# Evidence-Based Patient Safety Advisory: Patient Selection and Procedures in Ambulatory Surgery

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**Summary:** Despite the many benefits of ambulatory surgery, there remain inherent risks associated with any surgical care environment that have the potential to jeopardize patient safety. This practice advisory provides an overview of the preoperative steps that should be completed to ensure appropriate patient selection for ambulatory surgery settings. In conjunction, this advisory identifies several physiologic stresses commonly associated with surgical procedures, in addition to potential postoperative recovery problems, and provides recommendations for how best to minimize these complications. (*Plast. Reconstr. Surg.* 124 (Suppl.): 6S, 2009.)

Surgical technology and anesthesia delivery have become sufficiently advanced that an increasing number of patients with complex medical problems can safely undergo a variety of surgical procedures in the outpatient setting. Indeed, the proportion of outpatient operations performed in community hospitals in the United States jumped from 16 percent in 1980 to 63 percent in 2005.[1] Most surgical procedures are performed in one of three outpatient settings: hospital-based ambulatory surgical units, freestanding ambulatory surgery centers, or office-based surgery facilities. These ambulatory surgery facilities offer several advantages for both patients and providers, including greater control over scheduling, greater privacy and convenience for the patient, increased efficiency and consistency in nursing staff and support personnel, and possibly decreased cost to the patient.

Despite the many benefits of ambulatory surgery, there remain inherent risks associated with any surgical care environment that have the potential to jeopardize patient safety. As such, the growing demand for ambulatory surgery services has generated increased research on outpatient safety issues in the ambulatory surgery setting. The majority of the clinical research published on ambulatory surgery has been completed in the hospital-based ambulatory surgical unit setting, whereas research that specifically addresses freestanding ambulatory surgery centers and office-based surgery facilities remains scarce.[2]

In an effort to ensure patient safety in the ambulatory surgery setting, the American Society of Plastic Surgeons (ASPS) Patient Safety Committee sought to develop a practice advisory to assist decision-making in numerous areas of patient care. This advisory serves to update, combine, and expand on two prior practice advisories issued by the ASPS: one detailing patient selection in the office-based surgery setting, published in December of 2002,[3] and another detailing procedures in the office-based surgery setting, published in October of 2002.[4]

The current practice advisory provides an overview of the preoperative steps that should be completed to ensure appropriate patient selection for ambulatory surgery settings. In conjunction,

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attention is paid to various patient characteristics and comorbidities that may predispose the ambulatory surgical patient to intraoperative or postoperative complications. This advisory further identifies several physiologic stresses commonly associated with surgical procedures, and potential postoperative recovery problems, and offers recommendations for how best to minimize these complications.

This patient safety advisory was developed through a comprehensive review of the scientific literature and a consensus of the Patient Safety Committee. The supporting literature was critically appraised for study quality according to criteria referenced in key publications on evidence-based medicine.[5–9] Depending on study design and quality, each reference was assigned a corresponding level of evidence (I through V) with the ASPS Evidence Rating Scale (Table 1),[10] and the evidence was synthesized into practice recommendations. The recommendations were then graded (A through D) with the ASPS Grades of Recommendation Scale (Table 2)[11]; grades correspond to the levels of evidence provided by the supporting literature for that recommendation. Practice recommendations are discussed throughout this document, and graded recommendations are summarized in Appendix A.

**Table 1. Evidence Rating Scale for Studies Reviewed**

| Level of Evidence | Qualifying Studies |
|---|---|
| I | High-quality, multicentered or single-centered, randomized controlled trial with adequate power; or systematic review of these studies |
| II | Lesser-quality, randomized controlled trial; prospective cohort study; or systematic review of these studies |
| III | Retrospective comparative study; case-control study; or systematic review of these studies |
| IV | Case series |
| V | Expert opinion; case report or clinical example; or evidence based on physiology, bench research, or "first principles" |

## DISCLAIMER

Practice advisories are strategies for patient management, developed to assist physicians in clinical decision-making. This practice advisory, based on a thorough evaluation of the present scientific literature and relevant clinical experience, describes a range of generally acceptable approaches to diagnosis, management, or prevention of specific diseases or conditions. This practice advisory attempts to define principles of practice that should generally meet the needs of most patients in most circumstances. However, this practice advisory should not be construed as a rule, nor should it be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the appropriate results. It is anticipated that it will be necessary to approach some patients' needs in different ways. The ultimate judgment regarding the care of a particular patient must be made by the physician in light of all the circumstances presented by the patient, the diagnostic and treatment options available, and available resources.

This practice advisory is not intended to define or serve as the standard of medical care. Standards of medical care are determined on the basis of all the facts or circumstances involved in an individual case and are subject to change as scientific knowledge and technology advance, and as practice patterns evolve. This practice advisory reflects the state of knowledge current at the time of publication. Given the inevitable changes in the state of scientific information and technology, periodic review and revision will be necessary.

**Table 2. Scale for Grading Recommendations**

| Grade | Descriptor | Qualifying Evidence | Implications for Practice |
|---|---|---|---|
| A | Strong recommendation | Level I evidence or consistent findings from multiple studies of levels II, III, or IV | Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present. |
| B | Recommendation | Levels II, III, or IV evidence and findings are generally consistent | Generally, clinicians should follow a recommendation but should remain alert to new information and sensitive to patient preferences. |
| C | Option | Levels II, III, or IV evidence, but findings are inconsistent | Clinicians should be flexible in their decision-making regarding appropriate practice, although they may set bounds on alternatives; patient preference should have a substantial influencing role. |
| D | Option | Level V: Little or no systematic empirical evidence | Clinicians should consider all options in their decision-making and be alert to new published evidence that clarifies the balance of benefit versus harm; patient preference should have a substantial influencing role. |

## APPROPRIATE PATIENT SELECTION BASED ON PREOPERATIVE HISTORY AND PHYSICAL EXAMINATION

A complete preoperative history and physical examination serves two important purposes. First, the findings help to determine the most appropriate facility setting for the reconstructive or cosmetic surgery patient and the timing of the planned procedure. Second, the preoperative history and physical examination provides baseline information to assist the medical team in interpreting their possible findings while monitoring the patient intraoperatively and postoperatively.

A preoperative patient history should include personal health history, identification of comorbidities, social history, family history, medication regimen (prescription and nonprescription), allergies or adverse reactions (e.g., to anesthesia, drugs/medications, latex, tape), and a review of body systems. The physical examination is essential for assessing the patient's clinical status and should include an estimate of general health and appearance; measurement of height and weight; assessment of vital signs, including the heart and lungs; and an examination of the anatomical area of the operation. A sample preoperative history and physical examination form is shown in Figure 1.

An integral part of the patient selection procedure involves identifying patient characteristics and comorbidities that are relevant to the procedure or that may predispose the patient to intraoperative or postoperative complications. When evaluating the patient, particular attention should be paid to factors such as age, weight, and history of other illnesses, including diabetes mellitus, cardiac diseases, and respiratory conditions such as obstructive sleep apnea. The physician should also carefully assess the patient's risk for deep vein thrombosis. The surgeon should refer patients with significant comorbidities to medical specialists when indicated.

