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A prospective study on the causes of hyperbilirubinemia and its clinical markers in term and near-term newborns admitted to a tertiary care hospital in Patna, India

Pooja Mishra[1], Manisha Kumari[2]*

[1]*Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India*
[2]*Dept. of Paediatrics, RDJM Medical College & Hospital, Patna, Biahr, India*

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ABSTRACT

Objectives: This study aimed to investigate the root causes, prognostic factors, and therapeutic strategies for neonatal hyperbilirubinemia among term and near-term infants admitted to the Neonatal Intensive Care Unit (NICU) at IGIMS, Patna. Furthermore, the research aimed to analyze the clinical progression of these infants throughout their NICU stay.

Materials and Methods: Conducted within the NICU at IGIMS, Patna, Bihar, this study encompassed term and late preterm infants admitted with serum bilirubin levels exceeding 12 mg/dl. The primary focus was on identifying risk factors, etiological factors, and the clinical profile of these infants during their NICU tenure.

Results: The study examined birth weight distribution and concurrent medical conditions. Parameters included the initiation of phototherapy based on bilirubin levels and treatment methodologies. Out of the 210 infants studied, 27.14% and 47.62% weighed between 2001 and 2500 grams. The most prevalent causes were physiological (129 cases), fetal prematurity (30 cases), birth asphyxia (7 cases), and prolonged labor (18 cases). Idiopathic causes were observed in 28 instances, ABO incompatibility in 7 cases, and Rh incompatibility in 7 cases. G6PD deficiency was identified once. At the commencement of phototherapy, 19.52% had bilirubin levels between 12 and 15 mg/dl, 58.57% between 15.1 and 18 mg/dl, 11.91% above 20 mg/dl, and 10% between 18.1 and 20 mg/dl.

Conclusion: Physiological causes emerged as the most frequent contributors to neonatal hyperbilirubinemia, followed by septicemia and idiopathic factors. Infrequent causes included blood group incompatibility. Phototherapy was established as a cost-effective and efficient method for reducing bilirubin levels in neonatal jaundice. Exchange transfusion proved to be a safe therapeutic measure in cases of severe hyperbilirubinemia. Blood group incompatibility was the main determinant requiring exchange transfusion.

1. Introduction

Among the common issues necessitating phototherapy in neonates, hyperbilirubinemia stands out. Neonates exhibit clinical jaundice when serum bilirubin levels exceed 5-7 mg%.[1]

Jaundice is a frequent clinical finding in newborns. Studies suggest an incidence of neonatal jaundice in India ranging from 54.6% to 77%.[2] Jaundice emerges when the immature neonatal liver cannot efficiently eliminate bilirubin from the blood, resulting in a yellowing of the skin due to unconjugated lipid-soluble bile pigment accumulation.[3] Pathological jaundice occurs in 4-8% of neonates, often due to prematurity, G6PD deficiency, blood

* *Corresponding author*.
E-mail address: manishakumari.mk15@gmail.com (M. Kumari).

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group incompatibility, or sepsis.[4,5]

Differentiating jaundice requires daylight assessments. The skin is pressed over a bony area, blanching it, to observe the yellow hue underneath.[6]

The management of neonatal hyperbilirubinemia necessitates different approaches based on clinical scenarios and gestational age. Phototherapy and exchange transfusion recommendations by the American Academy of Pediatrics form the foundation for treating neonatal jaundice in infants over 35 weeks gestation.[5] Phototherapy proves to be a safe, cost-effective, and efficient approach. This study focuses on the clinical characteristics, etiology, and maternal/neonatal risk factors of hospitalized neonates with hyperbilirubinemia.[7]

2. Materials and Methods

This research was conducted at the Neonatal Intensive Care Unit (NICU) of IGIMS, Patna, Bihar, India. It encompassed infants admitted with serum bilirubin levels exceeding 12 mg/dl. The study, conducted with parental consent, spanned from October 2019 to October 2020.

2.1. Case selection

This study spanned a year and included infants both born at IGIMS and referred from other facilities. It encompassed healthy and ill late preterm and full-term infants.

2.2. Sample size

The sample consisted of 210 newborns admitted to the NICU at IGIMS, Patna, who experienced jaundice (serum bilirubin >12mg/dl) during the study duration.

2.3. Sampling method

Total of 210 newborns meeting the selection criteria within the hospital were included.

2.4. Inclusion criteria

1. Newborns admitted to IGIMS NICU with hyperbilirubinemia >12 mg/dl.
2. Intramural and extramural infants.
3. Age range: 0 to 28 days.
4. Gestational age ≥ 33 + 6 weeks.

2.5. Exclusion criteria

1. Outpatient-only cases.
2. Infants discharged against medical advice.
3. Gestational age < 34 weeks.
4. Parents declining participation.

2.6. Methods

Clinical assessment and biochemical analysis were employed to diagnose and evaluate jaundice. Clinical estimation of jaundice employed Kramer's rule, confirmed by serum bilirubin levels. Comprehensive prenatal, birth, and postpartum histories were obtained. Clinical risk factors for jaundice were recorded, and infants requiring jaundice treatment underwent neurological assessments including a BIND score. Infants with bilirubin levels above 18 mg/dl underwent basic aetiological assessments (CBP, Reticulocyte count, G6PD, and DCT).

Serum bilirubin concentration was determined using the Van den Bergh technique, limited to infants with levels exceeding 12 mg/dl. Neonates were subjected to phototherapy and/or exchange transfusion as per American Academy of Pediatrics guidelines. Serum bilirubin levels were monitored, and infants received routine care and observation. Adverse effects of phototherapy and/or DVET were documented.

2.7. Statistical analysis

Epi Info 7, Microsoft Word, and Microsoft Excel were used for statistical analysis.

