Chapter

17

Perioperative Analgesia in Children

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Introduction

Pain following surgery continues to be a common experience in children, despite advances in acute pain management. The effective and safe management of pain in children of all ages requires significant knowledge of the biopsychosocial experience of pain and strategies available for its management. Numerous factors can influence the success of analgesic treatment:

- Developmental age has a profound effect on both the processing of nociceptive information and the response to analgesia.
- The pharmacology of all drugs is age and size dependent, requiring appropriate dosage adjustments.
- Communication with the very young or those with developmental delay can influence the ability to assess pain and monitor the response to treatment.

Pain Perception

Nociceptive pathways are present from birth, and even the most premature infant is born with the capacity to detect and respond to painful stimulation. During foetal, neonatal and infant life, the nervous system is continually evolving. This allows structural and functional changes to occur continuously in response to the child's needs as it grows and develops. The pain pathways mirror these changes, with different components developing along differing time frames. The structural components required to perceive pain are present from early fetal life, although pathways involved in modifying pain perception are still developing during infancy. The expression of the many molecules and receptors involved in the pain pathways vary in their number, type and distribution between early life and adulthood. These structural and functional changes will affect both the immediate and short-term responses to pain and analgesic effect in infancy. Conversely, pain or analgesic treatment at this time may also predispose to persistent or long-term changes affecting the function of the somatosensory nervous system in later life.

Perioperative Pain Management

Perioperative pain management can be considered in three parts: preoperative assessment, intraoperative management and postoperative care. Successful pain management is based on the formulation of a sensible analgesic plan for each individual. It is best to take a practical and pragmatic approach depending on the patient, the type of surgery and the resources available. The primary aims are to:

- Recognise pain in children
- Prevent pain where it is predictable
- Minimise moderate and severe pain safely in all children
- Bring pain rapidly under control
- Continue pain control after discharge from hospital
- Reduce the risk of children developing a persistent pain presentation

The two primary aims of preoperative pain assessment are:

- Planning the analgesic strategy for the child both during and after their procedure
- Identifying children with risk factors for developing increased postoperative pain and/or persistent pain post discharge

Risk factors for poor perioperative pain management in children are not well described; however, evidence suggests these include the presence of preoperative pain and/or analgesic use; previous difficulties with pain control following procedures; psychological risk factors such as pain

catastrophising or anxiety (parent and/or child); and surgical factors, including anatomical location, duration, surgical approach and repeated surgery.

Preoperative assessment may also allow exploration of previously used pain management strategies and provide an opportunity to give general pain management education and information on postoperative pain strategies. This may help to alleviate anxiety. Early involvement of the hospital pain team can be useful for both those children with risk factors for challenging perioperative pain management and those at risk of developing chronic postsurgical pain (see the section 'Discharge Care and Chronic Postsurgical Pain').

Analgesic Plan

An individual analgesic plan should be devised for each patient (Table 17.1). The plan will depend on a number of factors and should be discussed with the patient, parents and staff to confirm acceptability, consider preferences, answer questions and take into account previous experiences. It should allow treatment to be titrated to effect, include provision for the rapid control of breakthrough pain and enable the identification and treatment of side effects. In established paediatric centres with a high level of resources, a dedicated paediatric pain service is the standard of care. Where this is not available, significant improvements in pain management can be made by the establishment of clinical routines and protocols for the treatment and assessment of postoperative pain, alongside a network of interested medical and nursing staff to provide ongoing education.

Table 17.1 Factors to consider in designing an analgesic plan

The pain	Type, severity, location, onset, duration
The patient	Age, development, medical history, drug history and ongoing treatment, cognitive ability
The setting	Home, hospital, available staff and resources
The techniques/ drugs available	Pharmacology, resources, safety, routes of administration

Multimodal Pain Management

Pain management involves considering the neurobiology of pain pathways and basic pharmacology to design an approach that targets multiple areas along the pain pathways. Perioperative care needs to appreciate that pain is a biopsychosocial experience that not only involves biological pathways but is influenced by psychological and social factors related to both the child and caregivers. Consequently, a comprehensive pain management strategy needs to appreciate all the facets that make up a child's pain experience and utilise a variety of methods to achieve analgesia.

