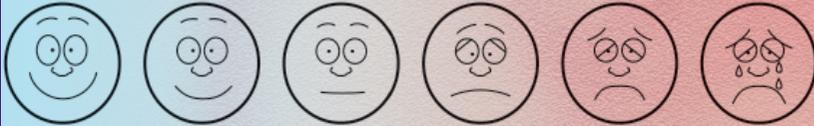


# Postoperative Pain Management – Good Clinical Practice



General recommendations  
and principles for  
successful pain management



Produced in consultation with the  
European Society of Regional Anaesthesia  
and Pain Therapy

**The authors and the publishers have written the information relating to the medications and their dosages with utmost care and in accordance with the routines of the authors' clinical practice, which may not agree with the manufacturer's recommendations. Therefore, the prescriber is expected to read the dosage recommendations and contraindications in the prescribing information for the drugs and use them at their own discretion.**

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## 1. Introduction and objectives

Effective postoperative pain management has a humanitarian role, but there are additional medical and economic benefits for rapid recovery and discharge from hospital. A number of factors contribute to effective postoperative pain management including a structured acute pain management team, patient education, regular staff training, use of balanced analgesia, regular pain assessment using specific assessment tools and adjustment of strategies to meet the needs of special patient groups, such as children and the elderly.

Recent advances in pain control provide greater potential for effective postoperative management. This document reflects the opinions of a panel of European anaesthesiologists. Its aims are to raise awareness of recent advances in pain control and to provide advice on how to achieve effective postoperative analgesia. The recommendations and advice are general principles of pain management and do not provide detailed advice for specific surgical procedures.<sup>1</sup>

<sup>1</sup> Although the choice of drugs shown here is indicative, adjustments will be required to take account of individual patient variation and are the responsibility of the prescribing physician.

## 2. Goals of pain treatment

Effective pain management is now an integral part of modern surgical practice. Postoperative pain management not only minimises patient suffering but also can reduce morbidity and facilitate rapid recovery and early discharge from hospital (see section 8, page 33), which can reduce hospital costs.

### The goals of effective and appropriate pain management are to:

- Improve quality of life for the patient
- Facilitate rapid recovery and return to full function
- Reduce morbidity
- Allow early discharge from hospital

## 3. Physiology of pain

Pain is a personal, subjective experience that involves sensory, emotional and behavioural factors associated with actual or potential tissue injury. What patients tell us about their pain can be very revealing, and an understanding of how the nervous system responds and adapts to pain in the short and long term is essential if we are to make sense of patients' experiences. The wide area of discomfort surrounding a wound, or even a wound that has healed long ago, such as an amputation stump, is a natural consequence of the plasticity of the nervous system. An understanding of the physiological basis of pain is helpful to the sufferer, and the professionals who have to provide appropriate treatment.

According to the International Association for the Study of Pain (IASP), pain is defined as

*"An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."* (IASP 1979)

There is individual variation in response to pain, which is influenced by genetic makeup, cultural background, age and gender. Certain patient populations are at risk of inadequate pain control and require special attention. These include:

- Paediatric patients
- Geriatric patients
- Patients with difficulty in communicating (due to critical illness, cognitive impairment or language barriers)

Postoperative pain can be divided into acute pain and chronic pain:

- Acute pain is experienced immediately after surgery (up to 7 days)
- Pain which lasts more than 3 months after the injury is considered to be chronic pain

Acute and chronic pain can arise from cutaneous, deep somatic or visceral structures. Surgery is typically followed by acute pain and correct identification of the type of pain enables selection of appropriate effective treatment. The type of pain may be somatic (arising from skin, muscle, bone), visceral (arising from organs within the chest and abdomen), or neuropathic (caused by damage or dysfunction in the nervous system). Patients often experience more than one type of pain.

### 3.a. Positive role of pain

Acute pain plays a useful "positive" physiological role by:

- Providing a warning of tissue damage
- Inducing immobilisation to allow appropriate healing

### 3.b. Negative effects of pain

*Short term negative effects of acute pain include:*

- Emotional and physical suffering for the patient
- Sleep disturbance  
(with negative impact on mood and mobilisation)
- Cardiovascular side effects  
(such as hypertension and tachycardia)
- Increased oxygen consumption  
(with negative impact in the case of coronary artery disease)
- Impaired bowel movement  
(while opioids induce constipation or nausea, untreated pain may also be an important cause of impaired bowel movement or PONV\*)
- Negative effects on respiratory function  
(leading to atelectasis, retention of secretions and pneumonia)
- Delays mobilisation and promotes thromboembolism  
(postoperative pain on mobilisation is one of the major causes for delayed mobilisation)

\* PONV = Postoperative Nausea and Vomiting.

*Long term negative effects of acute pain:*

- Severe acute pain is a risk factor for the development of chronic pain<sup>1</sup>
- There is a risk of behavioural changes in children for a prolonged period (up to 1 year) after surgical pain

There are two major mechanisms in the physiology of pain:

- **Nociceptive (sensory):** Inflammatory pain due to chemical, mechanical and thermal stimuli at the nociceptors (nerves that respond to painful stimuli).
- **Neuropathic:** Pain due to neural damage in peripheral nerves or within the central nervous system.

During normal physiology, pain sensations are elicited by activity in unmyelinated (C-) and thinly myelinated (Ad-) primary afferent neurons that synapse with neurons in the dorsal horn of the spinal cord. Sensory information is then relayed to the thalamus and brainstem.

Repetitive activation of C- nociceptive receptors produces alterations in central as well as peripheral nervous systems.

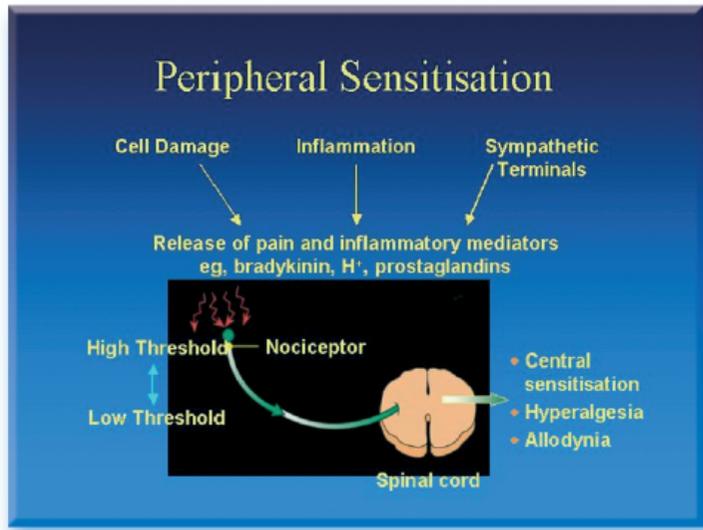
### 3.c. The mechanism of peripheral pain sensitisation

Normally, C- fibres (slow-conducting fibres that transmit dull aching pain) are silent in the absence of stimulation, but following acute tissue injury in the presence of ongoing pathophysiology, these nociceptors become sensitised and release a complex mix of pain and inflammatory mediators leading to pain sensations (Figure 1, page 6).

