

ORIGINAL ARTICLE

NEONATAL ANALGESIA: EFFECT OF SUCROSE SOLUTION VERSUS BREASTFEEDING IN PROCEDURAL PAIN

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Abstract

Objective: To compare analgesic effect of expressed breast milk (EBM) and 24% sucrose solution (SS) on procedural pain in neonates.

Setting: This randomized control trial was conducted in the postnatal Ward of Civil Hospital, Ahmedabad, Gujarat, India from August to October 2016.

Methods: Five hundred neonates were randomized into EBM group and SS group. Neonates were fed either EBM or SS 2 min before intramuscular Hepatitis-B vaccination. Neonatal pain score was recorded after 30 sec with help of Premature Infant pain profile (PIPP) and duration of cry were recorded with help of stopwatch by blinded observer.

Results: The mean PIPP score at 30 sec were 5.7 in EBM group and 6.9 in SS group ($p < 0.001$). The median duration of cry were 81.2 seconds in EBM group and 85.6 seconds in SS group ($p = 0.42$).

Conclusion: Breastfeeding is sterile, easily available, cost-effective and potent analgesic for procedural pain in neonates. So whenever possible breastfeeding or expressed breast milk should be given as an analgesic.

Keywords

Neonatal Analgesia, Expressed breast milk, Sucrose Solution.

Introduction

Earliest pain receptors appear in a fetus at 22 weeks of gestation and actual perception of pain starts from 29 weeks of gestation. (1) In last several years, evidence from clinical research has shown that newborns are sensitive to pain as older infants. Many procedures like vitamin K injection, immunization, estimation of sugar, intravenous catheter insertion, collection of blood, metabolic screening can evoke pain in a neonate. Painful stimuli in neonates can evoke negative behavioural, physiological or metabolic responses and are associated with long term neuro-developmental outcome. (1-4) 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) Breast milk, sucrose, dextrose have analgesic property and hence they are used as an analgesics in neonatal procedural pain. (1,2) We did this study to compare the analgesic effect of breast feeding and 24% sucrose solution (SS) in neonates who were due given Hepatitis B vaccine by recording the pain score after 30 sec with help of Premature Infant pain profile (PIPP) and duration of cry were recorded with help of stopwatch by blinded observer.

Methods & Materials

This prospective randomized control trial was conducted at the postnatal ward of Civil Hospital, Ahmedabad, Gujarat, India involving intramural delivered 500 healthy neonates. Written informed consent were taken from the parents and the ethical clearance was taken from Ethical committee of the institution. Full term neonates who were delivered by vaginal route and were breastfeeding and had received

vaccination within first 24 hours were enrolled for the study. This study was done over the period of 3 months from August to October 2016. Preterm neonates, neonates delivered by assisted vaginal or operative methods, neonates in the neonatal intensive care unit (NICU) and neonates having risk of developing neonatal enterocolitis (NEC) were excluded from the study. Patients were given intramuscular immunization of Hepatitis B vaccine and severity of the pain was assessed by PIPP score (1,6,7) after 30 seconds. PIPP score is a composite pain measure that can be used both in preterms and normal newborns and 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. (6-9)

The enrolled neonates were taken to quiet isolated room and randomized into 2 groups by simple randomization, i.e. expressed breast milk (EBM) group and SS group. Thus, each group had 250 neonates. Hours of life, gender, weight, height, head circumference, gestational age with help of modified Ballard score (10), behavioural state, resting heart rate and oxygen saturation (SpO₂) were recorded in pre-structured proforma. Neonates were given orally 0.5 ml of EBM or 0.5 ml of 24% SS in presence of two observers. After the 2 mins, neonates were given the intramuscular injection of Hepatitis B by the trained staff nurse by 23G 1" needle on anterolateral aspect of thigh after the cleaning the skin with spirit. The injection was given after calling a loud "in" when needle was inserted and "out" when the needle was removed. Two blinded observer were present during immunization. One observer was observing the facial expression (brow bulge, eye squeeze and nasolabial furrow) from the insertion of the needle till 30 seconds. Another observer was observing the maximum heart rate and minimum SpO₂ by pulse oximeter during 30 seconds from inserting the needle and 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 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 immunization. Procedure was done in awake neonates, if neonate was sleeping, he/she was gently awakened.

