

**A Hospital Based Observational Study to Correlate Serum Bilirubin Level by Transcutaneous Blood and Conventional Blood Sample****Rupesh Kumar<sup>1</sup>, Juli<sup>2</sup>, Akhilesh Kumar<sup>3</sup>**<sup>1</sup>Senior Consultant, Department of Neonatology, Yashvi Children Hospital, Patna, Bihar, India<sup>2</sup>Senior Resident, Department of Pathology, Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India<sup>3</sup>Assistant Professor, Department of Microbiology, RDJM Medical College and Hospital, Turki, Muzaffarpur, Bihar, India

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Conflict of interest: Nil

**Abstract:****Aim:** The aim of the present study was to correlate serum bilirubin level by transcutaneous blood and conventional blood sample.**Material & Methods:** In this cross-sectional study, a total of 100 full term normal neonates delivered in hospital over a period of two years were included in Department of Neonatology. Patients were included in the study after taking the voluntary informed consent of their parents.**Results:** In current study, distribution of newborns showed more number of males 65 (65%) and term 94 (94%) newborns with jaundice. The mean and the standard deviation for TSB and TcB at Forehead were 12.78±4.26, 13.17±4.66 respectively, p<0.5. Correlation coefficient 'r' was 0.7332 which shows a positive correlation between the TSB and TcB at Forehead. The mean and the standard deviation for TSB and TcB at sternum were 12.76±4.24, 13.12±4.96 respectively. The p value was significant being <0.5. Correlation coefficient 'r' was 0.7184 which shows a positive correlation between the TSB and TcB at sternum.**Conclusion:** The present study concluded that the transcutaneous bilirubin measured at forehead and sternum correlated very well with serum bilirubin hence can be used very widely to screen all the newborns before discharge. Our study also showed that the values at forehead correlated better than at sternum. Hence transcutaneous bilirubinometry can be used to screen all the newborns in a bigger way.**Keywords:** Neonatal Hyperbilirubinemia, Serum Bilirubin Level, Transcutaneous Blood, Conventional Blood.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Neonatal hyperbilirubinaemia is a common occurrence [1] but relatively few affected infants require intervention. Hyperbilirubinemia is common during the neonatal period and sometime requires treatment with either phototherapy or exchange transfusion. 2 Clinical evaluation of hyperbilirubinaemia involves visual inspection of the skin, sclera and mucous membranes to identify jaundice.[2] Management of neonatal hyperbilirubinemia becomes more challenging when at-risk newborn infants are discharged early without appropriate post discharge follow-up. This increases the risk of severe hyperbilirubinemia and its complications such as acute bilirubin encephalopathy, and bilirubin-induced neurologic dysfunction (BIND) in these infants.[3] Various methods have therefore been developed to aid non-invasive diagnosis of hyperbilirubinaemia and approximation of TSB levels. They include cephalocaudal staging of jaundice and transcutaneous bilirubin (TcB) reference devices.

Transcutaneous bilirubin (TcB) measurement is an easy, painless, and timesaving alternative to TSB measurement.[4,5] Transcutaneous bilirubinometry (TcB) is an alternative to TSB which would be useful in blood sampling for a frequent and usually benign clinical condition.[6] TcB measurement is an essential part of screening for neonatal jaundice that can decrease the need for TSB. [7,8]

Total serum bilirubin is commonly determined by spectro-photometric methods by analyzing serum sample requiring drawing of blood causing pain and trauma to the neonate. Total serum bilirubin (TSB) is fundamentally measured by venous blood sampling which increases the risk of infection, produces pain in the infant as well as anxiety to the parents, and takes 2 to 12 hours to report become available. Transcutaneous bilirubinometer allows a quick noninvasive estimate of bilirubin concentration to be used as an aid for the management of jaundice in infants. [9]

Bilirubinometers work by directing light into the skin of the neonate and measuring the intensity of specific wavelength that is returned. Neonatal hyperbilirubinemia is a very common entity and requires screening of all babies at discharge by traditional serum bilirubin which is cumbersome, hence the objective of this study was to see whether Transcutaneous bilirubin can correlate with serum bilirubin and can replace it.[10]

Hence the present study was conducted to correlate serum bilirubin level by transcutaneous blood and conventional blood sample.

### Materials & Methods

In this cross-sectional study, a total of 100 full term normal neonates delivered in hospital over a period of two years were included in Department of Neonatology, Yashvi Children Hospital, Patna, Bihar, India. Patients were included in the study after taking the voluntary informed consent of their parents. The random selection of the cases who met the inclusion criteria were done by tossing a coin. If the head comes, then that participant was included in the study. Both the genders were included in the study.

### Inclusion Criteria

- All full term normal newborn babies delivered in hospital

### Exclusion Criteria

- Babies with haemolytic disorders like Rh iso-immunization and ABO incompatibility.
- Preterm and IUGR babies.
- Babies of mother with bad obstetric history.

### Methodology

All the participant's parents were also informed about the study procedure and the information required from them for the study. A voluntary informed written consent was taken from the participant's parents those who consented were included in the study. Umbilical cord mixed blood samples was collected in a sterile container drawn from placental side of the umbilical cord incised while severing it at the time of birth of the baby. The mother's age, parity, residence, community, blood pressure, diabetes, use of iodine antiseptics on the mother prior to delivery will be recorded. The type of medications/anesthesia given including doses used, duration of anesthesia given to the mother till birth of the baby were recorded. At birth, the babies weight, sex, time to first cry, congenital abnormalities, Apgar scores was noted. Bilirubin was estimated within 24 hours by laboratory investigation, again blood sample was collected in sterile container on day 3, day 5 and day 7 by all aseptic means and serum bilirubin of particular day was also recorded by noninvasive hand held Trans-cutaneous bilirubinometer from Drager JM-103 for the comparison with its lab value.