Although a significant focus should be on providing effective multimodal pharmacological strategies, the integration of other aspects such as rehabilitation, physical therapy and effective psychosocial interventions (including psychological strategies, play and distraction) are key to comprehensive management. The use of valid and appropriate pain assessment tools alongside evaluating the impact of pain on a child's general recovery and function is important to achieving timely hospital discharge, which needs to be accompanied by individualised plans for follow-up.

Multimodal or balanced pharmacological analgesia involves the simultaneous use of a number of analgesic interventions to achieve optimal pain management. Analgesics acting independently and synchronously on pain mechanisms at different points on the pain pathway are likely to be more effective than a single drug. Potentially, this also minimises the doses of drugs used, thereby reducing side effects and possibly accelerating recovery. Multimodal analgesia also allows for the use of non-pharmacological pain control strategies where possible.

Using a multimodal approach, effective pain management is achievable for most cases, and the technique can be adapted for day cases, major cases, the critically ill child or the very young. In current practice, most analgesic techniques in children are based on different combinations of four main classes of analgesics:

- Paracetamol
- Non-steroidal anti-inflammatory drugs (NSAIDs)
- Opioids
- Local anaesthetics

Other analgesic adjuncts can also be considered. Unless there is a contraindication to do so, a local/regional analgesic technique should be used in all cases (see also Chapter 15). For many minor and day-case procedures, this may allow opioids to be omitted, particularly if used in combination with paracetamol and NSAIDs.

Routes of Administration

Analgesic drugs can be given by a variety of routes, and the choice of route can have a significant impact on the efficacy of pain management. The choice(s) must be acceptable to the patient, parents and staff. Where possible, prescriptions should allow for more than one choice of route.

The routes in common use are:

Oral: This is generally the preferred route but is not always achievable in the perioperative period due to the child being 'nil by mouth' for some of this time. Different formulations are available for most analgesics in terms of flavour and liquids or tablets to allow for the varied tastes of children.

Rectal: Although a useful and convenient alternative when the oral route is unavailable, rectal absorption of many drugs is slow, erratic and unreliable. Rectal administration can also be unpleasant or unacceptable to some patients, although its use under general anaesthesia is usually more palatable if discussed prior to surgery.

Intravenous: This allows for rapid onset and high efficacy and is therefore the preferred route intraoperatively, provided suitable formulations are available. Postoperative use will be dependent on the availability of trained staff, suitable resources and monitoring. Securing intravenous access is easily achieved under general anaesthetic but may prove problematic at other times.

Subcutaneous: This allows for continuous and intermittent infusion of low volumes of drugs. Subcutaneous access is easier to establish compared with intravenous access. Provided tissue perfusion is good, absorption seems to be predictable and rapid, but the pharmacokinetics of subcutaneous analgesics in children have not been well studied.

Epidural: This provides extensive and profound analgesia at the site of surgical insult with little systemic effect and the option of long-term infusion. It requires a skilled anaesthetist and trained staff with adequate resources and monitoring for subsequent management. Epidurals are inserted under general anaesthesia in the majority of children and have a good safety profile.

Transdermal and Transmucosal: Lipid-soluble drugs can be rapidly absorbed in small volumes from highly vascular sites. This allows a potentially rapid onset and high efficacy without the need for painful access. Intranasal diamorphine has been used with success in the emergency room and for painful procedures. Significant opioid-related side effects are still common. Transdermal absorption is slower, but newer technologies in delivery systems are improving this. Topical application of local anaesthetics is frequently used for minor painful procedures.

Inhalation: Nitrous oxide/oxygen (Entonox) inhalation has been used successfully for the management of brief painful procedures in children. Acceptability is often good, but trained staff with specialist equipment and a suitable environment are required.

