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Original Research Article

Breastfeeding versus dextrose as analgesic in newborns: A prospective study

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ABSTRACT

Aim: To assess the level of pain in infants in the control group and the experimental group before and after routine procedures. Secondly, to determine the effect of peroral dextrose solution and breastfeeding on procedural pain in infants in the experimental group.

Materials and Methods: This index study was conducted in the Department of Pediatrics of F.H. Medical College, Etmadpur, India. The newborns enrolled were late pre-term and full-term, having gestational age 34 weeks to 42 weeks. The enrolled newborns were either partial or complete breastfeeding and were assigned heel prick procedures. Newborns were randomized into 2 groups for analgesia, i.e., breastfeeding and 25% peroral dextrose solution. The independent variables were peroral 25% dextrose solution and breastfeeding. The dependent variable was procedural pain (heel prick) in the study groups. The primary outcome variable was the Premature Infant Pain Profile score. PIPP score consists of 2 physiologic indicators of pain (i.e., heart rate and oxygen saturation), two contextual factors (i.e., corrected gestational age and behavioral state), and three behavioral indicators (i.e., brow bulge, eye squeeze, and nasolabial furrow). The greater the PIPP score, the higher the pain perception. PIPP scores were assigned prior to the stimulus and post 30 sec after the stimulus.

Results: The mean pain score of 9.7 and 4.7 in the dextrose and breastfeeding groups, respectively, proves significant differences (p-value 0.000) were found in them. A lesser mean score in the breastfeeding group signifies the importance of breastfeeding during painful procedures compared to dextrose. The mean pain scores of both groups showed that pain was more prevalent in the dextrose group than in the feeding group. Hence, it is clear that the effect of breastfeeding reduced the pain among newborns in comparison to dextrose.

Conclusion: Breastfeeding and 25% peroral dextrose solution have analgesic effects during procedural pain. Breastfeeding has a significantly superior analgesic effect during procedural pain among newborns as compared to dextrose. Breastfeeding should preferably be chosen as a nonpharmacological intervention during procedural pain in newborns.

1. Introduction

Noxious stimuli in newborns have a deleterious effect on their health. Despite being aware of this fact, newborns are still being subjected to repeated painful stimuli as a routine practice in neonatal intensive care units without proper analgesia.

International Association of the Study of Pain states that pain "noxious emotional and sensory perception due to either actual or potential tissue loss."[1]

Extended pain procedures stimulate oxidative stress and inflammatory reactions and halt the development of pre-myelinating cells.[2]

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Premature babies have extended activation of the hypothalamic-pituitary axis, which leads to prolonged alteration in behavioral, hormonal, and physiological mechanisms.[3]

Amongst the routinely performed procedures in NICU, heel prick is commonly beinging practiced for capillary sampling.[4]

Ranger et al. found that repetitive skin prick procedures in newborns eventually lead to thinner cortical gray matter during their childhood period.[5] Extended research in this matter concludes that repetitive painful procedures in newborns lead to poor cognitive and motor function during their forthcoming development and also sub-optimal behaviors during their later life.[6]

Short-term painful procedures in newborns (heel prick) and non-pharmacological pain-relieving interventions are effective, economical, and safe as compared to pharmacological pain-relieving interventions. Non-pharmacological procedures likewise, swaddling, peroral dextrose solution, breastfeeding, non-nutritive sucking (NNS), facilitated tucking, and skin-to-skin contact have been effectively used for the reduction of minor painful procedures in newborns.[7] Pain perception during routine painful procedures in newborns can be effectively demonstrated by pain judgemental tools such as the PIPP scale (Premature Infant Pain Profile) devised by Stevens and colleagues.[8]

Any pain relieving measure in newborns which is cost effective, natural, and safe can being ideal for use in NICU receiving heel prick. Ongoing research has proved that both breast feeding and perperoral dextrose solution are effective measures to alleviate pain in newborns during painful procedures such as heel prick.

2. Aim and Objective

1. To measure the effect of peroral dextrose solution or breastfeeding on procedural pain in newborns of experimental group.
2. To quantify the association of the level of pain with sample characteristics of the newborns enrolled in this study.

3. Materials and Methods

The study was conducted in the neonatal unit of F.H. Medical College, Department of Pediatrics, Etmadpur. This study includes 104 newborns. The sample size is estimated based on previous studies.[5] Where in the experimental group, only 30% of subjects had severe pain post-vaccination, whereas in the control group, it was in 62.9% of subjects. Our sample size came out to be 47 subjects per group at a power of 90% and a confidence interval of 95%. For possible dropouts, it was decided to include 10% extra subjects, so finally, it was decided to include 104 subjects in total for both groups.

