What Should Preoperative Clinics Do to Optimize Patients for Major Surgery?

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Introduction

Preoperative evaluation and care are essential for optimal surgical outcomes and can provide health benefits long after surgical intervention.¹ Perioperative patient interactions should be utilized to improve outcomes and empower change in patient's lives. The aims of preoperative evaluation are to reduce the risks associated with surgery, increase quality, decrease unnecessary costs, and ultimately restore the patient to the desired level of functioning.² However, guidelines for care differ among hospitals and clinical settings.^{3,4}

The objective of this review is to provide an overview of clinical domains that can affect surgical outcomes. The following domains were selected as common health issues affecting patients' postoperative outcomes after interviewing nurses, physician assistants,

anesthesiologists, and surgeons. A further literature review was conducted to provide both preoperative and postoperative recommendations for anesthesiologists and surgeons. We offer the following review and recommendations in order to provide the best care practices during the perioperative period to help mitigate complications after patients undergo surgery.

Preoperative Care Management Domains

- Smoking
- Physical activity
- Nutrition
- Alcohol use
- Cardiac disease
- Deep vein thrombosis / venous thromboembolism
- Chronic narcotic use
- Obstructive sleep apnea
- Diabetes

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Review of Domains

Smoking

LITERATURE

Extensive research has demonstrated that cessation of smoking prior to an operation improves outcomes. Smokers face far more complications than nonsmoking surgical patients, including hypoxia, delayed wound healing, increased inflammation, and higher incidence of pneumonia.^{5,6} Smoking cessation is ideal, but the duration of smoking cessation prior to surgery is contested.

Smoking cessation prior to surgery can be helpful in reducing complication rates. Moller et al found that smoking cessation 6 to 8 weeks prior to surgery reduced the overall complication rate from 52% for those who continued smoking to 18%.⁸ But in a study by Warner et al, postoperative complication rates in those who stopped smoking for fewer than 2 months before surgery were almost 4 times higher than patients who had avoided smoking for more than 2 months.⁷ Despite compelling data to initiate smoking cessation early for improved surgical outcomes,¹¹ only 31% of physicians advise patients on the health risks of smoking, and only 23% recommend smoking cessation before surgery.¹⁰ Thus this is an area where further work has the potential to have a profound impact.

We advocate smoking cessation for all surgery patients—it engages and empowers patients to take control of operative outcomes. Effective preoperative counseling can encourage patients toward long-term smoking cessation.¹⁰

RECOMMENDATIONS

- Smoking cessation intervention, at least 6 to 8 weeks prior to surgery, should be provided to all smokers.
- Local and national resources (ie, National Smoking Cessation Collaborative, hospital-specific smoking cessation programs, etc.) can aid in maximizing the number of patients who are able to quit and providing support.

- Institutions are encouraged to develop protocols that emphasize postsurgical smoking cessation to all active smokers.

Physical Activity

LITERATURE

The literature supporting preoperative exercise is modest. However, preoperative walking programs are becoming the standard of care for all elective surgery patients at our institution. Several studies report that preoperative exercise, commonly known as “prehabilitation,” may reduce the average hospital length of stay by 2 days.^{9,12,13} Additionally, prehabilitation programs have been noted to increase muscle mass (up to 20% in joint replacement patients).¹⁰

There is robust support of prehabilitation, as seen in the orthopedic literature. Six weeks of prehabilitation has been associated with a reduced need for inpatient rehabilitation postoperatively (OR = 0.25). This has a potential benefit not only for patients but also for reducing institutional cost.¹⁴ In addition, these prehabilitation patients are more likely than postoperative rehabilitation patients to achieve initial baseline or improved exercise capacity (84% vs 62%, respectively).¹⁵

The Michigan Surgical and Health Optimization Program (MSHOP) is a University of Michigan program that analyzes surgical outcomes and their economic burden to insurance companies and payers. The program has implemented preoperative walking and activity tracking prior to elective major surgery.¹³ Initial data from MSHOP suggest the prehabilitation program reduces costs and length of stay.¹³ After enrolling more than 1000 patients and with patient compliance with the program above 85%, MSHOP has delivered positive outcomes, and patients feel engaged and empowered in their care.

