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Original Article

Paediatrics Section

Association of Maternal Factors with Hyperbilirubinaemia in Newborns at a Tertiary Care Hospital in Navi Mumbai, India: A Cross-sectional Study

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ABSTRACT

Introduction: Hyperbilirubinaemia in newborns is a common and serious condition, and it is also one of the most common causes of neonatal readmission to the hospital. It is challenging to diagnose or predict the onset of hyperbilirubinaemia in newborns. Therefore, identifying neonates with maternal risk factors is useful for early prediction of hyperbilirubinaemia, enabling effective management and prevention of complications such as acute bilirubin encephalopathy or kernicterus.

Aim: To estimate the prevalence of neonatal hyperbilirubinaemia and its association with various maternal risk factors such as parity, maternal diseases, blood group incompatibility, mode of delivery, etc.

Materials and Methods: This hospital-based descriptive, cross-sectional study was conducted at Dr. D.Y. Patil Hospital in Navi Mumbai, Maharashtra, India, from December 2021 to December 2022. A total of 500 healthy full-term neonates and their mothers were screened. Neonates with hyperbilirubinaemia during follow-up were evaluated. Data on maternal factors (e.g., parity, maternal diseases, polyhydramnios, premature rupture of membranes, ABO and Rh incompatibility) were collected, and their association with neonatal hyperbilirubinaemia was assessed. Statistical analysis of the data was performed using the Chi-square test to determine prevalence and significance.

Results: Out of the 500 babies studied, 95 had serum total bilirubin levels beyond the acceptable normal level of 13 mg/dL at 72 hours of life. The prevalence of hyperbilirubinaemia was 19%. Among the 95 babies, 40 (42.1%) were born to primigravida mothers, while 55 (57.9%) were born to multigravida mothers. In the present study, the authors observed that out of the 26 mothers suffering from hypothyroidism, 14 babies developed hyperbilirubinaemia. Similarly, out of the 24 mothers with preeclampsia, eight babies developed hyperbilirubinaemia. Furthermore, out of the 15 mothers with diabetes mellitus, six babies developed hyperbilirubinaemia. Additionally, out of the 11 mothers with polyhydramnios, two babies developed hyperbilirubinaemia, and out of the 10 mothers with Premature Rupture of Membranes (PROM), one baby developed hyperbilirubinaemia. Among the 208 male neonates, 58 developed hyperbilirubinaemia, while among the 292 female neonates, 37 developed hyperbilirubinaemia. ABO incompatibility was seen in 23 (24.2%) neonates, and Rh incompatibility was seen in 3 (3.2%) neonates, both of which were identified as important risk factors. A higher incidence of hyperbilirubinaemia was observed in neonates born via Lower Segment Caesarean Section (LSCS) compared to normal vaginal delivery.

Conclusion: In the present study, the prevalence of neonatal hyperbilirubinaemia was 19%. Male babies, babies born via LSCS, those with ABO incompatibility, and mothers with hypothyroidism were significantly more prone to develop hyperbilirubinaemia in neonates.

Keywords: Hypothyroidism, Jaundice, Mode of delivery, Neonate, Serum bilirubin

INTRODUCTION

Neonatal Hyperbilirubinaemia is the yellowish discoloration of the skin, conjunctiva, and the sclera from elevated serum or plasma bilirubin in the newborn period. It is a common and serious condition that affects 60% of term and 80% of preterm newborns [1], all over the world, and is also one of the most common causes of neonatal readmission to the hospital [2]. A bilirubin level exceeding 12 mg/dL for the full-term infant suggests more than normal physiology and is considered exaggerated hyperbilirubinaemia [3-6].

Various postulated predisposing factors responsible for the occurrence of this disease are gestational diabetes mellitus, race, lower gestational age, polycythemia, male sex, cephalhaematoma, medications, trisomy 21, weight loss, breastfeeding, delayed passage of meconium, and a family history of jaundice in previous siblings, etc. [7-11]. Furthermore, blood group incompatibility, congenital infections like cytomegalovirus, rubella, toxoplasmosis, syphilis, and maternal age over 25 years are some of the other factors that may contribute to it [12].

However, there are very few studies assessing the association of maternal risk factors with the development of hyperbilirubinaemia in neonates [13]. A study by Chander S and Kumar A found that out of 30 patients, neonatal hyperbilirubinaemia was seen in 60% of cases [14]. Vos GH et al., found similar results, with ABO incompatibility being a major cause of jaundice in almost 58% of infants [15]. Wijaya AB, observed that caesarean section was associated with an increasing risk of neonatal jaundice [16]. Previous studies by various researchers also found similar results, but none of the above mentioned studies were extensive and conducted over a long duration with a large sample size [7-12].

