years (35.05%). 71.29% of mothers had a normal BMI, 16.61% were overweight, 1.98% were obese, and that maternal height commonly ranged from 155–164 cm (69.05%).[11] In contrast, Ayalew et al. observed that the majority of mothers were 25–35 years old (56.2%), with equal proportions aged <25 years and >35 years (21.9% each) among cases.[12] Bizuneh et al. reported that most mothers in both case and control groups were 20–35 years old (85.2% in jaundiced cases), with smaller proportions younger than 20 years (9.4%) or older than 35 years (5.4%).[13] Our findings align with earlier studies, showing that mothers were mainly in their thirties with a generally normal BMI.

In our study, anaemia emerged as the most common maternal risk factor, followed by a history of caesarean delivery and blood group incompatibility. Other notable conditions included cephalopelvic disproportion, hypothyroidism, pregnancy-induced hypertension, foetal distress, and premature rupture of the membranes. Less frequent complications included gestational diabetes, reduced amniotic fluid, meconium-stained liquor, antenatal hypoxia, and placental abnormalities. Overall, most mothers experienced at least one obstetric or medical condition that contributed to neonatal vulnerability. This is similar to Sonawane et al. who reported maternal comorbidities among mothers of hyperbilirubinemic neonates, including hypothyroidism (13.3%), preeclampsia (7.6%), diabetes mellitus (5.7%), polyhydramnios (1.9%), PROM (0.95%), along with ABO incompatibility (21.8%) and Rh incompatibility (2.8%).[14]

He et al. identified several maternal and obstetric factors associated with adverse neonatal outcomes, such as gestational hypertension (8.57%), preeclampsia (5.93%), PROM (22.64%), scarred uterus (30.77%), placenta previa (4.84%), foetal distress (15.82%), and a high caesarean section rate (74.51%).[11] In addition, Yu et al. found higher caesarean section rates in the jaundice group (49.5% vs. 38.1%, $p < 0.001$), increased multiple gestation, and shorter ANC duration.[15] Bizuneh et al. identified key maternal and obstetric risk factors for neonatal jaundice, including primiparity (67.1%), previous neonatal jaundice (14.1%), inadequate ANC visits, obstetric complications (37.6%), and PROM (35.6%), as well as associated conditions such as hypertension, anaemia, antepartum haemorrhage, multiple pregnancy, obstructed labour, and gestational diabetes, with similar Rh status distribution across groups.[13] The predominance of anaemia, prior caesarean section, and blood group incompatibility in our study aligns with identifying these factors as contributors to neonatal hyperbilirubinemia.

In our study, most of the affected neonates were male, preterm, and had low birth weights. Caesarean section was the predominant mode of delivery, and the most common blood groups were B and A. The neonatal profile was characterised by preterm, low-birth-weight infants, mostly delivered by LSCS. Ayalew et al. reported that male neonates (82.8%), and observed low birth weight (51.6%) and preterm births (46.9%); however, their deliveries were predominantly vaginal (78.1%).[12] Also, Steve et al. found low birth weight in 34.8% of neonates, preterm birth in 37.1%, and hyperbilirubinemia in 50.6%, with strong associations between hyperbilirubinemia and both low birth weight (OR 2.34) and preterm birth (OR 2.55).[16] Sonawane et al. noted that 19% of neonates developed hyperbilirubinemia, with male predominance (58/95), and reported LSCS in 70.5% of the affected births. A significant association involving bilirubin levels, delivery mode, gender, maternal comorbidities, and ABO incompatibility.[14] He et al. observed a lower mean gestational age (38.47 ± 0.94 weeks) among infants with adverse outcomes, along with complications such as neonatal asphyxia (2.64%), septicaemia (1.98%), pneumonia (6.37%), HIE (1.54%), and congenital heart disease (7.69%), and reported mild male predominance (50.7%), higher birth weights in non-hyperbilirubemic infants, and a hyperbilirubinemia prevalence of 7.69%.[11] Bizuneh et al. found male predominance (58.4%) among jaundiced neonates and low birth weight in 39.6% and preterm birth in 38.3%. Neonatal complications, including birth asphyxia (28.2%), sepsis (54.4%), hypothermia (38.9%), and hypoglycaemia (18.1%).[13] Neonatal findings of male predominance, prematurity, low birth weight, and higher LSCS rates align with the existing literature, which consistently identifies these factors as predictors of neonatal hyperbilirubinemia.

Limitations

This study was limited by its single-centre design and reliance on self-reported maternal data, which may have introduced recall bias. The cross-sectional nature prevented the assessment of temporal or causal relationships between maternal factors and neonatal hyperbilirubinemia.

