Postdischarge complications and rehabilitation after ambulatory surgery

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Purpose of review

To present the literature on recent developments in anesthetic and analgesic techniques in ambulatory surgery.

Recent findings

Studies published during the past 12 months have provided results for several 'take home messages', which include use of perioperative celecoxib improves short-term and long-term postoperative outcome; perineural catheter analgesia is feasible and safe at home; small incision cholecystectomy is quicker to perform and has no disadvantages when compared with laparoscopic technique; 2-chloroprocaine appears to be the drug of choice for spinal anesthesia; simple regional anesthesia techniques such as wound infiltration and intraarticular local anesthetics are safe and effective; Society of Ambulatory Anesthesia guidelines for managing postoperative nausea and vomiting recommend use of regional anesthesia techniques and use of certain drugs (and avoidance of others) if general anesthesia is chosen.

Summary

During the last year, several studies have demonstrated the benefits of regional anesthesia techniques in reducing postdischarge complications and improving rehabilitation. Perioperative use of the COX-2 selective inhibitor celecoxib seems to provide short-term and long-term postoperative advantages.

Keywords

ambulatory surgery, analgesia, anesthesia, nausea and vomiting, regional anesthesia and analgesia

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Introduction

One of the most significant changes in surgical practice during the past two decades has been the growth of ambulatory surgery, which now accounts for the majority of surgery performed in the United States, some European countries, and Australia. It is expected that the number of patients undergoing surgery on an ambulatory basis will increase particularly in countries with low numbers today. Major ambulatory surgical procedures such as knee and shoulder reconstructions, laparoscopic-assisted vaginal hysterectomies, gastric fundoplication and splenectomy are being performed at many centers [1].

The present review will focus on some of the common issues in ambulatory surgery and will provide new information about questions such as: Does the choice of analgesic drug or technique influence outcome? Are catheter regional anesthesia techniques safe at home? Is the widely used laparoscopic surgery really that good? Which local anesthetic is best for spinal anesthesia? What are the best strategies for management of postoperative nausea and vomiting (PONV) in adults and in children? New information for some other topics is also presented.

Pain still the most common complaint after ambulatory surgery

During the past two decades, ambulatory surgery has grown dramatically and now accounts for the majority of operations performed in many parts of the world. However, international figures show wide variations between countries. There are also wide variations within countries and between hospitals [2].

We studied the practice of day surgery in Sweden by a questionnaire sent to all 92 hospitals. The response rate was 88%. The results showed that the proportion of day surgery against in-hospital procedures was 43% in adults and 46% in children. Most patients (>90%) underwent preoperative assessment by an anesthesiologist. Patient self-assessment questionnaires were common (86%). Risk stratification for PONV was used by 70% of the departments. Postoperatively, 93% of the units routinely

assessed patients' pain. Follow-up telephone calls within 1–2 days were performed regularly in about 40% of the units. Pain was the most frequent complaint on follow-up.

Most hospitals (80%) had standardized discharge criteria based on clinical assessment, and many required a patient escort at home for 24 h postoperatively [3].

COX-2 selective inhibitors can improve postoperative outcome

Nonsteroidal anti-inflammatory drugs (NSAIDs) are widely used as part of a multimodal analgesic regimen for preventing pain after ambulatory surgery. It is believed that analgesic regimens that work through different mechanisms should be combined. Studies involving COX-2 selective inhibitors have demonstrated that they can improve pain control after a wide variety of ambulatory surgery procedures [4–8]. Nevertheless, questions remain regarding the efficacy of perioperative administration of COX-2 inhibitors in improving the later recovery processes (e.g. recovery of bowel function, resumption of normal activities of daily living).

Arthroscopic reconstruction of the anterior cruciate ligament (ACL) is a common outpatient procedure associated with considerable postoperative pain, which may delay discharge, prolong hospital stay, impair rehabilitation, and delay recovery, resulting in poorer outcome and greater use of healthcare resources [4,5]. Optimal pain relief allowing normal function may be difficult to achieve with a single drug or technique. Such multimodal analgesic regimens for ACL reconstruction include NSAIDs, intraarticular analgesics, ketamine, regional nerve blocks, cryotherapy, and opioids [2].