The criteria to be met during the study were as follows:

Inclusion criteria: Newborns 0 to 28 days of age (with gestational age 34 weeks to 42 weeks) who are undergoing heel prick for blood sampling and who are on exclusive or partial breastfeeding. Gestational age was estimated by New Ballard's Score.

Exclusion criteria: Those excluded were sick babies with unstable vitals or on oxygen or with a history of severe birth asphyxia, with neurological abnormalities, facial palsy, or glucose intolerance. Infants at high risk for necrotizing enterocolitis, infants with severe birth asphyxia (i.e., Apgar score of 3 or less than 3 at 1 minute), infants with congenital heart disease that are not on established feeds, infants with feeding intolerance, infants with absent bowel sounds. Newborns with major congenital defects such as cleft lip, cleft palate, esophageal atresia, or tracheal esophageal fistula. Infants who are sedated or on other pain medications.

The independent research variables were peroral 25% dextrose solution and breastfeeding, and the dependent variable was procedural pain (heel prick) in newborns.

The subjects were randomized into 2 groups of 52 babies each through computer generated random numbers and these numberings were being put in serially ordered opaque sealed envelopes. The person generating random numberings and placing them serially in sealed envelope were not being involved in the study.

Breastfeed group: Babies in the breastfeeding group were breastfed throughout the intervention, starting 2 minutes before, during, and 2 minutes after the procedure. During breastfeeding, only one-half of the face was visible; thus, all facial parameters were based on the facial side, which the observer could see. However, if, for some reason, a parameter cannot be seen on both sides, a zero score is given to that parameter.

25% dextrose group: 2 ml of 25% dextrose was given per orally by a sterile syringe 2 minutes prior to heel prick. Heel pricks were being given while the baby was in the mother's lap. All the events were recorded on a video camera by a female investigator to ensure the mother's compliance. The principal investigator recorded the vital parameters for a total duration of four minutes after the prick and analyzed the outcome variables from the video recording in all the subjects. All enrolled babies were being fed at least 1 hour before the procedure. All the babies were being held in the mother's lap during the procedure. The mothers were allowed to hold, talk to, or rock the baby during the procedure in both groups. Written informed consent was taken from the parents.

Judgment of neonatal pain was done by using the Premature Infant Pain Profile. The minimum score is 0, and the maximum score is 21. PIPP score includes two physiologic indicators of pain (i.e., heart rate and oxygen saturation), three behavioral indicators (i.e., brow bulge, eye

squeeze, and nasolabial furrow), and two contextual factors (i.e., corrected gestational age and behavioral state). A 4-point scale (0–3) were being used. Scores on the seven indicators are added for a total pain score. The higher the score, the greater the pain. PIPP scores were assessed before giving the stimulus and again at 30 sec, 1 min, 2 min, and 4 min after the stimulus.

Results were analyzed using appropriate statistical tests by a statistician who was not involved in the study.

4. Results

The current study, "Breast Feeding Versus Dextrose as Analgesic in Newborns**,"** was conducted in F.H. Medical College on 104 newborns attending the hospital. Random seeds were generated, and newborns were divided into two groups on the basis of the identification number assigned to them randomly. Dextrose was used for newborns of one group (n=57), and breastfeeding was used for another group (n=49) during heel prick, and the comparison was done on the basis of various parameters according to PIPP criteria. The profiles of the newborns are described in the table.

Newborns aged 1 to 10 days were included in the study, with a mean age of 1.2 days. The males (65) and females (41) were in the gestation age of 32 to 41.1 weeks, with men's gestation age of 37.7 weeks. The average birth weight was 2648.1 ± 412.2, with a range of 1563-3632. The overall pain score among 106 newborns ranged from 3 to 13, with a 7.4 ± 3.3 mean score.

Age distribution of children in both groups. The distribution in both groups was almost the same and thus homogenous. The nonsignificant p-value (0.842) shows that both the groups had almost equal age distribution with the highest number of 1-day newborns, 24 (42.1%) and 23 (46.9%) in dextrose and breastfeeding groups, respectively.