<sup>1</sup> Several investigations into chronic pain have concluded that 20% to 50% of all patients with chronic pain syndromes started with acute pain following trauma or surgery, but the role of effective pain treatment in preventing this risk is not clear.

Figure 1.

### Mechanism of peripheral sensitisation



### 3.d. The mechanism of central sensitisation

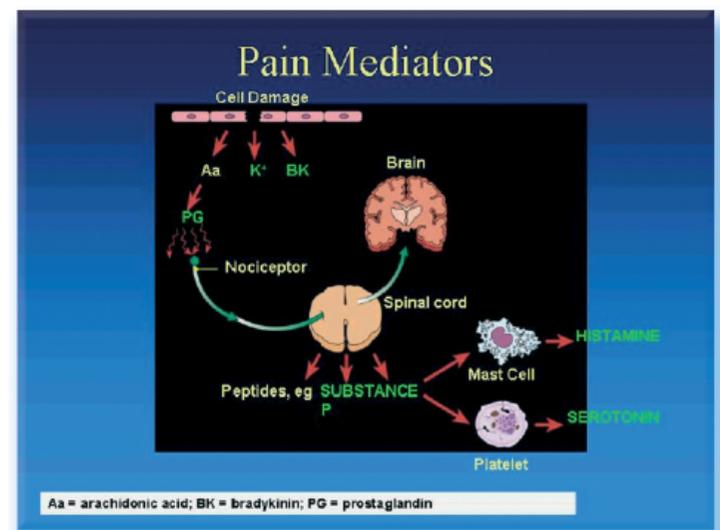
The responses in the CNS are primarily physiological. Central sensitisation is a physiological process and, only if there is continual firing of C-nociceptors over time, will these processes lead to more chronic pain syndromes.

Sustained or repetitive C-nociceptor activity produces alterations in the response of the central nervous system to inputs from the periphery. When identical noxious stimuli are repeatedly applied to the skin at a certain rate, there is a progressive build-up in the response of spinal

cord dorsal horn neurons (known as 'wind up'). This allows the size of the dorsal horn neuron's receptive field to grow (Figure 2). This process, called central sensitisation, occurs with any tissue damage. As with sensitisation of primary afferent nociceptors, this sensitisation of central pain transmission is a normal physiological response of the undamaged nervous system.

Figure 2.

### Pain mediators



Assessment of pain is a vital element in effective postoperative pain management. The principles of successful pain assessment are shown in Table 1.

Table 1

### Principles of successful pain assessment

- Assess pain both at rest and on movement to evaluate the patient's functional status.
- The effect of a given treatment is evaluated by assessing pain before and after every treatment intervention.
- In the surgical Post Anaesthesia Care Unit (PACU) or other circumstances where pain is intense, evaluate, treat, and re-evaluate frequently (e.g. every 15 min initially, then every 1-2 h as pain intensity decreases).
- On the surgical ward, evaluate, treat, and re-evaluate regularly (e.g. every 4-8 h) both the pain and the patient's response to treatment.
- Define the maximum pain score above which pain relief is offered (the intervention threshold). For example, verbal ratings score of 3 at rest and 4 on moving, on a 10-point scale.
- Pain and response to treatment, including adverse effects, are documented clearly on easily accessible forms, such as the vital sign sheet. This is useful for treatment, good communication between staff, auditing and quality control.
- Patients who have difficulty communicating their pain require particular attention. This includes patients who are cognitively impaired, severely emotionally disturbed, children, patients who do not speak the local language, and patients whose level of education or cultural background differs significantly from that of their health care team.

- Unexpected intense pain, particularly if associated with altered vital signs, (hypotension, tachycardia, or fever), is immediately evaluated. New diagnoses, such as wound dehiscence, infection, or deep venous thrombosis, should be considered.
- Immediate pain relief without asking for a pain rating is given to patients in obvious pain who are not sufficiently focused to use a pain rating scale.
- Family members are involved when appropriate.

#### 4.a. Specific tools for pain assessment

Specific pain assessment scales are used to quantify pain. The use of one scale within a hospital ensures that everyone in the team "*speaks the same language*" regarding the intensity of pain. The patient's own report is the most useful tool. The intensity of pain should therefore be assessed as far as possible by the patient as long as he/she is able to communicate and express what pain feels like. Always listen to and believe what the patient says.

A number of different patient self-assessment scales are available (Figure 3, page 12):

- A. Facial expressions: a pictogram of six faces with different expressions from smiling or happy through to tearful. This scale is suitable for patients where communication is a problem, such as children, elderly patients, confused patients or patients who do not speak the local language.
- B. Verbal rating scale (VRS): the patient is asked to rate their pain on a five-point scale as "none, mild, moderate, severe or very severe".

C. Numerical rating scale (NRS): This consists of a simple 0 to 5 or 0 to 10 scale which correlates to no pain at zero and worst possible pain at 5 (or 10). The patient is asked to rate his/her pain intensity as a number.

D. Visual analogue scale (VAS): This consists of an ungraduated, straight 100 mm line marked at one end with the term "no pain" and at the other end "the worst possible pain". The patient makes a cross on the line at the point that best approximates to their pain intensity.

The VRS and NRS are the most frequently used assessment tools in the clinical setting while the VAS scale is primarily used as a research tool.

#### 4.b. Selection of suitable assessment tool (Figure 3, page 12):

When selecting a pain assessment tool ensure that:

- It is appropriate for the patient's developmental, physical, emotional, and cognitive status
- It meets the needs of both the patient and the pain management team

#### 4.c. Documentation

Document pain regularly, take appropriate action and monitor efficacy and side effects of treatment. Record the information in a well-defined place in the patient record, such as the vital sign sheet or a purpose-designed acute pain chart.

- The nurse responsible for the patient reports the intensity of pain and treats the pain within the defined rules of the local guidelines.
- The physician responsible for the patient may need to modify the intervention if evaluation shows that the patient still has significant pain.

- The treatment strategy to be continued is discussed by the physician responsible for the patient in conjunction with the ward nurses.
- The physician and nurses pay attention to the effects and side effects of the pain treatment.

