

# MCN for Neonatology

## West of Scotland

### Neonatal Guideline



## Oral Sucrose for Procedural Pain

For use in neonates and infants

This guideline is applicable to all medical, nursing and midwifery staff caring for neonates and Infants in West of Scotland Neonatal Units and in the Royal Hospital for Children in Glasgow.

### **Summary of Changes in May 2026 Review**

Page 3	Insertion of neonatal dental extraction as an indication
Page 4	Insertion of number of drops of sucrose to table alongside approximate volume in millilitres

### **Introduction**

Comfort measures such as swaddling, tucking, kangaroo care and use of maternal breast milk should be considered prior to any procedure that may cause discomfort.

Maternal breast milk administered into the mouth has been shown to reduce procedural pain. If maternal breast milk is not available then small amounts of oral sucrose solution have also been shown to reduce procedural pain.

Oral sucrose is safe and effective for reducing minor procedural pain from single events like heel prick, intramuscular injection and venepuncture. There is high-quality evidence that sucrose reduces different measures of newborn pain during heel lance, venipuncture and intramuscular injection.

### **Aim**

The aim of this guideline is to provide information to all staff involved in care of neonates on safe and effective use of oral sucrose prior to painful procedures. For optimal results, oral sucrose should be administered with supportive interventions like non-nutritive sucking (NNS) (pacifier dipped in sucrose where parents have agreed to use pacifier). Other comfort measures such as swaddling, tucking and kangaroo care should be considered before any painful procedure. Use of maternal breast milk/breast feeding should be considered where available for pain relief prior to minor procedure.

### **Use of Sucrose for procedural pain**

The mechanism involved is an orally mediated increase in endogenous opioid. If sucrose is given directly into the stomach via nasogastric tube there is no analgesic effect.

There is a 2- minute peak effectiveness following administration which will provide short term pain management.

The effect may be prolonged by administering 2 or three repeat doses at 2 minute intervals during the procedure. Sucrose may be inadequate for painful procedures lasting longer than this and alternative analgesia should be considered.

The affect of sucrose is enhanced when combined with a concomitant breast feed, or where this is not possible, non-nutritive sucking using a dummy.

Sucrose action is temporary and analgesic - not sedative. For the irritable infant, comfort measures such as swaddling, tucking and kangaroo care should be incorporated as appropriate.

## Indications for Use

*Sucrose is indicated for procedural pain from minor procedures.*

In the Neonatal Unit it should always be used in conjunction with developmentally supportive care (see Developmental Care Guideline).

If maternal EBM is available this may be an alternative.

## Procedures known to cause pain and discomfort include:

- Venepuncture /arterial puncture/heel stab
- Lumbar puncture
- Suprapubic aspiration
- Eye examination e.g. for Retinopathy of Prematurity (ROP)
- *Echo, ECG*
- Suture removal
- Dressings
- Intramuscular/subcutaneous injection
- PICC line insertion
- Septostomy
- Rectal Biopsy, bowel washout
- Neonatal Bloodspot Test
- Theatre Recovery for acute discomfort
- Neonatal dental extraction in RHC and the Dental Hospital

*Sucrose can be used before checking glucose level. It is not likely to affect the result as the dose of oral sucrose used is too small.*

## Contraindications

- Infants with known fructose or sucrose intolerance
- *Glucose-galactose malabsorption*
- *Muscle relaxed neonates*
- Critically ill infants receiving appropriate intravenous analgesia

## Caution:

- *Infants with suspected or confirmed necrotising enterocolitis (NEC), unrepaired Tracheo-Oesophageal Fistula (TOF), nil by mouth, altered gag/swallow reflex*  
*For these infants oral sucrose may be applied by small swab on anterior two third of tongue.*
- *Parents should be advised that sucrose as analgesic is to be used by health professionals only and not for use at home.*

## Sucrose Preparations

- **Sucrose 24%** is available in single patient twist-cap vials, each containing 2 ml of Sucrose 24% Solution. Each single patient vial is graduated in 0.5ml increments so the sucrose can be accurately delivered, drop-by-drop to the baby. Administered straight from the vial or dripped on to a pacifier, no syringe is required. Multi use preparations should be avoided
- Any residual solution should be discarded.
- Oral sucrose solution should be ordered locally through pharmacy.

