The effect of facilitated tucking position on premature outcomes and pain intensity induced by invasive procedure in premature

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Abstract

Background: Premature neonates are vulnerable humans requiring much care and attention. pain experience in neonatal period leads to short- and long-term complications that could be prevented by means of neonatal pain relief. **Aim:** To assess the effect of facilitated tucking position on premature outcomes and pain intensity induced by invasive procedure in premature. **Methods:** Researcher conducted a quasi-experimental research design at neonatal intensive care units at Benha Children's Specialized Hospital. A purposive sample of premature neonates were randomly divided into two groups: control and study, each with 34 premature neonates. Researcher collected the data through neonatal characteristics, Vital signs sheet, Premature neonates pain profile, neonatal behavioral state. **Results:** The study revealed that 64.4% and 35.6% of study group had mild and moderate pain, while 48.9% and 8.9% of control group had moderate and sever pain post invasive procedure. Also, mean of quiet sleep of premature neonates in study group was 16.03±3.78, while in control group was 7.33±2.92, at *p* value 0.005**. **Conclusion**: Facilitated tucking position had significantly decreasing the severity of pain compared to control group. Also, the current results mentioned that, less than two thirds of study premature neonates had mild pain, while about half of them at control group suffered from moderate pain. In addition, facilitated tucking position decrease change in heart rate and oxygen saturation. Moreover, increase time of quiet and active sleep, while decrease time of active alert and crying among premature neonates **Recommendation**: Facilitated tucking position should be a part of the routine care for all premature admitted to NICUs. An illustrated leaflet demonstrating step by step about facilitated tucking position should be available at neonatal intensive care units. Continuous training program about facilitated tucking position should implement regularly.

Keywords: Facilitated tucking position, pain intensity, invasive procedure, premature, outcomes.

Introduction

Neonates who are born prematurely have gestational ages of fewer than 37 weeks (Wang et al., 2022). Every year, the World Health Organization estimates that 15 million preterm neonates are born (Huang et al., 2022), therefore there is a worldwide problem because the global rate of premature deliveries is about 11.1% and rising (De Costa et al., 2021). In Egypt, preterm birth problems are responsible for 38% of infant mortality (Hamad et al., 2022). Premature newborns in Neonatal Intensive Care Unit (NICU) are frequently exposed to several painful but necessary medical diagnostic and therapeutic procedures (Campbell-Yeo et al., 2022).

Early pain exposure might have negative effects, thus hospitalized premature need prompt pain care. Acute neonatal pain increases anguish and anxiety. Pharmacological or non-pharmacological baby pain treatment exists (Bucsea & Riddell, 2019). Pharmacological analgesia has recognized negative effects and uncertain premature outcomes. Non-pharmacological pain treatment is effective and comforting. These research and development approaches are crucial to preventing developmental disturbances in premature (Sadeghi et al., 2019).
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Premature pain is a complex, unique, subjective, and all-encompassing observation. The most painful treatments carried out on premature most frequently include many injections without pain control (Fatollahzade et al., 2022). Premature incapacity to communicate pain is the biggest challenge when assessing pain. Premature communication should focus on nonverbal cues. Premature pain is measured by physiological measurements, behavioral approaches, and stress hormones. Premature pain can change heart rate, breathing rate, blood pressure, and tissue oxygenation (Kahraman et al., 2020).

The new trend is to adopt non-pharmacological pain-relieving therapies for these operations since unpleasant procedures are frequently performed on ill and preterm neonates and because the adverse effects of the drugs given to them are concerning (Bueno et al., 2020). As the painful insult occurs at the crucial period of brain development, exposing them to potential long-term developmental and psychological issues, preterm newborns are more susceptible to these consequences (Park & Im, 2020). As a result, in the neonatal critical care unit, pain management in preterm newborns is a crucial concern (NICU) (Obeidat & Aloweidi, 2021).

Facilitated tucking is only one of the many crucial components of developmentally supportive care that neonatal nurses and other health care workers to reduce stress in infants who were born preterm. A strategy to help the newborn called "facilitated tucking" encourages the child to manage his or her body until it becomes autoregulated (Avcin & Kucukoglu, 2021).

