Ambulatory anesthesia:

Preventing perioperative and postoperative complications

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The rate of ambulatory surgery has been increasing steadily in the United States over the past 20 years. In the past, patients referred for ambulatory surgery were generally in good health, and the types of surgeries performed were limited to simple procedures of short duration. More recently, patients who have significant medical conditions or who have factors that increase their risk of complications from anesthesia, such as obesity or tobacco use, are being considered for ambulatory surgery. Patients with complicated disease states such as diabetes, heart disease, or poorly controlled hypertension are also being considered. In addition, populations excluded in the past, such as the very old and very young, are being seen on a more routine basis at freestanding ambulatory surgery centers (ASCs).[1]

Not all of the changes are related to the patient's medical condition. More complex surgeries of longer duration, and even dual surgeries, are being performed as well. Some of these longer, more complex surgeries are starting to be performed in settings that may have less technical support and expertise readily available, such as in surgeons' offices rather than in ASCs.[1]

Advances in ambulatory surgery have allowed these changes, but without proper caution, these trends elevate the risk for perioperative and postoperative complications, and consequently an increase in morbidity and mortality. Misperceptions about ambulatory anesthesia may heighten the risk of complications. This article will explore appropriate candidates for ambulatory surgery, the selection of anesthesia, and effective ways to prevent complications.

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GEARED TOWARDS EFFICIENCY

A range of surgeries is now being performed in ASCs. These include urologic, orthopedic, obstetric/gynecologic, colorectal, and otolaryngologic procedures. In addition, the majority of cosmetic plastic surgery cases are performed in ASCs or physicians' offices. Vascular surgery is also increasingly being considered, although there is currently a debate about whether arteriovenous fistulas can be performed safely despite being associated with a low rate of complications when performed in an inpatient setting.

The financial benefit to performing surgery in an ambulatory rather than hospital environment is considerable. Cost consideration is possibly the main driver behind the push to increase the types of surgeries performed in an ambulatory setting, in addition to the type of patients who are considered candidates to undergo these procedures.[2]

The concept of ambulatory surgery is structured around efficiency, which allows the centers to perform many surgeries with rapid turnover. ASCs have a higher volume of patients and shorter times to surgery than do hospitals. The ability to perform surgery is not tied to the availability of hospital beds, as the centers have been designed with adequate recovery rooms so that patients can recover from anesthesia and be discharged home quickly. From an anesthesiologist's perspective, this rapid turnover affords the ability to assist at many more surgeries and to enjoy more control over the progress of the workday.

In operating rooms located within the hospital, turnover time is variable depending on the type of case and instruments required, but usually will be 30 to 45 minutes. In ASCs, the expected turnover time, as determined by the ASC's administration, is frequently 15 minutes or less. Thus with faster turnover and shorter recovery times, a greater number of cases may be performed at an ASC compared with similar cases performed in a hospital setting.

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RISKS IN THE CURRENT ENVIRONMENT

When the decision is made to perform surgery in an ambulatory setting, the complexity of surgery and the patient's medical condition must be simultaneously taken into account. Failure to do so may expose the vulnerable patient to serious risks. Even minor surgeries, such as carpal tunnel release or cosmetic procedures, can be risky for patients with multiple medical conditions. When the procedures become more complex and longer, the risk is compounded.

We are in an era in which surgeries as complex as a cholecystectomy or abdominoplasty combined with liposuction may be performed in an ASC and in some cases in surgeons' offices. To ensure that the highest level of quality is maintained, various accrediting organizations, such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), define standards by which ASCs are measured. A difference still exists between the support available in a hospital operating room vs that at a freestanding ASC. As an example, the ability to obtain laboratory tests postoperatively, provide blood or blood products, or obtain consultations is frequently available in a hospital operating room. Rarely is it possible to provide this type of care in a freestanding ASC.

Decisions related to the appropriateness of a patient for surgery at an ASC can be complex. Sometimes patients receive an inadequate preoperative evaluation because the primary care physician or general internist performing the evaluation does not understand the complexity of the surgery or the risks inherent in the setting of an ASC. Cases scheduled by the surgeon may only take into account the complexity of surgery and not the associated medical problems. For patients with significant medical conditions, a team approach involving the patient's primary care physician, surgeon, and anesthesiologist is the best system to ensure optimal care for the patient pre-, intra-, and postoperatively.

