

REGULAR ARTICLE

Oral sweet solution to prevent pain during neonatal hip examination: a randomised controlled trial

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ABSTRACT

Aim: To determine if oral glucose can have a pain-relieving effect during routine hip examinations in newborn infants.

Methods: In this randomised controlled study 100 newborn infants undergoing the routine physical examination including the potentially painful hip examination were included between March 2016 and April 2017. Fifty infants were randomised to water (control) and 50 to oral glucose (intervention) before their examination. Pain was assessed using crying time, Astrid Lindgren and Lund Children's Hospital Pain and Stress Assessment Scale (ALPS-Neo) and Visual analogue scale (VAS).

Results: Total crying time ($p = 0.006$), crying time during the hip examination ($p = 0.026$), ALPS-Neo ($p = 0.004$) and VAS ($p = 0.006$) (when assessed by the physician) were all significantly decreased in the group of infants receiving glucose. VAS assessment made by the parents did not reach statistical significance ($p = 0.127$).

Conclusion: Oral glucose given before the examination has a pain-relieving effect during the hip examination in healthy newborn infants.

INTRODUCTION

Pain in newborns should be treated. This is no longer a controversial statement (1). Despite this, newborns are subjected to painful hip examinations during the physical examination. Pain relief is not routinely given before the examination and there is no previous research available about this. In most countries, all newborns go through routine medical examination or screening during their first days of life, following the recommendations of organizations such as the American Academy of Pediatrics (AAP) (2) and the British National Institute for Health and Care Excellence (NICE) (3,4). The aim of such examinations is to find potential innate abnormalities and ensure that the newborn is healthy enough to discharge from the hospital.

In the Swedish healthcare system, newborns are examined before discharge (5). The examination takes about five minutes to 15 minutes and has 21 different components. The results are recorded on a standardised form. Several parts of the examination such as heart auscultation and eye

examination are difficult to perform if the baby is agitated. Different methods, therefore, are used to keep the baby calm; for example, the examination table may be warmed by a lamp or the baby may be given a pacifier. The Barlow and Ortolani test for hip dysplasia can be painful, and if the baby is upset and crying, the examination will be more difficult to perform. Studies have also shown that pain in newborns can have both short- and long-term negative consequences (6,7) such as changes in the responsiveness of the neuroendocrine and immune systems to stress. It is therefore important to minimise the newborn's total exposure to pain.

Healthy, full-term newborns face several known occasions of pain, including the screening test for metabolic diseases performed on all children in Sweden, the hip examination and various vaccinations. Following the humane imperative, 'First, do no harm', although it cannot be known what more pain infants will be exposed to, all

Abbreviations

AAP, American Academy of Pediatrics; ALPS-Neo, Astrid Lindgren and Lund Children's Hospital Pain and Stress Assessment Scale for Preterm and Sick Newborn Infants; NICE, British National Institute for Health and Care Excellence; NIPS, Neonatal Infant Pain Scale; PIPP-R, Premature Infant Pain Profile-Revised; VAS, Visual analogue scale.

Key notes

- The hip examination that is a part of the routine medical examination performed on all newborn infants is painful.
- Oral glucose has a pain-relieving effect during the hip examination.
- No adverse effects were seen in the infants from the study solutions.

precautions should be taken to prevent or minimise their pain. Previous studies have shown that sweet-tasting solutions can reduce signs of pain during painful procedures (8,9) and such use has been recommended in international (10,11) and national guidelines (12).

To alleviate and treat pain in this non-verbal patient group it is first necessary to recognise their pain. Because self-reporting, the gold standard for pain measurement, is not possible, we must use other methods to assess their pain including scales such as the Neonatal Infant Pain Scale (NIPS) (13), the Premature Infant Pain Profile-Revised (PIPP-R) (14) and the Astrid Lindgren and Lund Children's Hospital Pain and Stress Assessment Scale for Preterm and Sick Newborn Infants (ALPS-neo) (15), cry duration and heart rate variability.

Several studies have shown the pain-relieving effect of sweet solutions during stressful or painful procedures, but to our knowledge, no study has addressed whether sweet solutions can reduce pain during hip examinations. The aim of this study was to investigate whether orally administered 30% glucose has a pain-reducing effect during hip examination that could also reduce examination time.

METHODS

We conducted the study at Örebro University Hospital from March 2016 to April 2017. The parents provided informed consent, and the study was approved by the regional ethical review board (Dnr 2015/295).

One hundred healthy, full-term newborn infants were randomised to either glucose or sterile water delivered orally at a routine medical examination before discharge. Exclusion criteria were prematurity, parents' inability to speak Swedish well enough to give consent, congenital malformations or other illnesses in the infant, or any pain-relieving medicine administered to the infant in the previous 24 hours. To allow a double-blind design, sealed envelopes holding identical 2 mL syringes marked only with a number, containing either 30% glucose (APL, Sverige) or sterile water (Fresenius Kabi, Sverige) were prepared by a nurse not otherwise involved in the project. The contents of the syringes were randomised using a sequence from <http://www.randomization.com> and kept in a locked refrigerator during the data collection period. The infant was first placed on a preheated examination table. Before the examination, the physician administered 1 mL of glucose or sterile water in the infants' mouth. The remaining solution could be administered during the examination if necessary or appropriate. Everyone in the examination room was blinded to the contents of the syringe. The physician then continued with the examination. Parents were invited to stay close to the infant, who was offered a pacifier or a parent's finger to suck on if possible.

