

COMPARISON OF CONTINUOUS WITH INTERMITTENT PHOTOTHERAPY IN THE TREATMENT OF NEONATAL JAUNDICE

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ABSTRACT

Objective: To compare the mean decrease in serum bilirubin after intermittent versus continuous phototherapy in the treatment of jaundice neonatorum.

Methodology: This randomized controlled study was carried out on neonates admitted to the neonatal unit of Department of Paediatric Medicine, Ward A, Lady Reading Hospital, Peshawar from 1st October 2012 to 31st March 2013. A total of 258 patients were enrolled for the study after fulfilling the inclusion/exclusion criteria to compare the decrease in serum bilirubin after applying continuous/intermittent phototherapy for the treatment of neonatal jaundice.

Results: Mean age of the patients was 3.89 ± 1.83 ($p=.91$) days, the mean baseline bilirubin was $17.56 \text{ mg/dl} \pm 1.42$ ($p=.36$), while the mean follow-up bilirubin was $12.85 \text{ mg/dl} \pm 1.65$ ($p=.95$), and the mean difference between the baseline and follow-up bilirubin was $4.7 \text{ mg/dl} \pm 1.19$ ($p=.32$). For the group A babies, the mean difference between the baseline and follow-up bilirubin was $4.78 \text{ mg/dl} \pm 1.20$ ($p=.32$). For the group B babies, the mean difference between the baseline and follow-up bilirubin was $4.63 \text{ mg/dl} \pm 1.18$ ($p=.32$). The difference between the mean age on admission, mean baseline bilirubin, mean follow-up bilirubin, and the mean decrease in serum bilirubin for both the groups A and B was statistically not significant.

Conclusion: Intermittent and continuous phototherapies were found to be equally effective. Because of its additional benefits intermittent phototherapy can be adopted as a routine procedure instead of continuous phototherapy in neonatal care units.

Key Words: Neonatal jaundice, Phototherapy, Continuous phototherapy, Intermittent phototherapy

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INTRODUCTION

Jaundice is the yellow discoloration of the skin and sclera that results from accumulation of bilirubin in the skin and mucous membranes. It is the commonest clinical condition requiring medical attention in the newborn babies¹. It affects 60% of term and 80% of preterm infants². In our area jaundice neonatorum affects 39.7 babies per 1000 live births³. This unconjugated bilirubin is an end product of heme-protein catabolism, and its raised levels are potentially neuro toxic². Irrespective of the cause of jaundice, the aim of therapy is to prevent unconjugated bilirubin related neurotoxicity⁴.

Phototherapy is the main stay of treatment of neonatal jaundice⁵. It acts by converting unconjugated bilirubin to more polar stereoisomer, which are less neurotoxic (cannot cross blood brain barrier) and can easily be excreted in bile and urine⁶. The effectiveness of pho-

totherapy depends upon the light energy emitted in the effective range of wavelengths, the distance between the light source and the skin, and the surface area of the baby exposed to the light². Photoisomerization is a rapid process, in a study it was found that significant amount of 4Z, 15E photo isomers were formed in 15 minutes⁶.

Phototherapy can be applied both in continuous and intermittent fashion. In a study, comparing intermittent and continuous phototherapy, it was found that there is no significant difference in the efficacy of continuous and intermittent phototherapy⁷. In this study, the mean total serum bilirubin at 36th hour was $9.17 \pm 1.83 \text{ mg/dl}$ in continuous group and $9.02 \pm 1.94 \text{ mg/dl}$ in the intermittent phototherapy group. The mean decrease in bilirubin from baseline was $7.43 \pm 0.07 \text{ mg/dl}$ in continuous group and $7.31 \pm 0.48 \text{ mg/dl}$ in the intermittent group⁷.

Most of the institutions use it in continuous way, but the intermittent application is more acceptable, easy and pleasant to the parents, better for neonate's feeding, promotes mother-infant bonding and also easy for hospital staff. Moreover some other beneficial procedures like baby massage and Kangaroo Mother Care, could better be applied in intermittent phototherapy^{8,9}.

The present study was designed to compare the mean decrease in serum bilirubin using continuous and intermittent phototherapy techniques for neonatal jaundice. This study was aimed to determine the local results of the both intermittent and continuous phototherapy techniques.

METHODOLOGY

This Randomized controlled study was carried out on neonates admitted to the neonatal unit of Department of Paediatric Medicine, Ward A, Lady Reading Hospital, Peshawar from 1st October 2012 to 31st march 2013. A total of 258 patients were selected by non-probability consecutive sampling, 129 in each group using 7.31 ± 0.48 mg/dl decrease in serum bilirubin after intermittent phototherapy and 7.43 ± 0.07 mg/dl decrease in serum bilirubin after continuous phototherapy, 95% confidence interval and 80% power of the test.