Figure 3  
Choice of assessment tool

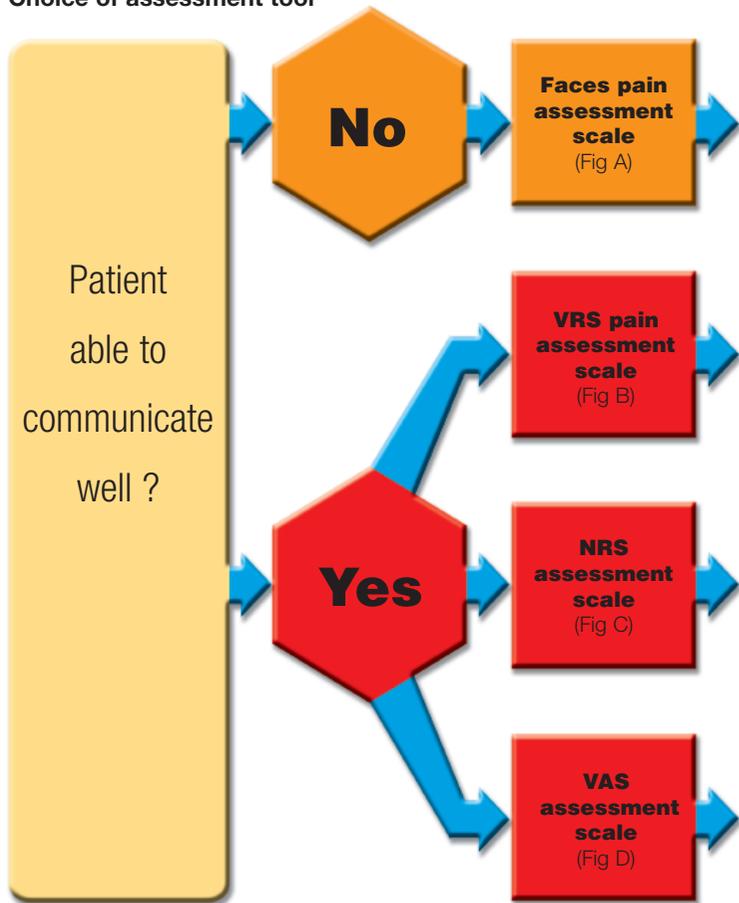


Fig A. Wong-Baker Faces Pain Rating Scale<sup>1</sup>



Fig B. VRS<sup>2</sup>

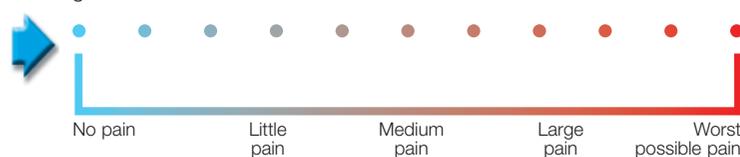


Fig C. NRS<sup>2</sup>

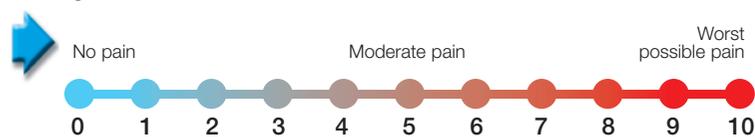
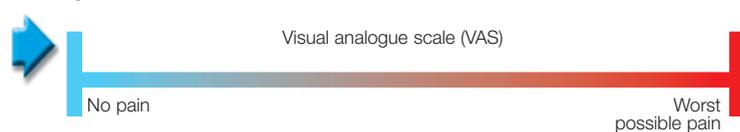


Fig D. VAS<sup>2</sup>



<sup>1</sup> With permission from Elsevier.

<sup>2</sup> Adapted from McCaffery M, Pasero C. Pain: Clinical Manual 1999 with permission from Elsevier.

Patients are unlikely to be aware of postoperative pain treatment techniques and as the success of pain relief is influenced by their knowledge and beliefs, it is helpful to give patients (and parents in case of children) detailed information about postoperative pain and pain treatment. Adequate information gives the patient realistic expectations of the care that can be provided (pain relief, not a "pain free status"). This information can include:

- The importance of treating postoperative pain
- Available methods of pain treatment
- Pain assessment routines
- Goals (optimum pain scoring) (see section 2, page 2)
- The patient's participation in the treatment of pain

Information for the patient can be given in different ways (in combination):

- Verbal information
- Written and/or audiovisual information
  - Brochures
  - Wall posters
  - Video films
  - Web pages

A preoperative discussion with the patient and relatives can include the following:

- Discuss the patient's previous experiences with pain and preferences for pain assessment and management.
- Give the patient information about pain management therapies that are available and the rationale underlying their use.
- Develop with the patient a plan for pain assessment and management.

- Select a pain assessment tool, and teach the patient to use it. Determine the level of pain above which adjustment of analgesia or other interventions will be considered.
- Provide the patient with education and information about pain control.
- Emphasise the importance of a factual report of pain, avoiding stoicism or exaggeration.

The "Patient Information Project" is a useful source of information for patients who require information about anaesthesia and postoperative pain management. This is a joint project between the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland, together with patient representative groups. The website is:

[www.youranaesthetic.info](http://www.youranaesthetic.info)

Effective treatment of postoperative pain includes a number of factors, including good nursing, non-pharmacological techniques, such as distraction, and balanced (multimodal) analgesia to provide adequate pain relief with optimal drug combinations used at the lowest effective doses.

### 6.a. Pharmacological methods of pain treatment<sup>1</sup>

Postoperative pain management should be step-wise and balanced (Figure 4, page 18). The four main groups of analgesic drugs used for postoperative pain management are shown in Table 2 opposite, with examples of drugs listed in each group.

#### 6.a.i. Balanced (multimodal) analgesia

Balanced (multimodal) analgesia uses two or more analgesic agents that act by different mechanisms to achieve a superior analgesic effect without increasing adverse events compared with increased doses of single agents. For example, epidural opioids can be administered in combination with epidural local anaesthetics; intravenous opioids can be administered in combination with NSAIDs, which have a dose sparing effect for systemically administered opioids.

Balanced analgesia is therefore the method of choice wherever possible, based on paracetamol and NSAIDs for low intensity pain with opioid analgesics and/or local analgesia techniques being used for moderate and high intensity pain as indicated (Figure 4, page 18).

<sup>1</sup> The example doses given are indicative and do not take account of individual patient variation.

Table 2

### Pharmacological options of pain management

Non-opioid analgesics	Paracetamol NSAIDs, including COX-2 inhibitors* Gabapentin, pregabalin <sup>2</sup>
Weak opioids	Codeine Tramadol Paracetamol combined with codeine or tramadol
Strong opioids	Morphine Diamorphine Pethidine Pirtramide Oxycodone
Adjuvants**	Ketamine Clonidine

\* At the time of writing, COX-2 inhibitor drugs are subject to scrutiny by international regulatory bodies with regard to adverse outcomes when used for long-term oral prescription or for pain relief in patients with cardiovascular problems such as myocardial infarction, angina pectoris, hypertension. Rofecoxib has been withdrawn from sales and prescription of valdecoxib has been suspended pending further research into its adverse events profile for cardiovascular morbidity and the occurrence of severe muco-cutaneous side effects. The injectable COX-2 inhibitor, parecoxib remains available for short-term use in treating postoperative pain. All NSAIDs should be used with care in patients with cardiovascular disease.

\*\* These adjuvants are not recommended for routine use in acute pain management because of their adverse side effects. Their use should be restricted to specialists in managing pain problems.

<sup>2</sup> Gabapentin and pregabalin are approved for pain management but at the time of writing there is little published data to recommend the use of these drugs for acute pain management.

