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For maximum impact, it is recommended that the case study and questions found on page xxix are reviewed before reading this chapter.

Key Learning Objectives

- Learn about patient selection, intraoperative management and postoperative care of ambulatory patients
- Understand specific practices of ambulatory anesthesia such as patient-centered care, fast-tracking and multi-modal management of pain and PONV

Introduction

Ambulatory surgery (a.k.a. day surgery) describes procedures performed in a wide variety of clinical settings such as hospital, ambulatory surgery centers, and clinics or offices. The patient is

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expected to return home within hours of the procedure in a condition that closely approximates baseline functional status. The variety and complexity of procedures that meet this definition are tremendous and as such ambulatory patients are not necessarily healthy or straightforward. Similarly some procedures are being done in the overnight observation category which is neither strictly ambulatory surgery nor considered to inpatient admission. Ambulatory surgery represents an ever changing landscape and the anesthesiologist must stay abreast of current advances, technologies, and regulatory changes.

The percentage of surgical procedures done in ambulatory and office settings continues to grow for a variety of reasons including cost, patient convenience, and system capacity and this is especially true after COVID-19 in contrast to hospitals, which can and do perform outpatient procedures, ambulatory surgical centers and office-based surgery practices are subject to strict regulations that vary by locality. These regulations stipulate types of surgery, rules of patient selection, protocols, and necessary emergency resources that are appropriate for each location. The Society for Ambulatory Anesthesia (SAMBA, www.sambahq.org) has extensive additional resources on this that the reader may find useful.

Ambulatory Surgery

Ambulatory surgery generally places a great emphasis on the aesthetics of the patient experience from arrival to discharge and on maximization of efficiency and facility throughput. It is the true opportunity for patient-centered care. The goals of ambulatory anesthesia include rapid emergence from anesthesia, expedited discharge by “fast-tracking” patients to the most robust functional recovery possible. This includes prevention and treatment of post-operative nausea and vomiting (PONV), adequate pain control, increased operating room efficiency, and attentiveness to patient expectations.

Preoperative Considerations

The range of facilities in which ambulatory procedures occur is diverse and represents an important consideration for patient selection and planning. Unforeseen difficulty can be managed rather routinely when ambulatory surgery is performed in the setting of the full support services of an inpatient hospital. In contrast, even basic problems, such as the need for postoperative bladder catheterization, may not be easily handled in the office-based practice.

Specific preoperative issues to consider for ambulatory surgery patients include:

1. Is the nature of the surgical procedure compatible with same-day discharge?
2. Do patient characteristics or co-morbid conditions (see Table 25.1) predispose the patient to complications that might require hospital admission?

Indeed, even the simplest procedure done on a physiologically complex patient may require hospital admission and overnight observation. Table 25.1 provides representative considerations used to decide whether the patient might be an appropriate candidate for ambulatory surgery. Table 25.2 presents surgery- and procedure-related factors one might consider in deciding whether the proposed procedure is appropriate for the ambulatory setting. Table 25.3 lists common ambulatory procedures. However, *no* procedure is *always*

Table 25.1 Patient selection factors for ambulatory surgery

Caregiver available for transport home and postoperative evaluation
Patient willingness to go home the day of surgery
Co-morbidities: morbid obesity, obstructive sleep apnea, poorly compensated cardiopulmonary disease, implantable cardiac device, chronic pain, renal failure, urinary retention, significant neurologic disease (myasthenia, Parkinson's, dementia), bleeding diathesis, severe anemia
Prior anesthetic problems: difficult airway, PONV, postoperative cognitive dysfunction, malignant hyperthermia, poor pain-control, difficult intravenous access

Table 25.2 Procedure-related considerations for ambulatory surgery

Duration of surgery (no absolute cutoff)
Risk of post-operative opioid induced respiratory compromise (elevated in OSA, obesity, chronic opioid use)
Intraoperative fluid shifts, bleeding and need for transfusion
Need for post procedure implantable cardiac device interrogation
Risk of serious postoperative complications (bleeding, infection, airway or pulmonary compromise)
Extent of postoperative pain and analgesic needs
Need for intravenous medications or inability to tolerate oral intake

