ORIGINAL RESEARCH

To assess the neuro developmental outcomes in NICU patients – A cross sectional study

[1]Dr. Falak Bansal, [2]Dr. Ramaneesh Prajapati

[1]MD, NNF Fellow, Department of Paediatrics, Cloud 9 Hospital, Noida, India
[2]MD, Department of Paediatrics, Subharti Medical College, India

Corresponding Author
Dr. Falak Bansal
MD, NNF Fellow, Department of Paediatrics, Cloud 9 Hospital, Noida, India

Received: 17 April, 2023 Accepted: 21 May, 2023

ABSTRACT
Introduction- Stressors for premature infants in the NICU include external stimulation with sounds, light, touch, and open positioning that have a negative impact on outcomes. The aim of the present study was to measure the effectiveness of a developmental positioning intervention on length of stay, weight gain, and tone/flexion compared with neonates without structured positioning. **Material & methods-** Preintervention sample was provided by 60 newborns with inclusion criteria of 34 weeks of gestation or fewer and no anomalies in the study's quasi-experimental design. The researcher employed the Infant Position Assessment Tool as a visual reference for positioning and rating intervention fidelity. **Results–** In comparison to the control group, the postintervention group was both sicker and younger ($P < 0.05$). The preintervention sample ($M = 7.21$) was older than the postintervention sample ($M = 7.07$). The preintervention sample ($M = 1376g$) was larger than the postintervention sample ($M = 1301g$). The post-intervention group's weight gain was clinically significant, and the higher mean Hammersmith score (3.47) indicated that positioning had a beneficial impact on tone and flexion scores. **Conclusion-** Results are improved with more organization and constant focus on developmental positioning. Stronger connections and relationships between posture and outcome measures will be revealed by additional study with larger sample numbers.

Keywords- Interventions, neurodevelopment, NICU, premature infant, preterm infant positioning

INTRODUCTION

The relevance of taking into account preterm children' cognitive outcomes has been highlighted over the past few decades by the rising survival rates of preterm newborns admitted to the Neonatal Intensive Care Unit [NICU] [1]. Given that their brains go through a key period of development and maturation between 24 and 40 weeks of gestation, occurring primarily during their NICU hospitalization, preterm children are more likely to suffer significant short- and long-term neurodevelopmental abnormalities [2, 3]. Given that neurocognitive impairments in infants born preterm are still reported in adulthood [4] significant neurodevelopmental disabilities associated with neurosensory, motor, behavioral, and cognitive outcomes may then emerge soon after preterm infants' birth and persist past school age and adolescence [5].

Numerous aspects of the NICU environment could either support or undermine the preterm infants' developing brains, which would affect how they develop neurodevelopmentally. Among important environmental NICU elements are environmental stimulation (such as light and noise) social interactions with parents, and caregiving experience. [6-8]

The NICU environment can be changed to more closely resemble the uterus in order to reduce the likelihood of some of the adverse outcomes associated with prematurity and developmental issues. By limiting stimuli, grouping care activities and procedures, and situating the newborn to create an environment resembling the uterus, developmentally appropriate care includes techniques to reduce the stress of the NICU setting.[9] Developmental results in this population are improved by isolette coverings to shield from outside stimuli, clustering of care, swaddling, and developmental posture.[10]

With attention to midline posture and symmetry, developmentally appropriate positioning helps the newborn maintain a more flexed, supported position. The constraints provided by this pose allow the extremities to remain extended and in a midline posture while yet allowing for movement that will aid in overall development.[11] After being discharged from the NICU, individuals with impaired neurodevelopment are referred to physical and/or occupational therapy. The cost-prohibitive follow-up care required to address neurodevelopmental issues that were discovered at the time of the patient's discharge from the inpatient setting can last for months or even years.

Stressed infants who are consuming more calories in the NICU can stop gaining weight or lose weight, which lengthens their stay in the hospital, raises the cost, and affects outcomes. NICU caregivers who receive more training and education are better able to arrange preterm infants in a developmental-appropriate way.

