



Accuracy Of Transcutaneous Bilirubin On Covered Skin In Preterm Neonates Receiving Phototherapy Using a JM-105 Bilirubinometer

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Abstract

Objective: To Compare Transcutaneous Bilirubin with Total serum bilirubin in Preterm neonates after initiation of phototherapy.

Method: Bilirubin was assessed in 196 preterm neonates before and 12 hours after initiation of phototherapy.

Result: This study showed a positive correlation between TSB and TCB in preterm neonates before and 12 hours after initiation of phototherapy. Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TCB) in 28–32-week is better compared to 33–36-week babies after initiation of phototherapy. Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TCB) after initiation of phototherapy in babies with hours of life (HOL) <72 is better than babies with >72 HOL at the time of presentation of hyperbilirubinemia.

Conclusion: Transcutaneous bilirubin showed a positive correlation between TSB and TCB in preterm neonates before and 12 hours after initiation of phototherapy at the patched sternal site.

Keywords: Transcutaneous bilirubin, Total serum bilirubin, Preterm new-born

Introduction

Almost 80% of preterm neonates are affected by neonatal jaundice during the 1st week of life. (1)

As preterm new-borns are more susceptible to adverse neurodevelopmental outcomes from neonatal jaundice, frequent monitoring of total serum bilirubin (TSB) is required. However, frequent skin pricks can lead to pain, sepsis, anaemia, and adverse neurodevelopmental outcomes by itself. (2)

Although the American Academy of Paediatrics recommends universal screening of all babies for neonatal jaundice, it seems impractical in developing countries with limited resources. [3,4]

Transcutaneous bilirubin meter (TcB) is an alternative in this situation. Screening with a transcutaneous device may significantly reduce the blood sampling in new-born babies and its use is rapidly gaining popularity in developing countries like India.

Thus, this study was conducted to find whether transcutaneous bilirubin (TcB) measurement correlates with total serum bilirubin, measures with standard laboratory method and to analyse the effect of gestational age and postnatal life on TcB and TSB.

Aims & Objectives

Aims

Comparison of Transcutaneous bilirubin (TCB) with total serum bilirubin levels in preterm neonates (28 week- <37week) receiving phototherapy.

Objectives

To compare transcutaneous bilirubin with total serum bilirubin in preterm neonates before and after initiation of phototherapy.

Compare transcutaneous bilirubin (TcB) with total serum bilirubin (TSB) after initiation of phototherapy according to gestational age [28-32 vs. 33-36 weeks] and postnatal age [less than 72 hours vs. more than 72 hours]

Materials & Methods

The present study was conducted in the Department of pediatrics, Tertiary healthcare center, Surat, Gujarat, India. After approval from the institutional ethical committee. Prior written consent was taken from the parents of neonates involved in study.

Characteristics Of The Study:

This is observational prospective study carried over a period of 15-18 months. A total of 196 neonates admitted in Neonatal Intensive Care Unit, who received phototherapy for neonatal hyperbilirubinemia had been included in the study.

Inclusion Criteria:

Neonates 28 weeks to less than 37 weeks of gestation with clinical detectable jaundice were enrolled into the study.

Exclusion Criteria:

Neonates with conjugated hyperbilirubinemia, evidence of hemolysis and those with poor perfusion [capillary refill more than 3 s or low blood pressure measurement] were excluded.

Methodology

Written consents of parents or guardians of neonates enrolled in study were taken.

A detailed history of enrolled neonates was taken and noted in predesigned proforma which included demographic profile; antenatal, perinatal and

postnatal history, vitals, general examination and systemic examination.

Approximately 2 ml of blood was withdrawn from peripheral vein with aseptic precautions and collected in the EDTA and PLAIN Vacuette, before starting phototherapy. Hematological parameters like CBC, Reticulocyte count, G6PD, and serum bilirubin were estimated. Simultaneously the TCB was measured on sternum using Drager jaundice meter JM 105.

Neonates were kept under double surface phototherapy with blue and white light with 40-50 flux, for continuous 12 hours. A patch of skin over the sternum was shielded using an electrode.

