Non-pharmacological treatment of pain in neonates and infants

A hospitalised neonate experiences, on average, between 7.5 and 17.3 painful procedures daily – the most frequent being heel lance, suctioning, venepuncture and cannulation (Cruz et al, 2016). In the UK, infants in their first year of life are routinely exposed to 12 potentially painful intramuscular injections, given on four occasions, as part of the NHS’s immunisation programme (Bit.ly/Immunisations2016). In neonates and infants, procedural pain cannot be treated in the same way as in older children or adults and the emphasis is on non-pharmacological techniques, which this article describes.

Long-term consequences of pain
Evidence shows repeated painful procedures carried out on premature neonates in intensive care may have long-term consequences on their neuro-development (Grunau et al, 2006). Changes to pain pathways can be seen in children aged 9-14 years who were exposed to pain as pre-term or full-term neonates (Hermann et al, 2006). Full-term neonates who underwent circumcision without analgesia showed an increased response to pain when vaccinated at age 4-6 months (Taddio et al, 1997). Full-term neonates exposed to repeated heel-lance procedures in the first 36 hours of life demonstrated increased pain responses to venepuncture (Taddio et al, 2002). This evidence reinforces the need for adequate management of procedural pain in young infants.

Pharmacological approaches
There are several limitations to the use of conventional analgesics in managing procedural pain in neonates. For example, although paracetamol reduces the morphine requirement of neonates post surgery, it has not been shown to be effective in reducing the pain associated with procedures such as assisted vaginal birth (vacuum or forceps), heel lance or eye examination (Ohlsson and Shah, 2015).

Non-steroidal anti-inflammatory analgesia is contraindicated in the early stages of infancy because of its effect on renal blood flow and cerebral autoregulation (Parry, 2008). Topical local anaesthetics do not reduce the pain of heel lance (Taddio et al, 1998), and some preparations used for venepuncture and cannulation are contraindicated in neonates; this is the case with 2.5% lidocaine/
2.5% prilocaine cream in pre-term neonates, and with 4% lidocaine cream in term neonates (Medicines and Healthcare Products Regulation Agency, 2013; Howard et al, 2012).

**Non-pharmacological approaches**

**Sucrose**

There is controversy about the description of sucrose as an analgesic agent (Harrison et al, 2012) and its potential mechanism of action remains unclear. Sucrose is unlikely to influence the modulation of pain through opioid mechanisms (Holsti and Grunau, 2010) or have activity in the neonatal brain or spinal cord nociceptive circuits (Slater et al, 2010). However, it has been identified as a useful non-pharmacological strategy when performing minor invasive procedures in neonates, as it has a calming effect and reduces behavioural indicators of pain (Campbell et al, 2014). There is evidence of the efficacy of a 24% sucrose solution in reducing pain in pre-term and full-term infants during single procedures such as intramuscular injection, venepuncture, and heel lance (Stevens et al, 2016).

Sucrose has an effect time of 1-5 minutes, so administering small portions of the total dose (aliquots) throughout a longer procedure may sustain the duration of its effect (Harrison et al, 2012). Dosing regimens vary and require standardisation (Campbell et al, 2014). Optimal and minimal effective doses have not been firmly established (Stevens et al, 2016) and the safety of repeated doses requires further investigation (Gao et al, 2016). There is evidence that administration should be limited to 10 doses per day, particularly during the first week of life (Harrison et al, 2012). Further guidance regarding the administration of sucrose is available (Howard et al, 2012).

**Breastfeeding**

Breastfeeding, when feasible, is a natural resource that is easily accessible at no cost in the neonatal setting (Shah et al, 2012). It should be started two minutes before, and continued during, the painful procedure (Modarres et al, 2013). Factors that may explain the effect of breastfeeding on the infant undergoing a painful procedure are listed in Box 1.

Compared with placebo, positioning or no intervention, full-term neonates who were breastfed during single heel lance or venepuncture had significantly reduced crying time and a lower increase in heart rate (Shah et al, 2012). Breastfeeding has been shown to reduce pain in full-term neonates having hepatitis B or diphtheria-pertussis-tetanus vaccination (Goswami et al, 2103; Modarres et al, 2013). Further studies are needed to ascertain the safety and efficacy of breastfeeding for repeated painful procedures, and for use in pre-term infants (Shah et al, 2012).

**Non-nutritive sucking**

Non-nutritive sucking (NNS) involves the use of a dummy (pacifier) or non-lactating nipple to stimulate sucking 1-3 minutes before, and during, a painful procedure (Pillai Riddell et al, 2015; Liaw et al, 2013). NNS is thought to stimulate orotactile and mechanoreceptors in the neonate’s mouth, causing the modulation of nociceptive (pain) transmission by endogenous non-opioid mechanisms (Liaw et al, 2013).