Reuben *et al.* [6] examined the analgesic efficacy of administering celecoxib for ambulatory ACL surgery. Two hundred patients received paracetamol 1 g and either celecoxib 400 mg or placebo 1–2 h before ACL surgery. All patients received intraarticular analgesics (bupivacaine, clonidine, and morphine) and had an external cooling system applied to the operative knee. After discharge, patients were instructed to take paracetamol 1 g every 6 h and either celecoxib 200 mg every 12 h or matching placebo for the first 14 days postoperatively. Oxycodone 5–10 mg was available for rescue analgesia. The perioperative administration of celecoxib decreased postoperative pain, opioid use, PONV, and recovery room length of stay. These results support the use of celecoxib as a component of a preventive multimodal analgesic technique for ACL surgery [6].

Preoperative parecoxib followed by short-term postoperative valdecoxib has been shown to improve recovery after laparoscopic cholecystectomy [9]. However, studies involving perioperative administration of these two COX-2 inhibitors in patients undergoing cardiac surgery found an increased incidence of postoperative wound infections [10] and cardiovascular complications [11]. Despite extensive worldwide use of COX-2 inhibitors in the perioperative period, there have been no reports of serious cardiovascular complications associated with short-term use of COX-2 inhibitors in noncardiac surgery patients [12].

White *et al.* [13] evaluated the effect of short-term postoperative administration of celecoxib on pain management and recovery outcomes following ambulatory laparoscopic surgery in 80 patients assigned to receive either celecoxib 400 mg per day or placebo. Celecoxib reduced pain scores and need for analgesics at 24 and 48 h postoperatively. The quality of recovery scores and patient satisfaction were higher in the celecoxib group. In this group, early recovery of bowel function (by 1 day) and activities of daily living (by 2 days) were also noted [13]. Despite the opioid-sparing effect of the COX-2 inhibitor, the overall incidence of PONV was not significantly reduced in this study. It was concluded that short-term administration of celecoxib, 400 mg per day orally (p.o.), decreased postoperative pain and the need for opioid-containing analgesic medication, leading to an improved quality of recovery after outpatient laparoscopic surgery [13].

Strategies to reduce postoperative nausea and vomiting: new guidelines

Evidence-based practice guidelines have the potential to provide valuable information to clinicians and their patients. Not only do they provide guidance in everyday practice, but they also establish the 'standard of care' for the specialty. PONV is a continuing concern in surgical patients and the management of this problem is still confusing. In the United States, more than 71 million inpatient and outpatient operative procedures are performed each year [14]. Untreated, PONV occurs in 20–30% of the general surgical population and in up to 70–80% of high-risk surgical patients [15,16]. PONV associated with ambulatory surgery increases healthcare costs due to hospital admission and accounts for 0.1–0.2% of these unanticipated admissions, which is significant in the United States where more than 31 million patients undergo ambulatory surgery each year [14,17,18]. Studies of PONV in children have been limited to the measurement of vomiting, as the reliable, effective evaluation of nausea in nonverbal children is difficult.

After ambulatory surgery, approximately one-third of patients experience PONV, many of whom did not experience PONV prior to discharge [19]. Such patients often do not have access to treatment for their postdischarge nausea and vomiting (PDNV). A systematic

review of all studies, assessing PDNV after outpatient surgery, found that on discharge 17% of patients experience nausea (range 0–55%) and 8% have vomiting [19].

A multidisciplinary international panel of individuals with interest and expertise in PONV developed specific guidelines under the auspices of The Society of Ambulatory Anesthesia [19]. The panel critically evaluated the literature to provide an evidence-based reference tool for the management of adults and children who are at increased risk for PONV. In brief, these guidelines identify risk factors in adults and children; recommend approaches for reducing baseline risk for PONV; identify the most effective antiemetic monotherapy and combination therapy regimens for prophylaxis; and recommend approaches for treatment of PONV when it occurs. Strategies to reduce the risk of PONV are as follows [20••]:

(1) use regional anesthetic (avoid general anesthetic);
(2) propofol for induction and maintenance;
(3) avoid nitrous oxide;
(4) avoid volatile agents;
(5) minimization of intraoperative and postoperative opioids;
(6) minimization of neostigmine;
(7) adequate hydration.

