



COMPARING PRE AND POST PHOTOTHERAPY VALUES OF TRANSCUTANEOUS BILIRUBIN LEVELS AND TOTAL SERUM BILIRUBIN LEVELS IN TERM INFANTS WITH NEONATAL HYPERBILIRUBINEMIA

Neonatology

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ABSTRACT

BACKGROUND: This is a prospective observational study to compare pre and post phototherapy values of Trans-cutaneous Bilirubinometer(TcB) levels and Total Serum Bilirubin(TSB) in term infants with neonatal Hyperbilirubinemia in a Tertiary care centre.

METHODS: All term new-born babies with Period of Gestation >37 weeks are included in our study. This is a prospective observational study carried out in neonatal division of a tertiary hospital. The pre and post transcutaneous bilirubin values of neonates who received phototherapy were recorded and compared to the standard Serum Bilirubin values.

RESULTS: In our investigation, it was found that rebound hyperbilirubinemia does not significantly differ between 2 groups, as phototherapy stopped at serum bilirubin ranges of 1- 2.9 mg/dl and ≥ 3 mg/dl below its level under which, phototherapy initiated. There was a strong correlation in our study 44.9% of infants are born via Normal Vaginal Delivery and 54% via Caesarian section. majority of the Child 38(38.8%) are B+ Blood Group, 22(22.4%) are O+ Blood group, 22(22.4%) of Child are A+ and O+ Blood Group equally, 13(13.3%) of Child are AB+ Blood Group and 3(3.1%) of Child are B- Blood Group. Rh Status, 97(99.0%) of respondents having Positive remaining only one respondent belonging into negative group. ABO Status, 82(83.7%) of respondents responded negative, whereas the remaining 16 (16.3%) respondents responded belonging into present group. DCT, 96(98.0%) of respondents having Positive remaining only two respondents belonging into negative group. There is a positive correlation between TcB values before and after phototherapy.

CONCLUSION: Neonatal Hyperbilirubinemia is a fairly common condition in newborns with mostly with recovery. But in few cases where the Serum bilirubin value measurement is not feasible

KEYWORDS

Jaundice, neonatal hyperbilirubinemia, phototherapy, kernicterus.

INTRODUCTION:

Neonatal hyperbilirubinemia is seen in about 50 -60 % of the healthy newborns from Day 2-4 of life'. Although in most newborns' bilirubin levels do not rise to an extent requiring treatment, but in some infants with exaggerated physiological jaundice, the levels may rise high enough to cause acute bilirubin encephalopathy. Acute Bilirubin Encephalopathy in the neonatal period is a major cause of permanent disability². Effective screening and surveillance are essential in the new-born period to enable timely management. Non-invasive transcutaneous bilirubin devices have been successfully used for screening in many settings³. To prevent bilirubin induced brain injury in the newborn, repeated blood withdrawals are necessary to ascertain bilirubin levels and institute care. Noninvasive, painless and bloodless screening using transcutaneous bilirubinometer is advocated as a screening test for unconjugated hyperbilirubinemia in the newborns so as to identify newborns who require further serum testing of bilirubin. However, after placing the neonate under phototherapy, transcutaneous assessment of bilirubin levels is no longer as accurate on account of bleaching of the skin due to phototherapy⁴. Therefore, after the patient is placed under phototherapy, further decisions like duration of phototherapy and cessation of treatment will be dictated by frequent blood sampling in the neonate which is not desirable. Placing a small photo opaque patch which would prevent bleaching of the skin in the covered area seems to be an exciting possibility with which noninvasive bilirubin assessment can continue to be as accurate and an effective tool in guiding further therapy thereby reducing the amount of blood sampling in the neonate⁵. Our present investigation intends to evaluate pre and post-phototherapy values observed from transcutaneous bilirubin levels and also from total levels of serum bilirubin in term infants along with neonatal hyperbilirubinemia.

AIMS AND OBJECTIVES:

To compare the Bilirubin levels as assessed by transcutaneous bilirubinometer vs Serum Bilirubin in term neonates with neonatal hyperbilirubinemia before and after phototherapy.