### Age

Studies conducted in the hospital-based ambulatory surgical unit setting report conflicting findings as to whether older age contributes to the risk of intraoperative and/or postoperative complications associated with ambulatory surgery. A prospective cohort study of 17,638 consecutive ambulatory surgery patients found that, compared with individuals younger than 65 years, those who were 65 years or older were 1.4 times as likely to experience an intraoperative event and 2.0 times as likely to experience an intraoperative cardiovascular event.[12] In contrast, elderly patients had a much lower incidence of any postoperative event (adjusted odds ratio, 0.4), postoperative pain (adjusted odds ratio, 0.2), nausea and vomiting (adjusted odds ratio, 0.3), and dizziness (adjusted odds ratio, 0.4). In a prospective study of over 1300 outpatients undergoing oculoplastic surgery, individuals older than 60 years were found to be at increased risk for intraoperative bleeding (adjusted odds ratio, 1.31) and postoperative bruising (adjusted odds ratio, 1.75) compared with younger individuals, although severe hemorrhage and bruising were rare.[13] Additional studies have documented a slightly greater risk of unanticipated hospital admission following ambulatory surgery in older aged patients (i.e., age 65 years or older, or older than 80 years),[14,15] whereas other studies have found no effect of age on unanticipated hospital admission or postoperative complications.[16,17] In sum, although various data illustrate that older age can modestly increase the risk of intraoperative and/or postoperative complications associated with ambulatory surgery, this risk is arguably not great enough to constitute a contraindication to ambulatory surgery based on advanced age alone.

### Body Mass Index

Individuals who are overweight (body mass index of 25 to 29.9 $kg/m^2$) or obese (body mass index $\geq 30\ kg/m^2$) constitute a large proportion of the patients treated in the outpatient clinical setting—sometimes upward of 75 percent.[18,19] Because excess weight can contribute to serious health-related causes of morbidity and mortality, additional precautions must be taken when obese patients undergo ambulatory surgery. Studies performed in hospital-based ambulatory surgical units have found that obesity correlates with an increased likelihood of failed regional anesthetic block, wound infection, unplanned hospital admissions, and complications, especially respiratory complications.[12,15,20,21] In addition, data from the nonsurgical setting indicate that obesity is an intrinsic risk factor that increases the odds of deep vein thrombosis 2.4-fold.[22]

Obese patients often present with a number of comorbidities that can complicate their management. As such, patient histories/comorbidities should be taken into account, and prophylaxis against deep vein thrombosis (i.e., with low-dose heparin, sequential compression devices, and postoperative ambulation) must be

**Name:** _____ **Date:** _____

**SOCIAL**
Age: _____ Sex: M o F o Married: Y o N Occupation: _____
Responsible Adult Available to Assist During Recovery Period Y o N o Relationship:_____

**HABITS**
Smoke: Y o N o Amount: _____
Alcohol: Y o N o Amount: _____
Coffee/Tea/Cola: Y o N o Amount: _____
Daily Exercise: Y o N o Amount: _____

**MEDICATIONS:** List dose or number of pills per day
Prescription Drugs
_____
_____
_____
_____

Non Prescription (Vitamins; Herbs)
_____
_____
_____
_____

Regular Aspirin Use: Y o N o Dosage & frequency: _____
NSA (Advil, Motrin, Ibuprofen): Y o N o Dosage & frequency: _____
Cortisone Injections Past Year: Y o N o Date(s) and injection location: _____

Drug Allergy: Y o N o List drug(s) and type of reaction: _____
_____

Latex Allergy: Y o N o Tape Allergy Y o N o

**FAMILY HISTORY:** Have any blood relatives every had the following problems:

| | | | | | |
|---|---|---|---|---|---|
| Abnormal Bleeding: | Y o N o | Coronary Surgery: | Y o N o | Kidney Disease | Y o N o |
| Abnormal Clotting: | Y o N o | Diabetes: | Y o N o | Tuberculosis: | Y o N o |
| Anesthetic Problems: | Y o N o | Heart Attack: | Y o N o | Other Serious Illness: | Y o N o |
| Cancer: | Y o N o | Hypertension: | Y o N o | | |

Please describe questions with a "Yes" answer: _____
_____

**PERSONAL PAST HISTORY:** Have you ever had:

| | | | | | |
|---|---|---|---|---|---|
| Abnormal Bleeding: | Y o N o | Asthma: | Y o N o | Hypertension: | Y o N o |
| Abnormal Clotting: | Y o N o | Diabetes: | Y o N o | Sleep Apnea: | Y o N o |
| Acid Regurgitation: | Y o N o | Fainting Spell: | Y o N o | Snoring: | Y o N o |
| Anemia: | Y o N o | Heart Attack: | Y o N o | Weight Change past 12 Mo.: | Y o N o |
| Angina: | Y o N o | Hepatitis: | Y o N o | Other Serious Illness: | Y o N o |

Please describe questions with a "Yes" answer: _____
_____

Have you ever received a transfusion? Y o N o If yes, what year? _____

Have you been tested for HIV? Y o N o If yes, what year _____ Test results: o positive o negative

Do you wear: Contact lenses: Y o N o Eye glasses: Y o N o Hearing aid: Y o N o Dentures: Y o N o

Previous Surgery, year and type of procedure: _____
_____

Indicate the type(s) of anesthesia received in the past, list any complications / reactions you experienced:

o Local anesthesia - (complications/reactions): _____

o General anesthesia -(complications/reactions): _____

o Spinal / Epidural - (complications/reactions): _____

Date last seen by Primary Care Physician: _____

Primary Care Physician (name) _____(telephone) (_____)_____
(address) _____

**Fig. 1.** Preoperative history and physical examination form.

**WOMEN PATIENTS ONLY:**
Number of pregnancies _____ Number of children_____ Last menstrual period _____ Did you breast feed? Yes No

**Name:** _____ **MRN**: _____ **Date:** _____

## Completed by Physician

**REVIEW OF SYSTEMS**

| | | | |
|---|---|---|---|
| Loose Dental Devices: | Y o N o | Chest Pain: | Y o N o |
| Neck Mobility Problem: | Y o N o | Irregular Heart Beat: | Y o N o |
| Short Neck: | Y o N o | Vomiting: | Y o N o |
| Cough: | Y o N o | Difficult Voiding: | Y o N o |
| Shortness of Breath: | Y o N o | Seizure: | Y o N o |
| Recent Upper Respiratory Infection: | Y o N o | Current Pregnancy: | Y o N o |
| Normal Menstrual Period: | Y o N o | Black Out: | Y o N o |
| Stroke: | Y o N o | Obesity: | Y o N o |

Comments: _____

**PHYSICAL EXAM**
Height: _____ Weight: _____ Blood Pressure: _____ Pulse: _____ Temp: _____

**GENERAL STATUS COMMENT**
HEENT: _____ Vision: _____ Pharynx: _____ Dental Devices: _____
Pulmonary: _____
Heart: _____
Abdomen: _____
Extremity: _____
Neurologic (if applicable): _____

Comments _____

**LABORATORY** (if applicable)

| | |
|---|---|
| H/H:_____ | WBC: _____ |
| PT: _____ | Chest X-Ray: _____ |
| Mammogram:_____ | EKG (Pt over 40):_____ |
| Pregnancy Test:_____ | Sodium Chloride: _____ |
| Potassium:_____ | $CO_2$: _____ |
| BUN: _____ | Creatinine:_____ |

Comments _____

**DIAGNOSES**
1. _____
2. _____
3. _____

**ASA CLASSIFICATION**
o P1 A normal healthy patient
o P2 A patient with mild systemic disease
o P3 A patient with severe systemic disease
o P4 A patient with severe systemic disease that is a constant threat to life

**FACILITY SELECTED**

o Office-based Surgical Facility
o Ambulatory Surgery Center
o Hospital
o

considered.[22–24] Respiratory abnormalities necessitate proper patient positioning and monitoring.[12,21,23] A semiupright position of the operating table is recommended for patients under sedation, because respiratory problems may be worsened in the supine position.[23] Airway management may be difficult in obese patients. The use of supplemental oxygen should be considered, and carefully sized airway adjuncts (e.g., oral/nasal pharyngeal airways, endotracheal tubes, laryngeal mask airways) should be immediately available for patients under moderate sedation or general anesthesia.[23] Blood pressure measurements and auscultation of the heart and lungs can also be difficult to obtain in obese patients, thereby possibly necessitating intravascular monitoring of arterial pressure and other approaches.[23]

Pharmacologic approaches to sedation and pain management also require proper consideration. Intravenous access can be difficult to obtain, and it is recommended that a catheter-over-needle system be used to prevent loss of intravenous access.[23] Also, short operation times and lighter levels of sedation are recommended. If the need for deeper anesthesia is required, obese patients are best managed in the hospital setting. Anesthetic agents in obese patients have a normal duration of activity that is only modestly decreased by an enlarged plasma volume. Adipose tissue has relatively low blood flow, and a calculated induction dose based on weight can lead to excess blood levels beyond what is recommended. Therefore, initial doses of pharmacologic agents should be calculated based on ideal body weight, as a reflection of lean body mass, rather than actual body weight.

