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Original Article

Effect of Nesting on Extensor Motor Behaviors in Preterm Infants: A Randomized Clinical Trial

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ABSTRACT

Background: The aim of this study was to investigate the effect of bedding preterm infants in nests on their motor behaviors in a neonatal intensive care unit (NICU) in Iran.

Methods: In this randomized controlled trial, 44 clinically stable preterm infants, admitted to the NICU, were recruited and randomly divided into two groups of control and intervention. The routine of the unit was to take care of infants on a flat mattress. The intervention was a U-shaped cloth nest in which the intervention group was bedded for 7 days. The control group consisted of infants who were normally cared without any boundaries. All infants were videotaped before and on the last day of the intervention. The motor behaviors, as defined in the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) sheet, were analyzed in each of the films.

Results: To compare the number of total extensor motor behaviors between the two groups, the change score in each group was calculated and compared between the two groups. The mean change scores in the intervention and control groups were -21.36±13.5 and 2.32±7.9, respectively. Accordingly, nesting significantly reduced the occurrence of unstable behaviors in the intervention group, compared to that in the control group (P<0.001).

Conclusion: According to the findings, supporting the preterm infant body even by accessible materials could enhance their neurodevelopmental strengths and motor behavior stabilities.

Keywords: Infants behaviors, Intensive care units, Neonatal, Nesting, Positioning, Premature infant

Introduction

Preterm birth is defined as delivery at a gestational age of < 37 weeks (1-3). In recent decades, preterm labor has increased significantly as reported in several studies. Accordingly, the global prevalence rate of this condition is reported to be about 11% of live births (4-7) with 15 million preterm births worldwide (8). In numerous studies, it was reported that late preterm infants are metabolically and physiologically immature (9-14). Based on the statistics, 35% of 3 million neonatal deaths in 2010 were associated with the direct complications of preterm birth. Preterm birth is considered the second common cause of death in children aged less than 5 years following pneumonia. Preterm labor through other causes, such as infections, increases the risk of death (15-17).

In preterm infants, motor system like other systems is immature and vulnerable. Inadequate support of preterm infant's body appears to be linked to later neurodevelopmental problems (18-20). For reducing neonatal motor system impairment during hospitalization in the neonatal intensive care units (NICUs), developmentally

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supportive care program suggests the implementtation of protective and supportive interventions to mimic the uterus environment (21, 22). One of these programs is to support the infant position by providing boundaries and using a soft, individually well-adapted nest, which will support the infant ‘nesting position’ in analogy to the fetus curled body in the womb (23).

This position support technique is incorporated into the routine care plans in many NICUs. Some researchers have explored the short- and long-term benefits of boundaries and even hand containment for preterm infants. Infants profit from positional supports in terms of motor system stability and low stress (24-26). The other researchers concluded that supporting preterm infant position with other developmental care interventions during hospitalization improved clinical outcomes (27, 28). However, all of them have emphasized that more research is indicated (29).

The current study set out to explore the effects of nesting position in a setting in Iran in which no specific position support intervention was provided for hospitalized preterm infants, and they were routinely bedded on a flat mattress. The outcome was investigated in the preterm infants' motor stability. The aim of the study was to decrease the behaviors signaling motor instability in preterm infants in the NICU by bedding them into nests for 7 days. For the purpose of comparison, a control group consisting of preterm infants bedded on a flat mattress, as a routine nursery practice, was used to compare the number of these behaviors between the groups.

Methods

Study Design

This study was an open-label randomized controlled trial. The infants eligible for the study were randomized immediately after clinical stability, and written informed consent was obtained from the infants’ parents. Upon consent, the parents selected one envelope from the box of sealed opaque envelopes and opened it to reveal a description of and directions for the treatment condition to which the infant was assigned. A copy of this description was also placed in the nursing notes of the infant chart. The process of recruitment, consent, and randomization had to be completed within 10 days of infant birth. The recruitment process was continued until the random assignment of 44 low-risk preterm infants to one of the two groups. The study was approved by the Research Ethics Committee of Teheran University of Medical Sciences, Teheran, Iran. The data were analyzed using the intention-to-treat analysis.

