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Original Research Article

COMPARISON OF TRANSCUTANEOUS BILIRUBIN AND TOTAL SERUM BILIRUBIN MEASUREMENTS IN JAUNDICED PRETERM NEONATES

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ABSTRACT

Background: 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. (1,2) An accurate noninvasive measure of transcutaneous bilirubin (TCB) would be helpful because it would decrease blood sampling for a frequent and usually benign clinical condition. Currently, transcutaneous bilirubin is recommended above 35 weeks of gestation. **Method:** We planned this study, to compare transcutaneous bilirubin and total serum bilirubin in jaundiced premature neonates according to gestational age (28-32 weeks v/s 32-37 weeks) before phototherapy. **Result:** In our study, we established a comparison of transcutaneous bilirubin and Total serum bilirubin measurements in preterm neonates 28 to 37 weeks of gestation before phototherapy. This study has demonstrated the reliability of TCB measurements in small preterm infants even before phototherapy. The mean difference between TCB and TSB was approximately 0.88mg%. Gestational age, comorbidities and risk factors for jaundice did not influence the correlation. **Conclusion:** TCB is an easy rapid non-invasive procedure that prevents pain, hematoma, risk of infections and decreases repeated drawing of blood.

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. **(1,2)** There are three methods for the estimation of jaundice. A) Visual estimation. B) Laboratory estimation of total serum bilirubin (TSB). C) Transcutaneous bilirubin (TCB).

Visual assessment of jaundice, a noninvasive assessment method, is regarded as inaccurate and therefore, not used to inform the management and treatment of hyperbilirubinemia **(3,4)**.

Serum bilirubin testing is considered the gold standard confirmatory measure used to diagnose, manage, and treat hyperbilirubinemia. Serum testing most often involves an invasive, painful heel stick, venipuncture, or arterial sampling, and less frequently, sampling by way of central catheters. Moreover, serial measurements are required, which may lead to anaemia.

The TCB measurements, first introduced in the 1960s, function as a screening method that can reduce the frequency of serum testing. **(5-7)** Of these 3 methods, transcutaneous bilirubin monitoring

offers 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 estimations are conducted by the conventional van der Bergh's test diazo method in most neonatal units. Its limitations include the need for a large blood sample size, lack of accuracy, reliability, and reproducibility of the result.

An accurate noninvasive measure of TCB would be helpful because it would decrease blood sampling for a frequent and usually benign clinical condition. An accurate, non-invasive test might permit the cost-effective implementation of a risk-based bilirubin screening program and follow-up to prevent the unexpected occurrence of severe hyperbilirubinemia and perhaps even kernicterus.

Currently, transcutaneous bilirubin is recommended above 35 weeks of gestation. A non-invasive method to estimate bilirubin levels in preterm babies is of enormous advantage, and one such device is the JM-103 (Drager) jaundice meter, which 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) before phototherapy

We conducted this study at Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India. We enrolled 100 preterm newborns in a one and half year period from January 2019 to June 2020. All neonates from 28 weeks to less than 37 weeks who visually appeared icteric up to the level of chest who was admitted in NICU and obstetrical ward in our institution were enrolled. We excluded newborns who were sick, congenitally abnormal, with conjugated hyperbilirubinemia, evidence of haemolysis or poor perfusion.

Written informed consent was obtained from parents before enrolment in the study.

The gestational age, day of life and other relevant information was recorded.

TCB was measured and recorded by JM-103 dragger jaundice meter on the midpoint of the sternum of infants thrice, after cleaning the device by sanitiser and the average of three readings was recorded in mg/dl, calculated by jaundice meter and taken as the final TCB.

Within 15 minutes of recording TCB, a venous blood sample was taken under all aseptic precautions in a plain vial and sent for total serum bilirubin estimation by using acid Diazo reaction (Van Den Bergh reaction) to biochemistry laboratory in our hospital using FUJI DRI CHEM NX500i clinical chemistry analyser.

Statistical analysis was done to know the correlation coefficients between two methods of bilirubin estimation.