A repeat TSB and TCB assessment was done 12 hours after the initiation of phototherapy on shielded skin area. The TSB and TCB was recorded within 15 minutes of each other.

The skin integrity was assessed with the neonatal skin condition score (NSCS) before and after the application of the skin patch.

Statistical Analysis

196 neonates were enrolled during our study period and analysed.

After data collection, all the data were entered in MS EXCEL spread sheet and analysed with the help of OPEN EPI and SPSS V.20.

1. Qualitative data explained with the help of frequency and percentage.
2. Quantitative data explained with the help of mean and SD.
3. Bar diagram and Pie chart used to explain qualitative variable
4. Significance of difference between variable explained with paired T test
5. Correlation between variable explained with Pearson’s correlation.
6. P value less than 0.05 was considered as significant and r used to explain co relation coefficient.

Observations & Results

The study included 196 preterm neonates. the baseline characteristics are shown in TABLE 1.

Table 1: Baseline characteristics of study population

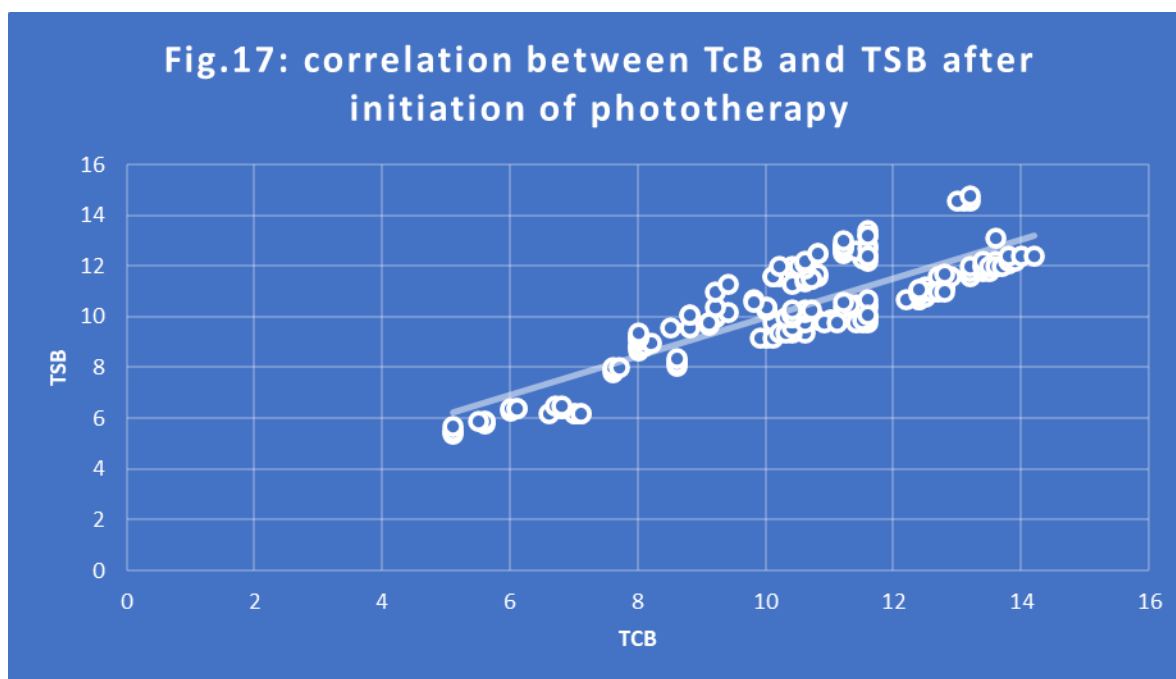
Characteristics	
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Male (n)	112
Female (n)	84
*Birth weight (g)	1884(498)
Normal vaginal delivery (n)	116
Cesarean Section (n)	80
Neonates with postnatal age <72 hour (n)	124
Neonates with postnatal age >72 hour (n)	72
New-born with 28-32 GA (n)	79
New-born with 33-36 GA (n)	117
*TCB after initiation of PT	10.54(2.22)
*TSB after initiation of PT	10.40(2)

*Values are expressed in Mean (standard deviation) ; TCB: Trans cutaneous bilirubin; PT: Phototherapy; TSB: Total serum bilirubin

Table 2 : Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TcB) 12 hour after initiation of phototherapy

Variable	r value	P value
TCB	0.8505	<0.001
TSB		



As above table correlation coefficient r was 0.8505 high positive (negative) correlation between TcB and TSB after initiation of phototherapy. P value was <0.001 which was statistically significant. Thus, in present study

TcB estimated at sternum correlated significantly with TSB 12 hour after initiation phototherapy over patched sternal area.

