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Evidence Grading

Literature Search

A consistent and defined literature search process is used in the development and revision of ICSI guidelines. See Appendix A for literature search parameters and search terms. In addition to the literature searches, articles were obtained by work group members and ICSI staff. Those vetted by the work group were included in the guideline when appropriate.

Methodology

ICSI utilizes the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology system. GRADE involves systematically evaluating the quality of evidence (high, moderate, low, very low) and developing a strength of recommendation (strong, weak). For more detailed information on GRADE, please visit http://www.gradeworkinggroup.org/. In addition, when GRADE methodology could not be applied, the work group developed consensus recommendations.

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Recommendations Table

The following table is a list of evidence-based recommendations for the Perioperative Guideline based on the review of primary literature and secondary references (in instances where primary literature was not found).

Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Preoperative Health Screening and Assessment	Not applicable	A preoperative health screening and assessment that includes a focused medical history and appropriate physical examination should be completed for all patients undergoing a surgical procedure, regardless of setting (unless the procedure involves mild sedation, or local/topical anesthesia).	Consensus	*Fleisher, 2014 (Guideline); Apfelbaum, 2012b (Guideline)*
Preoperative Testing	Low	Do not routinely test all patients undergoing elective, noncardiac surgery. The need for testing should be guided by individual patient's clinical risk factors (based on medical history and physical examination) and the risk of major adverse cardiac event (morbidity or mortality) associated with the planned procedure.	Strong	*Keay, 2019 (Systematic Review); Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*
Chest X-ray	Low	Do not routinely perform chest X-rays preoperatively unless indicated by the review of medical history and physical examination.	Strong	*Johansson, 2013 (Systematic Review); Joo, 2005 (Systematic Review)*
Hemoglobin/ Hematocrit Testing	Low	Do not routinely test for hemoglobin preoperatively in healthy, asymptomatic patients. Testing for preoperative hemoglobin level should be considered in: 1. Patients with a history of anemia or history suggesting recent blood loss or anemia *and* the planned procedure may lead to significant blood loss or physiologic stress or 2. Patients with prior or planned anticoagulation (expert consensus).	Strong	*Fowler, 2015 (Meta-Analysis); Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*

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Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Potassium/ Sodium Testing	Low	Do not routinely test for potassium or sodium level preoperatively in healthy, asymptomatic patients. Testing may be indicated in: 1. Patients who are on diuretic therapy, 2. Patients with kidney disease (stages 3–5), 3. Patients on potassium replacement therapy, or 4. Patients undergoing bowel preparation.	Strong	*Johansson, 2013 (Systematic Review); Wahr, 1999 (Observational Study); Munro, 1997 (Systematic Review)*
Renal Function (Creatinine Testing)	Low	Do not routinely test for creatinine levels in healthy, asymptomatic patients. Testing may be indicated in patients with known kidney disease or patients with a comorbid condition (e.g., diabetes, hypertension) that carries increased risk of acute kidney injury or kidney disease.	Strong	*Kork, 2015 (Observational Study), Johansson, 2013 (Systematic Review)*
Pregnancy Testing	Not Applicable	Do not routinely conduct urine tests for pregnancy. However, patients of childbearing age should be asked if there is a possibility they might be pregnant. Pregnancy testing is indicated in: 1. Patients planning to undergo surgeries involving the uterus (e.g., hysterectomy, myomectomy), 2. Uterine cavity surgery (e.g., dilation and curettage, endometrial ablation), or 3. Surgery that impacts blood flow to the uterus (e.g., endovascular surgeries that disrupt aortic blood flow, procedures involving the uterine arteries).	Consensus	*ACOG, 2019 (Joint Statement with ASA); ASA, 2016 (Statement); NICE, 2016 (Guideline); Apfelbaum, 2012b (Guideline)*

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Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Hemostasis (Coagulation) Testing	Low	Do not routinely perform coagulation tests before surgery unless indicated. Indications for testing may include the following: 1. Patients with potential bleeding/clotting problem, 2. Patients with a known history of bleeding/clotting abnormalities, 3. Patients with recent history suggesting the potential for bleeding/clotting problems, 4. Patients who are currently taking anticoagulant therapy, and 5. Patients who may need postoperative anticoagulation (where a baseline may be needed).	Strong	*Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*
Glucose Testing in Nondiabetic Patients	Not Applicable	Consider glucose testing in patients with risk factors for diabetes (as defined by USPSTF recommendations), or if a primary care provider feels that diagnosis of diabetes would alter the plan for surgery.	Consensus	*USPSTF, 2015 (Guideline)*

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Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Sleep Apnea	Not applicable	1. Clinicians should use a validated standardized screening tool to screen patients for suspected sleep apnea (risk factors or patient reporting problems) or sleep apnea symptoms, and communicate to the surgical team. Major risk factors for sleep apnea include obesity, increased neck size (> 37 cm in men, >35 cm in women), craniofacial abnormalities, older age and male sex. 2. Clinicians should remind patients who have been formally diagnosed with obstructive sleep apnea and have an oral appliance or continuous positive airway pressure equipment to bring their appliance or equipment with them on the operative day for use during the recovery from anesthesia or sedation. 3. Patients with suspected sleep apnea in the perioperative period should have a follow-up evaluation, typically in concert with the patient's primary provider (if one is available), and/or referral to sleep center. 4. Patients with known sleep apnea or suspected sleep apnea at a preoperative evaluation should have this communicated to the surgical and anesthesiology team and the patient made aware this may increase the surgical risk.	Consensus	*Chung, 2016 (Guideline); Gross, 2014 (Guideline)*
Nicotine Cessation	Low	Smoking cessation intervention (brief or intensive) should be initiated before elective surgery.	Strong	*Bayfield, 2018 (Meta-Analysis); Nolan, 2017 (Observational Study); Nolan, 2015 (Systematic Review); Thomsen, 2014 (Systematic Review)*

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Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
HbA1c Testing in Patients with Diabetes during Preoperative Clinic Visit	Not applicable	Consider obtaining a preoperative HbA1c test value, if not done in the past three months, on patients with known diabetes during preoperative clinic visit. Establish a plan for management of diabetes prior to surgery. The decision to proceed with surgery or postpone surgery based on preoperative HbA1c test value should be based on individual patient-centered factors such as urgency of planned surgery, overall mortality/morbidity risks, risks of perioperative infections, concerns for postoperative glucose control, and patient compliance.	Consensus	*ADA-Diabetes Care in the Hospital, 2019 (Guideline); van den Boom, 2018 (Observational Study); NICE, 2016 (Guideline); Yang, 2016 (Observational Study); Gustafsson, 2009 (Observational Study)*
Intraoperative and Postoperative Glycemic Control Targets for Patients with Diabetes	Low	Consider a glycemic target range between 140-180 mg/dL for surgical patients with diagnosed diabetes during the intraoperative and postoperative periods. Additional considerations: 1. For patients with diabetes with glucose levels typically <140, do not treat to 140. 2. Consider risk for hypoglycemia if necessary to treat for glycemic targets lower than 140.	Weak	*Nair, 2016 (Observational Study); Sathya, 2013 (Meta-Analysis); Buchleitner, 2012 (Systematic Review); Gandhi, 2007 (Randomized Controlled Trial); Ata, 2010 (Observational Study); Ramos, 2008 (Observational Study)*
Preoperative Opioid Tapering	Not Applicable	An individualized approach for tapering in patients who are on opioids preoperatively (including patients with chronic opioid use) should be taken. A decision on whether to taper preoperatively needs to be made well in advance of surgery. However, if a significant medical concern about opioid use is recognized closer to the surgery date *that could be made safe with a taper*, the patient, the provider and the surgical team should discuss whether delaying the surgery in order to treat the underlying condition is appropriate.	Consensus	*Jain, 2019 (Observational Study); Nguyen, 2016 (Randomized Controlled Trial); Hassamal, 2016 (Case Series)*

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Topic	Quality of Evidence	Recommendation(s)	Strength of Recommendation	Relevant Resources
Postoperative Opioid Prescribing	Not Applicable	The postoperative prescribed opioid doses at discharge should be the lowest effective dose of short-acting opioids.	Consensus	*Hill, 2018 (Observational Study); Koehler, 2018 (Systematic Review); Mark, 2018 (Observational Study); Bicket, 2017 (Systematic Review); Osmundson, 2017 (Observational Study); Thiels, 2017 (Observational Study); Ray, 2016 (Observational Study); Miller, 2015 (Observational Study); Dhalla, 2009 (Observational Study)*

The ICSI Work Group did not review primary literature and instead reviewed the recommendations from the relevant societies on the following topics (see specific section for the recommendations and ICSI work group's decision on endorsement):

- Electrocardiogram testing
- Cardiovascular diseases
- Cardiovascular medications
- Preoperative fasting
- Prevention of endocarditis
- Insulin therapy regimens in diabetes mellitus

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Foreword

Introduction

The ICSI Perioperative Guideline has been enhanced to include a new section – Perioperative Opioid Management – that was developed by a separate subgroup and reviewed and approved by the Perioperative Guideline work group. The new section addresses the entire continuum of perioperative opioid management (preoperative, intraoperative and postoperative).

The Perioperative Guideline addresses and includes recommendations on the following topics:

Section 1: General Preoperative Management

1. Preoperative Health Screening and Assessment
2. Preoperative Testing (Electrocardiogram, Chest X-ray, Hemoglobin/Hematocrit, Potassium/Sodium, Creatinine, Pregnancy, Hemostasis, and Glucose in Nondiabetics)
3. Sleep Apnea
4. Nicotine Cessation
5. Preparation for Surgery

Section 2: Perioperative Management of Select Conditions

6. Cardiovascular Considerations: Review of Select Recommendations from American College of Cardiology/American Heart Association Guidelines
7. Prevention of Endocarditis: Endorsement of Recommendations from American College of Cardiology and American Heart Association Guidelines
8. Anticoagulants/Antithrombotics
9. Diabetes Mellitus

Section 3: Perioperative Opioid Management

10. Preoperative Opioid Management
11. Intraoperative Pain Management
12. Postoperative Opioid Management
13. Perioperative Considerations for Patients with Opioid Use Disorder (OUD)

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Scope and Target Population

- Adults (aged 18 years and older) undergoing elective surgery.

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Aims

1. Increase the percentage of surgical patients undergoing elective surgery who have preoperative health screening and assessment.
2. Increase the percentage of surgical patients undergoing elective surgery who are smokers who have smoking addressed prior to surgery.
3. Increase the percentage of surgical patients undergoing elective surgery with any risk factor for obstructive sleep apnea (OSA) who are screened for OSA prior to surgery.
4. Increase the percentage of surgical patients undergoing elective surgery who have education on preoperative hair removal, bathing, fasting and oral hygiene prior to surgery.

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Implementation Recommendations Highlights

This section highlights general recommendations and tips on setting up organizational infrastructure to implement the recommendations from this guideline. Refer to the section for more information.

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Related ICSI Scientific Documents

- Pain: Assessment, Non-Opioid Treatment Approaches and Opioid Management

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Definitions

Surgical care team – includes surgeon, anesthesiologist, nursing staff, and opioid prescriber involved in patient care.

Primary care provider – a provider who performs preoperative health screening and assessment and conducts postoperative follow-up in primary care.

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Annotations

1. General Preoperative Management

Preoperative Health Screening and Assessment

Consensus Recommendation
A preoperative health screening and assessment that includes a focused medical history and appropriate physical examination should be completed for all patients undergoing a surgical procedure, regardless of setting (unless the procedure involves mild sedation, or local/topical anesthesia).
Benefit: Obtains current information on patient's medical status to assess for medical conditions that could potentially lead to adverse perioperative outcomes, and thus mitigate that risk. **Harm:** None. **Benefit-Harms Assessment:** Preoperative health screening and assessment is key to obtaining patient's current medical status to help clinicians determine if patient is at risk of adverse perioperative outcomes and to mitigate that risk.
Relevant Resources: *Fleisher, 2014 (Guideline); Apfelbaum, 2012b (Guideline)*

Preoperative health screening and assessment should be performed before all surgical procedures unless the procedure involves mild sedation or a local/topical anesthesia. The goal is to identify and manage medical conditions that may impact perioperative morbidity and mortality.

Preoperative health screening and assessment should include a focused review of medical history and appropriate physical examination. Additional testing including laboratory, electrocardiogram (ECG) and further cardiopulmonary evaluation should be based on medical history and physical exam and in consideration of surgical procedure risk for adverse cardiac event (see "Preoperative Testing" section for details).

Specifically, focused medical history and physical examination should include (by the expert consensus of the ICSI work group):

- **Medical history**

  Indication for surgical procedure

  Allergies and adverse reactions to medications (specify reaction type)

  Anesthesia related complications or adverse events (personal and family history)

  History of a difficult airway or intubation

  Medical history and active medical problems

  Surgical history

  Current medications, over-the-counter remedies, herbal and dietary supplements

  Implantable devices (cardiac devices, spinal stimulator, pain pumps etc.)

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Focused review of issues pertinent to the planned anesthesia and procedure:

- Current status of pertinent known medical issues
- Cardiac status
- Pulmonary status
- The ability to perform four or more METs
- Personal or family history of abnormal bleeding and history/at risk for anemia
- Pregnancy status
- Smoking, alcohol history and illicit drugs
- Risk factors for development of surgical site infection (e.g., smoking, diabetes, obesity, malnutrition, chronic skin disease)
- Risk factors for development of venous thromboembolism (VTE). VTE is a common and potentially fatal perioperative complication. All surgical patients should undergo risk assessment for the development of VTE and have appropriate measures taken to prevent both clotting and bleeding abnormalities in the perioperative period.
- Chronic pain and/or chronic opioid use; plan for postoperative pain management
- Discharge plan following surgery that includes social support
- Need for assistive devices following surgery (e.g., walker, hospital bed)

• **Physical examination**

Weight, height

Vital signs – blood pressure, pulse (rate and regularity), respiratory rate

Cardiovascular exam

Pulmonary exam

Other exams pertinent to surgical procedure and planned anesthesia such as:

- Skin exam for signs of infection
- Neurologic exam
- Musculoskeletal
- Airway exam including dentition

Primary care provider communication with the surgical team

The primary care provider should provide pertinent information to the anesthesiologist and surgeon on results of preoperative health screening and assessment in advance of anticipated day of scheduled procedure for all patients undergoing elective surgery. The report should include a comprehensive assessment, any adjunctive evaluation and specific recommendations. The ICSI work group acknowledges that regulatory agencies may have their own requirements for documentation of completion and timing of provision of information.

In instances that a review of the current history and focused physical examination is required on the day of surgery prior to the procedure, it may be done by the provider performing the procedure.

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Perioperative medication management

Ensure medication reconciliation, preoperatively. Navigating the topic of medications to stop or continue in the perioperative period can be complicated, especially as new medications come to market frequently. Working with a pharmacist to help develop and implement perioperative plans regarding medication management (medications to stop or continue) can be beneficial. The pharmacist can also perform medication reconciliation, guide medications decisions and oversee medication dispensing.

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Preoperative Testing

Recommendation	Quality of Evidence
Do not routinely test all patients undergoing elective noncardiac surgery. **The need for testing should be guided by individual patient's clinical risk factors (based on medical history and physical examination) and the risk of major adverse cardiac event (morbidity or mortality) associated with the planned procedure.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Keay, 2019 (Systematic Review); Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*	

A 1997 systematic review of case series studies found no evidence to support routine preoperative tests (chest X-ray, electrocardiogram, hemostasis, blood counts, hemoglobin, potassium, creatinine, glucose and urine testing for pregnancy) in healthy, asymptomatic adults. Very few patients went on to have a change in management of the condition prior to surgery. (*Munro, 1997*)

A systematic review of three randomized trials and 98 cohort studies found no evidence that preoperative testing is beneficial in healthy adults undergoing noncardiac surgery. (*Johansson, 2013*)

Large studies have found no evidence to support routine testing in low risk surgeries such as cataract surgery. A systematic review of three randomized controlled trials including 21,531 cataract surgery patients found routine preoperative medical testing did not reduce the risk of intraoperative or postoperative ocular adverse events when compared to selective or no testing. (*Keay, 2019*)

The need for preoperative testing should be guided by preoperative screening and assessment of clinical risk factors based on patient's pertinent medical history and physical exam, and in consideration of risk of major adverse cardiac event (morbidity or mortality) associated with the planned procedure. Consultation with the surgeon or proceduralist may be necessary to clarify relative procedural risk for the planned procedure.

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To help stratify surgical procedure risk, the American College of Cardiology (ACC)/American Heart Association (AHA) estimates the combined surgical and patient characteristics predict a risk of a major adverse cardiac event (MACE) of death or myocardial infarction of <1% in low-risk surgeries Procedures with a risk of MACE of >=1% are considered elevated risk. (*Fleisher, 2014*)

There is some evidence that older age may be a factor in increasing the risk of adverse cardiac event during surgery depending on the type of surgery. An analysis of 2,853 procedures found inpatient mortality rate for high-risk procedures in patients 65 years and older was double the rate of patients younger than 65 years. (*Schwarze, 2015*)

To guide perioperative mortality risk determination, the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery recommends the use of a validated risk prediction tool to predict the risk of perioperative major adverse cardiac event in patients undergoing noncardiac surgery. (*Fleisher, 2014*) Risk calculators may include the Revised Cardiac Risk Index, American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Myocardial Infarction and Cardiac Arrest (MICA), and American College of Surgeons NSQIP Surgical Risk Calculator. (*Fleisher, 2014*)

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Electrocardiogram

Cardiac arrhythmias and conduction disturbances are common findings in the perioperative period. However, limited evidence does not support routine testing in healthy, asymptomatic individuals. A 1997 systematic review of case series studies in healthy and asymptomatic adults found routine preoperative electrocardiograms were abnormal in 4.6-31.7% of cases (with the proportion of abnormal tests rising with age and worsening physical status) and led to a change of management in 0-2.2% of patients with unknown effect on patient outcomes. (*Munro, 1997*) A literature search by the ICSI Work Group did not find any new studies on relationship of preoperative electrocardiogram testing to perioperative mortality and morbidity outcomes.

