

Assessment and Evaluation of Effectiveness of Oral Administration of Dextrose for Pain Relief Following Venipuncture in Neonates

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ABSTRACT

Topic: A study to assess and evaluate the effectiveness of oral administration of dextrose for pain relief in terms of physiological parameters, pain and cry duration following venipuncture in neonates in selected hospital of Delhi

Objectives: The objectives of the study were to assess pain, physiological parameters and cry duration among neonates following venipuncture with and without oral administration of dextrose and to find out the association of pain in neonates with physiological parameters and cry duration

Methodology: A true experimental research approach with post-test only control group design. Non probability purposive sampling technique was used to assign 30 neonates each in experimental and control group. The data was collected using semi-structured interview schedule, Neonatal Infant Pain Scale, Pulse oximetry and second's watch. The experimental group received 2 ml of 10% dextrose, 2 minutes before the venipuncture and control group received only standard care.

Results: The study concluded that post interventional pain scores in the experimental was lesser than those of the control group. In case of heart rate, both the experimental and control group had increase in the heart rate but the increase in the control group was greater. Both the experimental and control group had reduction in oxygen saturation during venipuncture, but the reduction was much greater in control group. The cry duration in the experimental group was lesser than the control group. No association was found between pain and physiological parameters and between pain and cry duration.

Conclusion: The study concluded that oral administration of dextrose during venipuncture is an effective pain relief in neonates

Key Words: Neonatal Infant Pain Scale, Physiological Parameters

INTRODUCTION

Advancements in the medical technology and nursing care have increased the survival chances of preterm and term neonates. The neonatal intensive care unit (NICU) is a specialized unit, in which, health care professionals care for high risk infants, including those who are born preterm, low birth weight and neonates with other health problems. Care provided in the neonatal intensive care units have improved the mortality and morbidity of high risk

newborns. ^[1] Unfortunately, this highly specialized care comes at a cost.

A traumatic care is the key philosophy which guides nursing practice regardless of child's condition to promote the highest possible state of health. Preventing or minimizing bodily injury and pain is the most important principle to achieve the goal of a traumatic care, that is, "first, does no harm". It is a basic need and right of all children.

Neonates can face upto 400 painful procedures while they are being cared for in the neonatal intensive care units. [2] Many of them face painful procedures, like heel pricks, cannulation, endotracheal intubations etc daily. [3] Pediatric patients cited pain related to procedures especially with the placement of intravenous cannula as the most common one. [4]

Pain is a subjective experience. Early pain experiences may play an important role in shaping an individual's response to pain. Inadequate pain relief and distress during childhood may have long term negative effects on future pain tolerance and responses to pain. [5] Thus comfort measures and pain relief are very important. It has been noted that a gap remains between the protocol regarding pain management and actual pain management. [6]

One of the widely performed procedures is peripheral intravenous cannulation that is required for the administration of antibiotics, fluids, blood products and other therapies. It is often a necessary procedure and causes a lot of distress to the patients. Nurses play a valuable role in minimizing the physical discomfort and the related complications. [7] Peripheral intravenous cannulation is associated with a number of both physical and physiological complications.

Pediatric pain remains underreported and poorly understood. Pain prevention must become a responsibility of all health care providers. Pain prevention does not however minimize the necessity of pain assessment and treatment.

Infants are unable to verbalize pain and that is why it might go unnoticed. In the past, It was believed that neonates did not feel pain or that a painful experience would be forgotten as rapidly it has occurred. However recent evidences have come up which suggests that not only do they feel pain but they feel it more intensely than adults do. [8]

Adults and older children are able to verbalize when they are in pain but the

neonates and smaller children cannot do so. Behavioral and physiological reactions indicate when neonates are in pain. These reactions range from crying to increased heart rate. The question arises whether these reactions are reflex responses or do neonates and infants consciously feel pain as sensory, emotional and cognitive experience.

It was demonstrated by Rebecca Slater and colleagues at the University of Oxford with SezgiGoksan that most of regions in the brain that are involved in pain in adults are also activated in healthy full term babies. It was also found that fMRI response in babies occur at lower sensory threshold than in adults. This confirms that newborns are more sensitive to pain. [9]

Differences in anatomic, physiologic and biochemical structure and function may cause infants to feel pain more intensely than adults. [10] Inadequate evaluation of /failure to evaluate pain in newborns may lead to ineffective management of pain. Hence, accurate evaluation of pain and use of effective pain management strategies to reduce or eliminate pain, as well as comforting newborns should be the primary aims of the nurse providing care for them. Wide fluctuations in intracranial pressures may result in intra-ventricular hemorrhage. The long term effects of pain include disorders related to anxiety, altered pain sensitivity, stress, attention deficit and developmental delay. [11] The above mentioned outcomes are of concern as pain management techniques are infrequently used for most of the procedures.

