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Original Research Article

Improving positioning practices in preterm neonates: a point-of-care quality improvement initiative

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ABSTRACT

Background: Optimum positioning is one of the core components of developmental supportive care (DSC). Preterm neonates lack sufficient neurological and musculoskeletal maturity and are at risk of developing misalignment, skeletal deformation, and gross motor delay. Maintaining consistent, developmentally appropriate positioning in routine NICU care remains challenging.
Methods: The aim of this study is to improve optimal positioning practices by 50% among preterm neonates admitted to the NICU using a structured quality improvement (QI) approach This single-centre QI study was conducted over a 12-week intervention period (1st April to 30th June 2025) following a 4-week baseline assessment (1st March to 31st March 2025). Positioning quality was assessed using the infant positioning assessment tool (IPAT), with scores >8 considered optimal. The point-of-care QI (POCQI) model was applied, and five plan-do-study-act (PDSA) cycles were implemented. Interventions included nurse training, provision of linen to create nesting boundaries, use of appropriately sized diapers, reinforcement of correct positioning practices, and training mothers in proper positioning practices
Results: During the baseline phase, the mean IPAT score was 6.7, and 30% of preterm neonates achieved mean IPAT score more than 8. Following the interventions, the mean IPAT score increased to 10.2, with 86% of preterm neonates achieving mean IPAT score more than 8, demonstrating a significant improvement in positioning practices.
Conclusions: This study shows that simple, low-cost, and collaborative interventions can effectively improve positioning practices in preterm neonates. Incorporating structured QI strategies into routine NICU care may enhance delivery of DSC.

Keywords: Neonatal intensive care unit, Preterm neonates, Developmental supportive care, Positioning, Quality improvement, PDSA cycle

INTRODUCTION

Optimum positioning is one of the core components of DSC for newborns admitted in NICU.[1] Neurodevelopment follows a cephalocaudal and proximodistal pattern. The fetus begins to develop active muscle tone at 36 weeks gestation. The third trimester in utero provides the ideal environment for development of physiological flexion.[2]

Infants born prematurely do not have adequate physiological flexion as they lack sufficient neurological and musculoskeletal maturity. The extrauterine environment is characterized by an absence of appropriate boundaries, presence of increased gravitational pull, and abundance of neurosensory input. As a result, premature infants in the NICU often have an unfavorable alignment with a natural extended positioning for postural stability, placing them at risk for

developing misalignment, skeletal deformation, and gross motor delay.[3] Inadequate containment and flexion in the extrauterine environment are associated with hindered development of sensory information processing in this patient population.

Proper positioning helps to enhance sleep quality, alleviate pain, and reduce episodes of apnea and oxygen desaturation. Additionally, it helps to maintain normal temperature, maintain healthy skin integrity, and contributes to better neurobehavioral development.[4,5] Numerous studies have highlighted the positive impact of proper positioning techniques like decreasing musculoskeletal abnormalities and helps in better neuromotor development.[6,7] Regular changes in position, supported by use of nesting materials or conformational positioners, have been found to support better postural control and help sustain an ideal positioning of body.[8,9]

The IPAT is a pictorial tool developed in 2010 by Coughlin, Lohman, and Gibbins, and is copyright of Koninklijke Philips Electronics N.V., specifically developed to be used as an educational reference and evaluation instrument to standardize best positioning practices of premature infants in the NICU.[10] This tool provides an objective and measurable assessment of body alignment in supine, prone, and side-lying to improve consistency in positioning practices.

DSC is practiced in the unit, but many admitted preterm neonates were observed to have improper positioning and nesting. Positioning as a part of DSC is often not given importance in the management of preterm neonates in NICU and preterm neonates were observed to have extended arms and hip abduction. So, this QI study was pursued to improve positioning practices in the unit.

The objective of this study was to improve the positioning practices by 50% in preterm neonates admitted in neonatal intensive care unit (NICU) over a period of 12 weeks where IPAT tool was used to validate and standardize positioning practices.