Setting and Participants

The setting was the NICU of Hazrate Rasool Akram Hospital, a teaching hospital affiliated to Tehran University of Medical Sciences. The hospital serves the greatest Tehran area and has a maternity service with at least 3,000 births/year. All infants were born at Hazrate Rasool Akram Hospital. The neonatal ward was divided into two parts after passing the critical situation. The infants were cared in the stable neonatal division under the support of different nursing teams.

The inclusion criteria were: 1) gestational age at birth of 30-34 weeks (after mother's last menstrual period), 2) viability in room air without respiratory assistance, and 3) lack of Down syndrome, neurological anomalies, skeletal problems, or requirement for surgery. The infants were excluded for the following reasons: 1) maternal substance abuse, 2) evidence of intraventricular hemorrhage with a grade of > II, and 3) pharmacological treatment with phenobarbital or phenytoin within the course of the study (i.e., 7 days).

Intervention

The preterm infants randomized to the intervention group were placed into a nest for 7 consecutive days, in a prone, supine, or side-lying position, as deemed best by their caregiving nurse. The infants spent most of their time in the nest. They were removed for feeding, weighing, and other routine nursing/medical care procedures that required them to be taken out of the incubator/open crib. The nest consisted of a U-shaped cloth surface surrounded by soft cloth walls, specifically adjusted to each infant size and comfort (Product of the Tabriz Salar-Baft Co, Tabriz, Iran).

The infant was laid into the nest in a way that the legs, feet, and arms contacted the nest walls. A small roll of cloth was put around the head for supporting. The nurses caring for the intervention group were verbally instructed by the research team using a pictorial pamphlet. Instruction also included how to lay the infant into the nest in a prone, supine, and/or side-lying position (e.g., to enclose the infant with the hands, maintain the upper and lower extremities in a flexed position, close to the body with the hands close to the infant face and/or head). In the research setting, no specific infant bedding guidelines dictated how supportive care was provided for the control group. Therefore, the preterm infants randomized to the control group received care as deemed best by their caregiving nurse on a flat mattress covered with a plain cotton bed sheet in their incubator/open crib.

Outcomes and Measurements

Medical and demographic information was derived from the infant charts and supplemented by information obtained from parent medical history questionnaire.

Behavioral Assessment

Behavioral assessment was performed on the basis of videotape analysis. All infants were videotaped when they were bedded in a prone position on a flat surface in an incubator or open crib for 20 min, prior to being entered into their respective treatment condition. Videotaping was also performed 7 days after the onset of the respective treatment (i.e., after the termination of the treatment condition). The prone position was chosen for the assessments since the supine position has been reported to increase extensor behaviors (30). Following the translation of NIDCAP into Persian, 10 faculty members (i.e., neonatologist or neonatal nursing) assessed the tool, and its content and face validities were checked (31).

According to the NIDCAP manual, the duration of observation was at least 20 min (27, 28, 32). All videotapes were scored by one assessor, who was not certified in the NIDCAP course, and the training course was not held in that country. Therefore, the assessor was trained electronically via the internet by the originator of the scoring method (i.e., Dr. Heidelise Als) to distinguish and differentiate behaviors from each other just in terms of motor behaviors. In order to The assessors were trained by Dr. Als to inter-rater reliability of 78% concordance of frequency counts of the behaviors observed. For scoring, 10% of all observations (44 infants*2 observations equal to 88 observations in total; i.e., nine 20-minute video segments) were scored independently by the rater and the trainer to establish continuous inter-rater reliability.

The variables scored before and after the treatment condition were 17 behaviors, which showed motor instabilities derived from the Manual of Naturalistic Observation (33). They included flaccid arm posture, flaccid leg posture, extend arm activity, extend arm posture, extend leg activity, extend leg posture, arching, diffuse squirm movement, stretch/drown movement, arms airplane movements, arm salute movement, legs sitting on air movements, finger splay, fisting, tongue extension, gape face, and grimace. For video analysis, the recorded footage was viewed, and the infant behaviors were written down by pausing the video at 2-minute intervals to allow for the transcription of the behavioral data. The occurrence of any of these behaviors was marked (x) for the respective 2-minute segment (27, 28, 32). Behavior counts throughout the recorded 20 min were then summed up.

