

Original Research Article

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Effect of oral 25% dextrose on pain relief in newborn infants undergoing venepuncture

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ABSTRACT

Background: Aim of this study was to study effect of oral 25% dextrose for pain relief in newborns undergoing venepuncture.

Methods: This is a case control study conducted in NICU, Cheluvamba hospital attached to Mysore medical college and research institute during the period between September 2018 to November 2018. Babies with gestational age between 34 to 40 weeks of gestation who had clinical indication for blood sampling were included in the study. Neonates who are critically ill, suffered perinatal asphyxia and having congenital anomalies were excluded from the study. Hundred newborn babies admitted to NICU who had clinical indication for blood sampling were enrolled in the study. Study population were divided into 2 groups, dextrose (cases) and non-dextrose group (controls). The data analysis included gestational age, postnatal age, weight, sex, heart rate, oxygen saturation, crying time and behavioural pain assessment.

Results: Mean pain score, crying time and heart rate at 5 minutes of venepuncture were studied in both the groups. Mean pain score in dextrose group was 2.68 and in non-dextrose group was 7.18 with significant p value of 0.0062. Mean crying time in dextrose group was 8.98 minutes and in non-dextrose group was 42 minutes with significant p value of 0.001. Mean heart rate in dextrose group was 142 beats/minute and in non-dextrose group was 146bpm with p value of 0.08.

Conclusions: Pain in the newborns should be recognised and adequately treated. Lingual 25% dextrose can be used as safe and effective analgesia in neonates undergoing minor invasive procedures like venepuncture.

Keywords: Analgesia, Dextrose, Newborns, Pain score, Venepuncture

INTRODUCTION

Neonates are exposed to painful procedures during routine care in NICU and are often exposed to minor invasive procedures like venipuncture.^{1,2} Neonatal pain perception is more intense than in adults due to dense sensory nerve endings in neonatal skin and mucous membranes.^{3,4} From as early as 24 weeks of gestation, the neuroharmononal and neurochemical structures necessary for pain recognition are already developed therefore untreated painful interventions during this time may

change brain architecture with both immediate and late effects.⁵ The long term consequences may include altered pain sensitivity and permanent neuroanatomical, behavioural, emotional and learning disabilities.⁶

Neonatal physiologic and behavioural response to pain are less organised, less coordinated and more difficult to interpret.^{3,4} Painful experiences in newborn have to be evaluated indirectly by observing changes to physiological and behavioural parameters during the interventions. These physiological changes include the

following heart rate, respiratory rate, blood pressure, oxygen saturation, facial mimicry, motor patterns and crying.⁷

Several pharmacological and non-pharmacological therapeutic strategies have been developed and proposed to prevent or reduce pain in the neonates. Restricted and gentle handling, appropriate positioning, music therapy, acupuncture, massage, non-nutritive sucking, sweet solution and drug therapy are most often considered therapeutic strategies.⁸

Paracetamol has been studied for reduction of pain, but it is not effective but also has side effects.⁹ Parenteral analgesics have negative sequelae and are not effective in newborns.¹⁰ Kangaroo mother care is found to be effective, but it may not be feasible when the child is severely ill or provider is not available.¹¹

Sweet solution for analgesia in neonates undergoing painful procedures has been extensively investigated over past decades.¹² Sweet taste is believed to trigger the release of endogenous opioids which are apparently acting through μ receptors modulates pain stimulus.¹³ Sucrose as sweet solution is effective for reducing pain, but repeated dose of sucrose in the neonate may not be safe especially in preterm babies and pharmacological

preparations of sucrose is not available in India.¹⁴ So the study aims to find the effective non sucrose sweet solutions which can be used for neonatal analgesia.

METHODS

This is a case control study conducted in NICU, Cheluvamba hospital attached to Mysore medical college and research institute during the period between September 2018 to November 2018. Sample size was 100, calculated based on the formula $n=z^2pq/d^2$, where $z=1.96$, p is the number of newborns admitted in the NICU of Cheluvamba hospital attached to Mysore medical college and research institute, $q=1-p$ and $d=95\%$ confidence interval.

Inclusion criteria

Babies with gestational age between 34 to 40 weeks of gestation who had clinical indication for blood sampling were included in the study.

Exclusion criteria

Neonates who are critically ill, suffered perinatal asphyxia and having congenital anomalies were excluded from the study.

Table 1: CRIES Scoring system.¹⁵

Indicator	Scoring criteria		
	0	1	2
Crying	No cry or not high-pitched cry	High pitched cry, but consolable	High pitched cry, inconsolable
Requires oxygen for saturation >95%	No oxygen required from baseline.	Oxygen requirement <30% from baseline	Oxygen requirement >30% from baseline
Increased vital signs	Heart rate and blood pressure are both unchanged	Heart rate and blood pressure are increased by <20%	Heart rate and blood pressure are increased by >20%
Expression	None	Only grimace is present	Grimace and non audible grunt present
Sleeplessness	Continuously asleep	Awakens at frequent intervals	Awake constantly

Hundred newborn babies admitted to NICU who had clinical indication for blood sampling were enrolled in the study. Study population were divided into 2 groups, dextrose (cases) and non-dextrose group (controls). Dextrose group babies received 2 ml of 25% dextrose and non-dextrose group babies received 2 ml of sterile water 2 minutes before venepuncture. Pain reactions were scored according to CRIES scoring system (Table 1).

Domains of study tool were Gestational age, postnatal age, weight, sex, heart rate, oxygen saturation, crying time and behavioural pain assessment.

