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## ORIGINAL ARTICLES

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# Pain Management in Ambulatory Surgery

*Damon Kamming, BSc(Hons), MBCbB, FRCA*

*Frances Chung, FRCPC*

*Donna Williams, RN*

*Brid M. McGrath, FFARCSI, FRCA*

*Bruna Curti, RN, BScN*

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*Successful ambulatory surgery is dependent on analgesia that is effective, has minimal adverse effects, and can be safely managed by the patient at home after discharge. A number of studies have identified that the provision of effective postoperative analgesia is inadequate for a significant proportion of patients. The following discussion details the current available analgesic options for ambulatory surgery patients and the rationale for their use. Preemptive analgesia should be given to all patients unless there are specific contraindications. Consideration should be given to the use of long-acting oral COX-2 selective nonsteroidal anti-inflammatory drugs (NSAIDs) and long-acting oral opioids to treat postoperative pain. A standardized multimodal postdischarge analgesic regimen tailored to the patient's expected postoperative pain levels should be prescribed. Patient follow-up by telephone questionnaire will confirm those surgical procedures that result in mild or moderate-to-severe postoperative pain and the effectiveness of treatment plans.*

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*Damon Kamming, BSc(Hons), MBCbB, FRCA, is a Specialist Registrar in Anaesthesia at the University College Hospitals NHS Trust in London, United Kingdom; Frances Chung, FRCPC, is a Professor in the Department of Anesthesia at the University of Toronto and Medical Director of Ambulatory Surgical Unit at Toronto Western Hospital in Toronto, Canada; Donna Williams, RN, is the Clinical Nurse Educator of Ambulatory Surgery and PACU at Toronto Western Hospital in Toronto, Canada; Brid Mary McGrath, FFARCSI, FRCA, is a Consultant Anaesthetist at Norfolk and Norwich University Hospital NHS Trust in Norwich, United Kingdom; and Brunna Curti, RN, BScN, is the Care Leader of the Medical/Surgical Day Unit at Toronto Western Hospital in Toronto, Canada.*

*Address correspondence to Damon Kamming BSc(Hons) MBChB, FRCA, 190 Regents Park Road, London NW1 8XP, United Kingdom; e-mail address: damonkamming@btmail.com.*

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**SEVENTY PERCENT OF** all surgical procedures in North America are now performed on an ambulatory basis.<sup>1</sup> This is likely due to a combination of economic forces, improved anesthetic and surgical techniques, and better coordinated preoperative planning. Successful ambulatory surgery is dependent on providing effective analgesia that produces minimal adverse effects, such as nausea and vomiting, and can be easily managed after the patient is discharged from the surgical center.<sup>2</sup>

The management of postoperative pain following ambulatory surgery has been noted to be inadequate in a number of studies.<sup>3-7</sup> Pain is the most common reason for delayed discharge<sup>8</sup> and for

contacting the family physician after discharge from the hospital.<sup>9</sup> Inadequate pain control is the main reason for unanticipated hospital re-admission following discharge.<sup>10,11</sup> The introduction of government-mandated standards for pain management has reflected these findings.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) issued pain standards in January of 2000 that apply to all JCAHO-accredited hospitals and ambulatory centers in the United States, thus emphasizing the importance of pain management for patients, health care providers, and institutions.<sup>12</sup> Therefore, the continuing success of ambulatory surgery will depend on the successful implementation of postoperative pain management strategies. The evidence-based options for ambulatory pain management are reviewed here to enable health care professionals to make appropriate analgesia choices for their patients.

### **Incidence and Severity of Pain Following Ambulatory Surgery**

Recent studies have challenged the commonly held belief that patients experience merely mild pain after discharge following ambulatory surgery. The incidence of moderate-to-severe postoperative pain after discharge following ambulatory surgery has been reported as 21% in the United Kingdom<sup>5</sup> and ranging from 31%<sup>13</sup> to 40%<sup>4</sup> in North America. Most disturbing is that this moderate-to-severe pain can last for up to a week after surgery.<sup>3,4</sup> Despite this, patients in moderate-to-severe pain after discharge express satisfaction with their care.<sup>14</sup>

Patient satisfaction with pain management is a complex subject and is often related to communication issues, reluctance of patients to report pain, and the belief that pain is an inevitable consequence of surgery.<sup>4</sup> In the United Kingdom, a survey revealed that almost 50% of patients would tolerate pain after surgery rather than “complain” about it to their caregivers.<sup>14</sup> It is of interest that patients ranked pain in the top three most undesirable outcomes after ambula-

tory surgery.<sup>15,16</sup> Therefore, it is important for clinicians to realize that patients’ reports of satisfaction with their postoperative pain management after discharge do not necessarily mean that they are experiencing well-controlled pain during their recovery.