MATERIAL & METHODS

The present quasi experimental study was conducted among preterm infants for a period one year at a tertiary care center having NICU. The ethical clearance was obtained from the institutional ethical committee before commencement of study. Informed consent was signed by all participants.

The sample for the experiment consisted of premature babies born at less than 34 weeks' gestation. Any physical abnormality, flaw, or malformation met the exclusion requirements. 60 infants who had previously been NICU patients made up the control or pre-intervention group.

The intervention, which included direct care and in-service education for caregivers, was created using evidence-based literature. The caregivers, including nurses, nurse practitioners, and physical and occupational therapists, were directly educated before the recruitment of participants. Staff members received instruction in person during 30-minute sessions. To describe developmental placement with the tools available in the NICU, PowerPoint presentations, handouts, and question-and-answer sessions were held. They included tortles, long flexible positioners, Dandle ROO positioners, long flexible positioners, and positioners that looked like gel. The IPAT was used as a guide for caregivers to help posture infants as part of the intervention's second component. The IPAT was reviewed and discussed to ensure comprehension. Every bedside has a laminated copy of the IPAT for reference. The participants were then chosen as they met the inclusion criteria and were admitted to the NICU. For the first week after delivery, the unit closely followed its standard intraventricular hemorrhage precautions procedures.

The pre validated and reliable tool IPAT was used to document positioning throughout the infant's hospitalization[12]The educational program used with the IPAT tool was implemented at 6 NICUs with a statistically significant increase (P < .0001) in compliance with developmental positioning and IPAT scores.The outcome of interest, flexion, and tone scores was measured for each infant in numeric values at discharge by using Hammermith score . [13]

Demographic details of the pre- and post-intervention groups were described using descriptive statistics, such as frequency, percentage, mean, and standard deviation. To determine whether there were any significant variations in the gender distribution, gestational age, and birth weight between the two groups, independent t tests and 2 tests were conducted. The Hammersmith score, LOS, and weight gain were the outcomes of interest. An independent t test was also performed to compare them. Finally, a covariance analysis was carried out to ascertain how gender, birth weight, and confounding variables affected the outcomes of interest.

RESULTS

A convenience sample of 90 infants who fulfill the inclusion and exclusion criteria were taken in the study. There were 2 groups, the control or preintervention group (N = 60) and a postintervention group (N = 30). Table 1 describes the frequencies for gender, birth weight, and gestational age. The participants ranged in age at the time of admission from 23 weeks to 34 weeks of gestation he preintervention group (N = 60) was composed of 35% males and 65% females and the postintervention group (N = 30) had 70% males and 30% females. The most common diagnoses were prematurity and respiratory distress in both groups.The postintervention sample was younger at birth than the preintervention sample. The postintervention sample was slightly smaller in grams at birth than the preintervention sample. Variance tests between groups are addressed under inferential statistics. Independent samples t tests were used to detect statistically significant differences between the preintervention and postintervention groups' variable of birth weight and gestational age. (Table 1)

Table 1: Baseline characteristics of both the groups

Variable	Pre intervention group (60) N (%)/ Mean ±SD	Post intervention group (30) N (%)/ Mean ±SD	P value
Gender			
Male	21 (35)	21 (70)	<0.05*
Female	39 (65)	9 (30)	
Discharge weight in grams			
1501-2000	15 (25)	5 (16.6)	<0.05*
2001-2500	35 (58.3)	9 (30)	

2501-3000	12 (20)	7 (23.3)	
3001-3500	7 (11.6)	5 (16.6)	
3501-4000	1 (1.6)	2 (6.6)	
4001-4500	0	2 (6.6)	
Birth weight in grams	1376 ± 434.52	1301 ± 571.18	<0.05*
Gestational age at birth in weeks	7.21 ± 2.37	7.07 ± 2.06	<0.05*

