The high-risk patient for ambulatory surgery

Niraja Rajan

Purpose of review
This article describes the processes for identifying high-risk patients at the time of ambulatory procedure scheduling, enabling the implementation of multidisciplinary collaborative pathways for prehabilitation and optimization, allowing for risk mitigation and improvement in outcomes. This review is particularly relevant because of the current proliferation of ambulatory surgery with more complex procedures being performed on an outpatient basis on patients who may be American Society of Anesthesiologists Physical Status 3 or greater.

Recent findings
Increased longevity and rising prevalence of obesity have resulted in patients with a wide variety of comorbidities presenting for complex ambulatory procedures with the expectation of rapid recovery and same-day discharge to home. Recent literature highlights the importance of patient preparation, value-based healthcare, patient outcomes, and the role of anesthesiologists as perioperative physicians.

Summary
The focus of this article is on general principles and establishment of best practices based on current evidence and a brief description of anesthetic management of specific comorbidities. This review will provide guidance to the practicing anesthesiologist on identifying, stratifying, optimizing, and managing high-risk patients in the ambulatory setting.

Keywords
ambulatory surgery, high-risk patient, optimization, patient selection, prehabilitation

INTRODUCTION

In the United States, ambulatory surgery accounts for more than 66% of total surgeries performed based on self-reported data from the American Hospital Association from 2014 [1]. That number has been steadily increasing and is likely to continue to grow. Ambulatory surgery is performed in a variety of settings including free-standing ambulatory surgery centers (ASC), hospital outpatient departments, surgical hospitals with 23-h stay facilities, and office-based settings. The ambulatory setting offers numerous advantages to the patient, surgeons, hospitals, and payers. Advances in procedural techniques and instruments, and pharmacology have made it possible to perform many procedures in the ambulatory setting that were previously considered the sole purview of the inpatient setting. In turn, with improved longevity and the increased prevalence of obesity, the population in general is afflicted with many of the comorbidities that accompany aging and obesity. It is therefore becoming increasingly common to perform complex procedures on patients with multiple comorbidities in the ambulatory setting with the expectation of rapid recovery from anesthesia and discharge to home. This review will examine some of the recent evidence on identifying, stratifying, optimizing, and managing high-risk patients in the ambulatory setting with a focus on establishment of evidence-based processes.

DEFINING RISK

Perioperative risk stratification involves a consideration of the complex interplay between surgical, anesthetic, and patient factors. There are several risk stratification tools in use which incorporate preoperative, intraoperative, and postoperative variables [2] (Table 1). These tools have been validated in the

Department of Anesthesiology and Perioperative Medicine, Penn State Health, Hershey, Pennsylvania, USA

Correspondence to Niraja Rajan, MD, Department of Anesthesiology and Perioperative Medicine, H-187, 500 University Drive, Penn State Health, Hershey, PA 17033, USA. Tel: +1 717 531 4264; e-mail: nrajan@pennstatehealth.psu.edu

Curr Opin Anesthesiol 2020, 33:724–731
DOI:10.1097/ACO.0000000000000919

KEY POINTS

- Complex outpatient procedures on patients with multiple comorbidities are increasing.
- Identifying high-risk patients in the ambulatory setting is the first step.
- Patient screening, optimization, prehabilitation, and education constitute a major portion of perioperative management.
- The ambulatory anesthesiologist plays a pivotal role in establishment of collaborative multidisciplinary pathways.

inpatient setting but not for outpatients and there is need for a validated risk assessment tool in the outpatient population. To understand what constitutes high risk in the ambulatory setting, it is important to consider the outcomes of interest to the ambulatory setting. Ambulatory surgery, in the grand scheme is safe. Large retrospective database studies of ambulatory surgeries have estimated serious complication rates of less than 1% [3,4] and mortality rates of 1 in 50 000 to 1 in 100 000 [5,6].