Figure 4

### Treatment options in relation to magnitude of postoperative pain expected following different types of surgery<sup>1</sup>

Mild intensity pain	Moderate intensity pain	Severe intensity pain
<p><i>For example:</i> Inguinal hernia Varices Laparoscopy</p>	<p><i>For example:</i> Hip replacement Hysterectomy Jaw surgery</p>	<p><i>For example:</i> Thoracotomy Upper abdominal surgery Aortic surgery Knee replacement</p>
	<p>(i) Paracetamol and wound infiltration with local anaesthetic (ii) NSAIDs (unless contraindicated) and (iii) Peripheral nerve block (single shot or continuous infusion) or opioid injection (IV PCA)</p>	<p>(i) Paracetamol and wound infiltration with local anaesthetic (ii) NSAIDs (unless contraindicated) and (iii) Epidural local analgesia or major peripheral nerve or plexus block or opioid injection (IV PCA)</p>
<p>(i) Paracetamol and wound infiltration with local anaesthetic (ii) NSAIDs (unless contraindicated) and (iii) Regional block analgesia Add weak opioid or rescue analgesia with small increments of intravenous strong opioid if necessary</p>		

<sup>1</sup> The examples given here represent levels of pain commonly experienced and are subject to individual variation and contra-indications may apply.

### 6.a.ii. Opioids<sup>1</sup>

Table 3

#### Morphine and weak opioids

Morphine	
Administration	(i) Intravenous. (ii) Subcutaneous by continuous infusion or intermittent boluses via indwelling cannula. (iii) Intramuscular (not recommended due to incidence of pain. 5-10 mg 3-4 hourly).
Dosage: IV PCA  Subcutaneous	Bolus: 1-2 mg, lockout: 5-15 min (usually 7-8 min), no background infusion. 0.1-0.15 mg/kg 4-6 hourly, adapted in relation to pain score, sedation and respiratory rate.
Monitoring	Pain score, sedation, respiratory rate, side effects.
Comments	Side effects such as nausea, vomiting, sedation and apnoea. No other opioid or sedative drug should be administered.

*continued overleaf*

<sup>1</sup> The doses and routes of administration of drugs described above are general examples and each patient should be assessed individually before prescribing.

Table 3 (continued)

<b>Codeine</b>	
Administration	Oral
Dosage	3 mg/kg/day combined with paracetamol. A minimum of 30 mg codeine/tablet is required.
Monitoring	Pain score, sedation, side effects.
Comments	Analgesic action is likely to be due to conversion to morphine. A small number of patients derive no benefit due to absence of the converting enzyme.
<b>Tramadol</b>	
Administration	(i) Intravenous: inject slowly (risk of high incidence of NV). (ii) Intramuscular. (iii) Oral administration as soon as possible.
Dosage	50-100 mg 6 hourly.
Monitoring	Pain score, sedation, respiratory rate, side effects.
Comments	Tramadol reduces serotonin and norepinephrine reuptake and is a weak opioid agonist. In analgesic efficiency, 100 mg tramadol is equivalent to 5-15 mg morphine. Sedative drugs can have an additive effect.

NV = nausea and vomiting

<sup>1</sup> The doses and routes of administration of drugs described above are generally examples and each patient should be assessed individually before prescribing.

**6.a.iii. Non-opioids<sup>1</sup>**

Table 4

**Paracetamol**

Administration	(i) Intravenous: Start 30 min before the end of surgery. (ii) Oral administration as soon as possible. Duration: as long as required.
Dosage	4 x 1 g paracetamol/day (2 g propacetamol/day). Dose to be reduced (e.g. 3 x 1 g/day) in case of hepatic insufficiency.
Monitoring	Pain scores.
Comments	Should be combined with NSAID and/or opioids or loco-regional analgesia for moderate to severe pain.

Table 5

**Combination of codeine + paracetamol**

Administration	Oral.
Dosage	Paracetamol 500 mg + codeine 30 mg. 4 x 1 g paracetamol/day.
Monitoring	Pain score, sedation, side effects.
Comments	Analgesic action is likely to be due to conversion to morphine. A small number of patients derive no benefit due to absence of the converting enzyme.

<sup>1</sup> The doses and routes of administration of drugs described above are general examples and each patient should be assessed individually before prescribing.

Table 6

**NSAIDs<sup>1</sup>**

Administration	(i) Intravenous: administration should start at least 30-60 min before end of surgery. (ii) Oral administration should start as soon as possible. Duration: 3-5 days.
Dosage examples	(i) <i>Conventional NSAIDs include:</i> ketorolac: 3 x 30-40 mg/day (only IV form) diclofenac: 2 x 75 mg/day ketoprofen: 4 x 50 mg/day (ii) <i>Selective NSAIDs include:</i> meloxicam 15 mg once daily COX-2 inhibitors are now licensed for postoperative pain management. They are as efficient as ketorolac but reduce GI side effects. Examples include: parecoxib: 40 mg followed by 1-2 x 40 mg/day (IV form) or celecoxib: 200 mg/day. However, there is some debate due to cardiovascular risks in patients with arteriosclerosis. *See note below Table 2, page 17
Monitoring	Pain scores. Renal function in patients with renal or cardiac disease, elderly patients, or patients with episodes of severe hypotension. Gastrointestinal side effects. Non-selective NSAIDs would be combined with proton inhibitors (i.e. omeprazol) in patients at risk of gastrointestinal side effects.
Comments	Can be added to the pre-medication. Can be used in association with paracetamol and/or opioids or local regional analgesia for moderate to severe pain.

<sup>1</sup> The doses and routes of administration of drugs described above are general examples and each patient should be assessed individually before prescribing.

**6.a.iv. Adjuvants**

In addition to systemic administration of NSAIDs or paracetamol, weak opioids and non-opioid analgesic drugs may be administered "on request" for moderate or severe pain. These include ketamine and clonidine. Clonidine can be administered orally, intravenously or perineurally in combination with local anaesthetics. However, the side effects could be significant. The most important ones are hypotension and sedation. Ketamine can be administered via oral, intramuscular or intravenous routes. It has also significant side effects.

**6.a.v. Regional analgesia***Continuous Central Neuraxis Blockade (CCNB)*

CCNB is one of the most effective forms of postoperative analgesia, but it is also one of the most invasive. However, CCNB remains the first choice for a number of indications, such as abdominal, thoracic, and major orthopaedic surgery, where adequate pain relief cannot be achieved with other analgesia techniques alone.

CCNB can be achieved via two routes:

- Continuous epidural analgesia - the recommended first choice
- Continuous spinal analgesia - should be limited to selected cases only, as there is less experience with this technique

Postoperative epidural analgesia is usually accomplished with a combination of a long-acting local anaesthetic and an opioid, in dilute concentrations. Long-acting local anaesthetics are preferred because they are associated with less tachyphylaxis. Maintenance techniques in epidural analgesia include:

- Continuous Infusion (CI): An easy technique that requires little intervention. The cumulative dose of local anaesthetic is likely to be higher and side effects are more likely than with the other two techniques.

- Intermittent Top-up: Results in benefits due to frequent patient/staff contact but can produce a high staff workload and patients may have to wait for treatment.
- Patient-Controlled Epidural Analgesia (PCEA): This technique produces high patient satisfaction and reduced dose requirements compared with CI. However, sophisticated pumps are required and accurate catheter position is important for optimal efficacy.

Examples of drugs and dosages for use in continuous epidural analgesia are shown in Table 7.

