CHAPTER 20

PAIN CONTROL

20.1 PAIN CONTROL

R52.9

DESCRIPTION

Pain is an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage, or described in terms of such damage.

Pain is an inherent part of the pathology of most medical and surgical diseases. Children are especially vulnerable to poor pain management, largely due to underestimation of pain severity (by clinicians and parents). This frequently results in inappropriate management of pain, e.g. paracetamol only for management of moderate or severe pain, and not using opioids when indicated.

Acute pain is of sudden onset, is felt immediately following injury, is severe in intensity, but is usually short-lasting. It arises from tissue injury which stimulates nociceptors, and generally disappears when the injury heals.

Chronic pain is continuous or recurrent pain that persists beyond the expected normal time of healing. Chronic pain may begin as acute pain and persist for long periods, or may recur due to persistence of noxious stimuli or repeated exacerbation of an injury. Chronic pain may also arise and persist in the absence of identifiable pathophysiology or medical illness. Chronic pain can negatively affect all aspects of daily life, including physical activities, school attendance, sleep patterns, family interactions and social relationships and can lead to distress, anxiety, depression, insomnia, fatigue or mood changes, such as irritability and negative coping behaviour. As pain is an outcome of an interaction of many factors, a holistic approach to the child and family is required.

Good pain management involves 6 steps:

1. A high index of suspicion that pain is present.
2. Accurate pain assessment that is developmentally appropriate, using scoring tools.
3. Making an assessment of pain severity – mild, moderate or severe.
4. Initiating non-pharmacological pain management strategies.
5. Timely administration of analgesia, appropriate for the severity of pain.
6. Reassessment within an appropriate time period, and ongoing care.

Pain assessment

Evidence-based practice supports the routine use of pain scoring tools for pain assessment. These tools enable a more accurate pain diagnosis, which serves to guide appropriate pain management.

Accurate assessment of pain severity can be achieved through:

» Self-report: This is only possible for children aged 5–7 years and older.
» Behavioural tools: There are various composite tools that can be utilised for children who are preverbal, or cognitively impaired. The correct tool is one that is developmentally appropriate and can be used consistently.

Physiological variables such as heart rate, blood pressure, and respiratory rate are unreliable indicators of the presence or absence of pain.

Choose an appropriate pain assessment tool depending on the child's age and cognitive development. This facilitates the quantification of pain, which is then used to diagnose mild, moderate, or severe pain.

Neonates: Behavioural pain assessment tool (Table 1)

This tool is used in neonates and infants up to 2 months of age. The patient is observed for one minute and each parameter scored. The maximum score is 7. The score is tallied, and a diagnosis of pain severity is made (see below).

Table 1: Neonatal Infant Pain Scale (NIPS)

NEONATAL INFANT PAIN SCALE (NIPS)			
	0	**1**	**2**
Facial expression	Relaxed	Contracted	
Cry	Absent	Mumbling	Vigorous
Breathing	Relaxed	Different than basal	
Arms	Relaxed	Flexed/stretched	
Legs	Relaxed	Flexed/stretched	
Alertness	Sleeping/calm	Uncomfortable	

Infants and children (2 months to 18 years old): Behavioural pain assessment tool (Table 2)

This tool can be used in children aged 2 months to 18 years and includes descriptors for cognitively impaired children. The clinician assigns a score to each parameter, and tallies a score out of 10. The final score is used to diagnose mild, moderate, or severe pain, which must be treated accordingly (see below).

Table 2: Revised FLACC Tool (R-FLACC)

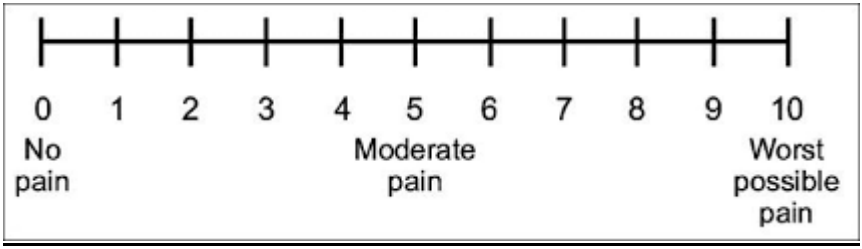
Revised FLACC Tool (R-FLACC)			
	0	**1**	**2**
Face	No particular expression/ smile.	Occasional grimace/frown; withdrawn or disinterested. Appears sad/worried.	Constant grimace/frown, quivering chin, clenched jaw. Looks distressed, expression of fright/panic.
Legs	Normal position or relaxed.	Uneasy, restless, tense. Occasional tremors.	Kicking or legs drawn up, spasticity, constant tremors, jerking.
Activity	Lying quietly, normal position, moves easily.	Squirming, shifting back and forth, tense, mildly agitated. Shallow, splinting respirations, intermittent sighs.	Arched, rigid, jerking. Severe agitation. Breath-holding, gasping, sharp intake of breath. Severe splinting.
Crying	No cry (awake/ asleep).	Moans or whimpers, occasional complaint, verbal outburst/grunt.	Crying steadily, screams, sobs. Frequent complaints/ outbursts, constant grunting.
Consolability	Content, relaxed.	Reassured by occasional touching, 'talking to', hugging. Distractible.	Difficult to console/comfort. Pushing away caregiver or comfort measures.

