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Patient selection in ambulatory surgery

John A. Hodgson, MD, Associate Professor [a],
Kyle L. Cyr, MD, Assistant Professor [a],
BobbieJean Sweitzer, MD, FACP, SAMBA-F, FASA, Professor [b, *]

[a] *Walter Reed National Military Medical Center and Uniformed Services University, 8901 Wisconsin Avenue, Bethesda, MD, 20889, United States*
[b] *Medical Education, University of Virginia, Systems Director, Preoperative Medicine, Inova Health, 3300 Gallows Road, Falls Church, VA, 22042, United States*

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Patient selection is important for ambulatory surgical practices. Proper patient selection for ambulatory practices will optimize resources and lead to increased patient and provider satisfaction. As the number and complexity of procedures in ambulatory surgical centers increase, it is important to ensure that patients are best cared for in facilities that can provide appropriate levels of care. This review addresses the multiple variables and resources that should be considered when selecting patients for anesthesia in ambulatory centers and offices.

One of the most important factors in determining the success of an ambulatory surgical practice, particularly in a free-standing center, separate from hospital-based care, is patient selection. Without careful consideration, hospital admissions or delayed discharges from the post-anesthesia care unit strain resources and cause inconvenience to patients. The lack of some resources in ambulatory surgery settings may increase adverse outcomes, including significant disability and death for some patients. Given the increasing numbers of patients having ambulatory surgeries and the increasing complexity of

Abbreviations: ADLs, activities of daily living; AF, atrial fibrillation; ASA, American Society of Anesthesiologists; ASA-PS, American Society of Anesthesiologists physical status; ASC, ambulatory surgicenter; BMI, body mass index; CAD, coronary artery disease; CFS, clinical frailty scale; CIED, cardiac implantable electronic device; CKD, chronic kidney disease; CVA, cerebrovascular accident; DAPT, dual antiplatelet therapy; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; EMI, electromagnetic interference; ESRD, end-stage renal disease; HF, heart failure; ICD, implantable cardiac defibrillator; MAC, monitored anesthesia care; MACE, major adverse cardiovascular event(s); MI, myocardial infarction; OSA, obstructive sleep apnea; RVR, rapid ventricular rate; TIA, transient ischemic attack; VTE, venous thromboembolism.

* Corresponding author.
E-mail addresses: drjahodgson@gmail.com (J.A. Hodgson), kyle.cyr@gmail.com (K.L. Cyr), bobbiejean.sweitzer@inova.org (B. Sweitzer).

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cases performed in ambulatory surgicenters (ASC), it is imperative to recognize patients who are best cared for in hospital-based settings. In this review, we address the multiple variables, including medical conditions and the proposed surgical procedures, that impact outcomes. We also review the benefit of ancillary studies in determining patient selection for ambulatory surgery. It is important to understand that overly conservative criteria lead to the improper use of limited hospital resources. A prime example of poor resource management is requiring patients with an American Society of Anesthesiologists physical status (ASA-PS) IV to be scheduled for a cataract surgery in a hospital rather than at an ASC [1]. Office-based settings typically have even more limited resources than traditional ASCs. According to the American Society of Anesthesiologists (ASA) guidelines for office-based anesthesia [2].

- Planned procedures should be within the scope of practice of the healthcare practitioners.
- The facility should have the necessary resources to carry out the procedure.
- The procedure should be of a duration and degree of complexity to allow the patient to recover and be discharged from the facility.
- Patients with medical conditions, which place them at undue risk for complications, should be referred to an appropriate facility for the procedure.

This guidance may seem straightforward, but this statement is vague on the definition of undue risk as well as which pre-existing medical conditions are too high risk and disqualify a patient from having a procedure in an office-based setting. Similarly, the ASA guidelines for the ambulatory anesthesia and surgery do not provide specifics regarding the definition or discussion of risk, procedure type, or patient medical conditions [3]. In practice, it is up to the proceduralists and anesthesiologists to determine the acceptable risk thresholds.

Predictors of risk

An obvious starting point regarding patient selection for ambulatory procedures is the ASA physical status classification system. ASA-PS I and II patients having ambulatory surgeries have a very low risk of morbidity and mortality [4]. The risk of adverse outcomes increases for ASA-PS III patients having intermediate-risk procedures and for ASA-PS IV patients having low– intermediate risk surgeries [4]. Fig. 1 demonstrates the correlation between ASA-PS status and the risk of adverse outcomes. Traditionally, ASA-PS I and II patients have been considered good candidates for outpatient procedures.

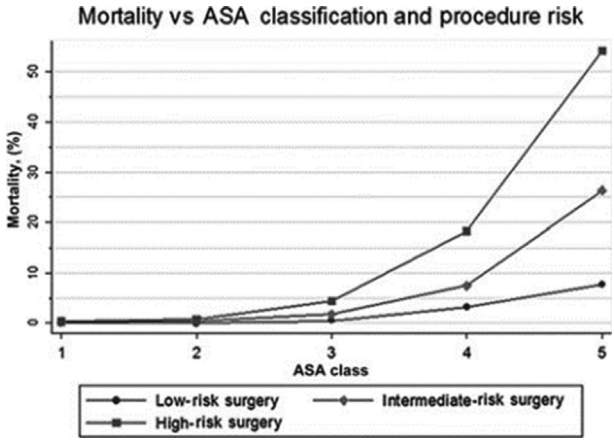

Fig. 1. The observed mortality rate as a function of the American Society of Anesthesiologists' physical status and surgery-specific risk. Glance LG, Lustik SJ, Hannan EL et al. The Surgical Mortality Probability Model: derivation and validation of a simple risk prediction rule for noncardiac surgery. *Ann Surg*. 2012; 255 (4):696–702. https://doi.org/10.1097/SLA.0b013e31824b45af.

The patient's ability to carry out activities of daily living (ADLs), including eating, dressing, and bathing, is a predictor of surgical outcomes. Patients who are completely or partially dependent on others for ADLs have been shown to have more complications than patients who are completely independent with ADLs [4]. For example, an ASA-PS II patient who requires assistance with ADLs has the same risk of complications as an ASA-PS III patient who is independent with ADLs. Individuals who are dependent or even partially dependent on others have more myocardial infarctions (MIs), cardiac arrests, cerebrovascular accidents (CVAs), pneumonia, urinary tract infections, renal insufficiency, wound infections, and failure to wean from mechanical ventilation [4]. ASA-PS I and II patients who are fully functional are excellent candidates for most outpatient procedures. ASA-PS III and ASA-PS IV patients may have unreasonable risks, and clinicians should carefully consider suitability before proceeding in a nonhospital setting. Factors to consider are independence with ADLs, comorbidities and degree of control, procedure type, and capabilities of the outpatient center.

The absolute number and type of prescription medications are a readily available source of information that can be used as a surrogate for comorbidities and to predict outcomes [5]. The number of medications correlates with the severity of chronic diseases. Dietrich et al. demonstrated a 19% increased risk for a complication within one year for each additional medication prescribed to patients presenting for elective primary total hip arthroplasty [5]. Furthermore, this study demonstrated that the number of preoperative medications was associated with the length of hospital stay, complications, and the need for blood transfusions (Fig. 2). While the number of medications is an important consideration, so is the type of medication. Patients on oral anticoagulants can be expected to have conditions such as atrial fibrillation (AF), coronary artery disease (CAD), CVA, peripheral arterial disease, venous thromboembolism (VTE), and coagulopathies. Other medications that predict significant diseases include steroids, inhalers, insulin, cardiovascular drugs, antiplatelet agents, and antihypertensives. Patients taking these medications should be screened for comorbidities, optimization, and suitability.