The guidelines also provide an algorithm for the management of individuals at increased risk for PONV. The experts recommend that children who are at moderate or high risk for PONV should receive combination therapy with two or three prophylactic drugs from different classes [20••].

No advantage of glucocorticoids for pain relief or postoperative nausea and vomiting

Although NSAIDs have a postoperative opioid-sparing analgesic effect, glucocorticoids have been shown to have both a postoperative analgesic effect and an antiemetic effect. Bisgaard *et al.* [21] found antiemetic and analgesic effects beyond 24 h from dexamethasone 8 mg given 1 h before laparoscopic cholecystectomy. However, the literature is not consistent on which steroid to use, the optimal dose, and the optimal timing for administration of corticosteroids for pain and PONV protection [22,23].

Thagaard *et al.* [24] evaluated the effect of single-dose intravenous (i.v.) dexamethasone or intramuscular (i.m.) depot betamethasone compared with i.v. ketorolac. One hundred and seventy-nine patients admitted for mixed ambulatory surgery were included in the study. After induction of general i.v. anesthesia, the patients were randomized to received double blindly either dexamethasone 4 mg i.v. or betamethasone depot formulation 12 mg i.m., or ketorolac 30 mg i.v. All the patients also received paracetamol and local anesthetic wound infiltration.

The authors found that ketorolac 30 mg provided superior analgesia and less PONV in the postanesthesia care unit (PACU) than either dexamethasone 4 mg or bethamethasone 12 mg. No significant difference was found after discharge. The expected prolonged duration of analgesia could not be demonstrated in this study [24].

2-Chloroprocaine superior to lidocaine for spinal anesthesia

Spinal lidocaine was extensively used for outpatient orthopedic procedures until transient neurological symptoms (TNSs) were consistently reported [25]. Small doses of long-acting drugs (such as bupivacaine, levobupivacaine, or ropivacaine), with or without additives, have been suggested as a possible alternative [26], but many practitioners report frequent failure with this technique, and recovery may be delayed [26,27].

2-Chloroprocaine is an amino-ester local anesthetic with a very short half-life and a potentially favorable evolution of spinal block for short outpatient procedures. Concerns for chloroprocaine-related neurotoxicity emerged two decades ago with eight cases of neurological injury associated with large doses of a chloroprocaine solution containing the antioxidant sodium bisulfite. Toxicological studies indicated sodium bisulfite as the likely cause [28,29], though an animal study in rats challenged this conclusion [30]. Clinical reports on off-label intrathecal use of preservative-free chloroprocaine in more than 100 patients, as well as rigorous investigations in more than 100 volunteers and outpatients, have not reported any cases of neurological toxicity [31].

In a well controlled study, Casati *et al.* [32••] tested the hypothesis that 50 mg of 1% preservative-free 2-chloroprocaine would provide a faster resolution of spinal block than the same dose of 1% plain lidocaine. Median times for recovery of sensory and motor function and unassisted ambulation were faster with 2-chloroprocaine. No differences in the first voiding were reported between chloroprocaine (180 min) and lidocaine patients (190 min). TNSs were reported in five lidocaine patients (33%) but not chloroprocaine patients (0%).

The authors concluded that intrathecal injection of 50 mg 2-chloroprocaine produced a faster onset spinal block with quicker recovery of sensory and motor function and unassisted ambulation and lower incidence of TNS than the same dose of lidocaine [32••].

Effective analgesia with local anesthetic wound infiltration

There are many reports on pain, analgesic requirements, and side effects after ambulatory herniorrhaphy. However, most of them focus on the immediate postoperative period, and few studies evaluate these topics at home for a longer period of time (i.e. >24). Ausems *et al.* [33] evaluated the efficacy of a multimodal pain protocol after ambulatory inguinal hernia repair for a 5-day postoperative period. Surgery was performed under general or spinal anesthesia. Two groups of 60 patients received wound infiltration with 20 ml levobupivacaine 0.5% or physiological saline 0.9%. All patients received 1 g paracetamol preoperatively. The results showed that wound infiltration with levobupivacaine significantly decreased postoperative pain and diminished the need for additional analgesics in the first 24 h after inguinal hernia repair [33].