Self-reporting pain assessment tools: The gold standard of pain assessment is self-report. Consider using self-report tools from > 5 years. If the child is unable to self-report, use R-FLACC.

Numerical Rating Scale (Figure 1)

The Numeric Rating Scale (NRS) (Figure 1) assigns a number to their level of pain. Ask the child: 'From one to ten, if one is very little pain and ten is the worst pain you could imagine, how bad is your pain now?'

Figure 1: Numeric Rating Scale (NRS)



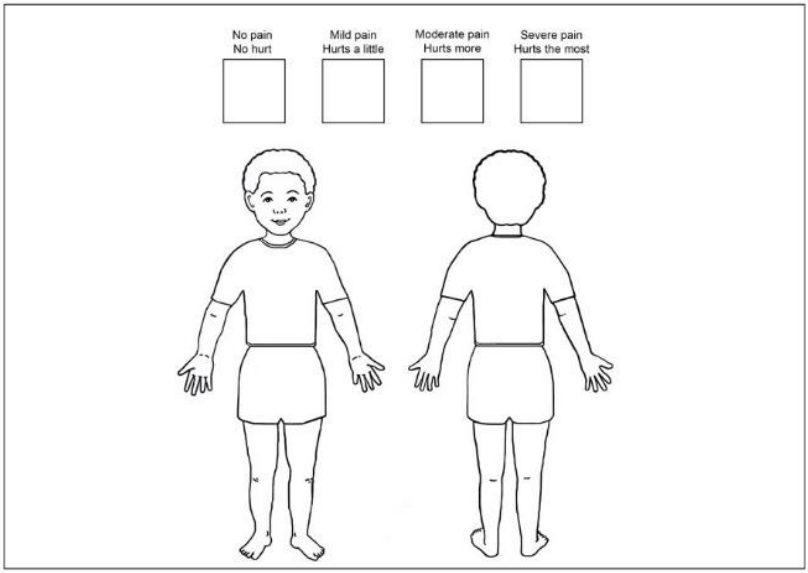
Self-reporting pain assessment tool – Eland Colour Tool (Figure 2)

After discussing with the child several things that have hurt or caused the child pain in the past:

1. Present the child with four crayons or markers of different colours.
2. Using the term that the family and child use to describe hurt or pain (the word 'pain' is used in these instructions), ask the following questions and, after the child has answered, mark the appropriate square on the tool:
   - » Of these colours, which colour is most like the worst pain you have ever had, or the worst pain anybody could ever have?
   - » Which colour is almost as much pain as the worst pain, but not quite as bad?
   - » Which colour is like a little pain?
   - » Which colour is like no pain at all?
3. Show the four colours to the child in order, from the colour chosen for the worst pain to the colour chosen for no pain.
4. Ask the child to colour within the body outlines in the places where it hurts on their own body, using the colours chosen to show how much it hurts.
5. When finished, ask if this is a picture of how it hurts now or how it hurt earlier. Be specific about what earlier means by relating the time to an event, for example, at lunch or in the playroom.

Note: Ask the child what their favourite colour is before starting and remove that one from the group of colours, as you don't want them to associate pain with this colour.

Figure 2: Eland Colour Tool



Assess pain severity

Use the pain assessment tools to make a diagnosis of no pain, mild, moderate or severe pain. For neonates/infants use the NIPS:

» 0–2 points = no pain.
» 3–4 points = moderate pain.
» > 4 points = severe pain.

For R-FLACC and NRS:

» 0 = no pain.
» 1–3 = mild pain.
» 4–7 = moderate pain.
» 8–10 = severe pain.

Once the severity of pain has been diagnosed, initiate the appropriate level of management.