Patient selection based on specific comorbidities

A history of anesthetic complications such as malignant hyperthermia, difficult-to-control pain, difficult airway management, and severe postoperative nausea and vomiting are predictors of management difficulties in the outpatient setting. Providing anesthesia in a free-standing ambulatory setting for patients who have experienced perioperative complications should only be done if proper resources are available to address similar complications including expeditious transportation to an advanced center if needed. The same considerations apply to patients at risk for other perioperative complications.

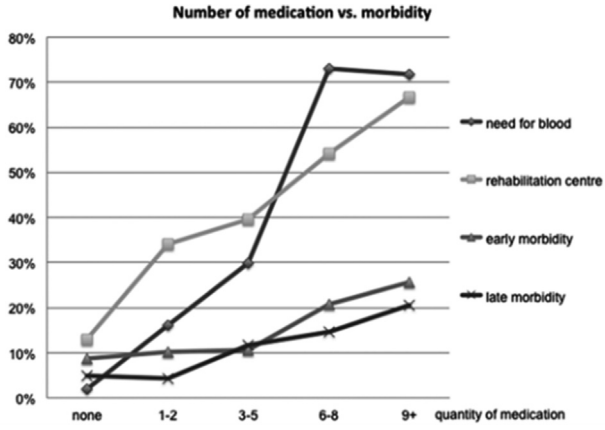

Fig. 2. Number of medications versus morbidity. Dietrich M, Zingg PO, Egbring M, Kamath AF, Dora C. Pre-hospital medications in total hip arthroplasty: risk factors for poor outcomes. *Hip Int.* 2015; 25 (3):215–220. https://doi.org/10.5301/hipint.5000227.

Cardiovascular disease

Patients with significant cardiovascular diseases have an increased risk of major adverse cardiovascular events (MACEs). Patients with recent MI, percutaneous interventions within 6 months, severe angina, significant arrhythmias such as ventricular tachycardia or AF with rapid ventricular rates (RVR), severe valvular disease, or advanced or symptomatic heart failure (HF) are poor candidates for ambulatory surgery. An MI within 60 days is a contraindication for elective procedures. The rate of recurrent postoperative MI is 33% within 30 days of a previous event, 19% within 60 days, and 8.5% within 90 days [6]. Patients with a recent coronary artery stent placement are at increased risk of MACE, particularly if dual antiplatelet therapy (DAPT) is interrupted. Studies have demonstrated that MACE occurs in 10.9% of patients with coronary stents who undergo noncardiac surgery. MACE was associated with five risk factors: anemia, renal failure, urgent surgery, high-risk surgery, and interruption of antiplatelet therapy [7,8,9,10]. The American College of Cardiology and American Heart Association guidelines recommend continuation of DAPT for a minimum of 2 weeks after percutaneous interventions without stenting, 30 days after bare metal stent placement, and 6 months ideally after drug-eluting stents [8]. If surgery is particularly time sensitive, there can be consideration of proceeding with surgery 3 months after placement of drug-eluting stents. However, because of the elevated risk during this time period, these patients are poor candidates for ambulatory procedures. If patients must proceed with surgeries during these high-risk periods, they should have procedures in centers with interventional cardiology availability, particularly if DAPT cannot be continued. Patients with coronary stents benefit from aspirin therapy regardless of the time elapsed since stent placement. The risk of MACE is significantly elevated if therapy is withheld [9,10]. Aspirin should be continued in patients with coronary stents unless the bleeding risk is excessive or would be catastrophic, for example, for intraspinal or intracranial procedures [9].

Cerebrovascular disease

Although there is a lack of ambulatory-specific data on perioperative stroke risk, we can reasonably extrapolate conclusions from studies assessing stroke risk in an elective noncardiac surgery. Patients who have had CVA exhibit a significant risk of MACE, recurrent CVA, and death with a short time interval between CVA and surgery. This risk decreases with time; however, it remains elevated compared with those without a history of CVA [7,11]. There is a 1.5–1.8-fold increase in mortality and a roughly 5-fold increase in rates of MACE, including CVA, when presenting for a surgery at any time interval compared with patients without a history of CVA [7,11]. The risk of MACE stabilizes at 9 months after a CVA, and the risks of recurrent CVA and mortality stabilize between 3 and 9 months [7,11]. Interestingly, the risk of MACE or stroke after a recent CVA was similar in low-, intermediate-, and high-risk surgeries [7,11] Thus, we recommend delaying elective surgery for 9 months regardless of the surgical type. For cases that cannot be delayed, we recommend avoiding procedures in centers without stroke- or cardiac-rescue teams for patients with a CVA, including transient ischemic attack (TIA), within the previous 9 months to mitigate the impact of MACE or CVA, should they occur.

In many cases, it is safe to care for patients with cardiac implantable electronic devices (CIEDs) in ambulatory surgical centers, provided the device is managed appropriately and the underlying cardiac condition is stable and of acceptable risk [12]. It is important not to focus on the device alone but also consider the indication for the CIED and underlying cardiac diseases. Patients with implantable cardiac defibrillators (ICDs) often have significant cardiomyopathies, lethal arrhythmias, or a history of sudden death. Optimized patients without decompensated or New York Heart Association class 3 or 4 HF and those who have not required frequent interventions for life-threatening arrhythmias may be safely cared for in many ambulatory settings, particularly if electromagnetic interference (EMI) is not anticipated.

Practitioners need to obtain the latest device information for all CIEDs. Patients with ICDs have device checks every 6 months, while patients with pacemakers have device checks yearly. Clinicians must understand the effects of magnet placement if monopolar electrosurgery above the umbilicus will be used. It is not appropriate to rely on industry personnel to make independent decisions on device management perioperatively [12]. Bipolar electrosurgery and ultrasonic scalpels will not cause

EMI. Short bursts of less than 5 s of a monopolar electrosurgery are generally considered a safe alternative plan. Even if EMI is not anticipated, other situations may warrant cessation of ICD tachytherapies. These include procedures when uncontrolled movement may be dangerous such as ophthalmologic and spinal procedures. Device interference can result from bone saws, radiofrequency ablation, magnetic resonance imaging, electroconvulsive therapy, and therapeutic radiation, but not diagnostic radiography.

Magnets generally yield predictable results when placed on pacemakers and ICDs, but the results are not 100% reliable. Some devices have programmable magnet features; hence, it is imperative to obtain information on the device ahead of the day of surgery. There are CIEDs, particularly Biotronik devices, that have atypical magnet functionality [13,14,15].

For the vast majority of devices, a magnet will shut off ICD antitachycardia therapy and force pacemakers to pace asynchronously. However, magnets will not force pacing with an ICD. These devices must be reprogrammed if EMI is anticipated in a pacemaker-dependent patient. The further away from the device the EMI source is, the less likely it will cause device interference. Typically, if electrosurgery is below the umbilicus or bipolar devices are used, then there is no need to use a magnet or reprogram the device. However, because of the large surface area of subcutaneous ICDs, they should always be inactivated if monopolar electrosurgery is used in any location [16]. “Leadless” pacemakers must be reprogrammed if EMI is expected because these devices do not respond to magnets. Access to programmability is mandatory as pacing thresholds can also be affected by local anesthetics, fluid management, or electrolyte perturbations with potentially disastrous results in pacemaker-dependent patients [17].

It is equally important that the electrosurgery current return pad or dispersive electrode is placed appropriately to minimize electrical conduction across the device or the leads (Fig. 3). The device should not be reprogrammed until the patient is monitored with electrocardiography, and alternative methods of pacing and defibrillation are immediately available. If the CIED is reprogrammed, the device must be returned to appropriate settings before the patient is removed from monitoring. The outpatient center needs to have CIED magnets, external pacing capability, external defibrillation devices, and adequately trained personnel prepared to promptly intervene. Following all these guidelines may be difficult for some outpatient settings. Ideally, ambulatory practices should have a policy and standardized guidance on the management of CIED. An example of such guidance is demonstrated in Fig. 4.