A survey conducted in United Kingdom reported that 25 % of neonatal units had no pain guidelines for routine painful procedures. [12] Nurses routinely utilize comforting techniques, but they rarely recognize them as non-pharmacologic interventions and provide limited documentation of the pain in neonates and infants and the interventions used for the pain. [13]

Objectives of the Study:

1. To assess pain among the neonates following venipuncture with and without the oral administration of dextrose
2. To assess the physiological parameters of neonates after the venipuncture with and without the oral administration of dextrose
3. To assess cry duration in neonates after the venipuncture with and without the oral administration dextrose
4. To find out the association of pain in neonates receiving venipuncture with physiological parameters and cry duration

HYPOTHESIS:

H₁: The mean pain score of neonates in experimental group who are administered oral dextrose will be significantly lower than the mean pain score of control group who are not exposed to oral dextrose as evident from Neonatal Infant Pain Scale at 0.05 level of significance.

H₂: The mean heart rate of neonates in experimental group who are administered oral dextrose will be significantly lower than the mean heart rate of control group who are not administered oral dextrose as evident from Pulse Oximetry at 0.05 level of significance

H₃: The mean SpO₂ of neonates in experimental group who are administered oral dextrose will be significantly higher than the mean SpO₂ of control group who are not administered oral dextrose as evident from Pulse Oximetry at 0.05 level of significance

H₄: The mean duration of cry of neonates in experimental group who are administered oral dextrose will be significantly lower than the mean duration of cry of control group who are not administered oral dextrose as evident from minute watch at 0.05 level of significance

H₅: There will be significant association between the mean pain scores in neonates receiving venipuncture with physiological parameters and cry duration as evident by Neonatal Infant Pain Scale, Pulse Oximetry and minute watch at 0.05 level of significance

MATERIALS AND METHODS

Research approach: Experimental approach

Research design: post-test only control group design

Research variables: Oral administration of dextrose, physiological parameters, pain and cry duration.

Setting of the study: NICU department at Tirath Ram Shah Charitable Hospital, New Delhi.

Population: neonates receiving venipuncture in NICU at Tirath Ram Shah Charitable Hospital, New Delhi.

Sample: Neonates (30 in Experimental Group and 30 in Control Group) receiving venipuncture in NICU

Sampling technique: Non probability purposive sampling technique

Procedure:

- Administrative and ethical approval was taken from Tirath Ram Shah Charitable Hospital, Delhi
- There was no interference on the routine care and the treatment of the subjects while collecting data.
- The researcher explained the study to the parents or local guardians of the subjects and written informed consent was obtained. The parents/local guardians were given full autonomy to take decision for the participation or withdrawal from the study.
- The tools used for data collection are Semi-structured Interview schedule to collect sample characteristics, Pulse oximetry, Neonatal Infant Pain Scale and seconds watch.
- The Semi- structured tool had 7 items dealing with sample characteristics that are code number, C.R number, Sex, Age in days, Diagnosis, Type of feeding and Weight. Pulse oximetry was used to measure the heart rate and oxygen saturation.
- Neonatal infant pain scale (NIPS) assesses six behavioral indicators in response to pain .this scale includes facial expression, cry, breathing

patterns, motor activity (arms and legs) and state of arousal. Scoring ranges from 0 to 1 in each category with the exception of cry which ranges from 0 to 2. Scores are totaled. The total score ranges from 0 to 7. Score 7 indicates highest level of pain and 0 indicates no pain.

- To ensure the validity tool was given to 9 experts from various fields (5 from Nursing Department and 4 Doctors). The experts were from the field of Pediatrics, Anesthesia and General Surgery. Some changes were incorporated in the tool as per the suggestion given by the experts.
- For the tools used, inter-rater/inter-observer technique was used to establish reliability. The percentage agreement for NIPS, cry duration, Heart rate and oxygen saturation were seventy ,eighty ,hundred and hundred percentage respectively
- The neonates were assigned to experimental and control group (30 in each) using odd and even method
- The researcher exposed the experimental group to the intervention, 2 minutes before the venipuncture and control group received only standard care. Pain,

physiological parameters and cry duration was measured at 0 minute, 2 minutes and 5 minutes after venipuncture.

