Managing pain during the first year of life

Managing a child's pain during the first year of life involves assessing pain intensity, implementing a treatment plan and evaluating the effectiveness of the treatment provided. This paper discusses the fact that infants feel as much pain as older children and investigates the consequences of not managing pain effectively. Ways of assessing pain during the first year of life and the pain-relieving interventions available are outlined.

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Key points

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1. Neonates/infants feel as much pain as older children and adults in a similar situation.
2. Not relieving pain effectively, has a number of undesirable consequences.
3. There are several ways of assessing a child's pain during the first year of life.
4. A combination of analgesic drugs and non-drug pain-relieving methods should be used to manage pain.

Definition of pain

In 1979, The International Association for the Study of Pain defined pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, described in terms of such damage[1]. This definition highlights that pain is subjective and a complex and multi-faceted phenomenon. However, it falls short in relation to those unable to communicate verbally, including neonates and young children. Pain perception is an inherent part of life that appears early in development to serve as a signalling system for tissue damage[2]. The signalling includes behavioural and physiological responses that are valid indicators of pain – behavioural responses which can be detected by observation and the physiological responses by measurement, such as blood pressure and pulse. The definition of the International Association for the Study of Pain has recently been amended to incorporate this aspect:

> "The inability to communicate in no way negates the possibility that an individual is experiencing pain and is in need of appropriate pain relieving treatment[3] (p.2)

Do infants feel as much pain as adults?

In the past, healthcare professionals often claimed that neonates and infants do not experience as much pain as adults. However, several papers have reviewed the evidence for such a belief, and shown it is false[4-7]. Nociception is the detection of a noxious stimulus and the transmission of information from the periphery to the brain. Nociception does not involve evaluating or attributing meaning to the subjective experience called pain; neonates/infants can, therefore, experience pain even if they do not understand what it is they are feeling.

Incomplete nerve fibre myelination was also used as an argument that neonates were incapable of pain perception. However, it is now known that painful stimuli are transmitted by both myelinated and unmyelinated fibres[8-9]. Incomplete myelination merely implies a slower conduction speed in the nerves, which is offset by the shorter distances the impulse has to travel[8, 10].

Crying and altered facial responses indicate that infants experience distress. Neonatal responses to heel-prick were videotaped in one study by Franck[11] in which it was that a two-component response to painful stimuli was demonstrated – immediate withdrawal of both legs followed by crying[11]. The crying was often accompanied by vigorous motor activity involving facial grimacing and movement of all extremities. Owens[12] suggested that:

> "The burden of proof should be shifted to those who maintain that infants do not feel pain." (p.215)

More recent studies confirm Owens' suggestion and the findings of Franck's[11] study. Indeed the International Consensus Statement for the Prevention and Management of Pain in the Newborn states that, compared with older age groups, newborns may experience a greater sensitivity to pain and are more susceptible to the long-term effects of pain[13].

Neonates have repeatedly been shown to demonstrate behavioural responses to pain[7, 14-16]. Although it is not possible to ask

neonates how much pain they are experiencing, one study demonstrated that behavioural cues indicative of an infant being in pain, decreased following the administration of analgesic drugs[17]. Thus, an infant's behavioural cues can provide an indication that they are in pain. Pain pathways (although immature) are present at birth and pain impulses are able to travel to and from the pain centres in the brain.

The effects of unrelieved pain

Painful experiences are part of life for every child and not being able to feel pain results in extensive damage to the body. However, unrelieved pain has a number of undesirable physical and psychological consequences which are summarised in **TABLE 1**. These demonstrate the importance of managing pain effectively.

- Rapid shallow breathing which can lead to alkalosis
- Inadequate expansion of lungs which can lead to bronchiectasis and atelectasis
- Inadequate cough which can lead to retention of secretions
- Increased heart rate and tissue ischaemia
- Patient will not move spontaneously and will not ambulate
- Increased fluid and electrolyte losses resulting in rapid respiration and increased perspiration and metabolic rate
- Increased risk of intracranial haemorrhage in neonates
- Psychological consequences, resulting in nightmares about pain and surgery – the patient will be less co-operative in the future and will have increased anxiety.
- May disrupt maternal bonding process

TABLE 1 Consequences of unrelieved pain.