The ICSI work group AGREES with the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery recommendation on preoperative electrocardiogram (ECG). (*Fleisher, 2014*):

- Routine electrocardiogram is not useful for asymptomatic patients undergoing low-risk surgical procedures.
- Electrocardiogram is reasonable in patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease or other structural heart disease, except for those undergoing low-risk surgery.

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Chest X-ray

Recommendation	Quality of Evidence
Do not routinely perform chest X-rays preoperatively unless indicated by the review of medical history and physical examination.	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Johansson, 2013 (Systematic Review); Joo, 2005 (Systematic Review)*	

Preoperatively, chest X-rays can help assess status for known chronic medical conditions or to detect previously undiagnosed diseases such as chronic obstructive pulmonary disease (COPD), heart failure, tuberculosis and lung cancer. (*NICE, 2016*)

The evidence does not indicate routine use of chest X-rays in healthy, asymptomatic adults. A 2005 systematic review of 14 studies found a highly variable rate of abnormalities (most common ones were cardiomegaly and chronic obstructive pulmonary disease) found on X-rays. The rate of abnormalities varied from 4-47% and increased with age. Few of these patients had a change in preoperative management. The rate of postoperative pulmonary complications was similar between patients who had preoperative chest X-ray and those who did not. (*Joo, 2005*) Similarly, a 2013 systematic review of two cohort studies found no significant association between abnormal chest X-ray tests and postoperative pulmonary complications in healthy patients undergoing elective, noncardiac surgery. (*Johansson, 2013*)

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Hemoglobin/Hematocrit Testing

Recommendation	Quality of Evidence
Do not routinely test for hemoglobin preoperatively in healthy, asymptomatic patients. **Testing for preoperative hemoglobin level should be considered in:** **1. Patients with a history of anemia or history suggesting recent blood loss or anemia *and* the planned procedure may lead to significant blood loss or physiologic stress, or** **2. Patients with prior or planned anticoagulation (expert consensus).**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Fowler, 2015 (Meta-Analysis); Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*	

One purpose of the routine preoperative measurement of hemoglobin is to detect anemia as anemia may impact general anesthesia or patient may be at risk of significant blood loss during procedure.

The evidence does not indicate routine use of hemoglobin tests in healthy, asymptomatic adults. However, the evidence suggests that it should be considered in patients who have anemia or had a recent blood loss and are at risk for significant blood loss during surgery. The ICSI work group expert consensus is that patients with prior or planned anticoagulation should also have their hemoglobin levels tested.

The evidence is insufficient to recommend an optimal preoperative hemoglobin levels that would avoid perioperative complications. The optimal preoperative hemoglobin level (that provides a reserve for unexpected blood loss or cardiorespiratory stress) varies by patient and by type of procedure. The ICSI work group expert consensus is that the primary care provider and the surgeon should work together to establish an individual patient plan for management of hemoglobin levels prior to surgery. It is imperative for the primary care provider ordering hemoglobin tests to communicate the results to the surgeon; conversely, the surgeon should communicate to the primary care provider if the procedure could potentially cause significant blood loss.

A 1997 systematic review of case series studies in healthy, asymptomatic adults found that routine preoperative hemoglobin testing level was lower than 10-10.5 g/dl in up to 5% of patients, but rarely lower than 9 g/dl with change of preoperative management in only 0.1% to 2.7% of patients. (*Munro, 1997*)

A 2013 systematic review of 35 cohort studies and four case-control studies found a strong correlation between low hemoglobin levels and the risk for perioperative and postoperative blood transfusions in patients with pre-existing conditions or signs of anemia during clinical examination and in medical history. (*Johansson, 2013*) A 2015 meta-analysis of 24 observational studies including 371,594 patients with anemia found that

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anemia was associated with increased mortality, acute kidney injury, infection and increased incidence of red cell transfusion in anemic patients undergoing noncardiac or cardiac surgeries. In cardiac surgery, anemia was associated with increased risk for stroke but not myocardial infarction. (*Fowler, 2015*)

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Potassium/Sodium Testing

Recommendation	Quality of Evidence
Do not routinely test for potassium or sodium level preoperatively in healthy, asymptomatic patients unless indicated. **Testing may be indicated in:** **1. Patients who are on diuretic therapy,** **2. Patients with kidney disease (stage 3–5), or** **3. Patients on potassium replacement therapy, or** **4. Patients undergoing bowel preparation.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Johansson, 2013 (Systematic Review); Wahr, 1999 (Case-Control Study); Munro, 1997 (Systematic Review)*	

Testing for serum potassium level is important in patients with conditions that may lead to significant hypokalemia or dialysis dependence (e.g., patients taking non-potassium sparing diuretics such as hydrochlorothiazide). Hypokalemia increases the risk of dysrhythmia and makes treatment of dysrhythmias difficult in patients undergoing general anesthesia. Hyperkalemia may also lead to delays or cancellations of elective surgeries due to potential for cardiac arrhythmias.

The evidence does not indicate routine use of potassium tests in healthy, asymptomatic adults undergoing elective surgery. However, the evidence suggests that potassium testing may be indicated in patients with conditions or medical history that put them at risk for cardiac arrhythmia or are undergoing cardiac surgery.

A 1997 systematic review of case series studies in healthy, asymptomatic adults found that in routine preoperative tests of serum biochemistry, abnormal levels of sodium or potassium are found in up to 1.4% of patients which rarely led to a change in preoperative management. (*Munro, 1997*) A 2013 systematic review of five cohort studies found that elevated and low sodium values correlated positively with 30-day mortality in one study in veterans with ASA physical status of one, two or three undergoing elective surgery; however, the other four studies included in the review found no significant relationship between electrolyte tests and perioperative complications for patients undergoing elective procedures. (*Johansson, 2013*) A 1999 case-control study of 2,402 patients undergoing elective coronary artery bypass grafting found significantly increased risk for serious perioperative arrhythmia, intraoperative arrhythmia and postoperative atrial fibrillation/flutter as well as increased need for CPR in patients with serum potassium level less than 3.5 mmol/L. (*Wahr, 1999*)

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Renal Function (Creatinine) Testing

Recommendation	Quality of Evidence
Do not routinely test for creatinine levels in healthy, asymptomatic patients unless indicated. **Testing may be indicated in patients with known kidney disease, or patients with a comorbid condition (e.g., diabetes, hypertension) that carries increased risk of acute kidney injury or kidney disease.**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Kork, 2015 (Observational Study), Johansson, 2013 (Systematic Review)*	

Acute kidney injury is one of the leading causes for postoperative organ failure, with an estimated incidence of approximately 1% in noncardiac surgery patients. (*Kork, 2015*)

The evidence does not indicate routine use of creatinine tests in healthy, asymptomatic adults undergoing elective surgery. However, the evidence suggests that creatinine testing may be indicated in patients with known kidney disease or patients who are planning to undergo procedures with increased risk of acute kidney injury. A baseline creatinine level should be established in these patients. It is the consensus of the ICSI work group to test potassium levels within 30 days of the planned procedure. If the values are expected to change or the patient has an acute condition, the levels may be redone closer to the day of the procedure.

A 2013 systematic review of 23 cohort studies on renal tests (creatinine and others) found a positive correlation between pathological renal function tests and the occurrence of complications in 11 studies of patients with known pre-existing renal disease (the remaining studies either did not provide data or there was no significant relationship). (*Johansson, 2013*) A 2015 study of 37,345 noncardiac surgery and 2,024 cardiac surgery patients found that patients with acute kidney injury had a fivefold higher mortality risk and a five-days longer hospital length of stay. The study also found that even minor creatinine increases (change in creatinine from 25-49% above baseline but < 0.3 mg/dl) not meeting criteria for AKI were associated with a twofold increased risk of death and two-days longer hospital length of stay in all patients. In patients undergoing noncardiac surgery, minor creatinine increases were associated with a fivefold risk of death and a three-days longer hospital length of stay. (*Kork, 2015*)

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Pregnancy Testing

Consensus Recommendation
Do not routinely conduct urine tests for pregnancy. However, patients of childbearing age should be asked if there is a possibility they might be pregnant. **Pregnancy testing is indicated in patients planning to undergo surgeries involving:** **1. The uterus (e.g., hysterectomy, myomectomy),** **2. Uterine cavity (e.g., dilation and curettage, endometrial ablation), or** **3. Surgery that impacts blood flow to the uterus (e.g., endovascular surgeries that disrupt aortic blood flow, procedures involving the uterine arteries).**
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing a potential pregnancy. **Benefit-Harms Assessment:** Given the low likelihood that routine pregnancy testing of all female patients will uncover a potential pregnancy and insufficient evidence on harms of anesthesia in pregnant patients, patients should be asked if there is a possibility they are pregnant and further test those where there is an indication. Shared decision-making discussions can help guide decisions whether to test.
Relevant Resources: *ACOG, 2019 (Joint Statement with ASA); ASA, 2016 (Statement); NICE, 2016 (Guideline); Apfelbaum, 2012b (Guideline)*

Elective surgery in pregnant patients is generally avoided unless absolutely necessary due to the concerns with anesthetic teratogenicity and miscarriage during the procedure. (*NICE, 2016*) The evidence, however, is unclear on the harm of anesthesia to pregnant patients and fetus during surgery.

Literature shows the overall frequency of an incidentally found positive preoperative pregnancy test ranges from 0.34% to 2.4%. (*Maher, 2012*) The American Society of Anesthesiologists (ASA) Task Force on Preanesthesia Evaluation literature review found insufficient evidence on harmful effects of anesthesia on early pregnancy. (*Apfelbaum, 2012b*)

The ICSI work group consensus is to not routinely conduct urine test for pregnancy. However, patients of childbearing age should be asked if there is a possibility they might be pregnant. Pregnancy testing is indicated in patients planning to undergo surgeries involving the uterus (e.g., hysterectomy, myomectomy), uterine cavity (e.g., dilation and curettage, endometrial ablation), or that impact blood flow to the uterus (e.g., endovascular surgeries that disrupt aortic blood flow, procedures involving the uterine arteries).

Shared decision-making approach can be used to inform patients of the relative risks and benefits of undergoing the planned surgery and anesthesia while pregnant and to determine if pregnancy testing is desired by the patient. The decisions to test should be guided by the following information:

- No currently used anesthetic agents have been shown to have any teratogenic effects in humans when using standard concentrations at any gestational age. (*ACOG, 2019*)
- Current scientific information is not sufficient to determine whether anesthesia causes harmful effects during pregnancy. (*ASA, 2016*)
- Current scientific information is not sufficient to determine whether pre-natal exposure to maternal anesthetics causes adverse neurodevelopmental effects. (*ASA, 2016*)

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Hemostasis (Coagulation) Testing

Recommendation	Quality of Evidence
Do not routinely perform coagulation tests before surgery unless indicated. **Indications for testing may include the following:** **1. Patients with potential bleeding/clotting problem,** **2. Patients with a known history of bleeding/clotting abnormalities,** **3. Patients with recent history suggesting the potential for bleeding/clotting problems,** **4. Patients who are currently taking anticoagulant therapy, and** **5. Patients who may need postoperative anticoagulation (where a baseline may be needed).**	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: • Ensures only tests of value for patients who need it are performed. • Decreases unnecessary perioperative costs for both patients and the health care system. **Harm:** • A possibility of missing an important diagnosis. **Benefit-Harms Assessment:** Given the low likelihood that routine testing of healthy, asymptomatic patients will uncover issues that might lead to adverse outcomes during perioperative period, only those patients who would benefit from additional testing should undergo it.	
Relevant Resources: *Johansson, 2013 (Systematic Review); Munro, 1997 (Systematic Review)*	

In the preoperative setting, hemostasis tests (e.g., prothrombin time, activated partial thromboplastin time, platelet count) are used to establish a baseline for the patient and may be used to plan the use of blood products and blood salvage techniques in the perioperative period. (*NICE, 2016*)

The evidence does not indicate routine use of hemostasis tests in healthy, asymptomatic adults undergoing elective surgery. However, the evidence suggests that hemostasis testing may be indicated in patients with a potential bleeding/clotting problem, patients with a known history of bleeding/clotting abnormalities, patients with recent history suggesting the potential for bleeding/clotting problems, patients who are currently taking anticoagulant therapy, and patients who may need postoperative anticoagulation (where a baseline may be needed).

A 1997 systematic review of case series studies in healthy, asymptomatic adults found abnormalities of bleeding time, prothrombin time and partial thromboplastin time in up to 3.8%, 4.8% and 15.6% of routine preoperative tests, respectively, which rarely leads to change in the clinical management. (*Munro, 1997*) A 2013 systematic review of nine cohort studies found one study that showed a correlation between an abnormal platelet count and an abnormal international normalized ratio test, and the outcomes in adverse events or morbidity in patients undergoing elective abdominal surgery. Another study in the review found a correlation between an abnormal prothrombin time and an abnormal platelet count, and mortality in patients undergoing miscellaneous surgeries. Both of these studies included patients with pre-existing conditions or who were older adults. The remaining studies in the review did not find valid evidence suggesting that routine preoperative hemostasis testing would lead to a change in clinical management or outcome in asymptomatic patients. (*Johansson, 2013*)

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Glucose Testing in Nondiabetic Patients

There is little evidence around screening for diabetes during the preoperative clinic visit.

The review of evidence shows no clear evidence to determine if diabetes screening in asymptomatic patients should be done preoperatively. A prospective study of 120 patients without known diabetes who underwent major colorectal surgery found that patients with a preoperative HbA1c level over 6.0% had higher mean postoperative glucose and C-reactive protein levels, and postsurgical complications than patients with a normal HbA1c level. (*Gustafsson, 2009*) A 1997 systematic review of case series studies found abnormal levels of glucose in up to 5.2% of healthy or asymptomatic patients undergoing elective surgery. These findings rarely led to change in clinical management. (*Munro, 1997*) A 2015 systematic review of 22 cohort and case-controlled studies found no data to support routine preoperative testing for blood glucose or HbA1c levels in otherwise healthy adult patients undergoing elective noncardiac surgery. (*Bock, 2015*)

Given the scarcity of evidence on preoperative HbA1c levels and postoperative outcomes, the 2016 NICE guidelines recommend against routinely offering HbA1c testing before surgery to people without diagnosed diabetes.

The U.S. Preventive Services Task Force (USPSTF) recommends screening for abnormal blood glucose as part of cardiovascular risk assessment in patients aged 40-70 years without obvious diabetes symptoms who are overweight/obese and seen in primary care settings. According to USPSTF, individuals who have a family history of diabetes, have a history of gestational diabetes or polycystic ovarian syndrome, or are members of certain racial/ethnic groups (i.e., African Americans, American Indians or Alaskan Natives, Asian Americans, Hispanics or Latinos, or Native Hawaiians or Pacific Islanders) may be at increased risk for diabetes at a younger age or at a lower body mass index. Clinicians should consider screening earlier in individuals with one or more of these characteristics. (*USPSTF, 2015*)

Given the available information, the consensus of the ICSI work group on glucose testing in nondiabetic patients during preoperative clinic visit is the following: Consider glucose testing in patients with risk factors for diabetes (as defined by USPSTF recommendation above) or if a primary care provider feels that diagnosis of diabetes would alter the plan for surgery.

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Sleep Apnea

Consensus Recommendation
1. Clinicians should use a validated standardized screening tool to screen patients for suspected sleep apnea (risk factors or patient reporting problems) or sleep apnea symptoms, and communicate outcomes to the surgical team. Major risk factors for sleep apnea include obesity, increased neck size (> 37 cm in men, > 35 cm in women), craniofacial abnormalities, older age and male sex. **2. Clinicians should remind patients who have been formally diagnosed with obstructive sleep apnea and have an oral appliance or continuous positive airway pressure equipment to bring their appliance or equipment with them on the operative day for use during the recovery from anesthesia or sedation.** **3. Patients with suspected sleep apnea in the perioperative period should have a follow-up evaluation, typically in concert with the patient's primary provider (if one is available), and/or referral to sleep center.** **4. Patients with known sleep apnea or suspected sleep apnea at a preoperative evaluation should have this communicated to the surgical and anesthesiology team, and the patient made aware this may increase the surgical risk.**
Benefit: Targeted screening and identification of at-risk patients can direct therapy that may prevent common complications associated with perioperative sleep apnea. **Harm:** False-positive screening may lead to unnecessary testing or surgical delay in some patients. **Benefit-Harms Assessment:** The potential to treat the myriad and serious harms associated with untreated perioperative sleep apnea outweighs the rare harms associated with additional testing.
Relevant Resources: *Chung, 2016 (Guideline); Gross, 2014 (Guideline)*

Obstructive sleep apnea has been identified as a perioperative risk factor with increased risks of pulmonary complications and desaturations, and has been linked to postoperative cardiovascular events, though its effect on perioperative mortality is less clear. (*Chung, 2016*) Thus, sleep apnea should be considered during the preoperative evaluation. Validated OSA screening tools in adult surgical patients include the STOP-Bang, P-SAP, Berlin, and ASA checklist. (*Chung, 2016*)

Some adult patients may not have a diagnosis of obstructive sleep apnea confirmed by polysomnography studies but are presumed to have obstructive sleep apnea based on the preoperative history and physical examination. Quick and inexpensive surrogates for polysomnography studies are not new and have several variants. Patients who score high on these indices may need to be treated in the perioperative period as though they have a formal diagnosis of obstructive sleep apnea. This information should be communicated to the surgeon and anesthesiologist before the patient undergoes any procedure involving general anesthesia, monitored anesthesia care, conscious sedation or the administration of narcotics. (*Chung, 2016*) At this point evidence does not support delaying surgery to have polysomnography for formal diagnosis. (*Chung, 2016*) However, it may be reasonable to delay surgery in certain situations such as patients undergoing surgery with a very high rate of OSA, e.g., bariatric surgery or where other pulmonary comorbidities are suspected, e.g., obesity hypoventilation syndrome or severe pulmonary hypertension. (*Chung, 2016*) Patients with known sleep apnea or suspected sleep apnea at a preoperative evaluation should have this communicated to the surgical and anesthesiology team, and the patient made aware this may increase the surgical risk. In patients with suspected sleep apnea in the perioperative period, follow-up evaluation is recommended in concert with the patient's primary provider (if one is available) and/or referral to sleep center.