Table 25.3 Common ambulatory procedures

Local lesion removal (cyst, melanoma, breast biopsy/part, mastectomy)
Most orthopedic procedures not involving major fractures
Basic ENT procedures (sinus, tonsillectomy, cochlear surgery, thyroidectomy, hyoglossal nerve stim)
Limited plastics procedures (blepharoplasty, scar revision, liposuction, breast implant/reduction)
Limited urologic procedures (cystoscopy, biopsy, vasectomy, circumcision)
Ophthalmologic procedures (excluding vitrectomy and enucleation)
Limited GYN procedures (hysteroscopy, D&C/D&E, cone biopsy, tubal ligation)
Limited spine surgery (single level microdisectomy)
Limited oncologic procedures (breast biopsy, lumpectomy, melanoma resection)

done in an outpatient basis. Even a low risk procedure (e.g. cataract removal) done on a physiologically complex patient may require hospital admission and overnight observation.

Preoperative testing and evaluation requires the use of patient triage protocols and following existing clinical guidelines. Patients are best screened and evaluated well in advance of the planned procedure. Advance assessment allows problem identification and implementation of optimization strategies that may facilitate handling of medically complex patients in the outpatient setting or appropriate shunting to a more clinically appropriate setting.

Generally, patients planned for same-day discharge should not have active issues that require substantial medical consultation or interdisciplinary planning. If such medical co-morbidities are present, regardless of anesthetic or surgical approach, the risk of perioperative exacerbation of underlying medical conditions is real and the expertise and resources to assess and manage these conditions may not always be available, especially in a free-standing ambulatory facility. The challenges and dangers intrinsic to the management of sick patients in a stand-alone ambulatory surgery center or office-based practice, in many cases, outweigh the potential benefits of rapid discharge, patient convenience, and decreased cost. However, a carefully selected patient with medically optimized conditions generally does quite well in the ambulatory center.

Preoperative testing focused on specific patient factors is appropriate. Medically informed common sense should guide this decision-making. For example, patients with hypertension or other known cardiovascular disease should have a preoperative ECG; patients on medications that affect electrolyte balance (e.g. furosemide, spironolactone, and potassium) should have a recent preoperative chemistry panel; patients with chronic anemia or recent active bleeding (e.g. menorrhagia, epistaxis, and GI bleed) should have a hemoglobin value measured since the last bleeding episode. Transfusion is not routine in the ambulatory setting and not usually an option in a stand alone surgical center due to the lack of a blood bank. A healthy patient generally needs no preoperative testing and “routine” tests such as complete blood count, chemistry panel and chest X-ray should never be ordered without a clear idea of why the test results will be useful in the anesthetic planning and perioperative management of the patient. Nil-per-os (NPO) guidelines have substantially evolved and this has always been a source of strain for patients. Clear liquids are now allowed and in many cases encouraged until 2 h before the procedure.

Certain procedures simply cannot be performed on an outpatient basis; this is primarily due to the need for continuous postoperative monitoring (e.g. measurement of gastric drainage, placement of drains for bleeding, and need for frequent electrolyte studies), ongoing interventions (intravenous medications for pain, fluid resuscitation, and complex dressing changes), or inability to eat, drink, or urinate. Examples are listed in Table 25.4.

Table 25.4 Procedure exclusions for outpatient management

Requires drain or nasogastric drainage tube to be placed Hysterectomy, bowel resection, multi-level, neck dissection
Oral medications inadequate for postoperative pain control Radical Mastectomy, major abdominal surgery
May require postoperative bladder catheterization Ventral hernia repair, bladder tumor resection, ureteral stent
Frequently requires intraoperative or postoperative transfusion Hysterectomy, ORIF femur
Expectation of postoperative electrolyte fluctuations Pituitary resection
Elevated risk for airway complications & inability to tolerate oral intake Transoral rontic surgery, Zencker's diverticulum, uvulopalatopharyngoplasty
Requires hourly patient assessment Free-flap, craniotomy, patients with severe sleep apnea