AF is the most common cardiac arrhythmia. AF is associated with an increased thromboembolic risk usually secondary to the development of thrombus in the left atrial appendage. Patients with new-onset or newly discovered AF in the perioperative period have an increased risk of stroke and mortality after surgery, both short (30-day) and long term. A recent meta-analysis of new-onset AF studies demonstrated the risk of short-term stroke to be 62% greater and mortality to be 44% higher than in those without new-onset AF [18]. Most elective surgeries, particularly in the ambulatory setting, should be delayed until an evaluation is completed. In a low-risk surgery, particularly those of short duration with minimal blood loss performed under sedation, it is reasonable to proceed in patients with newly discovered AF. Patients should be referred for timely outpatient evaluation afterward.

It is widely accepted that the perioperative risks associated with HF are significantly higher than in patients without HF. The majority of information was derived from nonambulatory surgeries until recently. HF of any degree increased the 90-day mortality and 30-day complication rates compared with patients without HF having ambulatory procedures [19]. The complications included MI, stroke, bleeding, and surgical site and urinary tract infections. The HF cohort had complication rates of 5.65% compared with 2.65% in the non-HF cohort [19]. The risk of death at 90 days was 10 times higher in patients with HF (3.57% vs. 0.39%) [19]. Furthermore, in patients with new-onset HF, the odds of VTE were over 120% greater at 30 days [20]. Given the risk of complications in patients with HF and the increased prevalence of this patient population having surgeries, clinicians must be prepared to manage these patients or refer them to hospital-based care.

Chronic kidney disease

Chronic kidney disease (CKD) is associated with perioperative morbidity and mortality. A serum creatinine >2.0 mg/dL is one of six independent predictors included in the revised cardiac risk index for

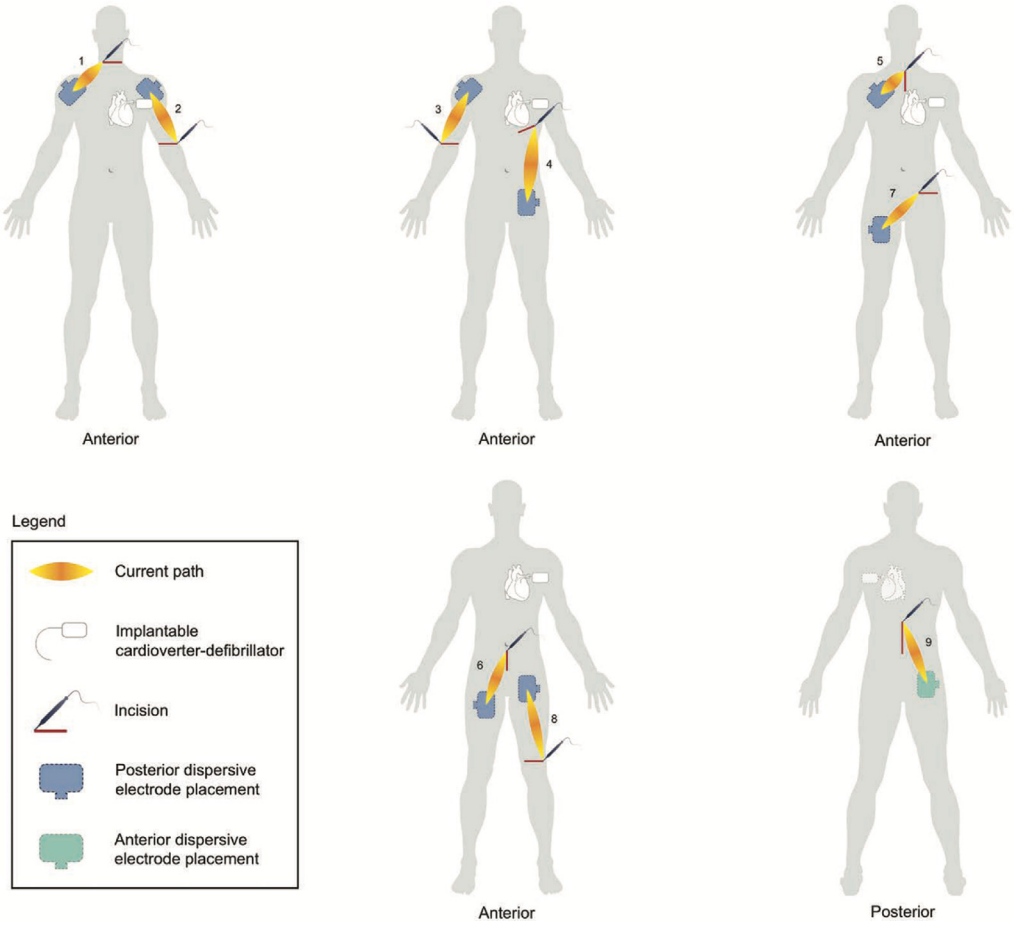

Fig. 3. Illustration of the protocolized position of electrosurgery unit-dispersive electrode positioning. Schulman PM, Treggiari MM, Yanez ND et al. Electromagnetic Interference with Protocolized Electrosurgery Dispersive Electrode Positioning in Patients with Implantable Cardioverter Defibrillators. *Anesthesiology*. 2019; 130 (4):530–540. https://doi.org/10.1097/ALN.0000000000002571.

predicting MACE in major noncardiac surgeries. Another measure of renal function, the estimated glomerular filtration rate (eGFR) predicts the risk, with decreasing eGFR associated with increased risk of MACE [21]. An eGFR of less than 45 mL/min/1.73 m^2 is a proposed cutoff to identify patients at high risk of MACE for a noncardiac surgery [21]. This eGFR value is supported by the ambulatory data from Harrison et al. [22] However, even milder degrees of renal dysfunction (e.g., eGFR less than 60 mL/min/1.73 m^2) are associated with an increased risk of MACE [23]. Patients with renal disease often have comorbidities such as diabetes and cardiopulmonary disease, which also increase the risk. The risk of perioperative death, acute MI, and hospitalization is higher for patients with CKD than in patients with normal renal function. The risk for these adverse outcomes is inversely associated with preoperative kidney function as measured by eGFR [22].

Hyperkalemia is a frequent concern and a common finding in patients with end-stage renal disease (ESRD). Hyperkalemia is more common in patients with CKD than in those without CKD. In dialysis-dependent patients having outpatient surgeries for hemodialysis access, one prospective study found that 14.3% of the patients had preoperative hyperkalemia, with an incidence as high as 38% in patients with a malfunctioning tunneled dialysis catheter [24]. While some clinicians may consider an