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Use of PAP for patients with known OSA may reduce postoperative complications. (*Chung, 2016*) Adult patients with a diagnosis of obstructive sleep apnea often have oral appliances or continuous positive airway pressure equipment and should be reminded to bring those appliances or equipment on the operative day, for use during the recovery from anesthesia or sedation. Additionally, expert recommendations suggest monitoring patients with known or high risk for OSA until they are no longer at risk of perioperative respiratory depression, though research supporting this practice is minimal. (*Gross, 2014*)

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Nicotine Cessation

Recommendation	Quality of Evidence
Smoking cessation intervention (brief or intensive) should be initiated before elective surgery.	Quality of Evidence: Low Strength of Recommendation: Strong
Benefit: Smoking cessation may reduce postsurgical complication with the best evidence suggesting reduced surgical site infections and pulmonary complications. Additionally, the long-term benefit of smoking cessation is substantial. **Harm:** Increased patient visits and patient cost when undertaking intensive smoking cessation. **Benefit-Harms Assessment:** The potential benefits of smoking cessation with postsurgical complications and long-term health outcomes outweigh minimal harms.	
Relevant Resources: *Bayfield, 2018 (Meta-Analysis); Nolan, 2017 (Observational Study); Nolan, 2015 (Systematic Review); Thomsen, 2014 (Systematic Review)*	

Although smoking cessation should always be encouraged, research suggests that intensive rather than brief interventions are more effective. A systematic review found that brief interventions reduce the number of patients smoking by the day of surgery, but have not consistently shown to decrease postoperative complications, nor is there any long-term reduction in smoking rates. (*Thomsen, 2014*) Intensive smoking cessation interventions (multisession face-to-face counselling) started greater than four weeks prior to surgery demonstrated efficacy at reducing smoking by the day of surgery, decreased postoperative wound and overall complications, and showed a significant reduction in smoking at 12 months. (*Thomsen, 2014*)

An observational study of smokers undergoing elective surgery found that smoking cessation started the day of surgery has been linked to lower postoperative surgical site infections. (*Nolan, 2017*) A meta-analysis found that cardiac surgery patients who are current smokers at the time of surgery had no increased 30-day mortality risk compared to ex-smokers, although they were at significantly increased risk of postoperative pulmonary complications. (*Bayfield, 2018*) Despite the limited data, this work group agrees that patients should be strongly encouraged at all times to abstain from nicotine any time before surgery.

Data regarding nicotine replacement therapy (NRT) is extremely limited, and there is no convincing research suggesting NRT is harmful. A systematic review of the topic notes that when NRT is used to help with smoking cessation, there is a reduction in perioperative complications. (*Nolan, 2015*) In sum, if patients are using nicotine replacement therapy prior to surgery, this should be continued preoperatively.

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Preparation for Surgery

Patient Preparation and Education

When providing patient education about their procedure, adequate attention to patients' reading level, potential visual impairments (if so, large print materials could be provided) and other potential learning barriers is a critical component for preparing them for surgery.

The components of patient education should include the following:

- Patients and families should be educated on how to manage postoperative pain, when to resume activities of daily living, and how to manage other risk factors such as diabetes, incontinence and impaired immune status/response.
- Patients should be educated and informed of fasting requirements sufficiently in advance of the procedure.
- Patients should be educated on medications that are prescribed at discharge. Medication reconciliation should be completed and a current medication list sent home with the patient.
- All patients should be educated on the signs and symptoms of surgical site infection.
- Patients and families should be provided emergency contact numbers and instructions on whom to call.
- Confirm that discharge instructions have been explained, and patients and family should verbalize understanding. Because patients may forget verbal instructions, written instructions should be provided.
- When necessary, it should be verified that the patient will have care assistance for at least 24 hours.
- Patient and families should be educated on the importance of good hand hygiene in the prevention of infection. Patients and families managing wound dressings should wash their hands (either soap and water or waterless hand gels) before and after every contact.
- Patients and families should receive proper instruction on wound care.

Preoperative Showering/Bathing, Hair Removal and Oral Hygiene

To prevent surgical site infections, patients should be advised to shower/bathe before arriving for their surgical procedure. However, there is no evidence that specific wash products with antiseptic solution are more beneficial than other wash products or soap without antiseptic. The evidence also did not find that hair removal was beneficial in preventing surgical site infection. If hair removal is necessary, hair clipping was found to be more effective in preventing surgical site infection than shaving or depilatory cream. Limited evidence indicates the benefit of perioperative oral hygiene in the reduction of postoperative respiratory airway infections. Each facility should establish specific guidelines for their patient population and the specific procedures being performed.

Preoperative Bathing. A 2017 systematic review of eight studies involving 10,655 patients undergoing clean surgeries found soap without antiseptic had the lowest rate of surgical site infection (5.1%) compared to chlorhexidine bathing (7.1%) or placebo solution (9.1%). There were no significant reductions in the infection rates in the comparison between patients who had preoperative bathing with 4% chlorhexidine vs. placebo solution as well as no difference was observed when comparing chlorhexidine bathing with soap. (*Franco, 2017*) A 2015 systematic review of seven randomized trials involving 10,157 patients undergoing invasive surgical procedures found no clear evidence of benefit in preoperative showering or bathing with chlorhexidine over other wash products, to reduce surgical site infection. (*Webster, 2015*)

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Hair Removal. A 2017 meta-analysis of 14 trials involving 7,278 patients found no significant differences between shaving, clipping, no hair removal and depilatory cream in the frequency of surgical site infections. The evidence suggests that when it is necessary to remove hair, clipping is more effective in reducing surgical site infections than shaving or depilatory cream. (*Shi, 2017*) A 2015 meta-analysis of 19 trials found no benefit of depilation to prevent surgical site infection, and a higher risk of surgical site infection when shaving is used for depilation as compared to clipping, chemical depilation or no depilation. The risk of surgical site infection seemed to be similar with both chemical depilation and clipping. (*Lefebvre, 2015*)

Oral hygiene. A 2016 systematic review of six trials and quasi-trials found systematic perioperative oral hygiene reduces postoperative nosocomial, lower respiratory tract infections and surgical site infections but not urinary tract infections. (*Pedersen, 2016*) Systematic perioperative oral hygiene involves mechanical removal of dental biofilm or plaques and/or systematic use of mouth rinse performed by patients themselves or by health care staff.

Preoperative Fasting Recommendations (Clear Liquids, Solids and Nonhuman Milk)

The ICSI work group AGREES with American Society of Anesthesiologists (ASA) recommendations on preoperative fasting for healthy adult patients undergoing elective procedures. (*ASA, 2017*):

- Clear liquids
  - Clear liquids may be ingested for up to two hours before procedures requiring general anesthesia, regional anesthesia, or procedural sedation and analgesia. These liquids should not include alcohol.
- Solids and Nonhuman Milk
  - A light meal or nonhuman milk may be ingested for up to six hours before elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation and analgesia.
    - Additional fasting time (e.g., eight or more hours) may be needed in cases of patient intake of fried foods, fatty foods, or meat.

The ASA guideline recommendations are further supported by a systematic review of 19 guidelines that found strong and consistent evidence exists for the minimization of perioperative fasting, for a two-hour preoperative fast after clear fluids, and for early recommencement of oral food and fluid intake postoperatively. (*Lambert, 2016*)

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2. Perioperative Management of Select Conditions

Cardiovascular Considerations

Cardiovascular Diseases

The ICSI work group AGREES with the select ACC/AHA disease-specific perioperative recommendations in the table below. The select recommendations are from the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery (*Fleisher, 2014*) and the 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with Coronary Artery Disease. (*Levine, 2016*) See guidelines for more information.

Coronary Artery Disease	Patients with known or clinic risk for coronary artery disease should be evaluated according to the ACC/AHA perioperative risk assessment protocol. (Based on ACC/AHA 2014 guideline)
	Elective noncardiac surgery should be delayed at least 60 days after myocardial infarction in the absence of coronary intervention. (Based on ACC/AHA 2014 guideline)
	Revascularization before noncardiac surgery is recommended in circumstances in which revascularization is indicated according to existing clinical practice guidelines. (ACC/AHA 2014 guideline recommendation)
	It is not recommended that routine coronary revascularization be performed before noncardiac surgery exclusively to reduce perioperative cardiac events. (ACC/AHA 2014 guideline recommendation)
	Elective noncardiac surgery should not be performed within 14 days of balloon angioplasty in patients in whom aspirin will need to be discontinued perioperatively. (ACC/AHA 2014 guideline recommendation)
	Elective noncardiac surgery should be delayed 30 days after BMS implantation and optimally six months after DES implantation. (ACC/AHA 2016 guideline recommendation)
	In patients treated with DAPT after coronary stent implantation who must undergo surgical procedures that mandate the discontinuation of P2Y12 inhibitor therapy, it is recommended that aspirin be continued if possible and the P2Y12 platelet receptor inhibitor be restarted as soon as possible after surgery. (ACC/AHA 2016 guideline recommendation)
	Elective noncardiac surgery after DES implantation in patients for whom P2Y12 inhibitor therapy will need to be discontinued may be considered after three months if the risk of further delay of surgery is greater than the expected risk of stent thrombosis. (ACC/AHA 2016 guideline recommendation)
	Elective noncardiac surgery should not be performed within 30 days after BMS implantation or within three months after DES implantation in patients in whom DAPT will need to be discontinued perioperatively. (ACC/AHA 2016 guideline recommendation)
	When noncardiac surgery is required in patients currently taking a P2Y12 inhibitor, a consensus decision among treating clinicians as to the relative risks of surgery and discontinuation or continuation of antiplatelet therapy can be useful. (ACC/AHA 2016 guideline recommendation)

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LV Function Assessment	It is reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function. (ACC/AHA 2014 guideline recommendation)
	It is reasonable for patients with heart failure with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function. (ACC/AHA 2014 guideline recommendation)
	Reassessment of LV function in clinically stable patients with previously documented LV dysfunction may be considered if there has been no assessment within a year. (ACC/AHA 2014 guideline recommendation)
	Routine preoperative evaluation of LV function is not recommended. (ACC/AHA 2014 guideline recommendation)
Cardiomyopathy	There is little information on the preoperative evaluation of patients with specific nonischemic cardiomyopathies before noncardiac surgery. Preoperative recommendations must be based on a thorough understanding of the pathophysiology of the cardiomyopathy, assessment and management of the underlying process, and overall management of the heart failure. (ACC/AHA 2014 guideline statement)
Valvular Heart Disease	It is recommended that patients with clinically suspected moderate or greater degrees of valvular stenosis or regurgitation undergo preoperative echocardiography if there has been either 1) no prior echocardiography within one year or 2) a significant change in clinical status or physical examination since the last evaluation. (ACC/AHA 2014 guideline recommendation)
	For adults who meet standard indications for valvular intervention (replacement and repair) on the basis of symptoms and severity of stenosis or regurgitation, valvular intervention before elective noncardiac surgery is effective in reducing perioperative risk. (ACC/AHA 2014 guideline recommendation)
Arrhythmias/ Conduction Abnormalities	Before elective surgery in a patient with a cardiac implantable electronic device (CIED), the surgical/procedure team and clinician following the CIED should communicate in advance to plan perioperative management of the CIED. (ACC/AHA 2014 guideline recommendation)

Cardiovascular Medications

The ICSI work group reviewed the ACC/AHA medications-specific perioperative recommendations in the table below. The select recommendations are from the 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery (*Fleisher, 2014*) and the 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with Coronary Artery Disease. (*Levine, 2016*) See guidelines for more information.

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Beta Blockers Therapy: ICSI Work Group AGREES with the following ACC/AHA Recommendations.

ACC/AHA Recommendation	ICSI Work Group Comment
Beta blockers should be continued in patients undergoing surgery who have been on beta blockers chronically. (ACC/AHA 2014 guideline recommendation)	Agree
It is reasonable for the management of beta blockers after surgery to be guided by clinical circumstances, independent of when the agent was started. (ACC/AHA 2014 guideline recommendation)	Agree
Beta-blocker therapy should not be started on the day of surgery. (ACC/AHA 2014 guideline recommendation)	Agree

Beta Blockers Therapy: ICSI Work Group DISAGREES with the following ACC/AHA Recommendations.

ACC/AHA Recommendation	ICSI Work Group Comment
In patients with intermediate- or high-risk myocardial ischemia noted in preoperative risk stratification tests, it may be reasonable to begin perioperative beta blockers. (ACC/AHA 2014 guideline recommendation)	**Disagree** (due to findings from the 2018 Cochrane systematic review of increased risk of all-cause mortality and increased risk in stroke rate in noncardiac surgery) In the 2014 ACC/AHA Guideline, it was acknowledged that beginning beta blockers ≤1 day before surgery is at a minimum ineffective and may in fact be harmful, and that decision to begin beta blockers should be influenced by whether a patient is at risk for stroke and whether the patient has other relative contraindications. (Fleisher, 2014) More recent findings from a 2018 Cochrane systematic review (Blessberger, 2018) demonstrated an association of beta blockers with increased all-cause mortality in **noncardiac** surgery. According to the authors of the review (Blessberger, 2018): • Data from low risk of bias trials further suggests an increase in stroke rate with the use of beta blockers. • As the overall quality of evidence is still low to moderate, more evidence is needed before a definitive conclusion can be drawn. • The substantial reduction in supraventricular arrhythmias and AMI in **noncardiac** setting seems to be offset by the potential increase in mortality and stroke.
In patients with three or more RCRI risk factors (e.g., diabetes mellitus, HF, CAD, renal insufficiency, cerebrovascular accident), it may be reasonable to begin beta blockers before surgery. (ACC/AHA 2014 guideline recommendation)	
In patients with a compelling long-term indication for betablocker therapy but no other RCRI risk factors, initiating beta blockers in the perioperative setting as an approach to reduce perioperative risk is of uncertain benefit. (ACC/AHA 2014 guideline recommendation)	
In patients in whom beta-blocker therapy is initiated, it may be reasonable to begin perioperative beta blockers long enough in advance to assess safety and tolerability, preferably more than one day before surgery. (ACC/AHA 2014 guideline recommendation)	

A 2018 systematic review and meta-analysis of 88 randomized controlled trials (53 trials in cardiac surgery and 35 trials in noncardiac surgery) on influence of beta blockers on perioperative adverse events had the following findings egarding **noncardiac** surgery outcomes (the overall quality of evidence was low to moderate). (*Blessberger, 2018*)

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- Beta blockers significantly increased the risk of all-cause mortality (number needed to treat for an additional harmful outcome NNTH 167), hypotension (NNTH 16) and bradycardia (NNTH 21).
- Beta blockers use had a potential increase in the risk of cerebrovascular events when all studies were analyzed; however, when only the studies with low risk of bias were analyzed, the risk was significantly increased (NNTH 265).
- Beta blockers significantly reduced the risk of AMI (NNTB 76), myocardial ischemia (NNTB 9) and supraventricular arrhythmias (NNTB 112).
- There was no clear evidence of an effect on ventricular arrhythmias, congestive heart failure and length of hospital stay.

ACE Inhibitors and ARB Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
Continuation of angiotensin-converting enzyme (ACE) inhibitors or angiotensin-receptor blockers (ARBs) perioperatively is reasonable. (ACC/AHA 2014 guideline recommendation)	Agree with qualification Recent evidence suggests the risk for intraoperative hypotension morbidity is significantly higher if continued the morning of surgery, with unclear effect on mortality and morbidity. The consensus of the ICSI work group is for anesthesiology team to be cautious about the risk for intraoperative hypotension in patients chronically receiving ACEIs/ARBs who are on it the day of surgery, and should know how to treat it effectively. The risks and benefits of continuing these medications should be weighed against patients' risk factors.
If ACE inhibitors or ARBs are held before surgery, it is reasonable to restart as soon as clinically feasible postoperatively. (ACC/AHA 2014 guideline recommendation)	

ACEI/ARB medications reduce the activity of the renin–angiotensin–aldosterone system, ultimately decreasing peripheral vascular tone and increasing perfusion. (*Fleisher, 2014*) Patients who use these medications are prone to developing side effects like hypotension and even refractory hypotension during anesthesia use, and whether ACEIs/ARBs should be continued or discontinued perioperatively in such patients remains debatable.

