CLINICAL PRACTICE RECOMMENDATIONS

Society for Ambulatory Anesthesia Position Statement on Risk Assessment and Prophylaxis for Prevention of Venous Thromboembolism After Ambulatory Surgery: A Simplified Approach

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Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT), pulmonary embolism (PE), and post-thrombotic syndrome (PTS), affects up to 900,000 people in the United States each year and as many as 60,000 to 100,000 of these patients may die. More than half of the VTE events occurring after hospital discharge are directly linked to a recent hospitalization or surgery. Sudden death is the first symptom in 25% of those who experience a PE, so prevention of VTE is of paramount importance. Several professional organizations have published perioperative guidelines for VTE prevention and accreditation organizations have incorporated VTE risk assessment and prophylaxis in their standards. Ambulatory anesthesiologists, by being part of multidisciplinary teams to establish enhanced recovery pathways at their outpatient facilities, play a pivotal role in identifying patients at risk for developing VTE, customizing risk assessment tools, and establishing thromboprophylaxis protocols for patients at their centers. In addition, anesthesiologists can play a key role in patient education, which is an important component of VTE prevention. With increased migration of complex procedures and patients to the outpatient setting, VTE risk in the high-risk groups of patients approaches inpatient levels. This position statement from the Society for Ambulatory Anesthesia (SAMBA) is tailored toward ambulatory surgery centers and summarizes and synthesizes existing VTE risk assessment and prophylaxis tools into an easy-to-use algorithm. (Anesth Analg 2026;XXX:00–00)

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT), pulmonary embolism (PE), and post-thrombotic syndrome (PTS), is a significant public health concern.[1] The Centers for Disease Control and Prevention (CDC) estimates that up to 900,000 people in the United States are affected each year by VTE and as many as 60,000 to 100,000 of these patients may die.[2,3] More than half of the VTE events occurring after hospital discharge are directly linked to a recent hospitalization or surgery.[2] VTE is also associated with reduced survival, substantial health-care costs, and a high rate of recurrence.[3] Sudden death is the first symptom in 25% of those who experience a PE, so prevention of VTE is of paramount importance.[2] The CDC, Agency for Health Research and Quality, Centers for Medicare and Medicaid Services, The Joint Commission, and the National Quality Forum have undertaken strategic initiatives to address this problem.[3,4] Several professional organizations have published perioperative guidelines for VTE prevention[5–7] and accreditation organizations have incorporated VTE risk assessment and prophylaxis in their standards.[8]

Ambulatory surgery has been shown to not only offer significant cost savings over inpatient surgery, but also, and more importantly, superior 30-day outcomes relative to inpatient-based care.[9] Therefore, a growing share of surgeries in the United States has shifted from the inpatient to the outpatient setting.[10] Given the trend toward increasingly complex procedures being performed in patients with multiple comorbid conditions in the ambulatory setting, it is imperative to evaluate for the risk of VTE.[11] Ambulatory anesthesiologists, by being part of multidisciplinary teams to establish enhanced recovery pathways at their outpatient facilities, play a pivotal role in identifying patients at risk for developing VTE, and customizing risk assessment tools, and establishing thromboprophylaxis protocols for patients at their centers.[11] In addition, anesthesiologists can play a key role in patient education, which is an important component of VTE prevention.

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This is a position statement from the Society for Ambulatory Anesthesia (SAMBA) tailored toward ambulatory surgery centers (ASCs) where VTE risk assessment may often be overlooked for many reasons of which the most prominent reasons observed by SAMBA members are: (1) the belief that ambulatory surgery does not increase risk for VTE and (2) the high-volume throughput of these centers making it cumbersome to implement the many inpatient VTE risk assessment tools. With increased migration of complex procedures and patients to the outpatient setting, VTE risk in the high-risk groups approaches inpatient levels.[9–11] A task force comprised of SAMBA members critically appraised the existing literature to develop a position statement with suggestions for VTE risk assessment and prophylaxis in adult patients undergoing ambulatory surgery. In addition, areas where further research should be prioritized were also identified. The position statement was reviewed and approved by the SAMBA Board of Directors. This position statement summarizes and synthesizes existing VTE risk assessment and prophylaxis tools into an easy-to-use algorithm. Though the algorithm is not yet validated and much more research needs to be done in this area, it does represent the most common elements of current practice among many SAMBA members and similar clinical decision support algorithms and protocols are currently being used by SAMBA members.