Most facilities therefore track patient-reported outcome measures and quality indicators that are reportable to regulatory authorities. The Ambulatory Surgical Center Quality Reporting (ASCQR) Program is a pay-for-reporting, quality-data program by the Centers for Medicare and Medicaid Services (CMS). ASCs report quality of care data for standardized measures to receive the full annual update to their ASC annual payment rate. Measures reportable for 2020 include patient fall, patient burns, and all-cause hospital admission/transfer [7]. Additionally State Departments of Health require reporting of transfer to hospitals, readmission within 24 h, acute care revisit (emergency room or clinic) within 24 h or return to the operating room.

Whippey *et al.* [8] examined a random sample of 400 patients (200 not requiring admission and 200

Table 1. Various risk assessment tools and their advantages and disadvantages

Risk stratification tools	Pros	Cons
ASA PS	Simple Widely applicable Independently associated with outcomes	Subjective Interrater variability Imprecise predictor of mortality
Revised cardiac Risk index (RCRI)	Predicts MACE after noncardiac surgery Moderate accuracy at high and low rates of MACE	Poor predictor after vascular surgery Poor predictor of mortality
ACS-NSQIP Risk calculators	Incorporates ASA PS, CPT codes, patient-reported functional capacity and patient-centered outcome measures (from previous procedures) Allows for procedure specific risk calculations	Web-based Requires internet connectivity Has been validated only in the United States
POSSUM	Incorporates 12 preoperative and 6 discharge variables Validated across 3 continents	Overestimates morbidity and mortality in low-risk patients
sAs	Includes intraoperative hemodynamic variables Validated in colorectal and vascular surgery Identifies patients at high risk of death within 3 days of surgery	Limited in applicability
Patient reported exercise capacity	Easy to assess Widely applicable	Poor sensitivity Poor predictive values
Duke activity Status index (DASI)	Validated test of functional capacity 12-Item questionnaire Predicts long-term disability Predicts 1-year mortality	Self-reported
6MWT	Tests functional capacity No equipment required Administered in <10 min	Only predicts disability and mortality in high-risk patients with poor performance
Frailty assessment (multiple scales available)	Prognostic indicator of postoperative outcomes and discharge destination Clinical frailty scale is easy to administer	Multiple scales but no gold standard. Some are difficult and time-consuming to administer

6MWT, 6-min walk test; ACS-NSQIP, American College of Surgeons' National Quality Improvement Program; ASA PS, American Society of Anesthesiologists Physical Status; MACE, major adverse cardiac events, POSSUM, Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity; sAs, surgical Apgar score.

requiring admission) out of 20 657 ambulatory procedures and found that length of surgery more than 1 h, high American Society of Anesthesiologists Physical Status (ASA PS), advanced age, and increased BMI were all predictors of unanticipated admission. Another study looking at outpatient urological surgery found an overall 3.7% readmission rate with higher rates of readmission and morbidity in patients with a history of cancer, bleeding disorder, male gender, or ASA PS 3 or 4 [9]. Mathis *et al.* [3] identified seven independent risk factors for 72-h morbidity or mortality: overweight BMI, obese BMI, chronic obstructive pulmonary disease (COPD), history of transient ischemic attack (TIA)/stroke, hypertension, previous cardiac surgical intervention, and prolonged operative time. Meguid *et al* [10]. identified eight independent variables that could produce risk estimates of postoperative mortality, overall morbidity, and six complication clusters with discrimination and calibration equivalent to that of up to 28 independent variables. These include four operative characteristics (work RVU, inpatient/outpatient operation, primary surgeon specialty, and emergency operation status) and four patient characteristics (age, ASA PS, systemic sepsis, and functional health status), all measurable before surgery [10].

It is reassuring that the data supports that ambulatory anesthesia is safe and most revisits or readmissions tend to be for surgical causes. In the ambulatory setting, the high-risk patient would be one at risk for unanticipated hospital transfer, acute care revisit, or readmission after surgery.

