

Effects of Body Massage on Response to Phototherapy in Neonatal Hyperbilirubinemia: A Randomized Clinical Trial

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Abstract

Background: Massage therapy has been commonly practiced as a traditional complementary therapy in neonates. This study was designed to evaluate the effects of massage on decreasing bilirubin levels in infants undergoing phototherapy.

Materials and Methods

A total of 60 term icteric infants without known risk factors who were admitted to the neonatal intensive care unit of Ghaem Hospital, Mashhad, Iran from 2016 to 2018 were involved in this preliminary clinical trial. The infant participants were randomly divided into the massage + phototherapy (intervention group, n=30) who received massage therapy (with field technique) thrice daily (every 8 hours) for 30 minutes each, and phototherapy alone (control group, n=30) who received phototherapy and routine care. Serum bilirubin samples were obtained at different time points in both groups.

Results: The mean feeding time in the intervention and control groups were 22.5 and 21.4 min, respectively. The mean birth weights in the intervention and control groups were 3052 and 3187 gr, respectively. No significant differences were found between the two groups in age, sex, Apgar score, maternal profile, and previous history of jaundice ($P>0.05$). Rates of bilirubin loss were 0.81 ± 0.19 mg/dl/h and 0.59 ± 0.18 mg/dl/h in the intervention and control groups, respectively ($P=0.043$), in the first 8 hours of admission which dropped to 0.46 ± 0.16 and 0.37 ± 0.22 , respectively ($P=0.958$), in the first 30 hours of admission.

Conclusion

Based on the results, massage is suggested as a complementary method for phototherapy, especially in the first eight hours of treatment during toxic high bilirubin levels and at the peak risk of kernicterus.

Key Words: Infant, Hyperbilirubinemia, Jaundice, Massage, Phototherapy.

*Please cite this article as Boskabadi H, Alfi N, Abrishami M, Moradi A, Kiani MA, Zakerihamidi M. Effects of Body Massage on Response to Phototherapy in Neonatal Hyperbilirubinemia: A Randomized Clinical Trial. Int J Pediatr 2020; 8(5): 11347-353. DOI: [10.22038/ijp.2020.41101.3462](https://doi.org/10.22038/ijp.2020.41101.3462)

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Received date: Apr.14, 2019; Accepted date: Jan.22, 2020

1- INTRODUCTION

Neonatal hyperbilirubinemia is generally a benign condition in 60-80% of newborns, most of whom gradually recover normal bilirubin levels. However, bilirubin levels can reach the 95th percentile in 8-11% of infants, where the condition may signal a major disease and must be treated. Severe, prolonged hyperbilirubinemia can lead to dangerous complications, such as kernicterus and lifelong disability (1-4). Jaundice complications have been reported in 13.37% of neonates with severe hyperbilirubinemia (5). Several approaches have been introduced for lowering the serum bilirubin, among which, blood exchange, phototherapy, and medical management are the most important treatments (6).

Currently, phototherapy is the most effective and common treatment for neonatal jaundice, which may be combined with exchange therapy in cases of no response or complications (e.g., kernicterus or extremely high bilirubin levels). Infant massage therapy has been commonly practiced as a traditional complementary therapy in preterm neonates. Massage therapy has achieved good results according to the mental relaxation in mother and infant as well as providing the necessary conditions for neonatal weight gain (7-10). Massage has also been shown to increase meconium resorption and decrease bilirubin levels in preterm neonates (8).

Massage may accelerate the release of various spatial bilirubin isoforms by phototherapy and subsequently allow the production of disposable products in the underlying soft tissues by increasing lymphatic drainage and skin blood flow (11). Lower subcutaneous levels of bilirubin in massage group suggest that massage is capable of lowering bilirubin levels in term healthy infants (12). Massage therapy has also been shown to

control serum bilirubin levels in preterm infants and postpone the need for phototherapy (13). Lowering the hospitalization time in infants undergoing phototherapy is desired by and a treatment goal for the neonatologists. Massage may help in achieving this goal. The purpose of this preliminary clinical trial was to assess the effects of massage on response to phototherapy in infants undergoing hyperbilirubinemia treatment.

2- MATERIALS AND METHODS

2-1. Study design and population

As a first study in this concept, the sample size was defined as 30 per group based on the first researcher's experience. Sixty icteric term infants (weight: 2,500–4,000 gr) who required phototherapy for idiopathic jaundice were enrolled in this preliminary clinical trial (IRCT201108077244N1) between 2015 and 2018.

2-2. Method

A pediatric resident recorded patients' data including sex, birth weight, age, duration of hospitalization, and type of treatment. Maternal data including age, blood group, pregnancy history, gestational age, delivery complications and type of delivery were recorded based on maternal history. A thorough examination of the newborn was done. Hematocrit, direct and indirect bilirubin and Coombs tests, reticulocyte count, infant and maternal blood group, and G6PD measurements were done to determine the cause and severity of jaundice. Massage was performed thrice daily (every 8 hours) for 30 minutes each. The researcher's hands were warmed to the infant body temperature before massage. Starting from the lower limbs, different parts of the infant body (lower limbs, upper limbs, abdomen, chest, back, head and neck) were massaged with gentle pressure and the soft parts of the fingers of both hands.