The possibility of drug interactions should also be considered. Caution should be used when developing an anesthetic plan for an obese patient taking appetite suppressants or other medications.[23] Opioids may need to be avoided in obese patients with respiratory problems because of their dose-dependent depression of ventilation and muscle-relaxing properties. If obstructive sleep apnea is diagnosed or suspected, opioids should be avoided or titrated carefully, and patients should be observed for extended postoperative monitoring. Nonopioid analgesics should be considered, as should moderate sedation with reversible agents.

### Obstructive Sleep Apnea

The significance of obstructive sleep apnea as a risk factor for complications during ambulatory surgery is unclear, in large part because of the difficulty of separating the effects of the surgery from the effects of the underlying apnea. A retrospective study that compared patients with obstructive sleep apnea to age-, sex-, and body mass index–matched counterparts without the condition, all of whom had outpatient surgical procedures performed in a hospital-based ambulatory surgical unit, reported no significant difference in the rate of unplanned hospital admissions or other perioperative adverse events between groups.[25] Moreover, respiratory or cardiovascular complications were rarely the cause of unplanned admission in the apnea patients who were unexpectedly admitted to the hospital. No evidence is available that specifically addresses obstructive sleep apnea status in either an ambulatory surgery center or office-based setting.

Although the literature is insufficient to contraindicate ambulatory surgery in patients with obstructive sleep apnea, American Society of Anesthesiologists guidelines state that these individuals are at increased risk for airway obstruction and respiratory depression, which may require a longer postoperative stay and monitoring.[26] In a recent survey of physician opinion, more than 90 percent of Canadian Anesthesiologist Society members agreed that patients with obstructive sleep apnea are suitable candidates for ambulatory surgery if the procedure is to be performed under monitored anesthesia care or regional anesthesia.[24] In contrast, 84 percent of members deemed patients with the condition to be unsuitable for ambulatory surgery if they required general anesthesia with postoperative opioids. For more information regarding obstructive sleep apnea and surgery, see Haeck et al., "Evidence-Based Patient Safety Advisory: Patient Assessment and Prevention of Pulmonary Side Effects in Surgery. Part 1—Obstructive Sleep Apnea and Obstructive Lung Disease," in this issue.

### Cardiovascular Conditions

Evidence from the hospital-based ambulatory surgical unit setting indicates that patients affected by various cardiovascular conditions (e.g., a history of heart disease, past stroke, elevated blood pressure) are at increased risk of intraoperative hemorrhage and postoperative complications following ambulatory surgery.[13,17] There is general agreement in the medical community that patients with low-grade or remote cardiovascular symptoms (e.g., angina pectoris Canadian Cardiovascular Society class II, prior myocardial infarc-

tion occurring more than 6 months ago, congestive heart failure New York Heart Association class I, asymptomatic valvular disease) are suitable candidates for ambulatory surgery, whereas those with more severe conditions (e.g., angina pectoris Canadian Cardiovascular Society class IV, prior myocardial infarction within the past 1 to 6 months, congestive heart failure New York Heart Association class III/IV) are not.[24] According to American College of Cardiology/American Heart Association guidelines,[27] patients with active cardiac conditions should be evaluated and treated before noncardiac surgery (Table 3).

Performing outpatient surgery on patients with cardiac pacemakers or implantable cardioverter-defibrillators can be accomplished safely. However, because these devices can be affected by electromagnetic interference (e.g., from electrocautery or radiofrequency ablation), it is important to determine the type and function of the cardiac device before surgery and to develop an operative plan appropriate for the device. Recommendations vary depending on the type of device and the patient's dependence on device functions. Pacemakers may require reprogramming to an asynchronous mode or suspension of rate-adaptive functions. Implantable cardioverter-defibrillators may require suspension of antitachyarrhythmia functions or, in patients who are dependant on pacing functions, alteration of pacing functions similar to pacemakers. Although some models can safely remain on during surgery if a magnet is placed over the device, this approach is no longer standard for every device, given the large variety of models on the market. Other recommendations include minimizing the adverse effects of electromagnetic interference by using bipolar cautery devices or ultrasonic (harmonic) scalpels, if available. The surgeon should consult with the patient's cardiologist and/or the device manufacturer's representative to develop the best course of action for the particular device.[28]

**Table 3. Active Cardiac Conditions That Should Be Evaluated and Treated before Noncardiac Surgery**

| Active Cardiac Conditions |
|---|
| Unstable coronary syndromes |
| • Unstable or severe angina* (CCS class III or IV)† |
| • Recent myocardial infarction‡ |
| Decompensated heart failure (NYHA class IV; worsening or new-onset heart failure) |
| Significant arrhythmias |
| • High-grade atrioventricular block |
| • Mobitz II atrioventricular block |
| • Third-degree atrioventricular heart block |
| • Symptomatic ventricular arrhythmias |
| • Supraventricular arrhythmias (including atrial fibrillation) with uncontrolled ventricular rate (heart rate >100 beats/min at rest) |
| • Symptomatic bradycardia |
| • Newly recognized ventricular tachycardia |
| Severe valvular disease |
| • Severe aortic stenosis (mean pressure gradient >40 mmHg, aortic valve area <1.0 $cm^2$, or symptomatic) |
| • Symptomatic mitral stenosis (progressive dyspnea on exertion, exertional presyncope, or heart failure) |

CCA, Canadian Cardiovascular Society; NYHA, New York Heart Association.

*According to Campeau L. Letter: Grading of angina pectoris. *Circulation* 1976;54:522–523.

†May include "stable" angina in patients who are unusually sedentary.

‡The American College of Cardiology National Database Library defines recent myocardial infarction as more than 7 days but less than or equal to 1 month (within 30 days).

Patients with cardiovascular conditions are often instructed to cease anticoagulant medications, including doses of 81-mg aspirin (baby aspirin), several days before surgery to avert uncontrolled bleeding during and after the procedure.[29,30] Studies performed in the ambulatory setting have indeed shown that continued aspirin use (doses ranging from 75 mg to 300 mg) before surgery is an independent risk factor for intraoperative and postoperative bleeding, although the increase in bleeding duration and severity is small.[31,32] Other studies have found that ambulatory surgical patients who take warfarin or platelet-inhibiting medications before surgery experience no increase in the incidence of complications compared with patients who discontinue or do not use these medications before surgery, suggesting that these medications need not be stopped before minor surgery.[13,17,33,34]