The present study aimed to investigate the association of maternal factors with hyperbilirubinaemia in newborns so that high-risk babies can be followed-up, diagnosed early, and treated in a timely manner to avoid complications. Hence, the present study was conducted to study the prevalence of hyperbilirubinaemia and establish the role of various maternal risk factors previously indicated as being responsible for it, ensuring timely diagnosis and management.

MATERIALS AND METHODS

This hospital-based, descriptive, cross-sectional study was conducted at Dr. D.Y. Patil Hospital, Nerul, Navi Mumbai, Maharashtra, India, over a duration of one year from December 2021 to December 2022. Ethical clearance was obtained before the initiation of the study (IEC Ref no: DYP/IECBH/2021/01).

Inclusion criteria: A total of 500 healthy full-term babies admitted to the Postnatal Care (PNC) ward and their mothers were included.

Exclusion criteria: Preterm neonates, low birth weight babies, post-term babies, and those with major illnesses or admitted to the neonatal intensive care unit were excluded.

Study Procedure

All babies were examined in a naked condition in natural daylight to assess the presence of icterus. A peripheral venous blood sample was drawn at the first significant clinical assessment of icterus [17] or at 72 hours of life, as per the protocol.

Data on serum total bilirubin levels at 72 hours of life for all 500 babies, as well as blood group and maternal factors such as parity, co-morbidities, and mode of delivery, were collected from case paper records and entered into a predesigned proforma after obtaining written informed consent. The prevalence of hyperbilirubinaemia, defined as serum total bilirubin levels >13 mg/dL in neonates [17], along with maternal factors, was noted and analysed.

STATISTICAL ANALYSIS

Data were collected in Excel format, and statistical analysis of all the data was performed using the Chi-square test. A p-value less than 0.05 was considered as the level of significance.

RESULTS

All 95 babies with hyperbilirubinaemia were admitted and discharged after treatment, and there were no mortalities in the present study. Out of the 500 babies studied, 95 had serum total bilirubin levels beyond the acceptable normal range (13 mg/dL at 72 hours of life). Therefore, the prevalence of hyperbilirubinaemia in the present study was 19%. Among the 95 babies with hyperbilirubinaemia, 40 (42.1%) were born to primigravida mothers, while 45 (47.3%) were born to multigravida mothers. Among the mothers of the 95 neonatal hyperbilirubinaemia cases, 14 (13.3%) had hypothyroidism, 8 (7.6%) had preeclampsia, 6 (5.7%) had diabetes mellitus, 2 (1.9%) had polyhydramnios, and 1 (0.95%) had PROM in the present study. Out of the 95 neonatal hyperbilirubinaemia cases, 23 (21.8%) babies had ABO incompatibility, and 3 (2.8%) babies had Rh incompatibility. Among the 95 neonatal hyperbilirubinaemia cases, 21 (19.5%) neonates were delivered by normal vaginal delivery, and 74 (70.5%) were delivered by Lower Segment Caesarean Section (LSCS) [Table/Fig-1].

Out of the 500 mothers, 422 had blood groups A, B, or AB, and among them, 21 babies had blood group O. The remaining 78 mothers had blood group O, and among them, 12 babies had blood groups A, B, and AB.

[Table/Fig-2] showing the mean, standard deviation, and p-value of the study data.

Factors	Parameters	Total neonates N (500)	Hyperbilirubinaemia prevalence=95 (19%)
Age (Mean±SD)	Mothers (years)	29±6	28±4
Gestational Age (mean age±SD)	in weeks	39±1	38±1
Gender of baby	Male	208	58
	Female	292	37
Gravida	Primigravida	215	40
	Multigravida	285	55
Mode of delivery	Vaginal delivery	231	21
	LSCS	269	74
Maternal co-morbidity	Hypothyroidism	26	14
	Preeclampsia	24	8
	Diabetes mellitus	15	6
	Polyhydramnios	11	2
	PROM	10	1
ABO incompatibility		33	23
RH incompatibility		5	3

[Table/Fig-1]: Demographic data of the study participants.
SD: Standard deviation

Factors	Parameters	Serum bilirubin total neonates (N=500)	Serum bilirubin hyperbilirubinaemic Neonates (N=95)	p-value
Gender of baby	Male	11.08±4.08	16.64±2.21	<0.0001
	Female	8.87±3.31	16.24±2.03	
Gravida	Primipara	10.62±3.49	16.84±1.67	0.8
	Multipara	9.15±3.8	16.23±1.46	
Mode of delivery	Vaginal delivery	8.39±2.78	15.54±1.4	<0.0001
	LSCS	10.97±3.96	16.75±1.97	
Maternal co-morbidity	Hypothyroidism	13.59±4.62	17.35±2.21	<0.0001
	Pre-eclampsia	11.73±4.63	17.81±2.01	>0.1
	Diabetes mellitus	12.16±4.3	16.93±1.04	0.06
	Polyhydramnios	8.9±3.58	15.66±1.9	0.9
	PROM	8.6±2.98	16.47±0	0.5
ABO incompatibility		14.61±4.01	17.11±2.15	<0.0001
Rh incompatibility		14.81±5.1	18.42±1.7	>0.3

[Table/Fig-2]: Mean serum bilirubin level of the study participants.

