# Optimizing postoperative pain management

R. MICHAEL RITCHEY, MD

Postoperative pain management is an important but seemingly undervalued component of perioperative care. Over the past decade, medical societies, governmental agencies, and accrediting bodies such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) have paid increasing attention to the management of all types of pain, including postoperative pain.

Despite this increased focus, the literature suggests that many patients continue to experience significant postoperative pain. A nationwide survey of 250 patients who had undergone surgery in the previous 5 years revealed that 82% reported postoperative pain, and 86% of those who reported postoperative pain had moderate, severe, or extreme pain.[1] It is clear that we have not yet won the battle against postoperative pain, and it is imperative that we bring every weapon at our disposal to the front.

This review will discuss potential consequences of postoperative pain and briefly outline some management options, including intravenous patient-controlled opioid analgesia (IV PCA).

## CONSEQUENCES OF POSTOPERATIVE PAIN

Inadequately controlled pain can cause postoperative morbidity, prolong recovery time, delay return to normal living, and decrease satisfaction with care. Inadequate pain management increases the use of health care resources, thereby increasing total health care costs.[2]

Postoperative pain may be a factor in the development of chronic pain. In a literature review looking at chronic pain as an outcome of surgery, the severity of postoperative pain was positively correlated with the incidence of chronic pain after breast surgery, thoracotomy, and inguinal hernia repair.[3]

From the Division of Anesthesiology, Critical Care Medicine, and Comprehensive Pain Medicine, Cleveland Clinic Foundation, Cleveland, OH.

Address: R. Michael Ritchey, MD, Department of General Anesthesiology, Cleveland Clinic Foundation, 9500 Euclid Avenue, E31, Cleveland, OH 44195; ritcher@ccf.org.

Disclosure: Dr. Ritchey reported that he has no financial relationships that pose a potential conflict of interest with this article.

## CONVENTIONAL THERAPIES

### Acetaminophen: Safe, but watch the total dose

Acetaminophen is considered a weak analgesic compared with other therapies. It has a ceiling effect for analgesia. Although it is considered safer than nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen has an upper-level dose above which patients are at increased risk for liver toxicity. The recommended maximum dosage in adults is 4,000 mg/day.

When acetaminophen is used postoperatively in combination with opioids, approximately 20% less morphine is required to achieve an equivalent level of analgesia; however, there does not appear to be a concomitant reduction in opioid-related side effects, including nausea and vomiting.[4]

### NSAIDs: May reduce opioid-related side effects

In appropriate patients, NSAIDs are excellent analgesics for the postoperative period. A recent meta-analysis found that NSAID administration decreased postoperative nausea and vomiting by 30%, most likely because of decreased opioid requirements.[5]

Potential side effects of NSAIDs include increased risks of bleeding (particularly gastrointestinal), gastrointestinal ulceration, and adverse renal effects.

### Opioids: The gold standard

Opioids are the gold standard of postoperative analgesia despite their undesirable side effects. They are the mainstay of treatment for moderate to severe pain and can be given by virtually any route. If not for the many adverse effects associated with opioids—some of them potentially serious—the search for other therapies would be much less necessary.

## NONTRADITIONAL THERAPIES

### Ketamine: Excellent analgesia at very low doses

Ketamine is an *N*-methyl D-aspartate (NMDA) receptor antagonist. This spinal cord receptor facili-

tates the development of pain sensitization and has an influence on the development of opioid tolerance. Subanesthetic doses of ketamine have been shown to decrease opioid requirements, decrease pain scores, and possibly prevent the development of opioid tolerance.[6] Ketamine, however, has significant adverse psychotomimetic effects, which limit its usefulness.

### Gabapentin: Analgesic and anxiolytic

Gabapentin is a gamma-aminobutyric acid (GABA) analog, but it does not act through the GABA-ergic system. Its exact mechanism of analgesia is unknown. Gabapentin was originally approved as an anticonvulsant but has been found to be effective in the treatment of chronic neuropathic pain.

