

Prevention and management of procedural pain in the neonate: an update, American Academy of Pediatrics, 2016

Yinru Lim,¹ Sunit Godambe²

¹Department of Paediatrics, North Middlesex University Hospital NHS Trust, London, UK
²Division of Neonatology, Imperial College Healthcare NHS Trust, St Marys' Hospital, London, UK

Correspondence to

Dr Yinru Lim, Department of Paediatrics, North Middlesex University Hospital NHS Trust, London, N18 1QX, UK; yinrulim85@gmail.com

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BACKGROUND

Neonates, especially preterm infants, are often subjected to frequent painful procedures during their stay in the neonatal intensive care unit.¹ Repeated painful stimuli in early life are known to result in both short-term and long-term sequelae. These include physiological instability, abnormal somatosensory and stress responses, and effects on long-term neurodevelopment, behavioural and social-emotional outcomes.^{2 3} The management of pain in a neonate is also challenging because neonates are unable to report pain, and it can be particularly difficult to assess pain in the extreme preterm, ill or neurologically compromised neonate. Therefore, it is important that all healthcare professionals who are involved in the care of these infants are aware of how to assess pain and stress, and manage pain appropriately.

INFORMATION ABOUT CURRENT GUIDELINE

In February 2016, the American Academy of Pediatrics (AAP) published an updated guideline entitled 'Prevention and management of procedural pain in the neonate'.⁴ The guideline development group included representatives from the AAP Committee of Fetus and Newborn, 2015–2016, and Section on Anesthesiology and Pain Medicine Executive Committee, 2014–2015.

PREVIOUS GUIDELINE

The previous guideline on the management and prevention of procedural pain in the neonate was published by the AAP in 2007. This revision updates previous recommendations with new evidence to aid healthcare professionals to 'implement

a pain assessment and management plan for the prevention of pain associated with routine minor procedures, and with surgery and other major procedures in neonates.'

KEY ISSUES

- ▶ Pain assessment
 - Effective and reliable pain assessment tools are essential for the management of neonatal pain. Numerous neonatal pain scales exist but only five have been subjected to rigorous psychometric testing with the use of patients as their own controls (see [box 1](#)).
 - New and emerging technologies which measure cortical and neurophysiological responses to pain are being investigated (eg, near-infrared spectroscopy, amplitude-integrated electroencephalography, functional MRI and heart rate variability assessment).
- ▶ Non-pharmacological treatment strategies
 - Skin to skin care (SSC): The use of SCC with or without sucrose has been shown to decrease some measure of pain in both preterm and term infants and some studies have reported physiological benefits.⁵
 - Breast feeding: Breast feeding during procedures such as a heel lance or venepuncture is associated with lower pain responses in term neonates compared with measures such as positioning, rocking and maternal holding.⁶
 - Breast milk: The provision of breast milk via a pacifier or syringe seems to be as effective as the use of sucrose solution.⁶
 - Sensorial stimulation: When all elements of sensorial stimulation (see [box 2](#)) are used, it is more effective than the use of oral sucrose.⁷
- ▶ Pharmacological treatment strategies
 - Sucrose: The use of oral sucrose is safe and effective for reducing pain from



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a single event in infants of gestational age from 25 to 44 weeks.⁸ The greatest reduction in both physiological and behavioural pain indicators is noted when sucrose is given approximately 2 min prior to a painful procedure. The effects last for approximately 4 min. However, the modes of action, optimal dose and long-term effects have not been determined.

- Non-opioids: Paracetamol use is limited to post-operative pain control and can be administered orally or intravenously. The use of paracetamol can reduce opioid use in the control of postoperative pain. Non-steroidal anti-inflammatory drug use is restricted to the pharmacological closure of patent ductus arteriosus.
- Opioids: Opioids are the most common agents used especially for persistent pain. Although studies on appropriate dosing and long-term effects are lacking and/or conflicting, it is recommended for procedures such as chest drain insertion and removal, and elective intubations.
- Although the use of opioids is common in mechanical ventilation in neonates, limited favourable effects have been reported and a meta-analysis has found insufficient evidence to recommend routine use of opioids in ventilated infants. Selective use is recommended after evaluation of pain indicators, clinical judgement and consideration of adverse effects (see box 3).⁹
- Other drugs: There is insufficient evidence for the use of midazolam infusions for sedation, and safety issues have been raised, in particular concerns about neurotoxicity.¹⁰ Other medications such as ketamine, propofol, methadone and dexmedetomidine have been proposed but studies on the neonatal population are sparse and caution should be exercised when considering these drugs.
- Topical anaesthetic agents: Topical agents such as Eutectic Mixture of Local Anesthetics and tetracaine gel have been found to decrease pain measures during procedures such as venepuncture, percutaneous venous catheter insertion, peripheral arterial puncture and lumbar punctures, particularly when used with sucrose. However, there are concerns about using these agents, especially in preterm infants, and these include methemoglobinemia, local skin irritation and toxicity.

