

THE EFFECT OF ORAL DEXTROSE ON PAIN RELIEF OF NEWBORN INFANTS

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ABSTRACT

Objective: In comparision with children and adults pain in the newborn infants is under assessed and under managed. Recently oral sweet solutions such as sucrose has been used for painful procedures in neonates. The objective was to assess the efficacy of 25% dextrose for managing of infants pain in neonatal peripheral venepuncture.

Methodology: In a randomized controlled clinical trial, 60 term neonates were enrolled in the study. They were randomized to receive oral dextrose (25%) or sterile water two minutes before venepuncture. Pain reactions were scored with CRIES pain scoring system, Crying time and heart rate at five minutes after venepuncture were recorded.

Results: There were significantly lower pain score and shorter crying time in dextrose group after venepuncture (CRIES pain score: 2.23 ± 1.45 vs 6.17 ± 1.66 P=0.001), (Duration of crying (sec) : 2.83 ± 1.64 vs 16.97 ± 8.49 P=0.001) respectively.

Conclusion: Using oral dextrose solution is a useful, non expensive and non pharmacologic method for managing pain of venepuncture in neonates.

KEY WORDS: Pain, Newborn, Dextrose, Analgesia.

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INTRODUCTION

Management of pain in neonates usually is less than optimal.^{1,2} Most physicians and nurses believe that neonatal pain conception in newborn infants is less than adults. However, by 20 weeks of gestation, the fetus has a highly differentiated and full functional sensory nervous system. At this time the pain experience is a dynamic process that links the nervous system to organ system throughout the body.

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During stimulation, nervous system induces complex and measurable responses in organ systems.² Neonatal pain perception may be more intense than in adults. It is due to dense sensory nerve endings in neonatal skin and mucous membranes. There is more excitatory neurotransmitters in ascending pathways along peripheral nervous system and spinal cord, and poor inhibitory transmitters which potentiate pain perception.^{2,3} Neonatal physiologic and behavioral responses to pain are less organized, less coordinated and more difficult to interpret. These responses may become more easily disorganized with stress or may adapt to pain more readily. Up to 50% of premature neonates don't exhibit crying behaviors during painful procedures.²⁻⁶ Stress of pain affects multiple organ systems. Acute effects of pain includes: increased plasma levels of cortisol, catecholamine, lactate, and glucose instability. There is also instability of respiratory pattern, hemodynamic variables and cerebral blood flow in response to pain.^{2,5,7} Pain and it's management in neonates has received very little attention.

Table-I: Neonatal Postoperative pain assessment score (CRIES)

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 or blood pressure is increased by <20%	Heart rate or blood pressure is increased by >20%
Expression	None (no grimace)	Only grimace is present	Grimace and nonaudible grunt present
Sleeplessness	Continuously asleep	Awakens at frequent intervals	Awake constantly

In recent years oral glucose solutions have been used for inducing analgesia in painful procedures.^{1,2,4-6,8} We assessed the efficacy of oral 25% dextrose in pain management of term infants who underwent venepuncture.

PATIENTS AND METHODS

In a randomized controlled clinical trial, 60 neonates with gestational age of 35-40 wk and 1-10 days postnatal age admitted for management of hyperbilirubinemia in nursery of Ghaem hospital (Mashad, Iran) were enrolled in this study. Inclusion criteria were Apgar score of more than 7 at both one and five minutes, no chronic or acute illness of the mother during pregnancy and normal physical examination,. Babies younger than 24 hours who were ill or on any medication were excluded. After obtaining parental consent, the infants were randomly allocated to two groups of 30 cases.

Randomization and application of the type of solution was performed by a nurse who was

not involved in the study measurements. Two minutes before venepuncture one group received 2ml oral 25% dextrose (0.5gr glucose) and for the other group 2 ml oral sterile water was administered.

Two neonatologists who were blinded to intervention assessed pain score in neonates by CRIES pain score (Table-I) and crying time. Behavioral parameters of CRIES system were assessed by viewing digital camera. Mean score was taken for each newborn infant. Heart rate at five minutes after venepuncture was recorded for each neonates.