Intraoperative Management

Anesthetic management in ambulatory surgery is based on the SAMBA S.A.F.E. principles. S.A.F.E. is an acronym that stands for *short-acting, fast-emergence* anesthetic. General, regional, combined regional/general, and monitored anesthesia care are all compatible with rapid patient discharge. An important consideration is that the anesthetic plan be compatible with patient expectations, surgical needs, and patient-specific factors. Many patients have a preconceived notion that general anesthesia implies delayed emergence and long recovery. These same patients may not appreciate, for example, the delay in discharge that can be associated with time needed for return of motor or bladder function after neuraxial (spinal, epidural) blockade or the residual “hangover” of benzodiazapines and fentanyl relative to propofol. Patients should participate in the anesthetic planning where appropriate, with their concerns specifically addressed in the pre-operative discussion. Default pre-medication with anxiolytics is common practice but not always necessary.

Generally speaking, short-acting anesthetic agents are better suited to rapid recovery. Midazolam is preferable to diazepam, propofol to thiopental, and bupivacaine or lidocaine to tetracaine. Likewise medications which may seem ideally suited to sedation such as dexmedetomidine often produce persistent effects in the recovery room (e.g. bradycardia or hypotension) that result in substantially enhanced PACU stays. There is no clear difference in outcomes or experience between a propofol based intravenous anesthetic and inhaled agents. The inhaled potent agents are all similar in their clinical profiles provided that depth is titrated appropriately, although desflurane, due to its low blood solubility, likely has some clinical advantage in subgroups of patients such as the morbidly obese. In this regard, a processed EEG, such as BIS or SEDLine monitors, may have some utility as a guide to titration of anesthetic depth in order to avoid overdose of agents, which may prolong emergence or recovery. Succinylcholine can produce very substantial myalgias and there is no reliable preventive or treatment strategy. This can be highly debilitating and dissatisfying to patients who expected to be ambulatory and functioning in the days after surgery.

Adequate postoperative analgesia is of paramount importance. In the absence of effective regional anesthesia, hydromorphone, morphine, and fentanyl are all acceptable opioid options in the intraoperative period. Using several analgesics that work by different mechanisms, known as **pre-emptive and multimodal analgesia** may help to reduce opioid requirements and related side-effects. Approaches may be protocolized and in some cases involve patient taking oral medications in the hours or days leading up to surgery. There is conflicting data regarding the efficacy of these approaches and careful attention should be given to patient selection. Part of the efficacy of this approach may be related to the anti-inflammatory effects of some medications. Analgesia options in selected patients include low-dose dexamethasone, low-dose ketamine, NSAIDs such as intravenous ketorolac or meloxicam, acetaminophen (oral or IV), intravenous lidocaine infusion, oral gabapentin or pregabalin, wound infiltration by long acting depot local anesthetic, or via single-shot nerve block or continuous catheter. Ketamine may enhance delirium in

older patients. Gabapentin may produce somnolence, dizziness, or confusion that could contribute to falls. Intravenous lidocaine can produce enhanced side-effects in patients with low albumin. Use of regional blocks requires staff with specialized training in the techniques, ultrasound equipment and needles, and intralipid for rescue of local anesthetic toxicity. Patients who have elevated pain and anxiety levels or chronic opioid use at baseline may not be optimal candidates for a fast-track approach. If they are, every effort should be made to encourage either adherence to the baseline regimen through the morning of surgery or otherwise attempt to taper pain medications under expert guidance.

