

**Assessing Bilirubin Measures: Serum Vs Transcutaneous in Neonates****Mithila Das Mazumder<sup>1</sup>, Joy D'souza<sup>2</sup>**<sup>1</sup>Assistant Professor, Department of Paediatrics, Vydehi Institute of Medical Science and Research Centre, Bangalore, Karnataka, India<sup>2</sup>Professor, Department of Paediatrics, Vydehi Institute of Medical Science and Research Centre, Bangalore, Karnataka, India

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Conflict of interest: Nil

**Abstract:**

**Background:** Neonatal Icterus in newborns is a serious condition. It's one of the most common reasons of infant immaturity. The total investigation of complete serum bilirubin (TSB) is a widely known procedure for identifying hyperbilirubinemia, but it is intrusive for neonates. TCB (TCB) was used to assess bilirubin levels since over 2 decades as just a non-invasive and painless method. Acute bilirubin encephalopathy, commonly referred as kernicterus, is indeed a bilirubin toxicity which is linked to significant morbidity and mortality. The focus of this research is and sees if there was a relationship among subcutaneous bilirubin levels and serum total bilirubin in normal babies with jaundice. The aim of this exercise would be to see how helpful a TCB metre would be the therapy of physical icterus.

**Methods:** This observation is a cross-sectional study was done with healthy Babies delivered and admitted to the inpatient postnatal ward of the division of paediatrics in during the study (January 2015 May 2016), Vydehi Institute of Medical Sciences and Research Centre, Bangalore). 300 Samples collected during the study period will be considered for the study, satisfying inclusion and exclusion criteria. The gestational age of the baby will be assessed according to the Expanded Ballard Score within 24hrs of birth. Babies in the postnatal ward satisfying the inclusion and exclusion criteria will be identified. TCB meter on the forehead and sternum on the newborn will be done within 10 minutes of blood collection for serum bilirubin determination, which will be done at around 72 hours as pre-discharge screening.

**Results:** There appears to be a strong link between TCB measurements and liver tests and Total serum bilirubin measurement. The serum bilirubin mean +/- SD is 12.19 +/-3.52. For both the forehead and breast bone the mean +/- SD for TCB were 10.33 +/- 3.34 and 12.40 +/-3.44, accordingly. As contrasted to a forehead, the standard error of a sternum as just a monitoring site in this research has the strongest relationship of 0.90 (p0.001) to serum bilirubin level.

**Conclusion:** The study clearly demonstrates that perhaps the QTCB measurements and TSB measure using Transcutaneous Icterus metre MBJ20 get a significant correlation. As per the research, the sternum relates more to serum bilirubin levels than that of the forehead whenever the site is considered. TCB could be used for recording pre-discharge bilirubin levels (screening tool) and also can be used to make a rapid decision on phototherapy and duration of service.

**Keywords:** Hyperbilirubinemia, New born TCB, Total serum bilirubin.

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**Introduction**

Neonatal Icterus in newborns are a major issue. Acute bilirubin encephalopathy, also referred as kernicterus, is a major bilirubin poisoning that causes significant mortality rates.

Unconjugated bilirubin has indeed been shown to pass its Barrier between both the bloodstream, producing encephalopathy with in short term as well as the possibility of choreathetoid cerebral palsy as well as other complications with in long term.[1] Phototherapy and interchange transfusions are the mainstay in avoiding bilirubin

encephalopathy, and they've been the subject of extensive study over the last 60-70 years. The visual assessment of icterus was imprecise.[2] However, in the clinical laboratory, determining serum bilirubin levels necessitates the collection of numerous specimens from healthy newborns. For the neonates and its parents, collecting blood samples is indeed a traumatic and painful experience.

A faulty collection technique can induce haemolysis throughout the specimen, interfering

with detection of serum bilirubin. A TCB metre could be used judiciously to lessen the symptoms of plasma sampling.[3] The readings from the a TCB metre were instantaneous and non-invasive. The reliability of the TCB metre is shaped by a range of variables, including gestational age, colour of skin, ethnicity, race, phototherapy, as well as the severity of jaundice.