OBJECTIVES

- To take phototherapy based treatment decisions for neonates with hyperbilirubinemia
- To evaluate bilirubin levels via transcutaneous bilirubinometer and compare with serum bilirubin levels of in term neonatal groups with neonatal hyperbilirubinemia

- To determine the statistical outcomes achieved from bilirubin levels via transcutaneous bilirubinometer Vs serum bilirubin levels estimated in the pre and post phototherapy period among neonates

Study method :

Hundred healthy term neonates with neonatal hyperbilirubinemia requiring phototherapy will form the subjects of the study . The neonates who have significant hyperbilirubinemia on visual assessment will be subjected for screening with transcutaneous bilirubinometer , Draeger JM-105 placed on the sternum . Those neonates whose transcutaneous bilirubin levels are found to be more than 95th centile as per Maisel's nomogram [appx A] , will be subjected to a serum bilirubin assessment . If the Serum levels fall within the prescribed range for phototherapy , then the patient will be placed under Lullaby LED Phototherapy System by GE healthcare with following specifications:

- Wavelength range 400 - 550 nm.
- Spectral irradiance:
- High Irradiance Mode: 45 μ W/ cm²/nm at a distance of 35 cm from the light unit
- Low Irradiance Mode: 22 μ W/ cm²/nm at a distance of 35 cm from the light unit

Prior to placing under phototherapy a 3MM ECG electrode [appx B] surrounded by aluminium foil will be placed over the sternum. Ten to fourteen hours through phototherapy, a repeat assessment of bilirubin levels by transcutaneous method will be done at the site where the photo opaque patch is placed and at an uncovered site , 1 cm adjacent to it . A serum bilirubin sample will be sent at the same time . Result will be collated as TcB and Serum bilirubin levels before phototherapy , TcB at photopaque site , TcB at uncovered site and serum bilirubin levels ten to fourteen hrs through phototherapy . No additional blood investigations will be done for the purpose of the study. As the invasive blood sampling is done as a part of treatment of the jaundiced neonate, the latter will not need to be subjected to any additional blood test

Study population: Neonates gestational age group ≥ 35 weeks with signs of neonatal hyperbilirubinemia that meets up with the AAP guidelines pertaining to PT.

INCLUSION CRITERIA:

1. Neonates who exhibit age ≥ 35 weeks,
2. Neonates birth wt > 1.8 kg,
3. Neonates needing PT under initial duration,
4. Babies with jaundice onset ≤ 7 days.

EXCLUSION CRITERIA:

- Neonates planned with an immediate exchange in the transfusion within the admission time.

Methodology:

Investigation approved as per that of Institutional Human ethics Committee and prospectively were registered in response to the CTRI. In regards to the study population which is comprised with neonates with the gestational age greater or equivalent with that of 35 weeks in case of neonatal hyperbilirubinemia as it meets that of AAP guidelines for PT as it were contacted for the investigation. Neonates comprised with exclusion criteria considered in case of excluding in the study.

Randomization were done via variable block randomisation. From the Randomisation details appeared to be concealed with sequentially numbered, sealed, opaque, envelope.

Data comprising of birth weight, gender, gestational age, history of jaundice in siblings, maternal blood group, presence of scalp hematoma, breast feeding, and excessive weight loss collected from case report form (CRF).

Statistical methods:

The statistical method involves entering the values of TcB and TSB before initiating phototherapy and comparing it with post Phototherapy values of TSB and dual readings of TcB at the photopaque sit and site exposed. These values are then entered in excel sheet. The software used is SSPS 2016. Descriptive statistics were presented in the form of propotions and percentage for categorical variables and mean and Standard deviation for continuous variables.

Relevant bar diagrams are made to show the proportion between two variables. Paired T test and correlations between samples taken are evaluated and conclusions were drawn.

RESULTS AND OBSERVATION:

Table: 01

Paired Samples Statistics(before phototherapy)	Mean	N	Std. Deviation	Std. Error Mean	
Pair 1	Before-TcB	14.31	98	2.275	0.229
	After-TCB at site of Photopatch	11.74	98	1.761	0.177
Pair 2	Before-TcB	14.31	98	2.275	0.229
	After-TCB 2.5 cm away for the site of Photopatch	7.04	98	1.555	0.157

From the paired sample statistics table, it provides pre and post measurement of mean and standard deviation values for the given Before TcB and After TcB group.

Table: 02

Paired Samples Correlations (before phototherapy)	N	Correlation	Sig.
Pair 1	Before-TcB and After-TCB at site of Photopatch	98	0.492 <0.001
Pair 2	Before-TcB and After-TCB 2.5 cm away for the site of Photopatch	98	0.442 <0.001

From the above correlation table, the r value is 0.492 and 0.442 and the significant value is <0.001 which shows there is positive correlation relationship between the before and after TcB.

Table: 03

	Paired Differences	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	difference	Significance
					Lower	Upper			
					Pair 1	Before-TcB - After-TCB at site of Photopatch			
Pair 2	Before-TcB - After-TCB 2.5 cm away for the site of Photopatch	7.272	2.114	0.213	6.848	7.696	34.053	97	<0.001

From the above paired sample test, the t value is $t(97)=12.220$ and $t(97)=34.053$ and the significant value is <0.001 which is less than 0.05 at 95% level of confidence interval for the Pair Before-TcB - After-

TCB at site of Photo patch and Before-TcB - After-TCB 2.5 cm away for the site of Photo patch respectively. Therefore, it shows there is significant relationship between the pre and post test variables.

