

Original Research Article

Correlation of transcutaneous bilirubin with total serum bilirubin in neonates with hyperbilirubinemia

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ABSTRACT

Background: For determining hyperbilirubinemia in a neonate, clinical evaluation, serum bilirubin estimation and trans cutaneous bilirubin estimation are the modalities available. Transcutaneous bilirubinometry (TcB) is routinely used to monitor jaundice in term and near-term infants. Literature shows a positive correlation observed between TcB and total serum bilirubin (TSB). The present study was conducted to determine the correlation of TcB with TSB in neonates with hyperbilirubinemia admitted at a tertiary care hospital, Chennai

Methods: A cross sectional study was conducted at a tertiary care hospital, Chennai where 350 neonates who have clinical jaundice and require estimation of serum bilirubin who are admitted to the tertiary care centre, Chennai during December 2020-March 2021 were included in the study. The ROCHE INTEGRA-e 411+ autoanalyzer was used to estimate TSB (mg/dl) using a modified diazo method. The Jaundice Meter JM-103 to measure TcB, (Manufactured by Draeger medical systems, Germany). Pearson correlation coefficient was used to find the correlation between the two variables. $P < 0.05$ was considered to be statistically significant.

Results: Out of 350 neonates admitted to the tertiary care centre, term deliveries were 57.1% and pre term were 42.9%. 83.1% were in the age group of 3-7 days. The mean weight of the study population was 2.16 ± 0.60 kg. In term babies, Pearson correlation between TSB and TcB shows a statistically significant positive correlation, $r = 0.90$ with $p \leq 0.0001$. Among pre term babies, Pearson correlation between TSB and TcB shows a statistically significant positive correlation, $r = 0.96$ with $p \leq 0.0001$.

Conclusions: This study's findings support the use of a TcB metre as a screening tool for clinically significant hyperbilirubinemia.

Keywords: Transcutaneous bilirubin, Hyperbilirubinemia, Neonatal serum bilirubin

INTRODUCTION

Neonatal jaundice is characterised by a yellowish discoloration of the skin, conjunctiva, and sclera caused by elevated serum or plasma bilirubin levels during the newborn period. Jaundice is derived from the French word "jaune," which means "yellow." In most newborns, neonatal jaundice is a mild and transient illness.¹

Almost all newborns will develop a total bilirubin level greater than the upper limit of normal for adults and older children of 1.5 mg/dl, with less than 5% of the total bilirubin conjugated.² Up to 60% of term infants and 80% of newborns with a gestational age of 35 weeks or more will develop jaundice, which occurs when serum bilirubin reaches and exceeds 5 mg/dl.^{3,4}

Hyperbilirubinemia is more common in newborns due to increased bilirubin production as a result of increased RBC destruction, defective bilirubin elimination as a result of defective hepatic uptake, defective conjugation due to newborn's immaturity, and increased entero-hepatic circulation. Pre-term babies are more likely than term babies to develop hyperbilirubinemia.

Clinical evaluation, serum bilirubin estimation, and TcB estimation are all methods for determining hyperbilirubinemia.

Many studies have shown that clinical estimation of serum bilirubin as a screening tool is unreliable and may fail to detect the significant neonatal hyper-bilirubinemia before the discharge, resulting in the insufficient follow-up.⁵⁻⁷

The present study was conducted to determine the correlation of TcB with TSB in neonates with hyperbilirubinemia admitted at a tertiary care hospital, Chennai.

Objectives

Objective of the study was to determine the correlation of TcB with total serum bilirubin in neonates with the hyperbilirubinemia.

METHODS

Study design

The study design used was cross-sectional study.

Study population

Neonates admitted with hyperbilirubinemia to a Shri Sathya Sai medical college.

Sample size

The total patients studied were 350.

Study period

The study conducted from December 2020 to March 2021.

Inclusion criteria

Neonates who have clinical jaundice and require estimation of the serum bilirubin were included in the study.

Exclusion criteria

Neonates who will receive phototherapy and an exchange transfusion were excluded from the study.

Method of data collection

TSB measurement

The ROCHE INTEGRA-e 411+ autoanalyzer was used to estimate TSB (mg/dl) using a modified diazo method. The assays used by this machine have previously been studied and found to correlate well with the gold standard bilirubin measurement of high-performance liquid chromatography (HPLC).⁸

TcB measurement

We used the Jaundice Meter JM-103 to measure TcB. (Manufactured by Draeger medical systems, Germany). All measurements were taken with a single Jaundice Meter JM-103 device, as recommended by the manufacturer.

TcB measurements on the sternum were performed within 15 minutes of TSB measurements in this study. Averaging five readings, which the Jaundice Meter does automatically when the desired number of measurements is set, provides a more precise TcB measurement than a single measurement.