BACKGROUND EVIDENCE

A directed literature review of the PubMed and Medline databases was performed to identify studies describing incidence, risk factors, and prophylaxis of postoperative VTE published from inception to September 30, 2025. The searches used Boolean operators to combine keywords and related terms relevant to the topic of interest including but limited to ambulatory surgery and VTE. The search terms used included venous thromboembolism, VTE, risk stratification, prophylaxis, ambulatory surgery, outpatient surgery, day surgery, postoperative VTE, risk factors for postoperative VTE, risk factors for VTE in ambulatory surgery, incidence of postoperative VTE, postoperative VTE screening tools, postoperative VTE screening tools in ambulatory surgery, postoperative VTE prophylaxis, postoperative VTE prophylaxis in ambulatory surgery, and VTE prophylaxis anesthesiologist's role. Inclusion criteria were studies published in English, including adult patients undergoing ambulatory surgery, evaluating the incidence, risk factors, screening tools, prophylaxis, and management of VTE. Authors NR and JG reviewed titles, abstracts, and full-text articles and articles pertaining specifically to ambulatory surgery were retained.

The search yielded nine articles pertaining to ambulatory surgery of which one was a guideline,[6] six were review articles,[12–17] one was an opinion piece,[18] and one was a prospective observational cohort study.[19] Overall, the evidence for VTE prophylaxis in ambulatory surgery patients is sparse, heterogenous, and of low-quality. Therefore, the task force considered data from studies involving the inpatient population that were thought to be relevant for the outpatient population which are referenced throughout the document.

INCIDENCE OF VTE IN AMBULATORY SURGERY

The incidence of VTE in the hospitalized surgical population is well established. A retrospective cohort study of 1,432,855 patients undergoing surgery under general anesthesia at 315 American hospitals from 2005 to 2011 found an overall VTE rate of 0.96% with DVT rates of 0.71% and PE rates of 0.33%.[20] Unlike studies in hospitalized patients, few studies have evaluated VTE risk in the ambulatory surgery patient population. A comprehensive, multicenter, prospective study of more than 200,000 outpatient procedures using data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) found an overall 30-day VTE incidence of 0.15% and an incidence of 1.18% in the "highest risk" outpatients.[19] The "highest risk" outpatients had rates similar to the inpatient surgical population. A review of elective outpatient general surgery procedures excluding bariatric, oncologic, orthopedic, vascular, and plastic surgeries found a 30-day VTE incidence of up to 0.5%.[21] The lower incidence of VTE was likely because the study primarily included low-risk surgical procedures such as laparoscopic cholecystectomy and inguinal/ventral hernia procedures, which differ significantly from the current surgical population at many outpatient centers.

Overall, while most ambulatory surgical patients have a lower risk of developing a VTE event, the highest risk subgroup of patients has a 30-day VTE risk that approaches inpatient surgical population levels. These results underscore the need to identify and prevent VTE in ambulatory surgical patients, particularly those at highest risk. However, <50% of ASCs screen for VTE or implement treatment based on that screening.[19] The majority of ambulatory procedures and patients pose a lower risk of developing VTE not because of the setting but because of their minimally invasive nature and lower comorbidity burden respectively. However, it is important for practitioners in the ambulatory setting to be aware that with the migration of more complex patients and procedures to the ambulatory setting, the VTE risk in these groups approaches inpatient settings. Thus, going forward, it is important for ASCs to have the

processes and policies to identify and provide appropriate VTE prophylaxis for these patients.