PAIN MANAGEMENT

After assessing and scoring pain, proceed to pain management according to severity. Optimal pain control includes managing baseline pain (usually associated with the pathology), and pain associated with procedures. Always include non-pharmacological pain management strategies. Anxiety, fear, and pain in children are intricately linked. Addressing these is important in managing pain adequately and holistically.

Principles of pain management in children (aligned with the World Health Organization)

» Each child deserves a pain management strategy that is tailored to his/her physical, physiological, emotional and social needs.
» Give analgesia 'by the clock'. Prescribe scheduled analgesia and avoid dosing 'as necessary' or pro re nata (PRN) as far as possible. If PRN dosing is used, ensure that the caregiver remains present and is sufficiently empowered to request analgesia if in pain, and that this request will be attended to by nursing staff.
» Give analgesia by the most appropriate route. Intermittent intramuscular injections are distressing to children and are less effective in achieving pain control than other routes of administration. Their use is strongly discouraged.
» Treat pain according to severity – mild, moderate or severe. To diagnose pain severity, always use pain scoring tools. This will direct appropriate pain management.

GENERAL AND SUPPORTIVE MEASURES

» Discuss pain management with the family, including the child, as developmentally appropriate.
» Address all factors that may contribute to pain and associated symptoms, e.g. family stress, anxiety and sleep deprivation. Address parental/caregiver anxiety.
» As far as possible, minimise separation of the child from the parent/ caregiver.
» Ensure that child is comfortable, e.g. nappy is clean and dry, child is fed.

NON-MEDICINE PAIN MANAGEMENT STRATEGIES:

Type of intervention	Examples of evidence-based interventions
Contextual	Cluster procedures to reduce handling and allow rest.
Physical	Breast feed, non-nutritive sucking (dummy/pacifier), Kangaroo Mother Care/parental holding (not restraint), facilitated tucking, 24% sucrose, massage, containment, aromatherapy, keep warm. Ice for acute injuries with significant swelling. Immobilise/splint fractures. Cover burns or bleeding wounds.
Cognitive	Explain procedures, allow music, provide appropriate reassurance, educate on pain mechanisms, encourage mindfulness, distraction, imagery, favourite toy, music therapy.
Emotional	Caregiver presence, structured caregiver involvement (provide guidance), caregivers voice, clinician voice calm, soothing, positive affirmations, active reassurance. Parental involvement and interaction should be actively encouraged and should be an integral part of care.

Type of intervention	Examples of evidence-based interventions
Environmental	Reduce noise, dim lights, set monitor alarms. Use incubator covers/sheets to decrease light levels as appropriate for each baby. Create a child-friendly environment.

The oral administration of sucrose is a safe and effective form of analgesia for short-duration procedures and may be given for repeated procedures. It is effective in neonates and infants up to 18 months of age. The dose is 0.05–0.5 mL. Technique for using sucrose:

» Two minutes prior to the painful procedure or to settle the neonate in pain, administer a small amount of the dose, about one drop, onto the neonate's tongue using a pacifier or syringe. If necessary, repeat giving a drop of sucrose onto the infant's tongue during the procedure.
» Use the smallest amount of sucrose to provide pain relief, and if necessary, administer in small drops until the maximum recommended volume is achieved.
» Sucrose is more effective if given in conjunction with non-nutritive sucking using a pacifier.
» Comfort measures, such as facilitated tucking, rocking, skin-to-skin care and swaddling, may be used in conjunction with the sucrose during the procedure.

20.1.1 MANAGEMENT OF PAIN

20.1.1.1 ACUTE PAIN

R52.0

DESCRIPTION

Acute pain is pain of short duration that usually resolves as injured tissues heal.

Note:
» Do not hesitate to start with opioid analgesia in cases of severe pain.
» Always reassess the degree of response and adjust management accordingly.

MEDICINE TREATMENT

» The correct use (dose, scheduling, duration) of the correct analgesic will relieve most pain in children.
» Multimodal analgesia employs a variety of treatment strategies, both medicine and non-medicine, targeting multiple receptors involved in nociception. This facilitates improved pain control, while allowing for reduced doses of agents with unfavourable side-effect profiles (e.g.

opioids). Adjuvant agents include local anaesthetics, simple analgesics, opioids, α_2 receptor agonists (clonidine), NMDA receptor antagonists (ketamine, magnesium sulphate), and anxiolytics.