**Dose: (24% sucrose and water solution)**

There is insufficient data to recommend a maximum safe and effective dose of Sucrose for babies undergoing multiple painful procedures, particularly in the youngest age range. Alternative strategies should be considered for babies undergoing frequent procedures, e.g. an indwelling arterial line for infants requiring frequent blood sampling.

<b>CGA</b>	<b>Dose</b>	<b>Frequency</b>	<b>Route</b>
< 31 weeks	0.05–0.1 ml per dose, as tolerated. (1-3 drops from ampoule)	Administer sucrose every 2 minutes during the procedure if required. Do not exceed 4 doses per procedure.	Oral
≥ 31-36 weeks	Up to 0.25ml per dose, as tolerated (5-7 drops)	Administer sucrose every 2 minutes during the procedure if required. Do not exceed 4 doses per procedure.	Oral
Term neonate	Up to 0.5ml per dose, as tolerated. (10-15 drops)	Administer sucrose every 2 minutes during the procedure if required. Do not exceed 4 doses per procedure.	Oral
Infants 1-12 months	Up to 0.5ml per dose, as tolerated. (10-15 drops)	Administer sucrose every 2 minutes during the procedure if required. Do not exceed 4 doses per procedure.	Oral

**Documentation**

•*Sucrose is a non medicinal product and does not need prescription prior to administration*

*Documentation however, is required, to maintain a record of administration and to ensure that excessive amount is not given especially in preterm babies less than 32 weeks in first week of life. Caution advised in such cases if >10 doses/day are required. Concerns about neurodevelopment in the long term were raised by old research although more recent evidence refutes this.*

*Record dose administered on "Maternity badger" for babies in PNW/LW. Go to the "Summary of care" for the Baby, click on the red + sign on top left side, it would open a drop down list. Use "medication" to document administration of "Oral Sucrose" and mention the dose given.*

*In units with no maternity badger, the administration should be recorded in the baby's record according to local guidance.*

## Administration

- An assistant may be required to administer sucrose during the procedure
- Administer sucrose solution (Appendix 1) on to anterior aspect of tongue or inside cheek, or dip dummy/pacifier into sucrose solution to coat (1 dip = about 0.1ml).
- Administer 1 to 2 minutes prior to procedure
- Offer a dummy/pacifier if part of baby's normal care (this promotes non-nutritive sucking which will enhance the effect of the sucrose)
- Repeat the dose upon commencement of the procedure and every 2 minutes *if required*.

*The peak action is 2 minutes*

The duration of action is 5-10 minutes

Observe for gagging, choking, coughing and vomiting

If an inadequate analgesic effect is achieved, consider additional therapies. Any remaining solution should be discarded after use (single use only)

### **ORAL SUCROSE for Procedural pain VIDEO link:**

<https://www.youtube.com/watch?v=0A2YuE-5K1U>

## **Literature Review/Evidence base background**

### **Neonatal Pain Assessment**

Historically a lack of knowledge and understanding on neonatal pain has hindered the development of comprehensive pain management strategies in the clinical area (Rouzan, 2001). There was a misconception that neonates were incapable of experiencing pain. This was a view accepted by many clinicians in the medical community (Alexander and Todres, 1998). These views were based on underlying theories that neonates had an underdeveloped central nervous system and a lack of pain receptors. There was also an assumption that new fibres require myelination to function in pain perception and that neonates were unable to remember painful experiences (Frank and Gregory, 1993, Stevens et al, 1995). Pain responses in preterm neonates were thought to be largely sub cortical, with functional maturation of higher brain centres being required to produce a pain experience. However recent studies dispel this theory by highlighting that acute pain activates the sensory cortex in even the extreme preterm neonate (Bartocci et al, 2005, Fitzgerald, 2005). Developmental neurobiologists also now support the view that neonates can experience pain and demonstrate specific pain behaviours. Fitzgerald and Howard (2003) reflect that early periods of development are particularly vulnerable to the effects of acute or repetitive pain exposures.