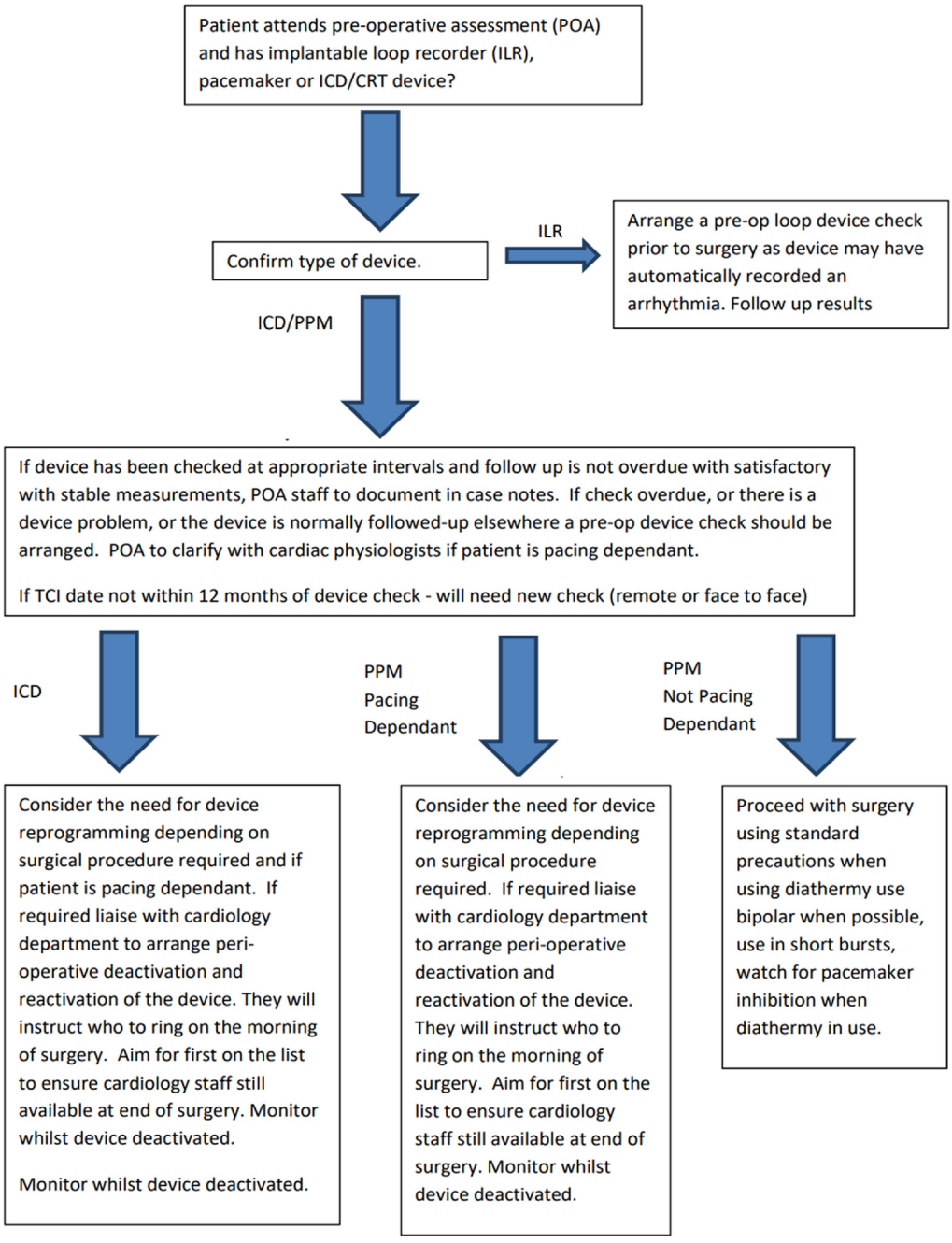

Fig. 4. Perioperative cardiac implantable electronic device management flowchart. POA, preoperative assessment; ILR, implantable loop recorder; ICD, implantable cardioverter defibrillator; CRT, cardiac resynchronization therapy; PPM, permanent pacemaker; TCI, interrogation. Thomas H, Plummer C, Wright IJ, Foley P, Turley AJ. Guidelines for the peri-operative management of people with cardiac implantable electronic devices: Guidelines from the British Heart Rhythm Society. *Anaesthesia*. 2022; 77 (7):808–817. https://doi.org/10.1111/anae.15728.

electrocardiogram (ECG) to screen for hyperkalemia, an ECG has been shown to be unreliable [25]. In a national retrospective cohort, hyperkalemia was associated with a higher odds of mortality within one day of the measurement compared with those without hyperkalemia. Among patients with hyperkalemia, there was an inverse association between the stage of CKD and the odds of 1-day mortality. Patients with chronic hyperkalemia have a reduced susceptibility to cardiac complications from hyperkalemia compared with patients with acute hyperkalemia [26]. Therefore, a patient with CKD and chronic hyperkalemia will likely better tolerate an elevated potassium concentration on the day of surgery than a patient with acute hyperkalemia. However, there is no defined safe potassium concentration to proceed with anesthesia. Recommendations for preoperative serum potassium concentrations considered too high to proceed with anesthesia vary from 5.5 mEq/L and above [24,27,28]. Patients with ESRD have safely undergone vascular access procedures with potassium concentrations greater than 6.0 mEq/L without adverse events [29].

Patients receiving dialysis having elective surgeries are at significantly increased odds for perioperative mortality compared with patients with normal kidney function [30]. Compared with patients with normal renal function, patients receiving dialysis have a 3-fold higher risk of death or MI [22]. Dialysis patients having common general surgery procedures have nine times higher odds of mortality than those without kidney disease. They also have higher rates of postoperative infectious, vascular, and pulmonary complications. Moreover, patients requiring hemodialysis have almost three times the rate of return to the operating room [31].

For some surgeries, such as vascular access procedures, patients have better outcomes at an ambulatory center compared with a hospital [32,33]. Many studies show advantages of regional anesthesia. For example, regional anesthesia improves the likelihood of arteriovenous fistula creation in place of originally scheduled arteriovenous grafting and demonstrates improved outcomes in vascular access procedures [34,35,36,37]. Additional benefits of regional anesthesia for vascular access surgeries include avoiding the hemodynamic impact of general anesthesia and decreased anesthesia times [34,36,38].

It is recommended that patients have dialysis on the day before surgery to minimize risks from anticoagulation used during dialysis, mitigate hyperkalemia, reduce acidosis, and allow resolution of fluid and electrolyte shifts [39,40]. Patients having timely dialysis (within 24 h of the procedure) with mild, well-controlled comorbidities having low–intermediate-risk procedures, particularly with regional anesthesia or sedation, can safely be cared for in an outpatient center. High-risk procedures, poorly timed dialysis, significantly elevated potassium concentrations above a patient's baseline, and significant or poorly controlled comorbidities represent unacceptable risk in ambulatory settings [26,28,39].

Chronic pain

Patients who have chronic pain, defined as persistent or recurring pain lasting more than three months, can pose challenges with postoperative pain control and with successful and timely discharge to home without requiring admission [41]. Pain management can be particularly challenging for those patients on chronic opioids and for patients with substance use disorders. Issues include excessive opioid requirements, ventilatory depression, sedation, and drug–drug interactions with commonly used medications such as methadone, buprenorphine, or naltrexone. With proper planning, including consideration of the procedure and anesthetic requirements, some of these patients can be successfully treated in ambulatory settings. Understanding the current pain control regimen helps in planning effective perioperative management. Regional, neuraxial, or local anesthesia and multimodal techniques can be used to provide analgesia and avoid reliance on opioids. Nonsteroidal anti-inflammatory drugs, acetaminophen, ketamine, and gabapentin, are options for analgesia [42]. Studies demonstrate that nonopioid regimens can be just as effective as opioids in reducing pain [43,44].

Patients on buprenorphine generally require larger-than-expected doses of opioids to achieve satisfactory analgesia. Some clinicians advocate a three-day holiday from buprenorphine before surgery to mitigate escalating opioid doses in the perioperative period. However, evidence is mounting that continuation of buprenorphine with a multimodal pain strategy is more effective [45,46,47]. If

there is a high risk of relapse in patients with substance use disorder, then buprenorphine should be continued. It is important to be aware of drugs such as ondansetron that can prolong the QT interval in patients taking methadone. Patients on naltrexone may require extremely high doses of opioids. Eliciting a history of difficult pain control with previous experiences or unplanned admissions because of pain should prompt clinicians to consider hospital-based resources, particularly if the planned surgery is typically associated with high levels of pain.