Though the 2014 ACC/AHA guideline recommends ACEI and ARB medications can be taken perioperatively, more recent evidence shows the risk for intraoperative hypotension morbidity is significantly higher if continued the morning of surgery with unclear effect on mortality and morbidity (*Fleisher, 2014*). The consensus of the ICSI work group is for anesthetists to be cautious about the risk for intraoperative hypotension in patients chronically receiving ACEIs/ARBs and are on it the day of surgery, and should know how to treat it effectively. The risks and benefits of continuing these medications should be weighed against patients' risk factors.

A 2018 systematic review and meta-analysis of 13 studies reporting on the incidences of intraoperative hypotension between patients who continued receiving ACEIs/ARBs and those who did not on the day of their surgical procedure found that hypotension during anesthesia was more likely to develop in patients who continued to take ACEIs/ARBs when compared to those who did not. However, no significant differences between these groups of patients were found with regards to postoperative complications including ST-T abnormalities, myocardial injury, myocardial infarction, stroke, major adverse cardiac events, acute kidney injury or death. (*Ling, 2018*)

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Another 2018 systematic review and meta-analysis of nine studies (five RCTs and four cohort studies) with a total of 6,022 patients on chronic ACEI/ARB therapy before noncardiac surgery found that while withholding ACEI/ARB therapy on the morning of surgery was associated with significantly less intraoperative hypotension, withholding ACEI/ ARB therapy was not associated with a difference in the mortality risk or risk of major adverse cardiac event vs. those who continued these medications on the morning of surgery. (*Hollmann, 2018*)

Calcium Channel Blocker Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
No specific recommendation.	A 2003 systematic review of 11 studies with 1,007 patients found calcium channel blockers significantly reduced ischemia and supraventricular tachyarrhythmia in the setting of noncardiac surgery. (Wijeysundera, 2003) While ACC/AHA guidelines do not provide specific recommendations, it is the consensus of the ICSI work group that it may be reasonable to continue calcium channel blocker therapy perioperatively.

Diuretic Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
No specific recommendation.	Thiazide and loop diuretic medications are commonly prescribed for treatment of hypertension as well as congestive heart failure. While ACC/AHA guidelines do not provide specific recommendations, it is the consensus of the ICSI work group that diuretic therapy should be held on the morning of surgery in most cases. Continuing diuretic therapy on the morning of surgery may be reasonable for patients with congestive heart failure.

Alpha-2 Agonists

ACC/AHA Recommendation	ICSI Work Group Comment
Alpha-2 agonists for prevention of cardiac events are not recommended in patients who are undergoing noncardiac surgery. (ACC/AHA 2014 guideline recommendation)	Agree

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Statins

ACC/AHA Recommendation	ICSI Work Group Comment
Statins should be continued in patients currently taking statins and scheduled for noncardiac surgery. (ACC/AHA 2014 guideline recommendation)	Agree
Perioperative initiation of statin use is reasonable in patients undergoing vascular surgery. (ACC/AHA 2014 guideline recommendation)	
Perioperative initiation of statins may be considered in patients with clinical indications according to GDMT who are undergoing elevated-risk procedures. (ACC/AHA 2014 guideline recommendation)	

Antiplatelet Therapy

ACC/AHA Recommendation	ICSI Work Group Comment
In patients undergoing urgent noncardiac surgery during the first four to six weeks after BMS or DES implantation, DAPT should be continued unless the relative risk of bleeding outweighs the benefit of the prevention of stent thrombosis. (ACC/AHA 2014 guideline recommendation)	Agree
In patients who have received coronary stents and must undergo surgical procedures that mandate the discontinuation of P2Y12 platelet receptor–inhibitor therapy, it is recommended that aspirin be continued if possible and the P2Y12 platelet receptor–inhibitor be restarted as soon as possible after surgery. (ACC/AHA 2016 guideline recommendation)	
When noncardiac surgery is required in patients currently taking a P2Y12 inhibitor, a consensus decision among treating clinicians as to the relative risks of surgery and discontinuation or continuation of antiplatelet therapy can be useful. (ACC/AHA 2016 guideline recommendation)	Agree
In patients undergoing nonemergency/nonurgent noncardiac surgery who have not had previous coronary stenting, it may be reasonable to continue aspirin when the risk of potential increased cardiac events outweighs the risk of increased bleeding. (ACC/AHA 2014 guideline recommendation)	Agree
Initiation or continuation of aspirin is not beneficial in patients undergoing elective noncardiac noncarotid surgery who have not had previous coronary stenting, unless the risk of ischemic events outweighs the risk of surgical bleeding. (ACC/AHA 2014 guideline recommendation)	Agree

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Prevention of Endocarditis

The ICSI work group did not find any new literature regarding antibiotic prophylaxis for prevention of endocarditis and agrees with the recommendations from the following guidelines:

- The 2007 American Heart Association (AHA) Guideline on Prevention of Infective Endocarditis (*Wilson, 2007*)
- The 2017 American Heart Association (AHA)/American College of Cardiology (ACC) Focused Update of the 2017 AHA/ACC Guideline for the Management of Patients with Valvular Heart Disease (*Nishimura, 2017*)

Summary of Recommendations:

1. **Increased Lifetime Risk of Acquisition of Infective Endocarditis**
   The 2007 AHA Guideline on Prevention of Infective Endocarditis (IE) does not recommend IE prophylaxis based solely on an increased lifetime risk of acquisition of IE. (*Wilson, 2007*)

2. **Dental Procedures**
   Both the 2007 AHA Guideline on Prevention of Infective Endocarditis and the 2017 AHA/ACC Focused Update of the 2017 AHA/ACC Guideline for the Management of Patients with Valvular Heart Disease recommend IE prophylaxis for certain cardiac conditions* associated with the highest risk of adverse outcome from endocarditis for patients undergoing dental procedures. (*Nishimura, 2017; Wilson, 2007*)

   *Specifically, prophylaxis against IE is reasonable before dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth or perforation of the oral mucosa in patients with the following:

   1. Prosthetic cardiac valves, including transcatheter implanted prostheses and homografts.
   2. Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords.
   3. Previous IE.
   4. Unrepaired cyanotic congenital heart disease or repaired congenital heart disease, with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or prosthetic device.
   5. Cardiac transplant with valve regurgitation due to a structurally abnormal valve.

3. **Gastrointestinal/Genitourinary Procedures**
   Both guidelines found no evidence for infective endocarditis prophylaxis in gastrointestinal procedures or genitourinary procedures, absent known active infection. (*Nishimura, 2017; Wilson, 2007*)

4. **Respiratory Tract/Infected Skin/Skin Structure/Musculoskeletal Tissue**
   The 2007 AHA guideline found antibiotic prophylaxis to be reasonable for procedures on respiratory tract or infected skin, skin structure, or musculoskeletal tissue only for patients with underlying cardiac conditions (listed above) associated with the highest risk of adverse outcome from IE. (*Wilson, 2007*)

5. **Invasive Procedures**
   The 2007 AHA guideline stated that it did not find published data that demonstrates convincingly that the administration of prophylactic antibiotics prevents IE associated with bacteremia from an invasive procedure. However, the possibility that there may be an exceedingly small number of cases of IE that could be prevented by prophylactic antibiotics in patients who undergo an invasive procedure could not be excluded. Such therapy should be restricted to those patients with the highest risk of adverse outcome and who would derive the greatest benefit from prevention of IE. (*Wilson, 2007*)

For information on prophylaxis on infective endocarditis, refer to resources such as the Sanford Guide for Antimicrobial Therapy or Micromedex.

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Anticoagulants/Antithrombotics

The evidence on anticoagulant bridging and reversal tends to be specific to individual procedure and clinical indication. The ICSI work group consensus is to take into consideration the following for perioperative management of anticoagulants/antithrombotics to potentially prevent or reduce risk of adverse events:

Preoperative

As part of the preoperative assessment, patients taking any medication that can affect hemostasis or may require antithrombotic therapy postoperatively should undergo the following workup:

- Estimate thrombotic risk and bleed risk (in consultation with the surgeon) in order to determine whether or not chronic therapy should be interrupted, or to determine choice of new antithrombotic therapy postoperatively (at surgeon discretion).
    - Timing of interruption of anti-thrombotic therapy can differ greatly among agents that affect hemostasis (e.g., non-steroidal anti-inflammatory drug (NSAID) vs. vitamin K antagonist vs. direct oral anticoagulant (DOAC) vs. antiplatelet)
- Determine whether or not patient requires bridging therapy if anticoagulation is interrupted.
- Determine a tentative plan for antithrombotic initiation or resumption postoperatively.
- Perioperative anticoagulation plan should be developed in conjunction with surgeon.

Intraoperative (Day of Surgery)

- Surgery may be delayed or cancelled if perioperative plan is not in place for patients taking certain anticoagulant medications (reversal of anticoagulants would be necessary in the setting of urgent/emergent procedures).
- Risk of epidural hematoma is increased with epidural placement/removal and concurrent use of some types of anticoagulation therapy. Ensure anesthesia team is aware of anticoagulation plan.
- Assess risk for development of perioperative VTE; weigh risk vs. benefit of mechanical vs. pharmacological VTE prophylaxis.

Postoperative

- Communicate with anesthesia team regarding anticoagulation management in the setting of neuraxial (epidural, spinal, paravertebral) anesthesia and analgesia.
- Implement postoperative anticoagulation plan as appropriate.
- Provide patient education surrounding anticoagulation management.

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Diabetes Mellitus

HbA1c Testing in Patients with Diabetes during Preoperative Clinic Visit

Consensus Recommendation
Consider obtaining a preoperative HbA1c test value, if not done in the past three months, on patients with known diabetes during preoperative clinic visit. **Establish a plan for management of diabetes prior to surgery. The decision to proceed with surgery or postpone surgery based on preoperative HbA1c test value should be based on individual patient centered factors such as urgency of planned surgery, overall mortality/morbidity risks, risks of perioperative infections, concerns for postoperative glucose control, and patient compliance.**
Benefit: HbA1c and especially glucose levels affect patient outcomes during surgery. It is beneficial to test preoperatively to understand the baseline and provide this information to surgeons. This would help surgeons guide and individualize their decision-making regarding whether to go ahead or delay surgery based on this information in conjunction with other risk factors. **Harm:** The evidence is not established on an optimal way to test for hyperglycemia during the preoperative phase in surgical patients. The patient may undergo multiple tests, which increases patient visits and cost. **Benefit-Harms Assessment:** Potential to prevent harm to patients by testing (using either HbA1c or glucose values) is greater than the harms of increased visits and cost. Therefore, testing should be pursued.
Relevant Resources: *ADA-Diabetes Care in the Hospital, 2019 (Guideline); van den Boom, 2018 (Observational Study); NICE, 2016 (Guideline); Yang, 2016 (Observational Study); Gustafsson, 2009 (Observational Study)*

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Intraoperative and Postoperative Glycemic Control Targets for Patients with Diabetes

Recommendation	Quality of Evidence
Consider a glycemic target range between 140-180 mg/dL for surgical patients with diagnosed diabetes during the intraoperative and postoperative periods. **Additional considerations:** **1. For patients with diabetes with glucose levels typically <140, do not treat to 140.** **2. Consider risk for hypoglycemia if necessary to treat for glycemic targets lower than 140.**	Quality of Evidence: Low Strength of Recommendation: Weak
Benefit: Elevated postoperative glucose has been associated with several adverse outcomes including wound infection, pneumonia, sepsis and cardiovascular events **Harm:** Individual patients may need different targets, depending on their medical comorbidities. **Benefit-Harms Assessment:** While it is critical to always individualize targets to each patient, the ICSI work group believes that 140-180 mg/dL reflects a reasonable target range that avoids the potential for hypoglycemia but also will mitigate adverse postoperative outcomes related to glycemic control.	
Relevant Resources: *Nair, 2016 (Observational Study); Sathya, 2013 (Meta-Analysis); Buchleitner, 2012 (Systematic Review); Gandhi, 2007 (Randomized Controlled Trial); Ata, 2010 (Observational Study); Ramos, 2008 (Observational Study)*	

Preoperative Testing during Clinic Visit

In the preoperative setting, the HbA1c test value may be used to alter diabetes management, with the aim of reducing postoperative morbidity and mortality. However, there is uncertainty regarding the optimal timing of the test in individuals known to have diabetes. (*NICE, 2016*)

Studies have shown a positive association between preoperative HbA1c and postoperative glucose levels. (*Yang, 2016; Gustafsson, 2009*) Evidence on how HbA1c directly affects outcomes such as mortality is less clear.

A retrospective analysis of 6,684 noncardiac and 6,393 cardiac surgeries in patients with diabetes found that although A1c was positively associated with perioperative glucose, it was not associated with increased 30-day mortality after controlling for glucose. Perioperative glucose predicted 30-day mortality, linearly in noncardiac and nonlinearly in cardiac procedures. (*van den Boom, 2018*) However, there have been a few low-quality retrospective studies that found an association between poorly controlled HbA1c (>7%) and postoperative complications such as infections and mortality. (*NICE, 2016*)

While not specific to perioperative patients, the ADA recommendation on patients admitted to the hospital is to perform an HbA1c test on all patients with diabetes or hyperglycemia (blood glucose >140 mg/dL) admitted to the hospital if not performed in the prior three months. Specific to patients undergoing surgery, the 2016 NICE guideline recommends that people with diabetes who are being referred for surgical consultation from primary care should have their most recent HbA1c test results included in their referral information and to offer HbA1c testing to people with diabetes having surgery if they have not been tested in the last three months. (*NICE, 2016*)

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The consensus of the ICSI work group is to consider obtaining a preoperative HbA1c, if not done in the past three months, on patients with known diabetes during a preoperative clinic visit.

Establish a plan for management of diabetes prior to surgery. The decision to proceed with surgery or postpone surgery based on preoperative HbA1c test value should be based on individual patient-centered factors such as urgency of planned surgery, overall mortality/morbidity risks, risks of perioperative infections, concerns for postoperative glucose control, and patient compliance.

Intraoperative and Postoperative Glycemic Control

The consensus of the ICSI work group is to consider a glycemic target range between 140-180 mg/dL for surgical patients with diagnosed diabetes during the intraoperative and postoperative periods. Additionally, given the complexities and wide variety of methodologies employed to achieve glycemic control, individual patient evaluation and instruction are required prior to surgery to avoid extremes in glucose levels. Therefore, the following additional considerations should be taken: 1) for patients with diabetes with glucose levels typically <140, do not treat to 140, and 2) consider risk for hypoglycemia if necessary to treat for glycemic targets lower than 140.

Hyperglycemia in the perioperative period is associated with several adverse outcomes including wound infection, pneumonia, sepsis, and cardiovascular events. (*Kwon, 2013*) In evaluating glucose control, there is evidence that evaluates the perioperative period as a whole while other evidence specifically looks at the intraoperative and postoperative periods, respectively. The lack of robust, high-quality evidence, including inconsistently defined populations and varied methodology, make it challenging to understand if intraoperative glycemic goals should be different from postoperative glycemic goals.

Perioperative period in general

The evidence shows that although an optimal target glucose range remains unknown for patients with diabetes, there is general consensus that adequate glycemic control, without hypoglycemia and excessive hyperglycemia, results in a better surgical outcome.

- A 2013 meta-analysis of six randomized trials and cohort studies found that in patients with diabetes, a moderate perioperative glycemic target (150-200mg/dl) is associated with reduction in postoperative mortality and stroke compared with a liberal target (>200mg/dl), whereas no significant additional benefit was found with more strict glycemic control (<150mg/dl). (*Sathya, 2013*)
- A 2012 systematic review of 12 randomized trials looking at perioperative glucose management in diabetic patients undergoing surgery found no significant difference in infectious complications, renal failure, cardiovascular events, and all-cause mortality between intensive glucose control and conventional glucose control groups (as defined by individual authors). It found that intensive glycemic control was associated with an increased risk of hypoglycemic episodes. (*Buchleitner, 2012*)

Intraoperative period

Intraoperative hyperglycemia has been found to be associated with adverse surgical outcomes, but the benefits of intensive glucose control during this period are uncertain. (*Simha, 2019*) A cohort study of adult surgery patients (both diabetic and nondiabetic) who required intraoperative glucose management found that a higher intraoperative glucose level is associated with a higher postoperative glucose level. Initiating insulin infusion when intraoperative glucose level exceeds 140 mg/dL to prevent hyperglycemia is associated with lower postoperative glucose levels and fewer incidences of postoperative hyperglycemia. However, patient- and procedure-specific variable interactions also play a role and may impact the relationship between intraoperative and postoperative glucose levels. (*Nair, 2016*) Specific to glucose control ranges, a 2007 randomized trial of intensive insulin infusion therapy to maintain blood glucose in the normal range of 80 to 100 mg/ dL

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in patients with and without diabetes undergoing cardiac surgery was not found to favorably influence postoperative complications and may be associated with greater harm. (*Gandhi, 2007*)

Postoperative period

A retrospective study of 995 patients (with and without diabetes) who had undergone general and vascular surgery that evaluated the association of perioperative hyperglycemia and postoperative infections found that postoperative hyperglycemia increased the risk of infections by 30% with every 40-point increase from normoglycemia (<110 mg/dL). Longer hospitalization for patients with postoperative glucose levels from 110 to 200 mg/dL and >200 mg/dL was also observed. (*Ramos, 2008*) Furthermore, a retrospective medical record review of 2,090 general and vascular surgery patients with and without diabetes found that postoperative hyperglycemia may be the most important risk factor for surgical site infections. (*Ata, 2010*)

Medications

Oral hypoglycemics

This ICSI work group agrees with the American Society of Anesthesia (ASA) recommendations on perioperative management of oral hypoglycemics with qualifications. These recommendations are from Perioperative Hyperglycemia Management: An Update. (*Duggan, 2017*)

Oral Medication Use the Day Before and the Day of Surgery

Of note, ASA gives two separate recommendations for the day of surgery. The first recommendation applies to patients with reduced postoperative oral intake *or* extensive surgery with anticipated hemodynamic changes and/or fluid shifts. We believe this will apply to a majority of surgeries. The second recommendation is if normal intake is anticipated the same day *and* it is a minimally invasive surgery.

