Effectiveness of sucrose analgesia in reduction of procedural pain in neonates

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ABSTRACT

Pain in newborn infants is a ubiquitous phenomenon. Newborns in the hospital setting are routinely subjected to painful procedures from very early in their lives. Neonatal pain management is suboptimal in India. The present study was aimed to evaluate the effectiveness of oral sucrose solution in reduction of procedural pain among neonates admitted in the NICU of selected hospitals.

Materials and methods: A double blind RCT was conducted among 400 neonates who underwent selected procedures (IM injection, NG tube insertion, heel stick, and venipuncture). The eligible neonates were pre-assessed for Prechtl sleep/wake states and baseline pain scores. In each procedure the experimental group (n = 50) received sucrose solution 0.5-2ml and the control group (n = 50) received the same dose of sterile water. Two minutes after administration of the study solution the prescribed procedure was performed. The pain was assessed by measurements of physiological changes (HR and SaO2) and behavioral changes using NIPS at various time points and monitored for adverse events. Statistical techniques like, generalized estimating equation, Wilcoxon rank sum tem, and McNemars tests were applied to analyze results of the data.

Results: The baseline variables were homogeneously distributed in both groups. There was no difference in sleep/wake states between groups except the IM injection group. Neonates in the NG tube group treated with sucrose solution returned to a faster, Prechtl prestate10 sec as compared to 13 sec in sterile water group. (p < 0.015)

Physiological parameters of Pain: Stable HR was maintained throughout the IM injection and NG tube insertion by the SG neonates while it was increased during (p< 0.001) and after (p< 0.001) in the SWG. Among the heel stick group the SG neonates had increasing HR during and after (p <0.001) as compared to a stable HR in the SWG of neonates. In the VP group HR increased from baseline during (p< 0.008) after which it was stable, whereas in the SWG there was a marked decrease during VP (p< 0.002), and a steep increase after VP also (p < 0.001). In xii relation to the SaO2 levels there was trend of lower SaO2 levels both groups during IM injection (p < 0.001) and increase after IM injection both groups (p<0.001). The SaO2 levels in both groups decreased during and after NG tube insertion (p < 0.001). During heel stick the SaO2 levels decreased (p = 0.012) in the SWG, whereas it was stable in the SG after heel stick. The SaO2 levels decreased during VP (p = 0.002) in the SWG whereas it was stable in the SG.

Behavioral parameters of pain (NIPS): Oral sucrose solution significantly reduced the pain caused by IM injection as compared to sterile water at 15, 30, 60,120 sec (p< 0.001). Pain was reduced significantly among the neonates of the NG tube insertion group at 15 sec (p = 0.040), 30 and 60 sec also (p <0.001). In the heel stick group oral sucrose reduced the pain in the post heel stage only at 60 sec. In venipuncture group sucrose solution reduced the pain during the cannulation stage at 1 and 30 sec (p < 0.001).
**Association:** There was no association between pain and the background variables. Only neonates who underwent NG tube insertion with postnatal age of <12 hours experienced lesser degree of pain 0.25(0.17-0.5).

**Adverse events:** None of the few adverse events required any interventions in both the groups.

**Conclusion:** Sucrose solution is effective in maintaining the neonates in quiet sleep state as compared to sterile water during IM injection and NG tube insertion. The physiological parameter of pain HR was stable in the SG of neonates during IM injection, NG tube insertion and venipuncture. Pain reduction was evident in SG of neonates who underwent heel stick and venipuncture by stable SaO2 levels throughout the procedures. Oral sucrose is effective in reducing behavioral parameters of pain during IM injection, NG tube insertion, Heel stick and venipuncture at various time points. Sucrose solution is found to be safe for use for procedural pain reduction.

**Key words:** Neonate; Pain; Sucrose solution (SS); Sterile water group (SWG); Heart rate (HR); Oxygen saturation (SaO2); IM injection; NG tube insertion; heel stick; venipuncture.