METHODS

The aim of this study was to improve positioning practices by 50% in preterm neonates admitted in NICU over 12 weeks from 1st April 2025 to 30th June 2025.

Study design and setting

This was a QI study, conducted at Department of neonatology, Fernandez hospital, Hyderabad, India, which is a tertiary care Centre, with level 3 NICU having more than 4000 deliveries per year and more than 800 NICU admissions in a year.

Study duration

This QI study was conducted over a period of 12 weeks from 1st April 2025 to 30th June 2025. Baseline data was collected for 4 weeks from 1st March 2025 to 31st March 2025. Sustenance phase was from 1st July 2025 to 31st August 2025 where improvement in IPAT score was monitored.

This study was pursued to improve positioning practices in the unit where IPAT was used (Table 1) to validate optimum positioning.

IPAT uses a two-point scoring system for six areas of the body, including the head, neck, shoulders, hands, hips/pelvis, and knees/ankles/feet. A score of zero to two is allocated to each body area, zero indicating misaligned positioning to two indicating ideal alignment (Table 1). Table 1 shows the components that are assessed in IPAT tool. IPAT score ranges from 0-12, with a total score greater than/equal to eight as indicative of acceptable developmentally supportive positioning of infant to account/technological interfaces necessary in NICU.

Table 1: Components of IPAT tool.

IPAT				
Patient name				
Clinician performing assessment				
Date/time of assessment				
Infant position(circle) side lying prone supine				
Indicators	**0**	**1**	**2**	**Total score**
Shoulders	Shoulders retracted	Shoulders flat/ in neutral	Shoulders softly rounded	
Hands	Hands away from the body	Hands touching torso	Hands touching face	
Hips	Hips abducted/externally rotated	Hips extended	Hips aligned softly, flexed	
Knees/ ankles/ feet	Knees extended, ankles and feet externally rotated	Knees, ankles and feet extended	Knees, ankles and feet are aligned and softly flexed	
Head	Head rotated laterally > 45 degrees from midline	Head rotated laterally 45 degrees from midline	Head positioned midline to less than 45^0 from midline	
Neck	Neck hyperextended	Neck neutral but poorly aligned with supine	Neck is in neutral position, slightly flexed forward aligned with supine	

This was a QI study based on POCQI model where a QI team was formed comprising two pediatricians, NICU in charge nurse, and 5 senior nurses. The aim was to improve positioning practices by 50% over 12weeks in preterm neonates where IPAT score more than 8 was taken as acceptable developmentally supportive positioning of the infant.

The study got approval from institutional ethics committee and informed consent taken from parents of participants in the study.

Inclusion criteria

All neonates with gestational age less than 37 weeks admitted to NICU were evaluated for IPAT score by the concerned nurse in every shift were included in the study.

Exclusion criteria

All neonates more than 37 weeks gestational age were excluded from the study.

Eligible neonates were scored in every shift; average daily score was assigned to them. The percentage of neonates who attained mean IPAT score ≥8 was the process measure. The outcome measure was the improvement in mean IPAT score.

Problem assessment was done by fish bone analysis (Figure 1). Figure 2 shows Pareto chart which helped us assess major cost-contributing interventions

Statistical analysis

Data were entered in Microsoft excel and analysed using statistical package for social sciences (SPSS) software version 24. Run charts were used to monitor the trend of outcomes.

Reasons for improper positioning were lack of knowledge among the nurses about the importance of proper positioning, lack of formal training, lack of standardised bed side measuring tool, limited supply of linen and no unit protocol to assess positioning.

PDSA cycles were utilised to implement interventions aimed at improving positioning.

Baseline phase (4 weeks) (1st March 2025 to 31st March 2025)

Baseline phase was conducted for 4 weeks during the month of March 2025. QI team was trained in DSC practices, optimum positioning and scoring of IPAT. In this phase QI team evaluated 20 preterms for IPAT score and the mean IPAT score was 6.7 and 30 % of neonates had mean IPAT score more than 8.