VTE RISK ASSESSMENT AND PROPHYLAXIS

Risk assessment tailored to the ambulatory patient population and the surgical complexity should determine the approach to VTE prophylaxis. Several VTE risk assessment tools exist with much of the focus on the hospitalized surgical patient (eg, Caprini Risk Assessment Model,[22,23] Pannucci Risk Assessment Model,[19] COBRA Risk Assessment Model,[24] and other modified versions of these models),[5,25,26] however, incorporating these models into existing order sets poses obstacles in environments with lean staffing, such as ambulatory surgical centers.[26,27] AI-integrated clinical decision support functions in modern electronic medical records (EMR)s will likely be able to support the efficient use of more complex validated VTE risk assessment models for all patient populations including outpatients in the future. However, most ASCs do not have electronic medical records. It is important to recognize that all risk assessment models have limitations in predictability. For instance, unpredictable events during surgery, such as bleeding or changes in surgical procedures, can impact prophylaxis plans and cannot be fully accounted for in preoperative assessments. Furthermore, balancing the potential benefits of preventing a VTE event with the risks of bleeding and other adverse effects from prophylactic measures is crucial.[28] Regardless of the disposition after surgery, the ideal VTE risk assessment tool at a minimum should consist of the key components presented in Box 1. These components are the expert consensus of the task force as to the qualities of an ideal VTE risk assessment tool in the ambulatory setting.

The two main categories of VTE risk assessment models are qualitative models and quantitative models.[3] Qualitative models categorize patients into general risk groups to guide decisions about VTE prevention. While these models are easy to use in clinical practice, they are often criticized for their simplicity and potentially overprescribing prophylaxis due to a low threshold for initiation. Quantitative models use a point-based approach to assess the potential risk of VTE. These models assign weighted scores to individual VTE risk factors based on their estimated contribution to a VTE event. The summed score then categorizes patients into distinct VTE risk levels.

CAPRINI RISK ASSESSMENT MODEL

The Caprini model is the most frequently used quantitative tool for assessing the risk of VTE.[22] It has been extensively validated in over 5 million patients and more than 250 clinical trials globally.[23] This model calculates a patient's risk based on their individual risk factors, assigning points that reflect their relative contribution to the likelihood of developing a thrombotic event.[22] The total score then categorizes the patient into one of four risk levels, guiding doctors to customize preventive care. Despite its widespread validation, the Caprini model's complexity limits its use in clinical settings. The time-consuming nature of the assessment and the challenges associated with incorporating it into existing order sets pose obstacles in environments with lean staffing, such as ambulatory surgical centers.[26,27] This can diminish the motivation to perform the assessment. Several modifications to the Caprini tool have been evaluated.[28]

The most recent version includes additional risk factors known to increase the risk of thrombosis, though these have not yet been extensively tested in validation studies.[28] These include body mass index >40 kg/m^2, smoker status, diabetes requiring insulin usage, active chemotherapy treatment, recent blood transfusion recipient, and duration of surgery >120 minutes. In addition to these risk factors, arthroscopic procedures, pneumoperitoneum, and Trendelenburg positioning have the potential for the development of VTE after ambulatory surgery.[21,28–30] Major joint arthroplasty also carries a high risk for VTE, and the combined use of intravenous tranexamic acid further contributes to the overall risk.[31] Overall, although the Caprini score is extensively validated for most surgical procedures,[32–35] it has not been validated for ambulatory surgery including major orthopedic surgery which is increasingly being performed on an outpatient basis.

PANNUCCI RISK ASSESSMENT MODEL

Pannucci et al[19] performed a prospective observational cohort study using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database of adult patients who had outpatient surgery or surgery with 23-hour observation. They used logistic regression to examine independent risk factors for 30-day VTE and created and applied a weighted risk index to the validation cohort.[19] This tool evaluates patient demographic data, patient comorbidities, and intraoperative variables to determine the risk of developing a VTE event (Table 1). The strengths of this model include the robust dataset from which the results are drawn and its ability to adjust risk estimates for patient-specific and surgical procedure-specific factors.[24] The limitations of this model include a narrow list of risk factors in comparison to the Caprini model, and underestimation of VTE risk due to limited post-discharge follow-up.

Table 1. Pannucci Venous Thromboembolism Risk Factors[19]

Age ≥60 y
BMI ≥40 kg/m^2
Active cancer
Current pregnancy
Operative time ≥120 min
Arthroscopic surgery
Saphenofemoral junction surgery
Venous surgery not involving the great saphenous vein

Abbreviation: BMI, body mass index.

