

Sucrose as analgesic for neonates health and social care essay



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In the first days of life most neonates experience pain from medical procedures such as heel lance and venepuncture to facilitate proper assessment and diagnosis. Effective strategies for the management of infant pain in major procedures, medical illness and surgery exist, however until recently means to prevent or reduce pain from minor diagnostic procedures have been lacking[1]. If pain from these procedures goes untreated it can have long-lasting effects on the child[2]. Although the mode of action is yet not fully understood, it is thought to involve activation of the endogenous opioid system through taste[3]. International clinical guidelines recommend that oral sucrose, a naturally occurring sweetener, is given to relieve procedural pain in neonates[4] as it is believed to have both analgesic and calming effects[5]. Objectives To review published literature on the analgesic effects of sucrose in terms of method of administration, efficacy, effect of dose and safety for relieving procedural pain in neonates, outline areas with sufficient evidence of effectiveness and identify areas of uncertainty.

Methods Criteria for selecting studies to review; -Types of studies: Double blinded, randomised control trials (RCTs) that evaluate the; efficacy, method of administration, effect of dose and safety of sucrose for relieving procedural pain as assessed by physiological and/or behavioural pain indicators were considered for review. Language restrictions were imposed so that only studies published in English were included. -Types of participants: Neonates, defined as baby's with a maximum postnatal age of 28 days -Types of interventions: Administration of sucrose via oral syringe as an intervention for any acute painful procedure including; heel lance, venepuncture and intra-muscular injection. Data collection Journals for review were selected using the search engine ' Pubmed'[6] on the 2nd of November <https://assignbuster.com/sucrose-as-analgesic-for-neonates-health-and-social-care-essay/>

2010. The initial search submitted to Pubmed included 4 terms; " Sucrose and analgesia and procedural pain and infants" and gave 25 hits. This number was then reduced to 13 based on language and appropriateness of the title to this study. After reading the abstracts of the 13 papers, only 3 articles; met the criteria mentioned above in terms of study type and participants and were accessible as either a free text or via Queen's University Belfast online resources. Therefore two more papers (marked with * in the table) which were accessible but had been eliminated from the 13 based on the outlined selection criteria were also included. These articles only slightly deviate from the criteria set out for this review and this will be taken into account during their analysis.

Study

Participant Population

Procedure

Interventions

Outcome(s) Measured

Results

Comments

Slater 2010

Study...

Slater 2010 759 newborn infants < 8 days old, who were born at 37-43 postmenstrual weeks. Heel Lance 0.5mL 24% sucrose solution or 0.5mL sterile water administered directly onto the anterior surface of the tongue with a syringe 2 min before a heel lance was done. Pain specific brain

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activity evoked by one time-locked heel lance, recorded with electroencephalography and identified by principal component analysis. Baseline behavioural and physiological measures, observational pain scores (PIPP) Spinal nociceptive reflex withdrawal activity. 29 infants were assigned to receive sucrose and 30 to sterilised water; 20 and 24 infants respectively, were included in the analysis of the primary outcome measure. Nociceptive brain activity after the noxious heel lance did not differ significantly between infants who received sucrose and those who received sterile water. Sucrose mean principal component weight- 0.10 (standard error- 0.03) Sterile water mean principal component weight- 0.08 (standard error-0.02) $p= 0.46$ No significant difference ($p= 0.49$) was recorded in the magnitude or latency of the spinal nociceptive reflex withdrawal recorded from the biceps femoris of the Results...stimulated leg between the sucrose (mean activity 36.11 μV , standard error 5.67) and sterile water (mean activity 30.82 μV , standard error 5.74) groups. The PIPP score was significantly lower in infants given sucrose than those given sterile water (Sucrose mean 5.8 compared with 8.5 for sterile water. $P= 0.02$). Significantly more infants had no change in facial expression after sucrose administration (35% of the sucrose group compared with none in the sterile water group. $P < 0.0001$) Randomisation and dispensing was done offsite at the UCH pharmacy. The samples of sucrose and water couldn't be visually distinguished by the packaging. The 60 samples were randomised by block design with a 1:1 allocation for sucrose and sterile water. The pharmacy labelled each sample with a computer generated randomised code that corresponded to the identity of the solutions. Only the hospital pharmacy had access to the randomisation codes that could be used to identify a solution. Throughout the study the <https://assignbuster.com/sucrose-as-analgesic-for-neonates-health-and-social-care-essay/>

researchers, clinicians, participants and parents were masked to the identity of the solutions. Comments...The sucrose and water samples were provided by Inspiration healthcare; however they were not involved in the study design, data collection, or data analysis. Observers were fully masked to the treatment allocation and stimulus type when they analysed the videos and an additional level of masking was imposed by mixing the video tapes with non-trial footage. Only one nociceptive stimulus was identified to increase generalisability. The sponsor of the study had no role in study design or data collection and analysis.