PATIENT SCREENING AND SELECTION

Patient screening in most ambulatory facilities is accomplished by a phone interview. Some larger facilities attached to hospitals may have the luxury of a preoperative clinic. Based on the responses to the screening questionnaire, the patient can be categorized as follows:

(1) **Patient has severe, unstable comorbidities that cannot be optimized any further:** unsuitable for elective surgery, urgent or essential surgery should be performed in an inpatient setting.
(2) **Patient has severe comorbidities likely to become unstable perioperatively:** unsuitable for the ambulatory setting, elective surgery should be performed in an inpatient setting.
(3) **Patient has moderate to severe comorbidities that can be optimized:** proceed with elective surgery in the outpatient setting after optimization.
(4) **Patient with mild, moderate, or severe optimized comorbidities:** proceed with elective surgery in the outpatient setting.

The goal of patient screening is to identify to which category the patient belongs, and appropriately direct management. Ambulatory facilities should develop patient screening tools with the above goals in mind. The screening tool needs to be customized to identify, stratify, and appropriately manage the high-risk patient. The ideal screening tool should be administered at the time surgery is contemplated which would be in the surgeon's clinic. The screening tool should include questions which would determine where the patient would be scheduled (inpatient versus outpatient setting), discharge disposition (home, rehabilitation, skilled nursing), and identify modifiable comorbidities and risk factors amenable to optimization and prehabilitation. Some patient conditions such as ASA PS 4, stroke/TIA/myocardial infarction less than 3 months ago, bare metal stent placement less than 1 month ago, drug-eluting stent placement less than 3 months ago, severe valvular disease, severe COPD, and pregnancy preclude outpatient surgery.

ROLE OF PREOPERATIVE TESTING

In general, outpatient surgeries do not require preoperative testing unless the test was indicated whether or not the patient was having surgery. Routine testing can increase costs and cause unnecessary delays in surgery. Eliminating routine testing for ASA PS 1 and 2 patients before ambulatory surgery does not increase adverse outcomes [11]. In addition, there is no role for preoperative testing before cataract surgery [12,13]. In general, a preoperative test is only valuable if it impacts perioperative decision-making and management by helping optimize the patient or altering intraoperative or postoperative management significantly.

PREHABILITATION

Prehabilitation is the process of preparing patients to withstand the stresses of surgery by improving their preoperative functional capabilities through targeted interventions to improve nutritional status, physical activity levels, and mental state. In their study investigating the feasibility and safety of a prehabilitation program for colorectal cancer, van Rooijen *et al.* [14▪] concluded that multimodal

prehabilitation including high-intensity training was feasible, safe, and effective. Owing to the short time available to us in the ambulatory setting, it would be useful to have a process in place for prehabilitation to be implemented at the time the patient is scheduled. Most prehabilitation studies in the ambulatory setting have been for joint arthroplasties where improvements in outcomes were reported [15–17]. Interventions included in most prehabilitation programs are nutritional supplementation, exercise programs, targeted activities to improve cognitive function, smoking cessation, and stress-reduction strategies. There is strong evidence that physical fitness is a modifiable factor, even in older patients, and even within a relatively short period. Patients with multiple comorbidities, or who are frail, severely depressed or have poor nutritional status may have the most to gain from a multimodal prehabilitation program [18]. Typical prehabilitation programs tend to use a multimodal approach incorporating two or more interventions. Patient and family education allows for clear expectation setting, encourages patient participation and engagement in their recovery, reduces anxiety, and increases patient satisfaction [19]. Most studies on psychological preparation for surgery are limited by their heterogeneity and only provide low-quality evidence [20,21].

OPTIMIZATION OF COMORBID CONDITIONS

Unlike prehabilitation which requires lifestyle changes made by the patient, optimization refers to medical interventions by the clinician to bring patient comorbidities to an optimal state before surgery.

Ideally, this process begins at the time of scheduling. The goal is to achieve the best possible control of modifiable risk factors which is accomplished by first identifying patients with poorly controlled comorbidities and referring them to their primary-care physician or specialist. The ideal window of time for patient optimization is between the time of scheduling and the day of surgery. This is also the time when the patient is likely to be highly motivated to follow instructions and maintain lifestyle changes as they want to have surgery [22,23,24▪].