During the hip examination a trained nurse assessed the infant's pain using ALPS-neo (15). Total examination time was measured, as were total crying time and crying time during hip examination. After the examination, the parents and the physician were asked to rate the infant's

pain on a visual analogue scale (VAS). Results are shown as numbers and/or per cent, or as median and interquartile range. We used Mann-Whitney U-test to calculate differences between the two groups, and a *p*-value of less than 0.05 was considered significant. SPSS v 21 (IBM Corp., Armonk, NY, USA) was used for statistical analyses.

RESULTS

One hundred newborns were included in the study before discharge from the maternity unit at the Örebro University Hospital. The patients were randomised to receive either water (50 newborns, control) or glucose (50 newborns, intervention). One patient in the intervention group was already diagnosed with congenital hip dysplasia and treated with a hip brace that made the hip examination impossible to perform. This patient was excluded, leaving 49 infants in the glucose group for analysis. Characteristics of the study groups are shown in Table 1. There were no significant between-group differences at baseline.

Results are shown in Table 2. Pain was assessed five ways, four of which showed significantly lower pain in the glucose group. The only method that did not show a significant between-group difference was the VAS

Table 1 Characteristics of the study groups

	Water group n = 50 (range)	Glucose group n = 49 (range)
Girls/boys	29/21	25/24
Gestational age	39 + 2 (38 + 3–40 + 1)	39 + 5 (38 + 2–40 + 5)
Birth weight, grams	3505 (3054–3714)	3345 (3120–3857)
Age at examination, days	2 (1,2)	1 (1–2)
Time since last feeding, minutes	30 (15–120)	60 (15–120)
Delivery type: PN/CS/VE/Other	40/7/2/1	34/9/4/2

Values are number, median and interquartile range (Q1–Q3). CS = Caesarean section; PN = Normal delivery; VE = Vacuum extraction.

Table 2 Results

	Water group n = 50 (range)	Glucose group n = 49 (range)	<i>p</i>
Total time of examination, seconds	299 (247–351)	308 (232–376)	0.545
Cry duration, total, seconds	91 (51–150)	49 (18–33)	0.006
Cry duration, hip examination, seconds	16 (7–24)	11 (1–16)	0.026
VAS parents	2.1 (0.8–2.9)	1.5 (0.5–2.6)	0.127
VAS physicians	3.8 (1.5–5.4)	2.0 (1.3–3.3)	0.006
ALPS hip examination	4.5 (2.0–6.0)	2.0 (2.0–4.0)	0.004

Values are median and interquartile range (Q1–Q3).

performed by the parents; this contrasted clearly with the VAS administrated by physicians, which showed a highly significant difference ($p = 0.006$). Both parents answered the questionnaire and rated the infant's pain on the VAS in 44% of cases; the mother alone answered in 36% of cases and the father alone in 19%.

The examinations were performed by 16 physicians (5 neonatologists, 3 paediatricians and 8 paediatric residents). Directly after the examinations, the physicians performed VAS evaluations, which indicated significantly lower pain in the glucose group (Table 2). Median crying time during the examination was 91 seconds in the control group and 49 seconds in the glucose group, indicating substantial clinical improvement with glucose. Crying during the hip examination was also reduced by five seconds in the glucose group, although we found no between-group difference in total examination time (median examination time: control group = 299 seconds; intervention group = 308 seconds; $p = 0.545$).

We observed no adverse effects in the infants during data collection or administration of the study solutions.

DISCUSSION

Mounting evidence shows the negative effect of repeated pain during the neonatal period (7), but this is the first study of the potential pain that millions of infants are subjected to every year during hip examinations. The pain-relieving effect of sweet solutions during painful procedures has been shown (9,16), but this is the first study to show a pain-relieving effect for oral glucose during hip examinations of healthy full-term babies. The hip examination appears to be painful, with obvious elevations on the pain-measuring scales that we used. We used the ALPS-Neo (15), originally designed to measure ongoing pain in infants in neonatal intensive care, but apparently also feasible and user-friendly for use in such short examinations. The VAS has been used in several studies using proxies such as parents to assess infants' pain (17–19).

The difference between the significance of physicians' and parents' VAS ratings might be explained by the physicians' accumulated experience of seeing and interpreting infant behaviour compared with the limited experience of parents who just recently met their newborn. Parents might also be more reluctant to acknowledge that their infant could be in pain. Research has shown that parents' pain ratings are not always predicted by the infant's behaviour, especially early in the infant's life (18), and that the amount of time spent with the infant determines how well parents understand an infant's expression of pain (19). The infants in our study were all examined within four days of birth, giving parents very little time to get to know their babies.

Pain is obviously subjective and best assessed by the one undergoing it, but options for these non-verbal patients are limited. A neurophysiological method such as NIRS (20) could replace a pain assessment scale, but because of the nature of the hip examination, the infant's movements

would most likely result in artifacts that make data difficult to interpret.

The 21 set components of the infant medical examination do not have to be performed in any specific order, and each physician has a different touch when handling a baby. Because we saw significant pain relief with glucose in examinations conducted by several physicians, the results are therefore more reliable and generalisable than if only one physician had participated. Since the crying time was reduced both for the hip examination and the entire examination, the results suggest a beneficial effect for all the procedures, although the examination time could not be shortened.

We used a double-blind, placebo-controlled design to prevent observer bias; however, some of the infants did show a preference for the content in the syringe and smacked their lips, which could suggest to observers that they had received the sweet solution. This might unintentionally have led to a lower assessment of those infants' pain. Future studies could be improved by administering the solution before the physician and study nurse enter the examination room.

This study showed that hip examination appears to be painful for infants and that although glucose has a pain-relieving effect, it does not reduce examination time. Given its low cost and low risk of adverse effects, we recommend that all infants receive an oral sweet solution before the hip examination.

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CONFLICT OF INTEREST

None.

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