### **The Problem With Pain**

In the pediatric and adult populations, postoperative pain is associated with increased postoperative nausea and vomiting (PONV).<sup>17,18</sup> As the age of patients having ambulatory surgery increases, the potential for severe pathophysiological changes increases. Pain is particularly harmful in older adults with underlying chronic conditions such as ischemic heart disease and hypertension.<sup>19</sup> Persistent pain after discharge following ambulatory surgery has numerous adverse effects. Beyond discomfort and suffering, patients may experience sleep deprivation and delayed return to normal functioning.<sup>19</sup> Inadequately treated and persistent postoperative pain may also progress to chronic pain.<sup>19,20</sup> For example, this has been shown to occur following inguinal hernia repair where the incidence of chronic pain has been reported to be as high as 12%.<sup>20</sup>

### **Identifying Painful Procedures**

Pain is a personal experience and must be measured objectively to adequately assess its severity and duration.<sup>19</sup> The visual analogue scale (VAS) and numerical pain rating scale have been validated for measuring pain intensity.<sup>19</sup> It is imperative that patients be taught how to use these self-report pain-rating tools before surgery when they are awake and best able to understand instructions.

In addition to proper assessment, an important first step in managing postoperative pain more effectively is to identify the procedures most likely to result in considerable pain. Being able to predict patients at risk for significant postoperative pain makes it possible to develop an effective preoperative, intraoperative, and postoperative pain management strategy that is tailored specifi-

cally to the age and physical condition of the patient, and the nature of the surgery.

Research by Chung and McGrath<sup>13</sup> noted that 29% of ambulatory surgery patients were suffering moderate-to-severe pain 24 hours after surgery. The ambulatory procedures most likely to result in moderate-to-severe postoperative pain were identified and ranked according to severity of pain intensity (pain rated 3 or higher on the 0 to 10 VAS). The most painful ambulatory procedures in descending order from highest to lowest pain intensity score were: 1) lumbar microdiscectomy, 2) laparoscopic cholecystectomy, 3) shoulder, 4) elbow and hand, 5) knee, 6) ankle, and 7) inguinal hernia surgery.

### General and Regional Anesthesia

The choice of anesthetic technique depends on patient and surgical factors. All general and regional anesthesia techniques have both advantages and disadvantages. The main disadvantages of general anesthesia are the high incidence of PONV and moderate-to-severe postoperative pain, which may delay discharge home.<sup>7</sup>

Regional anesthesia uses local anesthetics that inhibit the transmission of neural impulses by reversibly inhibiting sodium channels in pain fibers. The main disadvantage of regional anesthesia is that it is very time-sensitive. Planning is crucial because regional blocks take a longer time to take effect than general anesthetics, although competitive discharge times and costs compared with general anesthesia have been demonstrated.<sup>21</sup>

Regional anesthesia may be used as the sole anesthetic technique or in combination with general anesthesia to provide intraoperative and postoperative analgesia. The use of upper and lower limb peripheral nerve blocks provides excellent analgesia with minimal adverse effects such as PONV. Peripheral nerve blocks have enabled major shoulder and knee reconstructions to be performed on an ambulatory basis. The postoperative analgesia from a peripheral

block can be extended for up to 72 hours postoperatively by using peripheral nerve catheters and local anesthetic infusions from elastomeric pumps.<sup>22</sup>

Studies comparing patients having ambulatory arthroscopic shoulder surgery demonstrated that 8% of the patients who received general anesthesia without an interscalene block required unanticipated hospital admission overnight because of severe pain; none of the patients who received an interscalene block required an overnight stay.<sup>23,24</sup> Klein and colleagues<sup>25</sup> demonstrated that even with an insensate extremity after a block, patients could be safely discharged home. It is important to recognize that approximately 20% of these patients may require oral opioid analgesia for up to 7 days postoperatively, emphasizing the need to anticipate and adequately prescribe analgesics for moderate-to-severe pain following discharge.