The purpose of this study was to identify a global indication of motor instability regardless of the type of behavior exhibited specifically. The behaviors chosen have been studied in other investigations (27, 28, 30, 32, 34, 35), giving credit to the selection of behaviors determined for this study. The scorer was blind to the pre- or post-condition, as well as to the treatment condition of the infant scored. A color video camera (Sony DCR-DVD 805 E) was used to film the infants from above, when they were awake between 2 and 5 pm. The duration of one week was chosen with the expectation that it might be sufficient as the minimum duration for investigating nesting effectiveness in the modulation of movements (26, 27).

Sample size

The sampling method in this study was convenience sampling technique considering the inclusion and exclusion criteria. For our study, with a two-tailed α of 0.05, a study power of 0.80 (beta=0.20), and expected difference of 0.4 between the two groups, the sample size was estimated at 22 infants in each group. The newborns who passed the critical situation and were cared in the stable neonatal division over 4 months met the study inclusion criteria.

Statistical Analysis

Medical and demographic background variables were compared between the two groups using the independent sample t-test for continuous variables. Furthermore, the likelihood ratio Chi-square test was used to compare the categorical variables. To check the effect of nesting on the occurrence of unstable behaviors and also adjust the baseline values, the score of changes (i.e., post-intervention score minus pre-intervention score) in each group was calculated and compared between the two groups. Stata software (version 13; Stata Corp, College Station, TX, USA) was used for all statistical analyses. A p-value less than 0.05 was considered statistically significant (two-tailed test) for all analyses.

Results

In this study, 22 preterm infants in the intervention group and 22 patients in the control group were analyzed. Patient recruitment is shown in Figure 1. All recruited infants completed the study. The mean gestational ages in the control and intervention groups were 32.27±0.94 and 32.00±1.07 weeks, respectively (P=0.372). There was no significant difference between the two groups in terms of postnatal age (P=0.290), birth weight (P=0.193), and weight on the first day of study (P=0.402). Delivery type and gender had a similar distribution in the two groups. As shown in Tables 1, baseline variables are comparable between the two groups.

As indicated in Table 2, there is no significant difference between the two groups in terms of the mean occurrence of unstable behaviors at the baseline (i.e., before the intervention) (control group: 54.09±5.95 and intervention group: 55.23±6.53; P=0.549). There was a significant difference in the mean values of behaviors between the control and intervention groups after 7 days of intervention. The intervention group (33.86±8.58; P<0.001) had a significantly lower mean score of unstable behaviors than the control group (56.41±11.67; Figure 2). To compare the mean score of unstable behaviors between the two groups, the change score (post-intervention score minus pre-intervention score) in each group was calculated and compared between the two groups. The mean scores of change were -21.36±13.5 and 2.32±7.9 in the intervention and control groups, respectively. It indicates that nesting significantly reduced the occurrence of unstable behaviors, compared to that in the control group (P<0.001).

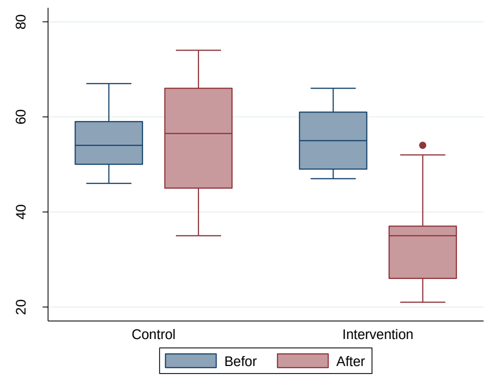

Figure 1. Mean score of motor stress behaviors before and after nesting in the two groups