Study

Taddio 2008

Study...

Taddio 2008

Study

Participant Population 240 newborns < 3 days old who were born at ≥ 36 weeks gestation (120 from diabetic mothers, 120 from non-diabetic mothers)

Population

Procedure

Intramuscular injection of vitamin K Venepuncture Heel Lance

Procedure

Intervention 2mL of 24% sucrose solution or 2mL of sterile water administered with a syringe onto the anterior surface of the tongue over a period of about 60 seconds, beginning 2 minutes before the procedure.

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Intervention

Outcome Pain was assessed using- Premature Infant Pain Profile (PIPP). This profile includes 3 facial actions (brow bulge, eyes squeezed shut, nasolabial furrow), 2 physiologic (heart rate, oxygen saturation) and 2 contextual (gestational age, infant state) indices of pain. The percentage of the total time that each facial action was observed during each phase was calculated. For physiologic data, changes in heart rate and oxygen saturation Outcomes...from baseline were recorded over the same period. The total PIPP scores for each procedure were calculated by summing the scores of the 7 indicators. Scores ranged from 0 (no pain) to 18 (maximum pain).

Outcome

Results 120 infants were in the sucrose group and 120 infants were in the placebo group. Pain scores during intramuscular injection did not differ between the sucrose and placebo groups. (Newborns of non-diabetic mothers had a sucrose mean score of 7.4 against a mean of 8.5 in the placebo group, $p = 0.10$. In the newborns of diabetic mothers the mean score in the sucrose group was 6.2 compared with 7.2 in the placebo group $p = 0.15$) During venepuncture pain scores were significantly lower among newborns of both non-diabetic and diabetic mothers. With $p < 0.001$ in both cases Among newborns of diabetic mothers, the pain scores during the first 3 heel Results...lances did not differ between the sucrose and placebo groups. The overall mean score for the Premature Infant Pain Profile was significantly lower among newborns who received sucrose (mean score 6.8, standard deviation 2.9) than among those who received a placebo (mean score 8.1, standard deviation 2.5). $p < 0.001$

Results

Comments Concealment of allocation was achieved, as randomization and dispensing functions were carried out off site. Using a random numbers table and allocation ratio 1: 1 for sucrose and placebo, a research pharmacist prepared 2 separate block-randomisation assignments. The sucrose and placebo solutions were identically packaged. Respironics provided the sucrose and placebo solutions and provided no other support, nor did they influence the design or conduct of the trial. The solutions were labelled with each newborn's name and stored in patient-specific plastic bags in the Comments...newborn's medication bin. The study personnel, health care workers and parents did not know which newborns received which treatment. The research assistant who reviewed the video tapes in order to calculate a score for facial action was not aware of treatment allocation, study hypothesis and whether the newborn was from a diabetic or non-diabetic mother. Adverse effects were included in the write-up of the study. To rule out an effect of baseline newborn and maternal characteristics on the effectiveness of sucrose, a post-hoc analysis was performed to adjust for birth Comments...characteristics.*Curtis 2007Study... *Curtis 200784 infants aged 0-6 monthsVenepuncturePatients were assigned to one of four groups as follows: a) Sucrose b) sucrose & pacifier c) placebo d) placebo and pacifier. Each child received, by mouth, 2ml of either 44% sucrose or sterile water, two minutes prior to venepuncture. Intervention...The solution was administered to the anterior aspect of the tongue via syringe over a 30 second period 2 minutes prior to venepuncture. Pacifier was inserted orally according to randomization. Pain was measured using the Face, Legs, Activity, Cry and Consolability Pain scale (FLACC) before and after the <https://assignbuster.com/sucrose-as-analgesic-for-neonates-health-and-social-care-essay/>