Analgesic Drugs and Techniques

Pain intensity and duration in the perioperative period are usually predictable, and planning analgesic requirements is relatively straightforward. Many combinations of drugs and techniques are possible. Potent analgesic combinations are usually required initially, with gradual reduction over time as healing occurs, and pain finally being managed by simple, readily available analgesics. Opioids, paracetamol and NSAIDs are usually administered regularly as part of a multimodal strategy. Local anaesthesia can be used in the form of a 'single-shot' technique at the time of surgery or as a postoperative infusion either centrally or peripherally. Other agents such as NMDA antagonists (ketamine), α_2-adrenergic agonists (clonidine/dexmedetomidine), magnesium, intravenous lidocaine and gabapentinoids can be considered as additives to supplement the multimodal strategy.

Whatever analgesic medication combinations are decided upon, it is important to ensure that, at a minimum, simple analgesia is prescribed at regular intervals. Research suggests 'as-needed' prescriptions can lead to analgesia not being given or children receiving as little analgesia as possible.

Regular administration reduces peaks and troughs of plasma drug levels and ensures that the child receives the medication. Medications prescribed 'as-needed' should be for management of breakthrough pain, that is, intermittent and unpredictable pain.

Paracetamol

Paracetamol is the most widely prescribed drug in paediatric hospitals and has become the mainstay base analgesic for almost all procedures. The analgesic potency is low, and it is effective against mild pain. In combination with NSAIDs and weak opioids, it has been shown to be effective for moderate pain and is opioid sparing when used in tandem with more potent opioids. Paracetamol has a mainly central mode of action, producing both analgesic and antipyretic effects. Its oral bioavailability is very good, being rapidly absorbed from the small bowel. Rectal absorption is slow and incomplete, except in neonates. Therefore, where possible, paracetamol should be given orally preoperatively or intravenously at the time of surgery. Intravenous paracetamol may have a higher analgesic potency than both the oral and rectal preparations, as uptake into the cerebrospinal fluid is greater and faster following intravenous administration than via the other routes. Paracetamol is very safe in children; however, data supporting its use in neonates are limited, and caution is required for those under 32 weeks' gestation, with use accompanied by monitoring of liver function.

Non-steroidal Anti-inflammatory Drugs

NSAIDs act mainly in the periphery inhibiting prostaglandin synthesis and reducing inflammation, although central effects have been postulated involving the opioid, serotonin and nitric oxide pathways. They are highly efficacious in the treatment of mild to moderate pain in children. NSAIDs have a reported opioid-sparing effect of 30–40% when used in combination with opioids. They also reduce opioid-related adverse effects and facilitate more rapid weaning of opioid infusions. They are highly effective in combination with a local or regional nerve block, and combination with paracetamol produces better analgesia than either drug alone. There are limitations to their use in paediatric populations. In the United Kingdom, ibuprofen is now available in over-the-counter formulations for ages three months and above, and it is used in children above one month in the hospital setting. At present, diclofenac and other NSAIDs are not recommended for children less than six months of age. Care should be taken in patients who are asthmatic or have a known aspirin or NSAID allergy, and those with hypovolaemia, dehydration, renal impairment, coagulopathy or where there is a significant risk of haemorrhage. A careful history of previous NSAID use should be taken in every case. Different NSAIDs have different side-effect profiles, and the relative risks associated with each of the contraindications given will differ between drugs. In the United Kingdom, the Committee on the Safety of Medicines has classified ibuprofen and diclofenac as having the best side-effects profile. Both rectal and oral bioavailability are good, though for short cases they are best given orally preoperatively. The dose is higher than expected in children if scaled by body weight from adult doses; recommended dose ranges for children should be used. Other routes of administration are available, such as intravenous and topical, although their use in children so far has been limited.

COX-2 selective inhibitors such as parecoxib have improved side-effect profiles compared to NSAIDs in adults. There is limited safety data in children; however, they have been used safely in paediatric rheumatology populations. Parecoxib works through an active metabolite; clearance of the active metabolite is reduced in younger age groups, requiring dose reduction or increased dose interval in children under two years. If parecoxib is given intraoperatively, a 12-hour delay is required before subsequent NSAIDs are used.

Opioids

Opioids remain the mainstay of analgesic treatment for the majority of all but minor surgical procedures. Whilst the tension between benefit and threat of opioid use and misuse is relevant to a paediatric population, this class of drugs remains the best and safest option to manage moderate to severe pain in children. Safe use therefore relies on health care professionals to

ensure appropriate in-hospital safety systems and stewardship for rare instances where children are discharged with continued opioid medications.