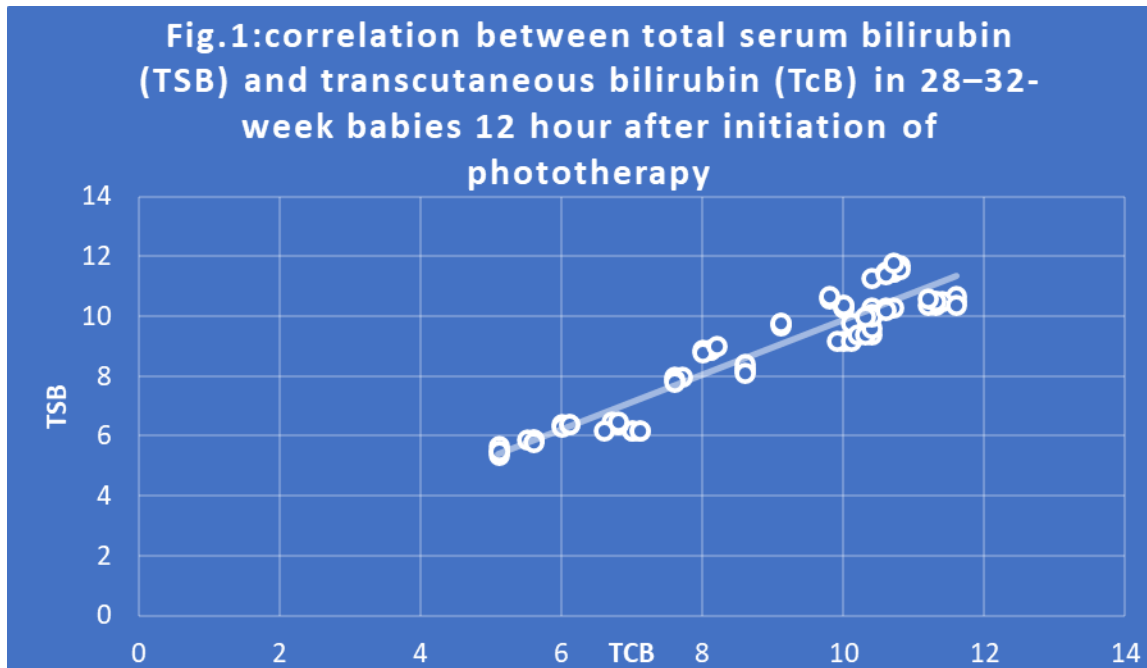
Table 3: Comparison between total serum bilirubin (TSB) and transcutaneous bilirubin (TcB) before initiation of phototherapy (PT) and 12 hours after initiation of phototherapy (PT).