Intervention phase

Reasons for improper positioning were identified, and a QI study was initiated, and interventions were done in 5 PDSA cycles.

PDSA cycle 1 (2 weeks) (1st April 2025 to 15th April 2025): Training nurses

IPAT scoring and documentation in case sheet was introduced as a routine protocol. All NICU nurses were trained how to do IPAT scoring by lecture classes, practical demonstration.

NICU nurses posted in level 3 and level 2 NICU were trained how to do IPAT scoring and how to document it. Classes were taken by QI team daily. IPAT score printouts and teaching material was made available to all nurses. Group teaching was done to all nurses about improving positioning and its advantages. Bedside practical demonstration of making nesting rolls, positioning of baby and how to assess optimum positioning by IPAT score was done by QI team (Figure 3). Skills of nurses in making effective nesting rolls and their efficiency in IPAT scoring was assessed biweekly. One to one teaching was done for nurses whose skills needs improvement. This PDSA cycle 1 was done for 2 weeks. By the end of this PDSA cycle, IPAT scoring was made as a NICU protocol, and it was done in each shift for all preterm neonates admitted in NICU.

PDSA cycle 2 (2 weeks) (16th April 2025 to 30th April 2025): Customised nesting boundary

Optimum positioning requires customised nesting boundary. Non availability of adequate linen was one of the limiting factors to prepare nesting boundaries. To address this issue a greater number of low costs, washable, autoclavable, reusable soft clothes were provided by the hospital. By this intervention nesting boundaries were prepared adequately for all preterm neonates in all shifts and the IPAT score improved. This PDSA cycle 2 was done for 2 weeks.

PDSA cycle 3 (2 weeks) (1st May 2025 to 15th May 2025): Using small diapers

In preterm babies if oversized diapers were used, position of hips and legs could not be maintained. So, use of small diapers was made compulsory for preterm babies. This improved positioning and the mean IPAT score. PDSA cycle 4 was conducted for 2 weeks.

PDSA cycle 4 (4 weeks) (16th May 2025 to 15th June 2025): Encouragement of nurses

Nurses who had done better nesting boundaries and attained better IPAT scores were encouraged by awarding them the title of “nurse of the week”. It motivated other nurses to attain better positioning of newborns and better

IPAT scores. Refresher classes and practical demonstrations were carried out thrice weekly and new employees were also trained. This PDSA cycle was done for 4 weeks. Positioning and IPAT scoring were made as a routine practice. Mean IPAT score improved by the end of this PDSA cycle.

PDSA cycle 5 (2 weeks) (16th June 2025 to 30th June 2025): Training mothers

After PDSA cycles 3 and 4 there was significant improvement in nesting boundaries and positioning practice and mean IPAT score improved. Preterm and low birth weight newborns were shifted to KMC and room once they were hemodynamically stable. To sustain the better positioning practices even at mother side, QI team decided to train mothers in preparing nesting boundaries and maintaining optimum positioning. Mothers were taught by the QI team in local language and using audio visual aids about importance of positioning as part of DSC, its long-term benefits, how to prepare nesting boundaries using easily available towels and position the babies. Mothers were also taught about proper and improper positioning. This helped in sustaining optimum positioning even after the baby is shifted to KMC. This PDSA cycle 5 was done for 2 weeks. Improvement in mean IPAT score was sustained by end of PDSA cycle 5.

Sustenance phase (1st July 2025 to 31st August 2025)

IPAT scoring was made as a part of daily nursing care for preterm neonates with scoring done in each shift and entered in nursing notes. Regular classes were taken for nurses, doctors and new staff were trained regarding optimal positioning, making nesting boundaries and IPAT scoring. Sustenance phase was conducted for 8 weeks during July, August 2025 and mean IPAT score was assessed.