Table 7

### Examples of local anaesthetics and opioids and doses in epidural analgesia<sup>1</sup>

Local anaesthetics/opioids	Ropivacaine 0.2% (2 mg/ml) <b>or</b> Levobupivacaine <b>or</b> Bupivacaine 0.1-0.2% (1-2 mg/ml)	Sufentanil 0.5-1 µg/ml <b>or</b> Fentanyl 2-4 µg/ml
Dosage for continuous infusion (thoracic or lumbar level)	6-12 ml/h	
Dosage for patient controlled infusion (lumbar or thoracic) <sup>2</sup>	Background: 4-6 ml/h Bolus dose: 2 ml (2-4 ml) Minimum lockout interval 10 min (10-30 min) Recommended maximum hourly dose (bolus + background): 12 ml	

<sup>1</sup> The tip of the catheter should be placed as close as possible to the surgical dermatomes: T6-T10 for major intra-abdominal surgery, and L2-L4 for lower limb surgery.

<sup>2</sup> There are many possible variations in local anaesthetic/opioid concentration yielding good results, the examples given here should be taken as a guideline; higher concentrations than the ones mentioned here are sometimes required but cannot be recommended as a routine for postoperative pain relief.

### Continuous Peripheral Nerve Blockade (CPNB)

Continuous peripheral nerve blocks are being increasingly used since they may provide more selective but still excellent postoperative analgesia with reduced need for opioids over an extended period. Peripheral nerve blocks (PNBs) avoid the side effects associated with central neuraxial blockade, such as hypotension and wide motor blockade with reduced mobility and proprioception, and complications such as epidural haematoma, epidural abscess and paraparesis.

After major orthopaedic lower limb surgery, clinical studies show peripheral nerve blocks are as effective as epidural and that both are better than IV opioids. Examples of drugs and dosages for use in continuous peripheral analgesia are shown in Table 8.

Table 8

### Examples of local anaesthetics and doses in continuous peripheral nerve analgesia

Site of catheter	Local anaesthetics and dosage*
	Ropivacaine 0.2% Bupivacaine 0.1-0.125% Levobupivacaine 0.1-0.2%
Interscalene	5-9 ml/h
Infraclavicular	5-9 ml/h
Axillary	5-10 ml/h
Femoral	7-10 ml/h
Popliteal	3-7 ml/h

\*Sometimes, higher concentrations are required in individual patients. As a standard, starting with a low concentration/dose is recommended to avoid sensory loss or motor block.

Patient Controlled Regional Analgesia (PCRA) can be used to maintain peripheral nerve block. A low basal infusion rate (e.g. 3-5 ml/h) associated with small PCA boluses (e.g. 2.5-5 ml - lockout: 30-60 min) is the preferred technique.

### Infiltration blocks

Pain relief may be achieved by infiltration of the wound with local anaesthetic. The technique is easy to perform by the surgeon at the time of surgery. The efficacy and duration of analgesia depend on the length of the wound and the type of local anaesthetic used (Table 9).

Table 9

#### Local anaesthetic infiltration

	Local anaesthetic	Volume	Additives
<b>Intraarticular instillation</b>			
Knee arthroscopy	0.75% Ropivacaine	20 ml	Morphine 1-2 mg
	0.5% Bupivacaine	20 ml	Morphine 1-2 mg
Shoulder arthroscopy	0.75% Ropivacaine	10-20 ml	
<b>Intraperitoneal instillation</b>			
Gynaecological	0.75% Ropivacaine	20 ml	
Cholecystectomy	0.25% Ropivacaine	40-60 ml	
<b>Wound infiltration</b>			
Inguinal hernia	0.25-0.5% Ropivacaine	30-40 ml	
	0.25-0.5% Levobupi*	30-40 ml	
	0.25-0.5% Bupivacaine	Up to 30 ml	

\* Levobupi = Levobupivacaine.

*continued opposite*

Thyroid surgery	0.25-0.5% Ropivacaine	10-20 ml	
	0.25-0.5% Levobupi*	10-20 ml	
	0.25-0.5% Bupivacaine	Up to 20 ml	
Perianal surgery	0.25-0.5% Ropivacaine	30-40 ml	
	0.25-0.5% Levobupi*	30-40 ml	
	0.25-0.5% Bupivacaine	Up to 30 ml	

\* Levobupi = Levobupivacaine.

Please consult the manufacturer's full prescribing information before use.

The advantages and disadvantages of various techniques of regional analgesia are shown in Table 10.

Table 10

#### Advantages of different techniques of regional analgesia

	Advantages	Disadvantages
<b>Continuous Epidural Analgesia (CEA)</b>	<p>Very effective.</p> <p>Much experience.</p> <p>Differential block with motor sparing is possible.</p> <p>Excellent postoperative pain control over an extended period.</p> <p>Useful for rehabilitation and physiotherapy.</p> <p>Reduces the quantity of opioid analgesics needed.</p>	<p>Motor block and urinary retention may develop or persist depending on the concentrations used. Drugs used must have low risk of systemic toxicity and produce as little motor block as possible.</p> <p>Requires regular clinical monitoring on surgical wards or ICU.</p> <p>There are no universal guidelines for monitoring.</p> <p>May mask a haematoma or abscess resulting in damage to spinal nerves.</p>

*continued overleaf*

Table 10 (continued)

	Advantages	Disadvantages
<b>Continuous Peripheral Nerve Blocks (CPNB)</b>	<p>Better efficacy than parenteral opioids and efficacy comparable to epidural for lower limb procedures.</p> <p>Incidence of side effects lower than with epidural.</p> <p>Avoids major complications e.g. epidural haematoma and epidural sepsis.</p> <p>Excellent postoperative pain control over an extended period.</p> <p>Useful for rehabilitation and physiotherapy.</p> <p>Reduces the quantity of opioid analgesics needed.</p>	<p>Slower learning curve than single shot techniques.</p> <p>Higher incidence of technical problems compared to single shot techniques.</p>
<b>Incisional catheter techniques</b>	<p>Simple technique.</p> <p>Promising results for pain management after lower abdominal procedures, breast surgery and body surface procedures.</p>	<p>Relatively new technique.</p> <p>Further studies needed to evaluate safety.</p>

### 6.b. Non-pharmacological methods of pain treatment

A number of non-pharmacological methods of pain management may be used in conjunction with pharmacological methods in the postoperative setting (Table 11).

Table 11

#### Examples of non-pharmacological methods of pain treatment

Cold	Iced-water is used in orthopaedic surgery after knee-surgery. It can be used both at hospital and at home. There are commercial systems, which are easy to use. The use of iced-water in other kinds of surgery needs further investigation.
Acupuncture	There are no documented effects of acupuncture in postoperative pain management. However, there may be an effect in reducing nausea and vomiting.
Relaxing therapy and distraction, such as music, imagery or hypnosis	These may have a positive effect in individual cases. There are commercial music CDs available for relaxation.

## 7. Structure of an acute pain management service

Treatment of postoperative pain requires good multi-disciplinary and multi-professional co-operation. Every care-providing unit where surgery is performed should provide a pain management team structured according to local needs. Helpful suggestions for starting and operating a pain management team are shown in Figure 5, page 32.

