RESEARCH ARTICLE

Effect of Sucrose on Sedation in Fasting Children in Waiting Room before Entrance to Operating Room

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Background: Cries of the newborn could be due to pain, thirst, hungry and fear from new environment. In our study we evaluated the effect of the sucrose drops on pacifying the children prior to a painful intervention or procedure with regards to the fasting condition of the children.

Methods: This triple blind clinical trial was conducted on 60 otherwise healthy children aged less than 1 year with ASA I, who were candidates for an outpatient surgical procedure after obtaining the parents' consent. Patients were divided in to two groups, one group received 0.5 ml oral sterile water and the other group 0.5 ml oral sucrose 24%. Heart rate and restlessness were evaluated based on the pediatric anesthesia emergence delirium (PAED) scale score system before and at 1, 3, 5, and 9 minute in both groups.

Results: 60 patients were evaluated in this study, 30 patients received sterile water and 30 patients received sucrose 24%. The sex, mean age and mean weight of the patients showed no significant difference between the two groups. The restlessness score according to the PAED in sucrose group (8.1, 7.97, 8.8, 9.63) is less than in the sterile water group (10.63, 10.77, 11, 10.9) ($p<0.001$). Heart rate in sucrose group is less than sterile water group in minute 3 ($p=0.006$). Parents' satisfaction in the sucrose group was more than sterile water group ($p<0.001$).

Conclusion: According to the findings of this study, we recommend the use of sucrose alone or with other methods (pacifier sucking, mother's hug) to decrease restlessness in children aged under one year whose restlessness is due to fasting.

Keywords: sucrose; sedation; fasting; children

The newborn cry is the first sign of life after birth. Crying can be due to environmental factors and should be interpreted in the context of family, social, and cultural behaviors [1]. In neonates and children who cannot speak, behavioral and physiologic signs are very important in understanding the reason of the restlessness. In this study, the level of the restlessness in children was measured based on the Post Anesthesia Delirium Emergence (PAED) scoring system. In this system, 5 variables are recorded and assigned a score (from 0 to 4) with a total of 20. A score of 10 or more indicates restlessness. This scoring system can be used in children aged 1 month to 7 years old [2].

Children's physiologic and affective responses to uncontrolled pain and hunger before and after surgical procedures and anesthesia can result in short and long term behavioral changes. Different methods such as local anesthesia, mixture of local anesthetics decrease these responses and their effects on the child's behavior have been evaluated in different studies [3].The analgesic effects of concentrated sucrose and glucose and pacifiers are clinically apparent in newborns, pacifiers being more effective than sweet solutions. These simple and safe interventions should be widely used for minor procedures in neonates [4]. One study demonstrated clearly that sweet-tasting solutions given before a painful intervention can reduce pain among newborns and activation of endogenous opioids has been suggested [6].

In one study it was found that the effectiveness of sucrose was limited to venipuncture for the newborn screening test [7]. Sucrose, or common sugar, is made from glucose and fructose. Sweet solutions may be useful, safe and cheap analgesics for minor invasive procedures in newborns [8]. Sucrose alone or on the pacifier considerably blocked the increase in heart rate during and after heel lance [3]. One study recommends that infants be given a sweetened pacifier before, during, and after circumcision [9]. In our study, we evaluated the effect of the sucrose drops on pacifying the children prior to a painful intervention or procedure with regards to the fasting condition of the children.

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Received: 12 April 2015, Revised: 6 May 2015, Accepted: 21 May 2015
The authors declare no conflicts of interest.
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Methods

This triple blind clinical trial was conducted on 60 healthy children aged less than 1 year with an ASA of 1 who were candidates for an elective outpatient surgical procedure, hernioraphy and undesending testis, after obtaining the parents' consent. This study was approved by the ethics committee of Tehran University of Medical Sciences and received an IRCT registration code (23590/210). Exclusion criteria were unwillingness of the parents, congenital diabetes, history of seizures, behavioral disorders, and the use of psychiatric or hypnotic drugs 24 hours before the procedure. The patients were divided in two groups as the blocks of four based on a random number table. Demographic data of the children including age, sex, and weight was also recorded. The patients received 0.5 ml distilled water in the "w" group and 0.5 ml sucrose 24% drops in the "s" group. After administering the drug and the placebo, heart rate and restlessness were measured (based on the PAED scoring system) at minutes 1, 3, 5, and 9 [10] (Table 1). Five variables are recorded in this system and each one receives a score (from 0 to 4) which a makes a total of 20. A score of 10 or more indicates restlessness. The satisfaction of the parents with the child's restlessness is determined with a ruler (0-3: complete satisfaction, 4-6: relative satisfaction, 7-10: complete dissatisfaction) [11].