To support the proper positioning of the preterm infant after birth, a cloth wrapped in a “U” or “O” shape can be used to support the premature from top to toe in a womb-like format (Nandini, 2021). This early tucking technique helps preterm newborns' physiological characteristics and neurodevelopment while also providing postural support. It also offers

comfort during painful interventions, and it's one of the most popular methods for easing preterms' tension (Kao et al., 2021).

Significant of study:

Premature neonates who admitted to the NICU undergo a number of invasive and often painful treatments. Premature neonates are particularly vulnerable to the long-term physiological and behavioral effects of painful operations (Sharma, 2021). However, these complications can be avoided with non-pharmacological therapies as facilitated tucking positioning that lessen the pain and stress of preterm newborns. Pain in preterm newborns must be assessed and treated urgently. Premature newborns should get pain relief and coping strategies that do not include the use of pharmaceuticals (Davari et al., 2019).

Methods

Aim: The study aimed to assess the effect of facilitated tucking position on premature outcomes and pain intensity induced by invasive procedure in premature.

Research hypothesis

H_1: Facilitated tucking position reduces premature pain during invasive procedure.

H_2: Facilitated tucking position enhance premature outcomes during invasive procedure.

Research design

Quasi-experimental study. Quasi-experiments are studies that aim to evaluate interventions but that do not use randomization.

Setting

The study was carried out at the neonatal intensive care units at Benha Children's Specialized Hospital, where included 47 incubators and 21 mechanical ventilators divided on three rooms.

Subjects

A purposive sample of preterm neonates (total n=68, 34 for each group) allocated from the NICU, whose caregiver's agreed their participation June 15th to Sept 30th, 2022. Inclusion criteria of neonates were gestational age 32–36 weeks, post-birth age 0–28 days, and hemodynamic stability. Excluded criteria as Premature neonates on mechanically ventilation support, treatment with sedatives, or analgesic drugs within the last 72 hours.

Sample size

The sample size calculated based on a study carried out by Ranjbar et al. (2020). By estimating an effect size 0.51, based on the mean score of patients at control group was 8.91 ± 0.18 and study group was 5.58 ± 0.53 and statistical power of 90%, level of confidence (1-Alpha Error): 95%, Alpha 0.05, Beta 0.1. The sample size determines at each group is 34 premature. Sample size calculates using test comparing two means

Tools of Data Collection

Tool I: Neonatal characteristics as gestational age, gender, birth weight, type of labor, and Apgar score.

Tool II: Physiologic outcomes for premature as temperature, pulse, respiratory rate, systolic blood pressure, diastolic blood pressure and oxygen saturation.

Tool III: Premature Infant Pain Profile (PIPP)

This tool adopted from Stevens et al. (1996), The PIPP scale was used to assess pain by seven indicators: three behavioral (facial expressions: brow bulge, eye squeeze, nasolabial furrow), two physiologic (heart rate and oxygen saturation) and two contextual (gestational age and sleep/wake state). Pain indicators were scored in this order: sleep/wake state, brow bulge, eye squeeze, nasolabial furrow "subtotal", gestational age, heart rate, and oxygen saturation. Each indicator is scored for pain on a 4-point scale (0–3); the total score can range from 0 to 21, depending on infant gestational age and sleep/wake state. Premature neonates Pain Profile scores ≥ 6 are suggested to indicate at least mild pain, and scores ≥ 12 are suggested to indicate moderate-to-severe pain. If subtotal score >0, add GA and BS indicator. Total

score: Sub total score + GA score + BS score. Internal consistency reliability (Cronbach's α) for PIPP emerged as "Excellent" 0.901.

Tool IV: Neonatal behavioral state: It was adopted from Saliba et al. (2020). It was used to assess behavioral state of premature neonates at both groups post feeding by assessing number of minutes at these states quiet sleep, active sleep, quite awake, active alert, and crying. Behavioral response (crying duration), whose length was measured in seconds by a stopwatch. The evaluation of the physiological parameters and crying duration was compared with that of the control group, who were provided with standard care (without facilitated tucking).

Pilot study

Pilot research was conducted on 10% of premature neonates. It is carried out prior to data collection to assess the feasibility, duration, cost, and adverse events of a full-scale research project and to enhance the study design. There were no changes were made as a result, so the sample includes participants from the pilot research.

