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RESEARCH ARTICLE

EFFECT OF WHITE CURTAIN AROUND THE PHOTOTHERAPY UNIT ON HYPERBILIRUBINEMIA IN FULL TERM NEONATES

[1]Ms. Divya R Nair and *,[2]Dr. Vetriselvi, P.

[1]Second year MSc Nursing, College of Nursing, JIPMER, Puducherry
[2]Assistant Professor, College of Nursing, JIPMER, Puducherry

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ABSTRACT

Background and Objective: Hyperbilirubinemia is a disorder, which is manifested by yellow discoloration of tissue and skin of a neonate. Phototherapy is considered as the prime treatment for neonatal jaundice. Phototherapy is used as a treatment modality of neonatal jaundice for more than a century, and it is considered to be easily accessible and causes no harm. Even though conventional phototherapy is used as the method of treatment of hyperbilirubinemia, little is known about the ways to enhance its effect further. If the duration of phototherapy can be reduced by any means this would be very effective not only for the well being of the neonates but also it can reduce the duration of hospital stay, the aim of the study was to assess the effect of white curtain around the phototherapy unit on hyperbilirubinemia in term neonates and to compare with conventional phototherapy units.

Methodology: A randomized controlled trial was used. The neonates included were term neonates with hyperbilirubinemia. Conventional phototherapy with curtains (n=47) were compared with those without curtains (n=47). The main outcomes measured were the duration of phototherapy and the rate of decline of serum bilirubin level. The control group was treated by standard phototherapy without cover around the unit and the experimental group received standard phototherapy with white curtain around the phototherapy unit. After enrollment, the total serum bilirubin was measured every 24 hours for 4 days. The cover was made of white cotton cloth which covered three sides of the phototherapy unit and one side was left uncovered for observing the newborn or for performing procedures. The distance between the infant and the phototherapy lamps was approximately 40cm. For all the infants under study, before starting phototherapy serum bilirubin was measured. While under phototherapy, neonates were left uncovered except for eye pads and diapers. Duration of phototherapy was recorded in hours.

Results: There was no significant difference in the gestational age, birth weight, postnatal age at time of admission, birth weight and blood group of the mother between the two groups. Total serum bilirubin level in the curtained group declined significantly in 24 hours (p=0.00) and 48 hours (p=0.004). However no reduction in serum bilirubin level was noted after 72 hours (p=0.7) and 96 hours (p=0.8) of phototherapy. The duration of phototherapy was reduced in the experimental group (49.5±18.9) when compared to control group (62.8±17.7) (p=0.0007).

Conclusion: White curtain around the phototherapy unit is an effective method in reducing the serum bilirubin level and at the same time it also reduces the duration of phototherapy. This can be used as a cost effect and non invasive method for the treatment of neonates with hyperbilirubinemia. The white curtain when made into practice can serve as a method that will reduce the hospital stay of the neonates thereby reducing the cost of treatment.

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INTRODUCTION

Hyperbilirubinemia is a disorder, which is manifested by yellow discoloration of tissue and skin of a neonate. If the bilirubin level is greater than 5 mg/dl, then it can be determined as hyperbilirubinemia. 60% of full term and 80% of preterm neonates are affected with hyperbilirubinemia. There is more likely chance of serum bilirubin level to be 13mg/dl or more for neonates at 37 week of gestation when compared to those born at 40 weeks of gestation (American Academy of Paediatrics, 1994). Most of the infants with hyperbilirubinemia does not have any major illness, this mostly happens when either the production of bilirubin is high or its excretion is low when compared to that seen in normal neonatal period (physiological). It can also be due to other