Obesity

Obesity alone presents challenges to anesthesia providers. Obesity is also frequently associated with a variety of comorbidities. Diabetes, hypertension, and pulmonary dysfunction are commonly present in obese patients. Patients with obesity and metabolic syndrome are at high risk of all-cause mortality, CAD, and HF [48]. In general, however, body mass index (BMI) should not be the sole determinant of suitability for ambulatory surgery. Decisions consider patient comorbidities. Obese patients undergoing ambulatory surgeries were not found to have an increased rate of unanticipated admissions [49]. However, patients with a BMI of 50 kg/m^2 or greater are at an increased risk for perioperative complications and should be carefully considered if appropriate for care at ambulatory centers [49,50].

Ventilatory mechanics are impacted at the baseline in patients with obesity and are exacerbated by positioning for procedures because of reduced chest wall and diaphragmatic excursion. Anesthesia further reduces ventilatory function [48]. Securing intravenous access in obese patients may be problematic [51]. Ultrasonographic guidance may improve success [52]. Similarly, airway management may be difficult in obese patients. Mask ventilation, laryngoscopy, intubation, and tracheostomy are more challenging [53,54,55]. Excessive tissue can be present externally in the neck and chest, and internally in the mouth and pharynx. Obstructive sleep apnea (OSA) is frequently associated with obesity and found in greater than 70% of the patients with a BMI above 35 kg/$m^{2.}$ [48] Patients with obesity-hypoventilation syndrome are at even higher risk for poor outcomes compared with patients with OSA or obese patients without an obesity-related breathing disorder. Patients with OSA are more likely to have complications related to opioids [48]. However, OSA is not an independent determinant of perioperative outcomes [49].

Difficult airways

When caring for patients with predicted difficult airways, proper planning can mitigate potential issues. Anesthetic techniques using short-acting medications at low doses, regional, and local anesthesia can avoid the need for intubation in some cases [56]. Appropriate emergency and alternative airway equipment should be immediately available as the need may arise to secure the airway despite efforts to avoid intubation. Proper patient selection and preparation and a keen understanding of local resources are critical. The presence of a chronic tracheostomy itself is not disqualifying for an outpatient center, but the medical comorbidities such as severe developmental delay, neurological disease, or pulmonary dysfunction may be more important to consider suitability in any given setting.

Developmental and cognitive disabilities

An often-overlooked patient population that may present unique challenges in resource-limited settings are individuals with cognitive and developmental limitations and those with psychiatric disorders. These patients should be carefully screened before the day of surgery to ensure they are suitable for an ambulatory setting. Clinicians must be confident that the patient will not offer to undo physical or verbal resistance. In some settings, uncooperative behavior can be overcome with additional staff, and, if necessary, pharmacological techniques, which may not be available in an office or free-standing outpatient center [57]. However, uneventful past experiences of the patient and use of prearrival medications often support care in diverse locations.

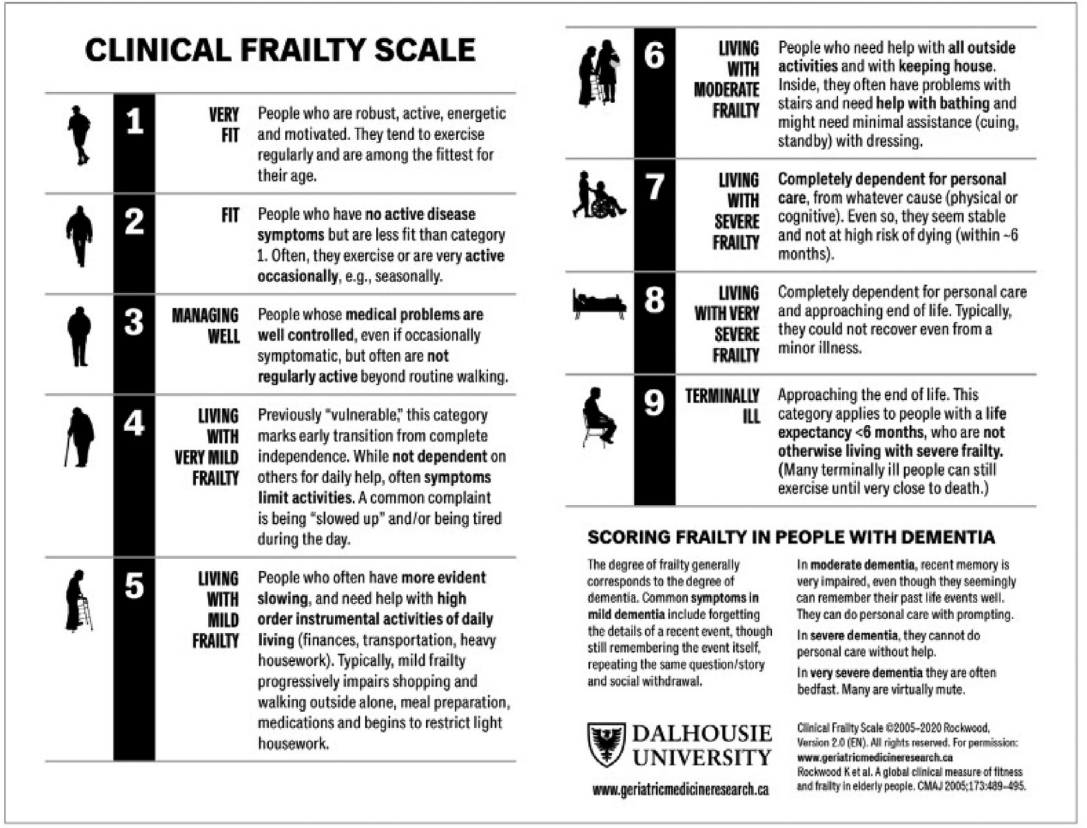

Fig. 5. The clinical frailty scale (CFS) version 2.0. Rockwood K, Theou O. Using the Clinical Frailty Scale in Allocating Scarce Health Care Resources. *Can Geriatr J*. 2020; 23 (3):210–215. Published 2020 Sep 1. https://doi.org/10.5770/cgj.23.463.

ECG	• Arrhythmias • Acute ischemia • Syncope
Complete blood count	• Anemia • Cirrhosis
Pregnancy test	Offered to women of childbearing age for whom the result will alter management
Coagulation studies PT/INR, activated partial thromboplastin time, platelet count)	• Personal/family history of bleeding • Warfarin use (PT/INR) • Cirrhosis (PT/INR, platelet count) • Significant malnutrition
Polysomnography	Positive sleep apnea screen (e.g., STOP-Bang ≥5)
Chest radiograph	New or active pulmonary symptoms
Type and screen	• Pregnancy termination (Rh) • Anticipated blood loss >500 cc
Electrolytes	• Diuretic use • ESRD
Creatinine	Use of contrast dye
Glucose	If hypoglycemia, diabetic ketoacidosis, or hyperglycemic, hyperosmolar nonketosis is suspected

Fig. 6. Preoperative (noncardiac) testing in ambulatory surgery patients. Patients having cataract surgery do not require preoperative testing. ECG, electrocardiogram; PT, prothrombin time; INR, international normalized ratio; ESRD, end-stage renal disease. Okocha O, Gerlach RM, Sweitzer B. Preoperative Evaluation for Ambulatory Anesthesia: What, When, and How? *Anesthesiol Clin.* 2019; 37 (2):195–213. https://doi.org/10.1016/j.anclin.2019.01.014.