Statistical analysis was performed with SPSS 14.0 soft ware by using t-test and chi-square test. Values of P<0.05 were considered statistically significant.

RESULTS

There was no statistically significant difference between two groups of neonates in respect to gestational age, birth weight, gender and postnatal age. The demographic characteristics of two groups are shown in Table-II.

Table-II: Patients characteristics

Characteristics	Patients(n)		P.Value
	Dextrose (30)	Sterile water (30)	
Gestational age (wk)	38.4 ± 1.54	38.6 ± 1.47	0.61
Birth weight (gr)	3195.67 ± 530.26	3234 ± 547.8	0.78
Postnatal age (day)	5.73 ± 1.55	5.53 ± 1.63	0.62
Gender (Male / Female)	16/14	17/13	0.79

Mean pain score in patients that received dextrose two minutes before venepuncture was significantly less than sterile water group. (P=0.000)

Table-III: Mean pain score, crying time and heart rate at five minutes after venepuncture in two groups

	Patients			P.Value			
	Dextrose		Sterile water				
	Mean ± SD	Min	Max	Mean ± SD	Min	Max	
Pain Score	2.23 ± 1.45	0	5	6.17 ± 1.66	3	5	0.0001
Crying time(sec)	2.83 ± 1.64	0	7	16.97 ± 8.4	5	40	0.0001
Heart rate/min	151.57± 14.25	120	180	146.8 ±14.44	120	180	0.20

Mean pain score in patients that received dextrose two minutes before venepuncture was significantly less than sterile water group. (P=0.0001)

Mean crying time after venepuncture was significantly shorter in dextrose group (P=0.0001). Heart rate at 5 minutes after venepuncture was not significantly different between two groups (P=0.203). Mean pain score, crying time and heart rate at 5 minutes after venepuncture in two groups are shown in Table-III. We didn't find any adverse reaction to 25% dextrose such as skin eruptions, vomiting and diarrhea following 24 hours of it's administration.

DISCUSSION

Although appreciation and management of operative and post operative pain in neonates has improved , use of analgesia for non operative painful procedures remains limited.^{5,7,10,11} It is broadly accepted that anesthesia and analgesia in the neonatal population have important clinical and physiologic consequences and may have long term physiologic impact.^{7,11}

Human and animal studies have shown compelling evidence. Early pain and stress affect nociception and behavioral responses to pain later in life. Conflicting results of these studies leave the nature and mechanism of these long term effects remain unexplained.^{7,10,11} Venepuncture is a painful procedure in nurseries but is less painful than heel stick. Reducing of pain perception in neonate may be achieved by different methods.^{2,9} Previous studies have shown that non nutritive sucking on a pacifier and non pharmacologic interventions such as sucrose attenuates behavioral distress during heel stick or venepuncture.^{1,5,8,12,13}

Analgesia which elicited by sweet solutions is probably mediated by the release of endogenous opioids.^{2,5,9} Although sucrose has been extensively used in clinical and animal studies. There are a few studies that have investigated the anti nociceptive affect of dextrose.^{9,14} Sucrose solutions are not available readily in nurseries. So we assessed the antinociceptive effect of dextrose which can be preferred for practical reasons. Our study revealed that 25% dextrose had a statistically significant antinociceptive effect than sterile water which reduced the immediate behavioral pain response and shortened crying time after venepuncture. Some concern has been raised about the potential for increased risk of necrotising entrocolitis as a result of repeated administration of hyperosmolar dextrose.^{2,10} As other previous studies in this study we couldn't find any gastrointestinal side effects related to single use of the concentrated dextrose solution.

So using dextrose solution in neonates is a useful, feasible, and nonexpensive method of inducing analgesia for painful peripheral venepuncture. It seems that further study is necessary for appreciating of different doses and concentrations of dextrose solutions for neonatal pain management.

CONCLUSION

Behavioral pain responses to venepuncture and other painful procedures can be relieved by oral dextrose as a nonpharmacologic, safe and effective method.

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