Preoperative Testing and Medication Management

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Disclaimer
Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.

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Preoperative Testing and Medication Management for Non-Cardiac Surgical Procedures

Preoperative Evaluation

- A preoperative evaluation must be done within 30 days before a surgical procedure.
- History and physical examination information must be reviewed and updated within 24 hours of admission or registration and prior to the planned surgical procedure.
- The preoperative evaluation is not a substitute for preventive health care but may be used as an opportunity to address preventive services.

Medical History

- Indication(s) for the surgical procedure
  - Allergies and adverse medication reactions
  - It is most helpful to specify the approximate date, the type of reaction, the treatment, the response, and if the agent was subsequently taken.
- Current medications including prescriptions, over-the-counter, and herbal and dietary supplements
  - Specify the generic and brand name, specific preparation (tablet, capsule, liquid), dose in each unit, route by which the agent is taken (oral, feeding tube, transdermal), number of units taken, and time(s) of day taken.
  - Pay special attention to high-risk medications including opioids, diabetes medications, antihypertensives, anticoagulants (warfarin, heparins, antiplatelet medications), and oral cancer/chemotherapy medications.
- Medical problems, including current status
  - Use the IHIS Problem List
  - Pay special attention to sleep apnea risk, abnormal airway, recent stroke or heart attack and intravascular stents
- Factors that increase infection risk
  - Skin disease (e.g., open lesions)
  - Diabetes mellitus
  - Malnutrition
  - Smoking
- Thorough evaluation of issues relevant to the planned procedure and anesthesia:
  - History of anesthesia complication, personal and family (e.g., obstructive sleep apnea, malignant hyperthermia)
  - Cardiac and pulmonary function
  - Functional capacity
  - History of clotting or bleeding abnormality, personal and family
  - History of tobacco, alcohol, drug use

Physical Examination

- Height, weight, and body mass index (BMI)
- Vital signs:
  - Blood pressure
  - Pulse (rate and rhythm)
  - Respiratory rate
- Airway assessment
- Pulmonary
- Cardiovascular
- Neurologic
- Other findings pertinent to the patient and the procedure

Preoperative Risk Assessment

- The American Society of Anesthesiology (ASA) classification is a global impression of the clinical state of a patient based upon all available history, physical examination findings, and laboratory data (Table 1 on page 3).
- Document ASA class, as it is a robust predictor of perioperative complications.
- Determine the perioperative cardiac risk based on the type of procedure planned (Table 2 on page 3).
- See page 4 for a more detailed algorithm on cardiac risk. (The algorithm addresses ordering electrocardiography and scoring cardiac risk.)

Preoperative Testing

- Laboratory and diagnostic tests are not routinely necessary unless there is a specific patient or procedural indication.

Nothing by Mouth (NPO)*

<table>
<thead>
<tr>
<th>Type</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Liquid</td>
<td>2 hours</td>
</tr>
<tr>
<td>Light Meal</td>
<td>6 hours</td>
</tr>
<tr>
<td>(A light meal consists of dry toast and clear liquids)</td>
<td></td>
</tr>
<tr>
<td>Full Meal</td>
<td>8 hours</td>
</tr>
<tr>
<td>Infant Formula/Non-Human Milk</td>
<td>6 hours</td>
</tr>
<tr>
<td>Breast Milk</td>
<td>4 hours</td>
</tr>
<tr>
<td>Tube Feeds</td>
<td>6 hours</td>
</tr>
</tbody>
</table>

*Recommendations for generally healthy patients who undergo elective procedures. Not recommended for women in labor.

doi:10.1097/ALN.0b013e3181fcbfd9
### Table 1: American Society of Anesthesiologists’ (ASA) Physical Status Classification