Poor pain management in early life can affect children when older. One study examined the pain-related attitudes in two groups of children, aged 8-10 years[18]. One of the groups (very low birthweight) had been exposed as neonates to painful procedures, whereas the other group had not. The two groups of children did not differ in their overall perceptions of pain intensity. However, the very low birthweight children rated medical pain intensity significantly higher than psychosocial pain, suggesting that their early experiences affected their later perceptions of pain. Further, in a separate study, boys who had been circumcised without anaesthesia as neonates, were observed to react significantly more intensely to vaccinations than uncircumcised boys[19]. Effectively managing pain in children during the first year of life is, therefore, imperative.

Assessing pain during the first year of life

Knowing how much pain a child is experiencing is the first step to providing effective relief. Even with patients who can communicate about their pain, pain assessment is complex. With children who are unable to verbalise their pain, assessing pain is even more complicated. However, using a combination of behavioural and physiological indicators, it is possible to obtain a measure of a child's pain.

Behavioural indicators of pain

Behavioural cues are a useful indicator of pain in children; some of the commoner behavioural cues are outlined in **TABLE 2**. There are no hard and fast rules about which behaviours indicate pain; a change from normal behaviour can indicate pain. Consulting parents about their child's normal behaviour is therefore essential. However, because children's pain behaviours are sometimes misleading, behavioural cues should be used in conjunction with other methods of pain assessment.

These behavioural cues may not be as apparent in the neonate. However, neonates do demonstrate behavioural pain cues. These include: facial expression, cry, gross motor movement, and changes in behaviour (such as sleeping and eating patterns). The typical facial expressions of pain are[16]:

- bulging brows and forehead
- eyes squeezed tightly closed
- cheeks raised to form a nasolabial furrow
- mouth opened and stretched – horizontally and vertically – so that it appears squared

General Behaviours	Specific Behaviours
Changed behaviour	Banging head
Irritability	Pulling ear
Flat effect	Curling up on side
Unusual posture	Refusal to move limbs
Screaming	Constantly rubbing specific region
Reluctance to move	
Aggressiveness	
Increased clinging	
Unusual quietness	
Loss of appetite	
Restlessness	
Whimpering	
Sobbing	
Lying "scared stiff"	
Lethargy	
Disturbed sleep pattern	

TABLE 2 Behavioural indicators of pain in children.

Gross body movements, such as attempts to withdraw from a painful stimulus, are also indicators of pain in infants. However premature or sick infants may not display these signs, but rather become limp and flaccid in response to noxious stimuli[16].

Use of physiological indicators of pain

Physiological signs can be used to establish whether children are in pain (**TABLE 3**). However, if pain persists over a period of time, adaptation occurs decreasing these sympathetic responses and thus there may be no alteration in a child's physiological signs. Physiological cues also change as a result of anxiety, crying or handling. When assessing a child's pain, physiological cues should, therefore, be used in conjunction with other variables to assess pain.

Pain assessment tools

Several pain assessment tools that combine behavioural and physiological indicators of pain are available for use with neonates and infants. When deciding which pain

Observation	Change in observation
Heart rate	Increases when in pain (after an initial decrease)
Respiratory rate	There is conflicting evidence about whether this increases or decreases, but there is a significant shift from baseline
Blood pressure	Increases when a child is in acute pain
Oxygen saturation	Decreases when a child is in acute pain

TABLE 3 Physiological signs used to assess pain[20-22].

Categories	Behaviours	Scoring
Face	No particular expression or smile	0
	Occasional grimace or frown, withdrawn, disinterested	1
	Frequent to constant quivering chin, clenched jaw	2
Legs	Normal position or relaxed	0
	Uneasy, restless, tense	1
	Kicking or legs drawn up	2
Activity	Lying quietly, normal position, moves easily	0
	Squirming, shifting back and forth, tense	1
	Arched, rigid or jerking	2
Cry	No cry (awake or asleep)	0
	Moans or whimpers, occasional complaints	1
	Crying steadily or sobs, frequent complaints	2
Consolability	Content. Relaxed	0
	Reassured by occasional touching, hugging, being talked to, distractable	1
	Difficult to console or comfort	2

TABLE 4 The FLACC pain assessment tool.

assessment tool to use with neonates their gestational age and health status also need considering. An example of a tool used for preverbal children is the FLACC[23] (**TABLE 4**). This has been validated for post-operative children aged 2 months to 7 years. The scores for each category are added together to give a rating of 0-10. Other pain assessment tools validated for use in this age-group are listed in **TABLE 5**.

