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Effect of Kangaroo Mother Care on Procedural Pain in Preterm Neonates

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Abstract
Background: *Pain in neonates can evoke negative behavioral, physiological or metabolic responses and associated with long term neuro-developmental outcome.*
Objective: *To study analgesic effect of Kangaroo Mother Care (KMC) on procedural pain in preterm neonates.*
Materials & Methods: *100 preterm neonates (gestational age 34-36 week) were randomized into KMC group and Control group at NICU of Civil Hospital, Ahmedabad. Kangaroo Mother Care was given to neonates before 30 minutes of heel prick in KMC group and incubator care was given to control group. Neonates pain score were recorded with help of Premature Infant pain profile (PIPP) and duration of cry were recorded with help of stopwatch by blinded observer.*
Outcome measure: *To assess severity of pain after one hour of KMC*
Duration of cry after KMC
Results: *The mean PIPP score at 30 sec was 6.2 in KMC group and 7.4 in control group (p 0.02). Significant improvement of oxygen saturation was noted in KMC group as compared to control group (p 0.025). But no significant change observed in reduction of maximum heart rate in both the group (p 0.64).*
Conclusion: *As even 30 minutes of KMC practise has good analgesic property, many minor painful procedures like sugar estimation, Intramuscular injection, infant tube feeding insertion and blood sampling can be done immediately after the KMC practise.*
Keywords: *Neonatal Analgesia, Kangaroo Mother Care, Procedural pain*

Introduction

The newborn period exposes infants to a variety of stressors including painful procedures such as venepunctures and heel lances etc. This painful stimuli in neonates can evoke negative behavioral, physiological or metabolic responses and associated with long term neuro-developmental outcome[1,2,3,4].. These painful procedures coupled with immaturity and reduced abilities in regulating their autonomic, motor, and state organization heightens their vulnerability to noxious stimulus and causes repetitive brain damage. Great emphasis is being laid in minimizing pain during procedure in neonates.

Many pharmacological and non-pharmacological methods have been proposed for reduction of pain in neonates [1,5]. Kangaroo Mother Care has been proposed one of the non pharmacological method of reduction of procedural pain in neonates. Kangaroo Mother Care (KMC) [6,7,8,9,10] is a special way of caring of low birth weight(LBW) babies carried out by skin-to-skin contact with the mother or provider. Present study was undertaken to evaluate the effect of KMC on procedural pain in preterm neonates.

Material and Methods

The prospective randomized control trial was conducted at Neonatal Intensive Care Unit of Civil Hospital, Ahmedabad involving 100 preterm healthy neonates with gestational age between 34-36 week. Late preterm term normal vaginal delivered neonates who are on breastfeeding and hemodynamically stable were enrolled for the study over the period of month of January 2016 to December 2016. Unstable or critically ill late preterm neonates, assisted vaginal and operative delivered neonates, neonates brought to NICU from postnatal ward were excluded from the study. Procedure used during the study was heel prick for sugar estimation and severity of the pain was assessed by Premature infant pain scale(PIPP score) [1,11]. PIPP score is composite pain measure includes contextual (behavioural state and gestational age), behavioural (brow bulge, eye squeeze and naso labial furrow) and physiological (heart rate and oxygen saturation) indicators of pain [11,12,13]. Written informed consent was taken from the parents before enrolment in the study.

Study Protocol

The enrolled neonates were randomized into 2 groups by simple randomization, i.e. KMC group and control group. The name, hours of life, sex, weight, height, head circumference, address, gestational age(with help of modified ballard score), behavioural state, resting heat rate and SpO_2 (with help of pulse oximeter-)were recorded in pre-structured proforma. Neonates were given 30 minutes of KMC in KMC group, while 60 minutes of incubator care was given to the neonates in control group. After the 60 minutes of KMC in KMC group or incubator care in control group neonates were given heel prick by the trained staff nurse by 26G 1" needle on lateral aspect of right heel after the cleaning the skin with spirit. The needle was inserted after calling a loud "in" and "out" when the needle was removed. Two blinded observer were present during procedure. One observer was observing the facial expression (brow bulge, eye squeeze and nasolabialfurrow) from the insertion of the needle till 30 seconds. Another observer was observing the maximum heart rate and minimum SpO_2in pulse oximeter during 30 seconds from inserting the needle & duration of cry after removing the needle with help of stopwatch. All events were recorded in proforma.

In order to avoid confounding factor following steps were taken: all babies were breastfed before 1 hour of immunization, only healthy late preterm vaginal delivered neonates were taken, two observer and trained staff nurse were remain the same throughout the study. All tests were performed during 9 am to 11 am to avoid diurnal variation in the pain. All babies were kept in the mother's lap during procedure. Procedure was done in only awake neonates.

Outcome variable of the study: primary outcome was severity of pain (assessed by PIPP score at 30 sec after removing the needle) and secondary outcome variable was duration of the cry in seconds. Result was analyzed by unpaired student t-test. Analysis was done by software. Crying time was analysed by Kruskal-Wallis test. A p value of 0.05 was considered a statistically significant level of difference.