Fieldwork

Data was collected over a five-months period from June 15th to Sept 30th, 2022. In total, 68 premature babies were selected through purposive sampling and were randomly assigned to the intervention (N=34) and control (N=34) groups, which contained the name of the methods to be used. After selecting the eligible premature babies, the researcher picked up an envelope to determine the method. For the intervention group, flexed fetal positioning (tucking position) (Figure 1) was applied 10 minutes before and continuing it during an invasive procedure as blood sampling and I.V cannulation. On the other hand, no interventional positioning was used in the control group, and invasive procedure was performed according to the routine NICU procedure.

Figure (1) Facilitated tucking position

Starting facilitated tucking position 15 minutes before and continuing it 15 minutes after an invasive procedure. Pain was scored 10 min before, 3 min during and 10 min after painful procedures.

Ethical Considerations

Ethical approved by the institutional review board of Faculty of Nursing, Menoufia University was obtained, parents of premature neonates who met the study criteria received full explanation of the study's aim in more detail and obtained parents' written approval. Furthermore, parents who accept their premature participation were informed that all information obtained would be kept private. They also have the right to withdraw their premature babies at any time freely without any responsibility.

Administrative design:

Necessary official approval to conduct the study was obtained from Menoufia university. Oral permissions to conduct the study were obtained from the head of NICU after explaining the purpose of the study.

Statistical Analysis

Data was sorted, classified, and the results were shown in tables. The Statistical Package for the Social Sciences was used to analyze the data on a suitable personal computer (SPSS Inc; version 21; IBM Corp., Armonk, NY, USA). The one-sample Kolmogorov–Smirnov test was used to determine the data's normality. Numbers and percentages were used to describe qualitative data. Continuous variables were presented as means ± standard deviation.

The *t*-test was used to compare two means. The results were considered significant when the probability of error is less than 5% ($p < 0.05$) and highly significant when the probability of error is less than 0.1% ($p < 0.001$).

Results

Table 1 illustrates premature neonates 'characteristics and clinical data. It was found that mean gestational age of preterm neonates in the study and control groups are 34.6 ± 2.20, and 34.52±2.8, respectively. The mean birth weight of preterm neonates in the study and control groups presented as 2.230±150.6, and 2.286±135.2, respectively. Vaginal labor constituted 51.1%, and 50%, of the study, and control groups respectively. Whereas C/S constituted 48.9%, and 50%, of the study, and control groups respectively. The mean Apgar score at 1st minute is 8.01±0.92, and 8.47±0.73, of the study, and control groups respectively. Moreover, it presented as 9.07±0.41 and 9.00±0.63 of the study, and control groups respectively at 5th minute.

Table 2 detected the mean premature neonates pain profile of preterm neonates. According to changes in HR, the study and control premature had a mean of 2.36±0.23 versus 6.77±2.18, respectively. Regarding changes at SpO2, the study and control premature had a mean of 1.85±0.41 versus 3.60±1.25, respectively. As regards, the Brow Bulge, the study, and control premature had a mean of 2.73±0.28 versus 5.01±1.11, respectively. Concerning, the Eye squeeze, the study, and control premature had a mean of 2.12±0.47 versus 5.03±1.40, respectively. Concerning, the Nasolabial Furrow, the study, and control premature had a mean of 2.55±0.35 versus 6.33±0.39, respectively. There is a statistically significant difference between the study and control group at a *p*-value =<0.05 for all.

Table 3. revealed that 64.4% of study group had mild pain, while 42.2% of control group had moderate pain post invasive procedure. Also, there was a statistically significant difference between the study and control group at a *p*-value <0.05 for all.

Table 4 presented that the mean of quiet sleep of premature neonates in study group was 16.03±3.78, while in control group was 7.33±2.92, at *p* value 0.005**. Also, mean score of active sleep of premature neonates s in study group was 22.54±5.00, while in control group was 18.92±3.70, at *p* value 0.006**. Furthermore, it was observed that there was highly statistically significant difference among study and control groups regarding the mean time of the various stages of sleep and wake at *p* value <0.01**.

Table 1: Distribution of studied premature neonates regarding their characteristics (n=68).