COBRA RISK ASSESSMENT MODEL

The COBRA (Cancer diagnosis, Old age, Body mass index, Race, and American Society of Anesthesiologists Physical Status) risk assessment model utilizes five key factors to predict VTE events.[24] These factors, identified as the most impactful in established models like Caprini, Padua, and Panucci (Table 2), form the basis of the COBRA score.[24] Notably, COBRA is designed for potential automation, aiming to streamline VTE risk assessment by avoiding the cumbersome manual data entry often associated with other models. Its strengths lie in its simplicity and efficiency in clinical settings, its alignment with established models like Caprini, its utility in providing clinicians with crucial decision support, and its broad applicability across diverse surgical specialties.[24] However, COBRA does have limitations. Its accuracy in predicting VTE in low-risk patients, such as those undergoing most ambulatory surgical procedures, is reduced.[36] Furthermore, the inclusion of race as a predictor raises concerns about potentially exacerbating existing inequities in care and outcomes.[36] Finally, the model's use of postoperative cancer diagnoses, as opposed to preoperative, can introduce nuances that require careful consideration.[37]

EUROPEAN SOCIETY OF ANESTHESIOLOGY AND INTENSIVE CARE UPDATE

The European Society of Anaesthesiology and Intensive Care recently updated their 2018 recommendations for VTE prevention in day surgery and fast-track surgery.[6] They classified procedures into high-risk or low-risk and made recommendations for the preoperative, intraoperative, and postoperative periods based on the presence or absence of additional patient risk factors. They also added specific recommendations for orthopedic surgery. The French Working Group on Perioperative Haemostasis[7] updated their 2011 guidelines and made 78 recommendations for VTE assessment and prophylaxis (27 with high level of evidence [GRADE 1] and 41 with a low level of evidence [GRADE 2] and 10 expert opinion) formalized into 17 sections, including patient-related VTE risk factors, types of surgery, extreme body weight, renal impairment, mechanical prophylaxis, and distal DVT. These recommendations weigh the perioperative risk for VTE (surgery-related and patient-related risk) against the adverse effects of thromboprophylaxis, either pharmacological or mechanical. Notably, these recommendations are not specific to ambulatory surgery and also do not address cardiac surgery, neurosurgery, or obstetrics.

Table 2. Pannucci VTE Risk Categories[19]

Numerical Pannucci VTE risk score	VTE risk category
0–2	Low risk
3–5	Moderate risk
6–10	High risk
>11	Highest risk

Abbreviation: VTE, venous thromboembolism.

VTE ASSESSMENT AND PROPHYLAXIS IN AMBULATORY SETTINGS

Ambulatory surgical patients should be screened for risk factors that lead to the development of a VTE event. However, given the high-volume setting of most ASCs and the expectation that the preoperative nurse will perform the initial risk assessment, followed by the surgeon ordering the VTE prophylaxis, using inpatient VTE risk assessment tools is cumbersome leading to the risk assessment not being performed at all. This position statement has incorporated the existing risk assessment tools into a pragmatic and time-efficient approach which is user-friendly and easily incorporated into the workflow focusing on categorizing patients into VTE risk groups (Figure). This approach minimizes unnecessary interventions and focuses resources where they are most needed. By adopting a stratified approach to VTE risk assessment and prophylaxis, ASCs can enhance patient safety, maximize efficiency, and ensure appropriate treatment for every individual. This simplified approach is easy to follow since there are only two potential decision points: identifying the no or low-risk patient and identifying the high-risk patient with no contraindications to pharmacological prophylaxis. All other patients would receive VTE prevention that involves reducing baseline risk and using mechanical and/or pharmacological prophylaxis (Figure).

The task force recommends that patients at low risk for VTE, which includes patients <18 years of age, procedures with expected duration of <60 minutes, and procedures performed under sedation or local anesthesia such as gastrointestinal endoscopy procedures, pain procedures, or cataract surgery, do not require any further risk assessment or intervention as no VTE prophylaxis is indicated.