Although continuing anticoagulant medications before surgery may place patients at increased risk for bleeding complications, ceasing such drugs may put patients with cardiovascular conditions at risk for other cardiac events, including thromboembolism, myocardial infarction, and cerebrovascular accident.[29,35] A recent meta-analysis of studies assessing aspirin use, bleeding complications, and cardiovascular risks in the ambulatory setting found that aspirin increased the rate of baseline bleeding 1.5-fold but had no effect on the severity of bleeding complications associated with outpatient surgery, with the possible exception of intracranial neurosurgery and transurethral prostatectomy.[36] In contrast, aspirin withdrawal was observed in up to 10.2 percent of all acute cardiovascular events, thereby calling into question the safety of aspirin withdrawal before surgery. A recent survey gauging expert opinion regarding the continuation or withdrawal of aspirin before an invasive procedure found that

most physicians would instruct patients with low thromboembolic risk to discontinue aspirin before the procedure and resume aspirin therapy once the bleeding risk had subsided.[37] The consensus for patients with high thromboembolic risk was to continue aspirin before an invasive procedure, particularly those procedures with a low bleeding risk, and an additional favored option was to substitute low-molecular-weight heparin for aspirin before a procedure with an intermediate or high bleeding risk. For patients taking clopidogrel, experts recommend maintaining treatment in individuals with unstable coronary syndromes and during the reendothelialization phase of stents (6 to 24 weeks).[29,35,38] If hemorrhage in a closed space is a concern in patients taking aspirin and clopidogrel, clopidogrel can be ceased and replaced with low-molecular-weight heparin, with or without tirofiban, while aspirin is continued.[30,35] In general, continuing or discontinuing anticoagulant and antiplatelet medications before surgery depends on the medical necessity of the agents for preventing cardiovascular events, thereby warranting consultation with a cardiologist, hematologist, or internist.[29,38]

### Risk of Thrombosis or Embolism

The development of deep vein thrombosis and pulmonary embolism poses a small but significant risk for surgical patients and may result in death or debilitating consequences. Very little information exists on the incidence of these events in the ambulatory surgery setting. However, the larger body of medical literature points to numerous intrinsic and transient risk factors that predispose a patient to deep vein thrombosis and pulmonary embolism. These include a personal or family history of the disorders, venous insufficiency, chronic heart failure, obesity (body mass index $>30$ kg/m$^2$), standing for more than 6 hours per day, a history of more than three pregnancies, current pregnancy, violent effort or muscular trauma, deterioration in general condition, confinement to a bed and/or armchair, long-distance travel, infectious disease, use of general anesthesia during surgery, and performance of abdominoplasty with or without another procedure.[22,39–41] Women with a current or recent history of contraceptive or postmenopausal hormone replacement use are also at increased risk for deep vein thrombosis and pulmonary embolism, especially if they have the factor V Leiden mutation; deficiencies in antithrombin, protein C, or protein S; or elevated levels of factor VIIIc.[42,43] Not only have heritable mutations in coagulation factor V and/or prothrombin (i.e., G20210A) been associated with an increased risk of thromboembolism, particularly in white individuals, they have also been shown to correlate with placental thrombosis during pregnancy, which itself is an acquired hypercoagulable state. The most definite of these pregnancy complications include stillbirth and preterm delivery and possibly recurrent miscarriage.[44–46]

On the basis of this information, patients should be categorized as low risk, moderate risk, or high risk, as shown in Table 4,[4,47] and thromboembolic prophylaxis should be implemented accordingly. Prophylactic measures that have proven to be effective for preventing deep vein thrombosis and pulmonary embolism in the ambulatory surgery setting include perioperative and postoperative administration of low-molecular-weight heparin and the use of intermittent compression devices.[39,48]

### American Society of Anesthesiologists Status

The American Society of Anesthesiologists (ASA) physical status classification scheme is an accepted standard for gauging preoperative fitness.[49] The surgeon and/or anesthesiologist should assign an ASA physical status classification rating for each patient to select the appropriate facility for ambulatory surgery. This rating should

**Table 4. Thrombosis Risk Categorization**

| Thrombosis Risk Rating | Description |
|---|---|
| Low | Patients who face uncomplicated surgery and who have no risk factors; these patients are usually younger than 40 years, although older patients undergoing short procedures may qualify. |
| Moderate | Patients aged 40 years or older who have no additional risk factors but who face procedures longer than 30 minutes; patients who use oral contraceptives or who are on postmenopausal replacement therapy are also at moderate or greater risk. |
| High | Patients aged 40 years or older with one or more risk factors who face procedures longer than 30 minutes under general anesthesia and/or who have other risk factors. |
| Highest | Patients older than 40 years having major surgery and a known history of venous thromboembolism, cancer, or a hypercoagulable state; hip or knee arthroplasty; hip fracture surgery; major trauma; or spinal cord injury. |

be based on a combination of the preoperative history and physical examination, comorbidities, laboratory results, and the medical specialist's evaluation. Table 5 outlines the ASA physical classifications.

Studies conducted in hospital-based ambulatory surgical units tend to support the safety of ambulatory surgical procedures for patients with an ASA physical status class 1 to 3. A large prospective study did report that an ASA rating of class 2 or 3 was a predictive factor for unanticipated hospital admission after ambulatory surgery that increased the risk 2.1-fold.[50] However, more recent retrospective studies identified no increase in the incidence of postoperative complications or unplanned admissions in ASA class 3 patients when compared with ASA class 1 and 2 patients undergoing similar procedures, regardless of whether local or general anesthetic was administered.[17,51] Bolstering these latter findings, a survey of members of the Canadian Anesthesiologist Society found that 94 percent of respondents agreed that ASA class 1 to 3 patients are suitable for ambulatory surgery, whereas 82 percent agreed that ASA class 4 patients are not.[24]

**Table 5. American Society of Anesthesiologists Physical Classification Status***

| ASA Class | Description | Examples |
|---|---|---|
| 1 | A fit patient with no underlying systemic disease and taking no medications | • A 43-year-old woman for bilateral breast enhancement<br>• A 32-year-old man for cosmetic rhinoplasty<br>• A 16-year-old girl for earlobe reconstruction from congenital anomaly<br>• A 26-year-old man for back lipoma excision |
| 2 | A patient with mild systemic disease, e.g., slightly limiting organic heart disease, mild diabetes, essential hypertension or anemia, obesity (by itself), chronic bronchitis, or any healthy individual younger than 1 year or older than 70 years | • Patients who smoke, drink alcohol frequently or excessively, or use street drugs<br>• Patients who are obese<br>• Patients who have any of the following, but under control without systemic compromise: diabetes, hypertension, asthma, gastroesophageal reflux disease, peptic ulcer disease, hematologic disorders, arthritis, neuropathy<br>• Patients with anatomical abnormalities of significance to health, such as hiatal hernia, difficult airways, nondebilitating heart anomaly, syndrome<br>• Patients with mild psychiatric illness that is under control (e.g., depression, anxiety disorder, and bipolar disorder)<br>• Patients with a remote history of coronary artery disease and no other systemic illnesses whose progress afterward showed no further chest pain and documented good exercise tolerance<br>• A 4-month-old infant for cleft palate repair<br>• A 73-year-old woman for bilateral breast enhancement<br>• A 21-year-old woman for breast augmentation with truncal obesity<br>• A 43-year-old woman for bilateral breast enhancement who smokes and has chronic obstructive pulmonary disease<br>• A 32-year-old asthmatic man for cosmetic rhinoplasty |
| 3 | A patient with a systemic disease or multiple significant mild systemic diseases, organic heart diseases, severe diabetes with vascular complications, moderate to severe degrees of pulmonary insufficiency, angina pectoris, or healed myocardial infarction | • Any third-degree or fourth-degree burn patient who is hemodynamically stable and undergoing graft surgery<br>• A 16-year-old woman for earlobe reconstruction after congenital anomaly, with a symptomatic ventricular septal defect<br>• A 26-year-old man for back lipoma excision, with controlled end-stage renal disease<br>• A 53-year-old man for liposuction who is hypertensive and has occasional chest pain<br>• A 32-year-old man for cosmetic rhinoplasty who frequently has sickle cell crisis, with hematocrit of 16<br>• A patient who is morbidly obese with OSA |
| 4 | Organic heart disease showing marked signs of cardiac insufficiency; persistent anginal syndrome; active myocarditis; advanced degrees of pulmonary, hepatic, renal, or endocrine insufficiency | • A 71-year-old woman for bilateral breast enhancement under general anesthesia who is asthmatic, smokes, and has chronic obstructive pulmonary disease<br>• A 16-year-old girl for earlobe reconstruction from congenital anomaly, with a cyanotic heart anomaly<br>• A 53-year-old man for liposuction who is hypertensive and has had congestive heart failure within the past 6 mo |

ASA, American Society of Anesthesiologists; OSA, obstructive sleep apnea.