Interscalene block versus intraarticular local anesthetics

Effective postoperative pain control is crucial in the outcome of shoulder surgery, permitting early rehabilitation and accelerating functional recuperation [34]. Of the different analgesic techniques reported in the literature, interscalene block and intraarticular injection of local anesthetics appear superior to surgical wound infiltration, suprascapular nerve block, and patient-controlled i.v. opioid analgesia [35–38].

Perineural continuous blockade is generally considered the gold standard for postoperative analgesia despite the additional technical and logistical challenges presented by catheter placement and use, especially in an outpatient setting. Intraarticular local anesthetic infiltration has the potential advantages of better preservation of motor function and technical simplicity, while providing superior analgesia.

Beaudet *et al.* [39] compared interscalene analgesia with intraarticular local anesthetic administration. Sixty patients undergoing shoulder surgery were randomly assigned into two groups; one group had interscalene block with catheter installation, whereas the other group received intraarticular local anesthetic, also with catheter installation. PACU measurements of immediate postoperative pain and opioid consumption favored perioperative interscalene analgesia over intraarticular analgesia. However, this benefit did not translate into lower overall pain for the first 24 h after surgery [39]. This study confirmed the superiority of perioperative interscalene over intraarticular local anesthetic boluses but only for the first postoperative hours.

Continuous femoral nerve block at home after total knee arthroplasty

Ambulatory continuous femoral nerve block (cFNB) offers the potential of providing prolonged analgesia while simultaneously decreasing disability and hospitalization duration after total knee arthroplasty (TKA) and other major hospital-based knee procedures. Within the United States, the average hospitalization duration after TKA decreased from nearly 11 days in 1990 to just over 4 days in 1996 but has remained relatively constant over the last decade [40].

Ilfeld *et al.* [41] tested the hypothesis that, compared with an overnight cFNB, a 4-day ambulatory cFNB increases ambulation distance and decreases the time until three specific discharge criteria are met after tricompartment TKA.

Preoperatively, all patients received a cFNB ($n = 50$) and perineural ropivacaine 0.2% from surgery until the following morning, at which time they were randomly assigned to either continue perineural ropivacaine or switch to perineural normal saline. Primary endpoints included time to attain three discharge criteria (adequate analgesia, independence from i.v. analgesics, and ambulation of at least 30 m) and ambulatory distance in 6 min the afternoon after surgery. Patients were discharged with their cFNB and a portable infusion pump; catheters were removed on postoperative day 4.

Compared with an overnight cFNB, a 4-day ambulatory cFNB decreased the time to reach the three discharge criteria by an estimated 53%. However, the extended infusion did not increase ambulation distance the afternoon after surgery [41].

Perineural catheter analgesia at home is safe

Continuous peripheral nerve block (CPNB) may be an optimal choice for analgesia after orthopedic procedures of the lower and upper extremities. A number of studies have demonstrated that resting and breakthrough pain scores are lower with CPNB than with conventional therapy using oral or parenteral analgesics [42,43]. Additionally, CPNB is associated with decreased time to functional recovery during rehabilitation. Despite the evidence, patients having orthopedic procedures associated with significant postoperative pain are rarely sent home with CPNB. Only a limited number of studies have been reported on patients sent home with CPNB [42,44–46]. Reluctance on the part of surgeons and anesthesiologists to treat these patients with CPNB reflect the limited data in the literature regarding the practice, as well as concern about complications such as catheter failure, infection, and local anesthetic toxicity [46].

No large studies have addressed practical questions for anesthesiologists who incorporate outpatient CPNB as a standard of care. One of the most common problems associated with CPNB involves accurate placement of the catheter. Failure rates of up to 40% have been reported when conventional techniques for catheter placement are used [47]. The recent introduction of ultrasound for placement of catheters is promising.