Statistical analysis

Data was entered in Microsoft excel and analyzed by SPSS for Proportion, Chi square test, mean, standard deviation.

RESULTS

Hundred neonates who were enrolled in the study were divided into dextrose(cases) and non-dextrose group(controls). Among 50 cases 28 were males and 22 were females. Mean gestational age in 50 cases was 37.5 weeks, mean birth weight was 2.96 kilograms and mean

postnatal age was 3.61 days. Among 50 neonates as controls 26 were males and 24 were females. Mean gestational age among controls was 38.4 weeks, mean birth weight was 2.78 kilograms and mean postnatal age was 4.35 days (Table 2). Mean pain score, crying time and heart rate at 5 minutes of venepuncture were studied in both the groups. Mean pain score in dextrose group was 2.68 and in non dextrose group was 7.18 with significant p value of 0.0062. Mean crying time in dextrose group was 8.98 minutes and in non dextrose group was 42 minutes with significant p value of 0.00048. Mean heart rate in 50 cases was 142 beats/minute and in non dextrose group was 146 beats/minute with p value of 0.08 (Table 3).

Table 2: Patient characteristics.

Characteristics	Dextrose group (50)	Control group (50)	p value
Gestational age (weeks)	37.5±1.65	38.4±1.56	0.55
Birth weight (Kilograms)	2.96±0.47	2.78±0.53	0.64
Postnatal age (days)	3.61±1.45	4.35±1.67	0.62
Sex (Male/Female)	28/22	26/24	0.81

Table 3: Mean pain score, crying time, heart rate at 5 minutes after venepuncture in two groups.

	Dextrose group			Non-dextrose (sterile water) group			p value
	Mean±SD	Min	Max	Mean±SD	Min	Max	
Pain score	2.68±1.73	0	5	7.18±1.52	3	5	0.0062
Crying time (s)	8.98±1.77	0	7	42±12.4	5	40	0.00048
Heart rate (bpm)	142±10.56	120	180	146±12.44	120	180	0.08

DISCUSSION

Venepuncture in newborns for investigation is a common procedure during their stay in the NICU. Venepuncture can cause pain in the neonate which can affect its cardiovascular function, metabolism and intracranial pressure.^{16,17} So we should have an ideal analgesia for these minor procedures in NICU, which is well tolerated, easily administrable and has rapid onset of action with minimal side effects.¹⁸ Sucrose as an efficient analgesia for minor invasive procedures in neonates has been demonstrated by various studies.^{19,20} However pharmacological preparations of sucrose are not easily available in India. So, this study aims to study the efficacy of non sucrose solutions like 25% dextrose in neonatal analgesia, which has its advantage of being sterile and easily available.¹⁸

Mean gestational age of cases (dextrose group) which are included in this study was 37.5 weeks and in controls (non dextrose group) was 38.4 weeks. Mean gestational age in the present study was more when compared to study done by A Ravishankar et al, (36.4 weeks) and less when compared to study done by Chermont et al, (39 weeks).^{21,22} Sex ratio among the cases in the present study was 1.27:1 and in controls was 1.08:1 which is comparable to studies done by Shreshta banga et al, (1.13:1) and A Ravishankar et al, (1:1).^{21,23}

Mean birth weight among cases in the present study was 2.96 kilograms(kgs) and in controls was 2.78 kgs. The mean birth weight was higher in cases than in controls

which may be attributed to higher mean gestational age among cases. Mean birth weight in present study was more when compared to study done by A Ravishankar et al, (2.04kgs) and less when compared to study done by Chermont et al (3.2kgs).^{21,22} Mean postnatal age among cases in the present study was 3.61days and in controls was 4.35 days. Mean postnatal age among cases in the present study was similar when compared to study done by Mundol TH et al, and was less when compared to study done by Saiprasad kavthekar et al (6.2weeks) which may due larger study group in the Saiprasad kavthekar et al study.^{24,25}

The mean pain score among the cases in the present study was 2.68 which is significantly less when compared to controls (7.18) with p value of 0.0062. The mean crying time was 8.98 seconds(s) in dextrose group which was less when compared to controls(42s) with significant p value of 0.00048. Mean heart rate among the cases was 142 beats per minute(bpm) and in controls was 146bpm without much difference between the two groups. Mean pain score, crying time and heart rate was less when compared to study done by Manizheh Mostafa Gharehbaghi et al.²⁶

There was no statistically significant difference between two groups of neonates with respect to gestational age, birth weight, gender and postnatal age but mean pain score and crying time duration was significantly reduced in neonates who had oral 25% dextrose administration prior to venepuncture. Upadhyay et al, and Uyan et al, have demonstrated that expressed breast milk given 2 minutes prior to venepuncture significantly reduced pain

in term infants in comparison to dextrose analgesia.^{27,28} This study results were supported by other studies like Stevens B et al, and Ogawa s et al, that showed the effect of 24% sucrose in reducing duration of cry and total CRIES score in venepuncture and heel lance.^{14,29} In this study 25% dextrose was used rather than 24% sucrose because of its easy availability. The effectiveness of 2 minute interval between glucose administration and noxious stimulation is suggested by a mechanism activated by the presence of solution in mouth rather than a metabolic mediation which is agreed by other studies.³⁰ So, using dextrose solution in neonates is a useful, feasible, and non-expensive method of inducing analgesia for painful peripheral venepuncture.

CONCLUSION

Pain in the newborns should be recognised and adequately treated. Lingual 25% dextrose can be used as safe and effective analgesia in neonates undergoing minor invasive procedures like venepuncture.

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