Section: Pediatrics

Original Research Article

EXAMINING THE RELATIONSHIP BETWEEN TRANSCUTANEOUS AND TOTAL SERUM BILIRUBIN LEVELS IN POSTNATAL PATIENTS AT A TERTIARY CARE CENTER

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ABSTRACT

Background: Jaundice in newborns is a common postnatal issue, generally considered to be harmless. The objective was to assess the effectiveness of transcutaneous bilirubin measurement as a screening method for clinically significant hyperbilirubinemia.

Material and Methods: The present study utilized a cross-sectional design conducted within the paediatric department at a Tertiary Care Teaching Institute in India over the course of one year. Following approval from the ethical committee, a total of 80 neonates exhibiting clinical signs of neonatal jaundice, characterised by a yellowish appearance, were included in the study after obtaining consent from their respective parents or guardians. Measurements of neonatal TCB levels and serum bilirubin levels were conducted. Severe hyperbilirubinemia is defined by a bilirubin level exceeding 425 µmol/l.

Results: The findings of the current study indicated a higher prevalence among males. There were 50 males and 30 females. A significant 60% of the cases involved full-term normal deliveries, while 40% were delivered via caesarean section. The average total bilirubin concentration was measured at 8.48±2. Seventy-five percent of neonates were breastfed, while only twenty-five percent received formula feeds. Statistical significance was observed for total cord blood (TCB) levels and severe hyperbilirubinemia.

Conclusion: The findings of the present study indicate that hyperbilirubinemia is frequently observed in males. The newborn presented with hyperbilirubinemia at the time of delivery. There was a notable statistical relationship observed between TCB levels and the severity of the disease.

Key Words: Hyperbilirubinemia, Jaundice, Neonates, Total Serum Bilirubin.

INTRODUCTION

Neonatal jaundice ranks among the most prevalent reasons for hospital admissions in the first week following birth. The condition is a result of hyperbilirubinemia.[1,2] While the majority of cases are harmless, severe neonatal hyperbilirubinemia has the potential to result in bilirubin encephalopathy, commonly known as kernicterus. Kernicterus presents a significant risk, characterized by a high mortality rate. Those who survive often face a range of complications, including athetoid cerebral palsy, high-frequency hearing loss, and intellectual disability.[3] Effective serum bilirubin monitoring and timely interventions such as phototherapy or exchange blood transfusion can prevent severe neonatal hyperbilirubinemia and its associated complications. Neonatal jaundice is typically a harmless condition observed in the postnatal phase; however, a select group of newborns may experience elevated serum bilirubin levels that can lead to serious health risks, including the potential for brain damage or even fatality.[4-6] The visual inspection method for estimating serum bilirubin levels in the skin offers a quick and cost-effective approach. However, it is important to note

that the potential for judgement errors remains significant, even among seasoned clinicians.[7] The estimation of total serum bilirubin (TSB) using laboratory methods is considered the gold standard for evaluating bilirubin levels. However, this approach necessitates blood sampling, an invasive procedure that poses risks such as anaemia, sepsis, and discomfort for the infant, as well as anxiety for the parents.[8]

The objective was to assess the effectiveness of transcutaneous bilirubin measurement as a screening method for clinically significant hyperbilirubinemia.

MATERIALS AND METHODS

The present study was a cross-sectional investigation carried out within the paediatric department of a Tertiary Care Teaching Institute in India over the course of one year. Following approval from the ethical committee, 80 neonates exhibiting clinical signs of neonatal jaundice or displaying a yellowish hue were included in the study, with consent obtained from their respective parents or guardians.

Criteria for inclusion: All newborns in the postnatal care ward are being clinically assessed for hyperbilirubinemia and have expressed their willingness to participate in the study.

Infants diagnosed with sepsis, those exhibiting direct hyperbilirubinemia, significant congenital anomalies, shock, prior phototherapy, and those who underwent blood exchange transfusion were not included in the study. Measurements of neonatal TCB levels and serum bilirubin levels were conducted. When bilirubin levels fall within the phototherapy range, the infant is transferred to the NICU for treatment. Following phototherapy, bilirubin levels are reassessed through TCB and serum measurements to evaluate the effectiveness of the intervention by comparing pre- and post-treatment levels. A bilirubin level exceeding 425 µmol/l has been established as the threshold for diagnosing severe hyperbilirubinemia.

Statistical Analysis

The collected data was systematically organised and input into a spreadsheet application (Microsoft Excel 2019) before being transferred to the data editor interface of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were characterised using means and standard deviations or medians and interquartile ranges, depending on their distribution. Qualitative variables were reported using counts and percentages. In all conducted tests, the confidence level was established at 95%, while the level of significance was determined to be 5%.