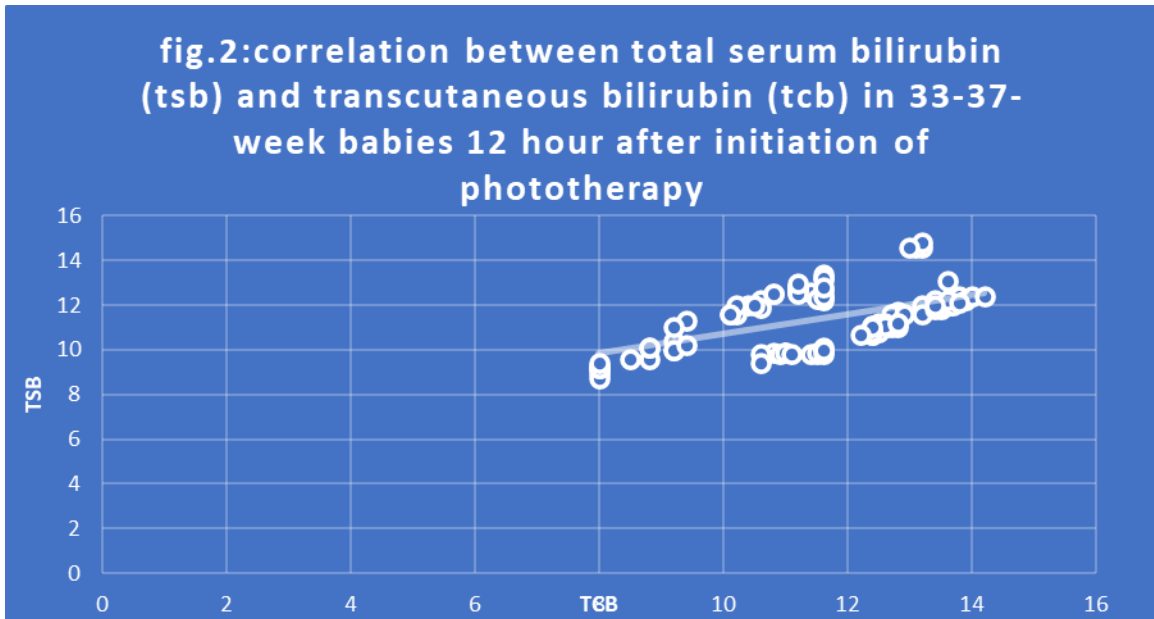
Variable		Mean ±SD	P value
TcB	Before PT	13.70±2.42	<0.001
	After PT	10.54±2.22	
TSB	Before PT	13.84±2.30	<0.001
	After PT	10.40±2.00	

Mean difference between TSB and TcB before initiation of phototherapy was 0.14 mg/dl and mean difference between TSB and TcB after initiation PT was 0.13 mg/dl. Changes in TcB and TSB before PT and 12 hours after initiation of PT were statistically significant.

Table 4: Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TcB) in 28–32-week babies and 33-36 weeks babies 12 hour after initiation of phototherapy

Gestation week	Variable	r value	P value
28-32 week	TcB	0.9463	<0.001
	TSB		
33-36 week	TcB	0.5441	<0.001
	TSB		