The serum bilirubin was checked every 8-12 hours and finally, a comparison of bilirubin changes was made in these two groups.

2-3. Intervention

The enrolled infants were randomized into two groups of control (phototherapy alone), and intervention (phototherapy + massage). The intervention group, in addition to the phototherapy, received massage with Field technique (a safe technique to use for infants older than 30 weeks gestation) {Field, 2010 #3825}. The indication for phototherapy was set based on the American Academy of Pediatrics Guidelines for Phototherapy. Intensive phototherapy was performed in all cases using two 8-lamp phototherapy devices which were randomly shifted between the two case and control groups. A trained neonatology resident performed the massage sessions at 8-hour intervals before and after starting phototherapy until the end of the treatment. The study was performed at the Neonatal Intensive Care Unit (NICU), Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

2-4. Ethical consideration

Infants were enrolled in the study only after their parents provided written informed consent. The ethics committee of Mashhad University of Medical Sciences approved this study (Grant No.: 88469, 910140). It was also registered in Iranian Registry of Clinical Trials (IRCT201108077244N1)

2-6. Inclusion and exclusion criteria

Infants with congenital anomalies, five-minute Apgar score < 7, or contraindications for massage (sores, cuts, burns, infectious rashes, dislocations, hyperthermia, and swollen joints) were excluded.

2-7. Data Analyses

IBM SPSS software version 19.0 was used for data analysis. All numeric variables were tested for normality of distribution by the Kolmogorov–Smirnov test. The results were reported as mean \pm SD. Chi-square and Student's *t*- tests and other nonparametric tests were used wherever necessary for data analysis. Linear regression model was used to evaluate the simultaneous effects of birth weight, bilirubin measurement time, and the duration of phototherapy on basal bilirubin level. The significance level in all cases was considered as $P < 0.05$.

3- RESULTS

The particulars of infants in both groups are shown in **Figure.1**. No significant differences in the frequency of urination ($P = 0.265$) or defecation ($P = 0.958$) were found between the two groups. 86.7% and 100% of infants in the intervention and control groups, respectively, defecated on the first day of birth ($P = 0.112$). The logicity of homogeneity of the two groups can be re-inferred from the lack of significant differences between the groups in age, gestational age, sex, and one-minute Apgar score ($P > 0.5$) as all studied infants were term (weight >2500 g).

Although we observed differences between the groups in terms of birth weight ($P=0.022$), and admission weight ($P=0.042$), linear regression indicated that these differences had no overall effect on the data (birth weight: regression coefficient = -0.001, 95% confidence interval = -0.003–0.006; admission weight: regression coefficient = -0.002, 95% confidence interval = -0.007–0.002; $P = 0.278$). The linear regression was used in order to study the simultaneous effect of variables such as new weight and phototherapy duration time on bilirubin basic levels. The bilirubin levels of newborns in the case and control groups were 22.48 ± 2.89 mg/dl/h and

21.48±2.28 mg/dl/h, respectively (P=0.15). The results of linear regression analysis showed that there were no significant differences between bilirubin basic levels in the two groups (P>0.1). A significant difference was seen in bilirubin reduction/hour at the first (8 hours after

start phototherapy) (P=0.043), and second (24 hours after start phototherapy) (P=0.008) measurement times between the two groups while the differences in bilirubin reduction/hour at third measurement was not statistically significant (P=0.958) (Figure.2).

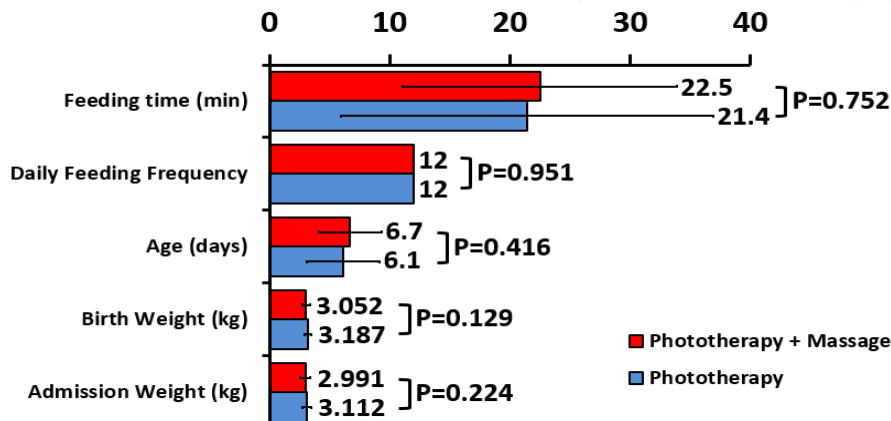


Fig. 1: Demographic profiles of icteric newborns treated with phototherapy alone (n=30) or phototherapy + massage (n=30).