International guidance discourages the use of dummies on the grounds that they may interfere with breastfeeding strategies (Bit.ly/UNICEFBabyFriendly), and some health professionals are concerned NNS may cause nipple confusion in the breastfed baby (Lopez et al, 2015), thereby negatively affecting the duration of breastfeeding and exclusive maintenance on breast milk (Howard et al, 2003). However, NNS is recommended in the non-pharmacological management of minor painful procedures of short duration in neonates (Howard et al, 2012; American Academy of Pediatrics et al, 2006). There is evidence of its effect in reducing the immediate reaction to pain and of its calming effect on neonates and older infants during a heel lance. It may also be effective in pre-term neonates (Pillai Riddell et al, 2015; 2011).

**Facilitated tucking**

Facilitated tucking (FT) involves the infant being held in a flexed manner by the carer, in a prone, supine or side-lying position (Sundaram et al, 2013). It is thought to have a calming effect, reducing the energy expenditure and oxygen consumption associated with painful procedures (Kucukoglu et al, 2015). The carer should place warmed hands gently on the infant’s head and buttocks, or at its hands and feet (Sundaram et al, 2013; Liaw et al, 2012). Minimal restraint should be applied to create a foetal-like position, with the infant’s hands and feet in a midline position close to the trunk (Golianu et al, 2007; Axelin et al, 2006). FT has been safely used in neonates from 23-36 weeks’ gestation undergoing heel lance or suctioning, and may be beneficial in reducing neonate’s response to painful procedures (Pillai Riddell et al, 2015; Obiedat et al, 2009). Further research is needed to identify any side-effects and evaluate the efficacy of this technique.

**Swaddling**

Swaddling (Fig 1a) contains reflex limb responses of young infants (Huang et al, 2004), reducing physiological responses to pain such as increased heart rate and reduced oxygen saturation (Shu et al, 2014). It is thought to reduce neonates’ stress response by stimulating proprioceptive, tactile and thermal systems; blocking nociception and promoting inhibitory mechanisms (Parry, 2008). A large cotton swaddling blanket, roughly 90cm x 90cm is placed under the infant, whose arms are flexed and placed close to the body with hands clasped or loose. Each side of the blanket is wrapped across the trunk and tucked under the body. The end of the blanket on the feet and legs is folded loosely up towards the abdomen or downwards under the back. In this way, the lower limbs are restricted from excessive movement but the blanket is loose enough to allow access to the limb to be used for the procedure. That limb should be removed from under the blanket for the procedure and placed back under it afterwards (Pillai Riddell et al, 2015; Shu et al, 2014; Johnston et al, 2011; Huang et al, 2004). Swaddling should begin 3-30 minutes before the procedure, and be continued for 5-31 minutes afterwards. The child may be held in an upright or supine position (Shu et al, 2014; Morrow et al, 2010; Huang et al, 2004; Prasopkittikun and Tilokskulchai, 2003).

Although more research is needed to draw firm conclusions, there is evidence to support the use of swaddling (Pillai Riddell et al, 2015), which has been found to reduce pain response to heel lance in full-term and premature neonates (Shu et al, 2014;
Nursing Practice Review

Fig 1. Non-pharmacological approaches

Box 2. Guidelines: acute procedural pain in neonates

Procedural Pain in the Neonate
Bit.ly/APAPainGuideline2012 (free)

Guidelines for Procedural Pain in the Newborn Bit.ly/LagoEtAl2009 (free)

Evidenced-based Clinical Practice
Guideline for Management of Newborn Pain Bit.ly/SpenceEtAl2009


Skin-to-skin care (SSC)

SSC (Fig 1b) — also called kangaroo care — has been used in neonates from 26 weeks’ gestation having painful procedures (Warnock et al, 2010). For around 25 minutes before the procedure, the infant, wearing only a nappy, is placed in an upright position on the bare chest of their parent and covered with a blanket. The parent’s clothing is applied over the blanket (Warnock et al, 2010; Chermont et al, 2009; Johnston et al, 2008).

SSC is thought to provide an analgesic effect by enhancing endogenous opioid activity (Chermont et al, 2009). It is a safe and effective method of reducing pain associated with a single painful procedure such as heel lance, venepuncture or intramuscular injections; however, the optimal length of treatment, long-term effects and efficacy in repeated painful procedures require further research, as does the effect of SSC at different gestational ages (Johnston et al, 2014).

Conclusion

Acute procedural pain in neonates and infants has potential long-term consequences and should therefore be effectively managed. A range of non-pharmacological strategies are available to health professionals, who can also refer to the clinical guidelines listed in Box 2.

References


For more on this topic go online...

- Treatment for early onset neonatal sepsis
  Bit.ly/NTNeonatalSepsis

Managing pain in children series

Part 1: Guidelines, strategies and tools for pain assessment in children

Part 2: Non-pharmacological treatment of pain in neonates and infants

Part 3: Procedural pain management in children and young people

May

Jun

Jul

Part 4: Clinical practice guidelines for pain management in children and young people

Copyright EMAP Publishing 2017
This article is not for distribution

Nursing Times [online] June 2017 / Vol 113 Issue 6

www.nursingtimes.net