Statistical Analysis:

- The data analysis was analyzed by using descriptive and inferential statistics.
- Frequency and percentage for sample characteristics.
- T test to compare the post-test pain ,physiological parameters and cry duration of experimental and control group
- Anova and Post hoc test to measure the difference in the post test scores of the measured parameters in experimental group at all-time intervals
- Chi square to find out the association of mean pain scores with physiological parameters and cry duration.
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RESULTS

TABLE 1: Frequency and percentage distribution of sample characteristics (Age in days, Sex, Diagnosis, Type of feeding and Weight) of neonates in experimental and control group. .N=60

S.NO	SAMPLE CHARACTERISTICS	EXPERIMENTAL GROUP n =30		CONTROL GROUP n =30		TOTAL FREQUENCY	%
		Frequency	%	Frequency	%		
1	Age in days	14	46.6	13	43.33	27	45
	0-10 days	9	30	10	33.33	19	31.66
	11-20 days	7	23.33	7	23.33	14	23.33
	21-30 days						
2	Sex	14	46.66	14	46.66	28	46.66
	Male	16	53.33	16	53.33	32	53.33
	Female						
3	Diagnosis	11	36.66	14	46.66	25	41.66
	Term/AGA	5	16.66	4	13.33	9	15
	Hyperbilirubinemia	6	20	5	16.66	11	18.33
	Sepsis	8	26.66	7	23.33	15	25
	Others						
4	Type of feeding	24	80	24	80	48	80
	Oral	6	20	6	20	12	20
5	Gavage						
	Weight	15	50	15	50	30	50
	2.5-3.0 kg	10	33.33	8	26.66	18	30
	3.0- 3.5 kg	5	16.66	7	23.33	12	20
	3.5-4.0 kg						

Table 2: Mean, Mean Difference, Standard Deviation Difference, Standard Error Mean Difference and “t” value of mean pain scores of experimental and control group of neonates receiving venipuncture N=60

GROUP	PAIN SCORES	MEAN	MD	S.DD	S.ED	“t” value
Experimental n=30	Post test	3.78	2.35	0.83	0.712	2.79*
Control n=30	Post test	6.13				

At 0.05 level of significance df(58) t=1.6716 * = significant at 0.05 level

Data in table 2 shows that the mean pain scores in experimental group (3.78) was lower than the control group (6.13). The mean difference was 2.35, which was found

to be statistically significant as evident from the “t” value of 2.79 for degree of freedom (58) at 0.05 level of significance.

Table 3: Mean, Mean Difference, Standard Deviation Difference, Standard Error Mean Difference and “t” value of mean heart rate of experimental and control group of neonates receiving venipuncture. N=60

GROUP	HEART RATE	MEAN	MD	S.DD	S.ED	“t” value
Experimental n=30	Post test	131.71	8.09	4.93	12.117	2.32 *
Control n=30	Post test	139.80				

0.05 level of significance at df(58) t= 1.6716 * = significant at 0.05 level

Data in above table 3 shows that the mean heart rate in experimental group (131.71) was lower than the control group (139.80). The mean difference was 8.09, which was found to be statistically significant as evident from the “t” value of 2.32 for degree

of freedom (58) at 0.05 level of significance. A statistical difference was found between these two groups which means that there was significant decrease in Heart rates after the oral administration of dextrose.

Table 4: Mean, Mean Difference, Standard Deviation Difference, Standard Error Mean Difference and “t” value of mean oxygen saturation of experimental and control group of neonates receiving venipuncture. N=60

GROUP	OXYGEN SATURATION	MEAN	MD	S.DD	S.ED	“t” value
Experimental n=30	Post test	96.62	2.49	0.15	0.55	3.36 *
Control n=30	Post test	94.13				

0.05 level of significance at df(58) t= 1.6716 * = significant at 0.05 level

Data in table 4 shows that the mean oxygen saturation in experimental group (96.62) was higher than the control group (94.13). A statistical difference was found in these two

groups which means that there was significant increase in oxygen saturation after the oral administration of dextrose

Table 5: Mean ,Mean Difference, Standard Deviation Difference, Standard Error Mean Difference and “t” value of mean cry duration of experimental and control group of neonates receiving venipuncture . N=60

GROUP	CRY DURATION	MEAN	MD	S.DD	S.ED	“t” value
Experimental n=10	Post test	0.98	1.9	0.15	0.024	12.66 *
Control n=10	Post test	2.88				

0.05 level of significance at df(58) t= 1.6716 * = significant at 0.05 level

Data in table 5 shows that the mean cry duration in experimental group (0.98) was lower than the control group (2.88). This

indicates there was a difference in the cry duration of neonates receiving venipuncture after the oral administration of dextrose.

