



PHOTOTHERAPY; COMPARISON OF NEW IMPROVED VERSUS CONVENTIONAL METHODS AMONG NEONATES WITH JAUNDICE

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ABSTRACT... Objective: To compare mean duration of stay (in hours) of patients with new improvised versus conventional methods of phototherapy among neonates with jaundice. **Study Design:** Randomized control trial. **Period:** Six months. **Setting:** Neonatal ward, Department of Paediatric Medicine, Lahore General Hospital, Lahore. **Subjects and Methods:** 160 patients, with the help of random number table, all the patients were randomly divided into 2 groups A and B, after getting the informed consent from their parents. Group A patients received conventional phototherapy. Group B patients received phototherapy with reflecting mirrors placed beneath and at the side of the patient in baby's cot (new improvised method of phototherapy). **Results:** In this study the mean age of patients in group-A and group-B was 2.70 ± 1.13 days and 2.12 ± 1.98 days respectively. In group-A there were 47 (58.75%) male and 33 (41.25%) female patients while in group-B there were 51 (63.75%) male and 29 (36.25%) female patients. According to hospital stay, the mean hospital stay in group A was 39.76 ± 11.80 hours and in group-B it was 44.90 ± 14.21 hours, the mean hospital stay was statistically significant ($p < 0.001$) **Conclusion:** Shorter mean duration of stay (in hours) was recorded in patients treated with new improvised as compared to conventional methods of phototherapy among neonates with jaundice, the data is primary in our country, this technique may be used further but after some more trials to confirm its efficacy regarding shorter duration of hospital stay

Key words: Neonatal jaundice, phototherapy, new improvised, conventional methods.

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INTRODUCTION

Hyperbilirubinemia though a common but in most cases a benign condition in neonates. Incidence of hyperbilirubinemia in our population is 39.7/1000 live births.¹ Approximately 60% of term and 80% of preterm infants are affected. The yellowness of skin results from the accumulation of unconjugated, lipid-soluble, nonpolar bilirubin pigment in the skin. This unconjugated bilirubin (indirect acting) is produced by catabolism of heme-protein and its elevated levels are potentially neurotoxic causing acute bilirubin encephalopathy or kernicterus.² No matter what's the cause of jaundice, the aim of therapy is to prevent neurotoxicity due to unconjugated heperbilirubinemia.³ Patients failing to respond to phototherapy are treated with exchange transfusion.⁴

Bilirubin reacts maximum to light in the blue

range (420–470 nm). There is a dose-response relationship to bilirubin degradation until reaching the saturation dose. This can be achieved by exposing the maximum skin surface to an irradiance of 40 pW/cm² per nanometer of appropriate light. A further increase in irradiance has no additional benefits. The dose of phototherapy is thus increased by exposing a larger surface area of the skin to the conventional irradiance of 7 to 10 pW/cm² per nanometer.^{5,6} In conventional phototherapy, single source(panel) of 5 fluorescent tubes lights of 40 watts with wave length of 450 nm are used mostly at 45 cm from body surface.⁷

Double phototherapy means using 2 light sources (panels) in the form of either 2 lateral panels, reflecting objects or fiber-optic blankets (which are placed below the baby). Among them 2 lateral panel technique is frequently used.⁸

The mean duration of stay in hospital with conventional phototherapy is 43.1 ± 21.4 hours & with double phototherapy that is 34.6 ± 16.5 .¹⁰ As no previous data is available so it is assumed that the duration of stay with our new improvised method of phototherapy will be equal to double phototherapy that is 34.6 ± 16.5 .¹¹

The rationale of this study was to find a way of decreasing hospital stay of jaundiced neonates in a cost effective manner for our setup because prolonged stay may lead to greater risk of iatrogenic infection, cessation of breastfeeding but an early discharge encourages family bonding and attachment, decreases hospital care and patient care cost.⁹ So in this study a new technique of phototherapy is being improvised by placing a reflecting mirror (simulating double phototherapy), covered by a plastic transparent sheet, beneath and at the sides of the baby's cot thus enhancing the surface area of exposure to phototherapy and hence accelerating the rate of fall of bilirubin, thus decreasing the duration of hospital stay. No such study has been conducted in Pakistan and this study will provide the base line data for our setup.

SUBJECTS AND METHODS

This randomized control trial study comprised 160 cases and carried out on the patients admitted in the Neonatal ward of Department of Paediatric Medicine, Lahore General Hospital/PGMI and Lahore over a period of 6 months. They were divided into two groups, each group comprised 80 cases. Neonates having term (≥ 37 wk) neonates (as mentioned in patient hospital record file), age >24 hour and ≤ 10 days (as mentioned in patient hospital record file), APGAR at 5 min greater than 6 (as mentioned in patient hospital record file) and serum indirect bilirubin level between 12 to 22 mg/dl (by blood sample tested in hospital lab) were included. Patients who have major congenital malformations like skeletal, cardiac, dysmorphism etc, sepsis i.e. fits, reluctance to feed and platelets <50000 , CRP >6 , positive blood culture from hospital lab, neonates on intensive care i.e. ventilator, endotracheal intubation were excluded. Group A patients

received conventional phototherapy. Group B patients received phototherapy with reflecting mirrors placed beneath and at the side of the patient in baby's cot (new improvised method of phototherapy). Blood samples were taken by the researcher and sent to hospital labs 12 hours apart to look for serum bilirubin levels. The samples were collected from the lab by the researcher and the serum bilirubin level was noted down in the Performa. Phototherapy was stopped by the researcher once the serum bilirubin level falls below 12mg/dl as mentioned in our operational definition. The duration of hospital stay was equal to the number of hours for which the patient had received the phototherapy. Duration of hospital stay was considered in number of hours from the time of initiation of phototherapy till completion of treatment (serum bilirubin level falls below 12mg/dl.) Data was analyzed using SPSS version 20. Quantitative variables such as age, hospital stay (hours) was presented as mean \pm SD. Qualitative variables such as gender was presented as frequency (percentages). To compare the mean of hospital stay between the two groups, t-test was applied and p value ≤ 0.05 was found statistically significant.

