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Original Research Article

Comparison of pain during heel prick in preterm neonates receiving only expressed breast milk and expressed breast milk with kangaroo mother care

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ABSTRACT

Background: Newborns' heels are sampled for blood, which is crucial in the identification of genetic and metabolic illnesses. Repeated painful stimulation impairs the future development of their normal motor and cognitive functions. Hence it is necessary to find out suitable remedy to alleviate the pain. The aim of this study was to observe the premature newborns' response to pain (Heel prick) by giving either single (EBM) or combined (EBM and KMC).
Methods: The analytical cross-sectional study was conducted in NICU of SMIMER. hospital, Surat from March 2022 to February 2023. The study included 56 premature newborns, divided into three groups. Group A received only EBM, Group B received EBM and KMC (15 minutes), and Group C received EBM and KMC (30 minutes) before the heal prick. The pain was assessed by PIPP score in all three groups at the end of 30,60 and 120 seconds after the procedure. Data were analyzed using SPSS 24 and a one-way ANOVA test was applied.
Results: The PIPP score after 60 seconds between Group A with B and A with C was statistically significant ($p<0.05$) whereas Group B with C was insignificant ($p>0.05$). The score after 60 seconds between Group A with B and A with C was statistically significant ($p<0.05$) whereas Group B with C was insignificant ($p>0.05$).
Conclusions: EBM with KMC (15 minutes) duration had an effective impact on pain relief as compared to EBM with KMC (30 minutes) duration at the interval of 60 seconds.

Keywords: Heel Prick, Newborn, Pain, Premature

INTRODUCTION

An unpleasant sensory and emotional sensation known as pain can result from real or potential tissue injury. Although it was often believed that infants feel no pain or felt it less intensely, it is now known that even premature babies have a strong sense of pain after 24 weeks.[1] A premature infant, especially a newborn, feels discomfort and reacts to it. The fact that a person cannot verbally express their needs for pain relief does not rule out the potential that they are in pain.[1-2] Newborns' heels are sampled for blood, which is crucial in the identification of genetic and metabolic illnesses such as hypothyroidism, hypo/hyperglycemia, and phenylketonuria.[3-4] However, infants feel pain, which can boost their metabolism and trigger stress reactions like an accelerated heart rate and aberrant immunological response.[5] Heel blood collecting is a painful operation. Repeated painful stimulation is also likely to impair the development of newborn nerve cells, leading to several behavioral alterations in childhood and impairing the future development of their normal motor and cognitive functions.[6-7] Drugs may not be used to treat pain in newborns since their physiological functions have not yet

fully matured; as a result, non-drug-based therapies are crucial for newborns who will have heel blood collection.[8]

Table 1: Premature infant pain profile score.

Process	Indicator	0	1	2	3
Chart	Gestational age	36 weeks and more	32 weeks to 35 weeks, 6 days	28 weeks to31 weeks, 6 days	27 weeks and less
Observe infant for 15 seconds Observe baseline: heart rate, O2 Saturation	Behavioural state	Quiet/Sleep Eyes closed No facial movement	Quiet/Awake Eyes open No facial movement	Active/sleep Eyes closed Facial movement	Active/Awake Eyes open Facial movements
Observe the infant for 30 seconds, 60 seconds, and 120 seconds	Heart rate max	0-4 beats/min increase	5-14 beats/min increase	15-24 beats/min increase	25 beats/min or more increase
	O2 Saturation min	0-2.4% Decrease	2.5-4.9% Decrease	5.0-7.4% decrease	7.5% or more Decrease
	Brow bulge	None 0-9% of the time	Minimum 10-30% of Time	Moderate 49-69% of time	Maximum 70% of the time or more
	Eye squeeze	None 0-9% of the time	Minimum 10-39% of Time	Moderate 49-69% of time	Maximum 70% of time or more
	Naso-labial furrow	None 0-9% of the time	Minimum 10-39% of Time	Moderate 49-69% of time	Maximum 70% of time or more

Administration of expressed breast milk is another strategy for minimizing procedural pain in newborns (milk). The practice of kangaroo mother care (KMC) encourages stable cardiac and respiratory function, reduces pointless movements, enhances behavioral state profiles, places the mother close by for attention/interaction episodes and allows the expression of self-regulatory behavior.[9-12] KMC might lessen the perception of pain. Studies on the combined effect of EBM and KMC on heel prick pain, however, are scarce. Preterm neonates experience when heel lancing. KMC might lessen the perception of pain. This study was conducted to evaluate the effectiveness of EBM alone and in combination with KMC in reducing heel prick pain as well as the impact of KMC duration on pain relief.

