



ACCURACY OF TRANSCUTANEOUS BILIRUBIN MEASUREMENTS DURING PHOTOTHERAPY IN JAUNDICED PRETERM NEONATES

Pediatrics

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ABSTRACT

Aim: It is very difficult to find veins and also seems unethical to withdraw blood daily in a preterm baby for the monitoring of jaundice during the course of phototherapy. So it becomes essential that we find out a method which is non-invasive and at the same time accurate to assess jaundice. Jaundice is the most common morbidity in the first week of life, reported in 60% of term, 80% of preterm (1, 2) & also being the commonest cause of readmission. **Materials and Method:** Study was planned to assess the accuracy of transcutaneous bilirubin in comparison to total serum bilirubin in premature jaundiced neonates of gestational age (28-32 weeks v/s 32-37 weeks) during phototherapy. **Result:** Study has demonstrated reliability of TCB measurements in preterm infants during phototherapy. Gestational age, comorbidities and risk factors for jaundice did not influence the correlation. **Summary:** This study reveals that Transcutaneous Bilirubin Estimation by bilirubin meter can be used as a non-invasive method for monitoring of jaundice treatment during phototherapy in preterm neonates.

KEYWORDS

Neonatal jaundice, transcutaneous bilirubin, preterm

Introduction:

Jaundice is the most common morbidity in the first week of life occurring in 60% of term and 80% of preterm newborns & it is the commonest cause of readmission after discharge from birth hospitalization. (3) There are three methods for the estimation of jaundice. A) Visual estimation. B) Laboratory measurement of total serum bilirubin (TSB). C) Transcutaneous bilirubin (TCB). (3) Jaundice in neonates is visible in skin and eyes when total serum bilirubin (TSB) concentration exceeds 5 to 7 mg/dl. In contrast to adult have jaundice visible in eyes when TSB concentration exceeds 2 mg/dl. Yellowish discoloration is first manifested on the skin of face, nasolabial folds, and tip of the nose. It is masked by the physiological plethora of new-born and can be brought out by blanching of the skin so that underlying yellowness of subcutaneous tissue and blood vessels can be visualised. Clinical examination with visual assessment for jaundice in newborns is neither reliable nor accurate. The decision to perform serum bilirubin testing should be based on additional factors. (3). The gold standard confirmatory parameter used to diagnose, manage, and treat hyperbilirubinemia is the serum bilirubin level. TCB has good correlation and agreement with TSB in preterm low-birth-weight neonates born at ≥ 28 weeks of gestation. (4-7). Out of these 3 methods, transcutaneous bilirubin serial measurements offer a chance to screen for jaundice in a reliable, yet non-invasive manner. The non-invasive TCB measurement is reliable within 2-3 mg/dl of total serum bilirubin level obtained by the biochemical method. Serum bilirubin measurements are conducted by the conventional van der Bergh's test diazo method which requires large blood sample volume. So there is need for a non-invasive and accurate method for measurement of TCB that would be helpful because it would decrease blood sampling for a frequent and usually benign clinical condition. Presently such a test is the transcutaneous bilirubin estimation which is used above 35 weeks of gestation. The device used is the JM103 (Drager) jaundice meter, that we are using at our department. We conducted this prospective study to compare the Total serum bilirubin (TSB) and Transcutaneous bilirubin by this instrument in jaundiced preterm neonates according to gestational age (28-32 weeks v/s 32-37 weeks) during phototherapy so that accuracy of TCB can be decided.

We conducted this study at Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India. Hundred preterm newborns were enrolled January 2019 to June 2020. Selection was done on the basis of visually icteric neonates up to the level of chest, who were admitted in NICU and obstetrical ward in Mahatma Gandhi Medical College. Sick, congenitally abnormal, neonates with conjugated hyperbilirubinemia or evidence of haemolysis or poor perfusion were excluded.

Written informed consent was obtained from parents before enrolment in the study. The gestational age, day of life and other relevant information was recorded. Recording and measurement of TCB was done by JM-103 dragger jaundice meter on the midpoint of the sternum of infants thrice, after cleaning the device by sanitizer and the average of three readings was recorded in mg/dl. Just after recording the TCB, venous blood sample was taken in a plain vial and sent for total serum bilirubin measurement by using acid Diazo reaction (Van Den Bergh reaction) to biochemistry laboratory using FUJI DRI CHEM NX500i clinical chemistry analyser. Correlation coefficients were calculated between two methods of bilirubin estimation by statistical analysis.

RESULTS:

Hundred preterm neonates fulfilling the criteria for our study were selected & this was a prospective cross-sectional study, done from January 2019 to June 2020. Study results are described as follows-

Table-1 Gestational age-wise distribution
Gestational age wise distribution-

Gestational age	Number	Percentage
28-32 weeks	55	55
32-37 weeks	45	45
Total	100	100

Among 100 preterm neonates enrolled in the study, 55(55%) were having gestational age 28-32 weeks and 45(45%) preterm neonates were of gestational age 32-37 weeks.

