

The effect of massage on neonatal jaundice in stable preterm newborn infants: a randomized controlled trial

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Abstract

Objectives: To evaluate the effects of massage therapy on transcutaneous bilirubin of stable preterm infants.

Methods: The controlled clinical trial was conducted in 2014 at Shahid Hasheminejhad Hospital, Iran, and comprised preterm neonatal children in the neonatal intensive care unit. The newborns were divided into two groups of massage and control via random allocation. The children in the control group received the routine therapy whereas those in the massage group underwent the same four days of routine plus 20 minutes of massage twice a day. The transcutaneous bilirubin and the number of excretions of the newborns were noted from the first to the fourth day of the intervention and results were compared between the two groups.

Results: There were 40 newborns in the study (20(50%) each in the two groups. There was a significant difference in the number of times of defecation ($p=0.002$) and in the level of bilirubin ($p=0.003$) between the groups with those in the massage group having a higher number of defecations as well as a lower level of transcutaneous bilirubin.

Conclusion: Through massage therapy the bilirubin level in preterm newborns can be controlled and a need for phototherapy can also be delayed.

Keywords: Neonatal jaundice, Massage, Preterm infants, Transcutaneous bilirubin. (JPMA 65: 602; 2015)

Introduction

Neonatal jaundice is such a common problem in newborns that 60% of term newborns and 80% of preterm infants succumb to the condition, which is caused by an increase in bilirubin level.¹ Neonatal jaundice or hyperbilirubin is mostly cured (20% cases) though it can still prove hazardous and need medical intervention.² The most life-threatening case arising from this condition is kernicterus. Unfortunately, this condition is fatal in 75% cases and 80% of those who stay alive do not escape unscathed and exhibit problems related to the nervous system. Thus a timely cure of neonatal hyperbilirubin can become a major preventive measure.³ Different methods are subscribed for the lowering of the bilirubin level, the most important of which are: exchange transfusion, phototherapy and using pharmacological agents.⁴

However, the remedial practice that has become most common for curing hyperbilirubin is phototherapy, which has several side-effects ranging from doing harm to the cornea and the genital region to causing dehydration, diarrhoea and bronze kid syndrome. Thus there is constant research going on to find a substitute for

phototherapy or to lessen the duration of the same.⁵ Infant massage is a traditional practice in several regions of the world, to be more precise, in the cultures of Africa and Asia, like in the people of indigenous South Pacific and in the Commonwealth of Independent States. A survey done recently in Bangladesh showed that 96% of the caretakers of neonates engaged in massaging the whole body of the infant one to three times a day. Healthcare practitioners in the West have also started to show interest in infant massage, especially, as an intervention measure for infants in neonatal intensive care units (NICUs) where mostly the environment is stressful and lacks adequate tactile stimulation. In order to promote infant growth, more parents and caretakers of low-risk babies are being trained in massage in the Western world.⁶ Few studies on the efficacy of infant massage on bilirubin levels have been carried out with a focus on the different techniques of massage and rarely have results been found to be very similar or stable in this regard.⁷⁻¹³ A couple of studies have been found to support the effect of massage on colicky infants.¹⁴ In recent years, the necessity for further research on the same has grown because of evidence showing an association between vagal activity and gastric motility.¹⁵ A study to see the effects of supplemental stimulation on preterm neonatal children suggested that the stimulation of peripheral nerves leads to a stimulation of the vagal nerve resulting in the release of gastrointestinal hormones like gastrin and cholecystokinin.¹⁶ These hormones in turn can increase the strength of digestion

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and the excretion of bilirubin.

Another research showed that massage stimulation encourages the passing of more meconium containing bilirubin by newborns and suggested that neonate massage can contribute toward the prevention of neonatal jaundice and the controlling of bilirubin to within normal range.¹⁷ Taking all the above into account, this research has been carried out with the aim of studying the effect of massage, using Field's Technique,¹⁷ on neonatal jaundice in stable preterm newborns.