Frailty

Frailty is a decrease in physiological reserve, reduced ability to execute ADLs, poor nutritional status, and decline in cognition. Frail patients are intolerant of even low levels of surgical stress from minor surgical procedures [58]. Increasing frailty is associated with worse perioperative outcomes such as increased mortality, readmission rates, length of stay, and surgical complications [28,59,60,61]. There is no accepted standard for measuring frailty. However, the clinical frailty scale (CFS) (Fig. 5) is a simple bedside assessment, and the risk analysis index provides a robust assessment using variables across multiple domains [28,58]. A retrospective study of frail patients having minor outpatient procedures identified the use of local anesthetics with monitored anesthesia care (MAC) as the only modifiable covariate that was associated with decreased odds of serious complications [59]. A specific age cutoff for ambulatory surgery has not been established. Rather, a patient's physiological reserve and ability to tolerate surgical stress using a validated frailty assessment tool such as the CFS should be considered instead of the physiological age. Age alone should not be used to exclude patients from ambulatory surgery.

Venous thromboembolism

Patients and associated procedures with increased risk for postoperative VTE include age over 60 years, cases 120 min or longer, BMI 40 kg/m^2 or greater, cancer, pregnancy, and arthroscopic or venous surgeries [62]. Based on the number of these criteria present, having outpatient surgery in this high-risk population has been shown to have as high as a 20-fold increase in VTE requiring therapy compared with patients considered low risk [63]. Furthermore, this high-risk group in the ambulatory setting has a VTE risk similar to inpatient populations with demonstrated 30-day VTE rates of 1.18% during ambulatory surgery versus 1.44% for all inpatients [62,63]. Other risk factors for postoperative VTE include personal or family history of VTE, known thrombophilia, use of hormone replacement therapy or oral contraceptives, and inflammatory bowel disease [62]. Despite the elevated risk of VTE in high-risk patients who undergo ambulatory surgery with increasing frequency, outpatient centers have been slow to adopt guidelines to address patient selection or management protocols, and even fewer adhere to them [64].

Preoperative testing

A commonly debated issue is whether laboratory and ancillary testing assist with the selection of patients for outpatient surgery. Preoperative testing of ASA-PS I and II patients generally only increases costs, wait times, and patient and provider frustrations. Testing may lead to further unnecessary care because of inaccurate or unhelpful results. Routine, untargeted testing in healthy patients only reassures providers at the expense of patients, with no actual clinical utility [65]. It is important to only order tests that address specific questions that will affect the patient management. If the result will impact clinical decision-making, testing may be appropriate in ASA-PS III and IV patients, particularly those having intermediate- or high-risk procedures. Fig. 6 reviews commonly ordered tests and their indications in the perioperative setting.

Summary

Not all outpatient settings have the same capabilities. Careful patient selection that accounts for available resources is one of the most important steps to ensure the safe conduct of a surgery in the ambulatory environment. Cardiac disease, renal dysfunction, obesity, cognitive dysfunction, and frailty are factors that can significantly influence the safety of and decision to proceed with a procedure in the ambulatory setting. Other patient characteristics such as the ability to independently perform ADLs and the number of prescribed medications can also predict a patient's surgical risk. It is important that any given patient care setting has the equipment, personnel, and training necessary to effectively care for their patients and properly handle emergencies that may arise. Ultimately, patient selection for procedures outside of a hospital setting is the responsibility of the proceduralist and the anesthesiologist.

Practice points

- The patient's ability to carry out activities of daily living (ADLs), including eating, dressing, and bathing, is a predictor of surgical outcomes.
- The absolute number and type of prescription medications are a readily available source of information that can be used as a surrogate for comorbidities and to predict outcomes.
- Patients with recent myocardial infarction (MI), percutaneous interventions within 6 months, severe angina, significant arrhythmias such as ventricular tachycardia or atrial fibrillation (AF) with rapid ventricular rates (RVRs), severe valvular disease, or advanced or symptomatic heart failure (HF) are poor candidates for ambulatory surgery.
- In many cases, it is safe to care for patients with cardiac implantable electronic devices (CIEDs) in ambulatory surgical centers, provided the device is managed appropriately and the underlying cardiac condition is stable and of acceptable risk.
- Patients with new-onset or newly discovered AF in the perioperative period have an increased risk of stroke and mortality after surgery, both short (30-day) and long term.
- HF of any degree increases 90-day mortality and 30-day complication rates compared with patients without HF having ambulatory procedures.
- The risk of perioperative death, acute MI, and hospitalization is higher for patients with chronic kidney disease (CKD) compared with patients with normal renal function.
- It is recommended that patients have dialysis on the day before surgery to minimize risks from anticoagulation used during dialysis, mitigate hyperkalemia, reduce acidosis, and allow resolution of fluid and electrolyte shifts.
- Recommendations for preoperative serum potassium concentrations considered too high to proceed with anesthesia vary from 5.5 mEq/L and above.
- Eliciting a history of difficult pain control with previous experiences or unplanned admissions because of pain should prompt clinicians to consider hospital-based resources, particularly if the planned surgery is typically associated with high levels of pain.
- Body mass index (BMI) should not be the sole determinant of suitability for an ambulatory surgery.
- Increasing frailty is associated with worse perioperative outcomes such as increased mortality, readmission rates, length of stay, and surgical complications.
- Patients and associated procedures with increased risk for postoperative venous thromboembolism (VTE) include age over 60 years, cases 120 min or longer, BMI 40 kg/m^2 or greater, cancer, pregnancy, and arthroscopic or venous surgeries.
- Preoperative testing of the American Society of Anesthesiologists physical status (ASA-PS) I and II patients generally only increases costs, wait times, and patient and provider frustrations.

Research agenda

- More research is needed to determine perioperative stroke risk in ambulatory surgery.
- More research is needed on how best to manage patients with chronic pain having ambulatory surgery.
- More research is needed on risk assessment of VTE and best practices to reduce VTE complications in patients having ambulatory surgery.

Disclaimer

The views expressed in this article are those of the authors and do not reflect the official policy of the Department of Army/Navy/Air Force, Department of Defense, or U.S. Government.

Declaration of competing interest

None.

References

*[1] Sweitzer B, Rajan N, Schell D, et al. Preoperative care for cataract surgery: the society for ambulatory anesthesia position statement. Anesth Analg 2021;133(6):1431–6. https://doi.org/10.1213/ANE.0000000000005652.

[2] American Society of Anesthesiologists Committee on Ambulatory Surgical Care. Guidelines for Office-Based Anesthesia. October 23, 2019. https://www.asahq.org/standards-and-guidelines/guidelines-for-office-based-anesthesia. [Accessed 26 October 2022]. Accessed.

[3] American Society of Anesthesiologists Committee on Ambulatory Surgical Care. Guidelines for Ambulatory Anesthesia and Surgery. October 17, 2018. https://www.asahq.org/standards-and-guidelines/guidelines-for-ambulatory-anesthesia-and-surgery. [Accessed 26 October 2022]. Accessed.

[4] Visnjevac O, Davari-Farid S, Lee J, et al. The effect of adding functional classification to ASA status for predicting 30-day mortality. Anesth Analg 2015;121(1):110–6. https://doi.org/10.1213/ANE.0000000000000740.

[5] Dietrich M, Zingg PO, Egbring M, et al. Pre-hospital medications in total hip arthroplasty: risk factors for poor outcomes. Hip Int 2015;25(3):215–20. https://doi.org/10.5301/hipint.5000227.

[6] Fleisher LA, Fleischmann KE, Auerbach AD, et al. ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. 2014 J Am Coll Cardiol 2014;64(22):e77–137. https://doi.org/10.1016/j.jacc.2014.07.944.

[7] Jørgensen ME, Torp-Pedersen C, Gislason GH, et al. Time elapsed after ischemic stroke and risk of adverse cardiovascular events and mortality following elective noncardiac surgery. JAMA 2014;312(3):269–77. https://doi.org/10.1001/jama.2014.8165.

