Procedural pain relief for neonates: Non-pharmacological methods

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ABSTRACT

It has been argued for years that neonates are unable to feel pain and therefore assessment and management of pain was not part of routine care delivery (Anand 2001, Rouzan 2001, Leef 2006, Castral et al 2007). However, such misconceptions have been quashed by the surge of evidence based data which showed that critically ill neonates often have several types and sources of pain and discomfort (Anand and Hickey 1987, Rouzan 2001). It has been documented that hospitalised neonates can face up to 400 painful procedures whilst they are being cared for in neonatal intensive care units (Cignacco et al 2005, Harrison et al 2006). The most common painful procedures performed daily include heel lancing, venepuncture and endotracheal intubation (Anand 2001, Harrison et al 2006). Even with a considerable body of research evidence that has proven not only that neonates are able to feel pain, but also that prolonged exposure to pain can have potentially devastating consequences, including death, it appears that pain management is still far from optimal in nature (Anand 2001, Rouzan 2001, Leslie and Marlow 2006). There should be recommendations for improvements in neonatal nursing practice, specifically regarding pain assessment and the use of non-pharmacological methods during painful procedures in the neonatal clinical settings.

Key words Neonates, Procedural Pain, Neonatal Pain Assessment, Non-Pharmacological Methods, Neonatal Nursing Practice

Introduction

The advancements in medical technology and nursing care have ensured that sick premature and term neonates have higher survival chances than they had even a decade ago (Anand 2001). Some neonates require specialist care and support and are therefore nursed in special care and intensive care settings. Many of these neonates experience daily painful procedures such as heal pricks, cannulations, endotracheal intubations and chest tube insertions (Cignacco et al 2006, Bilgen et al 2001). Although these procedures are vital and may
improve chances of survival the neonatal staff may not recognise and manage the pain associated with these procedures (Simmons et al 2003). Recently research evidence has started to emerge regarding under treatment of neonates during painful procedures (Twycross 2006, Gibbins et al 2002, Hodgkinson et al 1994, Anand and Hickey 1987).

Many misconceptions have been held regarding neonates’ ability to perceive and experience pain (Twycross 2006, Rouzan 2001, Abu-Saad 1998). These misconceptions include that neonates had an underdeveloped central nervous system, and that nerve fibres had to be myelinated to be able to project pain back to pain receptors and that neonates were unable to remember painful experiences. However, such claims were disputed by Anand and Hickey (1987) in their research of neonatal pain. They proved that premature infants have the neurotransmitters that transmit pain, and that they also have poorly developed mechanisms by which to inhibit pain. Research conducted by Truog and Anand (1989) confirmed that neonates are able to experience pain. Scanlon (1991) found evidence to suggest that premature neonates may also be even more sensitive to pain than term neonates. So it is imperative that neonatal nurses and all healthcare professionals involved in the care of these infants are aware that although neonates have an inability to verbally communicate pain they do not have inability to experience it (Bouwmeester et al 2005). Procedural pain relief for neonates should be a priority for neonatal nurses to recognise and manage and this management should include all methods that will offer effective pain relief. There is support that neonatal nurses could use non-pharmacological methods as an adjunct to pharmacological methods as a way to support the relief of pain and its management in this vulnerable group. Firstly however the procedural pain should be identified and assessed to allow management to be tailored to the individual neonate.

Neonatal Pain

Pain is a complex process and has been defined by McCafferty (1999) as ‘whatever the patient says it is and occurring whenever the patient says it does’ (p.5). However, such a claim warrants no acceptability in the neonate as it implies that only patients that are able to verbally communicate would therefore be able to state that they are in pain. This leaves vulnerable patients, such as neonates who are unable to formally communicate their distress under treated for pain (Twycross 2006). The most commonly used definition of pain is one
devised by the International Association for the Study of Pain (IASP) in 1979, whereby the pain was defined as: ‘...an unpleasant emotional and sensory experience accompanied with actual or potential tissue damage’ (p.250). Again this is a definition that fails to incorporate those unable to communicate verbally, such as neonates their distress and pain (Twycross 2006). Such omission was recently recognised by the ISAP (2001) and amendments to their original definition were made to incorporate this aspect by highlighting that the inability to verbally describe painful events in no way negates the possibility that pain is not experienced by a neonate.

