

# Managing post-operative pain through giving patients control

In the ninth article of a series on peri-operative medication, **Mohamed H. Rahman** and **Jane Beattie** give an overview of various techniques used in managing post-operative pain, including patient-controlled analgesia and peripheral nerve blocks, and monitoring requirements



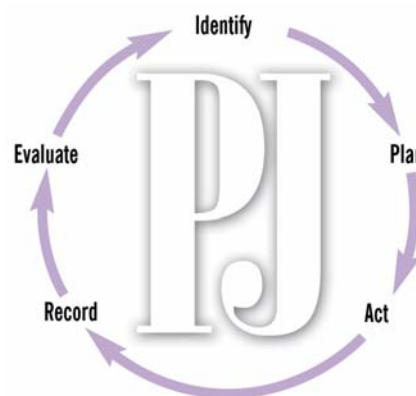
Mohamed H. Rahman

Post-operative pain is one of the main concerns of patients about to undergo surgery. The various methods available to alleviate pain should be discussed with patients before an operation and a treatment plan agreed. This includes discussing the pros and cons of the drugs available and their routes of administration and options such as patient-controlled analgesia.

## Patient-controlled analgesia

Intravenous patient-controlled analgesia (PCA) allows patients to titrate their own opioid analgesic, via an infusion pump, according to their needs. By pushing a button, the patient receives a small dose of the opioid when required. Limits for the dose received and the interval that must elapse between doses are pre-set by the patient's doctor or acute pain team. Dose limits can be individualised, taking into account factors such as a patient's age, weight and renal and hepatic function. PCA devices all have a lock-out time, during which no dose can be self-administered. For patients who experience severe pain or for those who required opioids to manage chronic pain pre-operatively, a background infusion rate can be set, with

**Mohamed H. Rahman, MSc, MRPharmS**, is principal pharmacist for surgical services and **Jane Beattie, MB ChB, FRCA**, is a consultant anaesthetist, both at Royal Liverpool University Hospital, Liverpool



## Identify knowledge gaps

1. What is patient-controlled analgesia?
2. Describe the complications associated with patient-controlled intravenous and epidural analgesia.
3. What monitoring is required for patients receiving opioids via a patient-controlled analgesia device?

Before reading on, think about how this article may help you to do your job better. The Royal Pharmaceutical Society's areas of competence for pharmacists are listed in "Plan and record", (available at: [www.rpsgb.org/education](http://www.rpsgb.org/education)). This article relates to "clinical pharmacy" (see appendix 4 of "Plan and record").

patients self-administering supplementary analgesia as required for breakthrough pain.

Analgesics used for PCA should always be given through appropriate administration systems that ensure the drug is delivered into the patient, rather than back into another fluid administration system (eg, through a dedicated single intravenous cannula). It must also be easy for ward staff to identify patients with a PCA system, so a specific system should be used within each hospital.

**Analgesics** Morphine is the most commonly used analgesic in PCA devices, with adult bolus doses varying from 0.5 to 2mg, and lock-out times between doses of five to 10 minutes. Background infusion rates are usually 2–5mg/h. Occasionally, fentanyl, oxycodone or pethidine are used for PCA. Pethidine or fentanyl are preferred by some surgical teams because they are thought to produce smaller increases in biliary tract pressures than mor-

## Panel 1: Precautions for dealing with patient-controlled analgesia

- Patients should not receive intramuscular or oral opioids while receiving opioids via an intravenous patient-controlled analgesia device.
- The syringe volume should be checked and recorded at regular intervals (eg, every two hours).
- An observation chart should be used to record cardiovascular parameters, sedation score, post-operative nausea and vomiting score and respiratory rate, at least hourly.
- The PCA prescription (eg, morphine 60mg in 30ml 0.9 per cent sodium chloride) and details of bolus dose and lock out time (eg, 1 mg/5 minute lock out) should be clearly shown on the PCA chart and the hospital inpatient prescription sheet.
- Anti-emetics often need to be prescribed regularly rather than when required.
- Ensure that supplementary oxygen is prescribed while the patient is receiving intravenous patient-controlled opioids because some degree of respiratory depression is likely.
- Ensure that naloxone is available in all areas where the patient is being nursed, and that protocols exist for management of marked respiratory depression.
- When PCA is stopped, the remaining syringe contents should be discarded appropriately and this witnessed. It is good practice to record disposal in the Controlled Drugs register as well as the PCA chart.

phine by causing less spasm in the sphincter of Oddi.