The choice of opioid will depend on the patient's medical history, type of surgery, drug availability, any locally devised protocols and often individual anaesthetic preference. The pharmacology of these agents changes during early life, and these changes are not consistent between different drugs. Understanding the pharmacology of each particular opioid in neonates and infants is important to ensure both efficacy and safety. It has been shown that individuals with central nervous system disease or disability may be more sensitive to the side effects of opioids, such as respiratory depression, and doses and/or dose intervals may need to be adjusted.

Morphine remains the most commonly used opioid. Morphine clearance is decreased and the elimination half-life is increased in neonates compared with infants and older children. In neonates, the glucuronidation pathways, the main metabolic pathways for morphine, are still developing, slowing morphine metabolism and giving a relatively increased production of morphine-6-glucuronide, an active metabolite. These differences may to some extent account for the increased efficacy of morphine seen clinically in neonates.

Oxycodone is similar in structure to codeine, although the analgesic effect is via the parent molecule rather than its metabolites. It has been shown to be effective for treatment of moderate to severe pain in children.

Tramadol has a dual mode of action. It is an agonist at mu receptors but also works by enhancing descending inhibition via the serotonergic and noradrenergic systems. In children, it has been shown to be efficacious for mild to moderate pain with a good safety profile.

Historically, codeine was commonly prescribed as a weak opioid to children. It works via its active metabolite morphine. The cytochrome P-450 enzyme, CYP2D6, responsible for this conversion demonstrates genetic polymorphism, leading to marked variability in activity. Although this can lead to reduced activity and thus little or no morphine being produced from a dose of codeine, far more concerning is increased activity leading to morphine toxicity and overdose. Consequently, codeine is currently not recommended for use in children under 12 years old in the United Kingdom.

Opioid Infusions

The requirements for opioid infusion analgesia include:

- Clear protocols for infusion rates and the detection and treatment of side effects
- Staff educated in the use of opioid infusion techniques
- Appropriate monitoring
- A safe nursing environment

If all these factors are in place, then opioid infusions can be effectively and safely used in even the most premature neonate.

Continuous infusion: Morphine at infusion rates of 10–40 mcg kg^{-1} h^{-1} will provide effective analgesia for most postoperative pain. Lower infusion rates (5–15 mcg kg^{-1} h^{-1}) should be used in neonates. Fentanyl (0.5–2 mcg kg^{-1} h^{-1}) and oxycodone (10–40 mcg kg^{-1} h^{-1}) are useful alternatives to morphine. Infusion analgesia can be comparable with the more flexible nurse-controlled and patient-controlled analgesia (NCA and PCA) techniques, but changes in infusion rate alter plasma levels slowly in comparison with methods that include supplemental boluses.

Nurse-controlled analgesia: This increases the flexibility of a continuous infusion by combining a moderate background infusion with the ability to give two or three extra demand-led boluses per hour. Efficacy is improved by the use of reliable pain assessment.

Patient-controlled analgesia: In children, a small background infusion (4 mcg kg^{-1} h^{-1}) has been shown to improve nighttime sleep patterns without increasing side effects. Aside from this, traditional adult PCA settings are used. With the right supervision and monitoring, PCA can be used in children as young as five years.

Opioid-related side effects such as nausea and vomiting, itching, sedation and respiratory depression can occur in a dose-dependent fashion. Sedation scoring and monitoring of the respiratory rate should be undertaken in all patients receiving parenteral opioids. Oxygen and opioid antagonist must be easily accessible in case of emergency, alongside antiemetics and antipruritics. The subcutaneous route is an alternative to intravenous administration, but it should not be used in hypovolaemic patients.

α_2-Adrenergic Agonists

Clonidine, an α_2-adrenergic agonist, has a long history of safe use in children. It can be used as part of a multimodal strategy for perioperative pain by oral and intravenous routes (dose ranges 1–2 mcg kg^{-1} every six to eight hours) or epidural routes. Clonidine is used as an adjunct to local anaesthetics. It is also used for premedication owing to its sedative properties. Dexmedetomidine, another drug in this class, has been shown to reduce postoperative pain, and despite associated cardiac issues such as variability in blood pressure and heart rate, has safety data from widespread use in paediatric intensive care. Although absorbed orally and intranasally, its main route of administration is via intravenous infusion, which limits its use for analgesia outside the critical care setting.