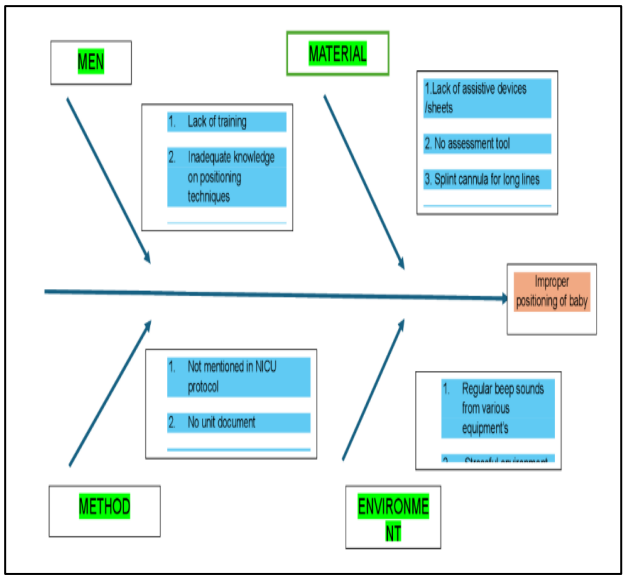

Figure 1: Fish bone diagram.

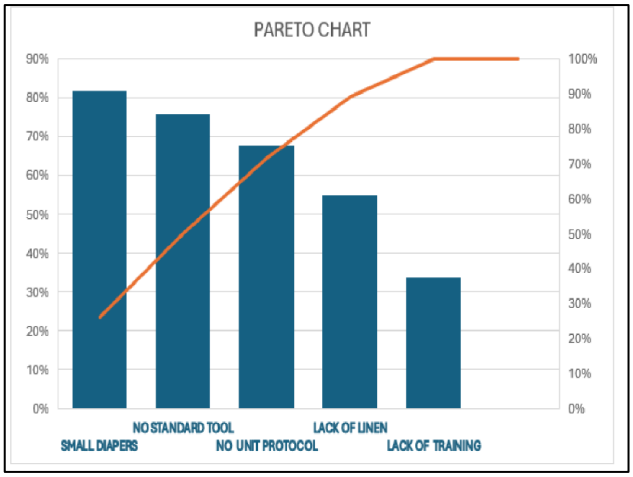

Figure 2: Pareto chart.

Figure 3: Training sessions for the staff.

RESULTS

During the baseline phase 20 neonates were assessed over 4 weeks. Mean IPAT score was 6.7 and 30% of babies had mean IPAT score more than 8.

During the intervention phase, 81 preterm neonates were assessed and IPAT score was recorded across 5 PDSA cycles. A progressive improvement in positioning scores was observed with successive interventions. After PDSA cycle 1, the mean IPAT score increased to 7.3, with 44% of neonates achieving a score greater than 8. Following PDSA cycle 2, the mean IPAT score improved to 8.0 and 50% of neonates had scores greater than 8. After PDSA cycle 3, the mean IPAT score further increased to 9.1, with 75% of neonates achieving scores greater than 8.

Continued improvement was noted in PDSA cycle 4, with a mean IPAT score of 9.6 and 83% of neonates scoring above 8. In PDSA cycle 5, mean IPAT score increased to 10.2, and 86% of neonates had scores greater than 8.

During sustenance phase conducted over eight weeks (July-Aug 2025), 40 preterm neonates assessed. Improvement sustained, with mean IPAT score of 10.1 and 85% of neonates achieving scores greater than 8.

Table 2 summarizes the PDSA cycles, interventions, process and outcome measures in the study. Figure 4 illustrates the trend in the IPAT scores over the study period.

Table 2: PDSA cycles, Interventions, process and outcome measures in the study.

