The lowering of bilirubin levels in patients with neonatal jaundice using massage therapy: A randomized, double-blind clinical trial

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A R T I C L E   I N F O

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Phototherapy
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Bilirubin

A B S T R A C T

Objective: Due to the effects of massage on various laboratory parameters (including those related to jaundice) in infants and the expansion of existing studies to achieve effective and safe therapy in the treatment of neonatal jaundice, this study aimed to investigate the effect of massage on bilirubin levels in cases of neonatal jaundice.

Methods: In this study, 134 patients were randomly assigned to either an intervention group (massage combined with phototherapy, n = 67) or a control group (phototherapy only, n = 67). In both groups, serum total bilirubin level and frequency of daily bowel movements were measured and compared during each of the first four days of treatment.

Results: Baseline levels of bilirubin were similar between the two groups (P > 0.05). During the measurements obtained post-intervention, significant differences surfaced between the two groups in bilirubin levels and frequency of daily bowel movements (P < 0.05 for both). No significant relationship was observed during days 1 and 2 of massage therapy between daily frequency of bowel movements and serum bilirubin level (P > 0.05); this relationship became significant during the third and fourth days (P < 0.05).

Conclusion: Massage therapy combined with phototherapy is an effective method for reducing serum total bilirubin in infants with neonatal jaundice.

1. Introduction

Neonatal hyperbilirubinemia refers to an excess of more than 5 mg/dl bilirubin above the normal level. Icterus (jaundice) appears as a result of the deposition of bilirubin in the skin and mucosa. Unconjugated (indirect) hyperbilirubinemia is usually benign, but severe cases can lead to kernicterus. Diagnosis and treatment of neonatal hyperbilirubinemia is of great importance in the prevention of encephalopathy. Increased bilirubin occurs in infants between 3 and 7 days of age. However, it is possible for jaundice to occur at birth or any time during infancy (Maisels & Newman, 2007; McGillivray, Polverino, Badawi, & Evans, 2016).

Researchers have considered different treatment methods ranging from phototherapy to neonatal blood transfusion to prevent the effects of hyperbilirubinemia. Each method has positive effects and drawbacks. Watery diarrhea, increased insensible water loss, skin rashes, blue baby syndrome, and temporary skin tanning are some of the effects of phototherapy. It is also a matter of debate whether phototherapy can cause melanoma in treating neonatal jaundice (Dennery & Lorch, 2007; Sharif et al., 2016). Complications associated with blood transfusion include allergic reactions and possible infections. Also, separation of the baby from the mother during...
phototherapy emotionally affects both the mother and the baby. Therefore, it seems necessary to simultaneously maintain the normal range of circulating bilirubin and control possible side effects.

Massage in infants after birth is a method that, in addition to inducing relaxation in the mother and baby, has also been proven to improve parameters such as height, weight, head circumference, bone density, sleep duration, and breathing patterns while reducing the incidence of infant colic (Field, Diego, & Hernandez-Reif, 2010; Hernandez-Reif, Diego, & Field, 2007) As is well-known, defecation is a mechanism whereby bilirubin is removed, decreasing the probability of jaundice (Diego, Field, & Hernandez-Reif, 2005). Published studies have reported that baby massage can ameliorate neonatal jaundice (Chen, Sadakata, Ishida, Sekizuka, & Sayama, 2011). In another study, Vimala massage did not have an effect on the processing of bilirubin (Seyyedrasooli, Valizadeh, Hosseini, Jafarabadi, & Mohammadzad, 2014). The conflicting results of these and other studies led to this study, in which the use of massage in tandem with phototherapy is investigated for its impact on increasing the frequency of daily bowel movements in neonates and thereby reducing neonatal jaundice.

2. Materials and methods

The infants were randomly divided into the intervention study group (67 infants undergoing massage with phototherapy) and the control group (67 undergoing phototherapy only). Infants in the intervention study group (under treatment) received massage and phototherapy 2 times a day for 15–20 min. The inclusion criteria were: 1–14 days after birth, gestational age of 38–40 weeks, no congenital anomalies, absence of maternal addiction to alcohol, cigarettes, or other drugs, no neonatal surgery, mother was exclusively breastfeeding (Jalali et al., 2016; Lotfi et al., 2016; Saba, Valeh, Ehteram, Haddad, & Ghazi, 2017). Each infant was carefully examined, and the related demographic and clinical data were registered in the checklist. Information recorded included gender, gestational age, mode of delivery, birth weight, Apgar score, maternal parity, delivery duration, mean birth weight during the first 4 days, defecation, the time of the first bowel movement (meconium) during the first 4 days, and total bilirubin within the first 4 days (Chen et al., 2011).

Infant massage was performed by mothers under the supervision of trained nurses. Infants were massaged an hour after waking up in the morning and at noon in a place with a room temperature between 24 °C and 28 °C. The mother would rub his/her hands together after washing and drying her hands so as to bring his/her body temperature close to the temperature of the infant’s skin. Massaging began with the face; baby oil was applied. The massager applied her two thumbs to gently and slowly massage the area around the eyes and cheeks. This action then continued from the bottom to the top of the chest area. Then, the massager performed some soft and semi-circular movements on the infant’s abdomen, followed by massaging with moderate pressure of the upper and lower limbs. Eventually, the spine was massaged using the two thumbs from top to bottom and from the neck to buttock. Terms and the method of massage were the same for all infants in the study group. The infants in the control group were given routine care.