DISCUSSION

In the present study, authors found that out of the 500 neonates, 95 had total serum bilirubin levels exceeding 13 mg/dL after 72 hours of birth, resulting in a prevalence of 19%. A similar incidence of 19% of neonatal hyperbilirubinaemia was found in a study conducted between January 2006 to January 2007, which screened 525 newborns at the Neonatal Care Unit of Valsalva Hospital in Catania, Italy [18]. This prevalence is comparatively lower than the prevalence of neonatal hyperbilirubinaemia reported in a study involving hospital-born babies in 10 tertiary care intensive care units in India, which showed a rate of 27.9% {National Neonatal-Perinatal Database (NNPD) 2004} [19]. A study by Jeffares MJ, reported the incidence of neonatal jaundice to be 8.6% [20]. A study from Pakistan showed an incidence of neonatal hyperbilirubinaemia of 27.6% [21].

In the present study, the association between neonatal serum total bilirubin levels and maternal parity was found to be insignificant (p-value=0.8), as out of the 95 neonates, 40 (42.1%) were born to primigravida mothers, while 55 (57.9%) were born to multigravida mothers. This result was similar to the study conducted by Brown WR and Boon WH in Chinese women, where they observed a slight increase in neonatal serum bilirubin levels with increasing parity [22]. Osborn LM et al., (p-value=0.780) did not observe such an association in their study [23].

In the study of risk factors in mothers, out of the 95 mothers, 14 (14.7%) had hypothyroidism, 8 (8.4%) had preeclampsia, 6 (6.3%) had diabetes mellitus, 2 (2.1%) had polyhydramnios, and 1 (1.1%) had PROM. A similar study conducted in 2011 by Boskabadi H et al., showed that neonatal jaundice was found in preeclampsia (14.3%), diabetes (2.78%), and PROM (2.7%), which is slightly higher than what was observed in our study [24]. Devi DS and Vijaykumar B conducted a case-control study that demonstrated the association between gestational diabetes mellitus and neonatal jaundice [25].

The present study showed that 24.2% of neonates with hyperbilirubinaemia had ABO incompatibility, while 3.2% had Rh incompatibility. In a study conducted by Samanta DK et al., the

incidence of hyperbilirubinaemia was 7.17% in ABO incompatibility and 4.16% in Rh incompatibility [26]. Another study by Patel A et al., showed that the incidence of ABO incompatibility was 13.79% and Rh incompatibility was 1.37% [27].

Regarding the mode of delivery, the present study revealed that out of the 269 neonates delivered by Lower Segment Caesarean Section (LSCS), 74 (27.5%) had hyperbilirubinaemia. Similar results were reported by Ozdemirci S, with 16.8% of neonates delivered vaginally and 22.6% of neonates delivered by LSCS having hyperbilirubinaemia [28]. Boskabadi H et al., also reported that 41.9% of newborns with jaundice were born via LSCS [24]. Previous studies have shown that children born via oxytocin-induced normal vaginal delivery had a higher incidence of neonatal hyperbilirubinaemia, which contrasts with the present study [29,30].

The findings of the present study indicate the need for more epidemiological studies to explore the association between hyperbilirubinaemia and maternal risk factors, enabling early detection and timely intervention to prevent adverse neonatal morbidity and mortality in a cost-effective manner. Evaluation of hyperbilirubinaemia should always be a priority at all levels of healthcare to promote better neonatal health.

Limitation(s)

The present study is a single-centre study; hence, the results may not be generalizable to a larger population but rather restricted to the area of study. A multicentre study would be both useful and desirable.

CONCLUSION(S)

The present study shows a prevalence of neonatal hyperbilirubinaemia of 19%. Additionally, it is observed that male babies, babies born via LSCS, those with ABO incompatibility, and babies born to mothers with hypothyroidism are significantly more prone to developing hyperbilirubinaemia in neonates. In future studies, these variables should be further evaluated with a larger sample size from all tertiary care hospitals in Maharashtra. This will allow authors to provide follow-up care to high-risk babies and facilitate early treatment for neonatal jaundice.

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