Items	**Study group 34**		**Control group 34**		**Test P value**
	N	**%**	**n**	**%**	
Gestational age: (weeks)					
32 - <34	7	20.6	8	23.5	T test
34 - 36	27	52.9	26	76.5	0.802
Mean SD	34.6 ± 2.20		34.52 ± 2.8		0.091
Gender:					Chi-square
Male	14	41.2	13	38.2	1.011
Female	20	58.8	21	61.8	0.076
Birth weight:					1.224
Mean SD	2.230 ± 150.6		2.286 ± 135.2		0.071
Type of labor:					Chi-square
Vaginal	18	51.1	17	50.0	1.876
C/S	16	48.9	17	50.0	0.060
Apgar score:					Chi-square
1st minute	8.01 ± 0.92		8.47 ± 0.73		2.661
5th minute	9.07 ± 0.41		9.00 ± 0.63		0.047*
					0.634
					0.083

*Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05

Table 2: Comparison of the mean score of pain profile scale in the premature neonates of the control and study groups (n=68)

Items	**Study**	**Control**	**T test**	**P value**
	Mean SD	**Mean SD**		
Change in HR post invasive procedure	2.36 ± 0.23	6.77 ± 2.18	5.113	0.018*
Decrease O_2 Saturation post invasive procedure	1.85 ± 0.41	3.60 ± 1.25	3.850	0.026*
Brow Bulge (sec) post invasive procedure	2.73 ± 0.28	5.01 ± 1.11	4.190	0.020*
Eye squeeze (sec) post invasive procedure	2.12 ± 0.47	5.03 ± 1.40	5.206	0.014*
Nasolabial Furrow(sec) post invasive	2.55 ± 0.35	6.33 ± 0.39	4.256	0.019*

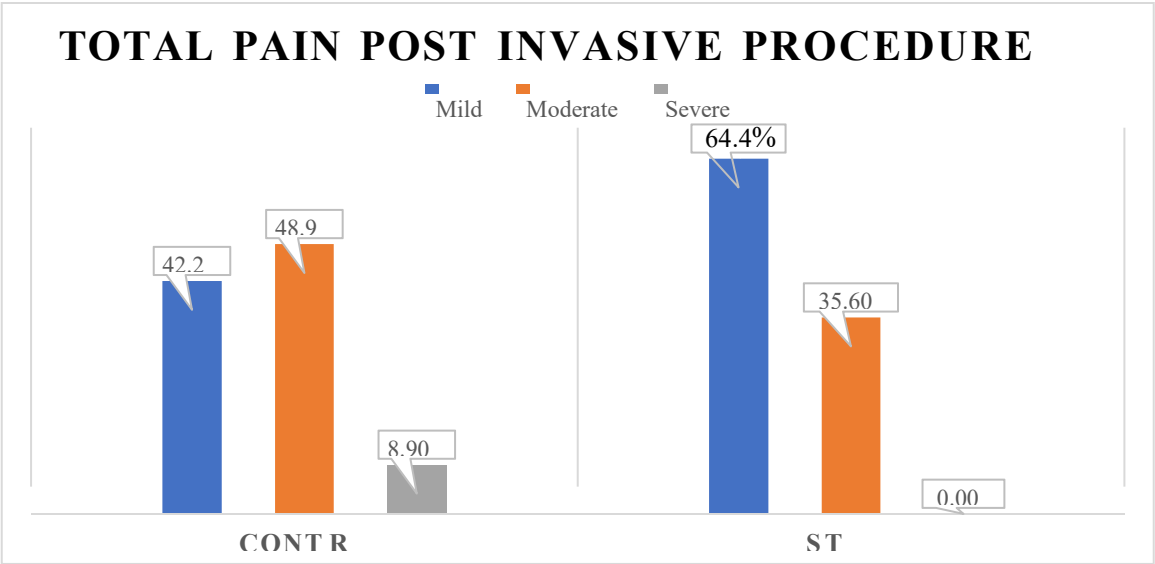
Table 3: Distribution of premature neonates among control and study groups related total pain scale (n=68).

Items	Study N=34		Control N=34		Chi-square	P value
	n	%	N	%		
Post invasive procedure						
Mild	29	64.4	19	42.2		
Moderate	16	35.6	22	48.9	5.173	<0.05*
Severe	0	0	4	8.9		

*Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05

Figure 1. Distribution of premature neonates among control and study groups related total pain scale post invasive procedure (n=68).