*Examples of ASA classifications created by Rebecca S. Twersky, M.D., member of the ASPS Task Force on Patient Safety in Office-Based Surgery Facilities and chair of the ASA Committee on Ambulatory Surgical Care. Dr. Twersky is professor of anesthesiology and vice-chair for research, State University of New York Health Science Center at Brooklyn, and medical director, Long Island College Hospital, Brooklyn, New York.

## PHYSIOLOGIC STRESSES ASSOCIATED WITH SURGICAL PROCEDURES

There are few data to support the exclusion of specific procedures from the ambulatory surgery setting. Nevertheless, the potential physiologic stresses caused by hypothermia, intraoperative blood loss, the type of anesthesia, malignant hyperthermia, multiple procedures, and the duration of the procedure(s) should be considered when selecting the appropriate facility setting.

### Hypothermia

Hypothermia, in which core body temperature drops below 36.5°C, can be a potentially serious complication of ambulatory surgery. Hypothermia develops because the typical operating room environment is cold. However, both regional and general anesthetics markedly impair the normal precise regulation of core body temperature, and it is anesthetic-induced impairment of thermoregulatory responses that contributes most to this condition.[52] The degree of hypothermia is a significant concern with regard to infection and the safety of anesthetic management. Several studies indicate that mild hypothermia (33.0° to 36.4°C) correlates with adverse postoperative outcomes, including wound infection, increased surgical bleeding, and morbid cardiac events.[53–57]

Studies specifically carried out among outpatients undergoing surgery with general anesthesia in hospital-based ambulatory surgical units demonstrate that the use of warming devices (e.g., forced-air blankets, intravenous fluid warmers) maintains normothermia much more effectively during and after surgery than standard heat-conservation measures (i.e., cotton blankets).[58,59] A wealth of studies performed in nonambulatory surgical settings confirms the enhanced effectiveness of forced-air warming blankets, resistive-heating blankets, or subcutaneous/intravenous fluid warming devices versus the use of cotton blankets, reflective blankets, or circulating water mattresses for preventing hypothermia during and after surgery.[60–65]

### Type of Anesthesia

The principal goals of ambulatory anesthesia include rapid anesthesia recovery to expedite patient discharge and the minimization of side effects. The choice of anesthetic technique for ambulatory surgery depends on both surgical and patient factors. Typically, general anesthesia tends to be associated with a slightly higher risk of complications than local anesthesia or moderate sedation, although all of these methods (Table 6) are quite safe when performed by a competent, board-certified anesthesiologist in a properly equipped and accredited facility.[66–69] The largest prospective study of office-based ambulatory anesthesia performed to date ($n = 34,191$) found an overall anesthesia complication rate of 1.3 percent, with no deaths or long-term adverse consequences observed.[66] Local anesthesia had the lowest complication rate (0.4 percent), with slightly higher rates associated with moderate sedation (0.9 percent) and deep sedation/general anesthesia (1.5 percent).

Issues that have been associated with general anesthesia (e.g., sevoflurane, propofol) in the ambulatory surgery setting include postoperative nocturnal hypoxemia and desaturation episodes,[70] an increased risk of unplanned hospital admission,[14] and delays in home readiness and discharge resulting from the persistence of side effects, namely, drowsiness, pain, and postoperative nausea/vomiting.[71] A meta-analysis of select randomized controlled trials performed in the ambulatory surgery setting determined that the use of bispectral analysis for the titration of general anesthesia modestly reduced anesthetic consumption (by 19 percent) and marginally reduced nausea/vomiting (by 6 percent) and time spent in the recovery room (by 4 minutes), although at a slightly higher net cost per patient ($5.55).[72]

Moderate sedation (i.e., local anesthesia with sedation) is a safe and effective anesthetic choice for routine ambulatory surgical procedures and may be used instead of general anesthesia. Moderate sedation (e.g., midazolam plus fentanyl) appears to be most beneficial during procedures of short duration (<3 hours), yielding relatively brief recovery periods and expedient discharge, few unintended admissions, and low rates of postoperative nausea/vomiting.[73] Local anesthesia with sedation is preferred over spinal anesthesia based on a randomized study showing that the former method (i.e., bupivacaine/prilocaine/epinephrine infiltrate plus intravenous midazolam) resulted in shorter hospital stays and lower medical costs compared with the latter method (i.e., hyperbaric bupivacaine) in patients undergoing ambulatory anorectal surgery.[74] In addition, the former technique produced no side effects. Another randomized clinical trial confirmed that systemic opioid analgesics (i.e., fentanyl) are safe to administer in combination with sedatives (i.e., midazolam) immediately before ambulatory surgery to alleviate the pain associated with local anes-

**Table 6. Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia***

| | Minimal Sedation (anxiolysis) | Moderate Sedation/Analgesia (conscious sedation) | Deep Sedation/Analgesia | General Anesthesia |
|---|---|---|---|---|
| Responsiveness† | Normal response to verbal stimulation | Purposeful response to verbal or tactile stimulation | Purposeful response following repeated or painful stimulation | Unarousable even with painful stimulus |
| Airway | Unaffected | No intervention required | Intervention may be required | Intervention often required |
| Spontaneous ventilation | Unaffected | Adequate | May be inadequate | Frequently inadequate |
| Cardiovascular function | Unaffected | Usually maintained | Usually maintained | May be impaired |

*Source: http://www.asahq.org.
†Reflex withdrawal from a painful stimulus is not considered a purposeful response.

thetic infiltration and patient positioning.[75] Supplemental opioid administration throughout the procedure did not improve the quality of perioperative patient outcomes, and increased the incidence of intraoperative hypotension and arterial oxygen desaturation, suggesting that continuous administration of sedative opioid analgesics should be reserved for select cases.

Most patients are suitable candidates for local anesthesia regardless of age, ASA class, use of medications affecting coagulation, smoking status, or type of surgery; however, male patients with elevated systolic blood pressure have been reported to have a significantly higher risk of complications associated with local anesthesia.[17]

### Malignant Hyperthermia

Malignant hyperthermia is a heritable disorder in which certain inhaled general anesthetics trigger an adverse biochemical chain reaction within the skeletal muscle of susceptible individuals. General signs of malignant hyperthermia include tachycardia, a surge in body metabolism, muscle rigidity, and/or fever that may exceed 110°F. In extreme cases, cardiac arrest, brain damage, internal bleeding, failure of other body systems, and death can result.

According to expert opinion, individuals susceptible to malignant hyperthermia can undergo ambulatory surgery provided that nontriggering anesthetics are used and patient temperature is carefully monitored for a minimum of 2.5 hours postoperatively.[76] Patients should be queried before ambulatory surgery about whether they have a personal or family history of malignant hyperthermia or adverse anesthesia reactions, including intraoperative trismus, unexplained fever, or death during anesthesia. If no history is reported, surgeons should be alert for clinical signs of malignant hyperthermia during surgery, and the surgical suite should be equipped to handle any crises that may develop. Although malignant hyperthermia is rare, its occurrence can be catastrophic. Offices in which triggering agents are used, including the use of succinylcholine for laryngospasm, should have equipment and protocols, including dantrolene, for the initial treatment and stabilization of the patient for a safe transfer to an acute care facility. For more information and recommendations regarding treatment of malignant hyperthermia, see Gurunluoglu et al., "Evidence-Based Patient Safety Advisory: Malignant Hyperthermia," in this issue.