Although many improvements are made with transcutaneous technology, there is still so much debate about its efficacy in detecting neonatal jaundice.[4] On the baby who's already begun phototherapy, TCB concentrations are erroneous. TcB levels measurements might be accurate phototherapy whenever a patch cover (photo opacity) is being applies to a skin of an infant (usually found on the brow) while light therapy are being received by the baby. The TCB known features are performed on tissue which has not been handled. Because of so many differences, each therapeutic decision is based on transcutaneous tendency instead of a target element.[5]

A TCB metre could be incredibly beneficial in healthcare where serum bilirubin level results are accessible at a time more than 6 hours. Preventing kernicterus in matured or later premature newborns is really a major concern in premature infants.[6] Members of an American Academy of Paediatrics Committee on Hyperbilirubinemia recommended that almost all babies be screened for neonatal icterus prior release using a serum bilirubin level or even a TCB assessment to help identify substantial hyperbilirubinemia earlier.[7]

Because QTCB testing offers a quick, non-invasive opportunity to verify for hyperbilirubinemia, it may be a promising modality. Occurs more commonly on the very same infant were simple to perform. Moreover, instead of waiting for such a serum bilirubin level to just be confirmed in a laboratory, which really is time-consuming. Results are quick and instantaneous in the TCB meter.

### Methodology

This Cross-sectional observational study was done with healthy Babies delivered and admitted to the inpatient postnatal ward of during the research study (January 2015 May 2016), the department of paediatrics at Vydehi Institute of Medical Sciences and Research Center in Bangalore.

The study will analyse 300 samples taken and during course of the study that satisfy the inclusion and exclusion criteria. Within 24 hours after birth, the baby's gestation would be determined using the Expanded Ballard Score. Infants that meet the inclusion and exclusion criteria throughout the postnatal ward would be identified.

After 10 minutes of blood collection for serum bilirubin determination on the newborn's forehead

and breast bone transcutaneous bilirubinometry on the newborn's forehead and sternum would be performed as a pre-discharge screen.

**Inclusion criteria:** Any term neonates having physiological jaundice, that is defined by Krammer scale as just a yellowish discoloration of a skin. Only breastfed neonates were included in research. Physiological icterus were checked and documented after 72 hours.

**Exclusion criteria:** A newborn who is suffering from Sepsis, congenital malformations, pathological jaundice, and conjugated hyperbilirubinemia are all terms that can be used to describe sepsis.

The 37-week gestation period has come to an end. A neonate weighed just under 1800 grams. Phototherapy/exchange transfusions were performed to go with a newborn. All healthy newborns delivered and admitted in the postnatal ward in the department of paediatrics, records of which were maintained in a registration book which would specify the identification and time of birth and date of birth of the baby. The gestational age of the baby was assessed according to the Expanded Ballard Score within 24hrs of birth. Babies in the postnatal ward satisfying the inclusion and exclusion criteria were identified.

A TCB meter on the forehead and sternum on the newborn was done within 10 minutes of blood collection for serum bilirubin determination, which will be done at around 72 hours as a pre-discharge screening. The BILIPROBE, MBJ20 subcutaneous icterus detector gadget were used throughout the study., spectrum splitter., NFM switch, pattern recognition, controlled spectrum filter and Filter optics methods are used for the creation of a MBJ20 Transcutaneous icterus detector. It integrates various wavelengths ranging from 450nm and 550nm, to penetrate in the different layers of skin.

The Diazo method has been used to measure serum bilirubin also in biochemistry lab. The Institutional Ethics Committee provided its permission to a research.

### Statistical Methods

STATA 11.2 has been used to perform the statistical study (college station TX USA). Receiver The optimal cut-off, sensitive, specific, positive predicting values, and negatives predictive value was established utilizing operating curves for Bilirubin IXa levels, breast bone and forehead lesion score to determine if phototherapy is required or otherwise.

