

## POSTOPERATIVE ANALGESIA IN PAEDIATRIC DAY CASE SURGERY

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Paediatric day case surgery was first described in 1909 by James Nicoll, who performed 8988 operations as day case at the Royal Glasgow Hospital. Since then, day case surgery has continued to grow and now about 50% to 60% of paediatric surgery is performed as outpatients in most of the western countries like USA and UK. In India, the incidence of paediatric day case surgery is low, i.e., 35%. This is because of illiteracy, lack of proper transport facilities and unhygienic conditions at home.

Key to success in paediatric day case surgery is proper selection of patients, prevention of common postoperative complications and adequate pain management. Severe postoperative pain not only decreases the patients' functional capacity but also is associated with longer postoperative stay and higher incidence of unanticipated readmission. Pain may precipitate postoperative nausea vomiting (PONV) which is another cause of unanticipated readmission. Hence adequate pain management is mandatory in day case surgery.

Planning for postoperative analgesia must be done during the preoperative visit, keeping in mind the age, psychological and ASA status of the patient, and the type of surgery. Appropriate assessment of pain is essential for providing optimal analgesia.

### ASSESSMENT

Numerous scoring systems are available for assessment of pain in paediatric patients. Each system has its own advantages and disadvantages. Selection of scoring systems mainly depends upon the age of the child.

**Neonates.** Day case surgery is not contraindicated in full term neonates - minor procedures like examination under anaesthesia and incision and drainage can be performed. Fortunately, these procedures do not produce much postoperative pain.

A variety of assessment tools have been developed for neonates. Observation of facial expression, body position and movement, crying, arterial pressure, heart rate, skin colour, ventilatory frequency and sleeplessness are used to find out the severity of pain in neonates. But these parameters can be altered by non-painful stimuli. Therefore a more rational approach is to assess the improvement of behavioural or physiological parameters in response to comfort, analgesia or sedation.

**Infants and Children up to 3 years.** Like neonates, assessment of pain in this age group of children is also based on behavioural and physiological response to comfort and analgesic therapy. Though exhibited behaviour may be more vigorous with an "all or nothing" type of response, sometimes the response is more precise and they can locate the pain. Objective pain scale (OPS) and toddler-preschooler postoperative pain scale (TPPPS) are commonly used to assess the intensity of pain.

**Children aged 3 to 7 years.** These patients can differentiate the presence or absence of pain and locate the pain. They can also express the intensity of pain in the form nil, mild, moderate and severe. The face scale or Oucher scale can be used in this age group. Children of five or more years old can operate visual or colour analogue scales for expression of pain.

**Older Children.** Like adults, children more than seven years old can express intensity, location and quality of pain. Any scoring system such as horizontal VAS, vertical colour analogue scale and self reporting are effective and reliable.

### MANAGEMENT OF POSTOPERATIVE PAIN

Operative procedures associated with severe postoperative pain should not be performed as day surgery. For most patients postoperative pain should not be a major problem provided that local anaesthesia and NSAID have been used either as a part of the anaesthetic technique or after completion of surgery. Oral analgesics are the mainstay of pain relief at home.

**Topical Anaesthesia.** EMLA cream is an eutectic mixture of prilocaine and lignocaine and is very effective at providing dermal anaesthesia. Topical EMLA decreases the pain associated with circumcision, release of preputial adhesion, myringotomies and skin grafting. To obtain effective analgesia cream should be applied to the skin with an occlusive dressing about 45 to 60 minutes prior to surgery. Duration of analgesia is about 1<sup>o</sup> hours. EMLA should be used with caution in infants less than 3 months of age or in patients who are taking sulphonamides or other methaemoglobin inducing medications because of potential of methaemoglobinaemia.

Lignocaine gel can be used to provide analgesia following circumcision and after repairs of lacerations. Parents can be taught to apply the gel for postoperative analgesia during first 24-36 hours. Application of bupivacaine and epinephrine (adrenaline) on the open wound towards the end of surgery provides excellent analgesia. Topical local anaesthetic eye drops can be used to provide analgesia following ophthalmic surgery.

**Instillation.** Bupivacaine instillation before closure of small wounds is very effective. Continuous infusion of 0.25% bupivacaine through a small cannula at a rate of 1-3mls/hour provides a simple, safe and effective method of analgesia at the donor site of skin graft or iliac crest bone graft.

**Wound infiltration.** Local anaesthetic agents may be administered intradermally or subcutaneously to block impulse conduction in local nerve fibres. Surgical wound infiltration can be used to provide analgesia following skin biopsies, muscle biopsies and virtually all procedures where other regional blocks are either inappropriate or contraindicated.

**Caudal epidural block** is widely used in paediatric patients to provide analgesia following surgery below the level of

the umbilicus. With a single injection, it provides long lasting postoperative analgesia in paediatric day case surgery.