procedure, using the change from baseline as the outcome. This tool assesses changes in these five behavioural categories, rating each on a scale of 0-2. Ten is the maximum score indicating severe pain and a score <2 generally indicates absence of pain. Crying time was Outcome...monitored by a stopwatch from the infant's first cry after venepuncture and recorded as the number of seconds that vocalizations were sustained, up to 5 minutes. Heart rate was measured pre procedure and at 1 minute intervals after the procedure for 5 minutes. The outcome measure was the difference between the highest value recorded over the 5 minute period and the baseline. There were 21 infants analysed in group a, 19 in b, 22 in c and 22 in d. Unadjusted effects: There was no significant difference in FLACC score between sucrose (score increased by an average of 3.2 ± 3.6) and placebo (score increased by an average of 3.6 ± 3.3) groups. $p= 0.66$ There was no significant difference in crying time between placebo (200.7 ± 96.0) and sucrose (168.4 ± 112.2) groups. $p= 0.16$ There was no significant difference in heart rate change between placebo and sucrose groups (sucrose: 28.1 ± 29.3 . placebo: 26.4 ± 18.7 , $p= 0.75$). There was a statistically significant Results... difference in crying time between pacifier and no pacifier groups (143.3 ± 101.7 , 229.1 ± 90.6 respectively. $p= 0.0001$ Adjusted effects following regression analysis: Age was the only variable that was found to significantly affect the FLACC pain score (older children experienced more pain, $p= 0.006$). Randomisation to the four treatment groups was done using block randomisation by the hospital pharmacist who held the numbered code list containing the identity of each solution until the study has officially ended and data analysis was completed. Each pre-prepared syringe containing either the sucrose or sterile water solutions was labelled 1-84 and was

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indistinguishable by colour, smell and flow during administration. Random assignment of pacifier use was also computer generated by the pharmacist, so that each syringe contained details to use or to omit the pacifier.

Comments...

All researchers, outcome assessors, subjects and statisticians were blinded to the identities of the solutions. However, use of pacifier was not blinded. All documentation n regarding the study was locked in a secure cabinet and kept confidential for the duration of the study. The pacifier & placebo group had a mean and median age that was half of the other three groups. This group also had the highest admission rate. Sponsors of the trail and any role that they played during it were not disclosed. Study Johnston 2002

Study...

Johnston 2002 Population 107 preterm neonates during their first week of life who were born at <31 weeks post conceptual age

Population

Procedure

Heel Lance Intravenous cannulation Arterial puncture Injection Endotracheal tube suctioning Tape/ leaf removal Gavage insertion for feeding

Procedure

Intervention 0. 1mL of 24% sucrose or water administered using a sterile syringe into the infant's mouth, at the beginning of the procedure, 2 minutes into the procedure and 4 minutes into the procedure. If the procedure was to last > 15 minutes, up to another 3 0. 1mL doses were to be Intervention...

given 2 minutes apart. Outcome Neurobehavioral development assessed by subscales of alertness and orientation (AO) and motor development and vigor (MDV) of the NAPI developed by Korner and colleagues measured at 32, 36 and 40 weeks PCA. Severity of illness during the course of the intervention and at discharge was assessed during the week of study by the Score for Neonatal Acute Physiology Outcomes...(SNAP) for each 24 hour period and by the Neuro-Biological Risk score (NBRS) at 2 weeks postnatal age and at discharge. Results 103 infants completed the study. Study doses given per infant during the week ranged from 24-125 with a mean of 58 in the water group and 63 in the sucrose group. On the two components of NAPI that were tested (MDV and AO), there were no significant differences found between the sucrose and water groups (MDV: sucrose at 32, 36, 40 weeks = 20.4, 48.6, 66.1; water at 32, 36, 40 weeks = 21.7, 49.7, 63.9: $p = 0.64$. AO: sucrose at 32, 36, 40 weeks = 16.0, 40.7, 54.3; water at 32, 36, 40 weeks = 19.5, 42.2, 55.5: $p = .162$). There were no group differences associated with SNAP each day or on the day of discharge (Sucrose = 3.72, Results...water = 4.10; $p = 0.761$). In the regression analysis younger age was predictive of higher SNAP scores on study day 7 for the water group only. There were significant dose-related effects within each group. In the sucrose group only, higher number of doses predicted lower scores on motor development and vigor, and alertness and orientation at 36 weeks', lower motor development and vigor at 40 weeks', and higher NBRS at 2 weeks. Higher number of invasive procedures was predictive of higher NBRS both times in the water group. Comments Pain intensity was not measured. There were 3 separate site of study which were similar in level of acuity of infants but differed in their level of developmental care. In addition <https://assignbuster.com/sucrose-as-analgesic-for-neonates-health-and-social-care-essay/>

one location used indomethacin more than the others. Infants were randomly assigned to the sucrose or water group from a computer-generated schedule for each site. Only the project nurses in each individual site were aware of the group assignment; clinicians were fully blinded. In some cases compliance was low; therefore number of doses of Comments...solution was examined for influencing outcomes. Funding for the trail is disclosed in the paper, however their role in the study in not mentioned.*Harrison 2009

Study...

*Harrison 2009

Study...