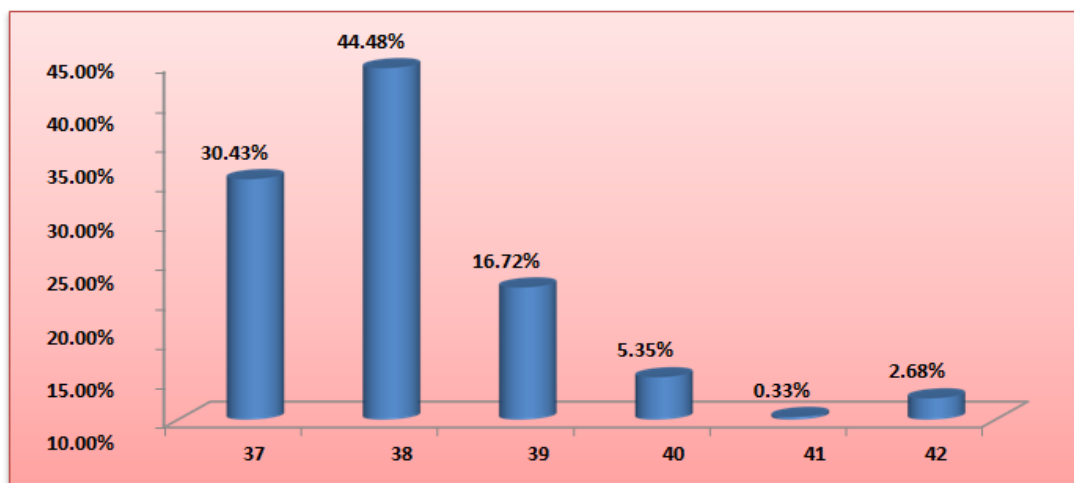
The correlation coefficient of pearson has been used to Examine the sternum's link with the frontal, the forehead's relationship with serum bilirubin,

and bilirubin levels' association with the sternum. Statistical result is defined as a P0.05 level.

**Results**

In maximum, 620 neonates was evaluated throughout the study, including 498 babies were evaluated for potential. Inclusion criteria, a total of

299 newborns were ultimately enrolled in the research. Criterion for expulsion (birth weight 1800 gram, sepsis, an unwell infant, rh compatibility, light therapy, congenital malformation, etc.) led to a exclusion of 180 neonates from of the research. Another 19 neonatal complaints unanswered. all of infants throughout the research was breastfed.



**Graph: 1 Showing Distribution of Cases According to Gestational Age**

**Table 1: Mean and Standard Deviation as Per the QTcB and Serum Bilirubin**

	Mean	SD	Min – Max
Forehead	10.33	3.34	0.5 – 16.8
Sternum	12.40	3.44	3.1 – 22.0
Serum Bilirubin	12.19	3.52	3.19 – 25.0

Table 1 showed the mean +/-SD for transcutaneous bilirubin for forehead and sternum was 10.33 +/-3.34, and 12.40 +/- 3.44 respectively. The above table summarizes the mean and standard deviation of the QTcB with the serum bilirubin levels.

**Table 2: Depicting the Distribution of Neonates Based on Growth Percentile Curve**

	Number of Cases	Percentage
AGA	273	91.30%
LGA	7	2.34%
SGA	19	6.35%
Total	299	100%

In table no 2 Most of the enrolled neonates was appropriate for gestational age, 273(91.30%).

**Table 3: Correlation between the Forehead, Sternum, and Serum Bilirubin**

	Correlation	P-value
Forehead with sternum	0.78	<0.001
Forehead with serum Bilirubin	0.71	<0.001
Serum Bilirubin with Sternum	0.90	<0.001

In table no 3: The correlation of coefficient of the sternum as a site of measurement in this study has the highest correlation of 0.90 (p<0.001) compared to the forehead with the serum bilirubin levels.

**Table 4: The Underlying the Sensitivity and Specificity**

	Forehead	Sternum	Serum Bilirubin
Sensitivity (%)	77.65	88.24	88.25
Specificity (%)	64.02	71.03	84.58
Positive predicted value (%)	45.83	54.74	69.44
Negative predicted value (%)	87.74	93.83	94.76
Cut off	10.60	12.53	12.81

Table: 4 We also assessed the sensitivity and specificity of QTcB measurements in correlation to forehead and sternum to the serum bilirubin levels along with the positive predictive value and negative predictive value.

**Table: 5 Receiver Operating Characteristic (Roc) Curves for Prediction of Serum Bilirubin and Transcutaneous Bilirubin with Cut off Index**

	ROC	95% C.I
Forehead	82.25%	76.17% - 87.78%
Sternum	89.60%	85.30% - 93.89%
Serum Bilirubin	93.67%	90.21% - 97.12%