The current study as planned to evaluate the effects of massage therapy on the transcutaneous bilirubin of stable preterm infants in a controlled clinical trial.

Patients and Methods

The randomised control trial was conducted at Shahid Hasheminejad Hospital, Mashhad, Iran, between January and November 2014. After getting approval from the Ethical Committee for Research, Gonabad Medical University, and informed written consent by the parents, newborns in the hospital NICU were selected and randomly allocated into Massage and Control groups. In accordance with similar research results¹⁸ we expected the difference in bilirubin level in both groups on the 4th day of intervention to be 2mg/deciliter ($x_1 = 11.97$, $x_2 = 9.92$, $S_1 = 1.52$, $S_2 = 1.30$) and the total variance of the groups to stand at 4. Therefore, according to the formula used in comparative studies for two independent mean populations, the sample size was estimated at 13 neonates for each group at 90% power with a 2-sided significance level of $\alpha = 0.05$. Further, by taking into account the experience of the researchers which shows that many newborns need phototherapy on day 4 after birth, it was decided to increase the number of subjects in each group so as to have ample amount of sample remaining after day 4.

The inclusion criteria comprised willingness of the parents, a medically-acceptable stable condition in the samples, birth weight 1500-2500g, gestational age 34-36 weeks, a fifth-minute Apgar score 8-10, breast feeding and the absence of any disease at birth such as neonatal asphyxia, haemolytic condition, patent ductus arteriosus (PDA), respiratory distress syndrome (RDS) and sepsis. Exclusion criteria comprised unwillingness of the parents, beginning of phototherapy for the newborn, signs of infection during the study and leaving hospital before the end of the study period. Those selected were randomly allocated to the two groups. To be able to balance the groups on the basis of number of participants, the randomisation was done within fixed-sized blocks each having a size of 4. Further, each block had 4 preterm

infants and lots were drawn for the order of entry in each group. The samples were not blinded through treatment allocation. One trained personnel administered the massage and had no other role in the study and was blinded to our hypothesis. Another assistant measured and noted the transcutaneous bilirubin and stool frequency of the patients, and he was blinded to the randomisation. Finally, in order to ensure comparability, all lab testing was done by a single person.

The variables that were collected from the patient's file on day 1 after birth included gender, weight of the newborns, gestational age, Apgar score in the 1st and 5th minutes, type of delivery, and parents' age.

Transcutaneous bilirubin was recorded on the 1st day of birth before any massage intervention as well as from the 2nd to the 4th both before as well as after massage using a Bilitest gadget (Technomedica) made in Russia. The accuracy and value of this gadget have been confirmed in research work undergone in Iran. The correlation coefficient of the transcutaneous and serum bilirubin was noted from two other studies respectively to be 0.82(3) and 0.88.¹⁹ In the present research, the transcutaneous bilirubin count was a mean of three readings each time that included once from the forehead and twice from the thorax.

The mothers were asked to fill a checklist that was given to them to note the number of times the newborn defecated during the day and this data was collected from day 1 to day 4.

Massage was done from the first postnatal day to the fourth for 20 minutes, twice daily 1 hour after the morning and mid-day feeds. In all cases, room temperature was maintained between 24-28°C, hands were washed thoroughly, almond oil (Barij Essence Pharmaceutical Co., Iran) was used, and pressure was applied to the newborn's skin with warm, bare hands. The massage started on the face with the two thumbs gently rubbing the periorbital and cheek regions. It continued on to the chest where the two hands of the administrator slid from the lower margin of the chest across to the upper edge, alternately; after that to the abdomen where the massager gently pushed a half circle corresponding with the structure of the colon. Next was the turn of the limbs, where the performer applied moderate pressure on the external side of the upper and lower limbs; and finally the back was massaged during which the performer slid both hands from the vertebra to the two sides from the neck to the buttocks. If the newborn cried or defecated during the massage, the act was interrupted and the massage was continued after normality was restored. The control group, on the other

hand, did not receive massage therapy. Both groups received standard NICU care as had been prescribed by their attending physicians.