Pain perception is an important part of life and development and it has protective qualities as it serves as a ‘signalling system’ for tissue damage (Twycross, 2006). As such it is a warning sign that incorporates behavioural and physiological responses as accurate indicators of pain. Behavioural changes, argues Twycross (2006) are detectable through holistic observation of the neonate while the physiological changes are measurable through assessments of the vital signs including blood pressure. The importance of early recognition, prevention and treatment of pain in neonates cannot be underestimated (Anand 2001). To highlight its impact, pain has been described by Twycross (2006) as the fifth vital sign drawing attention to its ever changing status and potentially damaging effects. Procedural pain causes physiological changes in the body of a neonate where an inflammatory response to the damaged tissues is initiated, while a stress response induces hormonal and metabolic changes affecting stability of the homeostasis (Bennet 2001). Severe unrelieved pain can cause an overwhelming stress response in both preterm and term neonates, which can lead to serious complications, including death (Pasero 2004).

Due to the mounting evidence regarding the potentially harmful consequences of untreated pain in neonates, The Evidence Based Group for Neonatal Pain, which consisted of medical experts from several countries, used systematic reviews and data synthesis with open discussion, to review current evidence and clinical practice and their findings were published in a document entitled: ‘A Consensus Statement for the Prevention and Management of Procedural Pain in the Newborn’ (Anand, 2001). One of the main factors underpinning this document was the need to consider management of pain as an imperative part of the care delivery to all neonates regardless of their gestational age or severity of their condition. This document also provides recommendations for clinical practice improvements highlighting the need for regular pain assessment and the importance of utilising not only available pharmacological but also non-pharmacological strategies to reduce pain during procedures.

However in a survey, carried out by McKechnie and Levene (2008) of all neonatal units in the United Kingdom, they found that no pain guidelines were present in 25% of units and additionally no guidelines for routine painful procedures were present in the majority of the neonatal units in the UK. Other reports from Canada, Italy, Australia and Norway showed similar findings (Johnston et al 2003, Lago et al 2005, Harrison et al 2006, and Andersen et al 2007). Even though there is a substantial body of ever-expanding research into the context of prevention of procedural pain in neonates, it is clear that pain assessment and management in the neonatal population is still highly variable. Hence regardless of the numerous research findings, it appears that many are not being incorporated into clinical practice, leaving neonates exposed to unnecessary pain and suffering. Neonatal nurses should and must be in an ideal position to have a positive impact on procedural pain management in neonatal units. They have a moral and ethical responsibility to learn and develop their knowledge regarding assessment and management of neonatal pain including procedural pain (Rouzan 2001).

Neonatal pain assessment

Most nurses rely on patients’ ability to verbally express the existence and intensity of pain. However in specialist a setting such as neonatal intensive care units, such self-report is completely entrusted into the neonatal nurses own perception (Herr et al 2006). As such, neonatal pain assessment becomes subjective in nature relying solely on the neonatal nurse’s individual perceptions unless an appropriate pain assessment tool is used as an aid (Twycross 2002). Over the last decade numerous pain measuring tools have been devised to assist clinicians in evaluating, assessing and managing pain in neonates (Burton and MacKinnon 2007, Twycross 2006, Boyd 2003, Hockenberry et al 2003, Abu-Saad et al 1998). They are highly sought after as they provide a framework for assessment and management of pain in neonates.
The main aim of pain assessment is early recognition of pain so that interventions to minimise the immediate and long-term consequences of pain can be implemented (Gibbins and Stevens 2005). Use and availability of pain assessment tools as aids in making decisions regarding management of procedural pain in neonates has been supported by research (Twycross 2006, Hockenberry et al 2003, Stevens et al 1996). There is numerous pain assessment tools specifically designed for use in neonatal intensive care units such as: Premature Infant Pain Profile-PIPP (Stevens et al 1996), CRIES (Bildner and Krechel 1995), Riley’s Infant Pain Scale-RIPS (Joyce and Schade 1994), The Neonatal Infant Pain Scale-NIPS (Lawrence and Alcock 1993), Neonatal Facial Coding System-NFCS (Grunau et al 2001). Their applicability and utilisation into clinical practice and their usefulness cannot be underestimated. However their validity, reliability and at times complex structures can potentially leave many neonatal nurses debating their effectiveness in clinical settings. Nonetheless, one pain assessment tool, Premature Infant Pain Profile (PIPP), has been vigorously tested in numerous research based studies (Jonsdettir and Kristjansdottir 2005, Simmons et al 2003, Stevens et al 1996) and it has been concluded that PIPP is a valid, reliable and user responsive tool, designed to measure neonatal procedural pain and can provide neonatal nurses and healthcare professional with an objective measure of pain, being experienced by both preterm and term neonates.