***Corresponding author:* Dr. Vetriselvi,**
Assistant Professor, College of Nursing, JIPMER, Puducherry

pathology like septicemia, hemolysis or disorders of metabolism (non physiological). Neonatal hyperbilirubinemia is noted by analyzing skin of the neonate, it is usually presented with icterus sclera and yellow color of the face that extends to the chest. The jaundice is primarily noted in the face and then it extends from head to trunk and finally to the extremities. The serum bilirubin level can be considered as an indicator of neurodevelopmental outcome, on long term basis. Neonatal jaundice is often associated with low birth weight, short gestation, infection and breast feeding. Increased bilirubin level causes damage to central nervous system irrespective of the gestational age. Kernicterus, a complication of neonatal jaundice is rare but it is still occurring. It can be prevented, only by preventing extreme cases of hyperbilirubinemia. Phototherapy is considered as the prime treatment for neonatal jaundice. Phototherapy is used as a treatment modality of neonatal jaundice for more than a century, and it is considered to be easily accessible and causes no harm. Phototherapy means using visible light for treating hyperbilirubinemia in neonates. The mechanism of phototherapy is such that it converts bilirubin to isomers soluble in water which gets eliminated without being conjugated in liver. Phototherapy is used to reduce level of bilirubin irrespective of gestational age or the presence or absence of hemolysis. The effect of phototherapy is measured by intensity and wavelength of the light used, the distance of infant from light and body surface area of the neonate that has been exposed. Neonatal jaundice is one of the major disorder in neonatal setting. Hyperbilirubinemia is the reason for high proportional readmissions in hospitals during the neonatal period. Many anecdotal reports have pointed out concern toward the occurrence of kernicterus and disorders related to neonatal jaundice, of these many can be avoided by new and improvised discharge practices of neonates along with technologies in monitoring and drug therapies. The healthy late preterm and neonates born after 37 weeks of gestation are often discharged early that makes prevention, detection and management of jaundice a major challenge.

Generally hyperbilirubinemia does not cause any harm but can cause serious damage to the brain. This can be avoided by identification of jaundice at an early stage and also with effective use of phototherapy. Phototherapy being one of the oldest method for the treatment of hyperbilirubinemia and is in usage for about 10 years. The complications associated with phototherapy is found to be few or none. So it is widely used. It is recommended by the AAP subcommittee that the nurseries and infant treating areas must have facility to phototherapy. The wide usage of phototherapy has reduced the need for other treatment options like exchange transfusion. Complications associated with neonatal jaundice can be minimized and the effectiveness of phototherapy can be improved by effective nursing care.

MATERIALS AND METHODS

A randomized controlled trial was used to assess the effect of white curtain around the phototherapy unit on hyperbilirubinemia in term neonates and to compare with conventional phototherapy units.

Inclusion Criteria: Included, neonates who had completed gestational age of 37 weeks or more and who were admitted in NICU.

Exclusion Criteria: Neonates with major congenital anomalies, hemolytic disease, on phenobarbital and infection.

Sampling: Simple random sampling technique was used.

Instrument: The data collection proforma consisted clinical characteristics of the neonate. This included the gestational age, postnatal age at the time of admission, weight at the time of admission, maternal blood group, mode of delivery and serum bilirubin level assessment (mg/dl).

Data Collection Procedure: The eligible neonates were identified based on the inclusion criteria. Informed consent was obtained from the parents. Neonates were assigned into two groups, experimental and control, by simple randomization technique. The allocation was done using computer generated random numbers. The control group was treated by standard phototherapy without cover around the unit and the experimental group received standard phototherapy with white curtain around the phototherapy unit. After enrollment, the total serum bilirubin was measured every 24 hours for 4 days. The cover was made of white cotton cloth which covered three sides of the phototherapy unit and one side was left uncovered for observing the newborn or for performing procedures. The distance between the infant and the phototherapy lamps was approximately 40cm. For all the infants under study, before starting phototherapy serum bilirubin was measured. While under phototherapy, neonates were left uncovered except for eye pads and diapers. Duration of phototherapy was recorded in hours.