Gabapentin also has been shown to be effective as a postoperative analgesic as well as an effective anxiolytic. Premedication with gabapentin was studied in patients undergoing arthroscopic anterior cruciate ligament repair.[7] Twenty-five patients received placebo and an equal number were given a single preoperative dose of 1,200 mg of gabapentin. Patients who received gabapentin had a reduction in preoperative anxiety scores, required less postoperative morphine, had less pain postoperatively, and had greater range of motion during postoperative physical therapy than the control group.

## ADVANCED OPTIONS FOR PAIN MANAGEMENT

### Epidural analgesia: Efficacious, but more difficult to manage

In an overview of randomized trials, Rodgers et al sought to determine reliable estimates of the effects of spinal or epidural anesthesia on postoperative morbidity and mortality.[8] A correlation was found between the use of these forms of anesthesia and a reduction in the risks of all-cause mortality, deep vein thrombosis, pulmonary embolism, blood loss, respiratory depression, transfusion requirements, and pneumonia.

Continuous epidural analgesia is one of the most effective options for postoperative analgesia. Problems with the technique center around the intense labor requirements to manage it and safety issues associated with thromboprophylaxis therapy.

### Peripheral nerve blocks and catheters: Extended-duration analgesia at home?

Peripheral nerve blocks of the upper and lower extremities are useful for postoperative pain relief and, in appropriate situations, as the main anesthetic for surgery.

Extremity surgery is particularly amenable to this type of postoperative pain management. In a study involving patients undergoing rotator cuff surgery, nerve block anesthesia (interscalene brachial plexus blockade) was compared with general anesthesia.[9] One half of the patients received general anesthesia followed by bupivacaine (0.25%) wound infiltration and the other half received interscalene brachial plexus block (0.75% ropivacaine). Compared with the group randomized to general anesthesia, patients assigned to receive the interscalene block had less pain, had less nausea and vomiting, were discharged earlier, were more satisfied with their overall therapy, and were more likely to accept the same therapy if they needed surgery again. Four patients in the group receiving general anesthesia required admission postoperatively because of intractable pain.

The placement of peripheral nerve *catheters* is an option that potentially allows for extended analgesia in an outpatient setting. An appropriate infrastructure must be in place, which includes thorough patient education and around-the-clock availability of staff for questions and issue resolution.[10]

## INTRAVENOUS PATIENT-CONTROLLED OPIOID ANALGESIA

IV PCA continues to be a popular choice for postoperative pain control. With IV PCA, after an appropriate loading dose to achieve analgesia, the patient titrates the dosage to his or her comfort level. This method attempts to solve the problem of the wide variability in response to opioids among patients. A systematic review of trials in which opioid-based PCA was compared with the same opioid given intramuscularly, intravenously, or subcutaneously showed that IV PCA improved analgesia and was the preferred route of administration.[11]

Nevertheless, IV PCA is not appropriate for all patients, particularly those who may not have the mental capacity to use it advantageously. Older patients in particular tend to have less success using this mode of analgesia. Patients must be actively managed for IV PCA to be effective; it cannot be a "set and forget" therapy.[12]

Three opioids are typically used for IV PCA: morphine, fentanyl, and hydromorphone. Meperidine has fallen out of favor.

Morphine is the most commonly used opioid, and it is well tolerated at low doses in patients with liver dysfunction. However, it has a renally excreted active metabolite, morphine-6-glucuronide, which can accumulate in patients with renal insufficiency and can increase the risk of sedation and respiratory depression.

**TABLE 1**
Equianalgesic opioid doses for intravenous patient-controlled analgesia

| |
|---|
| Morphine 2 mg |
| Fentanyl 20 µg |
| Hydromorphone 0.2 mg |

Fentanyl is another commonly used opioid in IV PCA. It has a rapid onset and a short duration of action. It has no active metabolites and can be used safely in patients with significant renal or hepatic dysfunction.

Hydromorphone also has no active metabolites. It is five to eight times as potent as morphine and may have fewer side effects.

Opioid dosing for IV PCA. Equianalgesic opioid doses for IV PCA have been established (Table 1), permitting easy interchangeability between opioids.