Neuraxial techniques remain an alternative to general anesthesia. Small-dose selective lidocaine spinal anesthesia has been compared with desflurane general anesthesia for outpatient laparoscopy and found to provide equally rapid recovery with less analgesic requirements.<sup>26</sup> The advantages of neuraxial techniques are the avoidance of the risks of general anesthesia, improved analgesia, and a much-reduced requirement for postoperative opioids for pain relief and, thus, a reduced tendency for PONV.<sup>27</sup> The potential disadvantages of this technique include the time required to perform and await the onset of the block, and neurological complications including postdural puncture headaches and the rare, but devastating, risk of spinal hematoma or infection.

Other regional anesthetic techniques appropriate for ambulatory surgery include peribulbar, retrobulbar, and topical anesthesia for ocular surgery, and intravenous regional anesthesia (IVRA) for short-duration (less than 45 minutes) surgery on the distal extremities such as carpal tunnel release and excision of ganglia.

## Preemptive Analgesia

Pain is produced by several different mechanisms with many different mediators. These mechanisms are inducible and once induced, the inflammatory process and sensation of pain are increased. The administration of analgesia before surgery (preemptively) may be effective in reducing the postoperative pain from surgery by preventing the peripheral and central sensitization caused initially by surgical incision and later by inflammatory injury.

There are studies that support the effectiveness of preemptive analgesia.<sup>28</sup> However, an extensive meta-analysis by Moiniche and colleagues concluded that there was a lack of evidence for preemptive treatment with NSAIDs, intravenous (IV) opioids, IV ketamine, peripheral local anesthetics, and caudal analgesia.<sup>29</sup> The effectiveness of preemptive analgesia is likely to remain a controversial issue for some time. Despite this, the preoperative administration of nonopioid analgesia, such as NSAIDs, ketamine, and local anesthetics, prior to surgical incision is an important component in reducing postoperative pain scores and analgesic requirements in the first 24 hours after discharge.<sup>30</sup>

## Multimodal Analgesia

Combinations of analgesics that act by different mechanisms result in additive or synergistic analgesia, allowing lower total doses of each of the drugs, thereby reducing adverse effects. A multimodal analgesic technique combines drugs, such as an opioid, NSAID, acetaminophen, and local anesthetic, which act on different targets of nociceptive pain transmission. The combination of these drugs is superior to any modality alone, and the technique is highly recommended.<sup>31</sup> Clinical trials have demonstrated a reduction in postoperative opioid analgesic requirements by up to 40% when acetaminophen and NSAIDs are coadministered perioperatively.<sup>32,33</sup>

### *Acetaminophen*

Acetaminophen (also known as paracetamol in some parts of the world) is the most commonly

used oral analgesic and antipyretic worldwide because it is cheap and effective for mild pain and has a low adverse effect profile when the recommended daily dose is not exceeded. Acetaminophen functions by blocking prostaglandin synthesis; however, unlike NSAIDs, it does not irritate the gastric mucosa, affect platelet function, or cause renal insufficiency. It continues to be underused in ambulatory surgery in North America as an adjuvant to NSAIDs and local anesthetics.

Acetaminophen has a significant opioid-sparing effect, which has been demonstrated in preoperative rectal doses of 40 mg/kg in pediatric surgery.<sup>33</sup> The recommended rectal dose (single preoperative dose up to 60 mg/kg) is higher than the recommended oral dose (15 mg/kg every 6 hours to a maximum of 75 mg/kg in a 24-hour period) because of unreliable absorption in the suppository form.<sup>34</sup> In children, a loading rectal dose of 60 mg/kg is currently recommended to a maximum of 90 mg/kg rectally in a 24-hour period to maintain therapeutic plasma concentrations.<sup>35,36</sup> The rectal route is preferred to avoid the problem of delayed gastric emptying or vomiting after opioid intake. The maximum adult oral dose is 4 g over a 24-hour time period.