Although the number of males was more among the total newborn but the above tables shows that the distribution in both groups was not statistically significant (p-value 0.075). The dextrose group had 30 (52.6%) males as well as 27 (47.4%) females. On the other hand 35 (71.4%) males and 14 (28.6%) females were in the breast feeding group.

Although 4 (7%) children with extremely low birth weight were in dextrose group compared to none in breast feeding group, yet the difference was not significant (p-value 0.090).

The gestation age according to PIPP criteria of both groups has been shown in figure. The percentage distribution was almost same in both groups with mostly infants in more than 36 weeks age group 84.2% and 83.7%, respectively.

In our study, 89 out of 106 newborns having 36 weeks or more gestational age at birth were well distributed between both groups, 48 (84.2%) in Dextrose and 41 (83.7%) in the breastfeeding group. The remaining 17 children were also showing the same trend and thus statistically non-significant (p-value 0.940) according to the chi-square test.

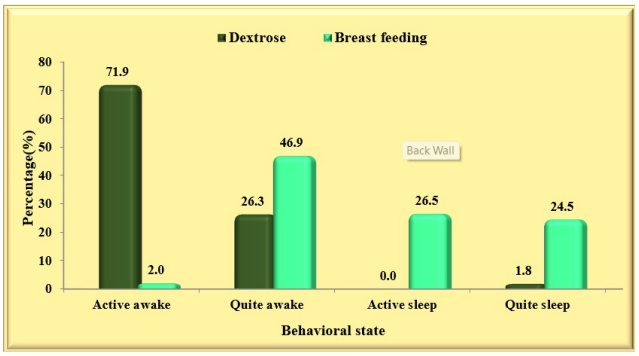

Figure 1: Behavioral state of newborn in both groups

The above figure shows the behavioral state of newborn in both groups before procedure. Most of the children 98.2% in dextrose group were in active and quite active state whereas 51% children in breast feeding group were in sleeping state.

The mean increase in heart rate was more than 1.7 in the dextrose group compared to 0.5 in the breast-feeding group. The mean comparison was statistically significant..

SPO_2 fall during the procedure was different in both the dextrose and breastfeeding groups. More fall, 5.0-7.4%, was recorded in dextrose group 20 (35.1%) compared to breastfeeding group 48 (98.0%) with 0-2.4%.

Maximum brow bulging ≥ 70% of the time was recorded in 35.1% of newborns of the dextrose group. On the contrary, 53.1% newborn of breastfeeding group showed none (0-9% of time).

Significant difference (p-value 0.000) while eye squeezing by newborn of both groups proves that 21 (36.8%) children in dextrose groups bear more pain as compared to breast feeding group 1 (2.0%).

With a higher mean score of 2.3, newborns in the dextrose group show more pain as compared to the 1.2 mean in the breastfeeding group. The significant p-value (0.000) gives a clear opinion that breastfeeding decreases the effect of pain during procedures.

The overall pain level of newborns in both groups has been depicted in the figure. In the breastfeeding group, 89.8% of children had no or minimal pain. In the dextrose group, a maximum of children, 73.7% had reported mild to moderate pain.

5. Discussion

In our study, overall average revised PIPP score were 7.4 ± 3.3 ranging from 0-21. The mean PIPP score of 9.7 and 4.7 in dextrose and breast feeding groups respectively. Similarly, Stevens et al, in their study on initial development and validation of PIPP scale during heel prick found mean PIPP score to being 8.8 ± 2.4.[9]

Table 1: Distribution of premature infant pain profile among patients

S. No.	Parameter	0	1	2	3	Mean ± SD
1.	What is gestation of infant?	89 (84.0)	17 (16.0)	0 (0.0)	0 (0.0)	0.2 ± 0.3
2.	Behaviperoral state before the procedure (15 sec.)	42 (39.6)	38 (35.8)	13 (12.3)	13 (12.3)	1.0 ± 1.0
3.	Difference between Baseline HR and maximum HR during the procedure	26 (24.5)	37 (34.9)	43 (40.6)	0 (0.0)	1.2 ± 0.8
4.	Difference between baseline SO_2% and minimum SO_2% during the procedure	64 (60.4)	22 (20.8)	20 (18.9)	0 (0.0)	0.6 ± 0.8
5.	Observe the infant for 30 sec immediately after the procedure for brow bulge	27 (25.5)	36 (34.0)	23 (21.7)	20 (18.9)	1.3 ± 1.0
6.	Observe the infant for 30 sec immediately after the procedure for eye squeeze	14 (13.2)	13 (12.3)	57 (53.8)	22 (20.8)	1.8 ± 0.9
7.	Observe the infant for 30 sec immediately after the procedure for nasolabial furrow	26 (24.5)	38 (35.8)	22 (20.8)	20 (18.9)	1.3 ± 1.0
	Total PIPP score					**7.4 ± 3.3**