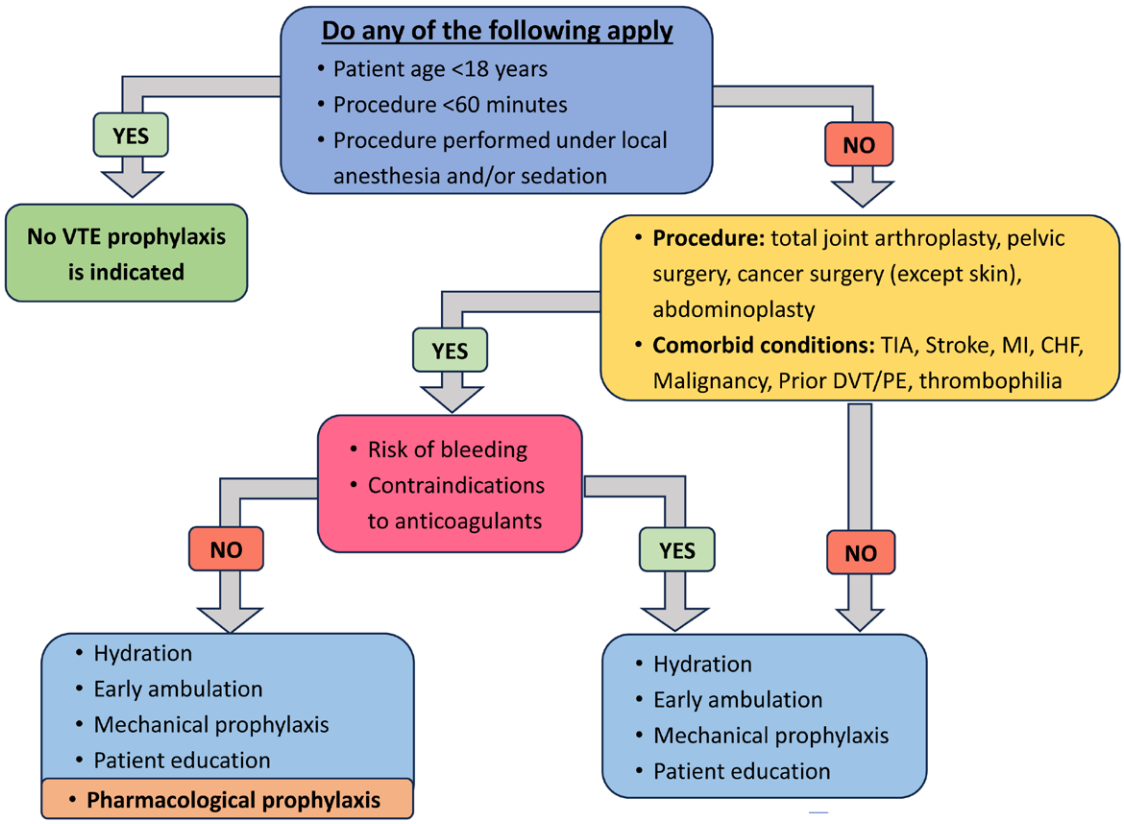

Figure. VTE prophylaxis for patients undergoing ambulatory surgery. CHF indicates congestive heart failure; DVT, deep vein thrombosis; MI, myocardial infarction; PE, pulmonary embolism; TIA, transient ischemic attack; VTE, venous thromboembolism.

Patients falling outside the previous categories will require a risk assessment and baseline interventions, and mechanical and pharmacological prophylaxis for VTE as outlined in the Figure. For example, surgical procedures such as lower limb major total joint arthroplasty, cancer surgery (except skin cancer), pelvic surgery, abdominoplasty, and patients with comorbidities such as prior DVT/PE, transient ischemic attack, stroke, myocardial infarction, congestive heart failure, current malignancy and/or chemotherapy, thrombophilia, current pregnancy—should receive baseline interventions (ie, patient education, perioperative hydration, and early mobilization), mechanical thromboprophylaxis, and pharmacological prophylaxis provided there are no contraindications such as bleeding risk.[38,39] The choice of pharmacological prophylaxis would be left to the surgeon. Patients at risk of bleeding (eg, known coagulopathy, severe kidney dysfunction, heparin-induced thrombocytopenia, hypersensitivity to unfractionated heparin or low molecular weight heparin, recent intraocular or intracranial surgery, and uncontrolled hypertension) or with contraindications to anticoagulants should only receive baseline interventions and mechanical prophylaxis. These recommendations are not validated and much more research needs to be done in this area; however, they represent the most common elements of current practice among many SAMBA members and similar clinical decision support algorithms and protocols are currently being used by SAMBA members at their facilities.

RESEARCH GAPS

There remain significant gaps in evidence regarding VTE risk factors, risk assessment tools, and optimal prophylaxis strategies for patients undergoing ambulatory surgery. Current approaches are often adapted from methods designed for hospitalized patients, which may not be appropriate for the outpatient setting. For example, patients with malignancies are at particularly high risk of VTE, yet no validated risk stratification tool nor clear prophylaxis guideline exists for outpatient cancer surgery. Although complex surgical procedures are increasingly being performed in ASCs, patient selection has generally been cautious, particularly with respect to comorbid conditions. Future research should focus on developing validated risk assessment tools tailored specifically to ambulatory procedures in the high-risk patient with multiple comorbidities.