RESULTS

A total of 160 patients (80 in each group) were enrolled after fulfilling the inclusion/exclusion criteria to compare the mean duration of stay (in hours) of patients in new improvised versus conventional methods of phototherapy among neonates with jaundice. In this study the mean age of patients in group-A and group-B was 2.70 ± 1.13 days and 2.12 ± 1.98 days respectively. In group-A there were 47(58.75%) male and 33(41.25%) female patients while in group-B there were 51(63.75%) male and 29(36.25%) female patients. According to hospital stay, the mean hospital stay in group-A was 39.76 ± 11.80 hours and in group-B it was 44.90 ± 14.21 hours, the mean hospital stay was statistically reduced in group – A as compared to group-B, p-value < 0.001 .

DISCUSSION

Jaundice is a common problem in the first few days

Variable		Group-A (n=80)	Group-B (n=80)	p-value
Gender	Male	47 (58.75%)	51 (63.75%)	> 0.05
	Female	33 (41.25%)	29 (36.25%)	
Age (days)		2.70±1.13	2.12±1.98	> 0.05
Hospital Stay (hours)		39.76±11.80	44.90±14.21	< 0.001

Table-I. Comparison of age, gender and mean duration of stay (in hours) of patients in new improvised versus conventional methods of phototherapy among neonates with jaundice

of life. It is challenge for the physician and problem for the parents. Unconjugated hyperbilirubinemia levels lead to toxic injury to brain resulting in neurological impairment even in term newborns. Approximately 60% of healthy term neonates develop significant jaundice in the first week of life.¹² Mostly it's benign requiring no intervention but about 5-10 % of them develop significant jaundice requiring phototherapy.^{13,14} Over the past four decades, phototherapy has remained the standard treatment of hyperbilirubinemia in neonates.¹⁵ Effective phototherapy accelerates the reduction of serum hyperbilirubinemia. The rate limiting step in eradication of hyperbilirubinemia by phototherapy is the formation of a water soluble compound, lumirubin.^{16,17} this is affected by two factors: the wavelength¹⁸ and the total dose of light delivered.^{19,20} Being a yellow pigment, it absorbs blue light (wavelength 420-470 nm).^{19,20} So, blue lamps are most efficient in lowering unconjugated hyperbilirubinemia but eye strain in treating physicians and staff nurses and difficulty in assessing cyanosis deter their use in hospitals.¹⁹ Although skin is more deeply penetrated by longer (green) wavelengths and they interact more effectively with albumin-bound bilirubin,¹⁹ but fluorescent white light remains is the most common form of phototherapy.

Being a developing country, we have limited resources. Even physiologic jaundice may linger over several weeks²¹ and the parents of the new borns are also not able to afford a prolonged hospital stay, so we planned this study to find a way of decreasing hospital stay of jaundiced neonates in a cost effective manner. As prolonged stay leads to increased risk of iatrogenic infections, cessation of breastfeeding but an early discharge encourages family bonding and attachment, decreases hospital care and patient costs. So in this study a new technique of phototherapy

was being improvised by placing a reflecting mirror (simulating double phototherapy), covered by a plastic transparent sheet, beneath and at the sides of the baby's cot thus increasing the surface area of exposure to phototherapy and hence accelerating the rate of fall of bilirubin, thus decreasing the duration of hospital stay. No such study has been conducted in Pakistan and this study will provide the base line data for our setup.

We recorded 0-3 years in both groups, mean and SD was calculated as 2.70 ± 1.13 in Group-A and 2.12 ± 1.98 years in Group-B, 58.75%(n=47) in Group-A and 63.75%(n=51) in Group-B were male, comparison of mean duration of stay (in hours) of patients in new improvised versus conventional methods of phototherapy among the neonates with jaundice reveals single phototherapy, mean duration of stay(in hours) as 44.90±14.21 hours while new improvised phototherapy administered group stayed for 39.76±11.80 hours at hospital which shows that new improvised phototherapy is favorable with regards to shorter hospital stay. The results of our study are in agreement with Dwyer BK who recorded the mean duration of stay in hospital with conventional phototherapy as 43.1±21.4 hours & with double phototherapy it was 34.6±16.5.¹⁰ No previous data is available so it may assumed that the duration of stay with our new improvised method of phototherapy was equal to double phototherapy that is 34.6±16.5.¹¹

Phototherapy has also significantly lower adverse effects with the use of an appropriate nursing care,²² the limitation of the study was that we did not included adverse effects in our data analysis, but fortunately, we observed no adverse effects in our patients. In line with published data, it seems unjustified to prolong newborns hospital stay after treatment with phototherapy for possibility of rebound in bilirubin levels.^{23, 24}

Though these results are comparable with other studies, but considering it as a primary data, more trials are required to confirm its efficacy regarding shorter duration of hospital stay so that this technique may also be used in future for reducing the avoidable burden of hospital stay.

CONCLUSION

Shorter mean duration of stay (in hours) was recorded in patients treated with new improvised as compared to conventional methods of phototherapy among neonates with jaundice, the data is primary in our country, this technique may be used further but after some more trials to confirm its efficacy regarding shorter duration of hospital stay.

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“Well organized effort;
excellent achievement.”

Shuja Tahir



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