Swenson *et al.* [48] presented their results from a large series of outpatients who were treated with CPNB using an established protocol. All catheters were placed using direct ultrasound visualization. These patients received extensive oral and written preoperative instructions and were provided continuous telephone access to the anesthesiologist during the postoperative period. All patients were also contacted at home by telephone on the first postoperative day. In addition, each patient was seen and examined by the surgeon within 2 weeks of hospital discharge. In the 620 patients, there were 190 interscalene (brachial plexus), 206 fascia iliaca (femoral nerve), and 224 popliteal fossa (sciatic nerve) catheters placed. A fixed infusion of bupivacaine 0.25% at 5 ml/h was used in all patients. A simple elastomeric infusion device was used that did not include features such as occlusion alarms or bolus capability. Despite a relatively low and fixed infusion rate, very few patients (1.1%) requested additional injections for inadequate pain control. Two patients (0.3%) had complications related to the nerve block. In both patients, the symptoms resolved within 6 weeks of surgery. Twenty-six patients (4.2%) required postoperative interventions by the anesthesiologist. One patient returned to the hospital for catheter removal. There were surprisingly few interventions requiring an anesthesiologist. Likewise, patients were able to manage and remove their catheters at home without additional follow-up.

The above fact suggests that with adequate instruction and telephone access to healthcare providers, patients are comfortable with managing and removing CPNB catheters at home. The author concluded that further studies are needed to define optimal local anesthetic dosing regimens in this population [48].

Unsafe to drive after ambulatory surgery

Discharge without an escort is contrary to guidelines issued by several anesthesia societies [49,50]. Home readiness is not equivalent to street fitness. The stress of surgery, possible lack of sleep, and residual effects of anesthetic may have an influence on driving performance. The current recommendations are that the patient should not drive for 24 h after ambulatory surgery.

Chung and Assman [51] looked at the database for Canadian malpractice patients who were discharged after ambulatory surgery. From this database, two malpractice cases of patients who were discharged without an escort were reported. Both had a car accident and sustained serious injuries. One patient had undergone right knee arthroscopy. This may have affected the patient's ability to properly use the brake pedal. On the basis of this, the authors do not recommend discharge without an escort after general anesthesia, regional anesthesia, monitored anesthesia, or sedation. Although ambulatory surgical units can verify the presence of an escort at discharge, it is impossible to ensure that someone will stay with the patient at home during the night or that recommendations regarding driving are adhered to. Hence, it is important that patients have a clear understanding of what the potential hazards are and why they are asked to comply with the recommendations [51].

Laparoscopic cholecystectomy not better than small incision surgery

The laparoscopic cholecystectomy procedure has gained rapid and widespread popularity and become the surgical treatment of choice even though its superiority was not in evidence [52]. Loss of functional residual capacity (FRC) as well as the diaphragmatic contribution to tidal volume has been suggested to be principally due to pain-induced shallow breathing (splinting). Pulmonary function differences between laparoscopic cholecystectomy and small incision cholecystectomy (SIC) have been studied in only a few randomized trials, but the literature is ambiguous.

Keus *et al.* [53] performed a trial to evaluate pulmonary function in patients randomized between laparoscopic cholecystectomy and SIC by measuring flow–volume curves and blood gases in a blinded fashion. A total of 257 patients were analyzed. In both groups, a similar reduction of approximately 20% in pulmonary function parameters occurred. Patients in the SIC group consumed more analgesia. Actual skin-to-skin time varied from 72 to 60 min for laparoscopic cholecystectomy and SIC, respectively, with total anesthesia also being shorter for the SIC group. No clinically relevant differences were found between SIC and laparoscopic cholecystectomy regarding pulmonary function. The acceptance of the laparoscopic cholecystectomy as the technique of choice appears to have little foundation in evidence. A significantly shorter operative time was found in SIC [53].

Conclusion

A review of literature published during the last year addressed several important issues. Management of pain and PONV continue to be important problems in ambulatory surgery. Use of perioperative celecoxib has shown impressive short-term and long-term benefits. The widely used laparoscopic surgery technique is no better

than SIC. Regional anesthesia techniques such as wound infiltration, intraarticular local anesthetics, and perineural catheters at home are very effective for postoperative pain relief. 2-Chloroprocaine appears to be superior to other local anesthetics for spinal anesthesia for ambulatory surgery. The guidelines produced by the Society of Ambulatory Anesthesia provide important information to develop strategies for prevention and management of PONV.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

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Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 813).

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