### 7.a. Staff training

All staff involved in the treatment of postoperative pain require regularly updated training emphasising the importance of team-working and co-operation including:

- Physiology and pathophysiology of pain
- Pharmacology of analgesics
- Locally available treatment methods
- Monitoring routines with regard to treatment of pain
- Local document for treatment and assessment of pain

### 7.b. Audit and quality control

Before establishing an acute pain service for the first time, it is important to audit the effectiveness of the current pain management systems in your hospital. By accurately measuring the effectiveness of the "old" pain management system it is then possible to compare the benefits resulting from the introduction of a formal acute pain service.

The following dataset of information allows comparisons to be made between the old and the new:

- Numbers of minor, intermediate, major and complex surgical cases treated
- Type and number of analgesic drug prescriptions issued/administered within the above groups

- Methods of analgesia used (IV PCA, other opioid use, non-opioid drugs, regional techniques)
- Patient satisfaction scores within each group (good, average or poor pain control)
- Length of time patient experienced poor pain control
- Side effects noted (nausea and vomiting, lack of sleep, emotional disturbance)

The above points are just a few examples of the sort of data that can be collected easily with patient questionnaires. The data can then be re-tested when the acute pain team has been established and repeated at regular intervals to maintain quality control of the service.

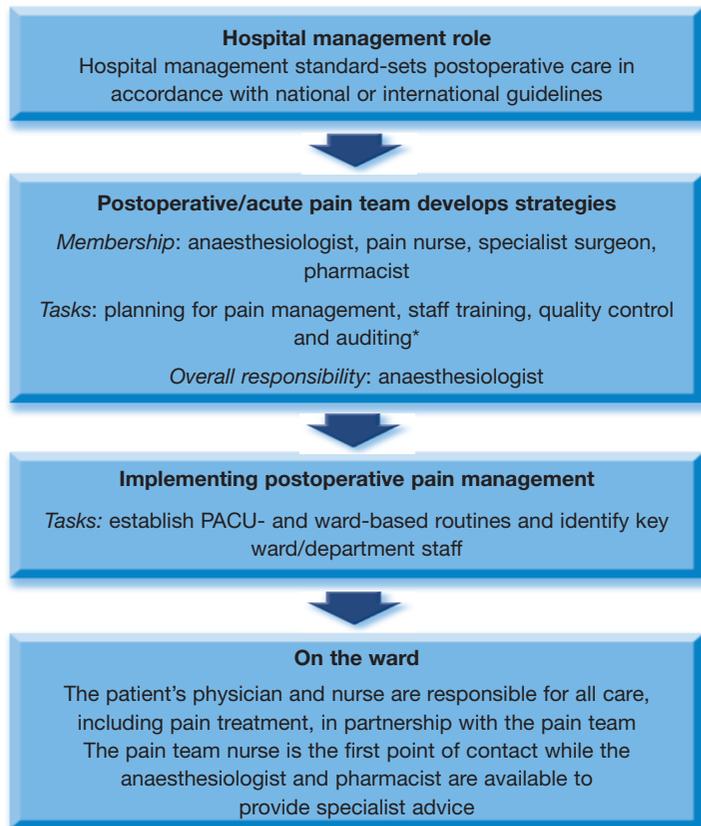
If unsatisfactory information is revealed, audit and quality control enable the problems to be identified and addressed.

In an established pain service, audit is equally important to monitor the activity and effectiveness of the team so that standards are maintained and areas for development and expansion of the service can be justified with accurate data.

Figure 5

### A model for organising postoperative pain management

(hospital, section, department or equivalent)



\*see7b : Audit and quality control

## 8. Day case surgery

As more complex surgery is performed on a day case basis, an improved quality of postoperative analgesia is required to ensure that patient discharge is not delayed and that pain control remains effective once the patient is at home.

### 8.a. Requirements for effective day case surgery analgesia

- Appropriate surgical techniques
  - Minimally invasive surgery
- Appropriate anaesthetic techniques
  - Avoid use of long acting opioids
  - Use regional anaesthesia techniques where possible
- Formal postoperative analgesia prescription guidelines
  - Nurse-prescribed drugs (where permitted)
    - Paracetamol, NSAIDs, combination oral analgesics
  - Physician prescribed drugs
    - Paracetamol, NSAIDs, combination oral analgesics
    - Weak opioids (tramadol, codeine)
    - Oral strong opioids (morphine, oxycodone)
- Clinical care pathways are an important part of day case surgery, within the overall pathway, pain management should be targeted to each specific procedure

### 8.b. The role of regional analgesia in day case surgery

There is much data and experience with regional analgesia, which offers a number of advantages for day case surgery patients:

- Flexible duration of analgesia
  - Ranging from 2-3 h to 20-24 h with single shot techniques
  - Up to 72 h with catheter infusions

- Flexible intensity of blockade
  - Initial, intense analgesia changing over time to a less intense analgesia, according to the type, concentration and volume of local anaesthetic
- Reduced need for opioids (see section 6.a.ii, page 19)

The following local analgesia techniques are useful in day case surgery:

- Wound irrigation or infiltration, or field block
- Intraperitoneal instillation
- Peripheral nerve blocks e.g. brachial plexus, femoral and sciatic nerves, ankle blocks

These techniques offer:

- Excellent pain management
- Reduced risk of opioid side effects (PONV and sedation)
- Reduced nursing workload
- Early intake of oral fluids and food
- Earlier rehabilitation and discharge from PACU i.e. the basic ingredients of "fast tracking"
- Fewer unplanned admissions

### 8.c. Postoperative pain management in day case surgery

Whether regional analgesic techniques or systemic analgesia are used, the aims are to:

- Administer effective drug combinations
- Produce maximum analgesic effect during early recovery
- Minimise the need for opioids

#### 8.c.i. Systemic analgesia

A step-up approach to analgesia (see Figure 4, page 18) is recommended, in the following order:

1. Paracetamol + NSAID administered at the appropriate time to achieve the maximal postoperative effect
2. "Weak" opioids, such as tramadol or codeine compounds
3. Stronger opioids should be administered in small IV increments (1 mg morphine per minute up to 5 mg) as rescue medication

#### 8.c.ii. Regional analgesia

##### *Single shot techniques*

Single shot brachial plexus and major peripheral nerve blocks can provide 12 to 24 hours analgesia. To avoid the sudden return of severe pain as the block wears off, start suitable sequential analgesia (see section 8.c.i) before the block fully wears off and ensure that it is taken regularly.

##### *Continuous techniques*

Continuous catheter infusions can extend postoperative analgesia for more complex day surgery e.g. knee ligament reconstruction and arthroscopic shoulder surgery. Regional analgesia can now be self-administered by the patient (Patient-Controlled Regional Analgesia [PCRA]) at home using elastomeric balloon or portable electronic pumps connected to perineural or wound catheters. These devices allow either a continuous infusion of local anaesthetic at a pre-set rate or patient controlled boluses, or a combination of both systems, with safeguards to avoid the risk of local anaesthetic toxicity:

- Adequate patient information is important
- Suitable local anaesthetics include ropivacaine, levobupivacaine, and bupivacaine in low concentration (1-2 mg/ml)

The techniques are still being evaluated in clinical trials and overall experience is limited at the present time.