Results

A total of 100 late preterm neonates were randomly divided into 2 group (KMC and Control group) with each group 50 neonates. Baseline characteristics of neonates enrolled in study were

described in table 1. The mean PIPP score at 30 sec was 6.2 in KMC group and 7.4 in control group (p 0.02). Detail comparison has been shown in table 2. Significant improvement of oxygen saturation was noted in KMC group as compared to control group (p 0.025). But no significant change observed in reduction of maximum heart rate in both the group (p 0.64). detail comparison of heart rate and SpO2 in KMC group and control group has been shown in table 3. Crying time was lower in KMC group as compare to control group. The difference between the crying time in KMC group and control group was not significant (p 0.42). There was no adverse effect in any of the both groups during the study.

Table No: 1 Baseline characteristics of the study group

Parameter	KMC group (n=50)	Control group (n=50)
Mean hours of life	69	72
Gestation(week)	34.8	35.1
Male	54	48
Weight(grams)	1856	1811

Table no: 2 PIPP score & duration of cry in late preterm neonates

Parameter	EBM group	SS group	P value
PIPP score at 30 seconds	5.9± 2.1	7.1± 2.5	0.02
Duration of cry	92.28 (54-202 sec)	96.44 (48-225 sec)	0.42

Table No: 3 Heart rate and SpO_2 in late preterm neonates

Parameter	Heart rate (beats/min)			SpO_2(%)		
	KMC group	Control group	P value	KMC group	Control group	P value
Baseline	128.96 ± 12.2	126.72 ± 11.7	0.40	96.78 ± 3.4	97.48 ± 3.1	0.33
After 30 sec of removal of needle	150.34 ± 16.0	151.90 ± 14.3	0.64	92.02 ± 2.65	90.62 ± 2.82	0.025

Discussion

Kangaroo Mother Care (KMC) was developed by Dr. Edgar Ray Sanbaria & Dr. Martinezin Bogota, Colombia in 1978 as an alternative to inadequate & insufficient incubator care in developing countries but now considered as the most feasible, readily available, and preferred intervention for decreasing neonatal morbidity and mortality in developed and developing countries [6,14,15].

Key features of KMC are [6,9,16]: Early, continuous and prolonged skin-to-skin contact, Exclusive breastfeeding & early discharge. It fosters infant health and wellbeing by promoting effective thermal control, breastfeeding, growth & neuro-development, physiological stability, infection prevention, and infant-mother bonding; there by decreasing duration of hospital stay. It is also used as effective transport modality and analgesic for mild procedural pain [6,17,18,19,20].

KMC is alternative to pharmacological measures to reduce newborn pain. Studies have demonstrated that KMC is efficacious as sucrose solution for reduction of procedural pain in newborn. KMC works on "The Gate Control Theory of Pain" which suggests that there is a "gating system" in the central nervous system that opens to let messages (pain) through to the brain and closes to block them. Noxious stimuli cause tissue damage which activates receptors called nociceptors, which are at the end of nerve endings that respond to intense stimuli. Impulses in small diameter nerve fibres tend to open the gate (facilitate transmission of pain), and impulses traveling along large fibers tend to close it (depress transmission of pain). The use of KMC which provides full body contact and other sensory stimulation activates a non-nociceptive tactile nerve impulse, closing the gate in the dorsal horn and inhibiting nociceptive transmission, thus reducing infant pain experience and responses. KMC thus likely decreases pain by activating the Gate Control Mechanism [21,22,23].

Present study has proven the efficacy of the KMC in reduction of procedural pain.. Mean PIPP score is higher in present study as compare to Nimbalkar et al [24] (Mean PIPP score – 4.85) which was also done on late preterm neonates, but improvement in oxygenation status was observed in Present study which was not observed in Nimbarkar et al [24], and both study demonstrate that there is no reduction in the maximum heart rate in both the study. Mean PIPP score of present study is comparable with Nanavati et al [25] study (Mean PIPP score – 5.9), but Nanavati et al [25]

study include VLBW neonates while present study is on Late preterm neonates.

In present study and Nimbalkar et al [24] study consist of two groups – KMC group and control group while in Nanavati et al [25] study consist of two group – KMC group and EBM group(a swab soaked in EBM was kept in the baby's mouth for 2 minutes before the removal of the adhesive tape and continued during the intervention). Nanavati et al [25] also proved analgesic property of the EBM (PIPP score EBM Group – 6.20).

Present study has demonstrated even 30 minutes of practise of Kangaroo Mother Care can reduce perception of minor procedural pain via controlling gate theory of pain in late preterm neonates.

Limitations & strengths: Limitation of our study was only late preterm neonates were included; however pain response can be altered by maturity, birth weight and other co-morbid condition. Strength of our study was it was double blind randomization trial and used validated and reliable tool for assessment of pain response – PIPP scale.

Conclusion

As even 30 minutes of KMC practice has good analgesic property compare to many pharmacological and non pharmacological agents. Many minor painful procedures like sugar estimation, Intramuscular injection, infant tube feeding insertion and blood sampling can be done immediately during or after the KMC practice.

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Conflict of interest

This study had not any competing financial interests in relation to the work done. There is no conflict of interest in doing and publishing this study.

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