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.

Statistical Analysis

Result was analysed by unpaired student t-test. Crying time was analysed by Kruskal-Wallis test. A p value of < 0.05 was considered statistically significant

Results

The baseline characteristics of neonates in each group is depicted in Table 1. The mean PIPP score was significantly lower in EBM group (5.7) than SS group

Table 1: Baseline characteristics of the study group

Parameter	EBM group (n=250)	SS group (n=250)	P value
Hours of life	15 ± 5.1	16 ± 5.9	0.04
Gestation (weeks)	38.0 ± 1.1	38.1 ± 1.1	0.42
Males	54%	48%	-
Weight (gms)	2620 ± 310	2566 ± 288	0.04
Heart rate (beats/min)	128.9 ± 11.9	126.9 ± 10.8	0.25
SpO2 (%)	96.8 ± 2.0	97.5 ± 1.7	0.31

Note: EBM = expressed breast milk, SpO2= oxygen saturation, SS = Sucrose solution

Table 2: Various parameters post-Procedure

Parameter (after 30 sec of removal of needle)	EBM group	SS group	P value
Heart rate	150.3 ± 16	154.9 ± 11.9	0.04
SpO2 (%)	92.0 ± 3.7	90.6 ± 3.1	0.07
Cry duration (sec)	92.3 ± 31.5	96.4 ± 40.7	0.42

Note: EBM = expressed breast milk, SpO2= oxygen saturation, SS = Sucrose solution

(6.9) ($p < 0.001$). There was a significant change in post procedural maximum heart rate and minimum SpO2 in EBM group as compared to SS group. Crying time was lower in EBM group as compare to SS group though not statistically significant (Table 2). There was no adverse effect in any of the both groups during the study.

Discussion

The analgesic effect of breast milk is related to sweetness of the milk (due to lactose content) or higher concentration of the tryptophan which is precursor of melatonin which increase the concentration of beta endorphins. (1,11) On the other hand, 24% sucrose solution when placed in the mouth induces the endogenous opioid production which provide the analgesia for the procedure. (1,12) Our study suggests that minimal amount (0.5ml) of EBM is more effective than same amount of the 24% sucrose solution in alleviating the procedural pain of immunization in neonates, however there was no difference in the total duration of cry in either of the group. We also found a lower heart rate in EBM group as compare to sucrose solution group and a better oxygen saturation in the EBM group as compared to SS group post 30 mins. Similar effectiveness of the EBM over sucrose solution was observed by Codipietro et al (13) for analgesia for heel lance and 1 ml of EBM and 24% sucrose solution as an analgesic solution. Similar effect of EBM was found by Upadhyaya et al (14) and Uyan et al (15) using EBM 2 min prior to venepuncture. Our study found that even 0.5 ml of EBM is effective for analgesia. This much of minimal amount of the EBM even can be given to child in whom feeding is contraindicated or withheld due to co-morbid condition. Use of EBM as

an analgesic in place of sucrose solution avoids risk of the septicemia with the improper administration of sucrose solution and it is easily available, safe and effective than sucrose solution.