METHODS

The present study was an analytical cross-sectional study conducted from March 2022 to February 2023 in, Neonatal Intensive Care Unit (NICU) of Surat Municipal Institute of Medical Education &Research (SMIMER) hospital, Surat. The present study was conducted at a neonatal tertiary care center in hemodynamically stable premature newborns (gestational age 32 weeks to 36 weeks) admitted in Neonatal Intensive Care Unit. A Total of 71 newborns were enrolled in the study, out of which 5 were discharged early, 6 videos were rejected, and 4 were LAMA (left against medical advice), so 56 newborns were included in the study for PIPP score assessment.

Informed Consent was obtained after enrolment in the study, from the parents of newborn. PIPP is a composite score for pain assessment that includes contextual (behavioral state and gestational age), behavioral (brow bulge, eye squeezing, and nasolabial furrowing), and physiologic; heart rate (HR) and oxygen saturation (SpO2) indicators of pain. Informed Consent was obtained after enrolment in the study, from the parents of newborn.

Inclusion criteria

Inclusion criteria were; Hemodynamically stable preterm neonates 32 up to 36 weeks and 6 days of age were admitted to the NICU after written and informed consent from their parents. Newborns are expected to have a heel-prick procedure for bedside glucose assessment as per routine medical management.

Exclusion criteria

Exclusion criteria were; Newborns with any major congenital anomalies, orofacial anomalies, or cleft palate, receiving donor human milk, Extramural preterm, not willing to give consent, and critically ill. CNS abnormalities, defective /blurred videos, any discrepancy

in the overall. PIPP score, receiving analgesia in the last 24 hour.

Procedure

Total 2 ml of expressed breast milk (EBM) of the mother with a spoon/paladai was fed to the newborn prior to the study. Each neonate was pricked only once with a 26-gauge disposable needle for heel prick and estimation of glucose was performed with a glucometer (Nocoding one plus, 2015) with full aseptic precautions. SP02 was monitored by monitor (BPL LYTA1F1695). Neonates were divided into three groups by simple random sampling using randomizer.org. Research Randomizer uses the "Math. random" method within the JavaScript programming language as the core method for generating its random numbers using Research Randomizer (Version 4.0). Neonates were divided into three groups based on a random number table i.e. Group A (28 Preterm receiving only mother's expressed breast milk) and Group B (14 Preterm receiving mother's expressed breast milk with kangaroo mother care for 15 minutes and Group C (14 Preterm receiving KMC for 30 minutes before administration of EBM). KMC was continued after the heel prick procedure. Videos for assessment of pain by PIPP method were recorded by mobile (iPhone 12, Modelno.MGJA3HN/A) and a portable Spo2 monitor was used for monitoring of oxygen saturation. One assigned fellow pediatric resident and principle investigator both measured the PIPP score. Each indicator is scored in a 4-point scale (0 to 3) and pain scores range from 0 to 21 for the infants. Scores of 6 or less represent the absence of pain or minimal pain, 7-12 represent moderate pain, and more than 12 indicates severe pain independently, from the recorded videos for the degree of pain estimation, independently, from the recorded videos for the degree of pain estimation. PIPP scoring was assessed at 30 seconds, 60, and 120 seconds after the heel-prick procedure.

Statistical analysis

Sample size was calculated using OPEN EPI Software. Data collected was tabulated in an excel sheet, under the guidance of a statistician. Data collected was tabulated in an excel sheet, under the guidance of a statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 24.00 for windows; SPSS inc, Chicago, USA). For each assessment point, data were statistically analyzed using one-way ANOVA. The difference between the groups was determined using t-test and the level of significance was set at $p<0.05$.