*Harrison 2009 55 infants in a tertiary referral neonatal intensive care unit
Population...with a predicted length of stay ≥ 28 days. The average age was 2 days and average gestational age at birth was 36 weeks
Heel Lance 0. 25mL or 0. 05mL (if patient was nil orally) of 33% sucrose solution
Intervention... administered via syringe onto the anterior surface of tongue 2 minutes before lancing of the heel. A further increment of sucrose solution was administered immediately before the heel lance and every 2 minutes thereafter until blood Intervention...collection was complete. A pacifier was offered if it was a normal part of the infant's care. The incidence of cry, duration of first cry until a 5 second pause and duration of crying during the blood collection and in the 3 Outcomes...minute recovery period after completion of the blood collection were measured. Facial expression score comprised of a 4 point subset of the Neonatal facial Coding System which involved visual assessment of the presence of; brow bulge, eye squeeze, nasolabial furrow and open mouth. Physiological parameters measured were
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heart rate and oxygen saturation. The total number of sucrose doses administered to the cohort ranged from 4 to 174 with a mean of 42 doses and a median of 34 doses. 50 infants with three or more observed Results... pain assessments were included in the regression analysis of successive responses to procedural pain. A total of 437 heel lance procedures for the 50 infants over the 11 month period were included in the analysis. The regression coefficient for the facial expression score upon heel lance for these 50 infants showed no significant change over the course of the hospitalization (the mean regression slope on the 0-4 scale was -0.0084 , $p=0.84$). Because the mean weighted regression slope of -0.0084 is close to 0, this indicates almost no overall change in facial scores at the point upon heel lance over successive observed procedures. Results... Facial scores from completion of blood collection to the final observation point 3 minutes after the end of the procedure showed a statistically significant decrease over successive heel lance procedures, with a mean regression slope of -0.022 . There was no significant change in the crying duration of first cry duration during the heel lance procedure over the courses of hospitalization. The heart rate change from baseline, expressed as a percentage change, showed a significant upward change over successive observations. There was no significant change from baseline in oxygen saturation levels over successive procedures. This was a prospective longitudinal cohort study. Data of the admissions from the previous 3 years on the NICU was used to predict those infants likely to Comments... require a length of stay of 28 days or more. Assessments of pain were conducted where possible during the first heel lance, thereafter pain assessments were done at weekly intervals, if possible, or more or less frequently depending on the requirement for <https://assignbuster.com/sucrose-as-analgesic-for-neonates-health-and-social-care-essay/>

pathology testing. Midway during the period of data collection, 31 cry recordings were randomly selected to be scored by a person independent to the trial. Agreement of the proportion of crying time during these recordings showed a correlation coefficient of 0.98. To ensure consistency of pain scoring, all assessments were done Comments...by the same person at the bedside. To minimize the risk of bias associated with this, inter-rater agreement was examined throughout the period of data collection by an independent assessor not involved in the study. Considered JudgementFrom all five studies it is evident that the most routinely used method of administration of sucrose is via a syringe onto the anterior surface of the tongue. As there was no investigation into the validity of other approaches we can therefore only presume that this is the most effective and appropriate method. In terms of the efficacy of sucrose as an analgesic, there was no definitive result backed up by all of the studies. It seems its effectiveness is dependent on many different factors such as the painful procedure itself and the pain assessment tool used. Both Slater⁷ and Taddio⁸ noted that the use of sucrose significantly lowered the PIPP score amongst the infants suggesting that frequency of distressed facial reactions is reduced by sucrose. However sucrose wasn't shown to produce a change in the magnitude of nociceptive brain or spinal response⁷ to the stimulus. In addition, studies failed to observe a decrease in crying time in infants who had been given sucrose over those who were on the placebo. Even though Harrison¹⁵ suggested that change in heart rate did significantly increase over successive observations when sucrose was given, this study had no control group for comparison and so we cannot conclude if this was due to sucrose or was just as result of the successive procedures themselves. The <https://assignbuster.com/sucrose-as-analgesic-for-neonates-health-and-social-care-essay/>

dose of sucrose given was not constant throughout the studies, varying in terms of the volume given, frequency of doses and the percentage of sucrose in the solution. Due to other confounding factors it is difficult to make a direct comparison of the effects of sucrose related to dose however Johnston¹¹ did suggest that higher number of doses predicted lower motor development scores. In relation to the safety of sucrose, not all studies reported adverse effects. Of those that did, spitting, vomiting and high glucose levels were reported at an extremely low frequency (around one adverse episode or less per study population) and were often not associated with the sucrose group. We can say that from these studies sucrose appears to be a safe solution with minor adverse effects; however more longitudinal studies would be useful to further evaluate this. Furthermore as sucrose is a common component in many foods we can presume it is safe to use.

Conclusion Sucrose is a safe solution effective in reducing observed pain behaviour, such as distressed facial reactions in neonates undergoing painful procedures; however appears to have little effect on other measures of pain outcomes. An optimal dose could not be indentified from these studies and further investigation is needed to evaluate the clinical significance of this intervention.