6.4.8 Ketamine

Ketamine is an NMDA receptor antagonist which is known for its haemodynamic and respiratory stability. It is effective in the management of acute, chronic and neuropathic pain, as well as allodynia and hyperalgesia. It displays synergism with opioids, resulting in reduced opioid requirements with a better side effect profile. 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., scoliosis, amputation, neurosurgical procedures, burns, mucositis of chemotherapy) or severe surgical pain. When used with morphine in PCA, ketamine has been found to result in improved sleep and pain control with no increase in side effects (nausea, hallucinations). The IV infusion dose is 5 mg/kg diluted to 50 ml 0.9% saline (0.1 mg/kg/ml) and administered at 0.2–0.5 mg/kg/hr IV (2–5 ml/hr).

6.5 Recommended analgesia strategies for specific surgical procedures

6.5.1 Ear, nose, and throat procedures

Myringotomy

- Oral paracetamol, ibuprofen or diclofenac, in suitable doses and administered 30 minutes preoperatively, can achieve adequate early postoperative analgesia.
- Ketorolac can provide satisfactory analgesia.
- Opioids are effective, but not recommended, for routine use because of the increased side effects of nausea and vomiting, compared to simple analgesics.

Tonsillectomy

- Tonsillectomy is associated with moderate to severe pain, behavioural disturbance, sleep disruption and altered activity which can persist for up to two weeks.
- Surgical technique is an important determinant of posttonsillectomy pain; cold dissection techniques are associated with less pain.
- NSAIDs do not increase the risk of re-operation for bleeding. However, ketorolac has been associated with increased bleeding and should be avoided.
- Intraoperative analgesia: a multimodal analgesic strategy is imperative, which includes a combination of individually titrated (short- and intermediate-acting) opioids, paracetamol, an NSAID and an alpha-2 agonist. Alpha-2 agonists are particularly advantageous in patients with obstructive sleep apnoea (OSA), where cautious use of opioids is recommended.
- Local anaesthesia either injected into the tonsillar fossa or applied topically improves postoperative pain scores and reduces the time to the first oral intake and the incidence of referred ear pain.
- Dexamethasone (0.5 mg/kg)

- Analgesic dose of ketamine (0.2 mg/kg)
- Postoperative analgesia: the *regular (around the clock)* administration of paracetamol and NSAIDs.
- Information given to caregivers on pain assessment and medication use following discharge is particularly important.

6.5.2 Common procedures performed in children and suggested regional anaesthesia techniques

Regional anaesthesia techniques, such as wound infusion catheters inserted at the end of the procedure, increase the time to opioid request, improve pain scores, and reduce opioid consumption.

In addition to prolonged analgesia with caudal blocks, IV clonidine added to local anaesthetic solution increases the duration of analgesia with the following nerve blocks: sciatic, penile, saphenous, brachial plexus, ilioinguinal and iliohypogastric. Add 1–2 mcg/kg to the local anaesthetic solution or administer it intravenously.

Table X: Suggested regional anaesthesia techniques for specific procedures

Procedure	Regional nerve block options	Dosing* (volume)
Umbilical herniorrhaphy	Rectus sheath	0.1–0.3 ml/kg/side
Inguinal herniorrhaphy	Caudal Ilioinguinal/iliohypogastric nerve block	0.15–0.2 ml/kg/side
Orchidopexy	Caudal Ilioinguinal and iliohypogastric	0.2–0.3 ml/kg/side
Circumcision	Dorsal penile nerve Caudal Pudendal nerve	1 ml/kg
Laparotomy (supraumbilical)	Thoracic paravertebral Subcostal transversus abdominus plane** Erector spinae plane Epidural with catheter Wound infusion catheter	0.5 ml/kg/side 0.3–0.5 ml/kg/side 0.5 ml/kg/side 0.5 ml/kg/side
Laparotomy (infra umbilical)	Caudal Epidural + catheter Quadratus lumborum Lumbar paravertebral plane Erector spinae plane Transversus abdominus plane** Wound infusion catheter	0.5 ml/kg/side 0.5 ml/kg/side 0.5 ml/kg/side 0.3–0.5 ml/kg/side 0.3–0.5 ml/kg/side

Laparotomy (midline)	Rectus sheath block** Caudal (only block lower midline reliably) Erector spinae plane Epidural with catheter Wound infusion catheter	0.1–0.3ml/kg/side 1.25–1.5ml/kg 0.5 ml/kg/side
Thoracotomy	Thoracic paravertebral Intercostal nerves Erector spinae plane Epidural with catheter Wound infusion catheter	0.5 ml/kg/side 0.5 ml/kg 0.5 ml/kg/side
Appendicectomy (laparoscopic)	Transversus abdominus plane** Quadratus lumborum	0.3–0.5ml/kg/side 0.5 ml/kg/side
Femur fracture Osteotomy	Fascia iliaca Femoral nerve, with or without sciatic or popliteal nerves Caudal, epidural with catheter	0.5 ml/kg