<table>
<thead>
<tr>
<th>ASA</th>
<th>Definition</th>
<th>Examples, including, but not limited to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA I</td>
<td>A normal healthy patient</td>
<td>Healthy, non-smoking, no or minimal alcohol use</td>
</tr>
<tr>
<td>ASA II</td>
<td>A patient with mild systemic disease</td>
<td>Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30 &lt; BMI &lt; 40), well-controlled DM/HTN, mild lung disease</td>
</tr>
<tr>
<td>ASA III</td>
<td>A patient with severe systemic disease</td>
<td>Substantive functional limitations; One or more moderate to severe diseases. Examples include (but not limited to): poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA &lt; 60 weeks, history (&gt;3 months) of MI, CVA, TIA, or CAD/stents.</td>
</tr>
<tr>
<td>ASA IV</td>
<td>A patient with severe systemic disease that is a constant threat to life</td>
<td>Examples include (but not limited to): recent (&lt; 3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis</td>
</tr>
<tr>
<td>ASA V</td>
<td>A moribund patient who is not expected to survive without the operation</td>
<td>Examples include (but not limited to): ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction</td>
</tr>
<tr>
<td>ASA VI</td>
<td>A declared brain-dead patient whose organs are being removed for donor purposes</td>
<td></td>
</tr>
</tbody>
</table>

Reference: American Society of Anesthesiologists’ (ASA) Physical Status Classification/1991 is reprinted with permission of the American Society of Anesthesiologists, 1061 American Lane, Schaumburg, Illinois 60173-4973

### Table 2: Cardiac Risk by Surgical Procedure

<table>
<thead>
<tr>
<th>HIGH RISK &gt;5%</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergent major operations, particularly in older adults (especially those &gt;75 years of age)</td>
<td></td>
</tr>
<tr>
<td>Aortic and other major vascular surgical procedures</td>
<td></td>
</tr>
<tr>
<td>Peripheral vascular surgical procedures</td>
<td></td>
</tr>
<tr>
<td>Major cardiac and thoracic surgical procedures</td>
<td></td>
</tr>
<tr>
<td>Anticipated prolonged surgical procedures associated with large fluid shift and/or blood loss</td>
<td></td>
</tr>
<tr>
<td>INTERMEDIATE RISK 1-5%</td>
<td></td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td></td>
</tr>
<tr>
<td>Non-major head and neck surgery / procedures</td>
<td></td>
</tr>
<tr>
<td>Non-major intraperitoneal and intrathoracic surgery / procedures</td>
<td></td>
</tr>
<tr>
<td>Orthopedic surgical procedures</td>
<td></td>
</tr>
<tr>
<td>Prostate surgical procedures</td>
<td></td>
</tr>
<tr>
<td>Urologic surgical procedures</td>
<td></td>
</tr>
<tr>
<td>LOW RISK &lt;1%</td>
<td></td>
</tr>
<tr>
<td>Biopsies and superficial procedures (e.g., breast biopsy)</td>
<td></td>
</tr>
<tr>
<td>Endoscopic procedures</td>
<td></td>
</tr>
<tr>
<td>Cataract surgery / ophthalmologic procedures</td>
<td></td>
</tr>
<tr>
<td>Breast surgery</td>
<td></td>
</tr>
<tr>
<td>Minor prostate procedures (e.g., cystoscopy)</td>
<td></td>
</tr>
</tbody>
</table>

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Indications for Electrocardiography Based on Cardiac Risk

Note: If the past medical history shows the patient has a medical issue which would indicate the appropriateness of an EKG (and this can be seen on the chart review before the provider does their own history and physical) consider obtaining an EKG.

Preoperative history and physical examination

Signs or symptoms of cardiovascular disease?

YES → Electrocardiography*

NO →

Low risk surgery**
(risk < 1%)

Intermediate risk surgery**
(risk 1-5%)

High-risk surgery**
(risk > 5%)

Electrocardiography NOT Indicated

At least one RCRI*** clinical risk factor?