Statistical analysis

Data entry and tabulation was done using Microsoft excel 2013 and analysis using SPSS 16. For quantitative data, Mean±SD was calculated. For qualitative data, frequency and percentages were estimated. Pearson correlation coefficient was used to find the correlation between the two variables. P<0.05 was considered to be statistically significant.

RESULTS

In our study 350 neonates who were admitted with hyperbilirubinemia to a tertiary care centre were included. Demographic data of the study participants is listed in Table 1. Term deliveries were 57.1% and pre term were 42.9% (Figure 1).

Table 1: Demographic data of the study participants.

Variables	Frequency (%)	
Ag (days)	<3	59 (16.9)
	3-7	291 (83.1)
Gestational age (Weeks)	<28	22 (6.3)
	28-32	34 (9.7)
	32-36	94 (26.9)
	>37	200 (57.1)
Gender	Male	176 (50.3)
	Female	174 (49.7)
Weight (kg)	2.16±0.60	
Hb	15.99±1.76	
PCV	54.77±6.19	

83.1% were in the age group of 3-7 days. The mean weight of the study population was 2.16 ± 0.60 kg. The mean bilirubin levels among the pre term were 13.90 ± 3.04 and among term was 18.16 ± 1.73 . Table 2 and Table 3 shows the summary of term and pre term study population characteristics.

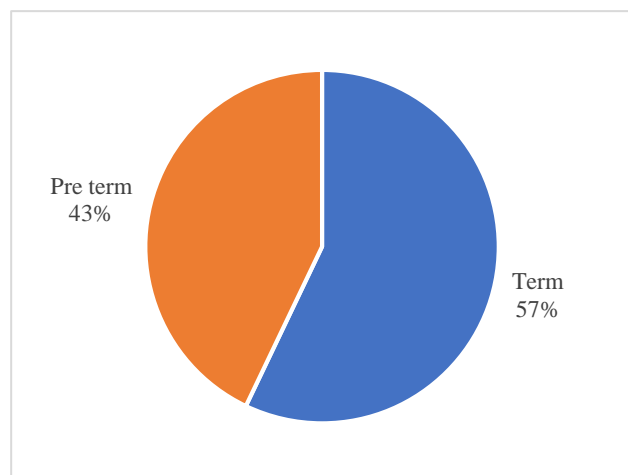


Figure 1: Distribution based on gestational age at delivery.

In term babies, Pearson correlation between TSB and TcB shows a statistically significant positive correlation, $r=0.90$ with $p \leq 0.0001$.

Table 2: Characteristics of study population who were at term.

Variables	Min	Max	Mean	SD	Median
GA (weeks)	37	39	37.99	0.79	38
Weight (kg)	2	3	2.49	0.29	2.5
Serum bilirubin	15	20.9	18.16	1.73	18.2
TCB sternum	11	19.6	15.59	2.04	15.9

Among pre term babies, Pearson correlation between TSB and TcB shows a statistically significant positive correlation, $r=0.96$ with $p \leq 0.0001$.

Table 3: Characteristics of study population who were at pre-term.

Variables	Min	Max	Mean	SD	Median
GA (weeks)	24	36	32.71	3.52	33
Weight (kg)	0.6	3	1.72	0.64	1.70
Serum bilirubin	9.1	20.80	13.90	3.04	13.2
TCB sternum	6.1	18.6	11.30	3.10	10.60

DISCUSSION

Present study showed a statistically significant positive correlation between the TSB and trans cutaneous bilirubin among the term ($r=0.90$, $p \leq 0.0001$).

Among preterm babies also showed a positive correlation ($r=0.96$) which is statistically significant ($p \leq 0.0001$).

Similar findings were reported in a study done by Ebbesen et al among 488 babies showed that TcB measurements at the forehead, sternum, knee, and foot were correlated with TSB, and it was found that TcB measurements at the forehead and sternum correlated well with TSB, while measurements at the knee and foot showed an no significant correlation, and among NICU babies, TcB measured on the forehead showed a better correlation than sternal TcB, which is statistically significant.⁹

In a study done by Maisels et al showed that correlation with TSB when TcB was observed on the sternum ($r=0.953$) than with the forehead ($r=0.914$).¹⁰

Bhutani et al in their study reported that among 490 term and near term new born infants showed that TcB measured with the help of Bili-Check device was equivalent to the estimation of TSB which was statistically significant ($p < 0.05$) and the device was accurate and reproducible.¹¹

Also, in a study done by Rubaltelli et al among 6 different European hospitals and a total 210 infants showed that correlation coefficient between TcB obtained over the forehead and bilirubin obtained by HPLC was 0.89.¹² The correlation coefficient between TcB obtained over the sternum and HPLC bilirubin was 0.881.

CONCLUSION

This study's findings support the use of a TcB metre as a screening tool for clinically significant hyperbilirubinaemia in Indian infants. The TcB metre had the advantage of having an excellent sensitivity, making it extremely unlikely that an infant with a significant level of hyperbilirubinemia would be missed with TcB measurement.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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