Does Periodic Positional Change have Additional Effect in Neonates Receiving Phototherapy?

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ABSTRACT

Introduction: Phototherapy for treatment of jaundice is highly effective and carries excellent safety profile. Though widely practiced, positional changes during phototherapy haven't been consistently shown to provide additional benefits and in resource limited settings puts additional burden on healthcare workers. We intended to study if positional changes actually benefitted neonates receiving phototherapy.

Material and methods: This study was conducted over 1.5 years from January 2019 to June 2020 at NICU of NMCH Patna including >24 hour age otherwise healthy neonates with jaundice and fulfilling phototherapy indication as per American academy of Pediatrics guidelines. Neonates were randomized into 2 groups and allocation concealed. Group A neonates underwent prone positioning from supine position every three hours and vice versa, whereas group B neonates continued to receive phototherapy in supine position. Outcomes studied were reduction in serum bilirubin after 12 hours and 24 hours of phototherapy, serum bilirubin at discharge and readmission rates for same problem in the two groups.

Results: 92 neonates were randomized into group A and B. The two groups didn't differ significantly in gestational age, admission weight, gender, dehydration, serum bilirubin at the time of admission or feeding practices. Serum bilirubin (mean, SD) at admission in the two groups were 16.3(2.9) and 16.8(2.7) respectively. After 12 hours and 24 hours of phototherapy it was 13.5 (2.1) vs14.1 (2.2) and 11.1 (1.7) vs 11.7 (1.8) respectively. The differences weren't statistically significant.

Conclusion: Though it seemed logical to change position of infants during phototherapy to bring newer areas of skin under phototherapy, the actual decrease in serum bilirubin was independent of changing the position of infants.

Keywords: Neonatal Jaundice, Periodic Positional Change, Phototherapy, Serum Bilirubin

INTRODUCTION

Jaundice is the commonest issue faced by neonates. It is also the commonest cause of readmission after the baby is brought home from hospital.[1] It affects more than 50% of term neonates and >75% of preterm neonates. In the vast majority of such neonates, jaundice is usually harmless and resolves without treatment which is required in only 5-10% cases. Nevertheless, in few cases it may become severe and lead to bilirubin encephalopathy. Deposition of unconjugated bilirubin in CNS may lead to neurodevelopmental impairment.[2] Significant jaundice in neonate results from varying contributions of 3 factors: increased production from degradation of RBCs, decreased clearance due to immaturity of hepatic mechanisms and reabsoption of bilirubin from gut (enterohepatic circulation). Phototherapy is the most common mode of treatment for hyperbilirubinemia. It is considered highly effective and has been in use for last 50 years. Phototherapy acts by converting insoluble bilirubin (unconjugated) into soluble isomers which are excreted out through urine and feces. It is generally agreed that the effect of phototherapy is directly related to bilirubin concentration in skin. Based on this, researchers have postulated that frequently changing the posture of a neonate receiving phototherapy would bring newer areas under irradiance and this should potentially lead to faster clearance of bilirubin. However, when the same was subjected to clinical trials, results were conflicting. Based on this background and keeping in mind the burden of jaundiced neonates in our NICU, we decided to conduct this study in non-hemolytic cases of neonatal jaundice in our NICU to find out if period positional changes would lead to a faster resolution of jaundice.

Aim and Objective

Current research aimed to study the role of periodic positional changes in resolution of jaundice in neonates receiving phototherapy with the primary objective to compare reduction in serum bilirubin in neonates subjected to period positional changes after 12 hours and 24 hours of phototherapy with the group receiving phototherapy in supine position and secondary objective to compare serum bilirubin at discharge between the two groups and to compare the readmission rate for the same issue in two groups.

MAERIAL AND METHODS

Current Double blinded Randomized control trial.N.I.C.U of deptt of Pediatrics N.M.C.H Patna for 1.5 years, from January 2019 to June 2020.