#### 8.d. Assessment, documentation and management of pain following discharge

Some day case surgery patients, including children, suffer moderate to severe pain during the first 24-48 h after discharge.

- In the case of day case surgery, pain should be assessed and documented in accordance with the same routines as for in-patients, prior to discharge.
- Maximum permissible pain score at discharge should be defined.
- The patient should be given appropriate analgesics and a prescription to take home (see section 11). Both verbal and written instructions must be given to the patient or their carer so that they understand the importance of taking the analgesics regularly, even if their pain intensity is mild. Their analgesics can be reduced over a period of a few days, as the intensity of the pain decreases.
- After surgery involving a child, the parents should be instructed to assess and treat the child's pain. The patient should be provided with a hospital telephone number for any questions that arise after he or she has gone home.

The work routines for day case surgery should include a telephone follow-up consultation with the patient on the day following the operation.

The use of pre-packaged, take-home analgesics specific to the type of surgery together with rescue analgesia can improve pain control at home. Suitable analgesia packs for adults should contain a 5-7 day supply of:

- Paracetamol 1 g or paracetamol 500mg/codeine 30 or 60 mg compound tablets 6 hourly
- Diclofenac 50 mg 8 hourly or other NSAID
- Tramadol 50-100 mg 6 hourly

Where a patient is prescribed paracetamol or a drug containing paracetamol it is important to ensure that they do not self-medicate with other sources of paracetamol. This also applies to self-medicating with

other sources of NSAIDs. A limited supply (maximum 48 hours) of a suitable strong opioid can be prescribed by the discharging doctor where indicated for rescue analgesia. This recommendation is controversial because of the potential complications of self-medicating with strong opioids and may not be recommended in some countries.

Children present a special challenge for postoperative pain management for several reasons.

Four out of five children require analgesia even after minor surgery.

Pain in children causes particular distress not only for them but also for their parents and the medical staff.

Pain in newborn, infants, and children has the same negative effects as in adults (see section 3.b, page 4). Pain management strategies should be aimed at well being, avoiding nausea and vomiting, sedation and motor block where possible. Information should be provided for parents, and also in a form understandable to young children. Special pain assessment tools are needed for young children who are unable to use verbal scales (Figure 3, page 13).

### 9.a. Symptoms of pain in children

In very young children, who do not have language skills, the following symptoms are indicators of pain:

- Physiological:
  - Increased blood pressure
  - Increased heart rate
  - Sweating
  - Reduced oxygen saturation
- Behavioural:
  - Crying
  - Restlessness

### 9.b. Education for children

A booklet to read prior to surgery for children and/or parents is very helpful. It can dispel fears and misconceptions about pain, and the drugs used to manage it. It is better appreciated if it contains pictures, provides a story, and uses a simple language describing:

- What happens in the hospital?
- What happens in a surgical operating theatre?
- What is anaesthesia?
- What is regional anaesthesia?
- What are pain and painkillers?

A questionnaire given to parents and children after surgery allows them to assess their satisfaction with the pain management (quality control).

Useful questions include:

- What did you think about the pain treatment your child received?
- Would you accept or recommend the same treatment again?

### 9.c. Assessment of pain in children

Many scales are available and the scale chosen should be appropriate for the child's age:

- A VAS or face scale can be used from 5- 6 years of age (Figure 3, page 13).
- For younger children, behaviour scales and/or physiological stress parameters are used (Table 12 overleaf).

Table 12

### Children and Infants Postoperative Pain Scale (CHIPPS)

The following behaviours are given scores of 0 to 2 as indicators of the level of pain experienced:

- Crying
- Facial expression
- Posture of the trunk
- Posture of the legs
- Motor restlessness

The scoring system can be found in:

Buttner W, Finke W. Analysis of behavioural and physiological parameters for the assessment of postoperative analgesic demand in newborns, infants and young children: a comprehensive report on seven consecutive studies. *Paediatr Anaesth* 2000;**10**(3):303-18.

#### 9.d. Drug selection

A multimodal approach with different drugs reduces the amount of each single drug used and gives better results, even in mild pain.

A combination of paracetamol and codeine is commonly used and very effective in conjunction with regional analgesia. The following drugs can be used in a variety of combinations:

- NSAIDs
- Opioids
- Local Anaesthetics

Ketamine and clonidine can also be used and have the following properties, which are useful in children:

- Associated with low risks
- Prolonged analgesic duration
- Use associated with less use of rescue drugs

#### 9.e. Regional analgesia in children

- The benefits of regional analgesia for children include safety, and efficacy with no increased risk when compared with general anaesthesia alone.
- Small regional blocks provide very effective pain relief in children. The techniques available are the same as for adults.
- Peripheral blocks are very useful in children, with suitable agents and techniques now available. Continuous peripheral infusion may be the technique of choice in children in the future.

### 9.e.i. Local anaesthetic agents

- For use in children, local anaesthetics should have a low risk of systemic toxicity, and as much separation of sensory and motor block as possible. Indeed, motor block is a frightening experience for young children who do not understand the reason for it. Ropivacaine and levobupivacaine are newer agents that have less systemic toxicity than bupivacaine. In addition, ropivacaine provides better sensory/motor separation than bupivacaine.

### 9.f. Routes of administration

Several routes of drug administration are available in children:

- Oral and rectal routes are the most commonly used
- Intravenous infusions
- Epidural/peripheral nerve infusions
  - Repeated doses
  - Continuous infusion by syringe-drivers, mechanical or electronic devices
  - Patient controlled administration is also used usually in children over 5-6 years old
- Sublingual transdermal or transmucosal routes
- Wound infiltration
- The subcutaneous route is also used for pain management, and is particularly important for providing analgesia in patients with burns or in chronic and terminally ill patients where veins are at a premium.
- Intramuscular administration should be avoided, not only because of pain and the psychological impact (sometimes children feel pain because of fear of the needle), but also because drug absorption and the timing of clinical effect can be unpredictable.

### 9.g. Doses of analgesic agents in children<sup>1</sup>

Doses of analgesic agents suitable for use in children are shown in Tables 13-18.

Table 13

#### NSAIDs and Paracetamol<sup>1</sup>

Drug	Dose	
Diclofenac	Oral, rectal	1 mg/kg/8h
Ibuprofen	Oral	10 mg/kg/8h
Ketorolac	0.5 mg/kg/8h or continuous infusion	
Paracetamol	Rectal	40 mg/kg; followed by 30 mg/kg/8h
	Oral	20 mg/kg; followed by 30 mg/kg/8h
	Newborn, rectal	20 mg/kg and 30 mg/kg/12h
	Newborn, oral	30 mg/kg and 20 mg/kg/8h

<sup>1</sup> Many of these drugs are not licensed for use in children and/or labelled for different routes or use. Please consult the manufacturer's full prescribing information before use.