Table-2**TCB and TSB during phototherapy -**

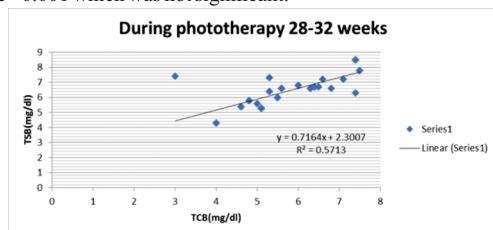
During phototherapy	Num ber	Maxi mum	Mini mum	Mean	Std. Deviation	Median	Result (P value)
TCB	100	7.5	3	5.78	0.98	5.6	<0.001
TSB	100	8.5	4.3	6.42	0.94	6.5	

Table 2 shows that the mean TCB was 5.78 and the mean TSB was 6.42. The difference between them, was not statistically significant. (p-value <0.001)

Table-3 Correlations**GA-28-32 weeks –**

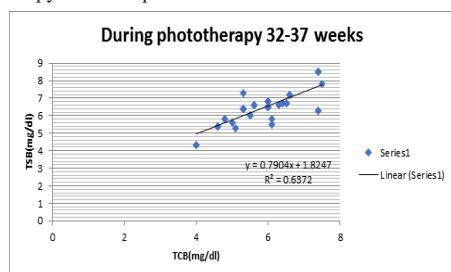
During phototherapy-		
TSB and TCB correlation coefficient	Pearson correlation	0.77
	P value	<0.001
	Number	55

Among all the 100 neonates included in the study out of them 55 were gestational age between 28-32 weeks Table 3 showed that the Pearson correlation between TSB and TCB in this gestation group was 0.77 p-value <0.001 which was not significant.

**Figure 1-**Scattered chart showing correlation between TCB and TSB in gestational age 28-32 Weeks During Phototherapy**Table-4****GA-32-37 weeks –**

During phototherapy-		
TSB and TCB correlation coefficient	Pearson correlation	0.79
	P value	<0.001
	Number	45

Among all the 100 neonates included in study out of them 45 were gestational age between 32-37 weeks. Pearson correlation between total serum bilirubin and midstream transcutaneous bilirubin during phototherapy 0.79 with p value <0.001.

**Figure 2-**Scattered chart showing correlation between TCB and TSB in gestational age 32-37 weeks before phototherapy.**DISCUSSION:**

This prospective study was carried out on newborns admitted in obstetrics ward & neonatal intensive care unit of Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, from January 2019 to June 2020. A neonate of 28-37 weeks gestational age who was visually icteric, up to the level of chest or below, and had not received phototherapy or exchange transfusion, was selected for inclusion in this study.

Our purpose was to find out whether TCB can be used as a parameter for monitoring treatment of jaundice by establishing a correlation between TCB and TSB. So this study was carried out by collecting samples and measuring TCB within 15 minutes time interval.

Samples of 100 preterm neonates with gestational age 28 to 32 weeks, 32 to 37 weeks were collected. There was a positive correlation between TSB and TCB in preterm neonates in both the groups. The difference noted between 28-32 week and 32- 37weeks gestation groups could be explained by the skin immaturity of very preterm neonates. There are no studies till date which have evaluated this difference.

In our study Pearson correlation among preterm neonates TCB and TSB correlation during phototherapy in neonates of gestational age 28-32 weeks was (r=0.77). It showed good overall correlation with p-value <0.001. Study found that TCB and TSB correlation during phototherapy in neonates of gestational age 32-37 weeks was (r=0.79) which is a good overall correlation with p-value <0.001.

The correlation coefficient was independent of chronologic age or the presence of risk factors or other co-morbidities. The primary finding of this study shows a similar degree of correlation as has been reported in previous studies.

A number of studies have reported correlation coefficients in the range of 0.68 to 0.96.

Amruta et al (8) study reported a smaller study of 30 newborn. TCB estimated at sternum correlated significantly with TSB prior to initiation of phototherapy (r=0.90, P<0.001). These correlations were very close to our study. TCB in babies 28- 32 weeks of gestation (r=0.97; P<0.001).

Cucuyet al (9) in a prospective study included 86 premature infants of 26-34 wks, weighing 618-2400 grams to evaluate the correlation between TCB and Total Serum Bilirubin (TSB) during phototherapy in preterm infants. This study has demonstrated acceptable correlation (r=0.8) between TCB and TSB in preterm infants with the mean TCB approximately 1 mg% lower than the mean TSB. The correlation coefficient of chronologic age or the presence of risk factors or other co-morbidities. The mean difference between TCB and TSB was approximately 1mg%. Gestational age, comorbidities and risk factors for jaundice did not influence the correlation. Results of this study are similar to our study.

Amy Jnahet al (10) study included Forty-five neonates, 30th weeks to 34+ 6/ 7 weeks' gestation, preterm neonates. A fair correlation was renewed between TCB and TSB measurements obtained during phototherapy (r = 0.588, P value .001). Correlation result was similar to our study. However the TSB measurements were constantly lower than TCB during phototherapy, which was opposite to our study. In our study TSB during phototherapy were higher than TCB.

CONCLUSION:

TCB can be considered as reliable, painless & non-invasive method for the estimation of Bilirubin. that can be used as a useful parameter for treatment monitoring during phototherapy in preterm neonates. The mean difference between TCB and TSB was approximately 0.64mg%. Gestational age, co morbidities and risk factors for jaundice did not influence the correlation. Further studies on larger sample size are required to corroborate our findings.

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