### Multiple Procedures

The cumulative effect of multiple procedures performed during a single operation may increase the potential likelihood that complications may develop. Nevertheless, many combined plastic surgery procedures are routinely and safely performed in ambulatory surgery settings. Although studies that support the feasibility and safety of performing multiple simultaneous surgical procedures in the ambulatory setting are scarce and limited to the office-based setting,[77,78] these findings are corroborated by additional studies carried out in nonambulatory or unknown surgical settings that identified no statistically significant differences in complication rates between single and multiple procedures (i.e., abdominoplasty with or without other procedures).[79–81] Despite the general safety of performing multiple surgical procedures in concert, certain patient factors have been correlated with an increased complication rate during multiple procedures, most notably, elevated body mass index.[79,80]

Some combination plastic surgery procedures are more controversial. For example, restricting liposuction in combination with multiple unrelated procedures has been the topic of many debates, largely because the actual volume of liposuction aspirate that can be safely removed during a combined procedure is as yet unknown. Given the lack of national consensus, some states have addressed this issue by implementing their own version of restrictions on liposuction aspirate. For instance, the state of Florida has determined that "liposuction may be performed in combination with another separate surgical procedure during a single Level II or Level III operation, only in the following circumstances: 1) when combined with abdominoplasty, liposuction may not exceed 1000 cc of supernatant fat; 2) when liposuction is associated and directly related to another procedure, the liposuction may not exceed 1000 cc of supernatant fat; 3) major liposuction in excess of 1000 cc supernatant fat may not be performed in a remote location from any other procedure."[82] Some data tend to support these limitations, whereas other data do not.[79,83–85] However, these collective data tend to be anecdotal or derived from studies that lack the level of rigor necessary to establish clear standards of practice. The practice advisory on liposuction suggests limiting liposuction aspirate to no more than 5000 cc (see Haeck et al., "Evidence-Based Patient Safety Advisory: Liposuction," in this issue). If a greater volume is to be removed, the liposuction procedure should be performed in an acute care hospital or a facility that is either accredited or licensed, regardless of the anesthetic route, and monitoring of the patient postoperatively in the hospital or appropriate overnight facility.

### Duration of Procedures

Most plastic surgery procedures performed in an ambulatory setting (e.g., face lifts, rhinoplasties, breast reductions, mastopexies, liposuctions, abdominoplasties) take longer than 1 hour to complete, and it is not uncommon for several procedures to be performed during the same operative procedure, thereby increasing the total duration of surgery. There are few prospective data and mostly conflicting opinions regarding the importance of surgery duration in the ambulatory setting as a sole predictor of adverse outcomes. A prospective study carried out on more than 15,000 ambulatory surgical patients treated in a hospital-based ambulatory surgical unit identified receipt of anesthesia for more than 1 hour and surgery ending after 3 PM as significant, independent predictors of unanticipated admission following surgery.[50] Several other less rigorous studies performed in various ambulatory settings have found that operations lasting beyond 30 minutes to 2 hours put patients at increased risk for minor complications (e.g., postoperative pain, bleeding, fever), delays in discharge, and/or unplanned admissions.[14,15,71,86] These risks may directly relate to the duration of the procedures performed, or they may indirectly reflect the complexity of surgery. Regardless, long or complex procedures should be scheduled sufficiently early in the day to allow for adequate recovery time before discharge, and elective surgery should ideally be limited to no more than 6 hours. Judgment regarding the planned duration of surgery should account for the type of case, the combination of procedures to be performed, and the general health of the patient.

## PREVENTION OF UNANTICIPATED ADMISSIONS

Averting unanticipated admissions is imperative for maintaining a high standard of patient care in the ambulatory setting. Several studies carried out in hospital-based ambulatory surgical units reveal that postoperative bleeding, pain, nausea/vomiting, and dizziness are leading causes and significant predictors of unplanned admissions following surgery.[15,50,71,87] In a large prospec-

tive study of ambulatory surgical patients treated in a hospital-based ambulatory surgical unit, these factors together accounted for 36 percent of all unplanned admissions.[50] This same study also found that receipt of anesthesia for more than 1 hour and surgery ending after 3 PM significantly and independently predicted unanticipated admission following surgery. It is important to recognize that many of these unplanned admissions may be avoided with proper patient screening, careful preoperative planning that minimizes the procedure duration and reduces the chance of surgical complications, and routine postoperative planning to ensure adequate support for patient recovery. One report determined that 75 percent of all unanticipated admissions assessed were non–life threatening and potentially preventable, because they were attributable to poor control of postoperative pain, postoperative nausea/vomiting, surgical observation, and social reasons.[87]

As mentioned above, proper postoperative care and management has the potential to minimize unnecessary readmissions. Important factors to consider include providing the patient with adequate pain medication and instructions on proper dosing; educating patients regarding wound care, movement/lifting, and complications; advocating early ambulation after surgery, especially after abdominoplasty, and/or the use of compression devices to decrease the risk for deep vein thrombosis; and scheduling a postoperative visit. Equally important, the surgical care team should ensure that a responsible adult will be available to assist the patient with postoperative instructions and care. Supplying the patient with an information packet before surgery that delineates postoperative care instructions for patients and their caregivers may avert the development of postoperative complications, and ensure that medical care is sought in a timely manner should complications arise.

## PROVIDER QUALIFICATIONS

The surgeon or anesthesiologist performing a given procedure, regardless of the location of the surgical facility, should have approved hospital privileges for the procedure and should be qualified for examination or be certified by a surgical board recognized by the American Board of Medical Specialties, such as the American Board of Plastic Surgery or the American Board of Anesthesiology.

## SURGICAL SAFETY CHECKLISTS

Surgical time-outs and checklists have generated increased acceptance, and surgeons should be aware of additional information regarding the effectiveness of such techniques.[88]

## SURGICAL FACILITY REQUIREMENTS

Plastic surgery performed under anesthesia, other than minor local anesthesia and/or minimal oral tranquilization, should be performed in a surgical facility that meets at least one of the following criteria:

- Accredited by a national or state-recognized accrediting agency/organization, such as the American Association for Accreditation of Ambulatory Surgery Facilities, the Accreditation Association for Ambulatory Health Care, or the Joint Commission on Accreditation of Healthcare Organizations.
- Certified to participate in the Medicare program under Title XVIII.
- Licensed by the state in which the facility is located.

## CONCLUSIONS

As more complex surgical procedures are performed in the ambulatory surgery setting, the surgeon must commit to quality assurance to ensure patient safety. Such measures include appropriate patient selection, thorough preoperative planning, and routine perioperative monitoring and postoperative follow-up. Toward this end, completing a comprehensive preoperative history and physical examination to accurately select the appropriate outpatient surgical facility for each patient and following the recommendations detailed in this article on how to safely address a variety of factors common to many plastic surgery procedures will contribute to a positive experience for both the patient and the physician.