Research by Brummelte et al (2012) & Ranger et al (2014) has shown a positive association between the number of painful procedures and increased risk of poor neurodevelopmental outcomes in preterm infants.

### **Pain Management**

Strategies have been developed in many units to manage post operative pain and major procedural pain. However the implementation of strategies to management or prevent pain during minor procedures such as venepuncture and heel lance remain poorly developed (Anand, 2001).

### **The Administration of Sucrose as a Method of Pain Management**

In recent years the administration of oral sucrose with or without non-nutritive sucking has been extensively studied for the relief of procedural pain. Sucrose has been reviewed for its effect in crying babies (Smith, 1992), and its pain relieving effects for procedures (Stevens 1997).

### **How Does Sucrose Work**

The physiological effects of oral sucrose and non-nutritive sucking are thought to be mediated by both endogenous opioid and non-opioid systems (Blass 1999). However the underlying mechanisms are believed to differ. The mechanisms involved are likely to be dependent on the normal functioning of central mechanisms, and may be synergistic or additive.

### **Evidence of Outcome**

*Cochrane review 2016: 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: There was high-quality evidence to support the use of 2 mL 24% sucrose prior to venepuncture: and intramuscular injections:*

Ramenghi et al (1999) reported that the administration of sucrose to the stomach by nasogastric tube was not an effective analgesia. The onset of action is reportedly 10 seconds, and is therefore so rapid that there is not enough time for absorption to occur (Blass and Shah, 1995). The duration of action is 5 to 10 minutes with the peak action being around 2 minutes. Sucrose cannot therefore be related to clearance from the circulation of any measurable agent (Blass and Shah, 1995).

### **Clinical Application**

Neonates routinely experience pain and discomfort from both invasive and non-invasive procedures in the neonatal unit. The benefits of sucrose administration during heel lance and venepuncture has been well documented (Carbajal, 2003, Abad et al, 1996, Johnston, 1998). There is now extensive evidence in support of the administration of sucrose for procedural pain, frequently in conjunction with both

pharmacological and non-pharmacological interventions (Anand, 2001). Further clinical indications for the administration of sucrose include eye examinations, oral suctioning, subcutaneous or intramuscular injection, nasogastric or orogastric tube insertion (Anand, 2001). The use of sucrose in addition to pharmacological measures has been recommended in more invasive procedures such as central catheter placement, lumbar puncture and chest tube insertion (Anand, 2001).

### **Dosing and Gestational Age Parameters**

There is insufficient evidence to recommend optimum dosing and age parameters for sucrose administration (Stevens et al, 2004). A Cochrane systematic review conducted in 2004 reported that sucrose volumes ranging from 0.05ml to 2ml had been identified (Stevens, 2004). However it is not the volume but the sweet substance that produces the analgesic effect, therefore studies report 0.05ml to 0.5ml of 24% to 25% sucrose as an adequate volume (Stevens et al, 2004, Stevens et al 2010).

Carbajal (2002) and Gibbons et al (2002) reported that sucrose can be effective in neonates as young as 25 weeks gestation. However there have been concerns surrounding developmental outcomes in infants less than 32 weeks corrected gestational age (Stevens 2004). Barr et al (1999) in an early study reviewed sucrose administration during immunisation. The authors reported that sucrose was less effective in infants older than 3 months. Lefrak et al (2007) in a review of sucrose analgesia highlighted that it should be emphasised to clinicians that it was the sweet taste that produced the analgesic effect and not the volume of sucrose administered. The authors reflected that this would reduce potential administration errors caused by giving large volumes and giving the solution via a nasogastric tube. Emphasis should also be placed on the 2- minute peak effectiveness and the fact that the duration of sucrose action is temporary and the analgesic not sedative for the irritable infant (Lefrak et al 2007).