**Monitoring** Regardless of the analgesic used, monitoring of PCA is essential, particularly to pick up signs of excessive opioid administration (eg, sedation and respiratory depression).

All reusable PCA devices have memory functions so pain teams can review the opioid use in each hour and in each 24 hours. In addition, the number of successful and unsuccessful requests (the number of times the administration button is pushed) for analgesia can be assessed to ensure appropriate use. Newer systems are able to produce a printed report of analgesic use over 24 hours or information that can be loaded onto a central database.

All reusable PCA devices emit an audible or visual signal, or both, to inform the patient that the administration button has been adequately depressed. They also have sensors and alarms to indicate blockage of the administration set. Single-use disposable systems lack these features so require greater vigilance and patient monitoring by nursing staff. However, they are less expensive than multi-use systems.

**Pain control** Repeated assessment of each patient's pain is important to determine the suitability and adequacy of prescribed drugs, and their doses and dosage intervals. At the Royal Liverpool University Hospital (RLUH) we use a simple scale to describe pain:

- 0 represents no pain on movement
- 1 represents mild pain on movement
- 2 represents moderate pain on movement
- 3 represents severe pain on movement

A high (above 2) or increasing pain score warrants review of analgesic prescribing by our pain team. Bolus doses may be increased (usually doubled), the lock out time may be decreased (usually halved) or an additional

analgesic agent may be prescribed, usually a different class of drug to be given by a different route.

**Sedation level** Several sedation scores can be used to monitor patients receiving strong opioids. At the RLUH, we use a simple 0, 1, 2 and 3 method. Zero represents a fully alert patient; 1 represents an occasionally drowsy, easy to rouse patient; 2 represents a frequently drowsy but rousable patient; and 3 represents a drowsy patient who is difficult to rouse and who requires urgent medical review.

**Respiratory rate** Respiratory depression is the most dangerous side effect of opioid administration and often occurs with sedation. The patient's respiratory rate should be carefully monitored and protocols for stopping the opioid and administering naloxone and oxygen, if required, need to be in place. If respiratory depression occurs the analgesia regimen should be reviewed by the acute pain team in consultation with the surgical team. A respiratory rate of six breaths or fewer per minute would trigger these actions at RLUH.

An intrinsic safety feature of opioid administration via a PCA device is that a drowsy patient should cease to self-administer the opioid. This feature is lost, however, if others press the administration button on behalf of the patient, or if there is a background infusion of the drug. Background opioid infusion should, therefore, be kept to a minimum.

## Panel 2: Using anaesthetics for pain management

The extension of the analgesic effect of an anaesthetic is not restricted to epidural anaesthesia. Other anaesthetic techniques that can be used for pain management include continuous nerve or plexus blocks.

**Bier's block** Regional anaesthesia can be used to provide analgesia for a specific limb or larger body areas. Intravenous regional anaesthesia (often referred to as Bier's block) involves injecting a local anaesthetic (eg, prilocaine) into the veins of an exsanguinated limb and keeping it there by using an arterial tourniquet. Good anaesthesia is produced in 10–15 minutes but only remains while the tourniquet is inflated. Duration is limited by the discomfort from ischaemia in tissues under the tourniquet that are not perfused by the anaesthetic solution. Bier's block is useful for short operative procedures on distal upper limbs (eg, manipulation of a wrist fracture). After 20–30 minutes enough anaesthetic should be fixed in the tissues so that limb reperfusion does not cause a toxic bolus dose of drug. When the local anaesthetic wears off pain can be managed with oral analgesia (eg, non-steroidal anti-inflammatory drugs or paracetamol and weak opiates).