Non-pharmacological methods of pain relief

It has been recommended that to ensure protection against procedural pain neonates should be safeguarded from the potentially life threatening consequences of exposure to frequent pain by the use of both pharmacological and non-pharmacological properties. None of the non-pharmacological measures when tested in isolation completely alleviate the effects of the procedural pain. However, research shows that when used in conjunction with other non-pharmacological measures, pain experience is significantly reduced minimising distress and ensuring effective and prompt return to the pain free status (Johnston 1999). The aim of non-pharmacological pain management is to utilise available non-pharmacological methods during painful procedures to minimise pain and distress in neonates. There are four main non-pharmacological methods that are commonly used to relieve pain in neonates. These methods being sucrose, breast milk, skin to skin contact and music.
The first method that neonatal nurses should consider in the management of procedural pain relief is sucrose. Researchers have found that sucrose may have pain relieving properties that stimulate analgesic like reactions in the body therefore minimising pain impact (Anand 2001, Mitchell and Waltman 2003, Harrison et al 2006, Leef 2006). Giving sucrose is the most widely studied non-pharmacological intervention for minimising procedural pain in neonates (Boyle et al 2006, Leslie and Marlow 2006, Cignacco et al 2006, Bilgen et al 2000). Sucrose is available in a wide range of dose concentrations; however doses of less then 0.12g have shown to be ineffective during invasive procedures in neonates (Boyle et al 2006). A study by Gradin et al (2002) compared use of a pharmacological local anaesthetic agent, EMLA cream, and the non-pharmacological preparation, sucrose, for pain reduction during venepuncture in neonates. Findings revealed that neonates receiving sucrose had significantly lower PIPP scores when compared with neonates in EMLA group. However, this study used term neonates, ≥ 36 weeks gestation. Therefore their findings could only be generalised in terms of its application to the healthy term neonates (Cormack 2000, Polit and Beck 2006).

Adverse effects of oral Sucrose, when used for procedural pain relief in neonates, seemed to be limited, (Anand et al 2001). However, Anand (2001) warned that due to such a shortage of evidence based research, the long term effects of sucrose administered to pre-term and term neonates, including hyperglycaemia, warrants health care professionals to remain vigilant whilst using sucrose especially if repeated doses where to be administered. Horwitz (2002) found that following the administration of the Sucrose, either with a syringe, dropper or a pacifier, transient desaturation and choking were noted in some neonates. Therefore, Horwitz (2002) concluded that the volume as well as the administration techniques will influence the degree of these adverse effects. These findings were supported by Gibbins et al (2002) whose research reported robustly on the short-term adverse effects of sucrose, reporting a 3% rate of problems including choking and desaturation. In a study by Johnston et al (2002)107 pre term neonates, with gestational age ≥ 31 weeks, were evaluated to determine the efficacy of sucrose giving analgesic effects for procedural pain in the first week of life. Motor development and alertness were followed up at the ages of 32, 37 and 40 weeks gestation. It was noted by the researchers that lower scores on motor development, vigour and alertness were observed in the sucrose group and that there was a correlation between the repeated doses of sucrose during the first week of life and the lower neuro-developmental scores (Johnston et al 2002). The researchers exercise caution against the use of sucrose
especially in pre-term neonates ≤ 31 weeks gestation, citing that further research is required to establish an optimal dose, administration route and primarily any potential adverse effects that the use of repeated doses of sucrose could have on the developmental outcomes of the pre-term neonates (Johnston et al 2002). Stevens et al 1997, noted high variations in the dosage ranges (0.012-0.12 g.); with doses as low as 0.01g. showing some benefit to pre-term neonates. However, Stevens et al (1997) also concluded that doses above 0.5g had no additional benefit over the lower doses. Stevens et al (1997) although, supporting the use of sucrose and recognising its benefits in minimising procedure related pain in the neonatal population, it underlines that such support is valid only when discussing sucrose analgesic effect during a single painful event (heel lancing or venepuncture). An implication for clinical practice perhaps mainly lies in the lack of clear guidelines regarding optimal doses and frequency of sucrose use in neonates (Leslie and Marlow 2006, Leef 2006).

A second non-pharmacological method for relief of procedural pain that neonatal nurses could consider is the use of breast milk. Breast milk has been studied by researchers’ to investigate whether breast milk has any preventative and analgesic effects that could be utilised during painful procedures (Shah et al 2006, Schollin 2004, Shendurnikar and Gandhi 2005, Bilgen et al 2001). Shah et al (2006) evaluated the effectiveness of breastfeeding and expressed breast milk administration in minimising the impact of procedural pain in neonates. This review highlighted 11 randomised and quasi-randomised trials of which five trials compared breastfeeding, whilst the effects of the expressed breast milk were studied in six trials, with no treatment or other treatment in both full term and pre-term neonates undergoing a single painful procedure (venepuncture or heel lancing). Neonates who were breastfed whilst undergoing a painful procedure showed greater reduction in behavioural and physiological responses to pain, when compared to neonates that either received placebo, no intervention or positioning (Shah et al 2006). Therefore, Shah et al (2006) recommended that breastfeeding should be used when available as a non-pharmacological intervention as it provides some analgesic relief during single painful procedures. Although the researchers emphasize that none of the studies claimed that breastfeeding eliminates procedural pain completely, it is beneficial and has a hidden benefit of being cost-effective (Shah et al 2006).