Neonatal Jaundice was defined as serum indirect bilirubin level of more than 12mg/dl in term neonates measured in the laboratory. Intermittent phototherapy means observing on-off schedule for the application of phototherapy.

Inclusion criteria were full term neonates (≥ 37 weeks) with age > 24 hours and ≤ 10 days and serum indirect bilirubin level between 12 to 20mg/dl. APGAR at 5 minutes greater than 6 (as mentioned in patient hospital record file). Exclusion criteria were patients on intensive care i.e. ventilator, endotracheal intubation, and peritoneal dialysis. Also patients with major congenital malformation like cardiac, skeletal, renal, dysmorphism etc and sepsis i.e. positive blood culture, fits, reluctance to feed, platelets < 50000 .

Informed consents were taken from the parents, (father/mother, which one available) of those babies fulfilling the inclusion criterion, and which were enrolled in the study from the Neonatal unit of Children A Ward, Lady reading Hospital Peshawar. We conducted this study by enrolling 258 babies, the male/female ratio, and mean baseline bilirubin level was matched between the two groups A and B. Group A received continuous phototherapy, while group B received intermittent phototherapy. Both the groups received phototherapy from apparatus of same manufacturer and same age. The height of phototherapy light (distance between the light source and the infant) was kept similar for both groups. The follow up bilirubin was measured at 36 hours.

All neonates were randomly allocated in two groups by lottery method. Group A patients received continuous phototherapy (2 hours on and 20 minutes off) while Group B patients received intermittent phototherapy (one hour on and 30 minutes off). The on off timing, of phototherapy was observed by the researcher. Blood samples were taken and sent to hospital labs, (on arrival before starting phototherapy, every 8 hourly while on phototherapy, and at 36th hour), by the researcher, to look for serum bilirubin levels. The results were collected from the lab by the researcher and the serum bilirubin levels were noted down in the Proforma. Exclusion criteria were followed, strictly, to control confounders and bias in the study results. All the laboratory investigations were done from hospital laboratory.

Data was analyzed using SPSS version 16. Quantitative variables such as age, serum bilirubin at start of phototherapy and serum bilirubin at 36th hour were presented as mean \pm SD. Qualitative variables such as gender were presented as %age and frequencies. To compare the mean of decrease in serum bilirubin between the two groups, t-test was applied and p value ≤ 0.05 were considered statistically significant. All results were presented as tables.

RESULTS

There were 258 patients in our study. Mean age of the patients was 3.89 ± 1.83 ($p = .91$), the mean baseline bilirubin of patients was 17.56 mg/dl ± 1.42 ($p = .36$), while the mean follow-up bilirubin was 12.85 mg/dl ± 1.65 ($p = .95$), and the mean difference between the baseline and follow-up bilirubin was 4.7 mg/dl ± 1.19 ($p = .32$).

For the group A babies, who received continuous phototherapy, the mean age on admission was 3.91 ± 1.82 ($p = .91$), the mean baseline bilirubin was 17.64 mg/dl ± 1.37 ($p = .36$), the mean follow-up bilirubin was 12.86 mg/dl ± 1.53 ($p = .95$) and the mean difference between the baseline and follow-up bilirubin was 4.78 mg/dl ± 1.20 ($p = .32$).

For the group B babies who received intermittent phototherapy, the mean age on admission was 3.88 ± 1.84 ($p = .91$), the mean baseline bilirubin was 17.48 mg/dl ± 1.47 ($p = .36$), the mean follow-up bilirubin was 12.85 mg/dl ± 1.76 ($p = .95$), and the mean difference between the baseline and follow-up bilirubin was 4.63 mg/dl ± 1.18 ($p = .32$).

Gender wise distribution is shown in Table 2.