Table 1. Comparison of baseline variables between the two groups

Variables		Control group (n=22)	Intervention group (n=22)	P-value
Gestational age at birth, week (SD)		32.27 (0.94)	32.00 (1.07)	0.372†
Postnatal age, day (SD)		12.73 (1.93)	12.14 (1.73)	0.290†
Birth weight, g (SD)		1393.2 (145.7)	1329.1 (174)	0.193†
Weight on the first day of study, g (SD)		1389.5 (167.6)	1345.9 (174.6)	0.402†
Delivery (%)	Vaginal	6 (27.27)	8 (36.36)	0.517*
	Cesarean	16 (72.73)	14 (63.64)	
Gender (%)	Female	10 (45.45)	11 (50)	0.091*
	Male	12 (54.55)	11 (50)	
Mechanical ventilation history (%)	Yes	10 (45.45)	10 (45.45)	0.999*
	No	12 (54.55)	12 (54.55)	

†Independent sample t-test, *Likelihood ratio Chi-square (2)

Table 2. Comparison of total stress motor behaviors between the control and intervention groups

Total stress motor behaviors	Control Mean (SD)	Intervention Mean (SD)	P-value†
Pre-intervention score	54.09 (5.95)	55.23 (6.53)	0.549
Post-intervention score	56.41 (11.67)	33.86 (8.58)	<0.001
Change score	2.32 (7.9)	-21.36 (13.5)	<0.001

†Two independent t-test

Discussion

Supporting and positioning preterm infants are among supportive care in many NICUs. The current study explored the cumulative effects of nesting in the preterm infants hospitalized in a NICU. It was expected that nesting would have a positive effect on infants' motor system regulation. As this study showed, after nesting preterm infants, the frequency of the behaviors caused by the instability of the motor system was significantly decreased in comparison with that in the infants who received no nesting support.

The results of our study are in line with those of other studies that showed the position support techniques enhance preterm infant motor system functions and improve developmental outcomes (22, 23, 26, 28, 32, 35-37). The results contradict those reported by Maguire et al. who reported no effect on neuromotor development at the term age after the institution of nesting and covering of the incubators (38). On the basis of prior research and the findings reported here, it can be suggested that preterm infants in any NICUs profit from nesting.

This study was designed as a randomized controlled clinical trial to test the effectiveness of nesting in the NICU in motor system function using a pretest-posttest design. The outcome measures were well defined and widely utilized stability of motor system indicators. Consistency and reliability of behavior scoring were aided by the video recording of all pretest and posttest behavior segments. Therefore, this study was an exploration of the supporting preterm infant motor system for one week. This research is also the first attempt targeted toward investigating nesting position in preterm infants in Iran.

Several studies have been performed to support the infant body during care. However, their examined intervention lasted only a few minutes, and they investigated physiological signs, such as heart rate and O_2 saturation. However, this was the first study in Iran that assessed the neonatal motor behaviors using the NIDCAP behavioral observation tool and a relatively long intervention (i.e., one week).

One of the limitations of the study is its small sample size. Therefore, this study should be replicated with a larger sample size, and the intervention should be administered for a longer time. In addition, formal observation training as a part of training to be certified in NIDCAP should be obtained by those performing the intervention and assessments. In this study, preterm infants aged 30-34 weeks with a mean weight of about 1,300 g were included. It was recommended that further studies be conducted on preterm infants with a limited gestational age range (e.g., moderately preterm, very preterm, and extremely preterm) and birth weight.

Conclusion

In conclusion, in this research, nesting was tested to investigate its effectiveness in reducing extensor motor indicators in preterm infants. The results indicated that individually adapted cloth nests aided preterm infants to gain flexion positions and improve motor system self-regulation. It is presumed that this may, in turn, improve the overall energy maintenance of these infants, thereby having beneficial effects on the health and development of such preterm infants. It is becoming increasingly apparent that focusing on the quality of life beyond survival is as important as focusing on survival itself for preventing neurobehavioral impairments in the future. Nesting appears to be a cost-effective and easy to actualize intervention facilitating the achievement of this goal. Moreover, it is likely to be available to most of the NICUs in most countries. Regarding this, these findings might be an indicator of the use of this measure in care plans in the NICUs of Iran.

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Conflicts of interest

All authors declared no conflict of interest.

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