Sucrose for analgesia in newborn infants undergoing painful procedures.

Cochrane Database Syst Rev. 2016 Jul 16;7:CD001069. doi: 10.1002/14651858.CD001069.pub5.

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Abstract

BACKGROUND:

Administration of oral sucrose with and without non-nutritive sucking is the most frequently studied non-pharmacological intervention for procedural pain relief in neonates.

OBJECTIVES:

To determine the efficacy, effect of dose, method of administration and safety of sucrose for relieving procedural pain in neonates as assessed by validated composite pain scores, physiological pain indicators (heart rate, respiratory rate, saturation of peripheral oxygen in the blood, transcutaneous oxygen and carbon dioxide (gas exchange measured across the skin - TcpO2, TcpCO2), near infrared spectroscopy (NIRS), electroencephalogram (EEG), or behavioural pain indicators (cry duration, proportion of time crying, proportion of time facial actions (e.g. grimace) are present), or a combination of these and long-term neurodevelopmental outcomes.

SEARCH METHODS:

We used the standard methods of the Cochrane Neonatal. We performed electronic and manual literature searches in February 2016 for published randomised controlled trials (RCTs) in the Cochrane Central Register of Controlled Trials (CENTRAL; The Cochrane Library, Issue 1, 2016), MEDLINE (1950 to 2016), EMBASE (1980 to 2016), and CINAHL (1982 to 2016). We did not impose language restrictions.

SELECTION CRITERIA:

RCTs in which term or preterm neonates (postnatal age maximum of 28 days after reaching 40 weeks' postmenstrual age), or both, received sucrose for procedural pain. Control interventions included no treatment, water, glucose, breast milk, breastfeeding, local anaesthetic, pacifier, positioning/containing or acupuncture.

DATA COLLECTION AND ANALYSIS:

Our main outcome measures were composite pain scores (including a combination of behavioural, physiological and contextual indicators). Secondary outcomes included separate physiological and behavioural pain indicators. We reported a mean difference (MD) or weighted MD (WMD) with 95% confidence intervals (CI) using the fixed-effect model for continuous outcome measures. For categorical data we used risk ratio (RR) and risk difference. We assessed heterogeneity by the I(2) test. We assessed the risk of bias of included trials using the Cochrane 'Risk of bias' tool, and assessed the quality of the evidence using the GRADE system.

MAIN RESULTS:

Seventy-four studies enrolling 7049 infants were included. Results from only a few studies could be combined in meta-analyses and for most analyses the GRADE assessments indicated low- or moderate-quality evidence. There was high-quality evidence for the beneficial effect of sucrose (24%) with non-nutritive sucking (pacifier dipped in sucrose) or 0.5 mL of sucrose orally in preterm and term infants: Premature Infant Pain Profile (PIPP) 30 s after heel lance WMD -1.70 (95% CI -2.13 to -1.26; I(2) = 0% (no heterogeneity); 3 studies, n = 278); PIPP 60 s after heel lance WMD -2.14 (95% CI -3.34 to -0.94; I(2) = 0% (no heterogeneity; 2 studies, n = 164). There was high-quality evidence for the use of 2 mL 24% sucrose prior to venipuncture: PIPP during venipuncture WMD -2.79 (95% CI -3.76 to -1.83; I(2) = 0% (no heterogeneity; 2 groups in 1 study, n = 213); and intramuscular injections: PIPP during intramuscular injection WMD -1.05 (95% CI -1.98 to -0.12; I(2) = 0% (2 groups in 1 study, n = 232). Evidence from studies that could not be included in RevMan-analyses supported these findings. Reported adverse effects were minor and similar in the sucrose and control groups. Sucrose is not effective in reducing pain from circumcision. The effectiveness of sucrose for reducing pain/stress from other interventions such as arterial puncture, subcutaneous injection, insertion of nasogastric or orogastric tubes, bladder catherization, eye examinations and echocardiography examinations are inconclusive. Most trials indicated some benefit of sucrose use but that the evidence for other painful procedures is of lower quality as it is based on few studies of small sample sizes. The effects of sucrose on long-term neurodevelopmental outcomes are unknown.

AUTHORS' CONCLUSIONS:

Sucrose is effective for reducing procedural pain from single events such as heel lance, venipuncture and intramuscular injection in both preterm and term infants. No serious side effects or harms have been documented with this intervention. We could not identify an optimal dose due to inconsistency in effective sucrose dosage among studies. Further investigation of repeated administration of sucrose in neonates is needed. There is some moderate-quality evidence that sucrose in combination with other non-pharmacological interventions such as non-nutritive sucking is more effective than sucrose alone, but more research of this and sucrose in combination with pharmacological interventions is needed. Sucrose use in extremely preterm, unstable, ventilated (or a combination of these) neonates needs to be addressed. Additional research is needed to determine the minimally effective dose of sucrose during a single painful procedure and the effect of repeated sucrose administration on immediate (pain intensity) and long-term (neurodevelopmental) outcomes.

Update of **Sucrose for analgesia in newborn infants undergoing painful procedures.** **[Cochrane Database Syst Rev. 2013]**

PMID: 27420164 DOI: 10.1002/14651858.CD001069.pub5