Despite the considerable benefits and pressures to perform surgery on an outpatient basis, physicians should be mindful that serious complications and deaths do occur. Preventing these outcomes hinges on a careful preoperative screening and evaluation. The elements to consider when deciding whether a case is appropriate for ambulatory surgery and anesthesia are:

- Surgical setting (surgeon's office vs ASC)
- American Society of Anesthesiologists (ASA) physical status (overall health of the patient)
- Surgical complexity and length
- Social support following surgery
- Anesthetic technique and its risk for the patient.

THE PREOPERATIVE EVALUATION

Not only does prescreening allow the ASC to determine which patients are not acceptable candidates for the proposed surgery, it helps the surgical center to operate efficiently by avoiding problems on the day of surgery. Problem avoidance may vary from simple actions such as requiring that a responsible adult accompany the patient home after surgery, to obtaining and reviewing all of the pertinent laboratory and test results or the reports of any required subspecialty medical evaluations.

A telephone call from the surgical center to the patient before surgery or a medical questionnaire completed by the patient and sent to the center before surgery are options for prescreening. When a medical questionnaire is used, patients can be called if further questions about their medical condition arise during its review.

The goals of prescreening are to uncover any morbidity that increases risk and to ensure that any disease state has been optimally controlled. Before coming to the ASC, all patients should have had a careful history taken, a physical examination performed, and any appropriate tests ordered.

Proper evaluation and disease optimization decreases delays and cancellations, identifies the possibility of avoidable complications, and ultimately improves outcomes.

PREVENTING COMPLICATIONS: FACTORS TO CONSIDER

Acceptable patient characteristics

Patients who are healthy (ASA class 1; see Table 1) or who have mild systemic disease (ASA class 2) are the best candidates for ambulatory surgery. However, patients who have systemic disease (ASA class 3) or severe systemic disease that is life threatening (ASA class 4) are now being scheduled for ambulatory surgery. At our ASC, we limit surgery to patients of ASA class 3 status or better. Occasionally, patients with ASA class 4 status are considered if the procedure is superficial and can be performed with minimal anesthesia. Patients with significant disease states must have information or results demonstrating that their disease processes have been adequately controlled for at least the 3 previous months. For instance, a patient with congestive heart failure (CHF) who has had symptoms in the past 3 months would not be an acceptable candidate for surgery at any of our ASCs.

The chronologic age of a patient is not the deciding factor as to whether surgery can be performed at

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an ASC. Rather, the status of the comorbid medical states in the elderly is the deciding factor. An 80-year-old patient with significant cardiac or pulmonary disease may be acceptable for surgery at an ASC only if these conditions are adequately controlled and if the surgery is of limited complexity and duration. A similar patient with little or no systemic disease may undergo a more complex and lengthly case with little risk of peri- or postoperative complications.

The invasiveness of a procedure should also be considered when deciding if a surgical procedure is acceptable for an ASC. The complexity and duration of procedures is increased as invasiveness is increased. Laparoscopic cholecystectomies are considered acceptable for ASCs; open cholecystectomies are not. The reason is that the physiologic changes that occur with these two cases will be dramatically different.

Increased complexity of surgery is usually associated with greater fluid shifts intraoperatively and greater blood loss, and in those patients with significant comorbid disease states, a greater risk of complications in the postoperative phase. Greater fluid shifts may be associated with signs of dehydration postoperatively, producing postural hypotension or decreased urinary output. Both of these symptoms would prevent discharge from an ASC.

In addition, for surgery that produces significant blood loss, transfer to a local hospital would be required because freestanding ASCs do not have the ability to store blood or blood products.

For patients who undergo surgery in the prone position, a significant amount of facial and therefore airway edema may be present, which may require prolonged ventilation before extubation can take place safely.

Many ASCs cannot allow for prolonged recovery time, although some are now able to provide extended recovery of up to 23 hours postoperatively. However, as the complexity of surgery is increased, so too is the duration. Together, they can be associated with an increased rate of postoperative complications, which many ASCs are not designed to handle except on an emergency basis.