SPSS 14 was used for statistical analysis. In order to confirm normality, Kolmogorov-Smirnov test was used and for the comparison of the quantitative variables with normal distribution (mother's age, father's age, transcutaneous bilirubin, stool frequency and weight) in the two groups, the independent sample t-test was used. For comparing the quantitative variable with non-normal distribution (gestational age, Apgar score), the non-parametric Mann-Whitney test was utilised. To compare ratios of gender and type of delivery in the two groups, chi-squared test was used. Moreover, the repeated measure analysis of variance (ANOVA) test was used to compare the quantitative variables of stool frequency and transcutaneous bilirubin in the two groups. P value below 0.05 was considered significant.

Results

Of the 48 patients meeting the inclusion criteria, parents of 8(16.6%) newborns refused to participate. The two groups at the start of the study period had 20(50%) newborns each. On the third day after intervention, 1(5%) child from the Massage group and 6(30%) from the Control group needed phototherapy and were thus eliminated. Finally, 14(70%) newborns in the Control group and 19(95%) in the Massage group completed the study.

There was no statistical difference in the two groups with regard to gender ($p=0.52$), type of delivery ($p=0.11$), Apgar score-minute-1 ($p=0.79$) and minute 5 ($p=0.43$),

Table-1: Demographic comparison.

Variable	Massage group	Control group	P-value
Gender			
Male	11	13	0.52*
Female	9	7	
Delivery Type			
Normal	11	6	0.11*
Caesarean	9	14	
Apgar Score1			
Median (Interquartile range)	7(7-8)	7.5(7-8)	0.79**
Apgar Score5			
Median (Interquartile range)	10(9.25-10)	10(10-10)	0.43**
Gestational age(wk)			
Median (Interquartile range)	35(35-36)	35.5(34-36)	0.98**
Mean Weight(g)	2141.00±250.84	2069.50±266.23	0.38***
Mean Age of father(y)	36.35±6.47	34.90±6.36	0.48***
Mean Age of mother(y)	31.7±6.45	30.05±5.26	0.38***

*P-values were resulted from chi-square test. **P-values were resulted from Mann-Whitney test.

***P-values were resulted from independent samples t-test.

Table-2: Comparison of the daily stool frequency.

Day	Massage group Mean±SD	Control group Mean±SD	P-value
1	2.60±0.50	2.05±0.39	0.001
2	3.20±1.00	2.45±1.15	0.02
3	4.53±1.35	3.50±0.89	0.01
4	4.79±0.98	3.81±1.60	0.04

Independent samples t-test was used.

Table-3: Comparison of the daily transcutaneous bilirubin.

Day	Massage group Mean±SD	Control group Mean±SD	P-value
1	5.60±1.14	5.65±1.09	0.98
2	6.60±1.09	7.30±1.49	0.1
3	8.05±1.39	9.75±1.61	0.003
4	9.90±1.30	12.00±1.50	<0.001
Diff. in Day 1 to 4	4.79±1.84	7.56±1.36	<0.001

Independent samples t-test was used.

weight on day 1 of birth ($p=0.38$), gestational age ($p=0.98$), father's age ($p=0.48$), and mother's age ($p=0.38$) (Table-1).

The mean stool frequency of the Massage group on day 1 ($p=0.001$), day 2 ($p=0.02$), day 3 ($p=0.01$) and day 4 ($p=0.04$) were significantly higher than that of the Control group (Table-2). A statistical difference was noted in stool frequency ($p=0.002$), showing a higher frequency in the Massage group against that of the Control group.

The mean transcutaneous bilirubin readings on the 1st day after birth, before any kind of intervention, stood at $5.65±1.09$ for the Control group and at $5.60±1.14$ for the Massage group ($p=0.98$). A meaningful statistical variation in transcutaneous bilirubin appeared from day 3 ($p=0.003$) and day 4 ($p<0.001$) after intervention i.e. The mean difference in bilirubin between the first to fourth day was $7.56±1.36$ and $4.79±1.84$ mg/deciliter for the Control and the Massage group, respectively ($p<0.0001$) (Table-3).