2.8. Ethical approval

Institutional Review Board approval was obtained prior to commencing the study.

3. Results

The study's findings, which focused on the distribution of newborns by birth weight and the causes of several illnesses linked to birth weight, are presented in the publication. The study also examines the distribution of newborns based on the modality of therapy used during treatment and the blood bilirubin levels at the time of initiating phototherapy. The difficulties that newborns face during phototherapy are also looked at.

The distribution of newborns by birth weight is shown in Table 1. The bulk of the 210 newborns in the research weigh between 2001 and 2500 grammes (27.14%), followed by 250 to 3000 grammes (47.62%). Additionally, a sizable proportion of newborns (10.48%) and those with birth weights of more than 3000 grammes (19.05%) were noted.

The aetiology of a few medical problems related to birth weight is revealed in Table 2. Among the neonates, physiological causes accounted for 129 instances, making them the most frequent cause. Notably, foetal preterm and birth asphyxia were reported in 30 and 7 instances, respectively, while extended labour was shown to be a relevant cause in 18 cases. 28 instances were caused by idiopathic causes, whereas 7 cases each of ABO and Rh incompatibility were found. G6PD insufficiency was only

Table 1: Distribution according tobirth weight

S.No.	Weight (Grams)	Frequency	Percentage
1	1000-1500	3	1.43 %
2	1501-2000	22	10.48 %
3	2001-2500	57	27.14 %
4	2501-3000	100	47.62 %
5	>3000	40	19.05 %

Table 2: Distribution based on birth weight

Etiology	"n"	Prom>18 hours	Prolonged Labor	Fetal Pre-maturity	Birth Asphyxia
Idiopathic	28	3	-	9	-
Physiological	129	4	12	12	4
ABO Incompatibility	7	-	-	-	-
Rh Incompatibility	7	-	-	3	-
Septicemia	33	2	6	6	3
G6PD Deficiency	1	-	-	-	-
Total	210	9	18	30	7

Table 3: Distribution based on sr. Bilirubin when starting phototherapy

S.No.	Sr. Bilirubin level (mg/dl)	Frequency	Percentage
1.	12-15	123	58.57 %
2.	15.1-18	41	19.52 %
3.	18.1-20	21	10 %
4.	>20	25	11.91 %
Total	210	210	100 %

Table 4: Distribution ofneonates based on mode of therapy

S.No.	Mode of Therapy	Frequency	Percentage
1.	Phototherapy Alone	206	98.10 %
2.	Exchange Transfusion and Phototherapy	4	1.90 %
Total	210	210	100 %

Table 5: Complications developed during treatment

Complications during phototherapy	Number of patients
Loose motions	4
Rash	3
Total	7

found to exist in one instance.

Based on their blood bilirubin levels at the time of phototherapy commencement, the distribution of newborns is examined in Table 3. Among the 210 newborns, 41 neonates (19.52%) and 123 neonates (58.57%) had serum bilirubin levels between 12 and 15 mg/dl and 15.1 and 18 mg/dl, respectively. In addition, 25 newborns (11.91%) had values over 20 mg/dl, and 21 neonates (10%) had levels between 18.1 and 20 mg/dl.

The type of therapy used throughout treatment is shown in Table 4. With 206 cases (98.10%), phototherapy was the only treatment given to the majority of newborns. Four patients (1.90%) received exchange transfusions in addition to phototherapy.

The issues that arose during phototherapy are shown in Table 5 . Four of the 210 newborns had loose movements, and three of the neonates got rashes. It is significant to highlight that in this investigation, exchange transfusion-related problems were not recorded.

4. Discussion

The study investigated a cohort of 210 neonates with neonatal hyperbilirubinemia, revealing a male predominance with 56.2% being male. Among them, 21.90% were born prematurely, while 78.10% were born after completing 37 weeks of gestation. Prematurity emerged as the second most prevalent contributor to hyperbilirubinemia, affecting 47.9% of preterm infants.[8,9]

The average age at which infants were admitted for phototherapy was 5 days. The majority of newborns exhibited birth weights ranging from 250 to 3000 grams. Notably, low birth weight (LBW) was observed in 35.71% of infants, with factors such as maternal malnutrition and economic constraints being implicated.[10,11]

The study delved into the risk factors associated with neonatal hyperbilirubinemia. Maternal factors encompassed prolonged rupture of membranes (PROM) and extended labor. Among fetal factors, prematurity and birth asphyxia were notable contributors.[12] Physiological hyperbilirubinemia was identified in 141 infants, which typically resolved within a specific timeframe. Idiopathic hyperbilirubinemia accounted for 13.33% of cases. Septicemia emerged as a causative factor in 12.40% of the afflicted infants. Rh and ABO incompatibility were found in 3.33% each, whereas G6PD deficiency was detected in only one neonate.[13]

Among the cases, three infants necessitated exchange transfusion due to Rh incompatibility. Strikingly, none of the infants exhibited symptoms of BIND (Bilirubin-induced neurologic dysfunction).[14] The average BIND score for the study cohort was 1.8, and the absence of encephalopathy cases could be attributed to early intervention and referrals by the vigilant pediatricians.[15]

5. Conclusion

Physiological, septicemia and idiopathic aetiologies were revealed to be the most frequent causes of newborn hyperbilirubinemia. Less frequent reasons were blood group compatibility issues. An inexpensive and efficient method to lower bilirubin levels in newborn jaundice is phototherapy. Thanks to pediatricians' increased knowledge and caution, the need for exchange transfusions has been greatly decreased. Exchange transfusion is a safe treatment that needs to be taken into account when BIND is present.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

Pooja Mishra, Senior Resident

Manisha Kumari, Assistant Professor

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