Simple analgesics

This includes paracetamol, NSAIDs and local anaesthetic agents. They are generally safe, provided dosing instructions and other cautions are adhered to, with favourable side-effect profiles. These agents should be considered as part of any analgesic strategy. They reduce the amount of opioid needed to achieve equivalent levels of analgesia.

- Paracetamol:
  - Oral paracetamol is the preferred route of administration. It is cheap and effective, and considers the placebo effect.
  - IV paracetamol should be reserved for patients who cannot receive oral paracetamol, i.e. those with gastrointestinal pathology causing poor absorption or not allowing for feeding.
  - Rectal route can be considered in patients who are unable to take oral medicines, where IV access is not available. Administration via the rectal route should be avoided in children with neutropenia.

Note: Suppositories should not be cut into pieces, as the amount of paracetamol in each portion may not be consistent.

Route	Loading dose	Maintenance dose				
		Preterm neonates < 32 weeks	Neonates	Infants 30 days to 3 months	3 months to 12 years	**Maximum daily dose**
Oral	20 mg/kg	10 mg/kg 12 hourly (Maximum 30 mg/kg/day)	10 mg/kg 6 to 8 hourly	10 mg/kg 6 hourly	15 mg/kg 6 hourly	Neonates: 60 mg/kg/day Children over 1 month: 90 mg/kg/day (Maximum 4 g/day)
Intravenous	20 mg/kg	10 mg/kg 12 hourly (Maximum 30 mg/kg/day)	10 mg/kg 6 to 8 hourly	10 mg/kg 6 hourly	15 mg/kg 6 hourly	Neonates: 60 mg/kg/day Children over 1 month: 90 mg/kg/day (Maximum 4 g/day)
Rectal	40 mg/kg	Not recommended	30 mg/kg/dose 6 hourly			Maximum5 g /day

» Avoid prolonged use of paracetamol.
» Caution and dose reduction needs to be considered when administering paracetamol to chronically sick or malnourished children.

Non-steroidal anti-inflammatory drugs (NSAIDS)
These should be considered as part of any analgesic strategy. Serious adverse events after NSAIDs are rare in children aged ≥ 6 months of age. Children over 3 months of age can safely receive ibuprofen. Due to the risk of Reye Syndrome, aspirin should be avoided.

- Ibuprofen, oral, 5–10 mg/kg/dose 6–8 hourly with meals.
  - Maximum daily dose is 40 mg/kg/day.
  - Can be used in combination with paracetamol and opioids.

Opioid therapies
Opioid medicines are essential in the management of moderate and severe pain. Unfortunately, fear and lack of knowledge about the use of opioids in children are often barriers to effective relief of pain and suffering.

Opioids
- Morphine, oral [Immediate release morphine (liquid)]:
  If 0–1 month of age: 0.05 mg/kg 6 hourly.
  If > 1–12 months of age: 0.1 mg/kg/dose 4–6 hourly.
  If > 12 months of age: 0.2–0.4 mg/kg/dose 4–6 hourly.
  - Onset of action: 20–40 minutes.
  - Time to peak action: 60–90 minutes.
  - Duration of action: 3–6 hours.
  - Neonates and patients with hepatic and renal dysfunction may require dose modification – specialist consultation.

- Morphine, IV:
  - IV morphine is indicated if pain is severe, or the patient is unable to take oral morphine. Titrate morphine slowly to achieve pain control and avoid side effects. Give small doses at 5–10 minute intervals, with frequent reassessment.
  - Time to peak action: 20–40 minutes.
  - Duration of action: 4–6 hours.
  - For infusions: Morphine 0.5 mg/kg diluted up to 50 mL with dextrose 5% or sodium chloride 0.9%. 1 mL = 10 mcg/kg.
  - Give morphine bolus slowly over 3–5 minutes.

Table: Dosing guide for IV morphine

Age	4 hourly bolus dosing (mg/kg)	Infusion dose (mcg/kg/hour)	mL/hour*
Neonate	0.025–0.05	5–10	0.5–1
1–6 months	0.05	10–30	1–3
6 months–1 year	0.05–0.2	20–30	2–3
1–12 years	0.1–0.2	20–30	2–3

- Fentanyl, IV:
  - Fentanyl is a strong opioid, 100 times more potent than morphine. IV fentanyl is the preferred agent in severe renal dysfunction or renal failure, and can also be used in patients with liver failure. Titrate fentanyl to achieve pain control and avoid side effects. Start at the lower dosing range in opioid naïve patients.
  - Bolus dose: 0.5–2 mcg/kg, repeated at 30–60 minutes. Give bolus slowly over 3–5 minutes.
  - Infusion dose: Give bolus dose, then commence infusion at 1 mcg/kg/hour.
  - Onset of action: 1 minute.
  - Time to peak action: 5.8 minutes.
  - Duration of action: 30–60 minutes.
  - For infusions:
    - Neonates: 200 mcg/kg in 20 mL 5% dextrose: 0.1 mL/hour = 1 mcg/kg/hour.
    - > 1 month: 20 mL neat fentanyl (50 mcg/mL). 0.1 mL/kg/hour = 5 mcg/kg/hour.