There is evidence that some sucrose analgesic effects persist up to 12 months of age although numbers of studies including children over 3 months old are limited. Sucrose solutions of 24% or stronger reduce the cry duration after immunisation (Barr 1995, Levindon 1998 & Thyr 2007). Studies conducted to date on children older than 12 months have failed to provide consistent evidence of pain reduction. It seems reasonable to offer sucrose to infants up to 12 months old, whilst being aware the effects are not as profound or reliable as following its administration in neonates.

### **Recommendations for Administration**

Studies have reviewed the optimum method of administration. This can range from sucrose administered via a syringe on to the tongue, sucrose directly on to a pacifier (dummy) or sucrose administered on the tongue followed by giving the baby a pacifier. It has been reported that the optimum effect is achieved from either administering sucrose on to the tongue followed by a pacifier (Gibbons et al 2002) or by giving a pacifier dipped in the sucrose solution (Stevens et al 1999). It is also recommended that the effect of sucrose could be further enhanced by utilising other comfort measures such as facilitated tuck, swaddling kangaroo care.

### **Adverse Effects of Sucrose**

Few studies have reported on adverse effects as a result of sucrose administration. However in a randomised controlled trial, Johnston (2000) reported lower scores on certain components of the "Neurobehavioural Assessment of the Preterm Infant" in babies who received higher numbers of doses of sucrose than those who received fewer. The babies who received more doses also had Neurobiological Risk Scores at 2 weeks postnatal age but not at discharge. As a result of the possible long term effects which have been implicated by these findings it has been advised that sucrose be used with caution and limited numbers of doses given in infants less than 32 weeks post conceptual age. However Stevens et al (2005), in a study reviewing management of repeated procedural pain with sucrose, concluded that the ongoing use of sucrose in infants with prolonged hospitalisations requiring repeated doses of sucrose over time resulted in no long term adverse effects.

Short-term side effects of oral sucrose were reported by two studies. Carbajal (2002) reported slight transient oxygen desaturation in 7 of 54 of their sample of neonates who received 0.3 ml of 30%

sucrose. Gibbons et al (2002) reported adverse effects as those which occurred immediately after administration such as choking coughing, vomiting. Adverse effects were noted in most often in the immature infant (4 of 23). The adverse effects were not clinically significant and none of the infants who received sucrose with non-nutritive sucking had any adverse effects. Further concerns in relation to possible adverse effects have been alterations in glucose homeostasis and necrotising enterocolitis. Sucrose however has not been proven to cause these adverse effects (Lefrak et al 2007).

### Further Research:

There has been abundant evidence showing statistically significant reduction of behavioural pain outcomes after sweet taste analgesia. There have been many studies in the last decade to understand the mechanism of pain better in the non verbal population in order to determine the treatment strategies. In future, neonatal pain studies using oral sucrose should select more ethically acceptable topics rather than continue to conduct "placebo" or "no treatment" controlled trials in infants. Further research should focus on dosing and any effect on long term neurodevelopment.