RESULTS

This was a prospective cross-sectional study, done over the period from January 2019 to June 2020. 100 preterm neonates, who fulfilled the criteria for my study, were included in the study. The results of the study are described below

Table-1

Gestational age-wise distribution-

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

Table 2 TCB and TSB before phototherapy chart-

	Number	Maximum	Minimum	Mean	Std. Deviation	Median	Result (P-value)
Before phototherapy							
TCB	100	14.0	6	9.45	1.89	9.45	<0.001
TSB	100	17.8	6.8	11.00	2.62	11.00	

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 shows that the mean TCB was 9.45 and the mean TSB was 11.00. The difference between them, was not statistically significant.(p-value <0.001).

Table-3 Correlations GA -28-32 weeks

Before phototherapy-		
TSB and TCB correlation coefficient	Pearson correlation	0.79
	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 0.79(p-value <0.001). Figure 1 is a scattered chart showing these findings.

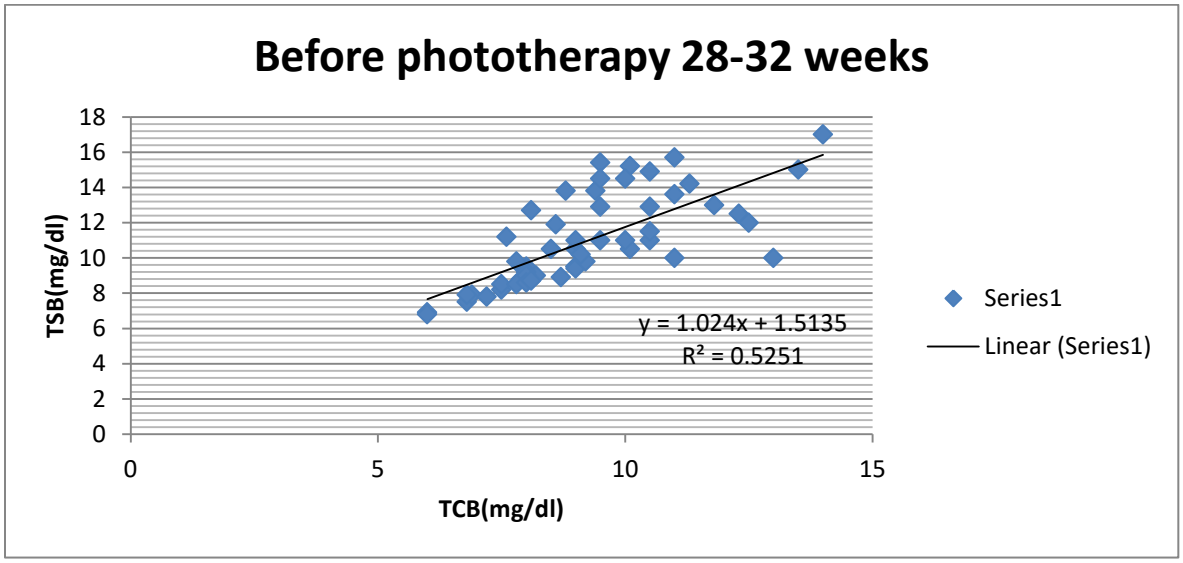

Figure 1-Scattered chart showing correlation between TCB and TSB in gestational age 28-32 Weeks Before Phototherapy

Table -4 GA -32-37 weeks –

Before phototherapy-		
TSB and TCB correlation coefficient	Pearson correlation	0.84
	P value	<0.001
	Number	45