Secretagogues:

1. Day before surgery: *take*
2. Day of surgery if reduced postoperative oral intake *or* extensive surgery with anticipated HD (hemodynamic) changes and/or fluid shifts: *hold*
3. Day of surgery if normal oral intake anticipated same day *and* minimally invasive surgery: *hold*

SGLT-2 Inhibitors:

1. Day before surgery: *hold*
2. Day of surgery if reduced postperative oral intake *or* extensive surgery with anticipated HD (hemodynamic) changes and/or fluid shifts: *hold*
3. Day of surgery if normal oral intake anticipated same day *and* minimally invasive surgery: *hold*

Thiazolidinediones

1. Day before surgery: *take*
2. Day of surgery if reduced postoperative oral intake *or* extensive surgery with anticipated HD (hemodynamic) changes and/or fluid shifts: *hold*
3. Day of surgery if normal oral intake anticipated same day *and* minimally invasive surgery: *take*

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Metformin

1. Day before surgery: *take* (*hold* if patient having a procedure with IV contrast dye administration, particularly in those with GFR<45 milliliters/minute)
2. Day of surgery if reduced postoperative oral intake *or* extensive surgery with anticipated HD (hemodynamic) changes and/or fluid shifts: *hold*
3. Day of surgery if normal oral intake anticipated same day *and* minimally invasive surgery: *take* (*hold* in patient having a procedure with IV contrast dye administration, particularly in those with GFR<45 milliliters/minute)

DPP-4 Inhibitors

1. Day Before Surgery: *take*
2. Day of surgery if reduced postoperative oral intake *or* extensive surgery with anticipated HD (hemodynamic) changes and/or fluid shifts: *take*
3. Day of surgery if normal oral intake anticipated same day *and* minimally invasive surgery: *take*

Insulin Therapy

For surgical patients with type 2 diabetes managed at home by diet, oral hypoglycemics or very low-dose insulin (less than or equal to 0.4 units/kg), in-hospital management with a basal-bolus regimen has been shown to be more effective than supplemental correction sliding-scale insulin alone. A randomized trial of 211 patients with type 2 diabetes undergoing general surgery found basal-bolus treatment with glargine once-daily plus glulisine before meals improved glycemic control and reduced hospital complications compared with sliding scale insulin. (*Umpierrez, 2011*) An observational study of 150 diabetic patients using a once-daily evening insulin glargine regimen found that the percent of normal insulin dose given the evening before surgery directly impacts perioperative glucose levels. More specifically, patients taking 60%-87% of their usual dose the evening before surgery were likely to arrive in target blood glucose range with decreased risk for hypoglycemia with the optimal dose around 75% of normal dose. (*Demma, 2017*) Both studies looked at the perioperative period.

This ICSI work group agrees with the American Society of Anesthesia (ASA) recommendations on how to adjust insulin regimens the day prior and the day of surgery for patients on insulin at home prior to surgery. These recommendations are from Perioperative Hyperglycemia Management: An Update. (*Duggan, 2017*)

Day before surgery insulin regimens

Glargine or detemir

- Normal diet until midnight (includes those permitted clear liquids until two hours prior to surgery): usual dose for AM dose, 80% of Usual dose for PM dose.
- Bowel Prep (and/or clear liquids only 12-24 hours prior to surgery): usual dose for AM dose, 80% of usual dose for PM dose.

NPH or 70/30 insulin

- Normal diet until midnight (includes those permitted clear liquids until two hours prior to surgery): 80% of usual dose for AM dose, 80% of usual dose for PM dose.
- Bowel prep (and/or clear liquids only 12-24 hours prior to surgery): 80% of usual dose for AM dose, 80% of usual dose for PM dose.

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Lispro, aspart, glulisine, regular

- Normal diet until midnight (includes those permitted clear liquids until two hours prior to surgery): usual dose for AM dose, usual dose for PM dose.
- Bowel prep (and/or clear liquids only 12-24 hours prior to surgery): usual dose for AM dose, usual dose for PM dose.

Noninsulin Injectables

- Normal diet until midnight (includes those permitted clear liquids until two hours prior to surgery): Usual dose for AM dose, usual dose for PM dose.
- Bowel prep (and/or clear liquids only 12-24 hours prior to surgery): Hold when starting clear liquid diet/bowel prep for AM dose, *hold* when starting clear liquid diet/bowel prep for PM dose.

Day of surgery insulin regimens

Glargine or detemir

- 80% of usual dose if patient uses twice-daily basal therapy

NPH or 70/30 insulin

- 50% of usual dose if BG 120mg/dL; *hold* for blood glucose (BG) < 120mg/dL

Lispro, aspart, glulisine, regular: *hold*

Noninsulin injectables: *hold*

3. Perioperative Opioid Management

Preoperative Opioid Management

Preoperative Patient Education

Preoperatively, patients should receive education about pain and opioids before the surgical procedure. The education should include multimodal pain management options, including opioids, and consistent messaging that the pain is an anticipated part of the postoperative course. Additionally, patient care goals and expectations in regard to pain during surgery should be understood to manage their expectations for surgical outcomes. Unrealistic goals jeopardize the patients' participation in their care and could lead to disengagement. Any common misconceptions that patients may have about opioids should be understood and addressed.

To support the discussion between provider and patient on care goals and expectations, shared decision-making process may be used (See ICSI Shared Decision-Making Model for more information on how to have these discussions). This approach takes into consideration patients' role in creating goals for pain and surgical outcomes, allows patients to have a clear understanding of their individual risk profile, and the risks and benefits associated with potential of opioid use during surgery, as well as exploration of their values and preferences. Additionally, within this process, patients should be well aware of the recommended guidelines for opioid prescribing in regard to duration and dosage.

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Preoperative Opioid Risk Assessment and Mitigation

Providers performing preoperative health screening and assessment should be aware of the following to help optimize the management of perioperative pain in their patients:

- Have a standard approach or checklist to assess for risk of adverse events (including risk for chronic opioid use and opioid use disorder) in patients for whom opioids are considered for pain control perioperatively.
- Assess preoperatively for appropriateness of nonopioid modalities for the treatment of perioperative pain.
- For complex patients (e.g., patients with chronic pain, long-term opioid use, or opioid use disorder), a multidisciplinary team that includes the primary care provider, pain management specialist, and surgical team (including postoperative opioid prescriber) may be needed prior to surgery to coordinate a plan of care. This approach incorporates biopsychosocial effects of the medical condition (*Gatchel, 2014; Gatchel, 2007*) and has shown to reduce pain severity, improve mood and overall quality of life for patients with chronic pain. (*Oslund, 2009; Gatchel, 2007; Gatchel, 2006*)
- Communication regarding opioids is needed among the primary care provider, surgical team (including postoperative opioid prescriber), pain specialist and hospitalist.

It is critical that the results of preoperative exam are documented in the chart.

To mitigate the risk of adverse effects due to opioid use perioperatively, it is important that a provider doing preoperative health screening and assessment performs and documents these findings on the preoperative exam:

- Directed physical examination
- Directed pain history
- Any patient care goals and preferences regarding pain control
- Review of PMP*

*Prescription Monitoring Program (PMP) provides information about the patient's exposure to opioids and other controlled substances, as well as whether patients receive opioids from other prescribers. A PMP query may affect the surgical team's decision-making on postoperative opioid prescribing. In a study looking at opioid prescribing behavior before and after a PMP query, a high proportion of prescribing decisions were changed in light of the information the PMP query provided. (*Gugelmann, 2011*) It is helpful to document the results of the PMP in the medical record, both to demonstrate the diligence in decision-making, and to capture outside information in the medical chart for future review.

Risk Assessment and Mitigation
Opioid problems
Psychiatric comorbidities
Elimination of drug
Respiratory compromise
Adverse reactions
Trouble (high-risk) medications
Early mobility and falls
Delirium

Prior to surgery, all patients should have an individualized assessment of risk(s) of adverse events of opioid use and risk(s) to be mitigated. This will help to more realistically counsel the patient, may guide choice of opioids and may improve the outcome(s) of surgery.

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Opioid Problems

What is the risk that a patient develops a new opioid use disorder (addiction) after surgery?

Opioid use disorder (OUD) should be recognized, diagnosed and charted in a timely manner. OUD carries great morbidity and mortality but also has effective treatments. (*Pierce, 2016; Volkow, 2014*) It is challenging to discuss OUD with patients. Counseling patients on possible outcomes of opioid prescriptions requires that the provider him or herself review the diagnostic criteria of OUD. (*Hasin, 2013*) OUD is also a challenging outcome to study. A recent study attempted to measure OUD in opioid-naïve patients exposed to opioids after surgery. The incidence of OUD was 0.2% postoperatively. The most important risk for OUD was duration of opioids; with each additional week of opioids, the risk of OUD increased 20%. (*Brat, 2018*) Preexisting substance use and mental health disorders also increased the risk of OUD. A timely discontinuation of postoperative opioids is the most likely way to mitigate risk of OUD.

Standard risk tools such as the Opioid Risk Tool (ORT) are used to predict opioid misuse, but poorly predict OUD itself. (*Klimas, 2019; Volkow, 2016*) Risk assessment tools should not be used to determine the indication or dose of opioids; rather, these tools inform the intensity of monitoring required. Risk tools may also facilitate shared decision-making with the patient. Note that the prevalence of OUD in the community is 1%, and it is often not disclosed or recognized in the preoperative visit. (*Han, 2018*) The TAPS tool for diagnosis of OUD may help recognize it in an outpatient setting. (*McNeely, 2016*)

How do I predict if my patient will overdose from opioids?

Past overdose is powerful predictor of future overdoses. Many patients who are hospitalized with a nonfatal overdose resume opioids, and this puts them at elevated risk of fatal overdose and increased all-cause mortality. (*Olfson, 2018; Larochelle, 2016*) A new screening tool to predict opioid overdose may prove useful. The Risk Index for Overdose or Serious Opioid-induced Respiratory Depression, or RIOSORD, accounts for medical and psychiatric comorbidities and prescription characteristics to generate a risk score that predicts chance of overdose. (*Zedler, 2018*) This tool can be incorporated into the preoperative assessment with prescription recommendations to avoid adding further risk. An additional safeguard is provision of a naloxone rescue kit to the patient with instructions; however, state laws governing naloxone prescriptions vary.

How do I prepare my patients with an established diagnosis of opioid use disorder for surgery?

Patients with OUD have a wide spectrum of clinical stability; they may be stable and in long-term remission, possibly on medication, or may be unstable and actively using intravenous drugs. This difference may affect the postoperative use of opioids. It is important to first ascertain if the patient is in treatment. Obtain a release of information and contact the treatment provider. Medications are an important component of recovery in OUD and should be carefully managed in the perioperative period. (*Alford, 2006*) Consider obtaining a urine drug screen, or reviewing the urine drug screen record with the addiction provider. It is critical to assess for recent IV drug use in OUD patients in the preoperative interview. Active IV drug use may require the surgery to be postponed. A focused addiction consultation may help assess the preoperative risk of drug use, and may help manage postoperative opioid use. See the "Perioperative Considerations for Patients with Opioid Use Disorder" section for more detailed information on medications and risk mitigation for these patients.

What is the patient's risk of continuing on opioids long-term after a surgery?

Opioid-naïve patients who receive opioid prescriptions after a cataract removal remain on opioids one year later 7.7% of the time; patients receiving an opioid prescription within seven days of surgery were 44% more likely to become long-term opioid users within one year compared with those who received no such prescription. (*Alam, 2012*) Healthy adolescents prescribed opioids for minor procedures, such as dental extractions, have a 30% increased relative risk of misusing opioids. (*Miech, 2015*) The presence of unused

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opioids in the home is itself a risk factor for someone in the household using opioids illicitly. (*Seamans, 2018*) Many patients have unused opioids after surgery. (*Bedard, 2018; Bates, 2011*) Therefore, in any instance where opioids are not routinely needed after a surgery, they should not be prescribed.

Postoperative short-term prescriptions may lead to chronic opioid use in patients who were opioid naive prior to the surgery. These patients do not meet criteria for opioid addiction. The likelihood of chronic opioid use after an acute pain episode is linearly dose-dependent on the opioid exposure. (*Shah, 2017*) The opioid exposure that predicts chronic use is the sum of the total opioids in the course of acute pain treatment (called total morphine milligram equivalent [MME]). Mental health comorbidities increase the risk of ongoing opioid use: depression and anxiety, use of antidepressants and benzodiazepines, substance use disorders, tobacco use. Average rates of ongoing opioid use after surgery is 6% at three months after the surgery and 1.5% one year after the surgery. (*Brummett, 2017; Sun, 2016; Carroll, 2012*) An article by Sun et al, 2016 provides relative risks associated with ongoing opioid use that can be used to individualize an assessment and incorporated in the preoperative evaluation (e.g., the relative risk for ongoing opioid use is 1.8 for patients also prescribed benzodiazepine). (*Sun, 2016*)

Psychiatric Comorbidities

Providers need to be aware of any psychiatric comorbidities that could affect pain management and of any medications patients are currently taking. If conditions are under poor control, therapies should be initiated prior to surgery if possible.

Certain mental health disorders pose a higher risk when initiating opioids. (*Davis, 2017; Volkow, 2016*) Patients with post-traumatic stress disorder or adverse childhood experiences are at very high risk for opioid misuse and addiction. Patients with eating disorders and obsessive-compulsive disorders are similarly at high risk but less studied.

Elimination

Renal impairment is an important limiting factor when choosing an opioid. Most opioids are cleared at least in part by the kidneys. In anyone other than young healthy patients, providers should have a recent measurement of renal function before prescribing an opioid. If the glomerular filtration rate is less than 60, consult a pharmacist before deciding on an opioid. (*Dean, 2004*)

Respiratory Compromise (and Immunocompromise)

Opioids suppress dyspnea, decrease ventilation, relax the muscles of the upper airway and reduce the gag reflex, and therefore cause a number of respiratory effects important in the perioperative period. Opioids in an opioid-naïve patient will worsen sleep apnea, hypoventilation syndromes and oxygenation in any patient predisposed to these issues. (*Mador, 2014*) Unrecognized obstructive sleep apnea increases the risk of death and heart failure after noncardiac surgeries, possibly related to opioid exposure. (*Chan, 2019*) Observation in the postoperative period may reveal apneic episodes in patients without an established sleep apnea diagnosis. Initiating opioids in an opioid-naïve patient with COPD doubles the mortality from pulmonary causes. (*Levine, 2017; Vozoris, 2016*) Opioids are associated with an increased risk of pneumonia, including invasive pneumococcal disease, and opioid prescriptions are overrepresented in deaths from pneumonia. (*Wiese, 2018; Hall, 2018*) The cause of the increase in pneumonia risk is not known but may be due to immunosuppression or aspiration. (*Wiese, 2019*) Patients hospitalized after a surgery can easily be observed for respiratory complications. However, outpatient surgeries for opioid-naïve patients with a respiratory illness may require educating the patient and family, and provision of a naloxone kit. It should be emphasized that the relative risks of respiratory events due to postoperative opioids may be large, but the absolute risk remains small.

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Adverse Reactions

Urinary retention is a common and underestimated adverse effect of opioids, especially given the risk of urinary tract infection postoperatively and the importance of minimizing unneeded urinary catheters. (*Benyamin, 2008*) Patients with preexisting urinary retention may particularly struggle.

Opioid-induced constipation results from decreased bowel motility and decreased mucosal secretions. Colace or fiber is not adequate treatment or prevention of opioid induced constipation. Senna may help situate the bowel but is often not sufficient if the stool is dry. Polyethylene glycol is a good agent to treat opioid-induced constipation. (*Swegle, 2006*)

Patients will often become nauseated when receiving opioids. This can be easily diagnosed and treated with traditional antiemetics as long as the provider is aware. (*Swegle, 2006*)

Patients will often develop pruritis on opioids. Antihistamines may reduce the pruritus, but some antihistamines have an anticholinergic effect that may interact with the sedating effect of the opioids. (*Ganesh, 2007*) Consider loratadine or cetirizine or fexofenadine before agents such as diphenhydramine. (*Swegle, 2006*)

It is important to distinguish true allergic reaction from adverse reaction when choosing opioid therapy for patients. If a true, IgE-mediated allergic reaction (hives, anaphylaxis) is documented, patients might tolerate opioid therapy from a different structural class. (*Powell, 2019*) Expected adverse reactions to opioids are common and can be managed with a variety of medications.