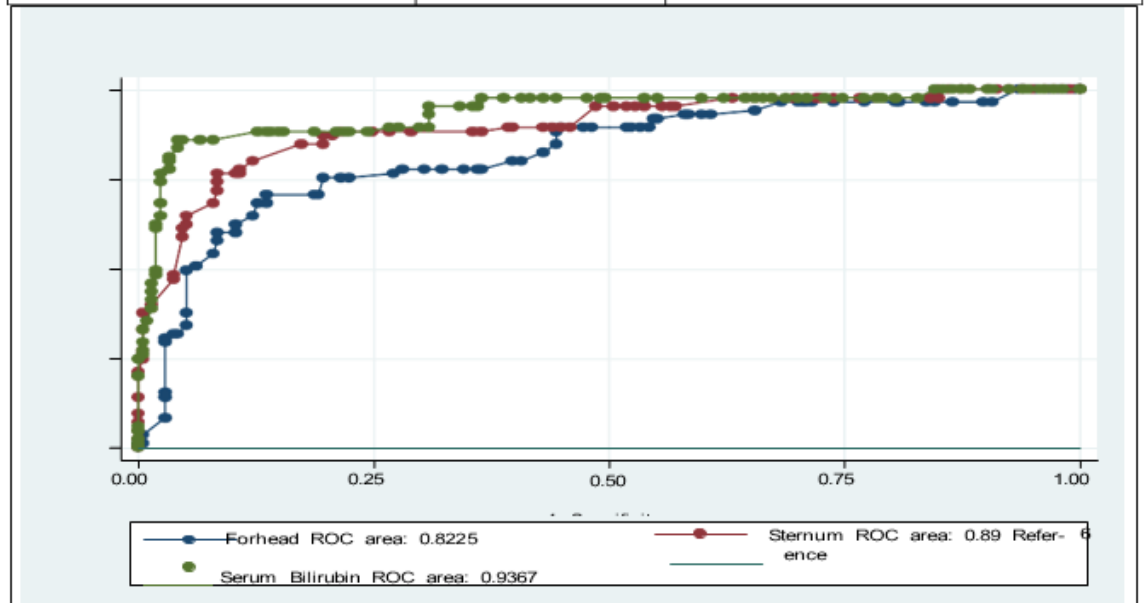
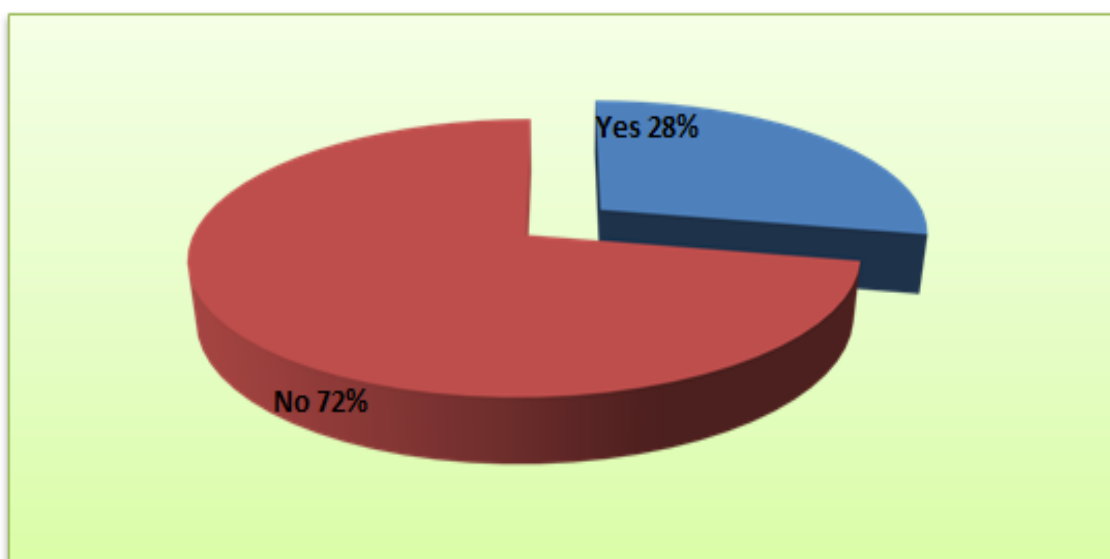


Table: 5 With the Receiver Operative Curve, the area under the curve for both sites forehead and sternum with serum bilirubin were comparable. The cut-off values for sternum and forehead and serum bilirubin respectively is 10.60, 12.53, 12.81, with the sensitivity of 77.65%, 88.24%, and 88.25%. The specificity for the above was 64.02%, 71.03%, and 84.5% for the forehead, sternum, and serum bilirubin respectively.