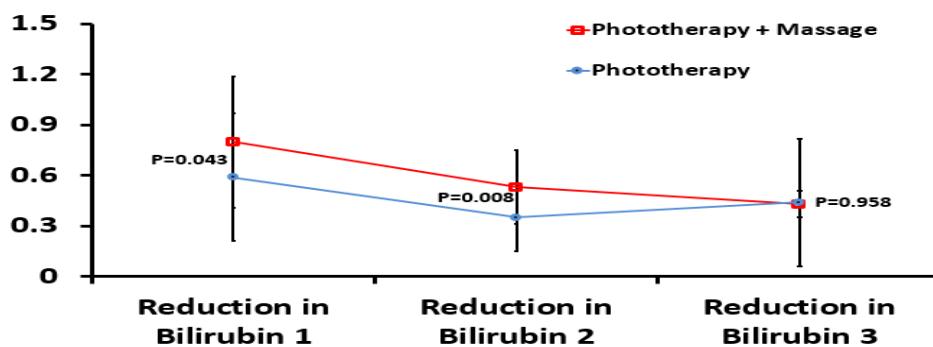


Fig.2: Comparison of bilirubin reduction per hour in three sequential time points in icteric infants treated with either phototherapy alone, or phototherapy + massage.

4- DISCUSSION

This preliminary clinical trial was aimed to assess the effects of massage on response to phototherapy in infants undergoing hyperbilirubinemia treatment. The present results suggest that massage is more effective in the early hours of phototherapy when skin bilirubin levels are higher. Compared with the control

group, neonatal hyperbilirubinemia was more reduced in the first 24 hours after admission and receiving massage therapy. The rate of bilirubin reduction was significantly higher and more pronounced in interventional group compared to the control (Phototherapy) group. This faster reduction of critically high toxic levels of bilirubin during the initial hours after birth

is substantially important in alleviation of the complications. A previous clinical trial on the effect of massage on phototherapy has concluded that massage therapy combined with phototherapy is an effective method for reducing serum total bilirubin in infants with neonatal jaundice (14). A different study on the effect of phototherapy and massage in hyperbilirubinemia reported that their intervention had a significant role in decreasing the bilirubin level, amount of urination, and duration of hospitalization of full-term infants suffering from hyperbilirubinemia (15).

Another study also has shown a non-significant difference in the level of transcutaneous bilirubin between the massage and control groups, suggesting that a combination of massage and phototherapy can be used to minimize the duration of phototherapy for premature healthy infants (16). A review of clinical trials on the role of massage therapy in the management of neonatal hyperbilirubinemia is supported by the current evidence (4, 17). Infant massage has been shown to reduce the risk of physiologic jaundice (18), which may be associated with its ability to increase the skin blood flow and drainage of the lymphatic vessels (10).

In this manner, massage may accelerate the release of no conjugated spatial isomer 4z, 15e from the skin. The conversion of no conjugated bilirubin with toxic 4z, 15z to spatial non-conjugated isomer 4z, 15e is reversible. Thus, isomer release may accelerate isomer 4z, 15e production and bilirubin reduction. The hypothesis that increased skin blood flow can decrease neonatal bilirubin levels should be proven in larger studies. The consistency of our results with previous studies, including those by Chen et al. (19) and Mainous et al. (20), suggests that the use of massage is effective and important in reducing the risk of neonatal jaundice.

In this study, 55% of the infants were males. In a similar study by Chen et al., the case group was distributed into 48% male and 52% female, compared to 38% male and 62% female in the control group. However, the two groups were not statistically different (19). Jaundice is more common among male newborns (11, 21-23), and male sex is an idiopathic predisposing factor for neonatal jaundice (24). In Chen et al. study, the defecation frequency was higher in the early days in the case group, whereas we observed no differences between the groups in terms of mean urinary or defecation frequencies. However, Chen et al., studied all term infants from birth; while the present study only included infants admitted to the hospital with complaints of jaundice (19).

4-1. Study Limitations

Considering the fact that this was a preliminary study, lack of a comparison between the phototherapy duration as well as the defecation and urination times were a limitation in our study.

5- CONCLUSION

Based on the results of this preliminary clinical study, compared to use of phototherapy alone, adjunctive use of massage therapy accelerated bilirubin reduction in the first hours of phototherapy. Because the greatest risk of kernicterus occurs during the early hours of phototherapy when bilirubin levels are high, we conclude that using massage and reducing the exposure time of infants to high bilirubin levels will decrease the risk of neurological complications. The results presented here could motivate other studies with different designs to assess whether clear benefits of massage therapy exist for infants.

6- CONFLICT OF INTEREST: None.

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