RECOMMENDATIONS

- All ambulatory patients should participate in a preoperative walking program (with

tracking of steps), with ideally 6 weeks of preoperative training.

- Patients should be encouraged to continue walking and tracking steps after surgery as part of health care maintenance modification.

Nutrition

LITERATURE

Proper nutrition is vital to reduce the risk of postoperative complications—well-nourished patients had a 25% reduction in complication rates compared to patients with 1 abnormality in weight loss, serum albumin level, and arm muscle circumference.¹⁶ Optimizing patients for surgery requires careful attention to their nutritional status. The preoperative period is a unique time to engage patients in their health, and for many patients, properly preparing for surgery includes following nutritional recommendations.

Screening tools for malnutrition should be used to assess a patient's nutritional status preoperatively. Multiple validated risk questionnaires, including the Nutritional Risk Score (NRS), can be utilized in the office setting to screen for malnourishment.¹⁷ Levels of prealbumin, a marker for protein nourishment, accurately predict outcomes for chronically ill patients.¹⁸ Risk stratification based on prealbumin suggests a poor prognosis for those with levels less than 5.0 mg/dL and significant risk for those with levels of 5.0 to 10.9 mg/dL.¹⁹ We suggest patients be screened using prealbumin levels in tandem with other malnutrition screening tools to better understand their general nutrition.

In patients found to be nutritionally depleted, consultation with a nutritionist for dietary intervention should be employed. Nutritional support should begin at least 7 to 10 days prior to surgery.^{16,20} Nutritional modulation in malnourished patients reduces surgical stress, insulin resistance, protein losses, and postoperative complications. When choosing a nutritional supplement, enteral compared to parenteral nutrition is associated with fewer complications, decreased length of hospital

stay, and lower costs.²¹ Additionally, patients may gain further benefit from newer immunonutrition formulations as well as disease-specific enteral formulas.²²⁻²⁴ Close collaboration with nutritionists in perioperative nutritional optimization is ideal, as it results in better nutritional support and decreased energy deficits.²⁵

RECOMMENDATIONS

- For all preoperative patients, a properly balanced diet of key nutrients, including carbohydrates, fats, protein, vitamins, and minerals, as well as nutrition education, should be part of the preoperative process.
- All patients should undergo screening to allow for early detection of malnutrition preoperatively. Patients who screen positive should initiate immediate nutritional support and warrant a full assessment by a nutritionist.
- Physicians and nutritionists should consider disease-specific formulas when recommending nutritional supplementation if available for the clinical condition.

Alcohol Use

LITERATURE

According to the World Health Organization, 7.4% of the US population has alcohol use disorder.²⁶ Preoperative alcohol consumption is associated with an increased risk of general postoperative morbidity and mortality, infection, wound complications, pulmonary complications, prolonged stay in the hospital, and admission to the intensive care unit.²⁷ Postoperative alcohol withdrawal is associated with significant morbidity and mortality if not recognized and treated early in its course. The first step in mitigating these risks is a proper preoperative work-up and identification of those at highest risk. Utilization of simple questionnaires, including CAGE or AUDIT-C, can be performed at preoperative visits.²⁸ Patients who screen positive should undergo evaluation of substance use disorders and undergo treatment prior to surgery as requested by an expert.