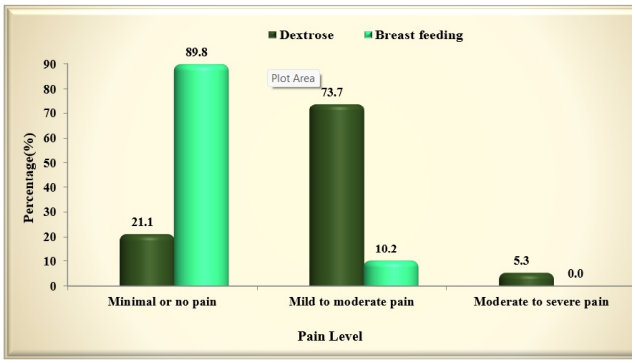

Figure 2: Pain level among newborn of both groups

Heish et al., found in their study, PIPP score to being 8.6 (mean= 7-12) among breast feeding group and 9.5 (6.75-11.25) among peroral dextrose group.[10] Codi Pietro et al., in their study of breastfeeding or peroral sucrose solution in term newborns receiving heel prick reported that the median difference of PIPP score were 5.0 among the two groups.[11] But Gradin et al., during their comparison of analgesic effect of breastfeeding versus glucose alone, and in combination, with controls receiving no interventions, on full term infant's pain response during heel prick, found that although breastfeeding alone decreased duration of crying time compared to control, PIPP scores and crying duration were lowest in the group receiving both interventions.[12]

Gradin et al, in their study found that the PIPP score (median) were 7, which is lower in breastfed/dextrose group than during breastfeeding alone with mean PIPP score of 10. There were a similar difference between the PIPP scores in the dextrose fed group were 9 in comparison to the control groups where PIPP score were 11.[12]

In this index study, in dextrose group 94.8% babies had minimal to moderate pain, with 3 (5.3%) having severe pain. But 44 (89.8%) babies having no or minimal pain were spotted in breast feeding group, 10.2% suffered from mild to moderate pain. None of the babies in breast feeding group showed symptoms of severe pain. The mean pain score of 9.7 and 4.7 in dextrose and breast feeding groups respectively proves significant difference (p-value 0.000) were found in them.

Similarly, Heish et al, found in their study, PIPP score to being 8.5 (mean= 6-11) among breastfeeding group and 9.5 (mean= 6.75-11.25) among peroral glucose group. Their study showed significant statistical difference (p<0.05) among breastfeeding and peroral dextrose groups.[10]

Codipietro et al, studied that median PIPP scores were 3.0, in the breastfeeding group which were lesser than those babies receiving 1 ml sucrose solution, with PIPP score of 8.5. The median group difference were 5.0.[11]

From the current discussion, inference can being drawn that lesser mean score (PIPP score) in breast feeding group signifies the importance of breastfeeding during painful procedures as compared to dextrose. Hence, it is clear in

our study that the effect of breast feeding reduced the pain among newborns in comparison to dextrose during heel prick.

6. Conclusion

In this index study, 104 newborns aged 1 to 10 days were included, with a mean age of 1.2 days. The overall pain score among 106 newborns ranged from 3 to 13, with a 7.4 ± 3.3 mean score. In the breastfeeding group, 89.8% of children had no or minimal pain. In the dextrose group, maximum children, 73.7% had mild to moderate pain. In the dextrose group, 94.8% of children had minimal to moderate pain, with 3 (5.3%) having severe pain. None of the children in the breastfeeding group showed features of severe pain. A lesser mean score in the breastfeeding group signifies the importance of breastfeeding during painful procedures as compared to dextrose.

The mean pain scores of both groups showed in the above figure that pain was more prevalent in the dextrose group than in the feeding group. Hence, it is clear that the effect of breastfeeding reduced the pain among newborns in comparison to dextrose.

7. What is already known?

Breastfeeding/dextrose solutions have pain-relieving effects in minor outpatient procedures (heel prick).

8. What does this study add?

Breastfeeding during and before heel prick is superior to 25% glucose solution as an analgesic in newborns.

9. Source of Funding

None.

10. Conflict of Interest

None.

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