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## Appendix A. Summary of Recommendations

| Recommendations | Supporting Evidence | Grade |
|---|---|---|
| PATIENT SELECTION | | |
| Preoperative tests<br>● Order pertinent tests based on the patient's preoperative history and physical examination results:<br>– Electrocardiogram in patients older than 45 yr<br>– Electrocardiogram at any age when known cardiac conditions are present<br>– Complete blood count/blood chemistries, as needed, for detailed evaluation of specific diagnosis<br>– Additional tests as appropriate | Expert opinion | D |
| Age<br>● Patients older than 60 years can be considered for ambulatory surgery but may be at increased risk for cardiac events, other complications, and unanticipated admissions.<br>● Cardiovascular monitoring is important; however, the level of monitoring depends on the patient's overall health, the presence and severity of cardiovascular disease, and the nature of the surgical procedure.<br>● Standard monitoring should include:<br>– Noninvasive blood pressure<br>– Heart rate<br>– Electrocardiography<br>– Pulse oximetry<br>– Respiratory rate<br>● Additional specialized monitoring may be needed (see Fleisher et al., 2007[38]) | 13, 15–17, 27, 89 | B |

(*Continued*)

**Appendix A. (*Continued*)**

| Recommendations | Supporting Evidence | Grade |
|---|---|---|
| BMI<br>● Ambulatory surgery can be considered for patients with:<br>– BMI 18.5–24.9 (normal weight)<br>– BMI 25–29.9 (overweight)<br>– BMI 30–34.9 (moderately obese)<br>● A hospital setting should be considered for patients with:<br>– BMI 35–39.9 (severely obese)<br>● A hospital setting is recommended for patients with:<br>– BMI ≥40 (morbidly obese) | 15, 18, 19, 23 | D |
| ● General management of obese patients:<br>– Consider histories/comorbidities that may complicate patient management.<br>– Consider prophylaxis against DVT (i.e., with low-dose heparin, sequential compression devices, and postoperative ambulation). | 20, 22–24 | B |
| ● Management of obese patients with respiratory abnormalities:<br>– Ensure proper patient positioning and monitoring.<br>– Use a semiupright position in a chair for patients under sedation.<br>– Consider supplemental oxygen.<br>– Carefully sized airway adjuncts (e.g., oral/nasal pharyngeal airways, endotracheal tubes, laryngeal mask airways) should be immediately available for patients under moderate sedation or general anesthesia.<br>– Consider intravascular monitoring of arterial pressure (or other approaches) if blood pressure measurements and auscultation of the heart and lungs is difficult to obtain. | 12, 21, 23<br><br><br>23 | B<br><br><br>D |
| ● Pharmacologic approaches to sedation and pain management in obese patients:<br>– Use a catheter-over-needle system to prevent loss of intravenous access.<br>– Short operation times and lighter levels of sedation are recommended.<br>– Consider a hospital setting if deeper anesthesia is required.<br>– Calculate initial doses of pharmacologic agents based on ideal body weight (as a reflection of lean body mass) rather than actual body weight.<br>– Consider possible drug interactions.<br>○ Exercise caution for patients taking appetite suppressants or other medications.<br>○ Consider avoiding opioids, especially in patients with diagnosed or suspected OSA; consider nonopioid analgesics and moderate sedation with reversible agents. | | |
| OSA<br>● Patients with OSA can be considered for ambulatory surgery; however, careful patient assessment is necessary.<br>● For patients *without* a prior diagnosis of OSA, inquire about the following symptoms:<br>– Airway obstruction during sleep<br>– Loud and frequent snoring<br>– Frequent arousal from sleep, especially with choking sensation<br>– Daytime somnolence or fatigue<br>– Falling asleep in nonstimulating environments (e.g., watching television, reading, driving)<br>● Also consider interviewing family members as to whether they have seen telltale OSA symptoms in the patient (e.g., apneic events, restless sleep, vocalizations)<br>● The physical examination should include an evaluation of the following:<br>– The airway<br>– Nasopharyngeal characteristics<br>– Tonsil and tongue size<br>– Neck circumference<br>– BMI<br>● For patients *with* suspected OSA, consider referring the patient for additional tests (e.g., sleep studies, more extensive airway assessment) and OSA treatment prior to surgery.<br>● Factors to be considered in determining whether outpatient surgery is appropriate for patients with OSA:<br>– Sleep apnea status<br>– Anatomical and physiologic abnormalities<br>– The status of coexisting diseases<br>– The nature of the surgery<br>– The type of anesthesia<br>– The need for postoperative opioids<br>– Patient age<br>– Adequacy of postdischarge observation<br>– Capabilities of the outpatient facility (availability of emergency difficult airway equipment, respiratory care equipment, radiology facilities, clinical laboratory facilities, and a transfer agreement with an inpatient facility) | 24–26 | D |

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**Appendix A. (*Continued*)**

| Recommendations | Supporting Evidence | Grade |
|---|---|---|
| • Discharge criteria for patients with OSA:<br>– Patients can be discharged from the recovery area to an unmonitored setting (i.e., the home, unmonitored hospital bed) when they are no longer at risk for postoperative respiratory depression.<br>– Because of the propensity to develop airway obstruction or central respiratory depression, OSA patients may require a longer stay as compared with non-OSA patients undergoing similar procedures.<br>– Document the adequacy of postoperative respiratory function by observing patients in an unstimulated environment (preferably while asleep) to establish that they are able to maintain their baseline oxygen saturation while breathing room air. | | |
| Cardiovascular conditions<br>• Patients with a history of cardiovascular conditions can be considered for ambulatory surgery; however, the surgery location depends on the severity of disease. Patients with moderate to severe cardiovascular disease may not be appropriate candidates for surgery outside of the hospital setting. | 13, 17, 24 | D |
| • General management of patients with cardiovascular conditions:<br>– Evaluate the risk of bleeding and thromboembolism.<br>– Adjust medications such as aspirin, warfarin, or clopidogrel bisulfate accordingly.<br>– Refer patients to their cardiologist, hematologist, or internist for preoperative evaluation and treatment. | 13, 17, 29–38 | B |
| Risk for thrombosis or embolism<br>• Assess risk factors:<br>– Patient history, including the use of contraceptives and hormone replacement, stillbirth, preterm delivery, and possibly recurrent miscarriage<br>– Family history, including past episodes of thrombosis or embolism<br>– Genetic disposition to clotting disorders (e.g., factor V Leiden, prothrombin G20210A)<br>– Edema, swelling, or other signs of venous insufficiency in the lower extremities | 22, 39–46, 90 | B |
| Thromboprophylaxis<br>Implement thromboprophylaxis according to risk rating: | 39, 47, 48 | D |
| • Low risk<br>– Patient education<br>– Early and frequent ambulation (continue at home)<br>– Flexion/extension of ankles (continue at home)<br>– Optional: GCS (may be used at home) | | |
| • Moderate risk<br>– Same as low risk, *plus*<br>– IPC if anticoagulation is not an option (continue until good ambulation)<br>– LMWH (30–40 mg SQ qd; initial dose 2 hr before surgery or 12 hr after; continue until patient is fully ambulatory and evaluate need for longer prophylaxis) *or* LDUH (q12h until patient is fully ambulatory) | 91–93 | A |
| • High risk<br>– Same as low risk, *plus*<br>– IPC and/or GCS (until good ambulation)<br>– LMWH (40 mg SQ qd; initial dose 2 hr before surgery or 12 hr after; continue for 5–10 days) *or* fondaparinux (2.5 mg SQ qd; initial dose 6–8 hr after surgery; do not give <6 hr postoperatively; continue for 5–10 days) | 91, 93–96 | A |
| • Very high risk<br>– Same as low risk, *plus*<br>– IPC and/or GCS (until good ambulation)<br>– LMWH (40 mg SQ qd; initial dose 2 hr before surgery or 12 hr after; continue for 7–12 days and seriously consider longer prophylaxis) *or* fondaparinux (2.5 mg SQ qd; initial dose 6–8 hr after surgery; do not give <6 hr postoperatively; continue for 7–12 days and evaluate need for longer prophylaxis)<br>– Longer term prophylaxis with warfarin *or* convert to warfarin at INR 2–3 (if patient risk factors indicate the need for other vitamin K antagonist long-term prophylaxis) | 91, 93–96 | A |