Table:04

Paired Samples Statistics(serum Bilirubin)	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Before-TSB	12.212	98	2.855
	After-TSB	9.962	98	2.029

From the paired sample statistics table, it provides pre and post measurement of mean and standard deviation values for the given

Before TSB and After TSB group.

Table:05

Paired Samples Correlations	N	Correlation	Sig.
Pair 1	Before-TSB and After-TSB	98	0.501 <0.001

Table:06

	Paired Differences	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
					Pair 1	Before-TSB - After-TSB			

From the above correlation table, the r value is 0.501 and the significant value is <0.001 which shows there is positive correlation relationship between the before and after TSB.

DISCUSSION:

In the current study mean weight was 2.643 ± 0.522 . similarly, Pendse et al.6 reported mean weight of 1.680 ± 0.633 . Tan et al.7 reported a mean weight of 3.237 ± 0.425 . Chakrabarti et al.8 reported mean weight of 2.846 ± 0.454 . Other study done by Cucuy et al.9 showed mean weight of 1.637 ± 0.430 . Rai et al.10 reported mean weight of 3.100 ± 0.561 and Conceição et al.11 reported mean weight of 3.22 ± 0.402 respectively.

From the above paired sample test, the t value is $t(97)=8.761$ and the significant value is <0.001 which is less than 0.05 at 95% level of confidence interval for the Pair Before-TSB - After-TSB, Therefore it shows there is significant relationship between the pre and post test variables

The mean TcB values before initiating phototherapy was 14.312,27. Similarly, in Alsaedi et al.¹² the mean TcB values before initiating phototherapy 10.752.43. Study done by Pendse et al.¹³ the mean TcB values before initiating phototherapy was 13.033.83. Tan et al.⁷ the mean TcB values before initiating phototherapy was 12.612.84. Varughese et al.¹⁴ the mean TcB values before initiating phototherapy was 07.741.42. Chakrabarti et al.⁸ the mean TcB values before initiating phototherapy was 16.222.31. Cucuy et al.⁹ the mean TcB values before initiating phototherapy was 07.852.80.

From the above table, the mean TcB values after completion of phototherapy measured at photopatch site is 11.741.76. Study done by Pendse et al.¹³ the mean TcB values after completion of phototherapy measured at photopatch site is 10.982.65. Tan et al.⁷ the mean TcB values after completion of phototherapy measured at photopatch site is 10.211.4. Varughese et al.¹⁴ the mean TcB values after completion of phototherapy measured at photopatch site is 09.672.81. Chakrabarti et al.¹⁴ the mean TcB values after completion of phototherapy measured at photopatch site is 09.672.81. Cucuy et al.⁹ the mean TcB values after completion of phototherapy measured at photopatch site is 05.983.00.

The above table shows the paired sample correlation which shows positive correlation in this study. This study showed a r value of 0.442 with p values of <0.001. There is also significant positive correlation from study Varughese et al.¹⁴ with r value of 0.957 with p value <0.001. Tan et al.⁷ had a r value of 0.800 with p value of <0.001. Alsaedi et al.⁹¹ had a r value of 0.821 with p<0.001. Chakrabarti et al.⁸ had a r value of 0.395 with p value <0.001. Cucuy et al.⁹ had a r value of 0.884 with p value of <0.001.

CONCLUSION:

Unconjugated neonatal hyperbilirubinemia is commonly seen in (preterm) infants and may result in permanent brain damage. Nevertheless, its pathogenesis is complex and still not fully elucidated. Although our understanding of this disease has vastly increased over the years, the translation of this knowledge to clinical care and new treatments has been limited. The success of phototherapy and the lack of accurate tools to quantify bilirubin-induced neurotoxicity has created an attitude of satisfaction and relaxation towards the current neonatal hyperbilirubinemia management, whereas improvements can certainly be made. Current management guidelines are based on TSB levels, whereas TSB is a poor predictor of bilirubin-induced neurotoxicity. Finally, in this thesis we emphasize the importance of intestinal bilirubin metabolism and its potentially underestimated role in neonatal hyperbilirubinemia. Further research should elucidate the exact mechanisms of intestinal bilirubin handling. Unravelling these mechanisms could open up an array of new therapeutic strategies for unconjugated hyperbilirubinemia, for neonates. Although the “yellow brick road” of hyperbilirubinemia research has been walked by many researchers, with this thesis we believe to have extended the road a bit further towards better understanding and treatment of neonatal hyperbilirubinemia and eventually better care for preterm jaundiced neonates.

Conflict of interest: none

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