Postoperative nausea and vomiting (PONV) is one of the major reasons for delayed discharge or unplanned admission after elective surgery. Anesthetic medications and opioids are both substantial contributors to PONV. In light of the availability of safe, efficacious, and inexpensive agents for PONV prophylaxis (see Chap. 7) there generally appears to be no downside to a single dose of a 5HT-3 antagonist for most patients. Multimodal PONV prophylaxis should be considered in patients at higher risk. High risk patients include those with prior history of PONV, motion sickness, female nonsmokers, and patients undergoing ear, eye, gynecologic, or abdominal surgery. Inner ear and eye surgery patients are also especially difficult. A common prophylactic combination is low-dose dexamethasone (4–8 mg) with 5HT-3 antagonist. Although associated with dry mouth, transdermal scopolamine is another excellent option with the advantage that the patch can be left on for up to 72 h if the patient is concerned about PONV during transit home or having significant opioid related symptoms. Caution should be used in patients with a history of delirium, dementia, Parkinson's disease or other neurologic impairment as the medication crosses the blood-brain barrier and could worsen symptoms. Medications such as metoclopramide are likely to have fewer sedating effects than droperidol, prochlorperazine, promethazine, or diphenhydramine but these medications should be considered when necessary for rescue or patients who have failed prior multimodal prophylactic regimens. A propofol-based anesthetic and fluid-loading may be advantageous in higher risk patients. In patients who have a history of PONV

despite aggressive prophylaxis, administration of the oral NK-1 receptor inhibitor aprepitant can be considered. Amilsupride, a D2/D3 dopamine receptor antagonist has recently been added to the armamentarium of medications for PONV.

Postoperative Management

Ambulatory surgery patients and their families desire rapid discharge from the PACU to home. Facilities differ in their discharge criteria, but almost all have well-defined protocols. PACU is often divided into Phase I (immediate recovery with active, ongoing issues such as blood pressure control, pain, and hypoxia) and Phase II (imminently ready for discharge except for voiding, ambulation, or demonstration of oral intake). Some facilities will use established scoring systems like those of Aldrete to objectively manage patient flow and discharge. These scoring systems emphasize pain control and return to baseline neurologic, hemodynamic, and pulmonary function. Most facilities require patients to have vital signs within 20% of baseline, to consume a light snack and beverage and reach reasonable pain control on oral medication prior to discharge. Some still require postoperative voiding while in many centers voiding is not a criterion, provided the patient is not at high risk of urinary retention, has access to support persons at home and can be transported to the ER in the event of a problem.

“**Fast-Tracking**” after ambulatory surgery is a widely accepted practice which involves transferring patients from the operating room to the later stage recovery area (Phase II), by bypassing the early stage (Phase I). The success of fast-tracking depends upon appropriate modification of the anesthetic technique, to allow rapid emergence from anesthesia and the prevention of pain and PONV. Implementation of a fast-track program involves the use of clinical pathways that reduce hospital stay and ensure patient safety.

Inadequate pain control and continued **nausea or vomiting** with inability to tolerate oral intake are the two most common reasons for discharge delay. These clinical problems should be treated aggressively. PONV in the PACU should be treated with

an agent of a different class than used for prophylaxis. Pain should be treated with rapidly acting IV analgesics, and the patient should then be transitioned to oral medications.

Case Study

A 49-year-old woman who takes oral Vicodin daily for lower back pain is scheduled for axillary lymphadenectomy. She is a caregiver to two children at home. She is strongly motivated to have the procedure performed as an outpatient and requested a first start to get home as early as possible. She has limited availability for additional childcare support as her partner works at night. She is generally healthy, though she notes that she has seasonal allergies and occasional wheezing for which she takes an antihistamine and uses a metered dose inhaler (albuterol) as needed. Her BMI is 29 and she snores but denies obstructive sleep apnea. She does not smoke, drinks alcohol on the weekends (3–4 drinks once per week), and does not use recreational drugs. She has a history of motion sickness.

Is it appropriate to do this case in an outpatient surgery center? What other information do you need to decide?

Of the various criteria commonly used, she meets most: she is motivated, generally healthy, and has only moderate coexisting disease. The procedure is limited, is not associated with high blood loss, fluid shifts, or the need for drains postoperatively. Her snoring is concerning, but otherwise she has no major risk factors for sleep apnea. She is on chronic opioid therapy and optimal management will be for her to take her baseline pain medications on the regular schedule. She will need no special post-op monitoring. She needs a caregiver for 24 h, and you will need to make sure her asthma symptoms are not currently active. She is at risk for PONV and needs to be counseled regarding the inability to guarantee that she will not experience nausea and vomit-

ing at home. As with any patient presenting for surgery in any venue, you will need to perform a complete history and certainly must assess her airway. Some centers have cutoff values for maximum BMI.