The number of bowel movements in the first 4 days was recorded based on the reports of mothers and nurses. Using venous sampling and testing, we measured serum total bilirubin level for 4 consecutive days (once daily) (Ferdosian et al., 2015).

2.1. Ethical considerations

This clinical trial study has been approved as a research project by the Vice Chancellor for Research and Technology of Hamadan University of Medical Sciences under the project number C.16.359.631. The study was conducted in 2015 on 134 infants admitted to the pediatric ward of Besat Hospital in Hamadan after approval by the ethics committee and registration in the Iranian Registry of Clinical Trials (IRCT2014121610933N4). All procedures involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments.

2.2. Statistical methods

The Kolmogorov-Smirnov test was applied to determine the normal distribution of variables (Hosseini, Moniri, Goli, & Kashani, 2016; Kashani & Moniri, 2015; Kashani, Nikzad, Mobaseri, & Hoseini, 2012; Nikzad, Kashani, Kabir-Salmani, Akimoto, & Iwashita, 2013). Analyses were carried out based on the intent-to-treat population and performed using the analysis of variance (ANOVA) method (Dehghani, Sharif, Moniri, Sharif, & Kashani, 2016; Kashani et al., 2013). We applied one-way, but two-tailed Student’s t tests and Chi-square test with independent samples to compare between-group ratios. As the bilirubin levels were nor normally distributed in the two groups, the Mann-Whitney was used for the comparison of bilirubin levels between them; \( P < 0.05 \) was considered statistically significant (Dehghani, Sharif, Assadi, Kashani, & Sharif, 2016). All statistical analyses were done using the Statistical Package for the Social Sciences, version 19 (SPSS Inc., Chicago, Illinois, USA) (Dehghani, Sharif, Madani, Kashani, & Sharif, 2016).
3. Result

In this study, no significant differences in gender distribution, gestational age, type of delivery, birth weight, and Apgar score were noted in infants with neonatal jaundice between the two groups (massage plus phototherapy; control group) ($P > 0.05$) (Table 1).

Bilirubin levels at the beginning of the study were similar between the two groups ($P > 0.05$). Significant differences surfaced in the first two days post-intervention ($P < 0.05$) (Table 2 and Fig. 1) (Graph 1).

Significant differences existed in the frequency of daily bowel movements daily between the two groups (Table 3) ($P < 0.05$).

No significant relationship existed between the frequency of daily bowel movements and serum bilirubin levels during the first and second day in massage group ($P > 0.05$). A significant statistical relationship existed between frequency of daily bowel movements and serum bilirubin level during the third and fourth days in massage group ($P < 0.05$); this relationship was not statistically significant on any of the four days in the control group (Table 4) ($P > 0.05$).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy</td>
<td>Massage: 37 (55.2%)</td>
<td>0.167</td>
</tr>
<tr>
<td></td>
<td>Control: 29 (43.3%)</td>
<td></td>
</tr>
<tr>
<td>Girl</td>
<td>Massage: 30 (44.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control: 38 (56.7%)</td>
<td></td>
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<tr>
<td>Gestational Age</td>
<td></td>
<td>0.236</td>
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<tr>
<td>Mean (SD)</td>
<td>Massage: 38.61 (1.27)</td>
<td></td>
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<tr>
<td></td>
<td>Control: 38.89 (1.6)</td>
<td></td>
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<tr>
<td>Delivery</td>
<td></td>
<td>0.603</td>
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<tr>
<td>Natural</td>
<td>Massage: 34 (50.7%)</td>
<td></td>
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<tr>
<td></td>
<td>Control: 38 (56.7%)</td>
<td></td>
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<tr>
<td>Caesarean</td>
<td>Massage: 33 (49.3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control: 29 (43.3%)</td>
<td></td>
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<tr>
<td>Birth Weight</td>
<td></td>
<td>0.06</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>Massage: 3.04 (0.19)</td>
<td></td>
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<tr>
<td></td>
<td>Control: 3.07 (0.19)</td>
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<tr>
<td>Apgar score</td>
<td></td>
<td>0.282</td>
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<tr>
<td>8</td>
<td>Massage: 39 (58.2%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control: 46 (68.7%)</td>
<td></td>
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<tr>
<td>9</td>
<td>Massage: 28 (41.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control: 21 (31.3%)</td>
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</table>
4. Discussion

