

3.23.2 **Post-operative pain management: general information**

3.23.2.1 *Epidemiology, aetiology and pathophysiology*

The provision of adequate pain control requires proper pain evaluation, accurate choice of drug and route of administration, and consideration of age, physical condition and type of surgery and anaesthesia [1409].

3.23.2.2 *Diagnostic evaluation*

Assessment of pain is the first step in pain management. Several pain assessment tools have been validated according to the child's age, cultural background, mental status, communication skills and physiological reactions [1410]. Depending on the child's age, the 0-10 Numeric Rating Scale, Faces Revised Pain Scale, Face Legs Activity, Cry and Consolability Scale (FLACC) or Colour Analog Scale, can be used [1411]. One of the most important topics in paediatric pain management is informing and involving the child and caregivers during this process. Patient-family-controlled- analgesia is the preferred pain management in the hospital and at home if the child and caregivers are provided with the correct information [1412, 1413].

3.23.2.3 *Disease management*

3.23.2.3.1 Drugs and route of administration

Pre-emptive analgesia is an important concept that aims to induce the suppression of pain before neural hypersensitisation occurs [1414]. Regional anaesthesia is given intra-operatively which can include a regional nerve block or local wound infiltration and has proven to reduce the need for post-operative analgesia [408]. The WHO's 'pain ladder' is a useful tool for the pain management strategy [1415]. Paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs) are the first choice. As they become insufficient to prevent pain, weak and strong opioids are added to oral drugs to achieve balanced analgesia. A proposed strategy for post-operative analgesia may be as follows:

1. Intra-operative regional block and/or local wound infiltration.
2. Paracetamol + NSAID.
3. Paracetamol + NSAID + weak opioid (e.g., tramadol or codeine).
4. Paracetamol + NSAID + strong opioid (e.g., morphine, fentanyl, oxycodone or pethidine).

The use of opioids in children has long held a standard role in the post-operative management of pain. Increased recognition of the adverse effects of opioids and prolonged opioid dependency demand a balanced intra-operative administration of opioids [1416]. Intra-operative adequate dosage of paracetamol and NSAIDs results in a decrease in opioid requirement in children [1417, 1418].

3.23.2.3.2 Circumcision

Circumcision requires anaesthesia and proper pain management [1419]. Potential analgesic interventions during circumcision include the use of a dorsal penile nerve block (DPNB) or ring block, topical anaesthetics (depending on age, weight and body surface), and sucrose preferably in combination [408, 1420]. Caudal blockade methods have similar efficacy compared to DPNB [1421]. However, caregivers should be informed about the more frequent incidence of post-operative motor weakness and micturition problems [1420, 1421].

3.23.2.3.3 Penile, inguinal, and scrotal surgery

Caudal blocks and peripheral nerve blocks (DPNB and pudendal) are commonly used methods for analgesia in hypospadias surgery. Several agents with different doses, concentrations and administration techniques have been used. All have been shown to have adequate post-operative analgesic properties and no increase in post-operative complications was seen [407-409]. Severe bladder spasms caused by the presence of the bladder catheter can be managed with antimuscarinic medications.

For inguinoscrotal surgery, various regional anaesthesia methods have been investigated, such as transversus abdominis plane block, quadratus lumborum nerve block, ilioinguinal/iliohypogastric nerve blocks and caudal blocks. All have been shown to have adequate post-operative analgesic properties [1422]. Additional local anaesthetics such as clonidine or dexmedetomidine has been shown to prolong the analgesic effect [1423, 1424].

3.23.2.3.4 Bladder and kidney surgery

Continuous local infusion (pain catheter) reduces the need for post-operative opioids [1425-1427], as well as systemic (intravenous) application of analgesics [1428], has been shown to be effective. Ketorolac (NSAID) is an effective agent that decreases the frequency and severity of bladder spasms, the length of post-operative hospital stay and costs, and intra-operative opioid administration [1429]. Open kidney surgery is particularly painful because all three muscle layers are cut during conventional flank incision. A dorsal lumbotomy incision