Is she at high risk of postoperative nausea and vomiting (PONV)?

Yes. According to the criteria proposed by Apfel she meets three of four: she does not smoke, and has a history of motion sickness (or PONV). The fourth factor, use of postoperative opioids, is something we can hope to plan to avoid. With three risk factors, her approximate risk of PONV is 60%.

How will you induce and maintain anesthesia?

You will follow the S.A.F.E. principles suggested by the Society for Ambulatory Anesthesia and give short acting, fast emergence drugs. Propofol for induction is a rational and popular choice. You can consider using no muscle relaxants and no intubation, maintaining the airway with an LMA and maintaining spontaneous respiration. Sevoflurane or desflurane are logical choices, given their low solubility and rapid elimination. You will also avoid large doses of intraoperative opioids and use short-acting drugs such as fentanyl, sufentanil, or remifentanyl. Total intravenous anesthesia is a potential alternative which can minimize the risk of PONV, but it will also generally require controlled ventilation, and often endotracheal intubation.

How will you manage postoperative pain?

Your goal is to have a comfortable patient but to minimize opioids. She will take her Vicodin pre-operatively according to the regular schedule and will be prescribed 975 mg of oral acetaminophen in the pre-op holding area. You will discuss local anesthetic infiltration with the surgeon and discuss the use of NSAIDs, such as single-dose ketorolac, to augment the effect of small doses of short-acting opioids such as fentanyl. A single shot regional block such as a pectoral block (PECS II) may also be considered.

How will you reduce the risk of PONV?

Given her relatively high risk for PONV, you will probably administer two- or three-drug prophylaxis. Dexamethasone and ondansetron is a popular combination. You can also consider a scopolamine patch, which has particular efficacy against motion sickness. Often patients do well in the PACU only to experience PONV on the ride home, so this is a good choice for this patient. Importantly, you should also set reasonable expectations with patient, and let her know that is acceptable to experience some nausea and vomiting, even after discharge, as long as she can take oral fluids.

Anesthesia and emergence are uneventful and you take the patient to the PACU. When can she go home?

She should meet the ordinary PACU discharge criteria for any patient: alert and oriented, hemodynamically stable, with reasonable control of pain and nausea. This does not imply that she must be 100% pain or nausea free, but she must be comfortable. There are also special considerations for discharge home. She needs a ride home with a responsible adult. She should be able to ambulate and take limited oral intake, which may be defined as fluids only, or fluids and light solids such as crackers. The latter varies by institution and is not an evidence-based standard. Formerly, many outpatients were required to void prior to discharge. However, many surgical patients may have reduced urine production due to the surgical stress response, drug effects, or mild hypovolemia. Many centers have therefore dropped this requirement and discharge patients with a “due to void” instruction and an understanding of what to do if she does not urinate within a few hours after discharge. Finally, she must understand her post-discharge instructions and be comfortable leaving the medical facility. You and her other physicians should have a way to reach her by telephone should any immediate follow-up be required, and she should know how to contact you and your colleagues should problems arise at home.

Suggested Further Reading

1. Afonso AM, Tokita HK, McCormick PJ, Twersky RS (2019) Enhanced recovery programs in outpatient surgery. *Anesthesiol Clin* 37(2):225–238
2. Aldrete JA (1995) The post-anesthesia recovery score revisited. *J Clin Anesth* 7:89–91
3. Apfel CC, Korttila K, Abdalla M, Kerger H et al (2004) A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. *N Engl J Med* 350(24):2441–2451
4. Liu SS, Strodbeck WM, Richman JM, Wu CL (2005) A comparison of regional versus general anesthesia for ambulatory anesthesia: a meta-analysis of randomized controlled trials. *Anesth Analg* 101(6):1634–1642
5. Raeder J, Urman RD (2015) *Practical Ambulatory Anesthesia*. 1st Ed, Cambridge University Press, New York
6. Twersky R, Philip B (2008) *Handbook of ambulatory anesthesia*, 2nd Ed. Springer, New York