*[8] Levine GN, Bates ER, Bittl JA, et al. ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease: a Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines: an Update of the 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention, 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery, 2012 ACC/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease, 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction, 2014 AHA/ACC Guideline for the Management of Patients With Non-ST-Elevation Acute Coronary Syndromes, and 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery [published correction appears in Circulation. 2016 Sep 6;134(10):e192-4]. 2016 Circulation 2016;134(10):e123–55. https://doi.org/10.1161/CIR.0000000000000404.

[9] Graham MM, Sessler DI, Parlow JL, et al. Aspirin in patients with previous percutaneous coronary intervention undergoing noncardiac surgery. Ann Intern Med 2018;168(4):237–44. https://doi.org/10.7326/M17-2341.

[10] Albaladejo P, Marret E, Samama CM, et al. Non-cardiac surgery in patients with coronary stents: the RECO study. Heart 2011;97(19):1566–72. https://doi.org/10.1136/hrt.2011.224519.

*[11] Glance LG, Benesch CG, Holloway RG, et al. Association of time elapsed since ischemic stroke with risk of recurrent stroke in older patients undergoing elective nonneurologic, noncardiac surgery. JAMA Surg 2022;157(8):e222236. https://doi.org/10.1001/jamasurg.2022.2236.

[12] Crossley GH, Poole JE, Rozner MA, et al. The Heart Rhythm Society (HRS)/American Society of Anesthesiologists (ASA) Expert Consensus Statement on the perioperative management of patients with implantable defibrillators, pacemakers and arrhythmia monitors: facilities and patient management this document was developed as a joint project with the American Society of Anesthesiologists (ASA), and in collaboration with the American Heart Association (AHA), and the Society of Thoracic Surgeons (STS). Heart Rhythm 2011;8(7):1114–54. https://doi.org/10.1016/j.hrthm.2010.12.023.

[13] Rooke GA, Bowdle TA. Perioperative management of pacemakers and implantable cardioverter defibrillators: it's not just about the magnet. Anesth Analg 2013;117(2):292–4. https://doi.org/10.1213/ANE.0b013e31829799f3.

[14] Rooke GA. Misadventures with implantable cardioverter-defibrillators: the hits just keep on coming. In Pract 2020;14(11):e01317. https://doi.org/10.1213/XAA.0000000000001317.

*[15] Rosero EB, Rajan N, Joshi GP. Pro-con debate: are patients with a cardiovascular implantable electronic device suitable to receive care in a free-standing ambulatory surgery center? Anesth Analg 2022;134(5):919–25. https://doi.org/10.1213/ANE.0000000000005776.

[16] Tully BW, Gerstein NS, Schulman PM. Electromagnetic interference with an underbody dispersive electrode in a patient with an implantable cardioverter-defibrillator undergoing noncardiac surgery: a Case Report. In Pract 2020;14(11):e01285. https://doi.org/10.1213/XAA.0000000000001285.

[17] Kitajima A, Nakatomi T, Otsuka Y, et al. Cardiac arrest due to failed pacemaker capture after peripheral nerve blockade with levobupivacaine: a Case Report. In Pract 2021;15(4):e01445. https://doi.org/10.1213/XAA.0000000000001445. Published 2021 Apr 1.

[18] Lin MH, Kamel H, Singer DE, et al. Perioperative/postoperative atrial fibrillation and risk of subsequent stroke and/or mortality. Stroke 2019;50(6):1364–71. https://doi.org/10.1161/STROKEAHA.118.023921.

*[19] Lerman BJ, Popat RA, Assimes TL, et al. Association between heart failure and postoperative mortality among patients undergoing ambulatory noncardiac surgery. JAMA Surg 2019;154(10):907–14. https://doi.org/10.1001/jamasurg.2019.2110.

[20] Smilowitz NR, Zhao Q, Wang L, et al. Risk of venous thromboembolism after new onset heart failure. 2019 Sci Rep 2019 Nov 22;9(1):17415. https://doi.org/10.1038/s41598-019-53641-0. Published.

[21] Mases A, Sabaté S, Guilera N, et al. Preoperative estimated glomerular filtration rate and the risk of major adverse cardiovascular and cerebrovascular events in non-cardiac surgery. Br J Anaesth 2014;113(4):644–51. https://doi.org/10.1093/bja/aeu134.