The adherence to VTE prevention guidelines is often suboptimal.[40] Potential explanations for poor compliance include limited physician awareness, patient-related barriers, and concerns regarding

BOX 1. KEY COMPONENTS OF AN IDEAL VTE RISK ASSESSMENT TOOL

- High sensitivity to accurately predict all patients at risk for developing a VTE event
- High specificity to reliably exclude patients unlikely to develop a VTE (ie, minimize over prophylaxis in low-risk patients)
- Provide prophylaxis recommendations for all levels of VTE and bleeding risk
- Validated across the spectrum of surgical patients
- Applicable in routine clinical practice
- Seamless incorporation into an electronic decision support system and medical record

Abbreviation: VTE, venous thromboembolism.

bleeding complications. It would be valuable to survey ambulatory facilities that have established VTE risk assessment pathways to determine if the protocols are consistently applied with appropriate prophylaxis prescribed. Effective VTE prevention requires a system that monitors performance and tracks adverse outcomes like bleeding.

The optimal duration of VTE prophylaxis following outpatient surgery remains unclear. The American Society of Hematology guideline panel suggests considering extended prophylaxis (beyond 3 weeks) for major surgeries.[5] The European Society of Anaesthesiology and Intensive Care recommends a minimum of 7 days of treatment for patients requiring pharmacological therapy and up to 4 weeks for high-risk procedures or when using aspirin.[6] However, these recommendations are based on limited evidence. While the immediate postoperative risk may be lower in outpatients compared with inpatients, evidence indicates that VTE risk persists for up to 12 weeks following an outpatient procedure.[41] Nearly half of the VTE events occur within the first week after surgery, with risk declining gradually in subsequent weeks.[42]

There is a need for standardized policies that incorporate preoperative risk assessment and prophylaxis protocols in the ambulatory surgical setting. These policies should also integrate "preventable VTE" into pay-for-performance initiatives, raise awareness through public health campaigns, and establish a national standardized system for tracking VTE events and prophylaxis practices.[43] A centralized data steward would be critical to oversee data collection, ensure consistent definitions, and provide resources to support national performance monitoring and quality improvement in ambulatory surgical care.

SUMMARY

The number of surgical procedures performed on an outpatient basis is rising rapidly. Most ambulatory surgical patients are considered low risk for a VTE event. However, as more complex surgeries are performed for patients with significant comorbidities in outpatient settings, the need to assess and prevent VTE becomes increasingly important. Although there is no standardized approach to VTE prophylaxis in ambulatory surgery, a practical strategy (Figure) involves first identifying patients and procedures that are lower risk for whom VTE prophylaxis is not indicated in the ambulatory setting. For higher-risk patients and procedures, a structured VTE risk assessment should guide decisions on thromboprophylaxis. Patients at high risk may require baseline VTE risk reduction, mechanical thromboprophylaxis, and pharmacological prophylaxis, if not contraindicated.

Anesthesiologists, as perioperative physicians, have established themselves as leaders in patient safety and innovation. Given their integral involvement across all phases of the perioperative continuum—preoperative, intraoperative, and postoperative—they are well positioned to lead initiatives that enhance patient outcomes. We suggest a joint evidence-based approach with the surgeon to decide the most appropriate pharmacological prophylaxis plan for patients. SAMBA is proposing a pragmatic approach to VTE risk assessment and prophylaxis in busy ambulatory settings using a synthesis from the existing tools. We have simplified the approach with the objective of universal applicability and have condensed decision-making to two points, thus optimizing implementation. However, developing customized tools for VTE risk assessment and prophylaxis, tailored both to the specific clinical setting of ASCs and to specific surgical populations such as cancer patients, is crucial for optimal preventive care. Future tools should integrate seamlessly into existing workflows and provide clear guidance for clinicians to make informed decisions about patient care. Future research is needed to validate the proposed approach with respect to its efficacy and refine risk factors as well as develop reliable tools to guide VTE prevention in ambulatory surgery. ■

DISCLOSURES

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