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Inclusion criteria: We included >24 hour age neonates with jaundice who were otherwise healthy at time of admission and who fulfilled the indication of phototherapy as per American academy of Pediatrics guidelines.[4]

Exclusion criteria: neonates with gestational age <35 weeks or having received phototherapy 48 hours prior to admission and those with obvious congenital malformation were excluded from the present study. Neonates with ABO or Rh incompatibility after investigating for the same were also excluded

Study technique: After obtaining written informed consent, we enrolled participants in the present study. Information regarding history, physical examination, admission diagnosis, baseline characteristics and subsequent lab investigation reports was recorded in a structured proforma. Infants were randomized in two groups (A and B) using a computer program and allocation was concealed. Group A neonates were subjected to prone positioning from supine position every three hours and vice versa, whereas group B neonates continued to receive phototherapy in supine position alone. In beginning, all neonates were kept under phototherapy in radiant warmer in supine position. Phototherapy was administered continuously except during feeding lasting 15-20 min. They were kept naked except for small diapers and eye pads. The neonates were treated with light from above. Distance from phototherapy apparatus to mattress was 25 cm (as recommended by the manufacturer) and this distance was kept constant for each neonate. The phototherapy apparatus used was Birdtech phototherapy device emitting blue light with an emission
peak at 470 nm as stated by the manufacturer. Phototherapy was continued till the TSB was <2 mg/dl below the recommended age specific cut offs for starting phototherapy. TSB was measured at start of phototherapy, after 12 hr, 24 hr and 48 hours or later if needed and recorded.

STATISTICAL ANALYSIS

Relevant information and data was first entered in Microsoft excel sheet and then analyzed by SPSS version 20 software. Results were presented as mean, median, standard deviation or percentage as appropriate. Dichotomous variables were compared by Chi-Square test and continuous variables were compared by Student t-test. *P* value less than 0.05 was considered significant.

RESULTS

108 neonates as per above mentioned inclusion and exclusion criteria were initially taken up for the study purpose. After excluding 16 neonates, 92 were finally randomized into two groups (group A and B) using computer generated program and allocation was concealed. Group A neonates were subjected to prone positioning from supine position every three hours and vice versa, whereas group B neonates continued to receive phototherapy in supine position alone.

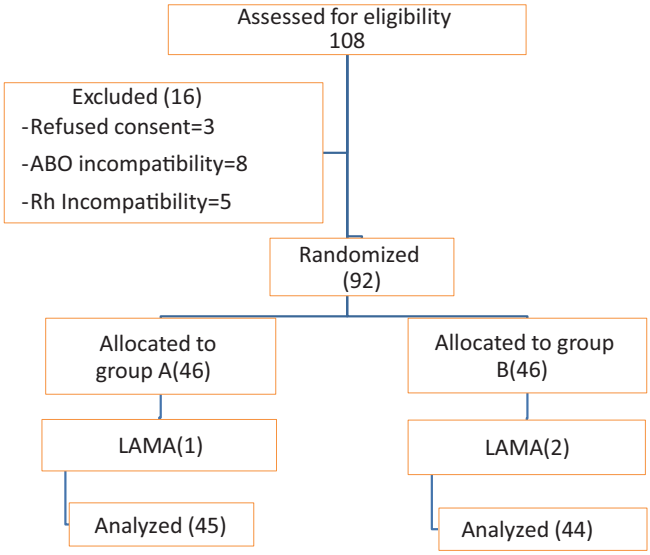

Figure-1: CONSORT diagram of our study

Study parameters	Group A (n=45)	Group B (n=44)	*P* value
GA in days: Mean (SD)	265.1 (15.6)	262.4 (14.9)	0.40
Admission weight in gram: Mean (SD)	2735 (523)	2815 (548)	0.48
Male gender: number (percent)	25(55.6)	23 (52.3)	0.75
Weight loss >10%: number (percent)	6(13.3)	7(15.9)	0.73
Serum Bilirubin on admission in mg/dl: Mean (SD)	16.3(2.9)	16.8(2.7)	0.40
Neonates on exclusive breastfeeding: Number (percent)	33(73.3)	35(79.5)	0.49

Table-1: Baseline characteristics of participants in the two groups:

A. Total serum bilirubin in mg/dl:	**Group A (n=45)**	**Group B (n=44)**	***P* value**
At start of phototherapy: Mean (SD)	16.3(2.9)	16.8(2.7)	0.40
After 12 hr of phototherapy: Mean (SD)	13.5 (2.1)	14.1 (2.2)	0.19
After 24 hr of phototherapy: Mean (SD)	11.1 (1.7)	11.7 (1.8)	0.11
At discharge: Mean (SD)	10.6(1.4)	11.2 (1.6)	0.06
B. Change in serum bilirubin:			
Change in ser bilirubin over 12 hours: Mean (SD)	2.8 (0.34)	2.7 (0.39)	0.20
Change in ser bilirubin over 24 hours: Mean (SD)	5.2 (0.65)	5.1 (0.72)	0.49

Table–2: Changes in serum bilirubin during phototherapy in neonates of both groups.

Fig 1 shows the CONSORT diagram.

The two groups didn't differ significantly in terms of gestational age (GA), weight on admission, gender, significant dehydration, serum bilirubin at the time of admission and feeding practices as shown in table 1.

We didn't find any significant difference in ser. bilirubin level between the 2 groups after 12 hours and 24 hours of phototherapy. Also, there was no significant difference in reduction in ser. bilirubin levels at 12 hours and 24 hours of therapy in the two groups. Only 1 neonate in group A and 2 neonates in group B were readmitted for jaundice, however the readmission rate was not statistically significant in the two groups (2.2% vs 4.4%, *p* value= 0.56) (table-2).

DISCUSSION

This study was done at a tertiary care level teaching hospital to study the role of periodic positional changes in resolution of jaundice in neonates receiving phototherapy for neonatal jaundice (NJ). As discussed in previous section, the two groups were comparable in their baseline characteristics. The present study showed that periodic position change during conventional phototherapy did not influence the duration of phototherapy or the reduction in serum bilirubin, though this is a widely accepted practice.

In 1989, Yamauchi et al[5] conducted a study to determine whether position changes might affect the efficacy of phototherapy in decreasing total serum bilirubin concentrations and concluded that six-hourly position change when compared with no change in position in term neonates did not significantly reduce the serum bilirubin concentration during or within 24 h after phototherapy. However, their study included only 44 neonates and randomization as well as blinding wasn't robust. Chen et al.[6] and Mohammadzadeh et al.[7] also reported similar findings with two- and three-hourly position change. In a larger study, Donneberg et al.[8] in 112 neonates born at ≥33 weeks also suggests similar findings. These studies as well as our findings do not support the biological rationale for position change proposed by Vogl et al.[9] Infact it has been now postulated that the contribution of unexposed area of skin in the reduction of total bilirubin during phototherapy is supposedly due to establishment of a new gradient between the bilirubin deposited in the unexposed area and intravascular compartment, leading to gradual efflux of bilirubin from unexposed skin.[10] In contrast to above explanations, Shinwell et al.[11] demonstrated supine position to be superior to position change. However, their study included only 30 neonates.

The strength of our study is larger sample size, proper randomization and double blinding. Most of the earlier studies on his subject either did not report the type of feeding or formula feeding was the predominant mode of feeding. But in our study, breastfeeding was the predominant mode of feeding as 3 out of every 4 neonates studied was exclusively breastfed in both the groups.

CONCLUSION

Though it seems logical to change the positing of infants during phototherapy to bring newer areas of skin under phototherapy, the actual decrease in serum bilirubin was independent of changing the position on infants. This provides some evidence to the notion that phototherapy converts bilirubin to photo-isomers at the same rate whether in blanched skin (continuously placed supine) or yellowish skin (position changed periodically) in a neonate with hyperbilirubinemia. Considering the scarcity of nursing staffs in our country, it seems quite reasonable to give phototherapy in supine position preferably as this would free them from unnecessarily handling and monitoring such otherwise healthy neonates.

Limitations

First limitation is that this is a single centre study. Second limitation is the relatively small sample size. Third limitation is non inclusion of hemolytic jaundice cases in this study due to which we couldn't study the role of periodic positional changes, if any, in neonates with more severe hyperbilirubinemia. Lastly, we couldn't do long term follow up of these neonates.

Abbreviations

GA: Gestational age; NJ: Neonatal jaundice; ser: serum;

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