DISCUSSION

We planned this study to find a way of decreasing burden on hospital staff, and providing the parents a more acceptable way of treating their jaundiced babies. In this study we compared two types of delivering phototherapy to the jaundiced newborns, continuous and

Table 1: Type of phototherapy, age of patient, baseline bilirubin, follow-up bilirubin, and the difference b/w baseline and follow-up bilirubin

Type of phototherapy given to patients	Age of patients in days	Baseline bilirubin	Follow up bilirubin after 36 hours	Difference between baseline and follow-up bilirubin
Continuous mean	3.9109	17.6434	12.8605	4.7822
N	129	129	129	129
Std. Deviation	1.8234	1.37238	1.53279	1.20231
% Of total sum	50.2%	50.2%	50.0%	50.8%
Intermittent mean	3.8857	17.4814	12.8473	4.6341
N	129	129	129	129
Std. Deviation	1.8395	1.47382	1.76742	1.18694
% Of total sum	49.8%	49.8%	50.0%	49.2%
Total mean	3.8983	17.5624	12.8539	4.7081
N	258	258	258	258
Std. Deviation	1.8279	1.42354	1.65106	1.19463
% Of total sum	100.0%	100.0%	100.0%	100.0%

Table 2: Gender distribution (n=258)

Gender	Group-A (n=129)		Group-B (n=129)	
	No. of patients	%	No. of patients	%
Male	69	53.5	70	54.3
Female	60	46.5	59	45.7
Total	129	100	129	100

intermittent. It also helps to promote mother infant bonding in a cost effective manner. No such study has been conducted in Pakistan and this study will provide the base line data for our setup¹⁰.

Gender wise the difference between the two groups, A and B, was statistically not significant. The difference between the mean decrease in serum bilirubin of both groups was statistically not significant.

The difference between the mean age on admission, mean baseline bilirubin, mean follow-up bilirubin, and the mean decrease in serum bilirubin for both the groups A and B was statistically not significant. (Table 1). Our results of this study were similar to those of Ninknafs et al in that there was statistically no significant difference in the effectiveness (mean decrease in serum bilirubin) of both types of phototherapy. Although we applied phototherapy for prolonged duration (2 hours on and 20 minutes off for continuous, and one hour on and 30 minutes off for intermittent group) compared to the above mentioned study (2 hours on and 30 minutes off for continuous and one hour on and one hour off for intermittent group). In their study the mean se-

rum bilirubin level before the start of phototherapy was 16.60mg/dl±1.67 for continuous and 16.33mg/dl±1.46 for intermittent group, and the mean serum bilirubin at 36 hours was 9.17mg/dl±1.83 for continuous and 9.02±1.94 for intermittent group, while in our study the mean serum bilirubin before the start of phototherapy was 17.64mg/dl±1.37 for continuous and 17.48mg/dl±1.47 for intermittent group, and the mean serum bilirubin at 36 was 12.86mg/dl±1.53 for continuous and 12.85mg/dl±1.76. In other words, in our study, the mean decrease in serum bilirubin was far less than theirs. This may be because of difference in the apparatus⁷.

In intermittent phototherapy group, we applied the phototherapy for one hour and observed 30 mins off, because we consider thirty minutes time is sufficient for baby cleaning, feeding, and other helpful interventions if needed. We avoided short on and prolonged off periods, because this was 1st local effort, and we do not took the possible risk of slow recovery of the neonate from jaundice. Now when the results are same, we are able to encourage more extensive studies, with prolong off time.

The limitation of our study was that we did not include the adverse effects in our data analysis, but fortunately, it was observed that no adverse effects occurred in our patients. It is same as observed by Maisels MJ, that phototherapy has significantly lower adverse effects with the use of an appropriate nursing care.¹¹

In agreement with published data, it seems unnecessary to maintain newborns hospitalized after treatment with phototherapy for possible rebound in bilirubin levels^{12,13}.

Intermittent phototherapy will also help in maintaining mother-infant bonding, and breast feeding, and through this it will help in achieving well-nourished and healthy babies. Moreover by involving mothers of the patients in the nursing care (like cleaning, feeding, changing diapers) of the babies, so the burden is shared between the mother and staff. In this way the mother will look after their babies, they will visit their babies after every 60 minutes and they will spend more time (30 minutes off time) with their babies, so they will be more satisfied.

It will help in promoting exclusive breast-feeding for 1st six months, will reduce diarrhoeal diseases and respiratory tract infections, and hence will help in reducing infant and childhood morbidity and mortality.

CONCLUSION

Intermittent and continuous phototherapies were found to be equally effective. Because of its additional benefits intermittent phototherapy can be adopted as a routine procedure instead of continuous phototherapy in neonatal care units, however it need to be confirmed by large scale RCTs.

RECOMMENDATIONS

On the bases of our study results we strongly recommend further such studies, to find some solution to the increasing staff-patient difference, decrease the worries of parents, and to find an easier way of treating neonatal jaundice, at a rapid rate than usual, by applying additional beneficial therapies like kangaroo mother care and baby massage simultaneously along with phototherapy.

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