Pain-relieving interventions

Once a child's pain has been assessed a treatment plan should be devised. This will include the administration of analgesic drugs and the use of non-drug methods of pain-relief.

Analgesic drugs

There are three types of analgesic drugs that can be used to treat pain in neonates and infants: non-opioids, weak opioids and strong opioids. The action of the different types of analgesic drugs are outlined in **TABLE 6**. The metabolism of neonates/infants differs from that of the older child and thus when prescribing and administering analgesic drugs, the pharmacokinetics and pharmodynamics of analgesic drugs in the neonate/infant need to be taken into account. Some examples of the factors that affect drug metabolism are:

- Gastric emptying is significantly slower in neonates and even slower in premature infants leading to delayed and/or incomplete absorption of some analgesic drugs.
- In infants brain and viscera constitute a greater proportion of body mass meaning that the passage of opioids into the brain is increased.

These are **not** reasons for **not** administering analgesic drugs to the neonate/infant. However, when administering analgesic drugs these factors must be considered and appropriate precautions taken. For example, if administering opioid analgesia, careful observations of the neonate/infant's respiratory function should be carried out.

Non-drug methods

There are several non-drug methods that can be used specifically with neonates/infants. These are outlined in **TABLE 7**.

Documentation

An important aspect of pain management is ensuring that pain intensity scores are documented. The pain-relieving interventions implemented and their effectiveness should also be recorded. Good documentation improves communication about the child's pain management and thus ensures a better continuity of care.

Conclusion

This paper has provided an overview of steps required to manage pain effectively during the first year of life. This includes assessing pain, using analgesic drugs and non-drug pain relieving methods. The importance of good documentation has also been emphasised. The United Nations Organisation, in its Declaration of the Rights of the Child, states that children should, in all circumstances, be among the first to receive protection and relief, and should be protected from all forms of

Drug type	Action
Paracetamol	• The most commonly prescribed analgesic in children • Appropriate for mild pain or as an adjunct to more potent analgesics • Thought to act by inhibiting prostaglandin synthesis in the brain • Probably impairs the perception of pain
Nonsteroidal anti-inflammatory drugs (NSAIDs) E.g. ibruprofen, diclofenac	• Used for mild to moderate pain • Have an inflammatory, anti-pyretic and analgesic action and inhibit/block the action of cyclo-oxygenase, an enzyme necessary in the formation of prostaglandins • This decreases pain as prostaglandins sensitise the pain receptors and thus make them more likely to become activated by other chemicals released during trauma • Containdicated if there is a renal impairment, hypovolaemia, low platelets or tendency to bleed, liver disease, children under 6 months, gastric ulceration and immuno-compromised children. Should be used with caution in children with asthma (may increase symptoms)
Opioids E.g. codeine, morphine	• Used for moderate to severe pain • Act on the body's opioid receptors which are found throughout the central nervous system • Opiate analgesics bind to these receptors and activate them, mimicking the effect of the endogenous enkephalins • Most opioid drugs are agonists, resulting in stimulation of the receptor • Opioid "partial agonists" (e.g.buprenorphine) bind to receptor sites but elicit only a partial response. They may antagonise the effects of more potent pure agonists by occupying the same binding sites. For this reason drugs such as buprenorphine and morphine should not be given together • Antagonists (e.g. naloxone) work by blocking the receptor sites and reversing the action of opioids

TABLE 6 The action of analgesic drugs.

