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The Effects of Massage on Oxygen Saturation of Infants with Respiratory Distress Syndrome Treated with Nasal Continuous Positive Airway Pressure

Tahereh Ramezani[1], Hamideh Baniasadi[2*] and Mohammad Reza Baneshi[3]

[1]Department of Nursing Public Health, Razi Faculty of Nursing and Midwifery, University of Medical Sciences, Kerman, Iran.
[2]Razi Faculty of Nursing and Midwifery, University of Medical Sciences, Kerman, Iran.
[3]Department of Research Center for Modeling in Health, Faculty of Public Health, Kerman Medical University, Kerman, Iran.

Authors' contributions

This work was carried out in collaboration between all authors. Author TR designed the study, wrote the protocol and authors TR and HB managed the analyses of the study. Author HB managed the literature searches and wrote the first draft of the manuscript. Author MRB performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Background: The aim of this study was to assess the effect of massage on oxygen saturation of infants with respiratory distress syndrome (tactile and kinesthetic stimulation). These infants have immature systems to cooperate with stressors. Massage is one of the best-known methods of supplemental care and there is no adequate evidence to support the claim that infants with complex medical conditions how response to massage.
Methods: This study was a quasi-experimental study with before and after design that conducted on 45 preterm infants who were admitted in neonatal intensive care unit. The subjects received massage 15 min per day for five days by using Field massage technique. Respiratory rate, oxygen saturation and heart rate were measured 5 min before and after massage. The data were analyzed using a mixed model.

**Corresponding author: E-mail: hamideh.baniasadi@chmail.ir;*

Results: There were no significant differences between before and after massage on oxygen saturation (P=0.13), but respiratory (P=0.004) and heart rates (P=0.03) were reduced after massage.
Conclusion: Massage therapy can provide developmental care for infants treated with nasal continuous positive airway pressure (NCPAP). These results could help health care professionals to provide efficient support, as well as perform the appropriate massage of preterm infants.

Keywords: Massage; respiratory distress syndrome; preterm infant; oxygen saturation; respiratory rate; heart rate.

1. INTRODUCTION

Infants born before the completion of 37 weeks of gestational age are preterm; these neonates are the classic high risk neonates because of their immature organs [1-3]. Immature lung tissue and respiratory distress syndrome (RDS) are the most common problems that indicate the need for neonatal intensive respiratory care [4]. New progresses in non-invasive devices for respiratory support have resulted in the use of nasal continuous positive airway pressure (NCPAP). Due to cost-effectiveness and easiness, NCPAP is used to help preterm neonates with respiratory distress and to prevent collapse of alveoli at the end of expiration [5]. It is important for neonatal care givers to focus on progresses in premature infants' health and to save their lives [6]. Recently, important emphasis has been placed on complementary treatment and supportive strategies for developmental and mental health [7]. It seems that these strategies for preterm neonates may reduce RDS [8]. Massage is one of the master key of complementary treatment. Complementary treatment is a crucial nursing practice for neonates [9]. So, massage is an intervention that may be beneficial for preterm infants and neonates with low birth weight. Performing massage for babies is a kind of alternative care that has been a matter of long debate [7]. Studies have shown that infants who receive massage are usually more compatible to environmental stressors and tolerate less negative effects [10]. Massage leads to early hospital discharge, coordination of heartbeat and breath, and reduction of costs [4,11-13]. Physiological indicators of pain and stress in preterm babies are similar and may lead to reduction of oxygen saturation and changes in respiratory rate [2]. So, these indicators are considered as the results of stress. Several studies have been conducted on massage of preterm infants with stable physiological conditions There is no clear and enough evidence to prove the unsafely of massage for infants with complex medical conditions such as those treated with oxygen therapy [14].

Literature review showed that massage is beneficial to premature infants. This study was conducted to assess the effect of massage on oxygen saturation of preterm infants with respiratory distress syndrome in NICU in south-east of Iran.

2. MATERIALS AND METHODS

2.1 Design

This was a quasi-experimental study with before-after design that conducted in Kerman, Iran. The sample of infants in this study was selected from one hospital under the supervision of Kerman University of Medical science.