The mean LOS increased from the preintervention group (51.78 days) to the postintervention group (67.86 days).Total weight gain decreased from the pre- to postintervention groups (pre: 937.21 g; post: 880.62 g). Again, this change was not statistically significant and the direction of this change was unexpected.The mean Hammersmith score for the preintervention group was slightly lower (M = 3.45) than for the postintervention group (M = 3.47).The postintervention group had only IPAT scores assigned had a mean IPAT score of 9.19, with a standard deviation of 0.86. (Table 2)

Table 2: Results for Pre and Post intervention Groups: LOS, Weight Gain, Mean Hammersmith Score, IPAT score

Variable	Pre intervention group	Post intervention group
Length of stay	51.78±25.2	67.86±40.27
Weight gain	937.21±470.89	880.62±684.34
Hammersmith score	3.45±0.19	3.47±0.49
IPAT score	-	9.19±0.86

To ascertain the impact of gender, birth weight, and gestational age on the important outcomes, a covariance analysis was carried out. When gender and gestational age were taken into account, the intervention had a significant impact (P =.033) on the Hammersmith scores. Gender and gestational age only had a modest, non-statistically significant impact on the positioning intervention's effect size (η= 0.992).(Table 3)

Table 3: Tests of Between-Subjects Effects

Dependent variable	Mean Hammersmith score					
	Type III sum of squares	df	Mean square	F	Significance	Partial η^2
Corrected model	5.051	18	0.303	24.404	0.033	0.992
Intercept	1.957	1	1.856	167.542	0.005	0.986
Gender	0.045	1	0.045	4	0.186	0.668
Admission gestational age	0.052	1	0.052	4.4	0.167	0.691
Post – intervention IPAT tool mean	4.039	14	0.279	22.671	0.45	0.995
Error	0.022	3	0.011			
Total	210.434	19				
Corrected total	5.127	18				

DISCUSSION

According to the literature, posture is crucial for the long-term health and growth of a preterm infant.[14] The IPAT and developmental positioning in-services utilized in this study helped to clarify the positioning objectives in this NICU and the most effective method for achieving them. At the time of discharge, the occupational therapist's use of the Hammersmith scoring system demonstrated that the intervention group had experienced a clinically significant improvement in tone and flexion. The IPAT and Hammersmith scores showed a positive connection, demonstrating that tone and flexion are influenced by developmental posture. [15]

The literature demonstrates a link between caregiver positioning education and the frequency of neurodevelopmental outcome. After teaching the nurses and other NICU caregivers about positioning alternatives and objectives, this study addressed the education part and discovered a relationship between the positioning intervention and outcomes. The conclusions of the literature that placement and education have an impact on long-term consequences are supported by the data.

Previous studies and meta-analyses were conducted to evaluate their impact on the short- and long-term neurodevelopmental outcomes of preterm infants [16,17]. They came to the conclusion that the NIDCAP showed significant results only at the age of 9 months, but not at 4, 12, 18, or 24 months CA. In accordance with other recent research, developmental care treatments improved preterm infants' long-term neurodevelopmental outcomes, with notable impacts on cognitive, mental, psychomotor, and linguistic development up to 18 months of age and IQ at age 5 [18,19].

A wide range of factors contributed to this study's limitations. A restriction was the small postintervention sample size. It was difficult to get parental approval to use the IPAT to evaluate infants.

During the study's data collection phase, the NICU likewise had a low census. Due to the small sample size, the significant results could represent a type 2 error. It was difficult to persuade nurses to promote positioning. There were few resources available on all shifts to inquire about positioning.

CONCLUSION

In this study, infants' pre- and post-intervention LOS, weight gain, tone, and flexion scores were assessed. Results are improved with more organization and regular focus on the developmental positioning strategies used by interprofessional NICU teams in conjunction with any available resources. It is necessary to provide caregivers with annual or more frequent training to recognize positioning behaviors, improve existing positioning knowledge, and emphasize positioning's significance in preterm infants' neurodevelopment.