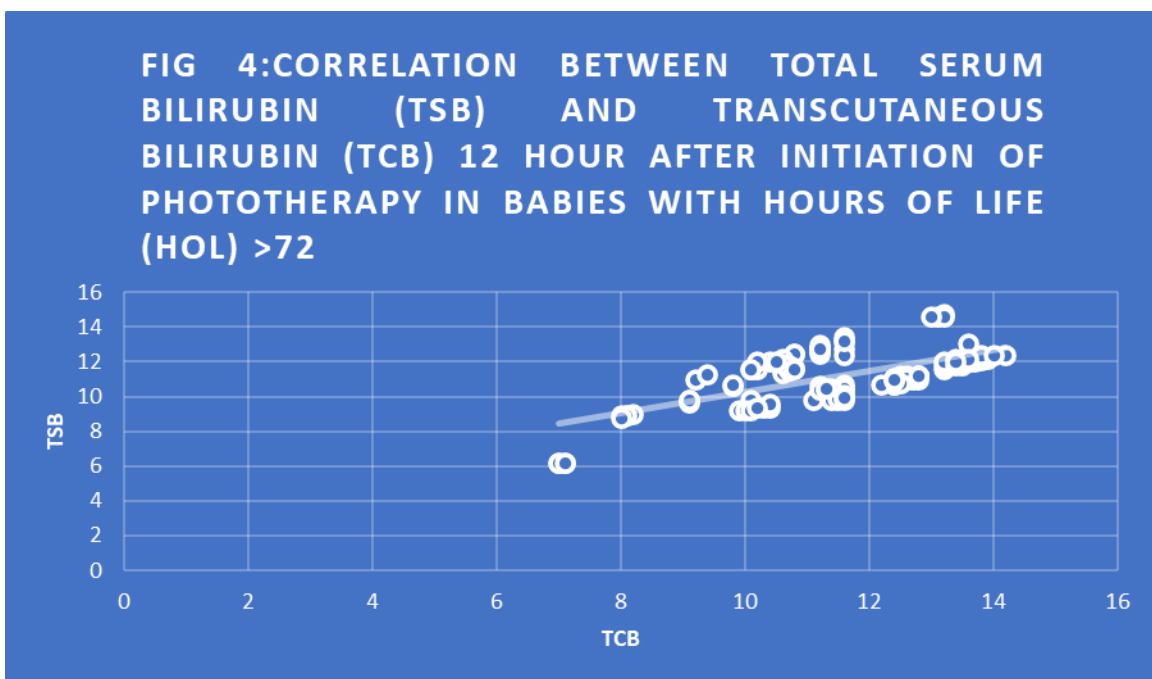
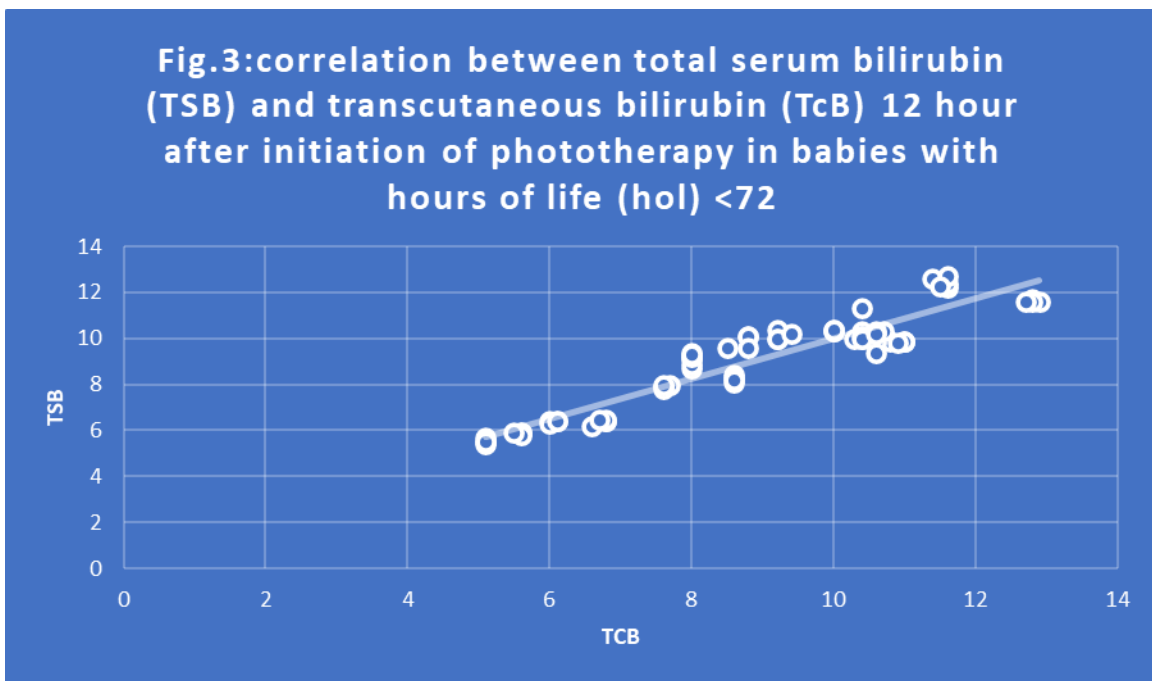




The correlation was better between TSB and TcB for neonates between 28-32 week than those between 33-36 weeks gestation groups after initiation of PT.

Table 5: Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TcB) 12 hour after initiation of phototherapy in babies with postnatal age <72 hours and babies with postnatal age >72 hours at the time of presentation of hyperbilirubinemia.

Postnatal age	Variable	r value	P value
<72 hours	TcB	0.9377	<0.001
	TSB		
>72 hours	TcB	0.6563	<0.001
	TSB		



Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TCB) after initiation of phototherapy in babies with hours of life (HOL) <72 is better than babies with >72 HOL at the time of presentation of hyperbilirubinemia.

