

## Efficacy of Conventional Single Phototherapy in the Management of Neonatal Hyperbilirubinemia

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Neonatal hyperbilirubinemia is a cause of major concern due to risk of neurotoxicity. To determine the efficacy of conventional single phototherapy on neonatal hyperbilirubinemia this observational study was conducted in the neonatal unit of Rangpur Medical College Hospital during April 2014 to September 2014. Seventy neonates both term and preterm with jaundice were enrolled into the study and grouped into three categories by birth weight (NBW, LBW and VLBW). All subjects were assigned to conventional single phototherapy. Total, direct and indirect serum bilirubin were estimated on day of commencement of phototherapy and every 24 hours until total serum bilirubin reached below the level at which phototherapy was no longer required. Results were analyzed statistically by paired student t' test and z' test. Mean age of 70 neonates was 45.56±5.52 hours. Majority of newborn, 35 (50 %) were NBW followed by low birth weight and very low birth weight respectively. Neonatal sepsis was the predominant cause of hyperbilirubinemia followed by jaundice of prematurity and perinatal asphyxia. Significant fall in total serum bilirubin after phototherapy was observed among all three groups, more in NBW subjects from 17.4±2.4 mg/dl before phototherapy to 12.3±1.9 mg/dl after phototherapy (p<0.05). In all three categories, decrement rate of serum bilirubin per day was significant, more marked 3.5±1.6 mg/dl in NBW subjects. Conventional single phototherapy reduces total serum bilirubin and shortens length of hospital stay effectively.

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**Key words:** Phototherapy, Hyperbilirubinemia. NBW (Normal Birth Weight), LBW (Low Birth Weight), VLBW (Very Low Birth Weight).

### Introduction

Neonatal jaundice is a common health problem affecting two-thirds of healthy term newborn and 80% preterm in the first few weeks of life.<sup>1</sup> Jaundice may not appear until serum bilirubin exceeds 5-7 mg/dl.<sup>2</sup> Approximately 5-10% neonates develop clinically significant

hyperbilirubinemia mandating the use of phototherapy.<sup>3</sup> Overall incidence of neonatal jaundice as reported by various Indian authors varies from 54.6% to 77%.<sup>4</sup> Hyperbilirubinemia with irrespective of causative factor with indirect bilirubin 20mg or more produce neurological signs and

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symptoms in newborn.<sup>5</sup> Kernicterus, a serious complication of hyperbilirubinemia develops at indirect bilirubin 20mg or more and can cause cerebral dysfunction leading to permanent crippling or even death.<sup>2,3</sup> The use of phototherapy for the prevention as well as control of neonatal hyperbilirubinemia has been wide throughout the world. Phototherapy reduces the need of hazardous exchange transfusion. However, use of phototherapy does not obviate the need for exchange transfusion in severe Rh hemolytic disease.<sup>6</sup> Phototherapy is less effective if jaundice is due to hemolysis or cholestasis. American Academy of Pediatrics (AAP) has recommended a guideline for phototherapy in term and near term baby.<sup>7</sup> For preterm and VLBW infants guideline for phototherapy is not so vivid for lack of data.<sup>3</sup>

One of the most conservative and least costly measure is single conventional phototherapy. Much of the evidence in support of effectiveness of single conventional phototherapy to reduce neonatal hyperbilirubinemia has been documented in several recent prospective studies<sup>1,2</sup>.

## Methods

This observational study was conducted at the Neonatal ward of the department of Paediatrics of Rangpur Medical College Hospital, Rangpur for duration of 6 months during April 2014 to September 2014. A total of 70 neonates diagnosed as neonatal jaundice were included with the inclusions criteria viz neonates (aged 2-14days), total serum bilirubin more than 10 gm/dl in preterm baby, total serum bilirubin more than 12 gm/dl in term baby. Exclusion criteria were conjugated hyperbilirubinemia, Preterm extreme low birth weight baby (wt.<1000gm), blood group incompatibility(Rh and ABO), very sick neonates, jaundice on first day of life, serum bilirubin reaching critical level of exchange transfusion, patients unwilling to be enrolled