Table 14

**Opioids<sup>1</sup>**

Drug	Dose	
Morphine	Newborn	0.02 mg/kg/8h
	Newborn (for continuous infusion)	5-15 µg/kg/h
	Children	0.05-0.1 mg/kg/6h
	Children (for continuous infusion)	0-30 µg/kg/h
Fentanyl	According to surgery	2-10 µg/kg
	In ICU	2-5 µg/kg/h
	Oral transmucosal fentanyl citrate lollipop	15-20 µg/kg
Remifentanyl	Surgery	0.5-1 µg/kg/min
	ICU	0.1-0.05 µg/kg/min
Codeine	Mainly used in combination with paracetamol (suppositories or syrup)	0.5-1 mg/kg/4h

<sup>1</sup> Many of these drugs are not licensed for use in children and/or labelled for different routes or use. Please consult the manufacturer's full prescribing information before use.

Table 15

**Examples of local anaesthetics and mean doses for single shot epidural<sup>1</sup>**

Local anaesthetic	Caudal block	Lumbar block	Thoracic block
Bupivacaine 0.25%	2.5 mg/kg	2 mg/kg	1-1.2 mg/kg
Levobupivacaine 0.2-0.25%	2-2.5 mg/kg	1.4-2 mg/kg	0.8-1 mg/kg
Ropivacaine 0.2%	2 mg/kg	1.4 mg/kg	0.8-1 mg/kg

Table 16

**Examples of local anaesthetics and mean doses for continuous infusion via epidural catheter<sup>1\*</sup>**  
(catheter tip close to the surgical area)

Local anaesthetic	Newborns and infants (up to 1 year)	Older children (> 1 year)
Bupivacaine 0.125% Levobupivacaine 0.1% Ropivacaine 0.1%	0.2 mg/kg/h	0.3-0.4 mg/kg/h

\* Ropivacaine is not licensed for use in infants under the age of 1 year.

<sup>1</sup> Many of these drugs are not licensed for use in children and/or labelled for different routes or use. Please consult the manufacturer's full prescribing information before use.

Table 17

**Adjuvant drugs for epidural use<sup>1</sup>**

Drug	Dose
Morphine	0.02-0.05 mg/kg
Fentanyl	1-2 µg/kg or 0.5-1 µg/kg/h
Sufentanil	0.2-0.3 µg/kg
Clonidine	1-2 µg/kg single shot or 3 µg/kg/24h in epidural infusion
Ketamine	0.5 mg/kg

Table 18

**Examples of local anaesthetics and mean doses for continuous peripheral nerve block in children<sup>1\*</sup>**

Local anaesthetic /adjuvant	Newborns and infants (up to 1 year)	Older children (> 1 year)
Ropivacaine 0.2% or Levobupivacaine 0.25%	0.2 mg/kg/h	0.4 mg/kg/h
Clonidine can be added as adjuvant	3 µg/kg/h	

\* Ropivacaine is not licensed for use in infants under the age of 1 year.

<sup>1</sup> Many of these drugs are not licensed for use in children and/or labelled for different routes or use. Please consult the manufacturer's full prescribing information before use.

**10. Patient groups with special problems for pain management**

Factors such as gender and age; physiological conditions such as depression, anxiety, and neuroticism; pre-existing pain conditions; and the preoperative use of opioids can produce poor pain control and increased analgesic needs in the postoperative period.

Problems for postoperative pain management due to opioid consumption, either illicitly or as a prescription medication, include:

- Pseudo-addiction, where medical personnel do not provide sufficient analgesia, provoking repetitive demands from the patient for analgesics.
- Tolerance or opioid-induced hyperalgesia (increased sensitivity to pain).

Therefore, the following issues should be considered when treating these patients:

- The doses of opioids required to achieve adequate pain relief may be higher than normal in opioid consuming patients.
- During surgery, the required opioid dose is composed of the daily opioid dose taken chronically before surgery and the opioid dose made necessary by surgical stimulation. Patients who use even modest opioid doses before surgery will often require their baseline opioid dose plus two or more times the amount of opioids typically used for adequate pain control in opioid-naïve patients.
- Regional analgesia provides excellent analgesia in chronically opioid-consuming patients.
- Opioid dependent patients need their daily systemic opioid dose to prevent withdrawal symptoms and because their chronic pain may not be affected by the surgical procedure.
- Administering partial opioid agonists, such as buprenorphine or nalbuphine to chronically opioid-consuming patients may induce abrupt opioid withdrawal.

*continued overleaf*

- After surgery, the transition from an intravenous or epidural to an oral opioid regimen needs special attention in chronically opioid-consuming patients. The transition to oral medication should not be unduly delayed. Use of intravenous opioids via PCA during the first 24 to 48 hours after surgery may be necessary in some patients. After that period, the total dose delivered intravenously can be converted into a daily oral opioid dose sufficient for alleviating pain.
- NSAIDs combined with paracetamol provide postoperative pain control that is superior to either class of drug alone.

## 11. Risk management/discharge criteria

As part of the clinical pathway setting, a timetable and suitable milestones need to be agreed for the safe discharge of both inpatients and day case patients with regard to effective pain control:

- Define maximum permissible pain score value at discharge
- Give the patient appropriate analgesics and written information about the use of these, to take home
- Provide the patient with a hospital telephone number for any questions or adverse events that arise after discharge
- For children, instruct the parents to assess and treat the child's pain. Patients have fewer problems with controlling pain if they have received effective education about the anticipated intensity and duration of pain, and the most suitable methods of treating the pain (see section 5, page 14).

### 11.a. Sequential analgesia

- Suitable analgesic therapy should be available to match the level of analgesia to the intensity of pain, as the intensity of postoperative pain diminishes with time.
- This is particularly important where a regional anaesthetic technique has been used to provide early postoperative analgesia.
- Effective oral or systemic analgesic drug therapy must be prescribed to be started before the block wears off, to avoid the patient suddenly experiencing pain.

### 11.b. Management of the insensate limb

Where regional analgesia has been used to provide extensive postoperative pain relief for upper or lower limb surgery, there will be an accompanying loss of sensation and proprioception for the duration of the block. In these cases:

- Patients and their carers need explicit instructions about how to look after the affected limb until full sensation and power return.
- In particular, the limb needs to be protected from thermal or pressure injury and extremes of joint mobility.
- General advice should also be available regarding the care of all surgical wounds.

### 11.c. Support following discharge

- Patients and their home carers need written advice about what to expect in the first few days of discharge to their homes.
- A brief guide to the most likely surgical and anaesthetic complications that might arise, and simple advice as to how to cope, can prevent unnecessary anxiety.
- Patients should have access to a telephone contact point with an appropriate nurse or doctor in the hospital in the event that further advice is necessary.

### 12.a. Recommended reading

#### Physiology of pain

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### Assessment of pain

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### Treatment options

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#### 12.b. Useful web sites

"PROSPECT" working party on postoperative pain

[www.postoppain.org](http://www.postoppain.org)

#### 12.c. Sources of patient leaflets

[www.youranaesthetic.info](http://www.youranaesthetic.info)

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