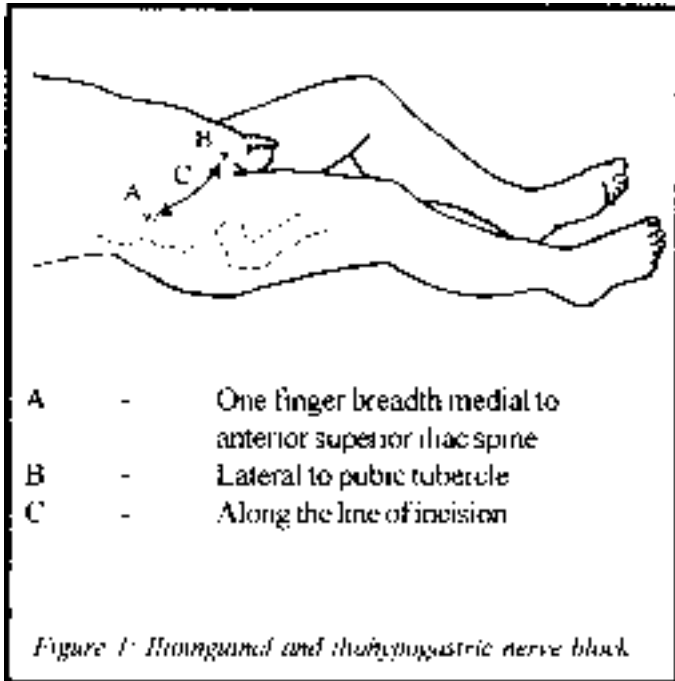
Caudal block is achieved by injecting local anaesthetic agents into the epidural space through the sacral hiatus, which is situated 1 to 2cm above the gluteal crease, superior to the coccyx and between the prominent sacral cornuae. The sacral hiatus can be located by drawing an equilateral triangle of which the two superior angles overlie the posterior superior iliac spines and third angle overlies the sacral hiatus (*see Update in Anaesthesia No. 9 1998*).

Under general anaesthesia the patient is placed in the lateral position. The skin is prepared using a standard sterile technique. The block is performed using a short bevelled needle of less than 3cm length to reduce the incidence of accidental dural puncture. The needle is inserted through the sacral hiatus at a 45 degree angle pointing rostrally (towards the head). Once the sacrococcygeal ligament is punctured the angle of the needle is decreased to 20 degrees. Approximately 0.75 to 1ml/kg of local anaesthetic agent is required for analgesia up to T10 level.

Weakness of the lower limbs associated with caudal block may delay the discharge of the patient. This can be minimised by using weaker local anaesthetic solutions such as 0.125% bupivacaine. Another drawback of single shot caudal block is its short duration. The duration can be prolonged by adding drugs such as clonidine an  $\alpha_2$  agonist, in a dose of 1-2mcg/kg or preservative free ketamine in a dose of 0.5mg/kg. Morphine and other spinal opioids are not recommended for paediatric day case surgery because of the risk of delayed respiratory depression.

**Peripheral Nerve Block.** Peripheral nerve blocks such as penile block, inguinal block, fascia iliaca block and sciatic nerve block have been demonstrated to be as effective as single shot caudal block. Moreover they produce longer lasting analgesia.

**Penile block** is performed to provide analgesia following circumcision, minor hypospadias surgery and other distal penile procedures. Different techniques have been described to block penile nerves including a midline and paramedian approaches. The paramedian approach is often preferred due to a lower incidence of complications such as intravascular injection, haematome and ischaemia. A short bevelled needle is inserted perpendicular to the skin at the inferior edge of the symphysis pubis at the 11 and 1o'clock positions. The needle is advanced until Bucks fascia is penetrated, which is determined by a loss of resistance. After careful aspiration plain 0.5% bupivacaine 1ml + 0.1ml/kg is administered. For better effect,



subcutaneous infiltration of local anaesthetics at the base of the penis from 3 to 9 o'clock position is recommended. However a full ring block should be avoided.

**Ilioinguinal and iliohypogastric blocks** provide effective analgesia after inguinal herniotomy and orchidopexy. The quality and duration of analgesia achieved by this block are comparable to caudal block.

A short bevelled 22 to 25 gauge needle is inserted, one patient's finger breath medial to anterior superior iliac spine. After penetrating the external oblique aponeurosis and the internal oblique muscle fascia, a sudden loss of resistance is felt and the local anaesthetic can be deposited after a negative aspiration test. A dosage of 0.4 ml/kg of 0.25% bupivacaine with or without adrenaline is used for unilateral ilioinguinal and iliohypogastric nerve blocks. Another injection immediately lateral to pubic tubercle to block the nerves coming from the opposite side and local infiltration along the line of incision improve the quality of analgesia.

In about 50% patients the subcostal nerve accompanies the iliohypogastric nerve and may be responsible for inadequate pain relief. Therefore a more effective block can be achieved by an injection directed laterally to contact the inside wall of the ilium and infiltrating local anaesthetic as the needle is withdrawn slowly. For pain relief after orchidopexy ilioinguinal and iliohypogastric blocks must be combined with local infiltration of the scrotum. This is because the inferior aspect of the scrotum is innervated by the pudendal nerve.