Trouble (High Risk) Medications: Tramadol, Meperidine, Methadone, Codeine, Long Acting Opioids and Benzodiazepines

Tramadol, tapentadol and meperidine lower seizure threshold. (*Manninen, 1997*) This epileptogenic effect is exaggerated in renal failure (*Pham, 2017*) and for those with preexisting seizure disorder. (*Boostani, 2012*) In such patients these medications should be avoided. Postoperatively, tramadol carries an increased risk of ongoing opioid use compared to other opioids. (*Thiels, 2019*) There is a black box warning against use of tramadol in children under 12 years of age and in breastfeeding women (https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-restricts-use-prescription-codeine-pain-and-cough-medicines-and). Meperidine may increase the risk of serotonin syndrome according to case reports. (*Tissot, 2003*) The Food and Drug Administration (FDA) released a statement in 2016 about several safety issues regarding the entire class of opioid medications, including the risk of serotonin syndrome. (*FDA, 2016*)

Many opioids prolong the QT interval, and in some instances, arrhythmias result. Methadone, even at low doses, has a high risk of QT prolongation. Oxycodone and tramadol show intermediate risk, but other opioids such as morphine and buprenorphine are considered low risk. (*Behzadi, 2018*) QT prolongation is multifactorial, typically resulting from other medications, electrolyte abnormalities, bradycardia, and individual susceptibility. (*Behzadi, 2018*) For patients with a long QT interval, consult with a pharmacist before initiating opioids, to avoid exacerbating the risk. (*Tisdale, 2016*)

The Food and Drug Administration has issued a black box warning against using codeine in children of any age after surgery, specifically after tonsillectomy and/or adenoidectomy, and against use in breastfeeding women. (*FDA, 2018*) This is due to the fact that many people are ultra rapid metabolizers of codeine, leading to the rapid buildup of the active metabolite, and therefore unexpected respiratory suppression. This effect is not unique to children; any patient may have respiratory suppression from codeine from this mechanism. (*Dean, 2012*)

Long-acting opioids should not be initiated for acute pain. Even in chronic pain, long-acting opioids are associated with increased mortality, including increased cardiovascular and pulmonary mortality. (*Ray, 2016*)

Benzodiazepines add risk of overdose, addiction, and ongoing use, and should be used sparingly and cautiously in combination with opioids in the postoperative period. (*Hozack, 2019*)

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Early Mobility and Falls

Opioids are associated with a 4.5-fold increase risk of falls and double the mortality in elderly patient compared to NSAIDs. (*Solomon, 2010*) Generally, for elderly patients, for the first two weeks after initiating opioid therapy, but not thereafter, short-acting opioids are associated with a greater risk of fracture than are long-acting opioids. (*Miller, 2011*) The highest risk opioid to cause falls is codeine; the lowest risk opioid to cause falls is tramadol. (*Buckeridge, 2010*)

Early mobilization is critical. For hospitalized patients, a physical therapist should be able to assess safety and should do so aware of the relationship of the assessment to the most recent opioid dose; the patient's safety assessment my change after he or she has taken an opioid. For outpatient surgeries, careful explanation of the risk of falls is important, and planning to minimize fall risk could help.

Delirium

Delirium is a possible outcome after any surgery and is usually multifactorial. Postoperative delirium occurs in 16-35% of patients. (*Leung, 2009; Morrison, 2003*) Pain can be an important contributor to delirium; patients receiving very low doses of opioids after hip replacement are at significant increased risk of delirium. Yet opioids themselves also contribute to delirium. (*Swart, 2017; Clegg, 2010; Morrison, 2003*) Meperidine and tramadol may be more associated with postoperative delirium than other opioids. (*Swart, 2017*) To further minimize the risk of delirium, polypharmacy and excessive sedation should be avoided, particularly by not starting benzodiazepines or not using anticholinergic antihistamines. (*Clegg, 2010*) Medical causes of delirium should be ruled out. Postoperative delirium will never be completely eliminated. However, by treating pain prudently, while minimizing unneeded opioids, avoiding benzodiazepines and anticholinergic medications, the risk and severity of postoperative delirium may be reduced.

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Preoperative Opioid Use

When looking at evidence in the postoperative outcomes of patients on preoperative opioids, the definition of preoperative opioid use varied across studies. The definitions ranged from any documented opioid use prior to surgery to more specific time frames defined by each study. Because of this broad definition of preoperative opioid use, it is hard to draw definitive conclusions. Additionally, there is variation among studies on inclusion of medical and mental health comorbidities (mood, anxiety), personality disorders, trauma and substance use disorders comorbidities (some studies looked at impact of this and others did not).

In general, available systematic review and observational studies, mostly comprising of patients undergoing orthopedic surgeries (e.g., primary total knee or hip arthroplasty), show that compared to opioid-naïve patients, patients with preoperative opioid use have worse postoperative outcomes. Those outcomes include physical and mental health outcomes including higher pain and function scores, higher likelihood of long-term opioid use, increased discharges to rehabilitation facility vs. home, greater length of stay, higher readmission rates, and higher rates of surgical site infections and revisions. (*Blevins Peratikos, 2019; Bonner, 2019; Goplen, 2019; Berglund, 2018; Bell, 2018; Politzer, 2018; Rozell, 2017; Zarling, 2017*) The results remained true after controlling for certain medical and mental health comorbidities.

Studies of other types of orthopedic surgery (spine, lumber fusion and cervical fusion) followed similar outcomes as did studies of abdominal surgery. (*Cron, 2017; Faour, 2017; Tye, 2017; Waljee, 2017; Issa, 2014; Lee, 2014*)

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Chronic Opioid Use

Studies that specifically looked at outcomes for patients with preoperative chronic opioid use differed on the definition of chronic opioid use. Also, the total body of literature is smaller compared to general preoperative opioid use and comprised mostly patients undergoing orthopedic surgeries such as total knee, shoulder arthroplasty, cervical spine fusion and lumbar spine fusion. None of the studies included patients with opioid addiction. Overall, these drawbacks limit the conclusions that may be drawn on patients on chronic opioids preoperatively.

Evidence shows that compared to patients who are opioid-naïve or not chronic opioid users, those who are chronic opioid users preoperatively have higher likelihood of long-term opioid use postoperatively, increased risk of complications (e.g., wounds, infections and constipation), ED visits, and revision surgery. (*Kalakoti, 2019; Jain, 2018a; Jain, 2018b*) Other findings show longer length of stay, continued and persistent chronic opioid use postoperatively, and higher MED consumption in chronic opioid users. (*Kim, 2019; Kim, 2018; Cheah, 2017; Aasvang, 2016; Zarling, 2016*) These studies have also found that patients with medical and mental health comorbidities (e.g., mood, anxiety) are more likely to be chronic opioid users preoperatively. The studies varied on which comorbidities were included.

Preoperative Opioid Tapering

Consensus Recommendation
An individualized approach for tapering in patients who are on opioids preoperatively (including patients with chronic opioid use) should be taken. **A decision on whether to taper preoperatively needs to be made well in advance of surgery. However, if a significant medical concern about opioid use is recognized closer to the surgery date *which could be made safe with a taper*, the patient, the provider and the surgical team should discuss whether delaying the surgery in order to treat the underlying condition is appropriate.**
Benefit: Small body of available evidence shows that postoperative outcomes (reduced risk of adverse events, reduced likelihood of revision surgery, reduced morphine equivalent dose (MED), and improved pain scores and patient-reported scores on physical and mental health outcomes) in tapered patients are comparable to the outcomes for opioid-naïve patients. **Harm:** Given that evidence on harms of tapering is not available and harms are unknown, there is a potential risk that a patient could experience adverse effects from opioid tapering. **Benefit-Harms Assessment:** Given the small body of evidence on perioperative outcomes for patients who are tapered from opioids preoperatively and unknown harms from it, primary care providers performing preoperative health screening and assessment should take an individualized approach to tapering as stated in the recommendation.
Relevant Resources: *Jain, 2019 (Observational Study); Nguyen, 2016 (Randomized Controlled Trial); Hassamal, 2016 (Case Series)*

There is only a small body of emerging evidence on tapering opioids prior to surgery. The largest study (n=58,082) found that stopping opioids three months before surgery for patients on opioids longer than six months reduced the risk of pain-related ED visits, readmissions, infections and revision surgery within one year, particularly in patients undergoing hip surgery and lumbar fusion. (*Jain, 2019*) One study of 41 patients who regularly used opioids and successfully tapered their morphine equivalent dose by 50% prior to a total knee or hip arthroplasty had greater improvements in physical health outcomes than patients who did not taper. Outcomes in the tapered group were also comparable to those of opioid-naïve patients. (*Nguyen, 2016*) A case series study of six spine surgery patients who underwent preoperative opioid reduction

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program for about six to eight weeks found a decrease in daily morphine equivalent dose (MED), and in pain score in five patients, and a surgery-related complication in one patient. All six patients had improvements in mental health outcomes such as depression, anxiety and fatigue. Most patients had improved physical functioning, disturbances in sleep and satisfaction with participation in social roles. (*Hassamal, 2016*) The tapering protocols varied between the studies. None of these studies identified potential harms from stopping opioids or tapering.

Given the lack of uniformity in the literature on the standard definitions of preoperative or chronic opioid use and lack of more expansive literature looking at efficacy and/or harms of tapering prior to surgery, **the ICSI Perioperative Opioid Management Subgroup consensus is to take an individualized approach for tapering in patients on opioids preoperatively**. A decision on whether to taper preoperatively needs to be made well in advance of surgery. However, if a significant medical concern about opioid use is recognized closer to the surgery date *which could be made safe with a taper*, the patient, the provider and surgical team should discuss whether delaying the surgery in order to treat the underlying condition is appropriate.

The individualized approach should take into consideration the following:

- Individual patient risk factors for adverse events of continued opioid use post surgery
- Individual patient risk factors for adverse events due stopping or tapering opioids prior to surgery
- Shared decision-making discussions between providers and patients on the risks of continued opioid use preoperatively, which include patient education on postoperative pain expectations
- Multidisciplinary approach that focuses on opioid management and communication between primary care providers and the surgical team both preoperatively and postoperatively
- Goals of an opioid taper (how much to taper and over what period of time) prior to surgery
- Follow-up and support for patients managing pain and changes to their medication regimens

Links to additional resources that provide specific guidance on opioid tapering (MN Health Collaborative Demystifying Opioids and U.S. Department of Health and Human Services guide on tapering) are available in "Implementation Tools and Resource Table" section of this guideline.

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Intraoperative Pain Management

An intraoperative plan of care should incorporate the results of preoperative health screening and assessment, optimize periprocedural regional analgesia/anesthesia techniques to reduce the need for opioid use postoperatively where possible. Additionally, the plan should emphasize use of multimodal analgesia (e.g., NSAIDs, Cox-2 inhibitors (COXIBs), or acetaminophen) when possible. This approach provides superior pain relief and decreases the need for supplemental opioid use compared to an unimodal analgesia approach, which in turn means that patients may only require nonpharmacologic modalities postoperatively. (*Apfelbaum, 2012a*)

The following table provides a summary of intraoperative approaches prior to incision vs. postincision during the surgical procedure. It is informed by the American Society of Anesthesiologists Task Force on Acute Pain Management Practice Guidelines for Acute Pain Management in the Perioperative Setting. (*Apfelbaum, 2012a*)

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Pre-Incision Medications and Techniques	Post-Incision Medications and Techniques
Acetaminophen* NSAIDs (COX-2 inhibitor) Gabapentinoids (gabapentin, pregabalin) Regional anesthesia • Neuraxial blockade - Continuous epidural analgesia Single-injection spinal opiates - Paravertebral • Peripheral nerve blockade (single injection or continuous) - Upper extremity • Interscalene block • Suprascapular nerve block • Supraclavicular block • Infraclavicular block • Axillary block - Lower extremity • Lumbar plexus/fascia iliaca block • Femoral nerve block • Distal femoral triangle block • Adductor canal block • Sciatic nerve block • Popliteal (sciatic) nerve block • Selective tibial nerve block • Ankle block • iPACK block • Truncal/fascial plane blockade (single injection or continuous) - Erector spinae plane (ESP) block - PECS I, II blocks - Serratus plane block - TAP block - Rectus sheath block - Quadratus lumborum block	Acetaminophen* NSAIDS (ketorolac, ibuprofen) Dexamethasone Regional/local anesthesia • See pre-incision regional techniques • Surgeon-administered incision infiltration • Surgeon-administered fascial plane blocks Lidocaine, bolus plus infusion Ketamine, bolus plus infusion Dexmedetomidine, bolus plus infusion Magnesium infusion

*A note on acetaminophen: There is some early evidence showing positive preventive effect of acetaminophen given within one hour of anesthesia vs. postincision; however, more evidence is needed to draw definitive conclusions. A 2015 systematic review and meta-analysis of seven randomized controlled trials with 544 patients aged 16 years and older including all types of surgeries looked at the relationship between acetaminophen as preventive analgesia and postoperative outcomes. Acetaminophen given preventively (defined as within one hour before induction of anesthesia) was compared to acetaminophen given after incision (any time between postincision and within 30 minutes from the end of surgery). The review found a reduction in 24-hour opioid consumption, lower pain scores at one hour and two hours, and a lower incidence of postoperative vomiting in the preventive acetaminophen group. (*Doleman, 2015*)

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Postoperative Opioid Management

Postoperative Opioid Prescribing

In general, multimodal pain management strategies that include use of medications from multiple therapeutic classes prioritizing nonopioid medications before administering opioid medications should be used whenever appropriate. These include, a scheduled regimen of NSAIDs, COXIBs or acetaminophen, when appropriate, and regional blockade with local anesthetics, when appropriate. (*Apfelbaum, 2012a*) These modalities may reduce pain enough to save opioids for extreme or break-through pain.

The surgical team should consider reviewing the following when determining individual patient postdischarge pain management plan with the goal of improving function and control pain:

- The results of preoperative health screening and assessment to understand the patient's history with pain management and medications
- Any plan of care that was set by a patient and the provider

If considering opioid prescribing postoperatively, review:

- Individual patient factors such as age, prior exposure to opioids, mental status, and pain management history
- Patient's pre-existing health conditions that increase the risk of adverse effects and addiction due to opioid use (see "Preoperative Opioid Risk Assessment and Mitigation")
    - This information should be available from preoperative health screening and assessment. If not available, the surgical team (including postoperative opioid prescribers) should assess.
- PMP
    - Findings should have been documented during the preoperative exam. If this was not done, the surgical team should query because it provides information about the patients' exposure to opioids and other controlled substances, as well as whether patients receive opioids from other prescribers.

Consensus Recommendation
The postoperative prescribed opioid doses at discharge should be the lowest effective dose of short-acting opioids.
Benefit: • Provides optimal pain control, reduces potential for unused opioids in the community and maintains patient satisfaction. • Initiation of long-acting opioids can harm the patient by increasing the risk of overdose or death. **Harm:** • Risks include overdose and death. **Benefit-Harms Assessment:** Opioids carry the risk of potential overdose and death. In order to mitigate for this risk, it is important that if opioids are prescribed postoperatively at discharge that the lowest effective dose of short-acting opioid is prescribed.
Relevant Resources: *Hill, 2018 (Observational Study); Koehler, 2018 (Systematic Review); Mark, 2018 (Observational Study); Bicket, 2017 (Systematic Review); Osmundson, 2017 (Observational Study); Thiels, 2017 (Observational Study); Ray, 2016 (Observational Study); Miller, 2015 (Observational Study); Dhalla, 2009 (Observational Study)*

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The higher total morphine milligram equivalent (MME) dose and a longer duration of opioids prescribed postoperatively during the inpatient stay are associated with many undesirable outcomes: longer hospital stays, increased readmission rate, mortality rate, chance of health care facility disposition and total cost of care. (*Shafi, 2018*) There is growing body of literature looking at patterns of opioid use postoperatively to determine the amount needed on discharge, if any at all. (*Hill, 2018; Mark, 2018*) Each patient is unique, and there is growing evidence that using a procedure-specific, patient-centered approach to guide the use of postoperative opioids provides optimal pain control, reduces unused opioids in the community, and maintains patient satisfaction. (*Bicket, 2017; Osmundson, 2017; Thiels, 2017*) Studies have also found that more than 80% of patients report unused opioids and 42-71% of pills dispensed went unused after surgery. (*Feinberg, 2018; Tan, 2018; Batemen, 2017; Bates, 2011; Bicket, 2017; Osmundson, 2017*)

Given the available evidence, it is the consensus of this work group that the postoperative prescribed opioid doses at discharge should be the lowest effective dose of short-acting opioids.

Other considerations for postoperative opioid prescribing at discharge for all patients include:

- Prescribed opioid doses should be individualized based on the risk of adverse events due to opioid use to each patient. It is out of scope of this document to address procedure-specific dosing. For information on procedure specific postoperative opioid prescribing at discharge, refer to the MN Health Collaborative Call to Action on standards for opioid prescribing based on the type of surgery.
- Avoid long-acting opioids. Initiation of long-acting opioids can harm the patient by increasing the risk of overdose or death. (*Ray, 2016; Miller, 2015; Dhalla, 2009*)
- Provide following information to patients on:
    - Expectations on length of time they would be on opioids for surgical-related pain
    - Risks of overdose and death (including the risk if opioids are taken with alcohol or illicit drugs)
    - The potential risk to other person/child, or pet, specifically if taken with alcohol or illegal drugs
    - Safe storage of the medications, preferably in a lockbox and with safe disposal instructions
    - Information on opioids and driving
    - Naloxone kit to high-risk surgical patients and/or their close contacts (e.g., family, friends, caretaker)

Additional considerations for patients with chronic opioid use preoperatively:

- Preoperatively, the patient should be educated that any new higher dosing of opioids for postoperative pain *is not* the new normal. The objective is to treat surgical-related pain, not chronic pain.
- Patients may not need their preoperative opioid dose after surgical healing, particularly if the surgery was done to help improve the issue for which opioids were initially prescribed.
- The surgical team and primary opioid prescriber should have clear communication on who is the active opioid prescriber at all times.
- Patients on chronic opioids preoperatively may be enrolled in a controlled substance agreement with the provider who prescribes their chronic opioids. While this should not preclude another provider from prescribing opioids in an acute setting, good communication is needed between care teams and with the patient.