The third non pharmacological method is to utilise one of the most natural and instinctive ways to comfort that of skin to skin contact. Kirsten et al (2001) describe this skin to skin contact kangaroo care as a unique bond between mother and her newborn following the birth and thereafter, particularly in preterm neonates. Kangaroo care is a way of holding a neonate
so that there is skin-to-skin contact between the neonate and the person holding the baby. Even though in many Western cultures the majority of nursing care has been based on ever changing medical advances, this natural bonding process appears to have a significant and positive impact on the care of very sick preterm and term infants, with added benefits to maternal well-being (Charpak et al 2005, Castral et al 2007). Johnston et al (2003) conducted a study on 74 preterm neonates with gestational age $\geq$ 32 weeks using a validated pain assessment tool, Premature Infant Pain Profile (PIPP), to investigate whether kangaroo care has any positive impact on pain responses in neonates during painful procedures. The study concluded that there was a significant reduction in pain responses shown in comparison to control group at all intervals (30, 60 and 90 seconds). Although the vital signs, heart rate and oxygen saturation readings were very similar between groups, the facial expressions as indicators to pain being experienced was according to research results 20% more evident in the control group. Therefore, neonates who receive skin-to-skin contact appear to have reduced behavioural and physiological responses to acute procedural pain (Castral et al 2007).

The fourth method of non-pharmacological pain relief is the use of music. It has for many years been thought that music can have beneficial effects on neonatal growth and development. According to Kemper (2005) music is widely used in the health care settings for both paediatric and adult patients. It is thought that analgesic effects of music stem from indirect effect on attention, where distraction averts concentration, enabling slower process of painful stimuli (Tsao et al 2007). In studies, which have focused on the effects of different sounds including instrumental music, cappella singing and intrauterine sounds, there is evidence of beneficial impact of such sounds (Burke et al 1995, Bo and Callaghan 2000, Butt and Kisilevsky 2000). All studies found that regardless of what type of music was being played, the beneficial effects on the pain responses were highly evident, almost instantly. Physiological parameters such as increased heart rate and more requirements for oxygenations were noted. However, rapid return to initial values was observed and the reduction in the excitation state was also noted. Music seemed to have greatest influence over stabilisation of heart rate. Research findings show that music should be played to neonates experiencing acute procedural pain. However, its use should be time limited, 15 minutes per intervention, to prevent the risk of sensory overload (Bo and Callaghan 2000, Butt and Kisilevsky 2000).
The four methods discussed have all shown to be effective in minimising procedural pain in preterm and term neonates. However, none have shown that when used in isolation or during multiple painful exposures their effects remain. It is therefore recommended whenever possible that non-pharmacological methods are used in conjunction with pharmacological agents to ensure that neonates are at all times exposed to procedural pain experiences have their pain effectively managed. Use of non-pharmacological methods is usually practical and easily implemented into daily care and can provide neonatal nurses with a range of methods for preventing procedural pain and protecting neonates.

Conclusion

Neonatal nurses and other healthcare professionals must safeguarded neonates from procedural pain by ensuring that appropriate pain relief is available. Research by (Lehr and Taddio 2007, Anand 2001, Heaton and Herd 2000) has advocated use of non-pharmacological methods in conjunction with pharmacological analgesia to minimise the procedural pain. Perhaps additionally these methods can assist in prevention of the long term consequences that can effect neonates from pain exposure (Heaton et al 2007, Axelin et al 2006, Lago et al 2005, Anand et al 2004, Huang et al 2004, Simmons et al 2003). However none of the non-pharmacological measures discussed completely alleviate the effects of the procedural pain. However, research shows that when used in conjunction with pharmacological measures, the pain experience is significantly reduced hence minimising distress and ensuring effective and prompt return to the pain free status (Johnston 1999). The complexity of ensuring optimal pain management in neonatal units cannot be underestimated (Halimaa 2003). However, the responsibility for its utilisation lies with neonatal nurses and all healthcare professionals working and caring for neonates. As Rouzan (2001) points out, ethically and morally pain management in neonates is not an option but a necessity.

Bibliography


