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TO DETERMINE THE EFFICACY OF INTERMITTENT VERSUS CONTINUOUS PHOTOTHERAPY IN THE TREATMENT OF NEONATAL HYPERBILIRUBINEMIA IN TERM NEONATES: A RANDOMIZED CONTROLLED TRIAL.

Pediatrics

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ABSTRACT

Background: To determine the effectiveness of intermittent and continuous phototherapy in reducing the serum bilirubin in neonatal jaundice in term neonates.
Methods: The current study was conducted on 100 term icteric neonates between June 2019 and March 2020. The neonates were divided randomly into two groups. In the continuous phototherapy group the on-off time was 2hours and 30 minutes respectively (on for 2hours and off for 30 minutes), whereas in the intermittent phototherapy group the on-off time was 2hours and 3hours respectively (on for 2hours and off for 3hours). The total serum bilirubin was measured every 6hours till the total serum bilirubin was <13mg/dl.
Results: The mean age of neonates in continuous and intermittent phototherapy group was 3.89±1.83 and 3.88±1.84 respectively (P=0.91). The mean follow-up bilirubin at 36 hours was 12.89±1.50 and 12.91±1.70 in the continuous and intermittent phototherapy group respectively (P=0.96). There was no statistical difference in the mean age of the neonate, baseline serum bilirubin and follow-up bilirubin at 36hours between the two groups.
Conclusion: The intermittent phototherapy was as effective as the continuous phototherapy in reducing neonatal hyperbilirubinemia.

KEYWORDS

phototherapy; continuous; intermittent; hyperbilirubinemia.

INTRODUCTION:

Jaundice is the most common clinical sign in neonatal medicine. Some two-third of healthy term infants and almost all premature infants develop jaundice in the first week of life[1]. One of the most effective forms of therapy for neonatal hyperbilirubinemia is phototherapy. Phototherapy can be therapeutic as well prophylaxis for neonatal jaundice[2]. Improvements in the delivery of phototherapy secure its place as the main treatment option for unconjugated hyperbilirubinemia and its role in reducing the requirement of exchange transfusion[3]. Phototherapy with three different mechanism i.e. photo-isomerization, photo-oxidation and structural isomerization can decrease the serum bilirubin in neonates. The photo-isomerization pathway is responsible for more than 80% of bilirubin elimination during phototherapy[4].

The fact that it takes up to 3hours for bilirubin to return to the skin following removal of photo-isomers has prompted intermittent phototherapy regimens[5]. The intermittent phototherapy is especially useful for hospitals where the equipment is not proportional to the number of neonates requiring phototherapy and it also helps to maintain baby-mother bonding.

The various studies comparing the intermittent and continuous phototherapy have conflicting reports. These conflicting results may be due to prolonged or short light on-off cycles[6].

Materials and Methods: This Randomized Controlled Trial was conducted on 100 term neonates with indirect hyperbilirubinemia admitted to the NICU of Govt. Thiruvarur Medical College & Hospital, between June 2019 and March 2020.

Inclusion criteria:
Term neonates (>37 weeks of gestation)
Age >1day & ≤10days
5minute APGAR ≥6 (from birth record)
Total serum bilirubin between 13-20mg/dl.

Exclusion criteria:
Preterm babies (<37 weeks of gestation)
Babies with congenital malformations

Sick babies requiring oxygen, ventilation, parenteral fluids or antibiotics.
Total serum bilirubin <13 or >20mg/dl.

After getting informed consent from the parents, the babies were randomly divided into two groups the continuous phototherapy group (group A) and the intermittent phototherapy group (group B). In the continuous phototherapy group (group A) the on-off duration of phototherapy was 2hours and 30 minutes respectively (phototherapy is on for 2hours and off for 30 minutes). Whereas in the intermittent phototherapy group (group B) the on-off duration of the phototherapy was 2hours and 3hours respectively (phototherapy is on for 2hous and off for 3hours). The phototherapy units used in both the groups were identical and the total serum bilirubin was measured every 6hours. In both the arms the phototherapy was continued until the total serum bilirubin was <13mg/dl.

Sps version 16 was used to analyze the data. Quantitative data's such as age, total serum bilirubin were presented as Mean ± SD, whereas the qualitative data's such as gender was presented as frequencies and percentage. The t test was used to compare the mean reduction of serum bilirubin between the 2 groups. A P value of ≤0.05 was considered statistically significant.