**Plexus blocks** Plexus blocks involve the deposition of a local anaesthetic around major nerves. This can be done as a single shot technique or via a fine catheter to allow a continuous infusion to be given post-operatively for several days. Muscle strength will be affected and sensation lost so plexus blocks require careful nursing, physiotherapy and patient education before the operation. The good pain relief achieved without the need for an opioid often outweighs these disadvantages. Blocks can be done of the brachial plexus, the sciatic or femoral nerves, and the lumbar plexus and are particularly useful following orthopaedic procedures. If the anaesthetic is placed close enough to the nerves plexus blocks can last for hours, even following single shot techniques.

**Topical anaesthesia** A local anaesthetic cream can be applied (under a protective dressing) to provide analgesia over small body areas, for short periods (eg, following circumcision). Local anaesthesia can also be injected subcutaneously into the desired area for several hours of pain relief (eg, into the wound after hernia repair).

**Post-operative nausea and vomiting** Many patients will also experience post-operative nausea and vomiting (PONV) with intravenous opioids. This can be so marked that the patients prefer to tolerate pain than receive the opioid. Nursing staff often need to administer regular anti-emetic drugs while a PCA device is in use. A combination of two drugs may be required, for example, prochlorperazine or cyclizine.

At RLUH we score PONV in an attempt to ensure that anti-emetic medicines are received when required. Scores of 0, 1, 2 or 3 indicate no nausea or vomiting, mild nausea with no vomiting, moderate nausea or occasional vomiting or both, and severe nausea or frequent vomiting or both, respectively.

In some hospitals, anti-emetics are added to PCA syringes so both drugs are administered together, but this requires physical compatibilities of the drugs to be checked before mixing.

**Stepping down** Intravenous opioids via PCA can be used for as long as is necessary after major surgery — usually until the patient is able to take oral fluids. Analgesia is then stepped down to oral therapy. This is usually codeine based but, occasionally, morphine or simple analgesia (eg, paracetamol or non steroidal anti-inflammatories, see *PJ*, 30 July, p145–8) or a combination of these are used depending on opioid use over the previous 24 hours. Choice of oral analgesic will be affected by the time elapsed since the surgery, the patient's gastrointestinal function and his or her ability to tolerate pain when moving or coughing (after an operation patients need to cough to avoid chest infections).

Precautions needed when dealing with PCA devices are listed in Panel 1.

### Patient-controlled epidural analgesia

Epidural anaesthesia involves the use of a local anaesthetic in the space outside the dura. Bupivacaine or chirocaine 0.125–0.5 per cent are commonly used in the UK. Weaker local anaesthetic solutions provide analgesia and diminish sensation, while muscle relaxation is seen with increasing local anaesthetic concentration.

Analgesia is usually established in 15 to 20 minutes, after a bolus dose of drug. The pain relief given by the anaesthetic lasts for between two and six hours, depending on volumes and concentrations of drugs administered. This can be extended into the post-operative period by the use of a continuous infusion or a patient-controlled epidural analgesia device.

The principles of PCA can be applied to epidural analgesia. Epidural analgesia is used to manage post-operative pain, particularly in patients who have had major surgery (eg, abdominal or thoracic surgery). It is also used to improve post-operative respiratory function, to allow patients to undertake chest physiotherapy without pain and to improve post-operative gastrointestinal function. Epidurals can also be infused at a low back-

## Monitoring of patient controlled analgesia is essential, particularly to pick up signs of excessive opioid administration

### Action: practice points

Reading is only one way to undertake CPD and the Society will expect to see various approaches in a pharmacist's CPD portfolio.

1. Discuss the benefits of patient-controlled analgesia with your pain team. Could patient control be applied to other medicines?
2. What pumps and monitoring parameters are used in your hospital?
3. Find out whether or not adequate anti-emetics are administered to patients receiving opioids in your hospital.

### Evaluate

For your work to be presented as CPD, you need to evaluate your reading and any other activities. Answer the following questions: What have you learnt? How has it added value to your practice? (Have you applied this learning or had any feedback?) What will you do now and how will this be achieved?

ground infusion rate with patient-controlled bolus doses as required to optimise analgesia and minimise the complications of unnecessary analgesic administration.

Opioids (eg, fentanyl or diamorphine) can be added to the anaesthetic solution so lower concentrations of local anaesthetic can be used. This minimises leg muscle weakness and allows patients to move around (with assistance) while receiving analgesia epidurally. Pressure area care and prevention of deep vein thrombosis are important if a patient has marked muscle weakness.

