

Original Research Article

Relationship of transcutaneous bilirubin with serum bilirubin in neonates with jaundice

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ABSTRACT

Background: Neonatal hyperbilirubinemia is a common problem in neonates with an incidence of about 60% in term babies and 80% in preterm babies. It is the commonest cause of admission to the hospitals in the newborn period. Studies comparing the correlation between total serum bilirubin (SBR) and transcutaneous bilirubin (TcB) have yielded different results. So, we planned this study to find out relationship between TcB and SBR values.

Methods: A hospital based prospective study was done during March 2016 to September 2016, in which a total of 120 newborns including term and preterm who were admitted with neonatal jaundice in NICU, Maharana Bhupal Hospital, Udaipur, Rajasthan were assessed in terms of age, sex and weight and investigated for both TcB and SBR. The sample size was calculated at a confidence interval of 90% and allowable error of 15%.

Results: Out of total 120 study subjects, 59 (49%) were males and 61 (51%) were females, out of which 53 (44%) were preterm and 67 (56%) were term neonates. Mean TcB and SBR values at the time of admission has a mean difference of 2.52 mg/dl with a p-value <0.001 (significant) on the other hand TcB and SBR at 24 hr of admission has a mean difference of 1.57 with a p-value >0.001, which is non-significant. TcB and SBR at 48 and 72 hr of admission also has a mean difference which is also non-significant (p >0.001).

Conclusions: From present study, we conclude that there is no significant difference between TcB and SBR values at 24, 48 and 72 hrs after starting phototherapy. The values of TcB are equally reliable as SBR values.

Keywords: Hyperbilirubinemia, Jaundice, Serum bilirubin, Transcutaneous bilirubin

INTRODUCTION

Neonatal hyperbilirubinemia is a common problem in neonates with an incidence of about 60% in term babies and 80% in preterm babies. It is the commonest cause of admission to the hospitals in the newborn period.¹ Clinically it becomes apparent when the serum bilirubin exceeds 7 mg/dl in neonates.² In most of the cases, it is benign and no intervention is required. Approximately 5-10 % of them have clinically significant hyperbilirubinemia mandating the use of phototherapy.^{3,4}

In recent decades, noninvasive bilirubin measurements have been presented for reducing patients stress, laboratory expenses, and the need for blood sampling. One of these noninvasive methods is transcutaneous bilirubinometry (TcB).

Studies comparing the correlation between total serum bilirubin (SBR) and TcB have yielded different results. So, we planned this study to find out relationship between TcB and SBR values.

METHODS

A hospital based prospective study was done during March 2016 to September 2016 at NICU, Maharana Bhupal Hospital, Udaipur, Rajasthan, India. In this study, a total of 120 newborns both term and preterm were included whose TcB at the time of examination were found to be more than 70th percentile of the SBR level recommended for phototherapy according to Bhutani hour specific bilirubin Nomogram.⁵ All the neonates were enquired about age in hours, gender, weight, gestational age, blood group of both mother and baby and details were entered in to predesigned proforma after taking informed consent from the parents of the babies. Neonates with hemolysis, sepsis, cardiac and pulmonary diseases, raised direct bilirubin and ABO and Rh incompatibility were excluded.

Blood sample was taken from peripheral vein for assessment of SBR and blood group at the time of admission. SBR was measured using spectrophotometry and a 2*2 size thick adhesive bandage was applied on the upper part of sternum over the skin and then neonates were started on double surface phototherapy. These neonates were followed up after 24 and 48 hours of starting phototherapy, to record any change in TcB and SBR values. The repeat TcB was recorded at the sternum where adhesive bandage was applied before.

For recording TcB we used Drager jaundice meter (JM-103), it works 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. These optical signals are converted to electrical signal by a photocell. These are analyzed by a microprocessor to generate a serum bilirubin value.

Sample size was reduced to n=80 at 24 hr, n=65 at 48 hr, n=21 at 72 hr and n=2 at 96 hr since the time of admission. Reason for this was that the phototherapy was stopped for some neonates whose SBR values were below the cut off values for phototherapy.

Statistical analysis

The sample size was calculated at a Confidence interval (CI) of 90% and allowable error of 15%. The permission was taken from the Medical Ethical Committee. The results were then formulated and analyzed using standard software of biostatics (SPSS version 21) using the suitable statistical tests for statistical significance.

RESULTS

Out of total 120 study subjects, 59 (49%) were males and 61 (51%) were females, out of which 53 (44%) were preterm and 67 (56%) were term neonates. The mean age of the icteric subjects was found to be 68.31 ± 29.5 hours. The average weight of the study subjects was 2.20 ± 0.6 kg.