RESULTS:

The demographic profile between the continuous phototherapy group and the intermittent phototherapy group did not differ significantly (Table 1)

Table 1: Gender distribution

Gender	Group A (no. 50)		Group B (no. 50)	
	Number	%	Number	%
Male	27	54	24	48
Female	23	46	26	52
Total	50	100	50	100

Among the 100 neonates 51 were male and 49 were female; using the Fischer exact test no significant gender difference was found between the two groups.

The mean age of the neonates was 3.89±1.83 and 3.88±1.84 in the continuous phototherapy and the intermittent phototherapy group respectively (P=0.91)

Table 2: Group A – Continuous Phototherapy

	Age of neonates	Total serum bilirubin at onset of phototherapy	Follow-up bilirubin at 36hours	Difference between the bilirubin levels
Mean	3.8938	17.6344	12.8942	4.7402
Std. deviation	1.82801	1.54179	1.49909	1.22031

Table 3: Group B- Intermittent Phototherapy

	Age of neonates	Total serum bilirubin at onset of phototherapy	Follow-up bilirubin at 36hours	Difference between the bilirubin levels

Mean	3.8751	17.4791	12.9137	4.5654
Std. deviation	1.83841	1.47612	1.70102	1.25564

The mean total serum bilirubin at the onset of phototherapy in the continuous and intermittent group was 17.63±1.54 and 17.48±1.48 respectively (P=0.37).

The mean follow-up bilirubin at 36hours in the continuous and intermittent phototherapy group was 12.89±1.50 and 12.91±1.70 respectively (P=0.96)

The mean difference between the total serum bilirubin at the onset of phototherapy and at 36hours of life was 4.74±1.22 and 4.57±1.26 in the continuous and intermittent phototherapy group respectively (P=0.32).

There was no statistical difference noted in any of the parameters namely, mean age of the neonate, the total serum bilirubin at the onset of phototherapy, follow-up bilirubin at 36hours and the mean reduction of bilirubin between the two groups.

Discussion: The mean age of the neonates, the total serum bilirubin at the onset of phototherapy, the mean follow-up bilirubin at 36hours of life and the mean reduction in serum bilirubin in both the groups A and B were not statistically significant. These observations were smilar to those of Roya Tahertafi et al.[7], Krithika A.P. et al.[8], Tikmani SS et al.[9] and Sachdeva et al.[10]. Though the observation in our study was similar to the above studies, there was gross variation in the on-off time cycle used for phototherapy in the continuous and the intermittent group. In Roya Taheritafi et al.[7] study in Iran, the on-off time cycle used for intermittent phototherapy was 12:12hours. The cut off time of 12hours was too long in which the chance of rebound hyperbilirubinemia was very high. In the study by Sachdeva M. et al[10]. and Krithika A.P. et al[8]. The on-off time used in the continuous phototherapy was 2hours and 30 minutes respectively, whereas for intermittent phototherapy it was one hour each. The off cycle of 30minutes and 1hour in the two groups were very narrow and too short to bring out the difference in the efficacy and also not optimal for practice.

In our study, the on-off time for phototherapy in the continuous group was 2hours and 30minutes respectively, whereas it was 2hours and 3hours respectively for intermittent group. The on-off schedule adopted in our study is in accordance with the principle that it takes up to 3hours for bilirubin to return to the skin following removal of photo-isomers by phototherapy[6], and also on the practical fact that 30minutes is sufficient for any interventions, breastfeeding and cleaning.

There are no uniform criteria in the literature for the on-off cycles in the intermittent phototherapy. In the current study the 3hours off cycle for intermittent phototherapy is as effective as continuous phototherapy in reducing the serum bilirubin. Its cost-effective – the phototherapy units half life can be saved, useful in resource poor settings where the number of phototherapy units were not in proportion to the number of babies requiring phototherapy and the side effects of phototherapy can also be minimized. So a large scale Randomized Controlled Trial will be definitely useful to develop a uniform protocol for the on-off duration for intermittent phototherapy.

Conclusion: The intermittent phototherapy is as effective as continuous phototherapy in reducing the serum bilirubin for neonatal hyperbilirubinemia. Instead of continuous phototherapy the intermittent phototherapy can be used routinely for babies with hyperbilirubinemia. A large scale Randomized Controlled Trial will definitely useful to determine uniform protocol for intermittent phototerapy.

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