**Brachial plexus block** may be used to provide postoperative analgesia following upper extremity surgery. The axillary approach is the safest, more reliable and most commonly used in children and may provide useful analgesia for operations below the elbow.

Positioning of the patient is very important to make the artery (which is surrounded by the nerve plexus) palpable. The child is placed supine and the arm is abducted to 90 degrees and rotated externally. The forearm is flexed to 90 degrees. A short bevelled needle is inserted perpendicular to skin at the most proximal part at which the artery can be palpated. The needle is advanced until a "fascial click" is felt. At this point arterial pulsation is usually transmitted to needle. These two signs indicate that the needle tip is within the fascial sheath. After a negative aspiration test, local anaesthetic agent may be injected. Bupivacaine 0.25%, 0.6ml/kg is usually adequate. A two point injection technique, i.e., one above and another below the artery improves the success rate.

**Femoral nerve block and 3 in 1 blocks** are indicated in day surgery to provide analgesia following skin grafting where the graft is taken from thigh and muscle biopsies. However due to the effect on the leg muscles, postoperative mobilisation is significantly affected which may delay discharge.

The femoral nerve is situated just lateral to the femoral artery below the inguinal ligament deep to the fascia lata and iliaca. Therefore when the needle is advanced, 2 losses of resistance must be felt. Usually 0.25% bupivacaine 0.3ml/kg is enough for adequate blocks of the femoral nerve (*see Update in Anaesthesia No. 11 2000*).

In a 3 in 1 block apart from the femoral nerve, the lateral cutaneous nerve of thigh and obturator nerve are also blocked. The volume of local anaesthetic should be doubled so that it can spread adequately between the iliacus fascia and muscle to reach the other nerves. Distal pressure on the femoral sheath during and after the injection improves the quality of nerve block.

**Greater auricular nerve block.** This nerve innervates most of the pinna and may be blocked to provide excellent analgesia after otoplasty. The block is performed by injecting 0.5% bupivacaine 1ml subcutaneously between the mastoid process and the descending ramus of the mandible.

## Systemic Analgesics

**Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)** along with local anaesthesia are the mainstay of postoperative pain relief in paediatric day case surgery. They have several advantages over opioid analgesics including a lack of respiratory depression and sedation. They do not cause nausea or vomiting.

NSAIDs have been found to be very effective analgesics in older children. However use of these agents are not recommended below one year of age due to the possibility of immature renal function and hepatic metabolism. Diclofenac, ibuprofen and ketorolac are the most commonly used agents. Administration of these agents before surgery as a premedicant provides optimal analgesia due to their anti-inflammatory activity.

Bronchospasm induced by NSAIDs is very rare in children and asthma is not a contraindication to the use of NSAIDs. However one should avoid them if the child has been recently or repeatedly hospitalised with asthma, or has required steroids systemically, or is known to be NSAID sensitive (Table 1).

**Paracetamol (acetaminophen)** is a very safe and effective analgesic in children including infants and neonates. Oral paracetamol 20mg/kg as a premedication is useful in achieving therapeutic plasma concentration postoperatively. The total daily dose of paracetamol can be up to 90mg/kg/day for the first 3 days in healthy children. This should be reduced to 60mg/kg/day in

Table 1: Doses of NSAIDs in Paediatric Patients

NSAID	Dose mg/kg	Maximum dose mg/kg/day
Ibuprofen	10	40
Diclofenac	1	3
Ketorolac	0.5	2
Naproxen	7.5	15
Indomethacin	1	3

Table 2: Dose of Paracetamol (Orally)

Loading dose	20 mg/kg
Maintenance dose	15 mg/kg
Maximum dose	90 mg/kg/day (Older children) 60 mg/kg/day (Neonates)

neonates (Table 2). The drug may be administered rectally but higher doses are necessary, due to poor and erratic absorption through the rectal mucosa.

**Opioids** are not ideal for paediatric day case surgery as they may produce ventilatory depression, excessive sedation and postoperative nausea and vomiting. With some procedures however opioids are required during and after surgery to control pain. Shorter acting opioids are ideal - fentanyl (1-2mcg/kg) is commonly used. Longer acting opioids (morphine / pethidine) may be required if postoperative pain is unexpectedly severe. Although the procedure may have been planned on a day case basis unexpected hospital admission may be required for control of severe pain.

**Non Pharmacological Therapy** may be helpful in some children. It includes distraction techniques like playing with toys, watching videos, music and hypnotic therapy. The child may be allowed to stay in a friendly atmosphere preferably with parents in the immediate postoperative period. All these measures reduce analgesic requirement and speeds recovery.

## Conclusion

Postoperative pain following day case surgery in paediatric patients is usually not severe and diminishes within 3 to 5 days. Peripheral nerve blocks by local anaesthetic agents provide optimal analgesia in the immediate postoperative period. Patients should not be discharged until pain is well controlled with oral medications such as paracetamol, ibuprofen or diclofenac.

## Further Reading

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