The mean TcB by bilirubinometer was 16.07 ± 3.0 mg/dl and the mean SBR by spectrophotometry was 12.93 ± 3.1 mg/dl.

Table 1: Distribution of study population.

	Male	Female	Total
Preterm	24	29	53
Term	35	32	67
Total	59	61	120

Table 2: Mean variables of study group.

Mean variables	
Mean age (hrs)	68.31 ± 29.5
Mean weight (kg)	2.20 ± 0.6
Mean TcB (mg/dl)	16.07 ± 3.0
Mean SBR(mg/dl)	12.93 ± 3.1

Table 3: Comparison of various characteristics between term and preterm neonates.

	Preterm	Term
Age (hrs)	67.35 ± 22.0	69.52 ± 37.2
Weight (kg)	1.67 ± 0.3	2.61 ± 0.4
TcB(mg/dl)	14.88 ± 3.5	17.02 ± 2.5
SBR (mg/dl)	11.38 ± 3.3	14.15 ± 2.3

Table 4: TcB and SBR values at different time interval.

Parameters	Mean	SD	Mean difference	P value
TCB at admission (n=120)	15.97	3.51	2.52	<0.001
SBR at admission (n=120)	13.45	3.61		
TCB at 24 hrs (n=80)	14.04	4.13	1.57	0.070
SBR at 24 hrs (n=80)	12.46	2.83		
TCB at 48 hrs (n=65)	16.07	2.38	1.45	0.068
SBR at 48 hrs (n=65)	14.06	2.72		
TCB at 72 hrs (n=21)	14.50	0.707	0.845	0.729
SBR at 72 hrs (n=21)	13.66	1.93		
TCB at 96 hrs (n=2)	15.00	**	1.94	**
SBR at 96 hrs (n=2)	13.06	**		

**Values not calculated due to sample size was very small, n= 2

Mean TcB of preterm neonates was 14.88 mg/dl and Mean SBR was 11.38 mg/dl in comparison to term neonates where it was 17.02 mg/dl, and 14.15 mg/dl respectively.

Table 4 shows various values of TcB and SBR at different time period after starting phototherapy. Mean TcB and SBR values at the time of admission has a mean difference of 2.52 with a p value <0.001 (significant) on the other hand TcB and SBR at 24hr after admission has a mean difference of 1.57 with a p value >0.001, which is non-significant. TcB and SBR at 48 and 72 hr after phototherapy also has a mean difference which is also non-significant (p>0.001).

DISCUSSION

In this hospital based prospective study we found out that the mean difference between TcB and SBR values is non-significant (p>0.001) at 24, 48 and 72 hrs after starting phototherapy on the other hand the mean difference at the time of admission was significant (p<0.001).

Briscoe and colleagues found a relatively high correlation between SBR and TcB; while Janjindamai and colleagues did not find a clear relationship between the results of the two measurements.^{6,7} In the former study, the researchers have mentioned that TcB is as accurate as SBR and can replace it.⁷ Karon et al showed that TcB is a sensitive but nonspecific method for predicting the risk of neonatal icterus.⁸

For the better treatment of neonatal jaundice, measuring bilirubin levels is vital; which is usually done by visual, cutaneous, and serum evaluations.⁹ Although visual assessment is simple, it has two major shortcomings; it is dependent on the physician's experience with no accurate and reliable criteria, and possible estimations in this method are based on the cephalocaudal trend of jaundice. Moreover, the color of skin and clothes as well as the lighting affect visual estimation.⁹⁻¹¹

In cutaneous method, the bilirubinometer is pressed against the skin causing pallor, and bilirubin levels are measured in different ways using light waves.^{12,13} Cutaneous method of measurement of bilirubin level is fast, simple, less time consuming and reduces patients stress from repeated blood sampling.

Total serum bilirubin (SBR) measurement is also not an ideal method of measurement because it could have complications such as infection, anemia, pain, and stress because of frequent blood sampling. Moreover, this method is stressful, time consuming and expensive.¹

CONCLUSION

From present study, it can be concluded that there is no significant difference between TcB and SBR values at 24, 48 and 72 hrs after starting phototherapy. The values of

TcB is equally reliable as SBR values and TcB values can be used for follow up of neonates receiving phototherapy for hyperbilirubinemia.

Recommendations

On the basis of current study, we recommend that TcB should be used for estimation of bilirubin values instead of repeated blood sampling in neonates receiving phototherapy for hyperbilirubinemia.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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