Currently, most preoperative evaluations occur closer to the date of surgery which does not permit sufficient time for patient preparation and optimization. The ambulatory setting offers more predictability in terms of types of procedures and practitioners and therefore may be an ideal setting to establish patient triage pathways. In their study of patients undergoing hip or knee arthroplasty, Dlott *et al.* [25▪▪] found that risk factor identification and optimization resulted in reduced hospital length of stay and postoperative emergency department visits.

In the ambulatory setting where the focus is on productivity and efficiency, having an established triage pathway for patient optimization could avoid delays and cancellations and improve postoperative outcomes. This is also the ideal opportunity to reinforce patient education and instructions and prescribe postoperative nausea and vomiting (PONV) prophylaxis.

In their review of perioperative care pathways, Grocott *et al.* [26▪▪] describe three categories of opportunity to improve preoperative care: shared (collaborative) decision-making, comorbidity management, and collaborative behavioral change. Therefore establishing any pathway requires a collaborative multidisciplinary approach. The ambulatory anesthesiologist can initiate such an approach at their ASC to establish pathways for identifying, prehabilitating, and optimizing high-risk patients long before they arrive at the center for their surgery, thus playing a pivotal role as perioperative physicians and improving overall population health and postoperative outcomes.

PREOPERATIVE PHONE CALL

Most patients scheduled at ASCs receive a phone call one to two days before surgery informing them of their arrival time and medication and Nil Per Os (NPO) instructions. This is a valuable opportunity to further instruct the high-risk patient on specifics relating to medication management, what to bring with them to surgery [continuous positive airway pressure (CPAP) machine, home medications that may be required after surgery, ambulation assist devices, hearing aids, glasses], and specific medications to take the night before or morning of surgery (PONV prophylaxis, medications for gastroesophageal reflux, bronchodilators).

DAY OF SURGERY MANAGEMENT

This section will describe management of the high-risk patient on the day of surgery.

PREOPERATIVE MANAGEMENT

The patient will be evaluated by the anesthesiologist in the preoperative area. Ideally, the high-risk

patient will have already been identified, prehabilitated, and optimized by this time. Bronchodilators, antireflux medications, PONV prophylaxis, anxiolytics, analgesics for multimodal analgesia, and regional anesthesia may be administered at this time.

INTRAOPERATIVE MANAGEMENT

General principles of the ideal ambulatory anesthetic include rapid onset, short duration, minimal interference with hemodynamics and cognition, and complete recovery with minimal side-effects. The ambulatory anesthetic is ideal for managing the high-risk patient because of its emphasis on quick recovery with minimal physiological perturbations. Specific management strategies would depend on the comorbidities, such as opioid-sparing analgesia for the obstructive sleep apnea (OSA) patient, avoidance of long-acting sedatives in patients at risk for postoperative cognitive dysfunction, active prevention of hypotension in patients with cerebrovascular or renal disease, avoidance of general anesthesia in frail patients procedure permitting, multimodal analgesia and regional anesthesia for the patient in an opioid dependence program, and multimodal PONV prophylaxis for the high-risk patient (Table 2).

POSTOPERATIVE MANAGEMENT

Most ASCs focus on rapid discharge of their patients from the postanesthesia care unit (PACU). ASCs usually offer a blended PACU where there is no physical separation of Phase 1 and Phase 2 recovery areas. This allows for efficient use of space and staff. Discharge readiness is determined by objective patient assessment criteria and is not time based. The PACU is where any immediate complications of the procedure or anesthetic such as respiratory adverse events (desaturation, apnea, and airway obstruction), PONV, pain, bleeding, urinary retention, or delirium would manifest and be managed. The PACU is also a valuable opportunity to reinforce patient and family education and instructions, ensure that the patient has the required phone numbers to contact in case of questions or concerns, ensure that the patient and family members know when to seek acute or emergency care. Specific instructions related to patient comorbidities are provided such as instructions on using CPAP, checking blood sugars, resuming home medications, and resuming pain medications. Communication and education play a critical role in preventing day of surgery cancellations, improving patient satisfaction, improving adherence to postoperative instructions, and decreasing postoperative acute care use. In their retrospective review of emergency room visits and hospital admissions within seven days after surgery in an ASC, Molina *et al.* found a 1.7% rate of postoperative acute care use. The risk was greater in sicker patients, and those with Medicaid insurance and lower median household income. They suggested that improving communication regarding postoperative follow-up may reduce acute care use in the high-risk groups [27].