2.2 Sample

Forty five neonates, who were admitted to neonatal intensive care unit in Afzalipour Hospital, participated in this study. All the infants were in a group and were assessed before and after field massage. This allocation technique was implemented considering the baby's weight at birth and gestational age. Inclusion criteria were (1) a gestational age of 28-34 weeks at birth, (2) no congenital anomalies, neurological and cardiovascular disorders, (3) not having undergone surgery, (4) Apgar score more than 6 at 5 min, (5) lack of medical condition contraindicating the running of field massage, (6) suffering from respiratory distress syndrome treated with NCPAP, (7) receiving NCPAP with fraction of inspired oxygen (FiO_2) of less than 70%, and (8) minimal oxygen saturation of 92% [2]. The Field massage intervention was provided for each infant 15_min that consist of three 5_min period in a day for 5 days. Each session lasted 15 minutes. The field protocol for preterm infants includes some of the key aspects of the traditional massage (warm hands, touch with

mild pressure and slow hand movement) that are appropriate for preterm infants. Before the initiation of the study, one of the researchers was trained in field massage. She was then evaluated by neonate subspecialist for correct administration of the intervention from the protocol. The protocol of field massage used in this study consists of the following procedures [15]. The researcher provided Filed massage to preterm infants that lasted 15 min: Tactile stimulation (5 min), kinesthetic stimulation (5 min) and Tactile stimulation again (5 min).

1. After wearing a clean inner gown, the researcher washed her hands and arms thoroughly with antimicrobial agents for 3 min.
2. The researcher warmed both of her hands using a radiant warmer until the temperature of the palms reached 93.28℉ (34.08℃).
3. The researcher relaxed both arms and the muscles of both shoulders for 1 min and breathed deeply to concentrate Ki energy on the palms.
4. The researcher provided field massage to preterm infants which lasted for 15 min: Tactile stimulation (5 min), kinesthetic stimulation (5 min) and tactile stimulation again (5 min).

    - Tactile stimulation (5 min): During tactile stimulation, the infant was placed in a prone position. The flats of the fingers of both hands stroked the infant for 5 min in each region of the body from head to toes.
    - Kinesthetic stimulation (5 min): For kinesthetic stimulation, the infant was placed in a supine position. This phase comprised of5 min of 6 passive flexion/extension movements lasting for approximately 10s for each arm, then each leg, and finally both legs together.
    - Tactile stimulation (5 min): The researcher followed the same tactile stimulation as described previously.

The person who was responsible for one intervention was not allowed to conduct the other intervention. The intervention was provided for 5 consecutive days: 15-minperiods at the beginning of three consecutive hours. Each massage always began approximately 1 h after the afternoon feeding (2 p.m.). The other person who was NICU nurse measured the respiratory rate (RR), FiO_2 and oxygen saturation 5 min before and after massage. The values were recorded in the relevant checklist. It should be noted that massage was promptly stopped and postponed for one hour in case of physiological distress. The massage therapy procedure was then repeated or the case was excluded. According to Harrison [16], physiological distress happens when an infant's heart rate (HR), indicated by pulse oximeter, is less than 100 or more than 200 per minute for 12 s or more and the oxygen saturation level is below 90% for more than 30 s. However, due to the sensitive conditions of newborns, these criteria were modified based on the advice of a neonatologist. Therefore, distress was considered as when the infant's HR, indicated by pulse oximeter, was less than 80 or more than 180 for 12 s or more and her/his oxygen saturation was lower than 90% for more than 30 s. Data was collected using a hospital documentation form which consisted of a part which assesses demographic characteristics and the chart of RR, FiO_2 and oxygen saturation. Data was recorded 5min before and 5min after the message. During the intervention, a monitoring system (Masimo S1600, Pooyandegan Rahe Saadat Co., Iran) and an air-oxygen blender system (Medin Co.) were used to record oxygen saturation and FiO_2, respectively; and RR (per minute) was observed and recorded.

2.3 Ethical Consideration

There was an approval from the heads of NICU prior to the collection of data. The study proposal was also reviewed and approved by center's office of Research Ethics in Kerman Medical Science University (Ethic code: K/92/225). The written informed consent forms were signed by the parents. The consent form explained that participation was completely voluntary, and they can withdraw from the study at any time. They were informed about the purpose of study and procedure, both verbally and with written information. For confidentiality, there was no personal information on the scale.

2.4 Data Analysis

Data was analyzed using SPSS22. Quantitative and qualitative variables were reported as mean (SD) and frequency (percentage), respectively. The mixed model was tested using covariance structure of compound symmetry and a Sidak post hoc test to compare quantitative variables in different time points and dates. The Chi-square test was used to compare gender distribution of

the study subjects and analysis of variance (ANOVA) was applied to compare gestational age and birth weight. P values less than 0.05 were considered as significant.

3. RESULTS

A descriptive analysis of the background information indicated that the premature infants belonged to the gestational age of 26-34 weeks with a mean age of 32.96 weeks. They were mostly males (62.2%). About 64% of them were born through cesarean section (C/S). The group's mean of birth weight was almost 1970 g. The mean score of Apgar for the group was 9 (Table 1). Statistical analyses did not show a significant difference between oxygen saturation across the intervention days (F=2.87, P= 0.13). During the 5 days of intervention, significant differences were observed between before and after of respiratory rate (F=2.87, P= 0.001) and heart rate (F= 2.25, P=0.03). Both of them were lower after massage in the intervention group (Table 2). In addition, Post Hoc test (LSD) showed that there were significant differences between first and third days (P value =0.002), and first and fourth day (P value =0.04) in regard to infants' oxygen saturation; between first and fifth days(P value=0.028), and second and third days (P value =0.01) in regard to infants' heart rates; between first and fifth days (P value =0.037) and between second and fifth days (P value=0.011), and fourth and fifth days (P value = 0.003) in regard to infants' respiratory rates.