### References

- -Stevens B, Yamada J, Ohlsson A, Haliburton S, Shorkey A. Sucrose for analgesia in newborn infants undergoing painful procedures. *Cochrane Database of Systematic Reviews* 2016, Issue 7. Art. No.: CD001069. DOI: 10.1002/14651858.CD001069.pub5
- -Harrison D, Larocque C, Bueno M, et al. Sweet Solutions to Reduce Procedural Pain in Neonates: A Meta-analysis. *Pediatrics*. 2017; 139(1):e20160955
- -Brummelte S, Granau RE, Chau V, et al. Procedural pain and brain development in premature newborns. *Ann Neurol*. 2012;71(3):385-396
- -Ranger M, Grunau RE. Early repetitive pain in preterm infants in relation to the developing brain. *Pain Manag*.2014;4(1):57-67
- 
- - Abad, F, Diaz NM, Domenech E, Robayna M, Rico J. (1996) Oral sweet solution reduces pain-related behavior in preterm infants. *Acta Paediatrica* 1996; 85:854-8.
- - Anand, K.J.S. (2001) International Evidence-Based Group for Neonatal Pain. Consensus statement for the prevention and management of pain in the newborn, *Archives of Pediatric Adolescent Medicine*, 155, pp173-180.
- - Barr RTG Young SN, Wright JH, Cassidy KL, Hendricks L Bedard Y. Sucrose analgesia and Diphtheria-pertussis-tetanus immunisations at 2 and 4 months. *J Dev Behav Pediatr* 1995; **16**; (4); 220-5
- - Barr, R.G., Pantel, M.S., Young, S.N., Wright, J.H., Hendricks, L.A., Gravel, R. (1999) The response of crying newborns to sucrose: is it a "sweetness" effect, *Physiology Behaviour*, 66, 409-417.
- - Blass EM, Watt LB. (1999) Suckling- and sucrose-induced analgesia in human newborns *Pain*, 83:611-23.
- - Carbajal, R., Veerapen, S., Coudere, S., Jugie, M., Ville, Y. (2003) Analgesic effect of breast feeding in term neonates: randomised controlled trial, *BMJ*, Vol 326, pp 326-313.
- - Johnston, C.C. (1998) Psychometric Issues in the Measure of Pain, in: *Measurement of Pain in Infants and Children, Progress in Pain Research and Management*, Vol 10, Finley, G.A., McGrath, P.J. Eds. IASP Press, Seattle.
- - Lefrack et al (2006) Sucrose analgesia: identifying potentially better practices *Pediatrics* 118: 197-202
- - Lewindon PJ, Harkness L, Lewindon N. Randomised controlled trial of sucrose by mouth for the relief of infant crying after immunisation. *Arch Dis Child* 1998; **78**; (5): 453-6
- - Ramenghi LA, Evans DJ, Levene MI. (1999); "Sucrose analgesia": absorptive mechanism or taste perception?. *Archives of Disease in Childhood. Fetal and Neonatal Edition* ;80:F146-7.
- - Rouzan, I.A.(2001) An analysis of research and clinical practice in neonatal pain management, *Journal of the Academy of Nurse Practitioners*, 13, 2 pp 58-60.
- - Smith BA, Stevens K, Torgerson WS, Kim JH. (1992) Diminished reactivity of postmature human infants to sucrose compared with term infants. *Developmental Psychology*; 29:811- 20.
- - Stevens, B.J., Riddell, R.R.P., Oberlander, T.E., Gibbins, S. (2007) Assessment of Pain in Neonates and Infants, In: *Pain in Neonates and Infants*, Anand, K.J.S., Stevens, B.J., McGrath, P.J. (Eds) pp 67-86, Elsevier, London.

- - Stevens B, Yamada J, Lee GY, Ohlsson A. Sucrose for analgesia in newborn infants undergoing painful procedures. *Cochrane Database of Systematic Reviews* 2013, Issue 1. Art. No.: CD001069. DOI: 10.1002/14651858.CD001069.pub4.
- - Stevens B, Yamada J, Beyene J, Gibbins S, Petryshen P, Stinson J, (2005) Consistent management of repeated procedural pain with sucrose in preterm neonates: Is it effective and safe for repeated use over time? *Clinical Journal of Pain*; 21:543–8.
- - Thyr M, Sundholm A, Teeland L, Rahm VA. Oral glucose as an analgesic to reduce distress following immunisation at the age of 3, 5 and 12 months. *Acta Paediatr* 2007; **96** (2): 233-6

#### **Review Authors:**

L. Raeside ANNP RHSC/SGH

#### **Previous reviewers:**

Tayyaba Yasmeen - LAT, DGRI, Dumfries

Asma Yasmeen - Specialty Doctor, NNU, PRMH, Glasgow

K. Trower Specialist in Pain Management, RHC, Glasgow

#### **Other Professionals Consulted**

Dr G. Bell Consultant Anaesthetist, RHSC

Stephen Bowhay Pharmacist GG&C

#### **Document Name**

WoS\_Sucrose\_Neonates

#### **Implementation / Review Dates**

Implementation Date 07/05/14

Updated 21/05/2026

Next review 01/06/2029