Managing opioid-related side effects:

Some side-effects are common and require prophylactic management. Fortunately, life-threatening side effects are uncommon, provided recommended dosing is adhered to. It is inappropriate to deny children appropriate opioid analgesia where indicated, due to fear of side-effects.

Constipation	• Lactulose, oral, 0.5 mL/kg 12 hourly. o Also see Chapter 21: Palliative Care, section 2.1.1.4: Constipation.
Nausea/vomiting	• Ondansetron, IV, 0.15 mg/kg 8 hourly.

Management of opioid-induced respiratory depression
Also see Chapter 18: Poisoning, section 18.1.10: Opioid poisoning.
	This is uncommon if safe prescription is adhered to – correct route/dose/scheduling.
	• Stop the opioid.
	• Stimulate the patient – gently rouse, call and ask to breathe.
	• Give oxygen.
	• Give naloxone if indicated.
	
	Indications for Naloxone:
	• Significant sedation – arousable only with deep or significant physical stimulation, or un-arousable.
	Instructions for administration:
	• Dose: 10 mcg/kg slowly (over 2 minutes) IV/IM/SC. Repeat if necessary.
	• For ease of dosing and administration:
	  o Naloxone: 0.4 mg diluted to 10 mL with 0.9% sodium chloride.
	  o Give 0.25 mL/kg/dose IV/IM/SC.
	• Repeat every 2 minutes IV, or every 15 minutes IM/SC, x 4 doses as needed.
	• If no IV access: Give intranasally (IN): 1 mg per nostril (NOT per kilogram). Repeat as needed after 3–5 minutes.

<u>Monitoring in patients receiving opioids (in ward/high care/ICU):</u>
A suitably trained nurse must be available to monitor, initiate management, and escalate care, or call a doctor when necessary. Resuscitation equipment must be readily available, checked, and in working order. Naloxone must be immediately available.

All patients receiving opioids should have the following monitored and documented:
» Heart rate.
» Oxygen saturation via continuous saturation monitoring for the first 15 minutes.
» Respiratory rate.
» Level of consciousness.
» Pain scores.

Frequency of monitoring:
» Observe closely for 15 minutes after administering the first opioid dose.
» Then do observations every 30 minutes for the first hour.
» Thereafter, observations must be documented 4 hourly.

Weaning from opioids
This must be done for any child who has received morphine for more than 5–7 days. Wean by decreasing the daily dose by one third for 3 days.

Note: Children receiving properly titrated doses of analgesics, including opioids, are unlikely to become dependent. There is a difference between tolerance, which is a need for escalating doses to achieve the same therapeutic effect, and addiction.

Adjuvant medicines used in pain management:
An adjuvant (or co-analgesic) is a drug that in its pharmacological characteristic is not necessarily primarily identified as an analgesic in nature but that has been found in clinical practice to have either an independent analgesic effect or additive analgesic properties when used with opioids.

Ketamine
Ketamine is an NMDA receptor antagonist known for its haemodynamic and respiratory stability. This agent should be considered for patients with high opioid requirements or opioid tolerance, or where there is a significant component of neuropathic pain (e.g. amputation, neurosurgical procedures with nerve injury, burns, mucositis, or severe surgical pain).

- Ketamine, oral:
  - 4–6 mg/kg 4–6 hourly.
  - Injectable formulation can be used, (concentration 100 mg/mL). It is bitter tasting, and should be mixed with a sweet-tasting substance e.g. paracetamol or ibuprofen.
  - Onset of action: > 5 minutes.
  - Time to peak action: 30 minutes.
  - Duration of action: 4–6 hours.

- Ketamine, IV:
  - 0.2–0.3 mg/kg/hour, IV, (2–3 mL/hour).
  - Infusion: Mix 5 mg/kg of ketamine diluted to 50 mL with sodium chloride 0.9%. 1 mL = 0.1 mg/kg.
  - Low dose ketamine delivered by IV infusion is safe and effective. It does not cause sedation, or any psychotropic effects.
  - Onset of action: < 1 minute.
  - Time to peak effect: 3–5 minutes.