Abstinence for 4 weeks prior to surgery has been shown to decrease complications from 71% to 31%.²⁹ If surgery is needed in an urgent fashion, postoperative monitoring of withdrawal should be performed in a systematic fashion. Utilization of a protocol for both monitoring and treatment of withdrawal should be implemented. At our institution, the Michigan Alcohol Withdrawal Severity (MAWS) Assessment Scale is both a scoring and a treatment protocol that utilizes frequent patient assessment for signs and symptoms of withdrawal, including central nervous system excitation, adrenergic hyperactivity, and delirium. Nearly all protocolized patients are initiated on thiamine and folate supplementation with the addition of benzodiazepines or haloperidol based on MAWS and clinical assessment. It is strongly encouraged to quickly transfer patients to higher-level care centers if symptoms of withdrawal worsen.³⁰

RECOMMENDATIONS

- All patients should be assessed for alcohol use prior to surgery. Consider CAGE, TASE, or AUDIT-C questionnaires for screening of alcohol use disorder.
- Patients who screen positive should be evaluated by a mental health professional regarding their need for substance abuse treatment prior to surgery.
- Perioperatively, patients with a history of significant alcohol use, or any patient displaying signs and symptoms of alcohol withdrawal, should undergo protocolized monitoring to prevent morbidity and mortality.
- All patients with alcohol use disorder or those who experience withdrawal postoperatively should be encouraged to pursue alcohol abuse treatment after discharge.

Cardiac Disease

LITERATURE

Patients with preexisting cardiac complications have a significantly higher morbidity and mortality rate postoperatively.³¹ One of the most common

causes of increased mortality is myocardial infarction.³² The optimal approach in management involves assessing a combination of patient-specific risk factors, surgery-specific risk factors, and exercise tolerance.³³ The Revised Cardiac Risk Index (RCRI) can provide a quick way of assessing surgical risk in cardiac patients based on clinical conditions (ischemic heart disease, heart failure, diabetes mellitus, cerebrovascular disease, high-risk surgery).³⁴ The American College of Cardiology and the American Heart Association (ACC/AHA) have published clinical practice guidelines for the optimal evaluation and management of patients with high cardiac risk. These guidelines are extensive and provide detailed advice for a wide spectrum of cardiac conditions. The complete guidelines can be found in published data from the ACC/AHA (<http://my.americanheart.org/professional/StatementsGuidelines/ByTopic>).³⁵ Key recommendations from the most recent 2014 guidelines are summarized below.

RECOMMENDATIONS

- Patients with known coronary or structural heart disease should be assessed with a 12-lead electrocardiogram.
- Assessment of left ventricular function using echocardiography should be performed in patients with dyspnea of unknown origin and for patients with known heart failure or heart failure symptoms.
- Exercise stress testing should be employed to assess patients with elevated cardiac risk and poor functional capacity. Those who cannot tolerate exercise stress testing should undergo dobutamine stress echocardiogram or myocardial perfusion imaging.
- Medication Recommendations:
 - o *Beta blockers* should be given to patients on chronic beta blockers, to those with noted intermediate or high-risk ischemia on stress tests, or when patients have 3 or more RCRI risk factors. They should be initiated at least 1 day prior to the

- operation to assess their safety/tolerability but never on the day of the operation.
- o *Statins* should be given to patients on chronic beta blockers or to patients undergoing vascular surgery.
- o *Angiotensin modifiers* should be continued throughout the perioperative period. If withheld before surgery, they should be restarted postoperatively when clinically feasible.
- Patients with cardiac electronic implantable devices should be monitored continuously during any period of perioperative inactivation, and external defibrillators should be available. If inactivation occurs, proper reprogramming after surgery should be ensured.

Deep Vein Thrombosis and Venous Thromboembolism

LITERATURE

In the absence of prophylaxis, the incidence of venous thromboembolism (VTE) in surgical patients has been shown to range from 15% to 30%.³⁶ VTE is a major source of preventable perioperative mortality and morbidity, with a complication of fatal pulmonary embolism occurring at a rate of 0.2% to 0.9%.³⁷ Administering either unfractionated heparin or low-molecular-weight heparin (LMWH) immediately preoperatively until discharge reduces the risk of VTE by at least 60% in surgical patients.³⁸ Despite these guidelines, more than 50% of patients receive inappropriate thromboprophylaxis, defined as administering no prophylaxis when indicated, administering the wrong type of prophylaxis, or the administering prophylaxis in the absence of proper indications.³⁹ The first step to eliminating inappropriate therapy is proper preoperative screening. Screening is easily performed preoperatively by utilizing a number of risk assessment tools, including the Caprini Risk Score.⁴⁰ At our institution, we use a modified Caprini system,