Table 6: Chi square value showing association between the main pain scores in neonates receiving venipuncture and physiological parameters. N=60

Selected Variable	Below Median	At or Above Median	Chi square	df	Chi square table value at 0.05 level of significance
HEART RATE					
115-130/mt	5	1	5.74 ^{NS}	2	5.991
131-145/mt	4	9			
146-160/mt	3	8			
OXYGEN SATURATION					
81-90%	0	22	0.20 ^{NS}	1	3.841
91-100%	13	25			
CRY DURATION					
0 -1.49 minutes	12	14	1.45 ^{NS}	2	5.991
1.5-3.0 minutes	0	4			

The findings were not found to be statistically significant as evident from the chi square value. Hence we failed to reject the null hypothesis H_{05}

DISCUSSION

The findings of the present study showed that there was significant reduction in pain due to venipuncture in the experimental group. Results of the present study is concurrent with the findings of researchers who conducted a double-blind randomized controlled study to assess the analgesic and adverse effects of orally administered 30% dextrose during venipuncture in neonates. The measurement was done by Neonatal Infant Pain Scale and the duration of cry. Dextrose was administered two minutes before the venipuncture. The NIPS score at 3 minutes after venipuncture for neonates given 30% dextrose was significantly lower than that for neonates who were given sterile water. The duration of cry in neonates given 30% dextrose was significantly shorter than that in neonates given sterile water. The study findings revealed that oral administration of dextrose was effective in reduction of neonatal pain. [14]

The study also concluded that mean heart rates in the experimental group was lower than the control group. This finding is consistent with the findings of the study which was conducted on 120 newborns to assess the effect of various interventions on pain and duration of crying. The interventions used were Expressed Breast Milk (EBM), Sucrose and Pacifier. The study results revealed that after the procedure, sucrose group showed the lowest

response to pain. Heart rate was lowest in sucrose (146.87) as compared to control (154.37), mother's milk (156.87) and pacifier (153.30). [15]

The study findings also showed that the mean duration of cry in experimental group was significantly lower in control group. This is congruent with the findings of the study in Infants (6 weeks -3 months) coming for their 1st DPT vaccination to compare analgesic effect of direct breast feeding, 25% dextrose solution and placebo. The primary outcome variable was the duration of cry after vaccination. Secondary outcome variables were Modified Facial Coding Score (MFCS) and latency of onset of cry. The study concluded that babies who were directly breastfed or given 25% dextrose had significantly shorter duration of cry, and lower pain score at 1min and 3min after needle insertion, as compared to placebo. [16]

Limitation:

- The study was limited to one hospital and therefore sample size was limited making generalization difficult

Recommendation:

- The study can be replicated on a large sample to validate the findings and to make generalization.
- A similar study can be conducted among preterm infants.
- This study can also be conducted in different settings like government institutions, rural settings
- A study can be done to compare the effectiveness of different concentrations of dextrose for pain relief.

- A study can also be done to check the effectiveness of 10 % dextrose for pain relief for other procedures like immunizations, heel lance prick etc.
- A study can also be done to compare the effectiveness of combinations of different non pharmacological methods like facilitated tucking and dextrose, non-nutritive sucking and dextrose.
- A study can also be conducted to check the effectiveness of non - pharmacological methods in older children.
- Nurses are central to hospital efforts to improve quality care. Comforting interventions in the field of nursing care will contribute to high patient satisfaction. An organized in-service training of practicing nurses on pain assessment and management in children including pharmacological and non-pharmacological techniques will be of paramount
- The findings of the study suggest that educational programmes should be organized for the nursing personnel so that the findings of the recent researches can be disseminated

CONCLUSIONS

- The intervention was effective in reducing pain scores during venipuncture as evident by the pain scores of both experimental and control group
- The intervention was effective in reducing heart rates during venipuncture as evident by the heart rate of both experimental and control group
- The intervention was effective in increasing oxygen saturation during venipuncture
- Oral administration was effective in decreasing cry duration during venipuncture
- No association was found between pain scores and physiological parameters and between pain scores and cry duration
- Nursing education should focus on practical side rather than theory. Training programmes should be conducted for student. It is important to ensure that sufficient time is allocated within nursing curriculum to pain management covering non-pharmacological measures also.

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IMPLICATIONS OF THE STUDY

- Pediatric nursing is no longer only task oriented, but it demands nurse to provide holistic care to the children. A traumatic care is the key element of such care which involves preventing and relieving pain.
- Neonates undergo painful procedures during hospitalization or even during routine immunizations. The painful experience may have negative sequelae in the child's life. This pain can be reduced by oral administration of dextrose.

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