RESULTS

The gender distribution among the study subjects is shown in (Table 2). It was seen that in Group A 46.4% were males and 53.6% were females and in Group B, 57.14% were males and 42.9% were females and in Group C 50% were males and 50% were females. The (Table 2) also demonstrates the distribution of Gestational age (weeks) among the study groups. In Group A 82.14% of subjects had 32-34 weeks gestational age and 17.86% of subjects have 34-35 weeks 6 days gestational age. In Group B 85.71% of subjects have 32-34 weeks gestational age and 14.29% of subjects have 34-36 weeks gestational age. In Group C 78.57% of subjects had 32-34 weeks gestational age and 21.43% of subjects had 34-35 weeks 6 days gestational age.

Table 2: Distribution of gender and gestational age in study groups.

Parameters	Gender distribution			P value
	Group A	Group B	Group C	
	N (%)	N (%)	N (%)	
Gender				
Male	46.4	57.1	50.0	0.68
Female	53.6	42.9	50.0	
Prematurity distribution; Gestational age (weeks)				0.42
32-34	82.1	85.7	78.6	
35-36	17.9	14.3	21.4	

The (Table 3) showed the Comparison of the PIPP score at 30 seconds between Group A and B. The mean PIP score among study subjects was 11.72±2.70, and 11.47±2.93 at 30 seconds respectively in Group A and Group B. The findings were not significant statistically. The (Table 3) showed the Comparison of the PIPP score at 30 seconds between groups A and C. The mean PIPP scores among study subjects were 11.72±2.70, and 11.43±2.31 at 30 seconds respectively in Group A and Group C. The findings were not significant statistically. Comparison of the PIPP score at 30 seconds between groups B and C. The mean PIP score among study subjects was 11.47±2.93, and 11.43±2.31 at 30 seconds respectively in Group B and Group C. The findings were not significant statistically.

The (Table 4) showed the comparison of the PIPP score at 60 seconds between Group A and B. The mean PIP score among study subjects was 6.5±1.16, and 6.04±1.79 at 60 seconds respectively in Group A and Group B. The findings were significant statistically. Comparison of the PIPP score at 60 seconds between groups A and C. The mean PIP score among study subjects was 6.5±1.16, and 6.02±1.11 at 60 seconds respectively in group A and

group C. The findings were statistically significant. Comparison of the PIPP score at 60 seconds between groups B and C. The mean PIP score among study subjects was 6.04±1.79, and 6.02±1.11 at 60 seconds respectively in group B and group C. The findings were not significant statistically.

Table 3: Comparison of PIP score at 30 seconds among Group A and B, Group A and C, Group B and C.

PIP Score			
	Group A	**Group B**	**P value**
	Mean (±SD)	**Mean (±SD)**	0.41
	11.72 (2.70)	11.47 (2.93)	
30 seconds	**Group A**	**Group C**	0.32
	11.72 (2.70)	11.43 (2.31)	
	Group B	**Group C**	0.81
	11.47 (2.93)	11.43 (2.31)	

Table 4: Comparison of PIP score at 60 seconds among Group A and B, Group A and C, Group B and C.

PIP Score			
	Group A	**Group B**	**P value**
	Mean (±SD)	**Mean (±SD)**	0.41
	6.5 (1.16)	6.04 (1.79)	
60 seconds	**Group A**	**Group C**	0.32
	6.5 (1.16)	6.02 (1.11)	
	Group B	**Group C**	0.81
	6.04 (1.79)	6.02 (1.11)	

Table 5: Comparison of PIP score at 120 seconds among Group A and B, Group A and C, Group B and C.

PIP Score			
	Group A	**Group B**	**P value**
	Mean (±SD)	**Mean (±SD)**	0.41
	3.82 (1.08)	3.77 (1.14)	
60 seconds	**Group A**	**Group C**	0.32
	3.82 (1.08)	3.80 (1.10)	
	Group B	**Group C**	0.81
	3.77 (1.14)	3.80 (1.10)	

The (Table 5) shows the Comparison of the PIPP score at 120 seconds between groups A and B. The mean PIP score among study subjects was 3.82±1.08, and 3.77±1.14 at 120 seconds respectively in group A and group B. The findings were not significant statistically. Comparison of the PIPP score at 120 seconds between groups A and C. The mean PIP score among study subjects was 3.82±1.08, and 3.80±1.10 at 120 seconds respectively in group A and group C. The findings were not significant statistically. Comparison of the PIPP score at 120 seconds between groups B and C. The mean PIP score among study subjects was 3.77±1.14, and 3.80±1.10 at 120 seconds respectively in group B and group C. The findings were not significant statistically.