Our triple blind study was performed as follows: The parents were unaware of the administered drug prior to the procedure. The researcher administered drug or placebo based on the blocks of 4. The researcher in charge of completing the questionnaire was unaware of the administered drug. The analyst analyzed drugs only after obtaining the results. The sample volume of the two groups was calculated 60 children using Stata 11, $\propto$=0.05, β=0.2, $z_{1-\alpha/2}$=1.96, $z_{1-\beta}$=1.28. The frequency percentage, mean and standard deviation were determined for the data. Chi-2 was used to evaluate the relationship of the qualitative and paired T-test was used for investigating the relationship of the quantitative variables.

Results

In this study, we evaluated 60 children under one year of age including 42 boys (70%) and 18 girls (30%). There was no significant difference in sex between the two groups (P=0.384). (Table 2) shows the characteristics of the patients including age, sex, and weight.

The mean age of the patients was 5.77 ± 2.96 s) months. The mean age of the patients in "w" and "s" groups was 5.90 ±5.63 months, Paired T-test showed no significance in age between the two groups (P=0.520). The mean weight of the patients was (7.28 ±1.70) Kg. The mean weight of the patients in "w" and "s" groups was (7.38 ± 7.17) Kg, Paired T-test showed no significance in age between the two groups (P=0.404).

Comparison of the two groups revealed a significant difference in mean heart rate only 3 minutes after administering the drugs (p‹0/001).

The mean restlessness according to the PAED score before and 1, 3, 5, and 9 minutes after administering the drugs was 11.03, 10.63, 10.77, 11, and 10.9 in the "w" and 11.37, 8.10, 7.97, 8.80, and 9.63 in the "s" group, respectively. We used Paired t-test to compare restlessness before and 1, 3, 5, and 9 minutes after administering the drug or placebo in each group separately which showed that p-value was 0.016, 0.058, 0.839, and 0.536 in the "w" group and the mentioned time points, The difference was only significant when comparing restlessness before and one minute after the administration of distilled water. In the "s" group, P value was always less than 0.001 before and after administering sucrose (P<0.001) and differences between baseline (before administering sucrose) and 1, 3, 5, and 9 minutes after the administration were all significant (Figure 1).

Regarding the comparison between the two groups, p value was 0.366 before and less than 0.001 at one, three, five, and nine minutes after administering the drug which showed a significant difference between the two groups in all evaluations after drug administration.

Parent satisfaction was 7.23, 6.40, 7.03, 7.17, and 7.20 in the "w" and 7.37, 4.60, 4.40, 5.50, and 6.23 in the "s" group before and 1, 3, 5, and 9 minutes after drug administration, respectively. We used Paired t-test to compare parent satisfaction before and 1, 3, 5, and 9 minutes after administering the drug or placebo in each group separately which showed that p-value was <0.001, 0.227, 0.702, and 0.851 in the "w" group and the mentioned time points, respectively. The difference was only significant when comparing parent satisfaction before and one minute after the administration of distilled water. In the "s" group, P-value was always less than 0.001 before and after administering sucrose (P<0.001) and differences between baseline (before administering sucrose) and 1, 3, 5, and 9 minutes after the administration were all significant (Figure 2).

Regarding the comparison between the two groups, p value was 0.423 before and less than 0.001 at one, three, five, and nine minutes after administering the drug which showed a significant difference between the two groups in all evaluations after drug administration.

Discussion

Children's physiologic and affective responses to uncontrolled pain and hunger before and after surgical procedures and anesthesia can result in short and long term behavioral changes in children. Many studies have assessed the effectiveness of sucrose drops in decreasing pain and restlessness in children following simple procedures like ocular examination, heel lance, and venipuncture [7]. Sucrose decreased heart rate at all evaluated time points, its effect was only significant 3 minutes after the administration. In other words, sucrose is most effective 3 minutes after its use. Another finding of our study was the effect of sucrose drops on decreasing restlessness which was measured through the PAED score and parent satisfaction score. The mean PAED score was less than 10 in all evaluations after administering sucrose which was significantly different with the PAED score before sucrose administration (P<0.001).

Moreover, the mean parent satisfaction score was between 4 and 6 at all the evaluated time points, indicating the relative satisfaction of the parents with their children's tranquility. There was a significant difference in patient satisfaction score between all post sucrose administration evaluations and pre sucrose administration (P<0.001), indicating that sucrose could be used for pacifying children.

Table 1- Pediatric anesthesia emergence delirium (PAED) scale score is sum of all values

Behavior	Not at all	Just a little	Quite a bit	Very much	Extremely
Makes eye contact with caregiver	4	3	2	1	0
Actions are purposeful	4	3	2	1	0
Aware of surroundings	4	3	2	1	0
Restless	0	1	2	3	4
Inconsolable	0	1	2	3	4

Table 2- Basic characteristic in both groups

	Water group	Sucrose group	P value
Sex(male/female)	20/10	22/8	P=0.38
Age(mo)	5.90	5.63	P=0.52
Weight (kg)	7.38	7.17	P=0.40

Figure 1- Pediatric anesthesia emergence delirium (PAED) scale score in both groups