POSTOPERATIVE PHONE CALL

It is important to have a process in place to contact patients on the first postoperative day particularly the high-risk patients. This is a valuable opportunity to obtain feedback on the perioperative patient experience and provide clarification on postoperative instructions, triage and manage any complications, and further provide instructions on when to seek emergency care. The postoperative phone call can provide valuable data on the effectiveness of process improvement measures.

CONCLUSION

An ounce of prevention is worth a pound of cure. A large proportion of the management of a high-risk patient for ambulatory surgery involves preoperative identification, optimization, prehabilitation, and education. The decision-making pathway for a patient presenting for ambulatory surgery is shown in Fig. 1. The ideal time to implement these interventions is at the time of scheduling the surgery. The reality is however that most patients are assessed closer to the date of surgery permitting very little time for long-term interventions. The ambulatory setting with its relative predictability in terms of types of cases and elective nature of cases provides a great opportunity for anesthesiologists as perioperative physicians to establish multidisciplinary, collaborative care pathways which would go into effect at the time of scheduling. These interventions would go a long way toward improving value of care and population health as patients tend to be highly motivated in the preoperative period, to adopt and maintain lifestyle changes to enable them to have surgery. Sometimes, implementation of these interventions may require the difficult decision of delaying elective surgery, which in the current healthcare system is not viewed favorably. In their recent article, Aronson *et al.* [28] describe the implementation of a

Table 2. Specific comorbidities and their management principles for ambulatory surgery

Patient conditions	Screen for	Prehabilitation	Optimization	Preoperative considerations	Intraoperative considerations	Postoperative considerations
• Age >65 years	• Frailty (CFS) • Cognitive dysfunction • Comorbid conditions	• Increase activity as tolerated • Cognitive training • Nutrition advice	• PCP revisit • Medication adjustment • Optimize comorbidities	• Avoid midazolam • Opioid-sparing analgesia • Fall risk	• Avoid BP fluctuations from baseline	• Cognitive assist devices (glasses, hearing aids) • Caregiver at bedside early • Mobility devices • Fall risk
• Obesity	• BMI • Airway assessment • OSA • Functional capacity • Comorbid conditions	• Increase activity as tolerated • Nutrition advice • Encourage use of CPAP	• Optimize comorbidities • Medication management for GER and diabetes	• Difficult IV access • Titrate anxiolytics • Regional anesthesia/ analgesia • Opioid-sparing analgesia	• Prepare for difficult airway • Positioning challenges • Adjust drug doses for lean/ideal body weight • Respiratory adverse events	• Respiratory adverse events • Pain sedation mismatch • Opioid-sparing analgesia
• OSA (diagnosed or presumed)	• Stop-bang score • Airway assessment • Comorbid conditions • Anticipated postoperative pain	• Increase activity as tolerated • Encourage Use CPAP	• Optimize comorbidities	• Difficult IV access • Titrate anxiolytics • Regional anesthesia • Opioid-sparing analgesia	• Airway management • Neuromuscular blockade titrated via quantitative TOF monitoring • Respiratory adverse events	• Use CPAP during daytime/nighttime sleep • Respiratory adverse events • Pain sedation mismatch • Opioid-sparing analgesia
• Myocardial infarction (more than 3 months ago)	• Functional capacity • PCI/CABG history • Dual antiplatelet therapy • MACE risk calculation	• Cardiac rehabilitation program • Increase activity as tolerated	• Continue antiplatelet therapy when feasible • Continue β-blockers • Discontinue ACEI or ARB day of surgery • Preoperative stress/ echo testing when indicated	• Anxiolytics	• Close regulation of hemodynamics • Monitor for cardiac ischemia	• Monitor for ischemia
• Diabetes mellitus	• Type • Duration • Other comorbidities • Long-term control	• Exercise • Increase activity as tolerated • Nutrition advice	• Medication management • Schedule earlier in the day • NPO instructions	• Point of care glucose testing • Treat hypoglycemia or hyperglycemia promptly	• Monitor for dysautonomia • PONV prophylaxis	• Resume PO intake • Resume antidiabetic regimen • Point of care glucose testing