A mean statistical difference in transcutaneous bilirubin in the two groups ($p<0.0001$) was also noted.

Discussion

Our findings showed that the level of transcutaneous bilirubin increased much less in stable premature neonatal children who had been given massage intervention compared to those who had not received the treatment. There was no meaningful difference in the average transcutaneous bilirubin of the newborns read on the 1st day after birth (before intervention) in both the groups. However, a meaningful statistical difference

started manifesting in bilirubin levels of both groups on the 3rd and 4th days after intervention as the mean level of bilirubin in the preterm neonatal sample group was considerably lower than that of the preterm neonatal control group. In a similar study on full-term newborns, it was concluded that the mean bilirubin level in newborns receiving massage was lower than the ones who did not receive massage, and that this difference was statistically meaningful.¹⁷ In another research done on full term newborns undergoing phototherapy, a greater decrease in levels of serum level bilirubin was seen in newborns who had received massage. The mean in the newborns of the massage and control groups was found to be statistically different on the 4th day after intervention.²⁰ In another research that was carried out to see the effect of skin-to-skin contact (kangaroo care) between mother and preterm newborn receiving phototherapy, it was observed that although the process of phototherapy was interrupted, the sample group newborns showed a greater decrease in bilirubin levels compared to those in the control group; and that this difference was statistically significant.¹³ Another research focused on the efficacy of massage on physiological jaundice in term neonates and concluded that a significant difference in mean transcutaneous bilirubin level index of the children in the massage group existed compared to the control group; showing that the mean index of the same was lower in the sample group.²¹ On the other hand, a group studied the physiologic and behavioural effects of gentle human touch on preterm newborns. No statistically meaningful difference was seen in the two groups with regard to number of days under phototherapy.¹² Further, a study on the bio-behavioural effects of gentle human touch on preterm neonatal stated that there was no statistically meaningful difference in the number of days the sample and control groups had undergone phototherapy.²² The reason for the difference in results of the two above-mentioned researches and the present study may be due to the difference in techniques used. We used the Field's Technique, which is a massage intervention method, while the therapists in the studies under question would only gently place their hands on the body of the newborns. Another reason could be the fact that phototherapy was also carried out simultaneously to the gentle human touch method in a study and the number of days under phototherapy in the two groups was compared. In our study, massage intervention was begun immediately after birth in order to prevent a rise in bilirubin and the mean level of transcutaneous bilirubin in the two groups was evaluated.

Moreover, our results showed the average stool frequency to be higher in the preterm neonatal of the Massage

group compared to those in the Control group; a meaningful statistical difference was seen from day 1-4 after intervention. In line with the same, a study on full-term neonates reported an increase in stool frequency in children who had received massage compared to those who had not; and this difference was statistically meaningful.¹⁷ Another study found a statistically meaningful difference in stool frequency in the control and sample groups on the 1st and 2nd days after intervention — showing a higher frequency in the sample group.²¹ The increase in stool frequency in the newborns receiving massage could be due to the stimulation of the vagal nerve which can be caused by a stimulation of the peripheral nerves. An increase in stool frequency reduces the re-absorption of conjugated bilirubin that is secreted in the intestines and thus prevents an increase in bilirubin. On the other hand, the stimulation of the vagal nerve causes an increase in gastrointestinal hormones that can further assist the digestion and excretion of bilirubin consequently decreasing the level of the same.

One of the limitations of our study was that serum level bilirubin tests were not carried out because of the unethical practice of drawing blood from newborns for bilirubin testing. Another one was limited external validity due to it being a single hospital study. The results of this study cannot be generalised to high-risk, and very low birth weight neonates. It is suggested that long-term efficacy of massage on preterm neonatal jaundice, especially during phototherapy, be studied further.

Conclusion

The level of bilirubin increased much less in stable premature newborns who had been given massage compared to the same type of newborns who had not received such a treatment. Massage can prevent excessive bilirubin elevation and it reduces the need for phototherapy and exchange transfusion.

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