Meperidine has a renally excreted active metabolite, normeperidine, which has a very long half-life and can accumulate even in patients who have normal renal function. Normeperidine causes neurologic side effects such as shakiness, tremors, myoclonus, jitters, and seizures. A retrospective review of the medical records of 355 patients showed that as the dose and duration of meperidine increased, so did the incidence of side effects and neurologic complications.[13] The authors found a 2% incidence of central nervous system excitation in the patients who were using the highest dosages (600 mg/day) for the longest duration of time. They recommended that if meperidine is used for IV PCA, the dosage should be limited to a maximum of 10 mg/kg/day for no more than 3 days. Meperidine is not used for IV PCA at The Cleveland Clinic.

### Example of an IV PCA program for morphine

Table 2 presents a standard PCA program for morphine administration in adults at our facility, with ranges for lower and upper limits. The demand dose (patient-activated dose) of morphine is usually started at 1 mg. The interval between available doses (lockout interval) is 6 minutes. We limit the number of patient-activated doses to a maximum of 10 per hour. For opioid-naïve patients, we do not initiate a continuous infusion, as it has been shown to increase the incidence of respiratory depression.[14] It is important to provide readily available doses that can be administered by the patient's nurse (nurse-activated dose) when breakthrough pain occurs.

**TABLE 2**
A typical PCA program for morphine

| |
|---|
| Dose: 1 mg (0.5–2 mg) |
| Lockout: 6 min (5–12 min) |
| Hourly limit: 10 doses (5–10) |
| Basal rate: 0 mg/hr (0–2 mg/hr) |
| Clinician (nurse-activated) dose |

PCA = patient-controlled analgesia

## MULTIMODAL ANALGESIA

Multimodal analgesia is a "shotgun" approach to postoperative analgesia. It relies on different classes of analgesics acting at different sites. Using a variety of analgesics at lower doses potentially provides effective analgesia while minimizing adverse effects of the individual therapies.[15] An example of multimodal analgesia would be the treatment of a patient who has had a total knee replacement with a continuous lumbar epidural utilizing a local anesthetic combined with an opioid. In addition, the patient may receive a scheduled dose of an NSAID as well as acetaminophen. Local therapy such as ice might also be applied.

## MANAGING INADEQUATE ANALGESIA

As stated earlier, IV PCA is not a "set and forget" therapy. Some patients do not attain effective analgesia and must be evaluated and managed in an expedient manner. Table 3 provides a list of steps to manage a patient who is not responding favorably to your efforts.

### Evaluate

First, evaluate the patient to determine the location of the pain and to assess for signs of a possible emerging process (ie, vital signs, physical exam, urine output). Assess the patient's intravenous site for evidence of infiltration or disconnection. Determine whether the patient is using the PCA appropriately, which can be assessed by reviewing the PCA flow sheet and by interrogating the PCA pump. If re-educating the patient does not result in increased use of the pump, an alternative to PCA should be provided, such as around-the-clock opioid administration by the nurse or, in some situations, continuous IV opioid infusion.

All of these therapies rely on frequent assessments of adequacy of analgesia and monitoring for possible sedation and respiratory depression.

### Reassess

After making the assessment, attempt to improve the patient's condition by administering additional doses of opioid (such as morphine 2 to 4 mg IV push). If the patient is actually self-administering more than 3 doses per hour and is still uncomfortable, increasing the demand dose by 50% to 100% and/or adding a continuous infusion is appropriate. The easiest way to add an infusion is by starting with a low dosage (morphine 1 mg/hr). If not already prescribed, an adjunctive medication such as an NSAID or acetaminophen is reasonable. Changing to an alternative opioid can be beneficial, as some patients respond better to one opioid than another.

### Consult

Finally, if the patient's pain is still uncontrolled, consider obtaining a pain management consult. A pain management consultant is usually more comfortable aggressively dosing opioids as well as adding nontraditional therapies. The consultant may be able to provide advanced pain management options such as peripheral nerve blockade and epidural analgesia. Finally, he or she will be able to help with the transition to oral analgesics.