4. DISCUSSION

The results of the present survey did not confirm the effectiveness of field massage on oxygen saturation of infants with RDS treated with NCPAP. There was no significant difference in oxygen saturation of infants before and after massage across the 5 days of intervention. This finding therefore supports previous studies that reported that oxygen saturation of infants remain within the safe limits during the massage sessions [13-15]. In contrast, Harrison [16] evaluated the effects of massage on oxygen saturation. He suggested that massage may decrease it. This inconsistency between the present study and that of Harrison's [16] could have resulted from differences in touch frequency, the age of subjects and the clinical condition. The work of [2,17-19,4,16-18] also reported that oxygen saturation may increase after massage. These findings are not too different from that of the present study. According to the results, slight increase was observed in the mean of the oxygen saturation across the intervention days. Massaging the skin makes catecholamine to be released. In addition, according to Livingstone's study epinephrine affects beta-adrenergic receptors in the air ways and increases their diameter which in turn leads to increased alveolar ventilation. This process finally leads to an improvement in mean oxygen saturation [20]. However, unlike the results of the present study, [16,18] reported no significant differences in them during intervention. This might be due to the diversity of medical conditions and use of different techniques. Also, the present study showed significant differences in RR Livingstone et al. and Basiri-Moghaddam et al. [20,21] found statistically significant differences in RR between treatment and control groups while the RRs were within normal range. However, unlike our results, Bostani Khalesi et al. and Harrison et al. [17,19] reported no significant differences in RR before and after the intervention. This might be due to diversity of medical conditions and using different type of massage or study.

The results show a significant decrease in heart rates that was supported by Modercine [22] and Horrisone [17] study, but Epstin [23] demonstrated that during stressful events in premature infants, an increase in heart rate. This finding shows that massage promotes infants' comfort, reduce their stress, and help them to be calm during their hospitalization.

Table 1. Characteristics of the study sample (n=45)

Characteristics		N (%) or Mean (SD)
Sex	Male	28(62.2)
	Female	17(32.8)
Delivery type	NVD	16(36)
	C/S	29(64)
Gestational age(week)		32.96(2.16)
Birth weight(gram)		1970.44(315.98)
Apgar score(5min)		9(0.98)

Table 2. Oxygen saturation, respiratory rate and heart rate before and after massage across 5 days

Massage		1 day Mean (SD)	2 day Mean (SD)	3 day Mean (SD)	4 day Mean (SD)	5 day Mean (SD)	F	P
Oxygen Saturation	Before	94.48(2.01)	94.48(3.06)	94.44(2.09)	94.82(2.67)	94.28(2.85)	2.87	0.13
	After	95.33(3.40)	94.88(3.01)	94.80(3.42)	95.08(2.93)	95.08(2.93)		
Respiratory Rate	Before	50.69(9.96)	48.36(11.09)	45.38(6.86)	44.76(6.35)	46.38(8.74)	2.87	0.004
	After	46.09(11.21)	46.87(14.76)	43.98(8.76)	42.13(11.33)	44.09(7.11)		
Heart Rate	Before	142.09(14.71)	142.51(15.69)	142.16(19.97)	140.84(13.05)	138.93(13.48)	2.25	0.03
	After	141.09(19.38)	138.56(19.96)	137.96(17.76)	139.40(13.77)	133.42(19.10)		

5. CONCLUSION

The result of this study showed that massage can reduce stress and energy expenditure, and consequently decrease oxygen dependency during the early weeks in the preterm infants with RDS and hospitalized in the NICU. They can consequently cause growth and development in the preterm infants. Of course, further research needs to be done in order to examine the effect of massage on later developmental outcomes in childhood. Since touch is one of the first strong positive senses in neonate, possibly, massage can enhance sensory maturation and thereby promote more optimal behavioral organization at the time of hospital discharge. This study suggests that appropriate effects of massage should be assessed in different situations, for example, painful procedures such as venipuncture, intubation and suctioning. According to the findings of this study, massage could be one of the safe interventions that nurses use for preterm infants in order to enhance their development. Nurses working in NICU and parents need to be educated on how to provide massage for preterm infants. All information on the risks and benefits as well as the best intervention strategies before this intervention is conducted should be included in the educational program. Further study suggests examining NICU nurses' views on one type of touch therapy (field massage), its benefits and disadvantages as well. It also suggests comparison of the effect of this type of touch on preterm infants when they are administered by NICU nurses and parents.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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