Notably, no significant differences existed among the background variables of gender, gestational age, mode of delivery, birth weight, and Apgar score of newborns with neonatal jaundice in the massage therapy and the control groups. Hence, the randomization process has been done appropriately, and these confounding factors cannot be considered to influence the differences between the treatment results of the two groups.
Based on the results of this study, the program of massage plus phototherapy, conducted for 4 days, had a significant impact on the reduction of total bilirubin in newborns with neonatal jaundice. In a study correlated with our study, was found that the bilirubin level in the massage plus phototherapy group was less than that in the control group (Dalili, Shokhi, Shariat, & Haghnazarian, 2016). Similarly, in another study, a significant reduction in bilirubin levels was reported within 4 days of treatment in the massage group compared to the control group (Basiri-Moghadam, Basiri-Moghadam, Kianmehr, & Jani, 2015). In a different study performed in 60 infants with jaundice, it was revealed (similar to our study) that bilirubin levels in the massage therapy and control groups were the same during the first and second days, but on the third day were significantly lowered in the massage therapy group compared to the control group (Lin, Yang, Cheng, & Yen, 2015). In another study by Chen et al. (2011) in 69 infants with jaundice, the level of total serum bilirubin on the fourth day in the massage therapy group was also significantly lower than in the control group (Chen et al., 2011), a finding (that is, lower serum bilirubin with massage) that is also supported by other studies (Moghadam, Moghadam, Kianmehr, Jomezadeh, & Davoudi, 2012).

The results of our study are consistent with the aforementioned studies in the field; however, other studies have arrived at different conclusions. In a study with results incompatible with the results of the present study, it was found that the levels of bilirubin within four days of treatment were the same in the massage therapy group and the control group (Seyyedrasooli et al., 2014). Likewise, a different study reported no significant difference between the control group and the massage plus phototherapy group in terms of the amount of bilirubin (Karbandi et al., 2016). The lack of compatibility between these studies with our research could be due to differences in sample size, massage therapy methods, and different incidences of jaundice.

Several studies have reported on the mean daily bowel movements in infants receiving massage plus phototherapy, specifically asserting that the incidence was higher in this group versus control groups. In a study similar to ours, Dalili et al., (2016) observed more frequent defecation in the massage therapy group versus a control group on the first day of treatment (Dalili et al., 2016). Another study found that the frequency of bowel movements during the 4 days of treatment was higher in the massage group than in the control group (Basiri-Moghadam et al., 2015). Furthermore, Lin et al. (2015) realized that frequency of bowel movements on the first and second days in their massage therapy and control groups were the same, but that on the third day that frequency of bowel movements was higher (and serum bilirubin levels) significantly lower in the massage plus phototherapy group than in the control group (Lin et al., 2015). Other researchers have found that the frequency of bowel movements within four days of treatment was greater in the massage therapy group than in the control group (Seyyedrasooli et al., 2014). Similarly, others have shown a significant between the frequency of defecation on the first and second days in the massage therapy group and the control group (Chen et al., 2011). However, in another study no significant difference was observed between the frequency of daily bowel movements in the message therapy and the control groups within the first 4 days. Such an incompatibility can be attributed to the difference in the kind of massage therapy used by each study (Seyyedrasooli et al., 2014).

In this study, no significant difference was seen in the massage plus phototherapy group regarding the frequency of daily bowel movements and serum bilirubin level on the first and second days; this difference only appeared on the third and fourth days. No significant relationship emerged at any point in time in the control group. Serum bilirubin levels can therefore be reduced through increasing the number of daily bowel movements using a program of massage plus phototherapy. Lin et al. (2015) have suggested that massage therapy can lead to early reduction in bilirubin levels, which may shorten treatment with phototherapy and thus lead to earlier discharge (Lin et al., 2015). Moreover, Chen et al. (2011) have indicated a mechanism of jaundice reduction in massage therapy that massage therapy can lead to early reduction in bilirubin levels, which may shorten treatment with phototherapy and thus lead to earlier discharge (Lin, Yang, Cheng, & Yen, 2015). In another study by Chen et al. (2011) in 69 infants with jaundice, the level of total serum bilirubin on the fourth day in the massage therapy group was also significantly lower than in the control group (Chen et al., 2011), a finding (that is, lower serum bilirubin with massage) that is also supported by other studies (Moghadam, Moghadam, Kianmehr, Jomezadeh, & Davoudi, 2012).

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Several limitations exist in this study. First, this study was conducted over 4 days; it is recommended that such a study be continued for a longer period of time to investigate the long-term effect of massage and phototherapy on serum bilirubin levels. Second, the sample size in this study was relatively small (N = 134); the lack of significance regarding differences in the variables of interest in this study could be due to the low sample size. We suggest that future studies be designed with larger sample sizes. Third, since the method of massage therapy plus phototherapy is an influential factor on neonatal bilirubin levels, and because this study has not dealt with the role of the type of a given massage therapy in neonatal bilirubin level, we propose that further research be conducted with respect to the impact of different massage methods.

5. Conclusion

Massage therapy combined with phototherapy is an effective method for reducing serum total bilirubin within 4 days in infants with neonatal jaundice. The frequency of daily bowel movements increased through the application of this program, likely leading to the consequent reduction of serum bilirubin levels.
Conflict of interest

The authors declared that they have no competing interests.

Ethical responsibilities of authors

This paper is our original unpublished work and it has not been submitted to any other journal for reviews.

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