DISCUSSION

The premature infant pain profile (PIPP) score is a composite score for pain assessment that includes contextual (behavioral state and gestational age), behavioral (brow bulge, eye squeezing, and nasolabial furrowing), and physiologic (heart rate and oxygen saturation) indicators of pain. It was developed at the University of Toronto and McGill in Canada. Each indicator is scored on a 4-point scale (0 to 3), and pain scores range from 0 to 21 for the infants. Scores of 6 or less represent the absence of pain or minimal pain, 7-12 represent moderate pain, and more than 12 indicate severe pain.[13] There are 2 approaches for the management of pain in neonates; they are categorized as pharmacological (morphine, paracetamol, and fentanyl).[14-17] and non-pharmacological measures (breastfeeding, nonnutritive sucking, swaddling, kangaroo mother care, massage, music, and sweet tasting solutions like sucrose or glucose.[18] Exclusive breastfeeding and Kangaroo mother care are part of essential newborn care. They are inexpensive, and readily available with no side effects. Therefore, their effectiveness and usage can help in alleviating pain. In this study, as seen in (Table 2) Out of a total of 56, the majority of newborns (46) were between 32-34 weeks. The male and female ratio was equal. The mean PIP score among study subjects was 11.72±2.70, 11.47±2.93, and 11.43±2.31 at the interval of 30 seconds in groups A, B, and C respectively. On comparing the PIPP score

among groups A and B, group A and C, and group B and C, it was found insignificant as the (p>0.05) 0.41,0.32 and 0.81 respectively, as depicted in (Table 3). It seems that at the early stages (30 seconds) after heal prick, there was no difference in pain perception by newborns in any of the groups.

As seen, from (Table 4) at 60 seconds, the mean PIPP score was higher in group A (6.5) as compared to groups B (6.04) and C (6.02) and with a statistically significant difference between group A and B (p<0.038) as well as between group A and C (p<0.038), thus KMC has an additional effect on alleviating pain along with EBM. However, there was no significant difference in PIPP score between group B and group C at 60 seconds (p=0.89). Thus, prolongation of KMC for more than 15 minutes before heel prick, does not have additional pain alleviating effect.

The (Table 5) depicts PIPP scores in all groups at an interval of 120 seconds after heel prick. Comparison among group A and group B, group A, and C, group B and C all have p values of 0.87,0.94, and 0.90 which is (p>0.05). Thus after 120 seconds of heel prick duration of KMC along with EBM has no significant difference in PIPP scores. Other studies are available, which have tested the effect of EBM or KMC on PIPP scores, Chidambaram et al, Mosayebi et al, Castral et al and Johnston et al studied the effect of KMC on PIPP scores in newborns, and it was found that scores were lower in the KMC group in comparison to the control group.[19-22] Ou-Yang et al, Shah et al, Shendurnikar et al, Bilgen et al, Craig et al and Gray et al have studied the analgesic effect of breastfeeding on heel lancing and showed that pain scores were significantly low in breastfed newborns.[25-28] Shukla compared the effect of EBM and EBM with KMC on the assessment of PIPP scores in newborns and found that EBM with KMC significantly reduces pain on heel prick in preterm newborns as compared to EBM alone and EBM with KMC should be the first choice as a method of pain control in preterm neonates.[29]

Limitations

As the number of subjects is less in this study, a study with more subjects is needed.

CONCLUSION

KMC and EBM both are easy, natural, low cost and non-pharmacologic intervention in preterm neonates between 32 to 36 weeks of gestational age and it is beneficial before a heel-prick procedure to decrease the pain. Further, in this study, KMC with EBM for a shorter period of 15 minutes duration had an effective impact on pain relief at the interval of 60 seconds after heel prick. However, it was observed that the longer duration of KMC of 30 minutes duration in this study did not have an additional effect on the relief of pain in the newborn.

Recommendations

EBM with Short duration of KMC for 15 minutes is an effective way of pain alleviation in neonates undergoing heel prick, however more studies are recommended with large subjects.

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