RESULTS

The current study revealed a greater prevalence of males. There were 50 males and 30 females. A significant 60% of the cases involved full-term normal deliveries, while 40% were delivered via caesarean section. The average total bilirubin level recorded was 8. 48±2.Seventy-five percent of neonates were breastfed, while only twenty-five percent received formula feeds. Statistical significance was observed for total cord blood (TCB) levels and severe hyperbilirubinemia. The application of the chi-square test yielded a p-value of less than 0.001, indicating a statistically significant result. The diagnostic accuracy of total cord blood bilirubin (TCB) surpassed that of total serum bilirubin in cases of severe hyperbilirubinemia.

Table 1: Mode of delivery

Delivery	Number	Percentage
Normal vaginal	48	60
LSCS	32	40
total	80	100

Table 2: Bilirubin levels

Variables	Number	Percentage
TCB levels	8.48	2.7
Total serum bilirubin level	8.15	1.9

Table 3: Correlation of TCB level and severe hyperbilirubinemia

TCB	Severe hyperbilirubinemia		Total
	Yes	No	
<7	11	37	48
>7	20	12	32
Total	31	49	80

DISCUSSION

Newborn jaundice stands as the most common health issue affecting neonates, prompting extensive research aimed at identifying effective methods for precise clinical assessment of jaundice. This research also seeks to develop alternative approaches for reliably measuring bilirubin levels. The current study revealed a higher prevalence of males. A total of 50 individuals were male, while 30 were female.

A significant 60% of the cases involved full-term normal deliveries, while 40% were delivered via caesarean section. The mean total bilirubin (TCB) level recorded was 8.48 ± 2.7, while the average serum bilirubin level stood at 8.15 ± 1.9. In a study conducted by Nahar et al., the mean values for transcutaneous bilirubin and serum bilirubin were found to be 14.59 ± 2.55 and 13.62 ± 2.86 mg/dl, respectively.[9] A prior investigation conducted in our country by Boo and Ishak,[10] revealed results that closely align with those of our study.

In the current study, it was found that 75% of neonates were breastfed, while only 25% received formula feeds. Statistical significance was observed for total circulating bilirubin (TCB) and severe hyperbilirubinemia. The diagnostic accuracy of transcutaneous bilirubinometry (TCB) surpassed that of total serum bilirubin in cases of severe hyperbilirubinemia, demonstrating a positive correlation. A study conducted by Durre et al. revealed a strong positive correlation between TcBR and TsBR values in high-risk neonates.[11] A study conducted by Fouzas et al demonstrated that the developed TcB nomogram accurately represents the natural progression of TcB levels in healthy neonates through the fifth postnatal day.[12] A distinct pattern in the rate of total bilirubin (TcB) increase was observed in neonates, regardless of whether they required phototherapy, although the TcB values remained nearly identical between the two groups.

Sarici et al. reported that the total bilirubin (TcB) level was at least 5 mg/dl in 41.98% of infants at an average age of 15.0±2.1 days and in 25.9% of infants at an average age of 30.9±2.6 days.[13] Chimhini's findings revealed that fifty-five percent of the infants studied were male. The serum bilirubin levels varied between 85 and 408 µmol/l, while the transcutaneous bilirubin measurements showed a range of 170 to 544 µmol/l at the sternum and 119 to 510 µmol/l at the forehead. Sharma and colleagues demonstrated a statistically significant relationship between TCB levels and severe hyperbilirubinemia.[14,15] The resemblance of the TcB findings in our research to those in previous studies may be attributed to the comparable gestational age of the neonates included in the investigation. We proposed that the possibility could arise from the fact that those neonates shared a similar skin tone, which may have contributed to the underestimation of the TcB. Rubaltelli et al.[16] found a strong positive linear correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TcB), noting that the TcB measurements taken from the forehead (r = 0.89) demonstrated a slightly stronger relationship compared to those from the sternal area (r = 0.88). Conversely, alternative research has yielded contrasting findings. Seventeen to nineteen A study conducted by Kosarat and Khuwuthyakorn in 2016, which included 257 neonates, revealed that the sternal measurement of total bilirubin (TcB) exhibited a stronger correlation coefficient (r > 0.8) with total serum bilirubin (TSB) compared to the forehead measurement of TcB.

The study faced limitations due to an insufficient number of very preterm and extremely preterm neonates, which hindered the ability to draw definitive conclusions regarding the accuracy of the TCB in this specific population. Consequently, additional research is necessary to focus on this group of patients. Conducting such studies on a larger population is essential for drawing reliable conclusions.

CONCLUSION

Present study concluded that hyperbilirubinemia is commonly seen among males. Newborn delivered had hyperbilirubinemia. Statistical significance was seen between TCB level and severity of the disease. Thus, Neonatal TCB levels can be used as a screening test for detecting hyperbilirubinemia in neonates. As TCB is a noninvasive and cost effective it can be used widely as predictor of the disease.

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