ACEI, Angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers; CABG, coronary artery bypass graft; CFS, clinical frailty scale; CPAP, continuous positive airway pressure; MACE, major adverse cardiac events; OSA, obstructive sleep apnea; PCI, percutaneous cardiac intervention; PONV, postoperative nausea and vomiting; TOF, train of four.

0952-7907

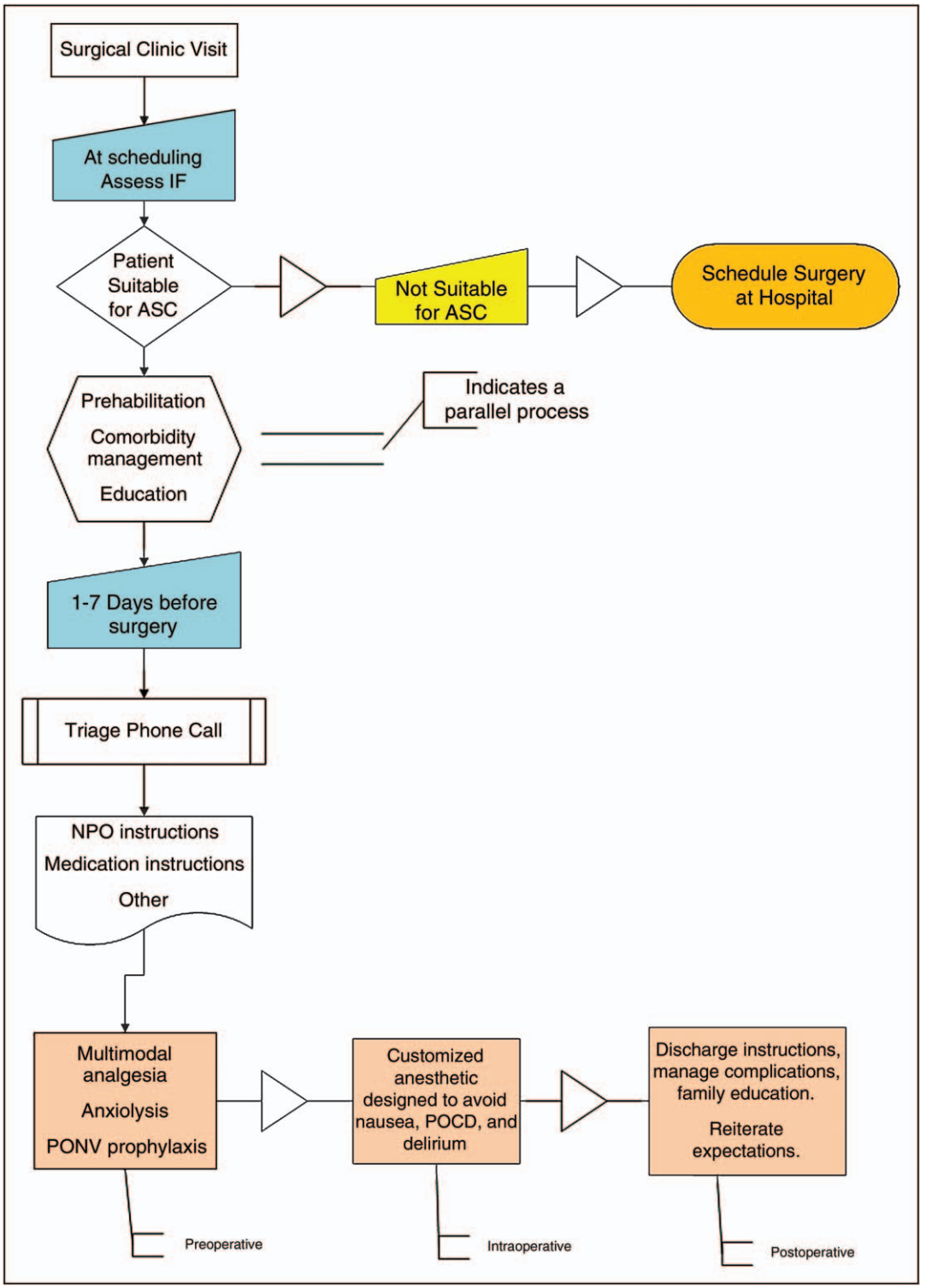

FIGURE 1. Patient flow pathway.

collaborative preoperative clinic with the aim of improving outcomes, a process that could be adapted for the ambulatory setting. Future research is required to provide quantitative evidence of improved perioperative health outcomes from these preoperative care pathways.

Acknowledgements

Srikantha L. Rao, MBBS, for formatting the figure and tables.

Financial support and sponsorship

None.

Conflicts of interest

There are no conflicts of interest.

REFERENCES AND RECOMMENDED READING

Papers of particular interest, published within the annual period of review, have been highlighted as:

- ■ of special interest
- ■■ of outstanding interest

1. American Hospital Association. Utilization and Volume. In: Trends Affecting Hospitals and Health Systems. 2016; chapter 3. https://www.aha.org/system/files/research/reports/tw/chartbook/2016/chapter3.pdf.
2. Bose S, Talmor D. Who is a high-risk surgical patient? Curr Opin Crit Care 2018; 24:547–553.
3. Mathis MR, Naughton NN, Shanks AM, *et al.* Patient selection for day case-eligible surgery: identifying those at high risk for major complications. Anesthesiology 2013; 119:1310–1321.
4. De Oliveira GS Jr, McCarthy RJ, Davignon K, *et al.* Predictors of 30-day pulmonary complications after outpatient surgery: relative importance of body mass index weight classifications in risk assessment. J Am Coll Surg 2017; 225:312–323.e7.