Existing medical conditions

Existing medical conditions that increase the risk of complications from anesthesia or ambulatory surgery are cardiac disease, pulmonary disease, and morbid obesity. Patients at the extremes of the age spectrum should be considered candidates only after careful deliberation. Patients with cardiac or pulmonary disease should have their disease state well controlled and their cardiac or pulmonary function optimized in order to continue for ambulatory surgery. Patients with chronic pain also require special consideration.

TABLE 1
ASA physical status classification

Class 1	Normal healthy patient
Class 2	Patient with mild systemic disease
Class 3	Patient with severe systemic disease
Class 4	Patient with severe systemic disease that is a constant threat to life
Class 5	Moribund patient who is not expected to survive without the operation

ASA = American Society of Anesthesiologists

Cardiac disease. The patients with the greatest risk of complications from anesthesia are those with cardiac disease, mainly uncontrolled hypertension, CHF, or angina. In a study of existing medical conditions as predictors of perioperative adverse events from ambulatory surgery, Chung et al found that patients with CHF had a 12% longer postoperative stay, which in some instances included admission to hospital.[3] They also found a twofold increase in intraoperative cardiovascular events in patients with hypertension. Interestingly, these researchers found no association between merely having coronary artery disease and any excess morbidity or mortality.[3]

Pulmonary disease. Chronic obstructive pulmonary disease (COPD), asthma, and tobacco abuse often lead to pulmonary complications. In the same study discussed above,[3] Chung et al examined the impact of pulmonary disease on complications from ambulatory surgery. Their results showed that asthma was associated with a fivefold increase in postoperative respiratory adverse events and that smoking was associated with a fourfold increase. In 2001, Arozullah et al found that patients with COPD had twice the standard risk for pulmonary complications from ambulatory surgery as did patients without COPD.[4]

Morbid obesity. The morbidly obese frequently have comorbidities, including coronary artery disease, CHF, hypertension, and obstructive sleep apnea. The study by Chung et al found a fourfold increase in adverse pulmonary events in morbidly obese patients compared with those of normal body weight.[3]

In patients with morbid obesity, the problem is twofold. Intraoperatively, these patients are prone to rapid desaturation. Adequate preoxygenation is

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therefore mandatory in these patients. In addition, the morbidly obese patient can experience bronchospasm, making ventilation difficult. Some ASCs are staffed such that limited help is available should an emergency occur. For these reasons, surgery that requires more than mild sedation for anesthesia in patients with a body mass index of greater than 35 kg/m^2 is discouraged at our ASCs.

Obstructive sleep apnea is known to increase the rate of airway events during induction of anesthesia, intubation, or when patients emerge from anesthesia. Currently, the ASA is developing guidelines for the care of patients with diagnosed or suspected sleep apnea. Once formulated, these guidelines will help determine which patients may have surgery at an ambulatory surgery facility and the precautions that should be taken for their care postoperatively.

Extremes of age. Patients older than 85 who are undergoing prolonged surgery and who have certain diseases, including cardiac disease, peripheral vascular disease, cerebrovascular disease, and malignancies, have an increased risk of postoperative complications with general anesthesia.[5] The complications include cardiac, pulmonary, and others.

Chronic pain. Patients with chronic pain are also being managed at ASCs. Because these patients' pain may be particularly difficult to control after surgery, and may require high-dose narcotics, a 23-hour stay may be required, even after minor surgery. In addition, narcotic requirements may be higher for these patients. Some anesthesiologists may be uncomfortable prescribing the doses of narcotics required following some procedures. Therefore, communication with the pain management specialist taking care of the patient is important.

Contraindications for ambulatory surgery and anesthesia

Uncontrolled chronic disease. Ambulatory surgery is not appropriate for patients with chronic disease that is not optimally managed. These include patients with unstable angina, symptomatic asthma, and brittle diabetes. Morbidly obese patients with known cardiac or pulmonary disease should be hospitalized following surgery.

Premature infants who are less than 60 weeks' postconceptual age should also have surgery only in the hospital setting.

Patients without adequate social support. Patients must have a responsible adult at home with them the night of the surgery, an especially important consideration for the elderly. JCAHO rules dictate that surgical providers can be held responsible should serious complications occur at home postoperatively when no one was available to attend to the patient.

Surgical contraindications. Procedures that would cause substantial blood loss or cause severe pain or immobility after the operation should not be performed in an ambulatory setting. All significantly invasive surgeries should be performed in an operating room located within a hospital.