The extent of anaesthesia and analgesia is determined by the level at which the epidural is inserted, the volume of local anaesthetic injected and gravity — patient positioning can, therefore, be important. The greater the dose injected the greater the number of dermatomes (areas of skin receiving sensation from a nerve entering a single nerve root of the spinal cord) in which analgesia is achieved.

The patient self-administers small boluses of the local anaesthetic or local anaesthetic-opioid mixture via an indwelling epidural catheter that has been inserted during the operation. Bolus lock out times are longer (because the drug takes longer to act epidurally than intravenously) and background infusions are more commonly used, for example, a 4ml/h background infusion rate via a low thoracic epidural with 4ml being available as a patient-controlled analgesic dose every 20 minutes.

**Precautions** The insertion of the fine epidural catheter is a blind procedure and there is always a risk that it can puncture a small blood vessel or the dura and lie within the vessel or cerebral spinal fluid rather than the epidural space. To ensure that the catheter is not misplaced, a small test dose of local anaesthetic is given to the patient when the catheter is first inserted.

Nursing staff need to check that the catheter has not moved into a dangerous position. This requires regular observations of cardiovascular parameters, respiratory rate, area of loss of sensation and leg strength to be made and recorded.

If both patient-controlled intravenous analgesia and patient-controlled epidural analgesia are available in a hospital, it is important that different and easily identifiable infusion devices are used to minimise the risk of drugs being given by the wrong route.

**Hypotension** As well as a sensory block, epidural anaesthetic solutions cause a loss of sympathetic tone. Peripheral vascular resistance is reduced and, in turn, vasodilation reduces venous return to the heart. Hypotension is, therefore, often a side effect of epidural anaesthesia. If hypotension occurs it is essential that other causes are excluded because hypovolaemia and myocardial infarction are common in the peri-operative period.

Hypotension should be managed with oxygen and intravenous fluids to increase the venous return. Vasoconstrictors (eg, ephedrine)

may be required for some patients to counteract peripheral vasodilation.

Nausea and vomiting may arise due to hypotension but may also be due to vagal stimulation or ileus following upper abdominal surgery. As well as giving patients antiemetics, the underlying cause should be determined.

**Bradycardia** If the central nerve block extends cranially beyond the fifth pair of thoracic spinal nerves (T5), the sympathetic nerves to the heart (responsible for increasing heart rate) are also blocked, leaving the vagal tone unopposed and resulting in bradycardia. Bradycardia is treated with atropine.

**Respiratory depression** Respiratory depression can occur if opioids are added to epidural solutions. Some of the drug will enter the cerebral spinal fluid and can ascend to affect the respiratory centre directly. Profound respiratory depression can occur unexpectedly. Respiratory rates (and sedation levels), therefore, need to be regularly monitored.

**Infection** Skin sepsis at the site of the epidural catheter can lead to the introduction of infection into the central nervous system, epidural abscess formation or meningitis.

## The principles of patient controlled analgesia can be applied to epidural analgesia

**Contraindications** Central neural blockade (as achieved through epidural anaesthesia) is contraindicated in hypovolaemic patients (eg, through blood loss or dehydration) because these patients can experience a profound fall in blood pressure with the onset of sympathetic blockade. Patients with low, fixed cardiac output (eg, severe aortic or mitral stenosis) are also at risk of morbidity with epidural anaesthesia because the reduced venous return or peripheral vasodilation decreases perfusion of vital organs.

Epidural analgesia is contraindicated in people with coagulation abnormalities because there is a risk of epidural haematoma formation. The timing of heparin administered to prevent deep vein thrombosis (see *PJ*, 13 November 2004, pp717–9) is relevant for epidural insertion and removal and the doses used or the timing of drug administration may need to be adjusted.

Other contraindications to epidural analgesia include raised intracranial pressure, known allergy to amide local anaesthetics, an unco-operative patient and concurrent disease of the central nervous system.

### **Anaesthetics for pain management**

The use of anaesthetics for pain management is discussed further in Panel 2 (p208).