Recommended multimodal pain management directed by pain severity (see pain assessment above):

Pain severity	Analgesia	Comments
Mild	Paracetamol ± NSAIDs	
Moderate	Paracetamol ± NSAIDs + Opioid: • Morphine, oral	
Severe	Paracetamol ± NSAIDs + Opioid: • Morphine, oral or IV. **OR** • Fentanyl, IV.	Titrate IV opioids for safety.
Adjuvant agents	Ketamine	Can be used with any pain severity. Re-commended for moderate/severe pain.
Interventional modalities	Regional anaesthesia. *See Chapter 22: Anaesthesia, section 22.1.1: Local and regional anaesthesia.*	Consider indwelling catheters.

Pain in children with severe neurological impairment (SNI):
Pain is a frequent problem in children with neurological impairment (from any cause), with the highest frequency and severity occurring in children with the greatest impairment. These patients are vulnerable to under-recognition and under-treatment of pain. Barriers to treatment include uncertainty in identifying pain, limited experience, and fear with the use of analgesics. A systematic approach to identifying a source of pain is suggested. The R-FLACC tool has been validated in this patient population for assessment of pain severity, but clinicians must note that this tool (and others) can underestimate pain in these patients.

Patients with SNI may suffer from neuro-irritability, which can be associated with pain. In a child with recurrent pain behaviour episodes (3 or more prolonged episodes per week or a monthly cycle of frequent episodes for 1–2 weeks each month), initiate:

- Clonidine, oral, 1–3 mcg/kg 6–8 hourly.

- Amitriptyline, oral, 0.5–1 mg/kg 8 hourly.
  - Maximum: 25 mg/dose.

Pain in children with burn injury:
Burn injury is often associated with severe pain. Pain severity is directly correlated with the extent of burn injury. In addition, anxiety and post-traumatic

stress disorder can contribute to the pain experience. These should be actively managed with non-medicine therapies and medicine therapies where necessary.

Manage baseline pain according to severity – see pain assessment and recommended multimodal pain management (above). Patients with significant burns often develop tolerance to opioids, and often require higher doses of opioids in addition to adjuvant medicines. Procedural sedation and analgesia (PSA) should be optimised to minimise further anxiety, pain and distress, and is indicated for IV access and dressing changes. Dressing changes involving a large total body surface area (TBSA), or patients who have failed previous attempts at PSA should undergo procedures under general anaesthesia.

Neuropathic pain: medicine management
If a child reports features suggestive of neuropathic pain – i.e. pain that is sharp/stabbing/burning in nature, or paraesthesia – or the mechanism of injury or pathology is in keeping with nerve injury or neuropathic pain, a trial of amitriptyline can be considered.

- Amitriptyline, oral, 0.1–1 mg/kg 8 hourly.
  - Start on a low dose and titrate up according to symptoms.
  - Maximum: 25 mg/dose.

20.1.1.2 PERSISTENT/CHRONIC PAIN (NON-CANCER PAIN)
R52.2

Persistent/chronic pain is pain that lasts longer than the expected time for healing, and does not always have an obvious physical cause. Best practices for the management of chronic pain in children as recommended by the World Health Organization include:

» Use a comprehensive biopsychosocial assessment to inform pain management and planning. Screen for and monitor pain intensity and its impact on the quality of life of the child and family.
» Evaluation of underlying conditions with access to appropriate treatment, in addition to appropriate interventions for the management of pain.
» Assessment by healthcare providers, skilled and experienced in the evaluation, diagnosis and management of chronic pain.
» Adopting an interdisciplinary, multimodal approach tailored to the needs and desires of the child, family and caregivers, and to available resources. This includes psychology/psychiatry, social worker, physiotherapy, and other providers of non-pharmacological pain management strategies, e.g. aromatherapy, acupuncture.
» Goals of care: return to function, attaining good quality of life, minimising absenteeism from school, and engagement with peers.

» There is insufficient evidence to support the use of medicines for the management of chronic pain, unless pain is associated with underlying pathology, e.g. rheumatological disease, nerve injury.

REFERRAL

» In patients with acute pain, adequate analgesia and application of relevant, developmentally appropriate non-medicine strategies will control pain in most cases.
» Patients with resistant chronic pain should be discussed or referred to specialist centres experienced in paediatric chronic pain management.