Ketamine

Ketamine is an NMDA receptor antagonist. It has analgesic properties in its own right at lower doses than those used for anaesthesia. It prevents the induction of central sensitisation, wind-up and the development of opioid tolerance. Efficacy has been shown in children when combined with opioids or with local anaesthetics when used as part of a multimodal strategy. At low doses used for analgesia, the potential psychomimetic effects of ketamine are rare. It has also been used successfully for premedication.

Intravenous Lidocaine

Intravenous lidocaine works by decreasing excitability in the dorsal horn and is thought to be anti-inflammatory, reducing nociceptor stimulation by inflammatory proteins. Data regarding its use in acute pain management continue to be equivocal in adults, and there are currently no trial data in children. Intravenous lidocaine should be regarded as a 'high-risk' medicine for use in selected patients only as part of a multimodal pain management strategy. It may be useful in procedures associated with significant postoperative pain. Dosing should be no more than a 1.5 mg kg^{-1} IV bolus given over 10 minutes, with a possible further infusion of 1 mg kg^{-1} h^{-1} for no longer than eight hours. It should not be used concurrently with other local anaesthetic techniques. Current use is off-label, and close monitoring of patients is required to identify cardiovascular conduction abnormalities or local anaesthetic toxicity.

Gabapentin and Pregabalin

Gabapentin and pregabalin work on ascending and descending pathways via voltage-gated calcium channels, influencing both nociceptive and affective components of pain. They rose to prominence when small trials in adults suggested gabapentin may be protective against developing chronic postsurgical pain. Use in patients at risk of developing acute neuropathic pain appears sensible, although evidence is scarce. Evidence regarding general use for acute postoperative pain in children is lacking. Gabapentin and pregabalin are associated with abuse and diversion. They have a significant side-effect profile, including weight gain, inability to concentrate, sleepiness and some evidence of increased suicidal ideation in adolescents, so they have a limited application in children.

Magnesium

Magnesium is a non-competitive NMDA receptor antagonist that has anti-inflammatory effects. Although some evidence supports opioid-sparing effects and reduced pain scores in adults, evidence is lacking in paediatric practice.

Local Anaesthetics

Nerve blockade is appropriate for nearly all surgical procedures and forms an important component of a balanced analgesic technique. It allows site-specific analgesia, demonstrates a lack of sedative and respiratory side effects and reduces systematic analgesic requirements. Many techniques of nerve blockade have been described in children of all ages, and they are generally simple, safe and effective (see Chapter 15).

Bupivacaine, ropivacaine and levobupivacaine remain the local anaesthetics of choice in paediatric practice. They all demonstrate efficacy and safety in children. Local anaesthetic agents have an increased half-life and decreased clearance and protein binding in neonates, requiring adjustment of dosing schedules to reduce the risk of systemic toxicity.

Single-shot techniques: Single-shot central blocks (epidural/caudal), regional or local blocks

can be used to provide excellent intraoperative and early postoperative analgesia. They decrease the use of other analgesics and the incidence of side effects and potentially avoid the use of opioids. The analgesic plan, however, must allow for sufficient analgesia to be in use when the effect of the block wears off.

Caudal analgesia remains popular owing to its versatility and simplicity. Adjuncts are often added to extend the spread and duration of the block. Ketamine and clonidine have been shown to be effective adjuncts, with a low incidence of side effects at low doses. Concern has been expressed about both drugs in relation to their effects on the developing nervous system and potential side effects in neonates and infants, thus questioning their use by the neuraxial route in these age groups. Clonidine appears to be safe in older children, but ketamine has potential neurotoxic effects at any age and would not be advised for use by this route unless there was a specific reason. Caudal opioids are associated with an increased incidence of side effects and are now not commonly used.