Acetaminophen is also available in combination with opioids for postoperative analgesia. It is combined with codeine in North America (Tylenol #3, Ortho McNeil, Raritan, NJ), dextropropoxyphene (co-proxamol) in the United Kingdom, and propoxyphene (Darvon, Darvocet, Eli Lilly, Indianapolis, IN), hydrocodone (Vicodan, Abbott, Abbott Park, IL; Lortab, UCB Pharma, Smyrna, GA), and oxycodone (Percocet, Endo Pharmaceuticals, Chadds Ford, PA; Tylox, Ortho McNeil, Raritan, NJ; Roxicet, Boehringer Ingelheim Pharmaceuticals Inc. Canada, Burlington, Ontario) in the United States. Caution is recommended in the use of nonopioid-opioid formulations. The ceiling on the recommended daily dose of nonopioid limits the usefulness of combination drugs to the treatment of short-term mild-to-moderate pain

only.<sup>19</sup> Propoxyphene and its metabolite, norpropoxyphene, can also accumulate with repetitive dosing and produce pulmonary edema and cardiotoxicity. Although it continues to be widely prescribed in the United States, propoxyphene is considered appropriate only for short-term mild, intermittent pain.<sup>19</sup>

#### *NSAIDs*

The 1992 Agency for Health Care Policy and Research (AHCPR) acute pain clinical practice guideline recommends that, unless contraindicated, all patients with postoperative pain should be given an NSAID.<sup>37</sup> In 1998, the Royal College of Anaesthetists in the United Kingdom issued similar guidelines for the use of NSAIDs in the perioperative period. On the basis of the strongest evidence available it stated, "In situations where there are no contraindications, NSAIDs are the drug of choice after day case procedures." The traditional NSAIDs, called nonselective NSAIDs, have significant gastrointestinal (GI), hematological, and renal adverse effects mediated through inhibition of the isoenzyme cyclooxygenase-1 (COX-1). Examples of nonselective NSAIDs are aspirin, ibuprofen, naproxen, indomethacin, and ketorolac.

Relatively new to the family of NSAIDs are the cyclooxygenase-2 (COX-2)-selective NSAIDs, sometimes called COX-2-selective inhibitors. Under normal physiological conditions, minimal COX-2 is expressed; however, the inflammatory response induces COX-2 expression. This expression is partly responsible for the pain the patient experiences postoperatively after discharge to home.<sup>38</sup>

Three oral forms of COX-2-selective NSAIDs are currently available: rofecoxib (Vioxx, Merck, West Point, PA), celecoxib (Celebrex, Pfizer, New York), and valdecoxib (Bextra, Pfizer, New York). All appear to be as effective as nonselective NSAIDs in suppressing inflammation and providing analgesia for ambulatory surgery<sup>39</sup> with less risk of GI toxicity. The incidence of endoscopy verified ulcers with these

drugs is reduced to levels similar to those seen with placebo.<sup>40</sup> Another significant advantage of the COX-2-selective NSAIDs over the nonselective NSAIDs in the perioperative patient is that they do not impair platelet function or increase bleeding time.<sup>41</sup> Rofecoxib (50 mg), taken 1 hour before ambulatory arthroscopic knee surgery, was compared with the same dose following surgery in a placebo-controlled study.<sup>42</sup> The patients who took rofecoxib 1 hour before surgery were found to have a longer duration of pain relief, decreased opioid use, and lower pain scores compared with the same dose taken after surgery.

A long-acting injectable IV formulation of a COX-2-selective NSAID, known as parecoxib, is available in the United Kingdom and Canada and is undergoing trials at this time in the United States. Parecoxib is hydrolyzed enzymatically to the active drug valdecoxib (which is available in tablet form). Both oral valdecoxib and IV parecoxib have been reviewed, and they were found to be effective treatments for acute postoperative pain in ambulatory surgery.<sup>43</sup> The IV preparation is particularly useful in the immediate postoperative period when patients are unable to take oral medication or are suffering from PONV.

#### *Opioids*

Postoperative pain control is started intraoperatively by supplementing general anesthesia with short-acting opioids, such as fentanyl. In the PACU, IV fentanyl or morphine can be used for moderate-to-severe pain. No difference in adverse effects was noted between IV morphine and IV fentanyl in the PACU setting; however, the incidence of nausea and vomiting in those patients who received morphine increased significantly on the trip home.<sup>44</sup> It is prudent, therefore, to consider using fentanyl for severe postoperative pain in the PACU in view of its ease of titration and rapid onset (3 to 5 minutes) compared with morphine (8 to 30 minutes).