20.1.1.3 CANCER PAIN

G89.3

DESCRIPTION

Pain in children with cancer is common and can be divided into four categories:

1. Pain as a result of the disease.
2. Pain secondary to treatment of the disease (chemo and radiotherapy).
3. Procedural pain (especially from bone marrow aspirations and LPs).
4. Pain from other causes as experienced by children in general.

» Pain caused by malignancy may be acute or chronic, acute-on-chronic or recurrent. It may be nociceptive or neuropathic or a combination of both. Sympathetic pain may occur with tumour infiltration of the sympathetic nervous system.
» Assessment of cancer pain follows the same general principles for pain assessment. The Eland Body Tool is particularly useful as a tool to identify multiple pain sites.
» General pain management also follows the basic principles of pain management with some extra considerations.
» Avoid NSAIDs in children with low platelets, renal dysfunction and dyspepsia.
» Procedural pain is common in children with cancer and may be more severe than pain related to the disease.
» Severe procedural pain is generally managed in oncology units with conscious sedation or general anaesthesia.
» Pain may have particular significance to the child and his/her parent or caregiver especially when it is the presenting feature of relapse.
» Children with cancer may under-report their pain for fear of further treatments.
» Pain is a common end-of-life symptom in terminally ill children that often requires escalating doses of opiates or opiate rotation to control it.

Pain type	Clinical presentation	Causes/ Mechanisms	Treatment
Bone pain.	Aching to sharp, severe pain, more pronounced with movement. Point tenderness common.	Primary and secondary (metastases). Strong neuropathic component (periosteum, Haversian canals).	• NSAIDs • Corticosteroids • Opioids • Adjuvants: Amitriptyline
Neuropathic pain.	Pain described as tingling, burning or stabbing. Dysesthesia: Allodynia and hyperalgaesia, Sometimes numbness, formication.	Nerve invasion by tumour. Chemotherapy side effects (vincristine, cisplatin, paclitaxel). Nerve entrapment. Phantom pain post amputation.	• Seek specialist advice. • Treat underlying cause – consider radiation. • Start NSAID if no contra-indications. • Opioids (morphine). • Add: Amitriptyline
Visceral pain. Pain arising from organs. Tumours of bowel ± obstruction. Retroperitoneal tumours.	Poorly localized pain. Varies in intensity. Deep aching pain.	Tumour infiltration. Serosal stretch. Obstruction	• Consider hyoscine butylbromide for cramps. • Low dose morphine.
Mucositis	Oral pain. Odynophagia Mucosal ulceration. Drooling	Post chemotherapy. Radiotherapy	See Chapter 21: Palliative care, section 21.1.1.1 odynophagia
Post-surgical	Pain related to tissue trauma post-surgery.		See post-op pain management.

REFERRAL

» All patients.

20.1.2 PROCEDURAL SEDATION AND ANALGESIA

Children in hospital are exposed to a variety of painful diagnostic and therapeutic procedures. The aim of procedural pain management is to minimise physical discomfort, pain, movement, and psychological disturbance, without compromising patient safety. Failure to provide adequate preventative pain measures increases anxiety in both the child and parent/caregiver, making repeat procedures more challenging.

GOALS OF PROCEDURAL SEDATION AND ANALGESIA

» Provide a safe environment for the patient.
» Effectively control pain, anxiety and movement.
» Decreased awareness and amnesia are also advantageous.

GENERAL AND SUPPORTIVE MEASURES

Non-medication measures are as important as medication measures in the management of procedural pain. These include adequate preparation /explanation to the child and parent/caregiver, correct positioning, and the use of distraction. For a comprehensive list see above.*

Note:

» It is the sedation team's responsibility to familiarise themselves with local guidelines for procedural sedation and analgesia. Important safety aspects must be adhered to including fasting, availability of equipment and the appropriate monitoring recommendations followed. All clinicians providing sedation need to have the necessary skills to manage a compromised airway, and haemodynamic compromise that may occur.
» Each case should be individualised. This table does not supersede clinical judgement.
» Timing of medications in relation to the procedure is essential.
» Always use simple analgesia in combination with other agents.

MEDICINE TREATMENT

Selection of medication and routes of administration should be guided by:

» Drug choice – specifically onset/peak and duration of action, and side effect profile.
» Child's age and level of cognitive development.
» Child's condition, comorbid diseases.
» Severity of pain associated with the procedure.
» Duration of the procedure.
» Level of immobility required to complete the procedure.