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Postoperative Patient Education

For patients who are prescribed opioids postoperatively, include information on potential of adverse effects of opioids and what to do if experiencing any adverse effects. Refer to "Preoperative Opioid Risk Assessment and Mitigation" section for detail on adverse effects.

For patients who are prescribed opioids postoperatively, PRN instructions on opioid prescriptions may not be sufficient for patients to understand when they should take opioids. Therefore, the providers may want to consider including clear prescription instructions on all opioid prescriptions for patients on how and when to decrease dose and to increase the interval between doses as pain subsides.

Naloxone

Naloxone is a medication that can reverse the sedating effects of opioids. Serious side effects from naloxone use are rare, but benefits during an overdose far exceed the risks. The reversal effect of naloxone may not outlast the sedating effect of many opioids, so it is recommended to activate the emergency services whenever it is used. (*CDC, 2018; Hooten, 2017*)

Administration can be intranasally, intramuscularly or subcutaneously. Anyone can administer it if received education on how to do it (free online or community training course are available; check for availability in your area).

Opioids Storage and Disposal

Proper storage and disposal of opioids can reduce diversion, accidental misuse and overdose. (*Hooten, 2017*) All patients should be instructed to store their opioids in a location, ideally locked, that is unreachable by family or house guests. Patients should be instructed to dispose of their unused medications promptly at the end of a pain episode.

Disposal options in the order of preferred method (see the "Implementation Resources Table" for more information):

- Medication take-back is the preferred method per the FDA. The U.S. DEA may periodically host prescription take-back events at temporary collection sites. Authorized collection sites in the community are also available and include local law enforcement facilities, retail pharmacies, hospital or clinic pharmacies.
- The second preferred option (if no take-back programs are available) is pharmaceutical disposal bags with activated charcoal, which can be purchased for at-home disposal.
- The third preferred method is flushing down the toilet. The FDA and DEA allow for opioids to be flushed down the toilet; however, this method is not endorsed by the EPA.

Opioids and Driving

The sedating effects of opioids may impair one's ability to operate a motor vehicle or carry out tasks that require wakefulness and reaction time. (*Hooten, 2017*). Therefore, it is important to warn patients about the risk to themselves and others while performing potentially dangerous tasks while on opioids.

Nontolerant opioid users will likely experience greater impairment. (*Hooten, 2017*) Alcohol and other CNS depressants may increase these effects and should be avoided while a patient is on opioid medications. (*Hooten, 2017*) When a patient has developed tolerance to the sedating effects of opioids, patients may safely operate a motor vehicle. (*Hooten, 2017*) Determining when the patient has developed enough tolerance is a judgment call, and prescribers should err on the side of caution.

There may also be legal implications for patients who drive while taking opioids, which can vary state to state. Local law may vary on what meets the definition of "driving under the influence" of a controlled substance, and prescribers should understand and follow local laws.

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Perioperative Considerations for Patients with Opioid Use Disorder (OUD)

Patients on Medication-Assisted Treatment (MAT)

Patients with opioid use disorder (OUD) are at high risk of opioid overdose and relapse if using opioids for management of acute pain. (*SAMHSA, 2018*) Thus, these patients may be at risk of having their acute pain underestimated or undertreated. (*Mehta, 2006*) Patients who are on medication-assisted therapy (MAT) should be carefully managed i.n the perioperative period if opioids are prescribed to manage acute pain. (*Alford, 2006*)

There is a lack of high-quality evidence on perioperative opioid management of patients with OUD on MAT. The evidence consists mostly of low-quality studies including case studies, retrospective studies and expert opinion. The specific protocols for perioperative MAT and acute pain management with opioids vary in the literature based on different expert consensus groups.

Given the complexities of acute pain management with opioids in OUD patients on MAT, the patient's provider and surgical team may consider a consult with addiction medicine and/or pharmacist to provide guidance on MAT and opioid management perioperatively.

Currently, three agents are used for MAT in OUD:

Methadone: A synthetic, long-acting opioid, approved for treatment of OUD in 1972. The dose generally ranges from 60-120 mg and is available for treatment of OUD only via methadone clinic.

Buprenorphine: A partial mu agonist, kappa antagonist and long acting. It was approved for office-based treatment of OUD in 2002.

Naltrexone: Opioid antagonist with a 28-day extended release formulation. Also available in PO formulation.

Patient Education

In addition to information in the "Preoperative Patient Education" section, a few additional considerations for patients with OUD who are currently on MAT undergoing surgery should include:

- Discussion of expectations of pain from surgery and expectations about opioids for pain from surgery
- *Reassurance* to patients regarding pain expectations and more specifically, their addiction history will not prevent adequate pain management. (*Alford, 2006*) Discuss and document previous experiences and utilize shared decision-making in discussions regarding decisions for opioids for pain management.
- Discussion of risk of relapse
- Discussion of risk of overdose
- Discussion of identifying triggers/cravings
- Discussion of availability and access to naloxone to patients and/or family members and training
- Discussion of storage/disposal/lockbox

Perioperative Pain Management

In general, pain management should use strategies that both provide effective analgesia and prevent withdrawal symptoms, with those being two separate goals. (*Quinlan, 2017*) Therefore, initially the goal is to maximize nonpharmacological options and nonopioid pharmacology. (*Quinlan, 2017; Mehta, 2006*) However, opioids may still be prescribed as part of multimodal pain management because OUD patients

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are likely to be opioid tolerant, but are often pain intolerant. (*Harrison, 2018*) If opioids are prescribed, there should be careful considerations for preoperative and postoperative management of MAT. The next section includes more specific considerations for each MAT agent.

Additional considerations include:

- Using regional anesthesia (*Quinlan, 2017*)
- Early recognition and treatment of symptoms and behavioral changes that might indicate withdrawal (*Quinlan, 2017*)
- Avoid use of mixed agonist and antagonist opioids because they may precipitate an acute withdrawal syndrome (*Alford, 2006*)
- Avoiding prescribing benzodiazepines and carisoprodol (*Quinlan, 2017*)
- Using tamper-proof and secure analgesia administration procedures
- Notifying the patient's MAT provider regarding the patient's discharge and confirming the time and amount of the last maintenance opioid dose (*Alford, 2006*)

Risk mitigation of adverse effects of postoperative opioid use in patients with OUD on MAT (regardless of agent) should include:

- Implementing risk mitigation rules: high frequency visits to closely monitor use of postoperative opioids, pill counts, checking of PMP, urine drug screening for alcohol/drug use
- No early refills
- No replacement of lost prescriptions
- Prescription only with visit
- Verifying availability of naloxone at home and patient/family member training on how to administer it

If Opioids are Prescribed, Specific Considerations by Each MAT Agent:

Methadone

Preoperative Management

- Verify patients' outpatient methadone dose with their methadone clinic.
- Verify availability of naloxone in hospital/at home.
- Continue daily dose preoperatively, understanding this dose is not adequate to treat postoperative, acute pain. (*Harrison, 2018*)
    - Example: Think of methadone as patients' basal needs, like basal insulin, and short-acting opioids as their acute needs, like mealtime insulin.
    - If unable to take PO, give IV and reduce dose by one-half to two-thirds and split three times a day (TID). (*Harrison, 2018*)
- Patients with OUD are more likely to exhibit hypersensitivity symptoms and high tolerance. (*Jamison et al., 2000; Barry 2009*)
    - Hypersensitivity and pain intolerance are common among those with OUD. This means that they feel pain more intensely and may require higher doses of opioids to feel the same relief.

- Relapse risk is high and worse with inadequate pain control. (*Ti, 2015; Voon 2018*)
  - The risk of in-hospital illicit opioid use is higher among patients with OUD and inadequate pain control, especially if they are denied pain medication. (*Ti, 2015*)
  - Focus groups involving 83 self-identified drug using patients, illustrated how restrictive policies regarding use of opioid pain medications for acute pain, serve as a risk factor for drug use. (*Voon, 2018*)
- Be aware of pharmacological properties. Avoid partial agonists (butorphanol, buprenorphine, nalbuphine). Giving a partial agonist with a full agonist (methadone) has the potential to displace the full agonist and cause precipitated withdrawal. (*Walsh, 2003; Clark, 2002; Strain, 1995; Walsh, 1995; Strain, 1993*)
- Communicate following information to methadone clinic:
  - Inform them the patient will undergo a procedure, and the hospital will administer methadone until discharge, and potential discharge date.
  - If patients are not hospitalized or in a TCU, they will need to get their methadone from the methadone clinic. The methadone clinic decides if the patient is eligible for take-home doses.

Postoperative Management

- Continue the daily dose throughout perioperative period, understanding this dose may not be adequate to treat postoperative, acute pain. (*Harrison, 2018*)
- Discuss postoperative opioid management plans with support person or OTP.
- Beware of high frequency visits/prescriptions (closely monitor use of postoperative opioids).
- Taper postoperative opioids in similar time frame for opioid-naïve patients. (*Expert Consensus*)

Buprenorphine

Preoperative Management

In general, the preferred method is to either continue patient's current dose of buprenorphine or continue a lowered dose prior to surgery. (*Harrison, 2018, Quaye, 2018*) Discontinuation is not preferred due to high risk of inadequate pain relief, relapse and overdose. (*Lembke, 2018; Quaye, 2018; Sen, 2016; Bentzley, 2015; Sigmon, 2013; Volpe, 2011; Ling, 2009; Breen, 2003*)

1. Continuing current dose buprenorphine **(preferred method)**

- The most prominent risk is inadequate pain relief. Buprenorphine is a partial mu agonist with high affinity, meaning it will block most other opioids from accessing the receptor. To overcome that blockade, higher doses and/or higher potency opioids may be needed. (*Expert Consensus*)
- The risk of relapse with this method would be related to undertreated pain. If pain is undertreated, the risk of relapse increases (*Ti, 2015; Voon, 2018*) because patients are likely to seek illicit sources to treat pain.
- Overdose risk is low with the combination of buprenorphine and short-acting opioids in a controlled and appropriate fashion.

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2. Continue lowered-dose buprenorphine **(preferred method)**

- The risk of inadequate pain relief is lessened with this method, because as the dose of buprenorphine is lowered, the receptor availability is increased, and therefore the patient can feel the effects of short-acting opioids. (*Greenwald, 2014; Greenwald, 2007*)
- The risk of relapse may be increased with a lowered dose of buprenorphine (*Expert Consensus*) given that maintenance buprenorphine doses are titrated to cravings, but there is evidence that pain control is manageable when the buprenorphine is continued. (*Vilkins, 2017; Hansen, 2016; Macintyre, 2013; Kornfeld, 2010; Meyer, 2010; Jones, 2009*)

Continuing current dose vs. lowering dose

Whether to continue the patient's current dose of buprenorphine or taper to a lower dose but not off, to provide more mu receptor availability, has not been studied. (*Lembke, 2018*) The decision of whether to continue the current dose of buprenorphine versus decreasing the dose of buprenorphine should be a shared decision between the provider and the patient that takes into consideration preoperative buprenorphine dose, previous patient experiences and OUD relapse risk.

***See table at the end of buprenorphine section for an example of buprenorphine perioperative management plan.**

3. Discontinuation of buprenorphine **(not preferred method)**

- A high risk of inadequate pain relief. Buprenorphine has a very high potency; 1 mg morphine is equivalent to 15-35 mcg of buprenorphine, so patients usually have a very high opioid tolerance. Attempting to treat their baseline opioid needs plus their acute pain needs requires astronomical doses of regular opioids. (*Volpe, 2011*)
  - Example: A patient on 8 mg buprenorphine, which is the equivalent of about 600 mg morphine, or 400 mg oxycodone, which is just their baseline need and wouldn't treat their acute pain.
- A very high risk of relapse. Because the patient is no longer on buprenorphine, he or she has no blockade of mu opioid receptors and thus can feel the full effects of all opioids. Discontinuation has been associated with increased risk of illicit opioid use. (*Quaye, 2018; Sen, 2016; Bentzley, 2015; Sigmon, 2013; Ling, 2009; Breen, 2003*)
- Because the risk of relapse is higher, the risk of overdose is also higher. (*Lembke, 2018*)

Postoperative Management

1. If continued current dose buprenorphine (*Expert Consensus*):

- Use higher potency opioids, e.g., oxycodone as opposed to hydrocodone.
  - If the initial dose set by the surgeon is not controlling the pain, it may be because the buprenorphine is blocking the effect of the opioid. Options:
    i. Increase the dose of the opioid or change to a higher potency opioid.
    ii. Decrease the dose of the buprenorphine, to increase receptor availability.
    iii. Increase and split the dose of the buprenorphine to TID, to achieve better pain relief. The peak pain relief of buprenorphine is at about 8 hours. (*Alford, 2006*)
- Taper postoperative opioids in similar time frame as for opioid-naïve.

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- If cravings or illicit opioid use occurs:
  - If undertreated pain is the cause, consider the above options.
  - Alternatively, if buprenorphine was lowered postoperatively, return to previous dose, or increase dose to TID.

iv. Attempt to treat the postoperative pain with only buprenorphine.

2. If continued lowered-dose buprenorphine (*Expert Consensus*):

- Use higher potency opioids, e.g., oxycodone as opposed to hydrocodone
  - If the initial dose set by the surgeon is not controlling the pain, it may be because the buprenorphine is blocking the effect of the opioid. Options:

i. Increase the dose of the opioid or change to a higher potency opioid.

ii. Decrease the dose of the buprenorphine to increase receptor availability.

iii. Increase and split the dose of the buprenorphine to TID, to achieve better pain relief. The peak pain relief of buprenorphine is at about eight hours. (*Alford, 2006*)

- Taper postoperative opioids in similar time frame as for opioid-naïve.
  - While tapering off the postoperative opioids, simultaneously increase the buprenorphine back to the previous dose.
- If cravings or illicit opioid use occurs:
  - If undertreated pain is the cause, consider the above options.
  - Alternatively, increase to previous buprenorphine dose, or higher and to TID.

iv. Attempt to treat the postoperative pain with only buprenorphine.

3. If discontinued buprenorphine (*Expert Consensus*):

- Will likely need higher potency opioids because the patient will have a high tolerance, but the pain management will likely be incredibly difficult
- Attempt to taper the postoperative opioids in a similar time frame as opioid-naïve.
  - This will likely be difficult because the patient is not used to being on zero opioids and, he or she has a baseline tolerance, so getting to zero is very difficult.
- After the postoperative opioids are completed, the patients still needs to get back on their buprenorphine, which requires a re-induction. They need to come completely off all opioids for a period of 12-24 hours (*SAMHSA, 2019*), depending on the opioid, to restart the buprenorphine to prevent precipitated withdrawal. This is incredibly difficult for most patients.
- If severe cravings or illicit opioid use occurs, stop all postoperative opioids for 12-24 hours (*SAMHSA, 2019*), re-induct on buprenorphine and attempt to treat as above (see 1 and 2).

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***Buprenorphine Perioperative Management Plan Example** *(Adapted from Quaye, 2018)*

	Low Pain Level	Moderate–Severe Pain Level + <8mg Buprenorphine	Moderate–Severe Pain Level + 9mg–15mg Buprenorphine	Moderate–Severe Pain Level + >16mg Buprenorphine
Pre-op Management	Continue current dose buprenorphine	Continue current dose buprenorphine	Consider tapering buprenorphine to 8mg over 1-4 weeks Discuss relapse risk with patient; if high, continue current dose and use higher potency or higher dose opioids postop	Taper to <16mg over 1-4 weeks, then to 8 the day prior to surgery Discuss relapse risk with patient; if high, continue current dose and use higher potency or higher dose opioids postop, ideally get to 16 mg or less
Post-op Management	Consider buprenorphine dividing dose to TID Consider very short-term postop opioids	Consider buprenorphine dividing dose to TID Postop opioids - Length same as opioid-naïve - Need higher potency opioid	Consider buprenorphine dividing dose to TID Postop opioids - Length same as opioid-naïve - Need higher potency opioid	Consider buprenorphine dividing dose to TID Postop opioids - Length same as opioid-naïve - Need higher potency opioid

Naltrexone IM/PO

Preoperative Management

1. Planned procedures: able to discontinue IM naltrexone >4 weeks prior to surgery (48-72 hours for PO) (*Expert Consensus*)

- Naltrexone works by antagonizing the opioid receptor, so it must be stopped and metabolized/eliminated before opioids will be fully able to access the opioid receptors. However, the patient still has an opioid use disorder, the "safety net" is being removed and a drug of choice given after the surgery; therefore, the risk of relapse and accidental overdose is high.
- Because patients still have OUD, they likely still have pain intolerance and hypersensitivity (*Jamison, 2000*) and may require higher doses or potency opioids. However, depending on how long it has been since they stopped using illicit opioids, they do not have the same tolerance to the respiratory depressant effects of opioids that they once had, so while they may not feel the pain relief, their risk of respiratory depression and overdose is back to baseline.

2. Unplanned procedures: Unable to discontinue naltrexone (*Expert Consensus*)

- Naltrexone works by antagonizing the opioid receptor, so it must be stopped and metabolized/eliminated before opioids will be fully able to access the opioid receptors.
- The naltrexone will need to be stopped as soon as possible and "override" the blockade with very potent and higher doses opioids.