In addition to appropriate IV opioid titration, a long-acting oral opioid should be considered for surgery which is likely to result in moderate-to-severe postoperative pain after discharge. The operating room anesthesiologist, who administers both intraoperative and immediate postoperative analgesia, can prescribe oral controlled-release oxycodone (OxyContin, Purdue Frederick, Stamford, CT) for patients having surgery known to produce significant postoperative pain. Controlled-release oxycodone has been demonstrated to provide analgesia that takes approximately 45 minutes to take effect and has a 12-hour duration of analgesic action. This allows a simple twice-daily dosing schedule ensuring better compliance and improved sleep after discharge.<sup>45</sup> Controlled-release oxycodone has high bioavailability because it does not undergo extensive first-pass metabolism and has a consistent absorption profile.<sup>46,47</sup> Comparison studies showed that controlled-release oxycodone has a better adverse effect profile for some patients than controlled-release morphine, with a tendency toward less nausea, vomiting, and pruritus.<sup>48</sup> Unlike codeine, oxycodone does not depend on a patient's genotype for its analgesic effect.

A study by Reuben and colleagues<sup>49</sup> demonstrated that 20 mg of controlled-release oxycodone given every 12 hours after ambulatory anterior cruciate ligament surgery provided superior analgesia with fewer adverse effects than "as required" immediate-release oxycodone in the first 3 postoperative days. All of the patients in this study also received an intraoperative dose of a short-acting NSAID. In a later study, Reuben and colleagues<sup>50</sup> randomized patients undergoing ambulatory laparoscopic tubal ligation to receive either 10 mg controlled-release oxycodone or placebo preoperatively. Those who received the preoperative dose of controlled-release oxycodone were found to have lower postoperative pain scores, reduced PONV, shorter time to discharge, and significantly reduced analgesic use after discharge home.

Every effort should be made to ensure that patients leave the hospital or surgery center with well-controlled pain and prescriptions for adequate and appropriate analgesics for the course of recovery. Patients should be told to take their opioid and nonopioid analgesics regularly "around-the-clock" initially rather than "as needed" (PRN). As pain subsides, the analgesics may then be tapered as appropriate.

Adverse effects of opioids include constipation, nausea, vomiting, sedation, and respiratory depression. Patients must be informed of these adverse effects, both verbally and in writing, and told what to do if they occur. They should also be told to prevent constipation by increasing their fluid, fruit, and fiber intake and by taking a laxative plus stool softener daily during opioid therapy.

#### *Ketamine*

There has been a recent resurgence of interest in the use of single low-dose ketamine (0.1 to 0.15 mg/kg) given toward the end of painful surgery. The use of this *N*-methyl *D*-aspartate (NMDA) receptor antagonist results in significant opioid-sparing effects that can be long lasting.<sup>51-53</sup> It is thought that ketamine protects the spinal cord from centrally mediated hyperalgesia in response to the peripheral noxious stimulation of surgery. Low doses make it possible to achieve this desirable analgesic outcome without the significant adverse effects, such as dissociation and hallucinations, which are reported with higher doses of ketamine.

## **A Pain Management Success Story**

### *Preoperative Patient Education*

The public often has misconceptions about pain and its treatment, such as fears about addiction and potential adverse effects. These misconceptions can lead to underdosing and poor compliance, which can result in significant postdischarge pain and the potential for the development of chronic pain. Postoperative pain is also associated with preoperative anxiety. Patient education has been shown to re-

duce anxiety and postoperative pain and have a major impact on patient satisfaction.<sup>54</sup> Patients should be educated preoperatively and provided with both verbal and written information on how their pain will be managed during the immediate postoperative period and how to manage their own pain after discharge to home.

Communication between patients and health care providers can influence the effectiveness of the pain management plan. The use of a simple pain assessment tool, such as the 0 to 10 VAS, helps the patient quantify pain intensity for the health care provider, who can then make appropriate decisions about the treatment plan. A preadmission program can initiate this process. The objective is to ensure patients have a clear understanding of the universal pain-rating scale. The preadmission period is also the ideal time to discuss the relationship between comfort and accomplishment of functional goals, such as deep breathing and ambulation. Frequent pain assessment and evaluation continue throughout the patient's perioperative stay, and interventions are implemented and the plan adjusted accordingly. The pain scale can also be incorporated into a postdischarge telephone interview to extend assessment and care of the patient's pain while at home.