**Graph 2: Pie Chart Showing the Number of Babies Requiring Phototherapy**

**Graph 2:** Transcutaneous bilirubinometry been found being an effective method for screening

neonates for physiologic icterus because it is a noninvasive its rapid method to retrieve bilirubin,

reducing the duration the babies spend inside the hospitals. It also was found that perhaps the QTcB could be used to precisely recognise whether an infant need phototherapy or is ready to be discharged. According to the results of an above study, 85 of a 299 babies needed phototherapy and needed a lengthier hospital stays, whereas the other infants was prepared to release and then were released after 75 hours.

### Discussion

So because mother and newborn were discharged from hospital so soon, neonatologists and paediatricians are much more worried regarding kernicterus and bilirubin encephalopathy. Limiting adequate monitoring of jaundice. The ability to identify the bilirubin level as well as its increment in first 73 hours after delivery that used a non-invasive, painless, and reliable method might be vital in reducing kernicterus.[9] The study's main objective is to understand the relation among multiple comparisons of subcutaneous bilirubin levels and serum bilirubin concentrations for neonates at 72 hours of existence.[10]

The correlation coefficient of 0.71 ( $p < 0.001$ ) discovered in this study was higher than that seen in other studies, although the standard error of a chest (sternum) QTcB of 0.90 was lower ( $p < 0.001$ ) is comparable to Leucine MI et al observations, 's and over sternum 0.79 to 0.92 ( $p < 0.001$ ) has also been summed up originally all throughout manuscripts.[10] The discrepancy throughout the frontal and overall blood serum bilirubin correlation has been attributable that perhaps the frontal is constantly subjected to artificial light, leading in findings which vary from baby to baby. The findings are comparable to that of this study; Other studies using various TcBmetres had showed significant differences in TSB and QTcB evaluated and over frontal and breast, with both the brow and chest QTcB likely to overestimate the TSB. The origin is unclear, it could be linked to exposure to light to a frontal and a lack of fat deposits throughout the sternal area.[11]

As per the results of the study, the TcBmetre helped with reaching a quick choice about whether or not to start phototherapy. The dilemma in the early discharge of the newborn baby has been there for ages given neonatal jaundice, TcBmeter allows quick, noninvasive techniques to screen the neonates at 72hrs, for neonatal jaundice.[12]

Numerous research findings and has shown a strong correlation among QTcB and TSB tiers utilising multiple tools available in the Market, as well as the American Academy of Pediatrics advises pre-discharge QTcB quantification as being one of the criteria for estimating the likelihood of developing or not continuing to develop hyperbilirubinemia afterward on[13]. In

such a prospective cohort, Samar Net. al found that a combination QTcB and gestational age enhanced the prediction accuracy of As just a result of rising blood bilirubin levels, the AAP's light therapy therapeutic limitation would have to be exceed.[14]

The demographics in the individuals were characteristic of neonatal physiological jaundice, also with majority of a neonates only being 37 weeks old and breastfed. Our study which was undertaken has some strengths and limitations, among the strengths which include that the study has included an entire population of term normal neonates admitted in the Vydehi hospital during the study period.[15] During the period of the study, our quality monitor showed more than 75% of the neonates had been discharged before 78hrs. Similar to the finding of Sathish Mishra et.al we found that simply. Whenever the pre-discharge QTcB measurements are combined with both newborn's gestation as well as the chance of developing hyperbilirubinemia, the chance of serious hyperbilirubinemia is correctly predicted.

When only breast-fed babies were included in study, the outcomes were slightly better, but just not substantially significant. Pre-discharge screenings does have the ability to reduce a need for unnecessary procedures and also the inappropriate need for light therapy, as shown throughout the previous.[16,17] More testing and therapy puts the mother-baby bond in danger and interrupts feeding. The estimated  $r$  is driven by the fact that many of the neonates had 2 QTcB reading until being released from hospital.[18-20]

### Conclusion

The visual evaluation of icterus and hyperbilirubinemia used to have a meaningful correlation. TCB is a much more efficient detection tool than visual assessment simply if used in conjunction with that as well. TCB is a non-invasive, rapid, and safe test for predicting neonatal hyperbilirubinemia, which significantly reduces use of invasive TSB tests in monitoring. The study clearly demonstrates that perhaps the QTcB measurement and The TSB evaluation with both the MJB20 Transcutaneous Icterus metre does have a good correlation. As per the research, the sternum relates more to serum bilirubin levels than that of the frontal whenever the location is considered. Transcutaneous bilirubinometry could be used as a screening tool to capture which was before bilirubin levels and also can be used to make a fast decision on light therapy and duration of service.

### The Institutional Ethical Committee Approved The Ethical Committee's Approval.

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