into the study. Main outcome variables were rate of decrease of total serum bilirubin level, duration of phototherapy, length of hospital stay. Just before commencement of phototherapy, 2cc venous blood was collected in a test tube covered with dark paper which was sent to the laboratory for estimation of serum bilirubin (total, direct & indirect). Total serum bilirubin was measured by an analyzer every 24 hours until it came down to the level below which phototherapy was no longer required. Conventional single phototherapy was selected upon availability of the device in neonatal unit. "B 100 infant phototherapy unit" which fulfills the criteria of conventional single phototherapy was used to ensure phototherapy. Phototherapy was initiated according to the guideline of American Academy of Paediatrics. Those neonates demonstrating critical level serum bilirubin requiring exchange transfusion despite phototherapy were excluded from the study. Data was analyzed by computer with the help of SPSS software (Statistical package for social science) Version 17.0 Statistical analysis were performed by paired students 't' test two sample 'z' test. P value <0.05 was considered as significant.

## Results

In this study total 70 neonates were included. Of them neonates older than 72 hours of age outnumbered the age group 0-72 hours (Table-I), Percentage distribution of 70 neonates according to birth weight revealed majority of newborn 35(50%) were NBW followed by low birth weight 25(35.7%) and very low birth weight 10 (14.3 %) respectively (Figure-I), Causes of neonatal hyperbilirubinemia were neonatal sepsis 28(40%), jaundice of prematurity 21 (30%), perinatal asphyxia 18 (25.7%) and infant of diabetic mother 3(4.3%) respectively (Figure-2). Table II shows TSB level in initial sample by birth weight. Total serum bilirubin level declined significantly in all age group of

neonates after phototherapy (Table-III). Mean duration of phototherapy was significantly low in NBW followed by LBW and VLBW respectively (Table-IV). Length of hospital stay was significantly low in NBW group followed by LBW and VLBW respectively (Table-V).

Table I: Age distribution of enrolled neonates (n=70)

Age in hours	Number of Patients	%	Mean±SD
0-72	4	5.7	45.5±5.5
72-168	66	94.2	

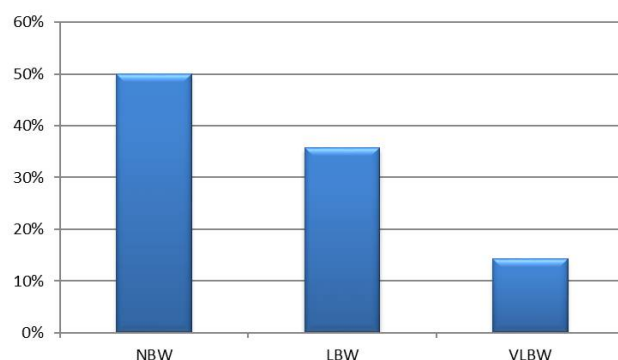


Figure I. Percentage distribution of 70 neonates according to birth weight

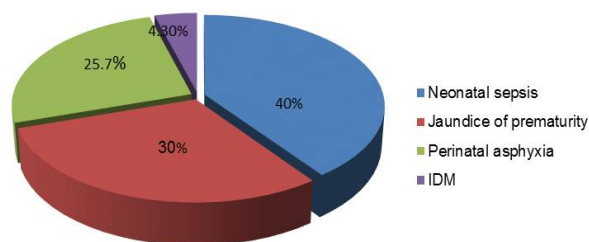


Figure 2. Percentage distribution of causes of hyperbilirubinemia

Table II: TSB level in initial sample by birth weight

TSB range (mg/dl)	NBW (n=35)	LBW(n=25)	VLBW(n=10)
10-14	4(11.4%)	13(52%)	5(50%)
14-18	15(42.4%)	12(48%)	5(50%)
18-22	16(45.7%)	00	00

TSB= Total serum bilirubin.