Ethical Consideration: Permission was obtained from the Institute ethical committee, human studies. Informed consent was obtained from mother of each neonate after a brief explanation regarding the study by the researchers. Confidentiality was maintained and participants were given freedom to leave the study at any time.

Data Analysis: The comparison of clinical characteristics like gender and blood group of mother was done using chi-square and that of post natal age at time of admission, gestational age and birth weight was done using independent student t test. The duration of phototherapy and the rate of decline of bilirubin level between the two groups were calculated using independent student t test.

Table 1. Distribution of study participants in relation to gender

N=94

Gender	Experimental Group		Control Group		p Value*
	N	%	N	%	
Female	22	46.8	27	57.4	0.3
Male	25	53.2	20	42.6	

Table 2. Distribution of study participants in relation to gestational age

N=94

Variables	Group	Mean (SD)	pValue*
Gestational Age (weeks)	Experimental	39.2(1.2)	0.5
	Control	39.1(1.3)	

Table 3. Distribution of study participants in relation to birth weight

N=94

VARIABLES	GROUP	Mean (SD)	p Value*
Birth Weight (grams)	Experimental	2872(463)	0.5
	Control	2911(424)	

Table 4. Distribution of study participants in relation to postnatal age

N=94

VARIABLES	GROUP	Mean (SD)	p Value*
Postnatal Age (days)	Experimental	2.78(0.85)	0.2
	Control	2.61(0.70)	

Table 5. Distribution of study participants in relation to blood group

N=94

Blood Group	Experimental Group		Control Group		p Value*
	N	%	N	%	
O Positive	30	63.8	35	74.5	0.1
A Positive	8	17	3	6.4	
B Positive	9	19.2	6	12.7	
AB Positive	0	0	3	6.4	

Table 6. Distribution of study participants in relation to mode of delivery

N=94

Mode of Delivery	Experimental Group		Control Group		p Value*
	N	%	N	%	
Vaginal Delivery	23	49	19	40.4	0.6
Vacuum Delivery	12	25.6	13	27.7	
Forceps Delivery	6	12.7	5	10.6	
Caesarean Section	6	12.7	10	21.3	

Table 7. Comparison of serum bilirubin levels between experimental and control groups

N = 94

Parameter	Experimental Group		Control Group		p Value
	Mean	Standard Deviation	Mean	Standard Deviation	
Initial TSB	17.1	1.3	17.2	1.3	0.7
TSB after 24 hours of phototherapy	14.4	1.7	15.9	1.6	0.00*
TSB after 48 hours of phototherapy	12.1	2.2	13.5	2.3	0.004*
TSB after 72 hours of phototherapy	12.4	2.1	12.2	1.9	0.7
TSB after 96 hours of phototherapy	10.8	0.6	11.2	0.3	0.8

Table 8. Comparison of Duration of Phototherapy Between Experimental and Control groups

N=94

Parameter	Group	Mean	Standard Deviation	P Value
Duration of phototherapy (hours)	Experimental	49.5	18.9	0.0007***
	Control	62.8	17.7	

RESULTS

- In the present study, the proportion of male were high (53.2%) in the experimental group when compared to females (46.8%). However the proportion of female (57.4%) was high in control group compared to that of males (57.4%).
- On the comparison of neonates on the basis of gestational age, it was found that the mean gestational age was 39.2±1.2 in experimental group when compared to 39.1±1.3 in control group. It was found that neonates are comparable on the basis of gestational age (p=0.5).
- The comparison of birth weight between the groups showed that the mean birth weight in experimental group and control group was 2872±463 and 2911±424 respectively, and the difference were found to be in significant (p=0.5). So groups were comparable on the basis of birth weight.
- On comparing the groups on the basis of post natal age, it was found that the mean post natal age was 2.78±0.85 in experimental group compared to that of control group 2.61±0.70. The groups were found to be comparable on the basis of post natal age (p=0.2).
- On analysis, it was found that there is no significant difference between the experimental group and control group in relation to the blood group of mother of neonates. The p value was 0.1, stating the groups are comparable on the basis of blood group.
- On comparing the study groups on the basis of mode of delivery, both the groups had high percentage of vaginal delivery (49% in experimental and 40.4% in control group) compared to other modes of delivery like vacuum, forceps and caesarean section. The groups were comparable on the basis of mode of delivery.
- It was found that the groups showed no difference on the basis of clinical characteristics studied like gender, birth weight, mode of delivery, post natal age, gestational age and blood group of the mother.
- The findings of the study stated that the initial level of serum bilirubin level before starting of phototherapy was comparable between both the study groups (17.1±1.3 vs 17.2±1.3). The mean bilirubin level after 24 hours of phototherapy was lower in experimental group (14.4±1.7) when compared to control group (15.9±1.6), stating that the rate of bilirubin level declined considerably in experimental group compared