***** Adhere to maximum doses (mg/kg) detailed in Table IV

****** Provides somatic analgesia only

6.5.3 Principles of postoperative analgesic prescription

- The oral route is well tolerated and is usually cheaper. Adhere to the World Health Organization's (WHO) 'by the mouth' recommendation. Monitor for any factors that may cause poor absorption (e.g. vomiting, ileus).
- IM injections are distressing and painful and are not recommended.
- Prescribe regular analgesia – i.e. 'around the clock'.
- Where de-escalation to 'when required' dosing is used, educate/empower both the patient and caregivers to request analgesia if the analgesia is insufficient.
- Small studies on the use of IV lignocaine infusions in children have shown encouraging results. However, further studies are needed before dosing recommendations can be made.
- Where PCA is used, the use of standardised protocols is recommended for safety reasons.

An important note on codeine

The efficacy of oral codeine is variable, and individual differences in the ability to generate the active metabolite – morphine – may reduce the efficacy or increase the side effects, including respiratory depression. A number of combination preparations contain codeine (e.g. Stopayne®, Myprodol® and Syndol®). Their use is not recommended in children who are under 2 years of age and should be used with caution in children above 2 years of age.

Table XI: Principles of postoperative analgesic prescription

Predicted postoperative pain	Recommended analgesia (inpatient)	Comments
Mild*	Paracetamol with or without an NSAID	
Moderate**	Paracetamol with or without an NSAID Tilidine **or** Tramadol Consider clonidine	Clonidine improves neuropathic pain and anxiety, and improves sleep
Severe***	Paracetamol with or without an NSAID Morphine p.o. or morphine infusion Consider clonidine Consider low dose ketamine infusion	Adhere to monitoring recommendations for morphine infusion

* Mild pain such as inguinal herniorrhaphy, myringotomy, incision and drainage of an abscess
** Moderate pain such as displaced fractures, tonsillectomy, orchidopexy, laparoscopic appendicectomy (unruptured) and Nissen's fundoplication
*** Severe pain such as laparotomy, tonsillectomy, thoracotomy with intercostal drain in situ, osteotomy, laparoscopic appendicectomy (ruptured)

6.5.4 Pain in children with cerebral palsy, deformities and cognitive impairment

A systematic approach to identifying the source of pain is suggested. Children who suffer from cerebral palsy or other deformities are not necessary cognitively impaired. Therefore, caregivers, including anaesthesiologists, must first attempt to communicate with the patients – not with their caregivers. However, caregivers could provide useful information on pain behaviours. The R-FLACC tool is used to assist with the diagnosis of pain and its severity.

Pain is a frequent and significant problem in children with cognitive impairment (from any cause), with the highest frequency and severity occurring in children with the greatest impairment. These patients are vulnerable to underrecognition and undertreatment of pain. Barriers to treatment include uncertainty in identifying pain, limited experience and fear about the use of analgesics (largely opiophobia).

Sources of pain include neuropathic pain (peripheral or central) due to altered excitability of the nervous system, muscle spasms, positioning and GI impairment (constipation, gastritis, ulcers or pancreatitis). New-onset pathology (e.g. otitis, urinary tract infection, nephrolithiasis, appendicitis, lower respiratory tract infection, dental pain, fractures or hip subluxation) should also be considered.

A trial of gabapentin is suggested for children with *neuropathic pain*, *visceral hyperalgesia* or *autonomic dysfunction*. *Spasticity* can be managed pharmacologically with baclofen, benzodiazepines or an alpha-2 agonist (clonidine). Interventional options include botulinum toxin injections or dorsal rhizotomy.

Non-pharmacological strategies for spasticity and dystonia include brace and positioning, passive stretching, massage and warm baths.

6.5.5 Pain in children with autism spectrum disorders

Autism spectrum disorders (ASDs) is a neuro-developmental spectrum of disorders, which comprise the following:

1. Impaired social functioning
2. Impaired communication skills
3. Disordered sensory processing
4. Restricted, repetitive behaviours

Pain behaviours in these patients may differ and distort pain diagnoses. Behavioural pain tools may be problematic and inaccurate. Every effort should be made to individualise care and minimise sensory stimuli by (i) providing a consistent environment with as much familiarity as possible, (ii) facilitating minimal separation between caregiver and patient, and (iii) minimising the use of restraint which help to alleviate psychological and emotional distress to the patient and family. It is important to seek expert advice or consultation.

6.5.6 Patients with obstructive sleep apnoea

Children with OSA have an increased sensitivity to opioids and are particularly susceptible to respiratory depression. Opioids must be used with caution, titrated wherever possible, with strict adherence to monitoring and, where appropriate, an escalated level of care.

6.5.7 Pain in children with cancer

The South African Cancer Pain Working Group published the *Guide to Treatment of Cancer Pain in South Africa* which can be referenced for guidelines.

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