Discussion And Conclusion

The present study was observational prospective study conducted in 196 patients of neonatal jaundice to compare the TcB and TSB in preterm neonates before and after initiation of phototherapy and to

compare TcB and TSB after initiation of phototherapy according to gestational age (28-32 vs. 33-36 weeks) and postnatal age (<72 vs. >72 hours) in neonates at tertiary care hospital.

Mean age of the neonates at the time of presentation of jaundice was 98.8 ± 38 hours. There were 63.26% patients in <72 hours of postnatal age and 36.73% of patients with >72 hours of postnatal age at the time of presentation of jaundice.

Majority of patients (57.2%) were males (n=112), while remaining 42.8% patients were females (n=84) with M: F ratio-1.33:1

Majority of neonates 59.18% were delivered by NVD and 40.81% were delivered by LSCS.

Mean birth weight of the patients was $1889 \pm (498)$ gm with (41.83%) neonates were more than 2 kg, followed by less than 1.5 kg (30.1%), 1.5-2 kg (28%).

Majority of neonates (59.69%) were between (33 to 36 weeks) and 40.30% were preterm neonates (28-32 weeks).

Majority of mother had blood group O (54.59%) followed by Blood group B (22.95%) and blood group A (19.38%) and blood group AB (3.06%).

Majority of babies had blood group B (36.73%) followed by Blood group A (29.59%) and blood group O (22.95%) and blood group AB (10.71%).

Correlation coefficient r was 0.8505 high positive (negative) between TcB and TSB after initiation of phototherapy. P value was <0.001 which was statistically significant. Thus, in present study TcB estimated at sternum correlated significantly with TSB 12 hour after initiation phototherapy over patched sternal area

Correlation coefficient r was 0.9463 very high positive (negative) between TcB and TSB 12 hour after initiation of phototherapy in 28-32 week of gestation which was statistically significant.

Correlation coefficient r was 0.5441 moderate positive (negative) between TcB and TSB 12 hour after phototherapy in 33-36 week of gestation which was statistically significant.

The correlation was better between TSB and TcB for neonates between 28-32 week than those between 33-36 weeks gestation groups after initiation of PT.

Correlation coefficient r was 0.9377 very high positive (negative) between TcB and TSB after initiation of phototherapy in babies with postnatal age <72 hours at the time of presentation of

hyperbilirubinemia which was statistically significant.

Correlation coefficient r was 0.6563 moderate positive (negative) correlation between TCB and TSB after initiation of phototherapy in babies with postnatal age >72 hours at the time of presentation of hyperbilirubinemia which was statistically significant.

Thus Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TCB) after initiation of phototherapy in babies with hours of life (HOL) <72 is better than babies with >72 HOL at the time of presentation of hyperbilirubinemia

This study showed a positive correlation between TSB and TCB in preterm neonates before and 12 hour after initiation of phototherapy. Many studies like A pendse et al(5) Syamal et al (6) N sajjandian et al (7) T jegathesan et al (8) demonstrated good correlation between TSB and TCB in preterm neonates.

Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TCB) in 28–32-week is better compared to 33–36-week babies after initiation of phototherapy in presence study and in A pendse et al (5) study. This difference could be explained by the skin immaturity of very preterm neonates.

Correlation between total serum bilirubin (TSB) and transcutaneous bilirubin (TCB) after initiation of phototherapy in babies with hours of life (HOL) <72 is better than babies with >72 HOL at the time of presentation of hyperbilirubinemia in our study and in A pendse et al (5) study. This could be explained by the skin pigmentation increase with age, correlation begins to decline.

None of the neonates has evidence of loss of skin integrity as assessed by NSCS.

This study has major implication for developing countries where the rate of prematurity is high. Necessitating prolonged NICU admission, phlebotomy losses and unavailability of micro methods for bilirubin estimation in most laboratories.

This study lack of comparison with other sites like forehead and intra-scapular area. Also, serial TcB measurement from the patched site after starting PT could have been a better guide to evaluate the trend in correlation during the course of PT.

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