**Statistical Analysis:** Data management and analysis was done using Microsoft excel and Epi-info software. The categorical variables were assessed using Pearson Chi-square. Sensitivity, specificity, positive predictive value, negative predictive value was assessed and the study subjects were compared using suitable statistical tests.

### Results

**Table 1: Distribution of newborns**

Sex	N (%)	Gestational age	N (%)
Males	65 (65)	Term	94 (94)
Females	35 (35)	Preterm	6 (6)
Total	100 (100)	Total	100 (100)

In current study, distribution of newborns showed a greater number of males 65 (65%) and term 94 (94%) newborns with jaundice.

**Table 2: Correlation of serum bilirubin and transcutaneous bilirubin (forehead)**

Parameters	Mean	SD	Paired t-value	P value	Correlation coefficient 'r'
TSB	12.78	4.26	2.812	0.0058	0.7332
TcB at forehead	13.17	4.66			

The mean and the standard deviation for TSB and TcB at Forehead were 12.78±4.26, 13.17±4.66 respectively, p<0.5. Correlation coefficient 'r' was 0.7332 which shows a positive correlation between the TSB and TcB at Forehead.

**Table 3: Correlation of serum bilirubin and transcutaneous bilirubin (sternum)**

Parameters	Mean	SD	Paired t-value	P value	Correlation coefficient 'r'
TSB	12.76	4.24	2.182	0.0272	0.7184
TcB at sternum	13.12	4.96			

The mean and the standard deviation for TSB and TcB at sternum were 12.76±4.24, 13.12±4.96

respectively. The p value was significant being <0.5. Correlation coefficient 'r' was 0.7184 which

shows a positive correlation between the TSB and TcB at sternum.

### Discussion

Hyperbilirubinemia is very common in neonates and, in many, a benign problem. Jaundice is observed in the 1st week of life in around 60% of term infants and 80% of preterm newborns. The yellow color usually is a result from the accumulation of unconjugated bilirubin pigment in the skin.<sup>11</sup> Jaundice is visible at a serum bilirubin level of 5 to 7 mg/dl. Jaundice usually appears in a cephalocaudal direction. Dermal pressure reveals the progression of jaundice (face, approximately 5 mg/dl; mid-abdomen, 15 mg/dl; soles, 20 mg/dl), but clinical examination cannot reliably estimate serum bilirubin levels. Noninvasive tests for transcutaneous bilirubin measurement that correlate with serum bilirubin levels may be used to screen newborns, but testing of serum bilirubin level is indicated in patients with elevated transcutaneous bilirubin levels, progressive jaundice, or risk of hemolysis or sepsis. The National institute for health and clinical excellence neonatal jaundice guidelines recommend measurement of serum bilirubin levels in all newborns with visible jaundice. The gold standard is total serum bilirubin (TSB). [12]

According to AAP (American academy of pediatrics), pre-discharge serum bilirubin assessments are required in order to prevent kernicterus. Transcutaneous bilirubinometry (TcB) is an alternative to TSB which would be useful in blood sampling for a frequent and usually benign clinical condition. [13] A noninvasive bilirubinometer (TcBM), that measures transcutaneous bilirubin levels, was developed by Minolta Camera Company, Ltd. [14] Total serum bilirubin is commonly determined by spectrophotometric methods by analyzing serum sample requiring drawing of blood causing pain and trauma to the neonate. Bilirubinometers work by directing light into the skin of the neonate and measuring the intensity of specific wavelength that is returned. The meter analyzes the spectrum of optical signal reflected from the neonate's subcutaneous tissues which are converted to electrical signal by a photocell. Signals are analyzed by a microprocessor to get a serum bilirubin value. The skin components, which impart the spectral reflectance, are melanin, dermal maturity, haemoglobin and bilirubin. [15] They permit rapid measurements but do not provide fractionation information. [16] In current study, distribution of newborns showed more number of males 65 (65%) and term 94 (94%) newborns with jaundice were found in study by Tiwari et al which showed 102 (59%) males and 70 (41%) females. [17,18] Karen et al found that, out of 150 newborns 99 (66%) were term and 51 (34%) were preterm.<sup>18</sup>

Results were similar in a study by Shah et al out of 430 newborns, 250 (59%) were term and 180 (41%) were preterm. [19]

The mean and the standard deviation for TSB and TcB at Forehead were 12.78±4.26, 13.17±4.66 respectively,  $p < 0.5$ . Correlation coefficient 'r' was 0.7332 which shows a positive correlation between the TSB and TcB at Forehead. The mean and the standard deviation for TSB and TcB at sternum were 12.76±4.24, 13.12±4.96 respectively. The p value was significant being  $< 0.5$ . Correlation coefficient 'r' was 0.7184 which shows a positive correlation between the TSB and TcB at sternum. Similar results were found in study conducted by Tiwari et al where coefficient correlation was found to be 0.8 but our study measured the TcB at two different sites.<sup>17</sup> These observations are similar to results found by Shah et al<sup>19</sup> which also showed a strong correlation between plasma and mean transcutaneous bilirubin measurement ( $CV=0.49$ ,  $r=0.8599$ ,  $p < 0.001$ ). Panburana et al showed that the TcB and TSB had linear correlation with significant correlation coefficient ( $r=0.81$ ,  $p < 0.001$ ). [20]

### Conclusion

The present study concluded that the transcutaneous bilirubin measured at forehead and sternum correlated very well with serum bilirubin hence can be used very widely to screen all the newborns before discharge. Our study

also showed that the values at forehead correlated better than at sternum. Hence transcutaneous bilirubinometry can be used to screen all the newborns in a bigger way.

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