Table III: Decline in TSB level in different categories of birth weight

Category of birth weight	Total Serum Bilirubin (mg/dl)		Probability
	Before PT	After PT	
NBW	17.4±2.4	12.3±1.9	S† (p<0.05)
LBW	14.2±1.3	9.9±1.1	S† (p<0.05)
VLBW	13.97±1.05	9.13±0.46	S† (p<0.05)

PT= Phototherapy, S= Significant

Table IV: Duration of phototherapy by categories of birth weight (n=70)

Birth weight	Duration (hours)
NBW	33.6±13.9
LBW	42.24±8.3
VLBW	48.0±11.3

Table V: Length of hospital stay by birth weight (n=70)

Birth weight	Length of Stay (days)
NBW	5.8±0.7
LBW	6.3±1.3
VLBW	7.6±1.1

## Discussion

Phototherapy is the standard of care for treatment of neonatal hyperbilirubinemia. In this study mean age of 70 neonate was 45.56±5.52 hours. Of total subjects, 66(94%) neonate were in the age group 3 to 7 days. This is consistent with the study by Paul et

al.<sup>1</sup> In this study number of term neonates were 35(50%) and preterm 35(50%). This is in contrast to observations by Paul et al where percentage of term infants exceeded preterm.<sup>1</sup> Majority of neonates 35(50%) were in the NBW group followed by LBW and VLBW. This corroborates with the studies of other authors.<sup>1,2</sup> Causes of hyperbilirubinemia were neonatal sepsis 28(40%), jaundice of prematurity 21(30%), perinatal asphyxia 18(25.7%) and infants of diabetic mother 3(4.3 %). Percentage of neonatal sepsis was lower and birth asphyxia higher than the study findings by Barua et al.<sup>2</sup> The explanation of increased number asphyxiated newborns is attributed to increased admission load.<sup>1,2,3</sup> Initial mean total serum bilirubin in NBW, LBW & VLBW group was 17.4±2.3 mg/dl, 14.2 ±1.3 mg/dl and 13.97±1.05 respectively. This is similar to the study findings by several authors.<sup>1,2,4,9</sup> In term and preterm neonates initial mean TSB were 17.40 ± 2.40 mg/dl and 14.14 ±1.30 mg/dl respectively. Similar observations were documented by other authors.<sup>1,9</sup> In NBW mean serum bilirubin levels before and after phototherapy was 17.4±2.4 mg/dl and 12.3±1.9 mg/dl respectively. Decrease was significant (p<0.05) when compared between two means. Several studies documented similar observations.<sup>1,2,8</sup> In LBW neonates phototherapy was also effective. In LBW mean serum bilirubin before and after phototherapy were 13.7±1.4 mg/dl and 9.9±1.1 mg/dl respectively which was supported by some studies.<sup>1,2</sup> Several studies demonstrated efficacy of phototherapy in VLBW neonate.<sup>1,2,8,9</sup> In this study mean serum bilirubin levels before and after phototherapy were 13.97±1.05 mg/dl and 9.13±0.46 mg/dl respectively closely similar to previous studies.<sup>1,10</sup> 24 hours decline in bilirubin level was significantly higher in NBW neonates 3.5±1.60 mg/dl followed by VLBW 2.4±0.56 mg/dl and in LBW 2.3±0.95 mg/dl. Decrement was significant in three

groups. Similar decrement was observed by other authors.<sup>2,4</sup> Mean duration of phototherapy in NBW was 33.6±13.9 hours which was lowest followed by LBW 42.24±8.3 hours and VLBW 48.0±11.3 hours respectively. Similar observations were demonstrated in several studies.<sup>1,2</sup> In this study mean length of hospital stay was highest 7.6±1.1 days in VLBW followed by LBW and NBW. This is because the VLBW neonates took longer time for recovery during phototherapy and from primary illness. This is similar to results in a study by Miliyana et al.<sup>11</sup>

### *Conclusion*

Neonates with sepsis, perinatal asphyxia and preterm infants are prone to develop significant hyperbilirubinemia. Results of the present study clearly demonstrate the efficacy of conventional single phototherapy on neonatal hyperbilirubinemia in all categories of birth weight.

### *Limitations of the study*

The effectiveness was not evaluated between two groups of closely matched neonates consisting of healthy and the other group of ill infants. Although age of the study sample was between 0-28 days, majority of the subjects were within 7 days of age. Rebound in bilirubin level after cessation of phototherapy was not measured. Samples were taken by purposive method in which question of personal biasness might arise. Sample size was relatively small.

### *Recommendations*

Conventional single phototherapy is simple, safe and cost effective. Based on the findings this study recommends management of neonatal hyperbilirubinemia with conventional single phototherapy in all tiers of health facility especially in resource limited small hospital settings.

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