REFERENCES

1. Aylward GP. Neurodevelopmental outcomes of infants born prematurely. J Dev Behav Pediatr. 2014;35(6):394–407.
2. Pickler RH, McGrath JM, Reyna BA, McCain N, Lewis M, Cone S, et al. A model of neurodevelopmental risk and protection for preterm infants. J Perinat Neonatal Nurs. 2010;24(4):356–65.
3. Volpe JJ. Brain injury in premature infants: a complex amalgam of destructive and developmental disturbances. Lancet Neurol. 2009;8(1): 110–24.
4. Rogers EE, Hintz SR. Early neurodevelopmental outcomes of extremely preterm infants. Semin Perinatol. 2016;40(8):497–509.
5. Eryigit Madzwamuse S, Baumann N, Jaekel J, Bartmann P, Wolke D. Neurocognitive performance of very preterm or very low birth weight adults at 26 years. J Child Psychol Psychiatry. 2015;56(8):857–64.
6. Aita M, Snider L. The art of developmental care in the NICU: a concept analysis. J Adv Nurs. 2003;41(3):223–32.
7. Santos J, Pearce SE, Stroustrup A. Impact of hospital-based environmental exposures on neurodevelopmental outcomes of preterm infants. Curr Opin Pediatr. 2015;27(2):254–60.
8. Xiong T, Gonzalez F, Mu DZ. An overview of risk factors for poor neurodevelopmental outcome associated with prematurity. World J Pediatr. 2012;8(4):293–300.
9. Legendre V, Burtner PA, Martinez KL, Crowe TK. The evolving practice of developmental care in the neonatal unit: a systematic review. Phys Occup Ther Pediatr. 2011;31(3):315-338.
10. Symington A, Pinelli J. Developmental care for promoting development and preventing morbidity in preterm infants. Cochrane Database Syst Rev. 2006;(2):CD001814.
11. Hunter J, Lee A, Altimier L. Neonatal intensive care unit. In: CaseSmith J, O'Brien JC, eds. Occupational Therapy for Children and Adolescents. 7th ed. St Louis, MO: Elsevier Mosby. 2015:595-634.
12. Coughlin M, Lohman B, Gibbins S. Reliability and effectiveness of an infant positioning assessment tool to standardize developmentally supportive positioning practices in the neonatal intensive care unit. Newborn Infant Nurs Rev. 2010;10(2):104-106.
13. Eeles AL, Olsen JE, Walsh JM, et al. Reliability of neurobehavioral assessments from birth to term equivalent age in preterm and term born infants. Phys Occup Ther Pediatr. 2016;37(1):108-119.
14. Laudert S, Liu WF, Blackington S, et al. Implementing potentially better practices to support the neurodevelopment of infants in the NICU. J Perinatol. 2007;27(suppl 2):S75-S93.
15. Perkins E, Ginn L, Fanning JK, Bartlett DJ. Effect of nursing education on positioning of infants in the neonatal intensive care unit. PediatrPhys Ther. 2004;16(1):2-12.
16. Ohlsson A, Jacobs SE. NIDCAP: a systematic review and meta-analyses of randomized controlled trials. Pediatrics. 2013;131(3):e881–93.
17. Symington A, Pinelli J. Developmental care for promoting development and preventing morbidity in preterm infants. Cochrane Database Syst Rev. 2009; 2:CD001814.
18. Burke S. Systematic review of developmental care interventions in the neonatal intensive care unit since 2006. J Child Health Care. 2018;22(2): 269–86.
19. Soleimani F, Azari N, Ghiasvand H, Shahrokhi A, Rahmani N, Fatollahierad S. Do NICU developmental care improve cognitive and motor outcomes for preterm infants? A systematic review and meta-analysis. BMC Pediatr. 2020; 20(1):67