Infusion techniques: Continuous local anaesthetic infusions can be used to extend the duration of nerve blockade for days into the postoperative period. Accumulation of local anaesthetic is a factor in children and potential toxicity can limit the duration and efficacy of an infusion. Local infection at the insertion site and catheter occlusion or dislodgement can also occur, especially in smaller children. Lumbar and thoracic epidural infusions are well established in children for severe acute pain. Efficacy and postoperative respiratory benefits have been demonstrated in children, but the relative benefits and risks in comparison with other techniques have not been well studied. Insertion is usually performed under general anaesthesia, and most practitioners use a continuous loss of resistance to saline technique. There is now increased use of ultrasound-guided insertion to improve success and safety of the technique. Shorter (5 cm) 18 G and 19 G Toughy needles are available for use in small children, with standard 8 cm 16 G and 18 G for older children. Catheter size varies according to needle size (23 G with 19 G needle and 21 G with 18 G needle). The 23 G catheter has been reported as having a high incidence of displacement. As with adults, at least 3 cm should be left in the epidural space to decrease the risk of the catheter falling out. Epidural infusions in children are prone to leaking but are often effective despite this. Opioids and clonidine have been used as adjuncts with the local anaesthetic to improve efficacy and limit local anaesthetic usage. Epidural clonidine is best avoided in neonates and infants, as discussed in the section 'α_2-Adrenergic Agonists'. Clear established protocols for the safe management of epidural infusions must be in place, along with trained staff, appropriate monitoring and a safe environment. Treatment protocols for side effects should also be used, and if opioids are added, urinary catheterisation is recommended. Continuous catheter-based infusion techniques in other anatomical locations, such as paravertebral and fascia iliaca compartment block, have been reported in children (see Chapter 15).

Non-pharmacological Pain Management Strategies

Effective multimodal analgesia for acute pain should include not only pharmacological strategies but also consider rehabilitation, psychology, spirituality and integrative ('non-pharmacological') modalities. These all act synergistically to provide effective paediatric pain control leading to fewer side effects compared to a single analgesic or modality. It is recognised that each technique in isolation is unlikely to be adequate, but many of these strategies have low side-effect profiles, and their addition to overall pain management may be helpful. Over recent years, psychologists have become important members of the multidisciplinary acute pain team, acknowledging how preoperative anxiety, depression and fear of postoperative pain in both children and caregivers can impact on postoperative experiences. Early involvement and psychological interventions may be helpful, especially in patients with underlying chronic pain, previous difficult postoperative pain control and those undergoing complex or repeated surgery. Physical therapy and exercise are key to both acute and chronic paediatric pain management in all settings. Increased activity improves pain, speeds up return to normal function and positively impacts on mood. Other physical therapies including transcutaneous electrical nerve stimulation (TENS) and massage can be helpful. Breast feeding, kangaroo care and facilitated swaddling are useful additional

strategies in infants. Finally, supporting a family's spirituality or life philosophy can be important in pain relief and overall care.

Pain Assessment

Appropriate clinical assessment of pain improves both the safety and efficacy of pain management in children. It allows for the prompt administration of analgesia and is an effective method of monitoring treatment. Effective pain assessment involves regular clinical monitoring of the child by trained staff allied with the use of an appropriate pain-scoring tool. Tools for routine clinical use should be practical, valid for the clinical setting and age range of the patients and acceptable to staff, patients and carers. Current validated tools in children focus on pain intensity, although overall pain assessment should also include a child's function, including ability to drink, eat and mobilise; emotional response; and global satisfaction of pain management by both the child and caregivers.

Pain is subjective in nature, and self-reporting pain tools are generally regarded as the gold standard measure. This requires a degree of both cognitive and physical development. 'Child-friendly' adaptations of these scores – for example, a face type scale (Figure 17.1) – have been designed for younger patients and have been used down to ages as low as four years of age. Older children are often able to use numerical pain scales effectively. At younger ages, the scales may not be truly linear and are not directly interchangeable or numerically comparable with other scales.