which assesses patient risk based on patient-related factors (age, body mass index [BMI]), medical history (malignancy, inflammatory bowel disease), deep vein thrombosis (DVT)/VTE history (familial clotting disorder, personal history of DVT), and procedure-related risks (laparoscopy, surgical duration, immobilization). Based on the risk score, an appropriate perioperative regimen is assigned, ranging from mechanical prophylaxis alone to pharmacologic anticoagulation. Documentation of patients deemed inappropriate for postoperative anticoagulation due to intraoperative coagulopathy, large blood losses, and intraoperative anticoagulation should be noted in the chart, and reinstitution of appropriate anticoagulation should be assessed daily to avoid DVT/VTE complications.

An additional option for patients when anticoagulation is contraindicated is the use of inferior vena cava (IVC) filters. The ease of deployment of these filters and the fact that they can be retrieved has made their use appealing.⁴¹

RECOMMENDATIONS

- All patients should be screened for DVT/VTE risk prior to surgery using a validated risk calculator.
- Institutional protocols should be used to facilitate the implementation of prophylaxis strategies that are effective and generalizable.
- Patients determined to be inappropriate for anticoagulation due to bleeding risk or other patient factors should be documented and regularly reassessed.
- An IVC filter should be considered when there is an absolute contraindication to anticoagulation.

Chronic Narcotic Use

LITERATURE

Preoperative use of opioids for chronic pain is common and is recognized as a barrier to adequate

perioperative care and a risk factor for adverse events. Hyperalgesia, or an increased sensitivity to pain, is a common side effect of chronic opioid use, and preoperative opioid use consistently predicts increased postoperative opioid utilization.^{42,43} Multiple complications are associated with postoperative opioid use, including decreased gastrointestinal functions, which result in longer hospital stays.⁴⁴ This combination of impaired pain control and gastrointestinal dysfunction complicates postoperative management and delays recovery following major surgery. Additionally, opioid users may be at a higher risk for complications, with opioids contributing immunosuppressive effects and infection risk.^{45,46}

Interventions aimed at preoperative opioid weaning and alternative pain management are needed. However, opioid cessation in chronic users may be difficult, and given the paucity of data, it is unclear if cessation will improve surgical outcomes. Treating comorbid mental illness may facilitate opioid cessation, as patients with depression have an increased propensity to use opioids.⁴⁷ A multidisciplinary approach to preoperative care is necessary to wean from opioids and manage chronic pain in this patient population.

RECOMMENDATIONS

- Opioid cessation may be beneficial; however, it remains unclear whether this will improve outcomes.
- Optimize nonopioid anesthetics and analgesics in the perioperative period—for example regional anesthesia, gabapentin, and serotonin-norepinephrine reuptake inhibitors.
- If preoperative opioid cessation is not possible, patients should at minimum return to their preoperative opioid dosing after acute pain has resolved.
- Comorbid mental illness should be screened for and addressed, and doing so may facilitate opioid cessation.

- Surgeons should be aware of the potential for increased perioperative morbidity in opioid users.