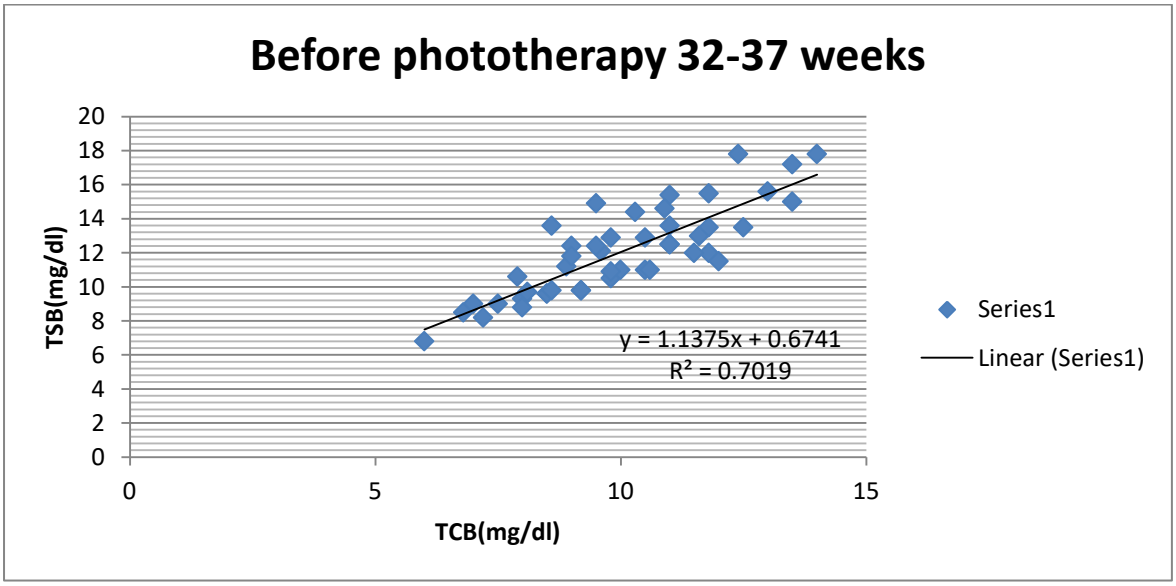

Figure 2-Scattered chart showing correlation between TCB and TSB in gestational age 32-37 weeks before phototherapy.

Among all the 100 neonates included in study out of them 45 were gestational age between 32-37 weeks. Table 3 showed that Pearson correlation between TSB and TCB in this gestation group was 0.84(p-value <0.001). Figure 2 is a scattered chart showing these findings.

On comparing both the scattered diagrams there is better correlation between serum bilirubin and transcutaneous bilirubin among 32-37weeks preterm neonates.

DISCUSSION

This prospective study was carried out in Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan. The study was conducted in level 2 and level 3 neonatal intensive care unit and newborns admitted in obstetrics ward from January 2019 to June 2020. A neonate of 28-37 weeks gestational age who was visually appearing icteric, upto the level of chest or below, and had not received phototherapy or exchange transfusion, was selected for inclusion in this study.

In this study, we intended to establish a correlation between TCB and TSB in preterm neonates, by collecting samples and measuring TCB within 15 minutes time interval.

We collected samples of 100 preterm neonates with gestational age 28 to 32weeks, 32 to 37 weeks. This study showed 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 previous studies in different parts of world there is a variable correlation between TCB and serum bilirubin among preterm neonates.

In our study Pearson correlation among preterm neonates TCB and TSB correlation before phototherapy in neonates of gestational age 28-32 weeks was (r=0.79) It showed good overall correlation with p-value <0.001 .Study found that TCB and TSB correlation before phototherapy in neonates of gestational age 32-37 weeks was (r=.84) which is a good overall correlation with p-value <0.001.

TCB and TSB in babies 32-37 weeks (r=0.84; P<0.001) were better correlated with TCB and TSB than 28-32 weeks of gestation (r= 0.79; P<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=0.903, P<0.001). These correlations were very close to the our study.TCB in babies 28-32 weeks of gestation (r=0.97; P<0.001) were better correlated with TSB than in 32-37 weeks (r=0.88; 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) before phototherapy in preterm infants. The correlation coefficient between TCB and TSB was 0.8 with p value< 0.001 and the mean difference between TCB and TSB was 1.2mg%. 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. The results showed a good correlation before phototherapy (r = 0.797, P <.001). Correlation result was similar to our study however the TSB measurements were constantly lower than TCB before phototherapy, which was opposite to our study. In our study TSB before phototherapy were higher than TCB.

Nagar et al **(11)** reported a meta-analysis in 2013 that included 22 additional studies with 3,453 pairs of measurements in preterm infants born before 32 weeks gestational age. The mean correlation of 0.83 was very close to that found in this study. The effects of birth weight and gestational age vary between studies, in part because of varying group definitions and limited sample sizes.

CONCLUSION

In our study we established a comparison of transcutaneous bilirubin and Total serum bilirubin measurements in preterm neonates 28 to 37 weeks of gestation before phototherapy. This study has demonstrated the reliability of TCB measurements in small preterm infants even before phototherapy. The mean difference between TCB and TSB was approximately 0.88mg%. Gestational age, co morbidities and risk factors for jaundice did not influence the correlation. TCB is an easy rapid noninvasive procedure which prevents pain, hematoma, risk of infections and decrease repeated drawing of blood.

Further studies on larger sample size are required to corroborate our findings.

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