to control group ($p<0.05$) in the first 24 hours of phototherapy.

- On comparing, the mean serum bilirubin level after 48 hours of phototherapy was found to be lower in the experimental group when compared to that of the control group (12.1±2.2 vs 13.5±2.3). It stated that the white curtain is effective in reducing the serum bilirubin level after 48 hours of phototherapy ($p=0.004$).
- In the present study, however no difference was found in the serum bilirubin level between the experimental and control group after 72 hours of phototherapy. The mean serum bilirubin level was 12.4±2.1 in the experimental and 12.2±1.9 in the control group ($p=0.7$).
- Similarly the mean serum bilirubin level in the experimental and control group after 92 hours of phototherapy was 10.8±0.6 and 11.2±0.3 respectively. There was no difference in serum bilirubin level after 96 hours between the study groups.
- The mean duration of the phototherapy was analyzed between the study groups. It was found that the mean duration of phototherapy was significantly reduced in the experimental group (49.5±18.9) when compared to the control group (62.8±17.7) and it was statistically significant at 0.001 level.

DISCUSSION

The results of the present study was consistent with the study findings of Kurniasih et.al (2011), the study was a RCT, to determine the effect of reflecting curtains on phototherapy. They found that there was reduction in serum bilirubin level after 12 and 24 hours of phototherapy in the study group(3.7 and 9.7 respectively) than in the control group (0.1 and 3.8 mg/dl respectively) ($p<0.05$). The present study also found out a reduction in bilirubin level after 24 and 48 hours of phototherapy ($p<0.05$). The present study is also consistent with the findings of study conducted by Babaei *et al* (2013). It was a RCT to analyze the effect of white plastic cover on phototherapy. They found that the serum bilirubin level has declined significantly in experimental group after 24 hours ($p=0.001$) and 48 hours of phototherapy ($p=0.003$). They also found out that there was reduction in duration of hospitalization ($p=0.0001$). The present study also found out that the white curtain reduces the serum bilirubin level and also the duration of phototherapy is reduced. Djokomulijanto *et al* (2006) conducted a RCT to note the effect of reflecting white curtains on phototherapy. They found out that duration of phototherapy was less in experimental group (12 hours) when compared to that of the control group (34 hours). The present study also stated a reduction in duration of phototherapy. Sivanandan *et al*. (2007) conducted a RCT to determine the effect of sling on phototherapy. They found that there was a fall in the bilirubin level in experimental group (0.23±0.46) compared to control group (0.03±0.47) ($p=0.06$).The study however noted no difference in duration of phototherapy ($p=0.6$). In the present study there was reduction in bilirubin level and also duration of phototherapy.

Conclusion

White curtain around the phototherapy unit is an effective method in reducing the serum bilirubin level and at the same time it also reduces the duration of phototherapy. This can be used as cost effective and non invasive method for the treatment of neonates with hyperbilirubinemia. The white curtain when made into practice can serve as a method that will reduce the hospital stay of the neonates thereby reducing the cost of treatment.

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