There was no significant difference in the total duration of cry in both the groups in our study, though Upadhyaya et al (14) demonstrated that median duration of cry was lower in EBM group as compared to sucrose solution group but they used 5 ml of EBM as an analgesic dose. This difference may be due to higher dose of EBM in their study. Our study also had documented reduction of tachycardia and hypoxia in EBM group as compare to SS group within 30 sec of the needle insertion. Similar results have not been demonstrated in other studies. (16)

Conclusion

Breastfeeding is sterile, easily available, cost-effective & potent analgesic for procedural pain in neonates. Even minimal amount (0.5ml) of breast milk is more potent than equal dose of 24% sucrose solution. Direct breastfeeding or expressed breast milk should be used as an analgesic for all types of procedural pain. Sucrose solution should only use in given circumstances when breast milk or EBM is not available. A recent Cochrane review has also concluded that if available, breastfeeding or breast milk should be used to alleviate procedural pain in neonates undergoing a single painful procedure compared to placebo, positioning or no intervention. (17)

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Conflict of Interest : None

References :

1. Turnage CS, LaBrecque MA. Preventing and treating pain and stress among infants in the NICU. In: Cloherty JP, Eichenwald EC, Hansen AR, Stark AR (eds). Manual of Neonatal Care. 7th edition. New Delhi. Lippincott Williams & Wilkins. 2012: 870-885
2. Anand KJ, Carr DB. The neuroanatomy, neurophysiology and neurochemistry of pain, stress and analgesia in newborns and children. *Pediatr Clin North Am.* 1989; 36:795-822.
3. Anand KJ, Skalzo FM. Can adverse neonatal experiences alter brain development and subsequent behaviour? *Biol Neonate.* 2000; 77: 69-82
4. Gruna R. Early pain in preterm infants. A model of long term effects. *Clin Perinatol.* 2002; 29:373-394
5. Carbajal R, Chauvet X, Couderc S, Olivier-Martin M. Randomized trial of analgesic effects of sucrose, glucose and pacifiers in term neonates. *BMJ.* 1999; 319: 1393-7.
6. Steven B, Johnston C, Petryshen P, Taddio A. Premature Infant Pain Profile: development and initial validation. *Clin J Pain.* 1996;12(1):13-22
7. Mayrock DE, Gleason CA. Neonatal pain & Stress: Assessment and management. In: Gleason CA, Devarkar S (Eds). *Avery's Disease of the Newborn.* 9th Edition. Elsevier. 2012: 429-444
8. Stevens B, Johnson C, Taddio A, Gibbins S, Yamada J. The premature infant pain profile: evaluation 13 years after development. *Clin J Pain.* 2010; 26:813-830.
9. Ballanntyne M, Stevens B, McAllister M, Dionne K, Jack A. Validation of the premature infant pain profile in the clinical setting. *Clin J Pain.* 1999;15: 297-303.
10. Singh M. Examination of baby. In: Singh M (ed). *Care of the Newborn.* 7th Edition. New Delhi. Sagar Publication. 2010: 117.
11. Blass EM. Milk-induced hypoalgesia in human newborns. *Pediatrics.* 1997; 99: 825-9.
12. Bass EM, Shah A. Pain-reducing properties of sucrose in human newborns. *Chem. Senses.* 1995;20(1):29-35
13. Codipietro L, Ceccarelli M, Ponzzone A. Breastfeeding or Oral Sucrose Solution in Term Neonates Receiving Heel Lance: A Randomized, Controlled Trial. *Pediatrics.* 2008;122: e716
14. Upadhyay A, Aggarwal R, Narayan S, Joshi M, Paul VK, Deorari AK. Analgesic effect of expressed breast milk in procedural pain in term neonates: a randomized, placebo controlled, double-blind trial. *Acta Paediatr.* 2004; 93:518-22.
15. Uyan ZS, Ozek E, Bilgen H, Cebeci D, Akman I. Effect of foremilk and hindmilk on simple procedural pain in newborns. *Pediatr Int.* 2005;47:252-7.
16. Desmukh LS, Udani RH. Analgesic effect of oral glucose in preterm infants during venipuncture - a double blind randomised controlled trial. *J Trop Pediatr.* 2002; 48:138-41.
17. Shah PS, Aliwalas L, Shah V. Breastfeeding or breast milk to alleviate procedural pain in neonates: a systematic review. *Breastfeed Med.* 2007;2:74-82.

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