5. Keyes GR, Singer R, Iverson RE, *et al.* Mortality in outpatient surgery. Plast Reconstr Surg 2008; 122:245–250Discussion 251–253.
6. Keyes GR, Singer R, Iverson RE, *et al.* Analysis of outpatient surgery center safety using an internet-based quality improvement and peer review program. Plast Reconstr Surg 2004; 113:1760–1770.
7. Centers for Medicare and Medicaid Services: ASC quality reporting. Site accessed July 02, 2020. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ASC-Quality-Reporting.
8. Whippey A, Kostandoff G, Paul J, *et al.* Predictors of unanticipated admission following ambulatory surgery: a retrospective case-control study. Can J Anaesth 2013; 60:675–683.
9. Aksharananda R, Richard M, Matthew P, *et al.* Predictors of readmission following outpatient urological surgery. J Urol 2014; 192:183–188.
10. Meguid R, Bronsert M, Juarez-Colunga E, *et al.* Surgical Risk Preoperative Assessment System (SURPAS): III. Accurate preoperative prediction of 8 adverse outcomes using 8 predictor variables. Ann Surg 2016; 264:23–31.
11. Chung F, Yuan H, Yin L, *et al.* Elimination of preoperative testing in ambulatory surgery. Anesth Analg 2009; 108:467–475.
12. Schein OD, Katz J, Bass EB, *et al.* The value of routine preoperative medical testing before cataract surgery: study of medical testing for cataract surgery. N Engl J Med 2000; 342:168–175.
13. Keay L, Lindsley K, Tielsch J, *et al.* Routine preoperative medical testing for cataract surgery. Cochrane Database Syst Rev 2012; 3:CD007293.
14. ■ van Rooijen S, Molenaar C, Schep G, *et al.* Making patients fit for surgery. Am J Phys Med Rehab 2019; 98:888–896.