ANESTHETIC TECHNIQUES: CHOICE IS BASED ON TYPE OF SURGERY, CONDITION OF PATIENT

Physicians should be mindful of the risks of ambulatory anesthesia in the vulnerable patient and that these risks can be compounded by other factors. As stated, a careful preoperative evaluation is required to prevent the serious peri- and postoperative complications that can otherwise occur.

The ideal anesthetic technique for ambulatory surgery provides a rapid and smooth onset of action, produces adequate amnesia and sufficient anesthesia intraoperatively, provides optimal conditions for surgery with no adverse effects, and allows for quick recovery. Because this desired result is not always achieved, the anesthesiologist must monitor the patient with the same level of vigilance and be prepared to use the same equipment as in a hospital operating room. The choice of anesthetic is based on the type of surgical procedure and the condition of the patient.

General anesthesia

General anesthesia is probably the most widely used technique in ambulatory surgery. General anesthesia produces changes in blood pressure, heart rate, and respiratory rate (which it can, of course, suppress to the point of stopping respiration).

For inhalational general anesthesia, the inhalational agents sevoflurane or desflurane are often used, as these agents are metabolized quickly, which allows rapid awakening. A drawback of inhalational agents may be a higher incidence of postoperative nausea and vomiting.

In total intravenous anesthesia, the medication propofol is combined with a short-acting narcotic such as alfentanil or remifentanil. Propofol has a short half-life, thus leading to rapid emergence or awakening. Because of this property, propofol is frequently used for the induction and maintenance of anesthesia in the ambulatory surgery setting.

Monitored anesthesia care

Monitored anesthesia care (MAC) is perceived as low risk. Yet patients undergoing MAC require constant

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vigilance by an expert to maintain adequate ventilation and oxygenation. With this technique, the patient can progress quickly from being lightly anesthetized to a deep sedation. The line between wakefulness and deep sedation is a fine one; the patient can move from being verbal to apneic in a short time.

MAC is also known as "conscious sedation." The goal of this technique is to cause minimal depression of consciousness, hence allowing rapid recovery, while providing anxiolysis, analgesia, and some sedation. With withdrawal of anesthesia, the patient should be awake and ambulatory. MAC is usually accomplished by a combination of intravenous sedation along with local infiltration of agents.

A perception exists that MAC can keep a patient from moving or talking but that at the same time it causes only light sedation. Such a scenario in reality does not exist. It is a technique that should not be taken lightly, and should not be administered by someone who lacks experience in ventilating a patient and keeping open an airway. Constant monitoring is critical.

Regional anesthesia

Regional anesthesia may be central (neuraxial) or peripheral.

Neuraxial anesthesia may be provided by a spinal or epidural block. Spinal and epidural anesthesia have few side effects but, depending on the local anesthetic agent used, may be associated with long recovery times, thus delaying discharge from the recovery room, which ultimately reduces the efficiency of the ASC. One of the side effects associated with neuraxial anesthesia is the development of a sympathetic block. This may cause profound changes in blood pressure. In addition, spread of the local anesthetic to the cardiac accelerators of the spinal cord can make a patient profoundly bradycardic. This type of block, therefore, should not be used in patients in whom dramatic changes in blood pressure or heart rate would be problematic. Central blocks also can cause urinary retention, which lengthens time in recovery.

Peripheral nerve blocks are best for upper and lower extremity surgery. They provide good analgesia intra- and postoperatively, allow the patient to go home quickly, and produce few hemodynamic changes. They include axillary, interscalene, IV (Bier), popliteal, and ankle blocks. These blocks may also be converted to provide continuous analgesia with a nonelectric infusion pump.

Other options for postoperative pain relief include small multiport catheters inserted in the incision by the surgeon and attached to a small grenade-shaped device filled with local anesthetic. The local anesthetic is continually released, producing localized anesthesia for 2 or 3 days postoperatively.

CONCLUSION

The number and complexity of surgeries performed in the outpatient setting will no doubt continue to rise. Careful evaluation and optimization of patients' medical conditions is critical for continued positive outcomes. Awareness of the patient's medical condition, the type of surgery, and the setting in which the procedure will be performed can minimize inefficiencies and dangerous complications.

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