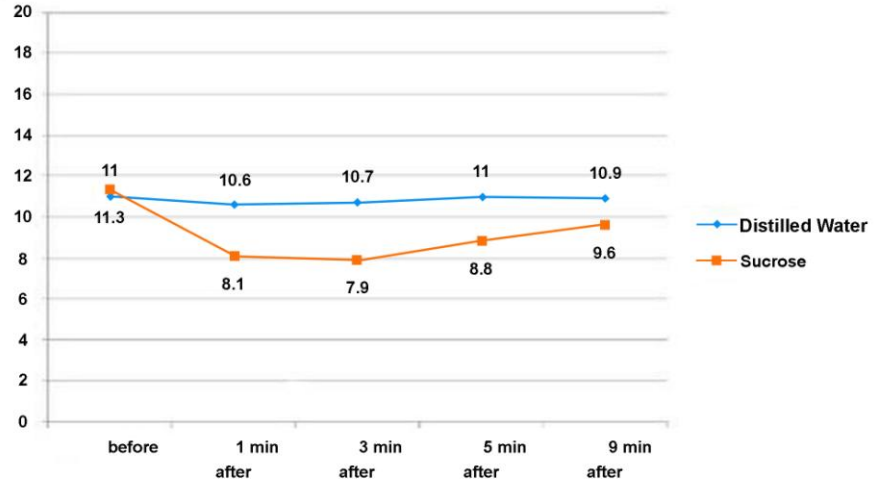
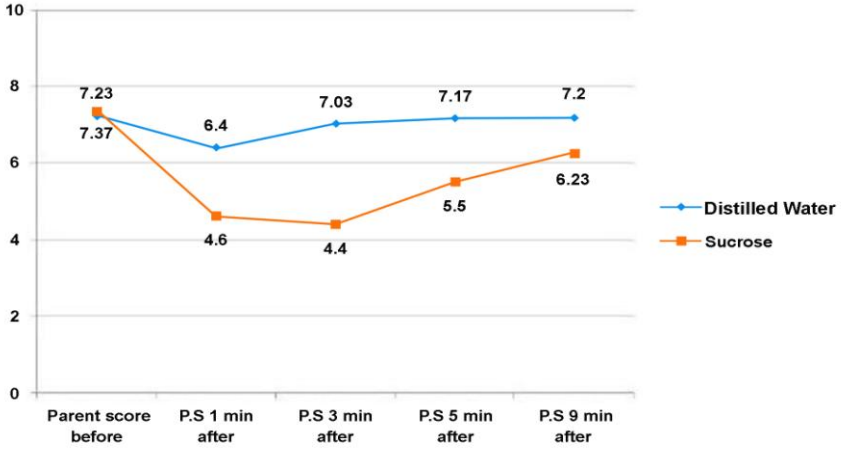


Figure 2- Parent satisfaction score in both groups



According to our findings, the effect of sucrose on decreasing the restlessness and pacifying children is maximal three minutes after its administration (PAED Score= 7.97, Parent Score=4.40, p<0.001). Haouari et al. have also reported a significant decrease in the duration of cry and heart rate three minutes after receiving a 50% solution; the maximum decrease was observed 1 minute after the procedure in the 50% solution and 2 minutes after the procedure in the 25% solution [12]. In Acharya's study, venepuncture pain in healthy neonate is significantly reduced by administration of 2 ml 25% sucrose solution given orally two minutes before the procedure [13] Sucrose

reduced pain score in neonates screening for ROP at beginning of eye examination but not at the last seconds of examination [14].

In another study, sucrose alone or on the pacifier considerably blocked the increase in heart rate during and after heel lance [4]. Stevens' study, sucrose did not affect heart rate [15]. Ramenghi said that engagement of the taste sense is essential to promote the "sucrose analgesia" in neonates exposed to minor painful procedures [16]. The Pediatric Anesthesia Emergence Delirium (PAED) scale was recently validated and might provide a comprehensive measure of the severity of ED [17]. A score of >10 corresponded to patients who needed treatment for ED [18].

Acharya performed a study about assigning to receive 0•5 mL 24% sucrose solution or 0•5 mL sterile water 2 min before undergoing a clinically required heel lance. He concluded that oral sucrose does not significantly affect activity in neonatal brain or spinal cord nociceptive circuits, and therefore might not be an effective analgesic drug. The ability of sucrose to reduce clinical observational scores after noxious events in newborn infants should not be interpreted as pain relief [13]. Rogers, shows that there was no overall treatment effect when using an oral sucrose solution before bladder catheterization in infants younger than 90 days of age. However, infants younger than or equal to 30 days of age who received sucrose had smaller increases in pain scores, less crying, and returned to baseline more rapidly than infants receiving placebo. Older infants did not show an improved pain response with oral sucrose [19]. The lacks of accurate tools for measuring restlessness were important limitations of our study. Since a limited number of studies have evaluated the relationship between sucrose administration and tranquility and sedation in children, more studies are recommended in this regard.

In conclusion, according to the findings of this study, we recommend the use of sucrose alone or with other methods (pacifier sucking, mother's hug) to decrease restlessness in children aged under one year whose restlessness is due to fasting.

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