Tool and reference	Validated	Indicators	Comments
CHEOPS[24, 25] (Children's Hospital of Eastern Ontario Pain Scale) Neonates/infants/toddlers	Yes	Alertness, calmness/agitation, respiratory response, physical movement, blood pressure, heart rate, muscle tone, facial tension	Disadvantages: • Complicated behavioural scale • May not track pain well in 3-7 year olds as pain behaviour inhibited • 10 categories, 4 of which are similar • Confusing (high score = low pain) • Cannot be used in intubated or paralysed patients
COMFORT[26] Neonates/infants/toddlers	Yes	Alertness, calmness/agitation, respiratory response, physical movement, blood pressure, heart rate, muscle tone, facial tension	Disadvantages: • Complicated • 8 categories and many sub-categories • Cannot be used in intubated or paralysed patients
CRIES[27] (Crying, Requires O_2 for saturation above 95, Increased vital signs, Expression and Sleeplessness Neonates	Yes	Cries, oxygen saturation, heart rate/ blood pressure, expression, sleeplessness	Advantages: • Easy to remember and use • Valid and reliable down to 32 weeks' gestational age • Reliable between observers • Tracks pain and the effect of analgesics Disadvantages: • Uses oxygenation as a measure, which can be affected by many other factors • BP measurements may upset babies
FLACC[23] Infants/toddlers	Yes	Face, Legs, Activity, Cry, Consolability	• Behavioural scale • Postoperative pain • 5 categories to score (0-2) • Easy to use in practice • Validated for postoperative children aged 2 months to 7 years
LIDS[14] Liverpool Infant Distress Score Neonates	Yes	Spontaneous movements, spontaneous excitability, flexion of fingers and toes, facial expression, quantity of crying, sleep pattern and amount	Advantages: • Assesses postoperative pain • 0-5 point scale
NFCS[28] Neonates	Yes	Bulging brows, eyes squeezed tightly shut, deepening of nasolabial furrow, open lips, mouth stretched, taut tongue	Anatomically based system for assessing facial expression
NIPS[29] (Neonatal Infant Pain Scale) Neonates	Yes	Facial expression, cry, breathing patterns, arms, legs, state of arousal	Disadvantages: • Uses 6 categories, 2 of which are similar • Hard to remember • Cannot be used in intubated or paralysed patients
OPS[30-32] (Objective Pain Scale) Neonates/infants/toddlers	Yes	Blood pressure, crying, movement, agitation, verbal evaluation/body language	Advantages: • Easy to use • 5 categories • Reliable between observers • Tracks pain and score decreases with analgesia Disadvantages: • BP measurements may upset neonates • Cannot use in intubated paralysed babies
PIPP[33] (Premature Infant Pain Scale) Neonates	Yes	Gestataional ages, behavioural state, heart rate, oxygen saturation, brow bulge, eye squeeze, nasolabial furrow	Advantages: • Each indicator evaluated on a 4 point scale • Total score dependent on infant's gestational age Disadvantages: • 7 indicator pain measures
TPPPS[34] (The Toddler/Pre-Schooler Postoperative Pain Tool) Infants/toddlers	Yes	Verbal pain, complaint/cry, groan/moan/grunt, scream, open mouth squint, brow bulge, restless motor behaviour, rub/touch	Advantages: * Validated for postoperative children aged 1-5 years • Tracks pain relief and effects of analgesia • Correlates with nurse and parental pain assessments Disadvantages: • 7 categories to score

TABLE 5 Pain assessment tools for use with neonates (0-1 month) and infants and toddlers (1 month-3 years) (adapted from Royal College of Nursing, 2000[39]).

neglect, cruelty and exploitation[36]. This can be applied to the management of pain, particularly as good practice guidelines are available[37, 38]. Although some postoperative discomfort is inevitable, children should not have to experience prolonged moderate to severe unrelieved pain. Not providing children of any age with satisfactory pain relief can be considered a violation of their human rights. Indeed, when the consequences of unrelieved pain are taken into account, managing children's postoperative pain effectively can be seen as an ethical imperative.

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Factor	Description
Environmental factors	Managing environmental factors such as bright lights and reducing the volume of monitor alarms are effective ways of reducing and/or preventing pain in the neonate/infant Maintaining a normal sleep/wake cycle within the intensive care unit by dimming lights at night has also shown to promote well-being in the neonate/infant
Developmentally sensitive care	Positioning: • Proper positioning affects a neonate/infant's physiological and behavioural responses • Care should be taken to position a neonate/infant as normally as possible despite the need to attach monitors, probes, etc. Containment/swaddling: • Containment/swaddling increases an infant's feelings of security and self-control and reduces stress • Swaddling and a neonate/infant reduces the length of time taken for behavioural and physiological cues to return to normal following a painful procedure Non-nutritive sucking: • There is an increasing body of research that demonstrates the pacifying effect of a dummy during painful procedures
Sucrose	The administration of sucrose with and without non-nutritive sucking (dummy) has been used to manage procedural pain in the neonate/infant A systematic review of the efficiacy of sucrose suggests that it is a safe and effective method of reducing procedural pain[35] Information about the optimum dose remains inconclusive

TABLE 7 Non-drug methods of pain-relief for neonates/infants (adapted from Stevens, 1999[16]).