Obstructive Sleep Apnea

LITERATURE

Obstructive sleep apnea (OSA) is associated with serious perioperative complications, including cardiac arrhythmias, myocardial injury, and sudden death.⁴⁸ Approximately 20% of adults have sleep apnea, with many going undiagnosed, which complicates postsurgical care.⁴⁹ To attempt to discover these high-risk patients prior to elective surgery, several questionnaires have been developed. The Berlin questionnaire, American Society of Anesthesiologists checklist, STOP-Bang questionnaire, and Sleep Apnea Clinical Score are all validated tools to screen for OSA.³⁴ Patients who test positive for OSA on screening should be referred to a sleep medicine specialist for proper evaluation and management. Notify anesthesia colleagues of patients with known OSA and discuss the case prior to surgical intervention. Altered anesthetic plans, when safe, should be considered, including local blocks and spinal anesthesia.²⁷ Postoperative airway adjuncts, such as continuous positive airway pressure (CPAP), should be employed when patient condition and procedure warrants it based on surgeon and anesthesiologist assessment.⁴⁹

RECOMMENDATIONS

- Use quick, validated screening devices such as the Berlin questionnaire and STOP-Bang scoring system. Clinical suspicion should be highest among the elderly and obese.
- Include anesthesia colleagues in discussion to consider the possible use of regional anesthesia over general to minimize OSA complications, where appropriate.
- Encourage patients who are prescribed CPAP to use their machines throughout the perioperative period.

Diabetes

LITERATURE

Proper glycemic control in the perioperative period is vital in improving surgical outcomes.⁵⁰ Patients with diabetes often have serious comorbidities, such as cardiovascular disease, obesity, and chronic kidney disease—all of which significantly increase surgical risk.⁵¹ Additionally, patients with diabetes undergoing surgery are more prone to postoperative infectious complications such as pneumonia, surgical site/wound infection, and sepsis.⁵² Abnormal HbA1c levels are associated with longer hospital length of stays.⁵³ Optimizing a patient's blood glucose and HbA1c levels preoperatively, along with close glucose monitoring and control perioperatively, improves overall outcomes.⁵² Postoperatively, optimization can be challenging, given frequent episodes of fasting and changes in metabolic needs. The specific targets for postoperative glycemic control include blood glucose levels of less than 140 mg/dL for most postoperative patients and between 140 and 180 mg/dL for critically ill patients. Patients who utilize oral medications (eg, sulfonylureas, metformin, thiazolidinediones, GLP-1 agonists) for glycemic control as outpatients should withhold their medications immediately prior to and following surgery. The perioperative period of fasting and inflammatory responses makes medication and blood glucose levels less predictable. Therefore, oral medications should be withheld while patients are not on a regular diet, and sliding-scale insulin formulations should predominate in the in-hospital perioperative period.⁴⁹ Patients should be transitioned to their home oral regimen when they are tolerating oral intake and prior to discharge.

RECOMMENDATIONS

- Preoperative medication changes should be made to improve glycemic control in patients whose HbA1c levels exceed 8%. This should include close discussion with the patient's

primary care physician or endocrinologist to develop a plan for preoperative glycemic optimization.

- Glucose should be closely monitored to achieve specific glycemic targets for inpatients postoperatively:
 - Less than 180 mg/dL in critically ill patients
 - Less than 140 mg/dL in stable patients
- Discontinue use of oral medications used for glycemic control immediately prior to and following surgery until condition and diet stabilize.
- Patients should use insulin formulations in the perioperative period while they are inpatients and unable to tolerate a regular diet.

Conclusion

Perioperative care for patients is extremely complex. The objective of this review is to provide recommendations for care in clinically relevant and modifiable health domains. Adherence to these recommendations has the potential to improve overall cost effectiveness of surgical procedures by mitigating complications and decreasing length of stay. While we feel this review presents sufficient data to support the listed recommendations, it is not intended to be entirely comprehensive. The main objective of the review is to synthesize the current literature into one concise document for easy review by providers. We recognize this review provides general recommendations supported by literature, and it is not meant to be exhaustive or entirely comprehensive. Given the large amount of literature for each domain, including all data and pertinent studies is beyond the scope and goal of this review. That being said, readers are encouraged to explore the cited work if they wish to delve deeper into certain domains. We hope our work will provide an easily accessible reference for perioperative care and guide the delivery of the highest quality of care to patients throughout their surgical experience.

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