Variables	Baseline period	PDSA 1	PDSA 2	PDSA 3	PDSA 4	PDSA 5	Sustenance phase
Number of preterm neonates	20	16	14	12	24	15	40
Intervention		Training nurses	Customised nesting boundary	Using small diapers	Encouragement of nurses	Training mothers	
Duration in weeks	4 weeks (1st March to 31 March 2025)	2 weeks (1st April to 15th April 2025):	2 weeks (16th April to 30th April 2025)	2 weeks (1st May to 15th May 2025)	4 weeks (16th May to 15th June 2025)	2 weeks (16th June to 30th June 2025):	8 weeks (1st July to 31st August 2025):
Process measure							
Percentage of babies with IPAT score >8	30	44	50	75	83	86	85
Outcome measure							
Mean IPAT score	6.7	7.3	8.0	9.1	9.6	10.2	10.1

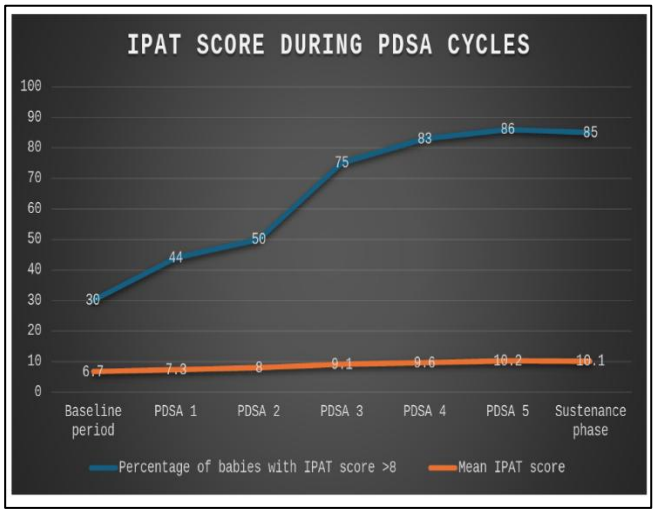

Figure 4: Improvement in IPAT score.

DISCUSSION

This QI study demonstrates that simple, low-cost, and structured interventions can substantially improve positioning practices in preterm neonates. Implementation of five PDSA cycles-including nurse training, creation of nesting boundaries, use of appropriately sized diapers, encouraging nurses and training mothers led to a significant increase in mean IPAT scores from 6.7 at baseline to 10.2 post-intervention, with the proportion of neonates achieving optimal positioning rising from 30% to 86%. These findings highlight that structured QI initiatives can be effectively applied in routine NICU care.

As per previous QI studies done to improve positioning, nursing education through structured teaching and hands on training sessions proved to be useful. In this study significant improvement in IPAT score and proper positioning was achieved within 12 weeks which was shorter than compared to previous studies.[11-13] Active participation of the mothers was the main strength of this QI study and it reinforces the ideas of family centred care.

Utilizing the IPAT, which is a reliable and validated assessment tool, allowed us to measure improvements effectively. The methodical use of the POCQI approach and several PDSA cycles helped us to carry out interventions effectively and to monitor them to get better outcomes.

Although this research was limited to one center, the interventions are practical, low-cost, and easily transferable to other NICUs, including those with limited resources. While the total number of neonates involved might be limited, all eligible admissions during the study period were evaluated, delivering a representative snapshot of our NICU population. The evident and measurable increase in IPAT scores highlights the effectiveness and consistency of the actions taken.

In this study positioning outcomes were studied till the neonate is discharged from the hospital but long-term neurodevelopmental follow-up was not performed. But by achieving optimal positioning helps to attain good musculoskeletal alignment and neurosensory development. Further studies could evaluate the long-

term neurodevelopmental impact of optimum positioning practices.

The interventions in this study are practical and can be easily implemented in all NICU setups at low cost without need of extra manpower even in resource limited settings.

CONCLUSION

In conclusion, this study shows that well-structured, collaborative, and cost-effective QI measures can greatly enhance-positioning-practices for preterm neonates. Implementing similar approaches across NICUs could improve DSC and optimize immediate clinical results.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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