## TRANSITIONING TO ORAL ANALGESICS

The transition from IV PCA to oral analgesics can result in therapeutic failure and decreased patient satisfaction if dosages are inadequate and dosing intervals are improper. These outcomes are particularly a possibility for patients who have been on chronic opioid therapy prior to surgery (see the following section). A recommended approach to handle this transition is the scheduled dosing of an acetaminophen/opioid combination such as 2 tablets of acetaminophen 325 mg/oxycodone 5 mg every 4 hours for 24 to 48 hours, depending on the patient's level of pain. This schedule will help reduce the delays inherent in as-needed dosing strategies.

Early in the transition period, extra medication should be readily available in case the initial therapy is inadequate. A pure oral opioid, such as oxycodone, and/or an NSAID (if not already prescribed as a scheduled medication) is appropriate (eg, oxycodone 5 to 10 mg orally every 4 hours as needed). With more painful procedures, an additional IV opioid as needed is appropriate (eg, morphine 2 to 4 mg IV every 4 hours as needed for breakthrough pain).

**TABLE 3**
Approach to the patient who has received inadequate analgesia

| |
|---|
| Evaluate patient |
| Reassess program |
| Increase dose |
| Add basal dose |
| Change narcotic |
| Consider adjunct medications |
| Consider pain management consult |

## MANAGING OPIOID-DEPENDENT PATIENTS

Mitra and Sinatra have published a useful review of perioperative pain management in the opioid-dependent patient.[16] Many of the concepts presented in this section have been described in their review.

Besides illicit use and use for cancer pain, opioids are being used more frequently for noncancer-related pain. Patients with noncancer ("benign") pain frequently use long-acting opioids, sometimes at alarmingly high doses. As a result, more patients are coming to the operating room with a significant tolerance to opioids, and often suffer excruciating pain postoperatively because they are routinely relatively underdosed. If possible, a pain management consultant should be involved with these patients' care from the beginning.

Very few opioid-dependent patients are truly addicted. They are tolerant to opioid effects, however, and can have a physical dependence to opioids. Tolerance and physical dependence are not equivalent to addiction.

### Prevent withdrawal

The first step in managing the opioid-dependent patient is to prevent opioid withdrawal. Patients should be instructed to take their morning dose of opioids on the day of surgery. Consider the patient's preoperative opioid use to be the baseline requirement. If the patient will be NPO after surgery, convert this dose into an equivalent continuous intravenous infusion. It is important to remember (but is often forgotten) that this baseline infusion only covers the patient's *preoperative* requirements. The patient's postsurgical requirements will have to be added to the

baseline. These patients often require doses of analgesics that make any practitioner nervous.

### Reduce opioid requirement when possible (but maintain baseline requirements)

Using a multimodal approach is beneficial when managing an opioid-dependent patient. Local anesthetic infiltration by the surgeon, ketamine infusion, clonidine patch, acetaminophen and NSAIDs, muscle relaxants, anxiolytics, peripheral nerve block, and epidural analgesia should be used when appropriate.

### Do not rely solely on pain scores when assessing analgesic efficacy

Opioid-dependent patients and patients with chronic pain routinely report high pain scores regardless of their overall condition. They may report a verbal pain rating of 8 out of 10, but then say they are feeling fairly well. Looking at as many objective signs as possible when assessing their overall progress is important. Diet intake, ambulation, ability to cough and breathe deeply, and resumption of "normal" activities (such as smoking) are all important aspects of recovery, and failing to appreciate these aspects may result in unnecessary increases in analgesic doses.

### Transition to oral opioids

Opioid-tolerant patients often require an increase in their baseline oral opioid requirements in the several days following surgery. Increases of 30% to 50% are not unusual. Dosages can be tapered back to their baseline requirements over a 1- to 2-week period. If the surgery actually resulted in a decrease of their preoperative pain, further weaning may be possible. Weaning of opioids is a gradual process and should be carried out with the assistance of a physician knowledgeable in this process.

## SUMMARY

The quality of postoperative pain management can be improved. Although many safe and effective therapies exist, their utilization varies considerably between and within institutions. Major challenges include the appropriate prescribing of analgesic therapies and the timely response to suboptimal pain control. Patients' satisfaction with their analgesic care may depend less on how well their pain is controlled and more on the attentiveness of their caregivers.

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