In younger, especially non-verbal children, or those with cognitive or communication difficulties, other approaches are necessary and tools using behavioural and/or physiological measures have been developed, such as the face, legs, activity, consolability (FLACC) pain measurement tool (Table 17.2). It is important to remember that these behaviours are affected by a number of factors:

- Age of the child
- Other factors such as hunger, distress and anxiety
- Concurrent drug treatment
- Individual interpretation by health care workers using the tools

Postoperative Nausea and Vomiting

Postoperative nausea and vomiting (PONV) are common in children. The causes are multifactorial with analgesia potentially involved, especially opioids. Pain can also be a contributory factor, and adequate analgesia has been shown to reduce the incidence of PONV. Other risk factors are increasing age (age greater than three years), a history of PONV or motion sickness, the duration and type of surgery and the use of volatile anaesthetics. The effect of nitrous oxide in increasing PONV has not been proven in children. A multimodal-type strategy may give better outcomes for treatment of PONV owing to the complexity of the pathogenesis of PONV. Ondansetron and dexamethasone are the most commonly used drugs perioperatively. Combination therapy has been shown to be superior to either drug alone.

Discharge Care and Chronic Postsurgical Pain

Pain management is integral to discharge planning following surgery. This should include clear documentation of which medicines are to be continued and which are to be stopped, the time analgesia use is expected to continue for and whether it should be slowly tapered or simply stopped. Instructions for parents should be both verbal and written and include contact details should pain continue to be problematic after a predetermined time frame. Early follow-up by surgical teams should include children discharged using strong opioids or other analgesic adjuncts such as gabapentinoids, those who had a

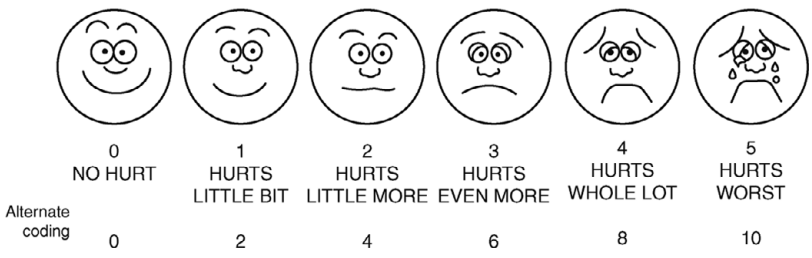

Figure 17.1 Wong-Baker faces pain rating scale.
Source: Originally published in Whaley and Wong's *Nursing Care of Infants and Children*. © Elsevier Inc., 2023. Reproduced with permission.

Table 17.2 FLACC behavioural scale

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

Note: Each of the five categories – (F) face; (L) legs; (A) activity; (C) cry; (C) consolability – is scored from 0–2, which results in a total score between zero and 10.

difficult or prolonged postoperative pain journey and children who are at risk of developing chronic pain conditions, including chronic post-surgical pain (CPSP) or complex regional pain syndrome.

CPSP is pain that develops or increases in intensity after a surgical procedure and persists beyond the healing process. The current definition stipulates its occurrence continuing at least three months after the initiating event, the pain being localised either in the surgical field or projected to the area of innervation of a nerve from this area and where other causes of the pain have been excluded. Prevalence depends on the surgery undertaken but may occur in up to one in five children. Risk factors have been extensively explored in adults but less so in children. Current evidence in paediatric populations suggests these include pre-existing anxiety, parental pain catastrophising, poorer pain coping efficacy and possibly pre-existing pain prior to surgery.

Ideally hospitals will have transitional pain clinics to review patients who develop chronic pain after surgery; however, when these are not available, there should be mechanisms in place to ensure rapid referral and review by an experienced chronic pain team.

Key Points

- Nociceptive pathways are present from birth, and even the most premature infant has the capacity to detect and respond to painful stimulation.
- Developmental age has a profound effect on both the processing of nociceptive information and the response to analgesia.
- It is essential to understand the pharmacology of analgesic drugs in children of all ages.
- An analgesic plan is required in all cases and should be flexible, sufficient and safe.
- Adopting a multimodal approach to treatment provides optimal pain management.
- Regular pain assessment improves the safety and efficacy of pain management in children.
- Complex pain management requires the use of clear protocols and the detection and treatment of side effects. It also requires educated staff, appropriate monitoring and a safe nursing environment.

Further Reading

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