CONCLUSION

Maternal factors, particularly anaemia, previous LSCS, blood group incompatibility, hypothyroidism, and CPD, are commonly associated with neonatal hyperbilirubinemia. Most affected neonates were male, preterm, had low birth weight, and were delivered via caesarean section. This highlights the importance of early maternal risk assessment to optimise neonatal monitoring and reduce the burden of jaundice in vulnerable populations. Future research should include multicentre longitudinal

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studies to better establish the causal relationships between maternal factors and neonatal jaundice. Incorporating bilirubin monitoring and maternal biochemical profiling may provide deeper insights into predictive risk models.

REFERENCES

1. Rennie JM, Beer J, Upton M. Learning from claims: hyperbilirubinaemia and kernicterus. Arch Dis Child Fetal Neonatal Ed 2019;104:F202–4. https://doi.org/10.1136/archdischild-2017-314622.
2. Devi DS, Vijaykumar B. Risk factors for neonatal hyperbilirubinemia: a case control study. Int J Reprod Contracept Obstet Gynecol 2016;6:198. https://doi.org/10.18203/2320-1770.ijrcog20164657.
3. Ansong-Assoku B, Adnan M, Daley SF, Ankola PA. Neonatal jaundice. StatPearls Publishing; 2025 Updated 2024. https://www.ncbi.nlm.nih.gov/books/NBK532930/.
4. Boskabadi H, Rakhshanizadeh F, Zakerihamidi M. Evaluation of maternal risk factors in neonatal hyperbilirubinemia. Arch Iran Med. 2020;23:128–140. https://pubmed.ncbi.nlm.nih.gov/32061076/.
5. Isa HM, AlBuainain NY, Bunajem FY, Masood AS, Bucheery YA. Neonatal and maternal risk factors for indirect hyperbilirubinemia: A cross-sectional study from Bahrain. Int J Pediatr 2022;2022:5199423. https://doi.org/10.1155/2022/5199423.
6. Tavakolizadeh R, Izadi A, Seirafi G, Khedmat L, Mojtahedi SY. Maternal risk factors for neonatal jaundice: a hospital-based cross-sectional study in Tehran. Eur J Transl Myol 2018;28:7618. https://doi.org/10.4081/ejtm.2018.7618.
7. Jiang N, Qian L, Lin G, Zhang Y, Hong S, Sun B, et al. Maternal blood parameters and risk of neonatal pathological jaundice: a retrospective study. Sci Rep 2023;13:2627. https://doi.org/10.1038/s41598-023-28254-3.
8. Chen K, Yuan T. The role of microbiota in neonatal hyperbilirubinemia. Am J Transl Res 2020;15:12:7459–74. https://pmc.ncbi.nlm.nih.gov/articles/PMC7724329/.
9. Yacoub V, Carletti V, Maneschi F, Valensise H. Perinatal risk factors for neonatal hyperbilirubinemia in healthy term neonates: a retrospective case-control study. Ital J Gynaecol Obstet 2023;35:26. https://doi.org/10.36129/jog.2022.s25.
10. Flagg J, Busch DW. Utilizing a risk factor approach to identify potential breastfeeding problems. Glob Pediatr Health 2019;6:2333794. https://doi.org/10.1177/2333794X19847923.
11. He J, Song J, Zou Z, Fan X, Tian R, Xu J, et al. Association between neonatal hyperbilirubinemia and hypoglycemia in Chinese women with diabetes in pregnancy and influence factors. Sci Rep 2022;12:16975. https://doi.org/10.1038/s41598-022-21114-6.
12. Ayalew T, Molla A, Kefale B, Alene TD, Abebe GK, Ngusie HS, et al. Factors associated with neonatal jaundice among neonates admitted at referral hospitals in northeast Ethiopia: a facility-based unmatched case-control study. BMC Pregnancy Childbirth 2024;24:150. https://doi.org/10.1186/s12884-024-06352-y.
13. Bizuneh AD, Alemnew B, Getie A, Wondmieneh A, Gedefaw G. Determinants of neonatal jaundice among neonates admitted to five referral hospitals in Amhara region, Northern Ethiopia: an unmatched case-control study. BMJ Paediatr Open 2020;4:e000830. https://doi.org/10.1136/bmjpo-2020-000830.
14. Sonawane VB, Kotrashetti V, Gupta S, Bunde S. Association of maternal factors with hyperbilirubinaemia in newborns at a tertiary care hospital in Navi Mumbai, India: a cross-sectional study. J Clin Diagn Res 2023;17:SC15–SC17. https://doi.org/10.7860/JCDR/2023/64375.18486
15. Yu Y, Choi J, Lee MH, Kim K, Ryu HM, Han HW. Maternal disease factors associated with neonatal jaundice: a case-control study. BMC Pregnancy Childbirth 2022;22:247. https://doi.org/10.1186/s12884-022-04566-6.
16. Steve C, Hidayah D, Nugroho ID, Putra AT. The relationship between infant birth weight, gestational age, and hyperbilirubinemia incidence in neonates. J Matern Child Health 2024;9:753–63. https://doi.org/10.26911/thejmch.2024.09.04.12.

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