*[22] Harrison TG, Hemmelgarn BR, James MT, et al. Association of kidney function with major postoperative events after non-cardiac ambulatory surgeries: a population-based cohort study [published online ahead of print, 2021 Jul 7]. Ann Surg 2021. https://doi.org/10.1097/SLA.0000000000005040.
[23] Mooney JF, Ranasinghe I, Chow CK, et al. Preoperative estimates of glomerular filtration rate as predictors of outcome after surgery: a systematic review and meta-analysis. Anesthesiology 2013;118(4):809–24. https://doi.org/10.1097/ALN.0b013e318287b72c.
[24] Ross J, DeatherageHand D. Evaluation of potassium levels before hemodialysis access procedures. Semin Dial 2015;28(1):90–3. https://doi.org/10.1111/sdi.12243.
[25] Aslam S, Friedman EA, Ifudu O. Electrocardiography is unreliable in detecting potentially lethal hyperkalaemia in haemodialysis patients. Nephrol Dial Transpl 2002;17(9):1639–42. https://doi.org/10.1093/ndt/17.9.1639.
[26] Einhorn LM, Zhan M, Hsu VD, et al. The frequency of hyperkalemia and its significance in chronic kidney disease. Arch Intern Med 2009;169(12):1156–62. https://doi.org/10.1001/archinternmed.2009.132.
[27] Schonberger R. Chapter 21: fluid, electrolyte, and acid-base disorders. In: Hines RL, Marschall KE, editors. Stoelting's anesthesia and Co-existing disease. 7th ed. Philadelphia, PA: Elsevier; 2018. p. 416.
[28] Rajan N, Rosero EB, Joshi GP. Patient selection for adult ambulatory surgery: a Narrative Review. Anesth Analg 2021;133(6):1415–30. https://doi.org/10.1213/ANE.0000000000005605.
[29] Olson RP, Schow AJ, McCann R, et al. Absence of adverse outcomes in hyperkalemic patients undergoing vascular access surgery. Can J Anaesth 2003;50(6):553–7. https://doi.org/10.1007/BF03018639.
[30] Palamuthusingam D, Nadarajah A, Pascoe EM, et al. Postoperative mortality in patients on chronic dialysis following elective surgery: a systematic review and meta-analysis. 2020 PLoS One 2020 Jun 26;15(6):e0234402. https://doi.org/10.1371/journal.pone.0234402. Published.
[31] Brakoniecki K, Tam S, Chung P, et al. Mortality in patients with end-stage renal disease and the risk of returning to the operating room after common general surgery procedures. Am J Surg 2017;213(2):395–8. https://doi.org/10.1016/j.amjsurg.2016.03.009.
[32] Dobson A, El-Gamil AM, Shimer MT, et al. Clinical and economic value of performing dialysis vascular access procedures in a freestanding office-based center as compared with the hospital outpatient department among Medicare ESRD beneficiaries. Semin Dial 2013;26(5):624–32. https://doi.org/10.1111/sdi.12120.
[33] Sawant A, Mills PK, Dhingra H. Increased length of stay and costs associated with inpatient management of vascular access failures. Semin Dial 2013;26(1):106–10. https://doi.org/10.1111/j.1525-139X.2012.01083.x.
[34] Flaherty J, Horn JL, Derby R. Regional anesthesia for vascular surgery. Anesthesiol Clin 2014;32(3):639–59. https://doi.org/10.1016/j.anclin.2014.05.002.
[35] Cole NM, Vlassakov K, Brovman EY, et al. Regional anesthesia for arteriovenous fistula surgery may reduce hospital length of stay and reoperation rates. Vasc Endovasc Surg 2018;52(6):418–26. https://doi.org/10.1177/1538574418772451.
[36] Jorgensen MS, Farres H, James BLW, et al. The role of regional versus general anesthesia on arteriovenous fistula and graft outcomes: a single-institution experience and literature review. Ann Vasc Surg 2020;62:287–94. https://doi.org/10.1016/j.avsg.2019.05.016.
[37] Zarkowsky DS, Wu B, Gray AT, et al. Functional outcomes of arteriovenous fistulas recruited with regional anesthesia. J Vasc Surg 2020;71(2):584–91. https://doi.org/10.1016/j.jvs.2019.03.083. e1.
[38] Mariano ER, Chu LF, Peinado CR, et al. Anesthesia-controlled time and turnover time for ambulatory upper extremity surgery performed with regional versus general anesthesia. J Clin Anesth 2009;21(4):253–7. https://doi.org/10.1016/j.jclinane.2008.08.019.
[39] Trainor D, Borthwick E, Ferguson A. Perioperative management of the hemodialysis patient. Semin Dial 2011;24(3):314–26. https://doi.org/10.1111/j.1525-139X.2011.00856.x.
[40] Renew JR, Pai SL. A simple protocol to improve safety and reduce cost in hemodialysis patients undergoing elective surgery. Middle East J Anaesthesiol 2014;22(5):487–92.
[41] Scholz J, Finnerup NB, Attal N, et al. The IASP classification of chronic pain for ICD-11: chronic neuropathic pain. Pain 2019;160(1):53–9. https://doi.org/10.1097/j.pain.0000000000001365.
[42] Charipova K, Gress KL, Urits I, et al. Management of patients with chronic pain in ambulatory surgery centers. 2020 Cureus 2020 Sep 12;12(9):e10408. https://doi.org/10.7759/cureus.10408. Published.
[43] Jones CA, Throckmorton TW, Murphy J, et al. Opioid-sparing pain management protocol after shoulder arthroplasty results in less opioid consumption and higher satisfaction: a Prospective, randomized controlled trial. J Shoulder Elbow Surg 2022;S1058–2746(22):552–3. https://doi.org/10.1016/j.jse.2022.05.029.
[44] Berardino K, Carroll AH, Popovsky D, et al. Opioid use consequences, governmental strategies, and alternative pain control techniques following total hip arthroplasties. Orthop Rev 2022;14(4):35318. https://doi.org/10.52965/001c.35318.
[45] Bryson EO, Lipson S, Gevirtz C. Anesthesia for patients on buprenorphine. Anesthesiol Clin 2010;28(4):611–7. https://doi.org/10.1016/j.anclin.2010.08.005.
*[46] Hickey T, Abelleira A, Acampora G, et al. Perioperative buprenorphine management: a multidisciplinary approach. Med Clin 2022;106(1):169–85. https://doi.org/10.1016/j.mcna.2021.09.001.
[47] Kohan L, Potru S, Barreveld AM, et al. Buprenorphine management in the perioperative period: educational review and recommendations from a multisociety expert panel. Reg Anesth Pain Med 2021;46(10):840–59. https://doi.org/10.1136/rapm-2021-103007.
[48] Cullen A, Ferguson A. Perioperative management of the severely obese patient: a selective pathophysiological review. Can J Anaesth 2012;59(10):974–96. https://doi.org/10.1007/s12630-012-9760-2.
[49] Joshi GP, Ahmad S, Riad W, et al. Selection of obese patients undergoing ambulatory surgery: a systematic review of the literature. Anesth Analg 2013;117(5):1082–91. https://doi.org/10.1213/ANE.0b013e3182a823f4.
[50] Moon TS, Joshi GP. Are morbidly obese patients suitable for ambulatory surgery? Curr Opin Anaesthesiol 2016;29(1):141–5. https://doi.org/10.1097/ACO.0000000000000266.
[51] Adams JP, Murphy PG. Obesity in anaesthesia and intensive care. Br J Anaesth 2000;85(1):91–108. https://doi.org/10.1093/bja/85.1.91.

[52] Costantino TG, Parikh AK, Satz WA, et al. Ultrasonography-guided peripheral intravenous access versus traditional approaches in patients with difficult intravenous access. Ann Emerg Med 2005;46(5):456–61. https://doi.org/10.1016/j.annemergmed.2004.12.026.
[53] Aceto P, Perilli V, Modesti C, et al. Airway management in obese patients. Surg Obes Relat Dis 2013;9(5):809–15. https://doi.org/10.1016/j.soard.2013.04.013.
[54] Kristensen MS. Airway management and morbid obesity. Eur J Anaesthesiol 2010;27(11):923–7. https://doi.org/10.1097/EJA.0b013e32833d91aa.
[55] Wadhwa A, Singh PM, Sinha AC. Airway management in patients with morbid obesity. Int Anesthesiol Clin 2013;51(3):26–40. https://doi.org/10.1097/AIA.0b013e318298140f.
*[56] Grewal G, Joshi GP. Obesity and obstructive sleep apnea in the ambulatory patient. Anesthesiol Clin 2019;37(2):215–24. https://doi.org/10.1016/j.anclin.2019.01.001.
[57] Charipova K, Urits I, Viswanath O, et al. Preoperative assessment and optimization of cognitive dysfunction and frailty in the ambulatory surgical patient. Curr Opin Anaesthesiol 2020;33(6):732–9. https://doi.org/10.1097/ACO.0000000000000901.
*[58] Shinall Jr MC, Arya S, Youk A, et al. Association of preoperative patient frailty and operative stress with postoperative mortality. JAMA Surg 2020;155(1):e194620. https://doi.org/10.1001/jamasurg.2019.4620.
[59] Seib CD, Rochefort H, Chomsky-Higgins K, et al. Association of patient frailty with increased morbidity after common ambulatory general surgery operations. JAMA Surg 2018;153(2):160–8. https://doi.org/10.1001/jamasurg.2017.4007.
[60] Makary MA, Segev DL, Pronovost PJ, et al. Frailty as a predictor of surgical outcomes in older patients. J Am Coll Surg 2010;210(6):901–8. https://doi.org/10.1016/j.jamcollsurg.2010.01.028.
[61] Okocha O, Gerlach RM, Sweitzer B. Preoperative evaluation for ambulatory anesthesia: what, when, and how? Anesthesiol Clin 2019;37(2):195–213. https://doi.org/10.1016/j.anclin.2019.01.014.
*[62] Pannucci CJ, Shanks A, Moote MJ, et al. Identifying patients at high risk for venous thromboembolism requiring treatment after outpatient surgery. Ann Surg 2012;255(6):1093–9. https://doi.org/10.1097/SLA.0b013e3182519ccf.
[63] Bahl V, Hu HM, Henke PK, et al. A validation study of a retrospective venous thromboembolism risk scoring method. Ann Surg 2010;251(2):344–50. https://doi.org/10.1097/SLA.0b013e3181b7fca6.
[64] Shabbir J, Ridgway PF, Shields W, et al. Low molecular weight heparin prophylaxis in day case surgery. Ir J Med Sci 2006;175(4):26–9. https://doi.org/10.1007/BF03167963.
[65] Vikas M, John K, Apruzzese P, et al. Utility of preoperative laboratory testing in ASA 1 & ASA 2 patients undergoing outpatient surgery in the United States. J Clin Anesth 2022;76:110580. https://doi.org/10.1016/j.jclinane.2021.110580.