Figure 1. revealed that 64.4% and 35.6% of study group had mild and moderate pain,



while 48.9% and 42.2% of control group had moderate and mild pain post invasive procedure

Table (4) : Comparison between the mean times of sleep and wake state among premature neonates in study and control groups (n=68).

Items	Study	Control	T test	P value
	Mean ±SD	Mean ±SD		
Quiet sleep	16.03 ± 3.78	7.33 ± 2.92	9.886	0.005**
Active sleep	22.54 ± 5.00	18.92 ± 3.70	8.124	0.006**
Quite awake	2.40±0.72	5.16 ± 1.3	10.001	0.003**
Active alert	4.5 ± 1.6	8.32 ± 3.5	8.503	0.006**
Crying	1.12 ± 0.13	2.10 ± 0.78	7.662	0.008**

*Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05

Discussion

Facilitated tucking position is one of the above-mentioned methods that involves the use of touching and positioning the premature neonates. Prompt interventions to pain management are crucial in decreasing the potentially unfavorable consequences of early exposure to pain and promoting the positive outcomes in hospitalized premature neonates **(Bozdağ & Balci, 2022).** Therefore, this study aimed to assess the effect of facilitated tucking position on premature outcomes and pain intensity induced by invasive procedure in premature.

The current study showed that facilitated tucking position 10 minutes before and continuing it during an invasive procedure was effective in decreasing pain post the invasive procedure in premature. Significantly decrease the severity of pain compared to control group. Also, the current results mentioned that, less than two thirds of study premature neonates had mild pain, while about half of them at control group suffered from moderate pain. In addition, facilitated tucking position decrease change in heart rate and oxygen saturation. Moreover, increase time of quiet and active sleep, while decrease time of active alert and crying among premature neonates. Furthermore, facilitated tucking position improving premature heart rate and oxygen saturation.

These results supported with the study conducted by **Gomes Neto et al., 2020** reported that a significant reduction in pain during endotraqueal suctioning. Also, **Kucukoglu et al., 2015** showed that mean pain scores of infants vaccinated in the facilitated tucking position were significantly statistically decreasing. In addition, **Lopez et al., 2015** detected that the Premature neonates Pain Profile score for the treatment group was significantly lower than for the control group. Moreover, **Altay & Küçükoğlu, 2022** stated that facilitated tucking improve physiological parameters, comfort level and sucking success of late premature neonates. Likewise, **Francisco et al., 2021** concluded that positioning should be used as a nonpharmacological strategy for procedural pain relief in newborns. Too, **Ranjbar et al., 2020** mentioned that the pain score's increase during heel stick was significantly lower post facilitated tucking at ($P < 0.001$, $\eta 2 = 0.971$). **Cirik & Efe, 2020** indicated the swaddling+expressed breast milk method is clinically better pain relief nonpharmalogical option. **BOZDAĞ & BALCI, 2022** reported that facilitated tucking positions can be given to improve the sleep-wake status of premature neonates receiving care in neonatal intensive care units and **Ribas et al., 2019** detected that Hammock positioning was an effective treatment option to reduce pain and improve sleep-wakefulness state. Additionally, **Özdel & Sarı, 2020** reported that Preterm babies consume less energy by giving positions that increase their comfort and improve their physiological parameters. Likewise, **Bastani et al., 2017** mentioned that KC had positive effect on sleep status of premature baby. Therefore, it is recommended that facilitated tucking position is taken as one of the routine cares of premature neonate. To sum up, facilitated tucking position may be a safe analgesic in premature neonates exposed to invasive painful procedure.

Conclusion

Based on our current study, it was concluded that facilitated tucking position had significantly decreasing the severity of pain compared to control group. Also, the current results mentioned that, less than two thirds of study premature neonates had mild pain, while about half of them at control group suffered from moderate pain. In addition, facilitated tucking position decrease change in heart rate and oxygen saturation. Moreover, increase time of quiet and active sleep, while decrease time of active alert and crying among premature neonates

Recommendation

Based on the previous findings we can recommend that facilitated tucking position should be a part of the routine care for all premature admitted to NICUs. An illustrated leaflet demonstrating step by step about facilitated tucking position should be available at neonatal intensive care units. Continuous training program about facilitated tucking position should implement regularly.

Declaration of Conflicting of Interests

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