This innovative study of colorectal surgery patients provides preliminary evidence of the feasibility, safety, and effectiveness of a short-term, multimodal, high-intensity prehabilitation program.

15. Chen H, Li S, Ruan T, *et al.* Is it necessary to perform prehabilitation exercise for patients undergoing total knee arthroplasty: meta-analysis of randomized controlled trials. Phys Sportsmed 2018; 46:36.
16. Jahic D, Omerovic D, Tanovic AT, *et al.* The effect of prehabilitation on postoperative outcome in patients following primary total knee arthroplasty. Med Arch 2018; 72:439.
17. Clode NJ, Perry MA, Wulff L. Does physiotherapy prehabilitation improve presurgical outcomes and influence patient expectations prior to knee and hip joint arthroplasty? Int J Orthop Trauma Nurs 2018; 30:14.
18. Short CE, James EL, Stacey F, Plotnikoff RC. A qualitative synthesis of trials promoting physical activity behaviour change among posttreatment breast cancer survivors. J Cancer Survivor 2013; 7:570–581.
19. Edwards PK, Mears SC, Lowry Barnes C. Preoperative education for hip and knee replacement: never stop learning. Curr Rev Musculoskelet Med 2017; 10:356.
20. Levett DZ, Grimmett C. Psychological factors, prehabilitation and surgical outcomes: evidence and future directions. Anaesthesia 2019; 74(Suppl 1): 36.
21. Powell R, Scott NW, Manyande A, *et al.* Psychological preparation and postoperative outcomes for adults undergoing surgery under general anaesthesia. Cochrane Database Syst Rev 2016. (5):CD008646.Published 2016 May 26.
22. Levett DZ, Edwards M, Grocott M, Mythen M. Preparing the patient for surgery to improve outcomes. Best Pract Res: Clin Anaesthesiol 2016; 30:145–157.
23. Aronson S, Martin G, Gulur P, *et al.* Preoperative optimization: a continued call to action. Anesth Analg 2020; 130:808–810.
24. ■ Aronson S, Murray S, Martin G, *et al.* Roadmap for transforming preoperative assessment to preoperative optimization. Anesth Analg 2020; 130:811–819.

The authors describe implementation of a collaborative preoperative clinic with the primary aim of patient outcomes improvement which is as yet a novel concept and could be adapted to the ambulatory setting.

25. ■■ Dlott CC, Moore A, Nelson C, *et al.* Preoperative risk factor optimization lowers hospital length of stay and postoperative emergency department visits in primary total hip and knee arthroplasty patients. J Arthroplasty 2020; 35:1508–1515.e2.

This study of knee and hip arthroplasty patients adds to the limited existing literature, on the effectiveness of multidisciplinary pathways to address modifiable risk factors, on decreasing adverse outcomes after surgery.

26. ■■ Grocott MP, Edwards M, Mythen MG, Aronson S. Peri-operative care pathways: re-engineering care to achieve the 'triple aim'. Anaesthesia 2019; 74(Suppl):190–199.

This review focuses on the evolution of perioperative care, how perioperative medicine meets the challenge of the 'triple aim': improved population health, healthcare, and value, and on specific opportunities to improve care and value through pathway modification in the preoperative, intraoperative, and postoperative phases.

27. Molina G, Neville BA, Lipsitz SR, *et al.* Postoperative acute care use after freestanding ambulatory surgery. J Surg Res 2016; 205:331–340.
28. Aronson S, Murray S, Martin G, *et al.* Perioperative Enhancement Team (POET) roadmap for transforming preoperative assessment to preoperative optimization. Anesth Analg 2020; 130:811–819.