WHAT DO I NEED TO KNOW?

- What should I ensure I've started doing? Ensure the availability of a stepwise pain prevention, assessment and treatment guideline.
- Use validated neonatal pain assessment tools before, during and after painful procedures and select the assessment that is appropriate to the clinical situation and the type of pain being assessed.
- Pain assessment and prevention should be carried out on a continuing basis throughout an infant's stay in the neonatal unit.
- Ensure continuing education for all healthcare providers in the recognition, assessment and management of pain in neonates, including any new available evidence.

Box 1 Pain assessment tools for neonates (validated with patients serving as own controls)

- ▶ Neonatal facial coding system
- ▶ Premature infant pain profile
- ▶ Neonatal pain agitation and sedation scale
- ▶ Behavioural indicators of infant pain
- ▶ Douleur Aiguë du Nouveau-né

Box 3 Potential adverse effects of opioids

- ▶ Respiratory depression
- ▶ Hypotension
- ▶ Increase in duration of mechanical ventilation
- ▶ Development of dependence and tolerance
- ▶ Urinary retention and constipation

- What can I continue to do as before? Always use non-pharmacological strategies for short-term, mild to moderately painful procedures.
- Consider additional use of sucrose along with non-pharmacological strategies to achieve effective pain relief in mild to moderately painful procedures.
- Exercise caution when considering newer medications for which data are sparse or non-existent.
- What should I do differently? Ensure that potential and actual benefits and burdens are weighed up before the use of pharmacological treatment.

UNRESOLVED CONTROVERSIES

The use of sucrose to provide analgesia has been extensively studied but yet gaps remain as to the mechanism of action, the ideal time interval between administration and painful procedures, appropriate dosing and its long-term consequences.

1. Time interval: Contrary to the recommended time of administering sucrose 2 min before a painful procedure,⁸ a recent observational study on premature and unwell neonates reports no correlation between timing of sucrose administration and pain intensity of heel lance.¹¹ The validated premature pain profile tool was employed in this study while no validated tools have been used in the recommendation of a 2 min interval. Evaluation in a randomised controlled trial is needed.
2. Dosing: The Cochrane review has recommended doses of 0.5 mL of sucrose for procedures such as heel lance and 2 mL of sucrose in venepuncture.⁸ However, safety of long-term sucrose administration is unknown and concerns have been raised about neurodevelopmental outcomes, especially in preterm infants, therefore recommending dosing based on weight (0.2–0.5 mL/kg).¹² Further studies are required to determine the optimal dose; meanwhile, both gestational age and weight should probably be considered when administering sucrose.

Guideline review

Similarly, studies of appropriate dosing and long-term effects of opioids are lacking. Research is required for existing and newer pharmacological and non-pharmacological strategies, and continued education and incorporation of new evidence are essential for effective management of procedural pain in neonates.¹³

Clinical bottom line

- ▶ Repeated painful procedures have the potential for short-term and long-term adverse consequences for neonates.
- ▶ Assessment of pain should be made using validated pain assessment tools.
- ▶ Appropriate management of pain is essential and ethical, and further research is needed to allow improvements.
- ▶ It is important to always consider the use of non-pharmacological strategies with or without sucrose solution for short-term, mild to moderately painful procedures.

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Box 2 Sensorial stimulation: simultaneous gentle stimulation of all four elements

- ▶ Tactile, for example, stroking or massaging of face or back
- ▶ Gustatory, for example, provision of sucrose or breast milk
- ▶ Auditory, for example, talking to the infant
- ▶ Visual, for example, looking at the infant

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