#### *Protocol-Based Analgesic Management*

Analgesic protocols can be useful tools for standardizing pain management approaches and reducing variation in practice. Crews<sup>55</sup> described the use of a multimodal analgesic ladder for postoperative ambulatory surgery based on whether the patient was expected to have mild, moderate, or severe postoperative pain. The protocol proposes a standardized stepwise approach to pain management for ambulatory surgery and is based on the ubiquitous analgesic ladder of therapy for cancer pain developed by the World Health Organization.

Lopez and colleagues<sup>56</sup> demonstrated that a clinical guide for the treatment of postoperative pain based on Chung and McGrath's prediction

of painful procedures<sup>13</sup> could be used to improve pain management. Eighty-six percent of patients who were cared for according to the guideline in this study rated their pain as less than 3 (per 0 to 10 VAS) after discharge.

At Toronto Western Hospital, nurses assess and administer preoperative medications (NSAIDs and acetaminophen) to all surgical patients who meet established criteria on the basis of a medical directive. For example, patients having surgery typically associated with significant postoperative pain are prescribed 1 g of acetaminophen and 500 mg of naproxen (unless specific contraindications are noted) 30 to 90 minutes preoperatively with a sip of water according to a standardized protocol. Patients having less extensive surgery are prescribed naproxen alone. The nurses working in the Ambulatory Surgery Unit, in conjunction with a surgeon's directive, administer acetaminophen plus oxycodone (Percocet) prior to inguinal hernia procedures. The incision site is infiltrated with local anesthetic (preemptively), and the inguinal hernia repair is performed under general anesthesia. A set of standardized postoperative orders provides the surgeon, anesthesiologist, and nurse with a broad range of analgesia options that incorporate medications discussed earlier, including controlled-release oxycodone (OxyContin).

Marquardt and Razis<sup>57</sup> reported that providing patients with discharge instructions that include protocols for ongoing maintenance analgesia and instructions on how to increase the analgesic dose for breakthrough pain resulted in improved pain control, mobilization, and sleep patterns for 72 hours postoperatively. Postoperative pain may be present for at least a week after ambulatory surgery; therefore, an adequate supply of multimodal analgesics should be supplied in appropriate tapering doses.<sup>4</sup>

Future research at Toronto Western Hospital includes a randomized study to compare the efficacy of a prepackaged postoperative multi-

modal analgesic regimen compared with the standard practice of PRN analgesia for postdischarge pain control. The prepackaged regimen will be provided to patients undergoing ambulatory surgery which is known to result in significant pain following discharge from the hospital.

#### *Patient Follow-Up*

At Toronto Western Hospital, all patients are provided with a written pamphlet entitled "Managing Your Pain at Home Following Ambulatory Surgery." The pamphlet contains information specific to the patient's surgery and how to manage pain at home, including how to regulate analgesia and how, when, and where to seek emergency care if required. Following the outcomes of ambulatory patients by means of a postdischarge telephone interview using a standard questionnaire has improved the quality of ambulatory surgical services. The follow-up call also facilitates evaluation of the patient education provided and the collection of valuable feedback from the patients regarding their satisfaction about the care they received at the ambulatory surgery unit. This feedback is used to make changes and continually improve care. The postoperative telephone interview has also ensured that ambulatory surgery pa-

tients are no longer "out of sight and out of mind" following discharge.

### **Recommendations**

Ambulatory surgery departments should strive to standardize postdischarge analgesia regimens for all anticipated intensities of postoperative pain and provide clear instructions on how to take additional analgesics for breakthrough pain. It has been noted that postoperative pain may be present up to a week following specific types of ambulatory surgery. Therefore, an adequate supply of appropriate analgesics must be prescribed at discharge.<sup>3</sup> Patient follow-up after discharge with a standardized telephone questionnaire to screen for patient understanding of postoperative instructions related to analgesia is essential because it allows patients to communicate concerns regarding their care, and it monitors the effectiveness of pain treatment. The telephone questionnaire is not merely a tool to enable rigorous audit and quality control, but a mechanism that allows extended patient care. This approach has the potential to produce high patient satisfaction with pain management. This is of utmost importance because improved pain management is essential for the future development of ambulatory surgery.

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