Providing safe and effective procedural sedation and analgesia can be a challenging undertaking, particularly in inexperienced hands. Some children are difficult to sedate with recommended dosing, and may require multiple agents or general anaesthesia to facilitate successful completion of the procedure. If so, refer the child to an experienced seditionist, or for general anaesthesia. Do not cause the child undue distress and emotional trauma.
Some children are at higher risk for morbidity (and even mortality), and should also be referred to an experienced seditionist, or for general anaesthesia. This includes children with severe systemic illness, life-threatening conditions, raised intracranial pressure, anticipated difficult airway, obesity, congenital syndromes, advanced respiratory disease, cardiac dysfunction, and a depressed level of consciousness. Refer to Chapter 22: Anaesthetics for recommendations.

The intranasal route of administration is a relatively painless, fast-acting, effective means of providing analgosedation. To maximise delivery, maximise concentration and minimise the volume. To further minimise the volume per nostril, divide the dose in half, and each half is administered into each nostril.

- Fentanyl:

Fentanyl provides analgesia and sedation. It should never be used as a sole agent. Combine with paracetamol ± NSAID. If used in combination with other respiratory depressant medicines, use lower doses and titrate to effect. The most frequent side effects include an itchy nose and dizziness.

Route	Dose (mcg/kg)	Onset (minutes)	Peak (minutes)	Duration (minutes)
Intranasal*	1–2	10	15	60–120
IV	0.25	1	5–6	30

*Intranasal route is preferred.

LoE III[1]

A 'top up' dose can be considered if satisfactory analgesia is not reached with the initial dose.

- Ketamine:

Ketamine provides analgesia, anxiolysis and sedation. It is bitter tasting, and should be mixed with a sweet-tasting substance, e.g. paracetamol or ibuprofen. It may burn when given via the intranasal (IN) route. To decrease burning, administer 0.25 mL of 2% lignocaine prior to medication.
The most frequent side effects include nausea and dizziness.
For children who are hypotensive or in situations where opioids should be avoided for airway concerns, IN ketamine could be an alternative option.

Route	Dose (mg/kg)	Onset (minutes)	Peak (minutes)	Duration
Oral	6–10	> 5	30	4–6 hours
Intranasal	5	5–10	20	20–120 minutes
IV (bolus)	0.25–1	< 1	3–5	10–15 minutes
IV (infusion)	0.5–1 mg/kg/hr	< 1	3–5	10–15 minutes
Intramuscular*	2–4	2–5	20	30–120 minutes

*IM injections are painful and distressing, and should not be utilised as a first option.

LoE III

- Midazolam:

Midazolam provides anxiolysis and sedation ONLY. It does not have any analgesic effect. It is bitter tasting, and should be mixed with a sweet-tasting substance, e.g. sucrose, paracetamol or ibuprofen.

Route	Dose (mg/kg)	Max. dose (mg/kg)	Peak (minutes)	Duration (minutes)
Oral	0.25–0.5	15	10–30	60
Sublingual	0.25–0.3	0.3mg/kg	10–15	20–60
Intranasal	0.2–0.3	0.3mg/kg	10–15	60–120
IV	0.025–0.1	1	3–5	20–60

Table: Procedural Sedation and Analgesia

	Procedures associated with mild pain	Procedures associated with moderate to severe pain
Examples	Blood taking. Heel prick. IM injection. Nasogastric tube insertion. Urethral catheterisation. Peripheral cannulation.	Arterial line, central venous catheter. Simple laceration. Intercostal drain insertion/removal. Dressing change for burns. Lumbar puncture. Fracture reduction/manipulation. Bone marrow aspirate and trephine.
ANALGESIA		
Local anaes-thesia*	• Topical lidocaine (lignocaine)/prilocaine 1 hour before procedure) covered with occlusive dressing. • Lidocaine (lignocaine) infiltration 0.5, 1 or 2% (lower concentrations burn less). • Consider regional anaesthesia (e.g. digit blocks, wrist block).	
Systemic	• Sucrose 24% solution (up to 12 months). • Breastfeed • Paracetamol • ± Ibuprofen	• Paracetamol ± ibuprofen **AND** **one** of the following medicines: • Ketamine **OR** • Fentanyl

**Local anaesthetics are used in combination with systemic agents corresponding with the severity of pain associated with the procedure.*

References

[1] South African Society of Anaesthesiologists (SASA) Paediatric Sedation Guidelines for Procedural Sedation and Analgesia. South Afr J Anaesth Analg. 2016, 22(1) (supplementary 5). https://painsa.org.za/wp-content/uploads/2020/03/Untitled-attachment-00037.pdf