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**Appendix A. (*Continued*)**

| Recommendations | Supporting Evidence | Grade |
|---|---|---|
| Mechanical prophylaxis<br>● Methods recommended for patients with a high risk of bleeding or as an adjunct to chemoprophylaxis:<br>– GCS<br>– IPC devices<br>– VFP<br>● IPC devices or VFP are recommended for any procedure that lasts >1 hr, and for all patients receiving general anesthesia; begin 30–60 min before surgery.<br>● Also consider patient positioning on the operating room table.<br>– Flex the patient's knees at 5 degrees *or*<br>– Reposition the patient's legs at regular intervals throughout a procedure. | 39, 47, 48 | D |
| Chemoprophylaxis<br>● Use chemoprophylaxis (e.g., LMWH, fondaparinux, idraparinux, direct thrombin inhibitors) in patients undergoing:<br>Abdominoplasty<br>Circumferential body contouring<br>Thighplasty<br>Combined procedures<br>Procedures lasting >4 hr<br>Surgery requiring open-space dissection<br>TRAM flap procedures<br>Surgical procedures likely to contribute to venous stasis or compression.<br>● Recognize the increased risk of bruising or hematoma and the possible need for blood transfusion when using chemoprophylaxis; bleeding incidence is strongly associated with dosage. | 39, 47, 48 | D |
| ASA status<br>● Patients categorized as ASA class 1–3 can be considered for ambulatory surgery; however, the setting should be determined by the ASA class, the type of procedure, and the type of anesthesia. | 17, 24, 50, 51 | B |
| ● ASA class 4 patients can be considered for ambulatory surgery; however, the setting is dependent on the type of procedure and type of anesthesia. | Expert opinion | D |
| ● Office-based procedures:<br>– ASA class 1 and 2 patients are generally considered the best candidates for ambulatory surgery and reasonable candidates for the office-based surgery setting. | | |
| – ASA class 3 patients may also be reasonable candidates for office-based surgery facilities when local anesthesia, with or without sedation, is planned and the facility is accredited. | Expert opinion | D |
| – ASA class 4 patients are appropriate candidates for the office-based surgery setting only when local anesthesia without sedation is planned. | | |
| If a free-standing ASC or office-based setting is chosen, it should be accredited with appropriate hospital transfer arrangements. | Expert opinion | D |
| MANAGEMENT OF PHYSIOLOGIC STRESSES ASSOCIATED WITH SURGICAL PROCEDURES | | |
| Hypothermia<br>● General strategies:<br>– Equip the ambulatory surgery suite so that temperatures can be adequately monitored and adjusted.<br>– Have equipment available [e.g., Bair Huggers (Arizant Healthcare, Inc., Eden Prairie, Minn.), forced-air warming blankets, intravenous fluid warmers] to warm the patient, as necessary, especially during more extensive procedures.<br>– When no hypothermia prevention measures are available, the procedures performed should be of short duration (1–2 hr) and limited to no more than 20% of the body surface area.<br>● Recommended protocol for hypothermia prevention during general or regional anesthesia:<br>– Actively prewarm patients.<br>– Monitor core temperature throughout administration of general and regional anesthesia.<br>– Cover as much body surface area as possible with blankets or drapes to reduce radiant and convective heat loss through the skin. | 58–62, 64, 65, 97, 98 | B |

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**Appendix A. (*Continued*)**

| Recommendations | Supporting Evidence | Grade |
|---|---|---|
| – Actively warm patients intraoperatively with a forced-air heater or resistive-heating blanket to prevent heat loss and add heat content; rearrange covers every time the patient is repositioned to warm as much surface area as possible.<br>– Minimize repositioning time as much as possible so that the active warming method can be quickly continued.<br>– Warm intravenous fluids and/or infiltration fluids if large volumes are used.<br>– Warm incision irrigation fluids.<br>– Aggressively treat postoperative shivering with a forced-air heater or resistive-heating blanket and consider pharmacologic intervention. | | |
| Intraoperative blood loss<br>● Procedures performed on the average-size adult patient in which blood loss ≥500 cc is anticipated should be performed only in facilities where adequate blood and blood components are readily available. | 99 | D |
| Type of anesthesia<br>● General anesthesia, moderate sedation, and local anesthesia can be used safely in the ambulatory setting. The type of anesthesia administered depends on the invasiveness of the procedure, the health status of the patient, and the preference of the physician and patient. The physician should discuss anesthetic options with the patient and determine the most appropriate regimen. | 17, 27, 66–75 | B |
| ● The ASA and AAOMS recommends the following measures for patients undergoing deep sedation/general anesthesia:<br>– Continuous use of pulse oximetry<br>– Recording of blood pressure every 5 min<br>– Continuous cardiovascular monitoring with an electrocardioscope<br>– Use of supplemental oxygen throughout the anesthesia period<br>– Ventilatory monitoring should include auscultation of breath sounds and ≥1 of the following:<br>○ Observation of the chest wall<br>○ Observation of the reservoir bag<br>○ Monitoring the color of skin, nails, mucosa, and the surgical site<br>○ Capnography<br>– Additional monitoring should include either auscultation of heart sounds or palpation of peripheral pulses.<br>– Capnography—end tidal carbon dioxide when endotracheal anesthesia or laryngeal mask airway (LMA) is inserted. | 66, 100 | D |
| Multiple procedures<br>● The presumed benefits of combining procedures, particularly liposuction, must be weighed against the possibility of adverse events.<br>● Liposuction can be performed safely in the ambulatory setting when performed in accordance with ASPS recommendations to limit the total aspirant (supernatant fat and fluid) to ≤5000 cc.<br>● Combining large-volume liposuction with certain other procedures (e.g., abdominoplasty) should be avoided because of the possibility of serious complications. | 77–81, 83–85 | B |
| Duration of procedures<br>● Long procedures should be scheduled sufficiently early in the day to allow for adequate recovery time before discharge.<br>● If possible, surgery should be completed by 3 pm to allow adequate time for recovery and discharge.<br>● The overall duration of the procedure(s) should ideally be completed within 6 hr.<br>● Attention to patient selection, intraoperative management, and postoperative care is of particular importance when procedures of longer duration are to be performed in the ambulatory setting. | 14, 15, 50, 71, 86, 101 | B |

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**Appendix A. (*Continued*)**

| Recommendations | Supporting Evidence | Grade |
|---|---|---|
| Preventing unanticipated admission<br>• Control of pain, nausea/vomiting, dizziness, and postoperative bleeding is essential to postoperative recovery and discharge.<br>• Pain management should be correlated to BMI and the procedure being performed, and the patient should be sent home with sufficient medication to control pain and with adequate instructions on the use of this medication.<br>• Recommendations regarding the duration of procedure(s) also apply. | 15, 50, 71, 87 | B |

ACC, American College of Cardiology; AHA, American Heart Association; ASA, American Society of Anesthesiologists; ASC, ambulatory surgery center; CCS, Canadian Cardiovascular Society; DVT, deep vein thrombosis; GCS, graduated compression stockings; INR, international normalized ratio; IPC, intermittent pneumatic compression; VFP, venous foot pumps; LDUH, low-dose unfractionated heparin; LMWH, low-molecular-weight heparin; NYHA, New York Heart Association; OSA, obstructive sleep apnea; q12h, every 12 hours; qd, once daily; SQ, subcutaneously; TRAM, transverse rectus abdominus musculocutaneous; AAOMS, American Association of Oral and Maxillofacial Surgeons; MHAUS, Malignant Hyperthermia Association of the United States; PACU, postanesthesia care unit.