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- For PO naltrexone, elimination half-life is about 13-14 hours, so to fully remove the drug from the system requires 50-60 hours. (*SAMHSA, 2009*)
- For IM naltrexone, depending on when the injection occurred, it may take weeks for elimination.
- If high potency and high dose opioids are used to "override" the blockade, as the naltrexone is eliminated, the blockade will become less and less powerful and the opioids may become too potent, causing respiratory depression/overdose.
- The risk of inadequate pain relief is therefore very high, and thus the risk of illicit opioid use is very high. The patient may try to overcome the blockade with illicit opioids. (*Ti, 2015; Kunoe, 2010; Vickers, 2006*)
- Plan on using nonopioid medications aggressively; involve pain and/or addiction medicine consult teams.

Postoperative Management

1. For planned procedures where naltrexone was discontinued (*Expert Consensus*):
   - Naltrexone works by antagonizing the opioid receptor, so a patient cannot be on both an opioid agonist and an opioid antagonist (naltrexone) at the same time.
   - Attempt to taper the postoperative opioids in a similar time frame as opioid-naïve.
   - Restart the IM or PO naltrexone after 7-10 days off all opioids (naltrexone medication package insert).
   - If illicit opioid use is suspected, consider options with patient:
     - Discontinue all opioids and restart naltrexone as soon as possible.
     - Consider buprenorphine induction; follow instructions above for postoperative pain management on buprenorphine.
2. For unplanned procedures where naltrexone was *not* discontinued. (*Expert Consensus*) **Do this in coordination with addiction specialist and/or pharmacist.**
   - Naltrexone works by antagonizing the opioid receptor, so a patient cannot be on both an opioid agonist and an opioid antagonist (naltrexone) at the same time.
   - Pain management in this situation is very difficult; involve addiction medicine or pain consultants or pharmacy whenever possible.
   - If high potency and high dose opioids are used to "override" the blockade, as the naltrexone is eliminated, the blockade will become less and less powerful and the opioids may become too potent, causing respiratory depression/overdose.
     - This occurs after 50-60 hours with PO naltrexone and 1-4 weeks with IM naltrexone. (*SAMHSA, 2009*)
     - The provider will need to know when the patient had their last injection, to understand when the injection will start to wear off.
     - Start to wean opioids to less potent/lower doses as the date the injection wears off approaches.
   - Attempt to taper the postoperative opioids in a similar time frame as opioid-naïve.

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- Restart the IM or PO naltrexone after 7-10 days off all opioids (naltrexone medication package insert).
- If illicit opioid use is suspected, consider these options with patient:
    - Discontinue all opioids and restart PO naltrexone as soon as possible. (If IM, and injection is still active, discontinue just opioids.)
    - Consider buprenorphine induction, follow instructions above for postoperative pain management on buprenorphine.

Patients Not on Medication-Assisted Treatment (MAT)

Patients with opioid use disorder currently using opioids should not undergo a procedure unless it is urgent or emergent. Treatment of the substance use disorder should take priority. Once the patient is on MAT, the procedure can take place.

If a procedure is urgent or emergent, every effort should be made to start MAT before the procedure takes place. A consult with an addiction medicine or pain specialist is recommended.

If that is not possible, the management plan should include maximizing nonpharmacological intervention, maximizing nonopioid pharmacology, and a consultation with an addiction medicine or pain specialist as soon as possible to initiate MAT after the surgical procedure. Opioid management of the acute pain may still be needed, but should be monitored carefully. Refer to the MN Health Collaborative Algorithm for Screening and Treatment of Opioid Use Disorder (OUD) for more information on how to address patients with OUD and not on MAT.

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The intent of this section is to provide resources, strategies and measurement to help close the gap between current clinical practice and the recommendations set forth in the guideline.

Measurement is one of the key components of quality improvement. It evaluates the impact of clinical evidence-based recommendations on current clinical practice, and can assure that new practices are being implemented. The measures are recommended by each guideline workgroup and confirmed through consensus. ICSI's Committee for Evidence-Based Practice provides oversight and final approval for the measures as part of the guideline revision process.

As part of the process, local and national resources for measures are searched and relevant measures are included if aligned with the workgroup recommendations. These resources include: National Quality Forum (NQF), Joint Commission, National Committee for Quality Assurance (NCQA), MN Community Measurement (MNCM), CMS MACRA-MIPS measures and resources specific to the guideline topic.

ICSI work groups focus on quality improvement measures, not measures for accountability. Our goal is to help organization understand how closely practice mirrors guideline recommendations and monitor this over time as quality improvement changes are implemented.

Types of measures included are measures of process, experience, and outcomes; each measure is labeled accordingly. Measurement data should be tracked and compared over time to help gain insight into effectiveness of interventions. Measurement definitions and data collection frequency need to be consistent to ensure validity of data comparisons over time.

The subdivisions of this section are:

- Aims and Measures
- Implementation Recommendations
- Implementation Tools and Resources

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Aims and Measures

These are suggested aims and measures by the work group. These do not include measurement specifications.

1. Increase the percentage of surgical patients undergoing elective surgery who have preoperative health screening and assessment.

   Measure for accomplishing this aim:

   a. Percent of patients undergoing elective surgery who have preoperative health screening and assessment.

2. Increase the percentage of surgical patients undergoing elective surgery who are smokers who have smoking addressed prior to surgery.

   Measures for accomplishing this aim:

   a. The percentage of current smokers who abstain from cigarettes prior to anesthesia on the day of elective surgery or procedure. (ASA) (MACRA-MIPS)

3. Increase the percentage of surgical patients undergoing elective surgery who have risk factors for obstructive sleep apnea (OSA) who are screened for OSA prior to surgery.

   Measures for accomplishing this aim:

   a. Percentage of surgical patients undergoing elective surgery with risk factors for OSA who are screened for OSA prior to surgery.

4. Increase the percentage of surgical patients undergoing elective surgery who have education on preoperative hair removal, bathing, fasting and oral hygiene prior to surgery.

   Measure for accomplishing this aim:

   a. Percentage of patients with education on preoperative hair removal, bathing, fasting and oral hygiene prior to surgery.

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Implementation Recommendations

Prior to implementation, it is important to consider current organizational infrastructure that addresses the following:

- Develop a reliable, standardized system to obtain complete preoperative basic health assessments and appropriate preoperative testing to eliminate unwarranted variation
- Establish a reliable, standardized system to communicate completed preoperative basic health assessments and associated test results to surgical team prior to procedure.
- Develop a comprehensive patient-centered approach to education and appropriate procedure preparation.
- Establish a reliable, standardized system for the surgical team to communicate pertinent postoperative information to primary care to help guide postoperative assessment and management.
- Develop consistent messaging about pain and opioids for patients and family, and educate all staff and providers on the value of its use.
- Assure that workflows and electronic records are up to date and support desired improvements.

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Implementation Tools and Resources

Criteria for Selecting Resources

The following tools and resources specific to the topic of the guideline were selected by the work group. Each item was reviewed thoroughly by at least one work group member. It is expected that users of these tools will establish the proper copyright prior to their use. The types of criteria the work group used are:

- The content supports the clinical and the implementation recommendations.
- Where possible, the content is supported by evidence-based research.
- The author, source and revision dates for the content are included where possible.
- The content is clear about potential biases, and conflicts of interests and/or disclaimers are noted.

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Implementation Tools and Resources Table

Author/Organization	Title/Description	Audience	Web Site
The MN Health Collaborative Call to Action: Adult Opioid Postoperative Prescribing	Standards on postoperative opioid prescribing at discharge by procedure type	Health Care	https://www.icsi.org/programs/mn-health-collaborative/
The MN Health Collaborative: Demystifying Opioids Package	Guidance on Opioid Use Disorder Algorithms & Tapering Frequently Asked Questions (FAQs)	Health Care	https://www.icsi.org/programs/mn-health-collaborative/
The MN Health Collaborative Call to Action: Opioid Disposal	Guidance on Appropriate Disposal of Unused Opioids	Health Care	https://www.icsi.org/programs/mn-health-collaborative/
ICSI Shared Decision-Making Model	A guide for health care providers on conducting collaborative conversations with patients	Health Care	https://www.icsi.org/guideline/perioperative-guideline/
U.S. Department of Health and Human Services	HHS Guide for Clinicians on the Appropriate Dosage Reduction or Discontinuation of Long-Term Opioid Analgesics	Health Care	https://www.hhs.gov/about/news/2019/10/10/hhs-announces-guide-appropriate-tapering-or-discontinuation-long-term-opioid-use.html
U.S. Food and Drug Administration (FDA): Disposal of Unused Medicines: What You Should Know	FDA Information on Disposal of Unused Controlled Substances	Health Care	https://www.fda.gov/drugs/safe-disposal-medicines/disposal-unused-medicines-what-you-should-know
U.S. Drug Enforcement Agency: Diversion Control Division	Search engine for finding public locations to dispose of unused controlled substances. Other information also available. This resource link may be provided to patients by a health care provider.	Health Care	https://www.dea.gov/diversion-control-division

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The subdivisions of this section are:

- References
- Appendix

References

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Appendix A: Literature Search Description

Search Terms: Perioperative
Preoperative screening; perioperative care; perioperative period; perioperative care; elective surgery; preoperative medical evaluation; preoperative clearance; preoperative health assessments; preoperative testing; diagnostic tests routine; electrocardiogram; hemoglobin; creatinine; potassium; chest X-ray; pregnancy test; preoperative management of medical conditions; cardiovascular disease (Beta blockers, statin therapy, anticoagulation and blood disorders); sleep apnea; diabetes; diabetes mellitus; nondiabetic patient; blood glucose; glucose levels; glycemic control; A1c; HbA1c; diabetes management and glycemic control; glucose levels; glycemic control for nondiabetic patients; glucose levels; prevention of endocarditis; management of patients with coronary stents; preoperative nicotine cessation; preoperative showering/shaving; preoperative fasting recommendations; coagulation studies; antiplatelets for patients with ischemic stroke disease, heart failure, arrhythmia, heart valve disease (outside of stents and ischemic cardiac disease); when to stop ACE inhibitors in patients with ischemic cardiac disease, ischemic stroke, heart failure, arrhythmia, heart valve disease; when to stop antithrombotics and anticoagulants prior to surgery; when to resume antithrombotics and anticoagulants after surgery; when to bridge anticoagulants prior to surgery; when to resume anticoagulants after surgery; anticoagulant reversal in surgery only.

Search Terms: Perioperative Opioid
Perioperative opioid managment; preoperative and postoperative opioid management; perioperative chronic opioid management; preoperative and postoperative chronic opioid management; analgesics, opioid/administration and dosage; analgesics, opioid; chronic opioid use; preoperative care; perioperative care; postoperative care; postoperative pain management; postoperative complications; chronic opioid disorders; opioid-related disorders; analgesic, patient controlled; pain, postoperative/drug therapy.

Age group:
Patients 18 years of age and older

Inclusions:
Routine and elective procedures only

Exclusions:
Emergency and urgent procedures

Time period:
Jan. 1, 2014–April 30, 2019 (Jan. 31, 2019 for perioperative opioid)

Types of studies:
Systematic review/meta-analysis
Randomized controlled trials
Observational studies (cohort, case-control and cross-sectional)

Human studies: English

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ICSI has long had a policy of transparency in declaring potential conflicting and competing interests of all individuals who participate in the development, revision and approval of ICSI guidelines and protocols.

In 2010, the ICSI Conflict of Interest Review Committee was established by the Board of Directors to review all disclosures and make recommendations to the board when steps should be taken to mitigate potential conflicts of interest, including recommendations regarding removal of work group members. This committee has adopted the Institute of Medicine Conflict of Interest standards as outlined in the report, Clinical Practice Guidelines We Can Trust (2011).

Where there are work group members with identified potential conflicts, these are disclosed and discussed at the initial work group meeting. These members are expected to recuse themselves from related discussions or authorship of related recommendations, as directed by the Conflict of Interest committee or requested by the work group.

The complete ICSI policy regarding Conflicts of Interest is available at http://bit.ly/ICSICOI.

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ICSI facilitates and coordinates the guideline development and revision process. ICSI members review and provide feedback but do not have editorial control over the work group. All recommendations are based on the work group's independent evaluation of the evidence.

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ICSI seeks review from members and the public during the revision process.

Member Review

All ICSI documents are available for member review at two points in the ICSI revision process. The ICSI Response Report is sent to members at the beginning of a document revision. The goal of this report is to solicit feedback about the guideline, including but not limited to the algorithm, content, recommendations and implementation. Members are also welcome to participate in the public comment period (see below).

The work group would like to thank the following member organizations for reviewing the ICSI Perioperative Guideline in the public comment period:

- *M Health Fairview*
- *Sanford Health*

Public Comment

ICSI makes a draft of the guideline available to the public on the ICSI website. The public is invited to comment in an effort to get feedback prior to its finalization. All comments will be reviewed by the ICSI facilitator and work group members as needed. ICSI work group may or may not make changes to the guideline based on public comment responses.

The work group would like to thank all who reviewed the draft and submitted comments for the ICSI Perioperative Guideline.

Invited Reviewers

For some guidelines, ICSI invites experts in the community to comment on a guideline draft prior to finalization. This is done during the public comment period.

The work group would like to thank following individuals who reviewed the draft and submitted comments for the ICSI Perioperative Guideline:

- *Michael Hooten, MD; Mayo Clinic*
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Document History

In 2005-2007, ICSI hospital members championed patient safety activities aimed at advancing efficient surgical process flow and creating safe and reliable practices that reduced the number of adverse events in surgery. In collaboration with its members, ICSI developed standardized surgical protocols for safe site marking, and the reduction of surgical site infection and retained foreign objects. This work resulted in the creation of three specific safety protocols:

Safe Site Protocol for All Invasive, High-Risk or Surgical Procedures; Prevention of Unintentionally Retained Foreign Objects in Surgery; and *Prevention of Surgical Site Infection*.

In 2007-2008, ICSI facilitated a Reliability Centered Surgical Care Redesign Collaborative, which provided a collaborative learning environment for participants to become knowledgeable in reliability theory and principles. This collaborative provided an opportunity for participants to share their learnings as they worked to implement these and other surgical-related protocols.

Recognizing that these surgical processes are part of the comprehensive perioperative experience, these three distinct protocols were merged in 2008 to create one comprehensive Perioperative Guideline consistent with the requirements established by The Joint Commission National Patient Safety Goals.

In 2013-2014, the Preoperative Guideline and Perioperative Protocol were merged into one document.

The 2019 revision included the following updates:

- The guideline name changed from Perioperative Protocol to Perioperative Guideline.
- A new section on perioperative opioid management has been added. It was developed by a separate subgroup and reviewed by the Perioperative Guideline work group.
- Since an extensive revision was done on the clinical content of this guideline, the work group members recruited for this revision were primarily from content areas related to recommendations addressed in this revision. Work group members were not recruited to review and update the "Surgical Care Protocol (Human Factors)" section; thus, that section was not addressed in this version.

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ICSI Document Development and Revision Process

Overview

Since 1993, the Institute for Clinical Systems Improvement (ICSI) has developed more than 60 evidence-based health care documents that support best practices for the prevention, diagnosis, treatment or management of a given symptom, disease or condition for patients.

Audience and Intended Use

The information contained in this ICSI Health Care Guideline is intended primarily for health professionals and other expert audiences.

This ICSI Health Care Guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients and families are urged to consult a health care professional regarding their own situation and any specific medical questions they may have. In addition, they should seek assistance from a health care professional in interpreting this ICSI Health Care Guideline and applying it in their individual case.

This ICSI Health Care Guideline is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a guideline for all patients with a particular condition.

Document Development and Revision Process

The development process is based on a number of long-proven approaches and is continually being revised based on changing community standards. The ICSI staff, in consultation with the work group and a medical librarian, conduct a literature search to identify systematic reviews, randomized clinical trials, meta-analysis, other protocols, regulatory statements and other pertinent literature. This literature is evaluated based on the GRADE methodology by work group members. When needed, an outside methodologist is consulted.

The work group uses this information to develop or revise clinical flows and algorithms, write recommendations, and identify gaps in the literature. The work group gives consideration to the importance of many issues as they develop the protocol. These considerations include the systems of care in our community and how resources vary, the balance between benefits and harms of interventions, patient and community values, the autonomy of clinicians and patients and more. All decisions made by the work group are done using a consensus process.

ICSI's members review each guideline as part of the revision process. They provide comment on the scientific content, recommendations, implementation strategies and barriers to implementation. This feedback is used by and responded to by the work group as part of their revision work. Final review and approval of the guideline is done by ICSI's Committee on Evidence-Based Practice. This committee is made up of practicing clinicians and nurses, drawn from ICSI member medical groups.

Implementation Recommendations and Measures

These are provided to assist medical groups and others to implement the recommendations in the protocols. Where possible, implementation strategies are included that have been formally evaluated and tested. Measures are included that may be used for quality improvement as well as for outcome reporting. When available, regulatory or publicly reported measures are included.

Document Revision Cycle

Scientific documents are revised every 2-5 years as indicated by changes in clinical practice and literature. ICSI staff monitors major peer-reviewed journals every month for the guidelines for which they are responsible. Work group members are also asked to provide any pertinent literature through check-ins with the work group midcycle and annually to determine if there have been changes in the evidence significant enough to warrant document revision earlier than scheduled. This process complements the exhaustive literature search that is done on the subject prior to development of the first version of a guideline.

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