YES → Electrocardiography*

NO

*ECG is valid for 6 months if patient is clinically stable

**Please refer to Table 2 on page 3 for cardiac risk by procedure

***RCRI = Revised Cardiac Risk Index (see below)

Risk Factor | Points
--- | ---
History of stroke or transient ischemic attack (TIA) | 1
History of MI, CABG, or PTCA | 1
Heart failure | 1
Serum creatinine level > 2.0mg/dL | 1
Diabetes mellitus requiring insulin | 1
Major vascular, intrathoracic, infra-abdominal, or intracranial procedure | 1

Revised Cardiac Risk Index (RCRI)***

<table>
<thead>
<tr>
<th>Points</th>
<th>Risk %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4</td>
</tr>
<tr>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>2</td>
<td>6.6</td>
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<tr>
<td>&gt; 3</td>
<td>&gt;11</td>
</tr>
</tbody>
</table>

This algorithm is for patients who have a carotid bruit discovered during preoperative examination.

First, determine if the patient has had stroke/TIA symptoms in the previous 9 months. Examples of stroke/TIA symptoms include, but are not limited to:

- Shade coming down over the eye or other sudden vision change
- Sudden confusion or difficulty talking
- Sudden loss of balance or difficulty walking
- Sudden focal weakness or loss of dexterity

If the patient has had stroke/TIA symptoms in the previous 9 months, and, if there is no contraindication, then ensure they are taking aspirin 81mg PO daily.

Next, obtain carotid duplex ultrasound within the previous 6 months.

- OSUWMC order “vasc duplex carotid bilateral”

### Result of carotid duplex ultrasound

- **< 50% internal carotid stenosis (both sides)**
  - Asymptomatic: OK for surgery/procedure
  - Symptomatic: Consider atrial fibrillation as well as other causes and consult Cardiology, Stroke Neurology, or “Neurovascular/Stroke Neurosurgery” as indicated.

- **70-99% internal carotid stenosis (either side)**
  - Refer to Endovascular Neurosurgery OR Vascular Surgery at the preference of the referring physician.

- **50-69% internal carotid stenosis (one or both sides, but no more than 69% either side)**
  - Asymptomatic: OK for surgery/procedure
  - Symptomatic: Refer to Endovascular Neurosurgery OR Vascular Surgery at the preference of the referring physician.
Preoperative Testing Grid

<table>
<thead>
<tr>
<th>Medical Condition or Current Treatment</th>
<th>OPAC/PAT¹</th>
<th>ECG</th>
<th>CXR²</th>
<th>CBC Ediff Pit</th>
<th>Coagulation Tests</th>
<th>T&amp;Ca</th>
<th>Hgb A1c</th>
<th>Chem 6</th>
<th>K+</th>
<th>LFTs</th>
<th>TSH, Free T4</th>
<th>UA Total with Reflex to Culture</th>
<th>MRSA/ MSSA Screen²</th>
<th>DOS³</th>
<th>HCG</th>
<th>UCG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing Prior to Procedure</td>
<td>30 days</td>
<td>6 mos</td>
<td>1 yr</td>
<td>6 wks</td>
<td>INR/PT</td>
<td>PTT</td>
<td>30 days</td>
<td>4 wks</td>
<td>6 wks</td>
<td>DOS²</td>
<td>6 wks</td>
<td>6 wks</td>
<td>6 wks</td>
<td>DOS³</td>
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</tr>
<tr>
<td>Preoperative screening and laboratory testing is unwarranted and may be harmful unless the patient has a specific clinical indication.</td>
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</tbody>
</table>

1. Appropriate for OPAC/PAT visit if also has ASA score of 3-4
2. PA & Lateral CXR or equivalent radiologic examination
3. DOS = Day of Surgery
4. See Surgical Blood Order Schedule (SBOS) for maximum recommended blood volume per procedure
5. See OSUWMC Obstructive Sleep Apnea guideline
6. Also refer to surgeon’s preference list
7. If MRSA/MSSA Screen positive, order mupirocin/bactroban

Preoperative screening and laboratory testing is unwarranted and may be harmful unless the patient has a specific clinical indication.
### Preoperative Testing Grid

<table>
<thead>
<tr>
<th>Medication History</th>
<th>OPAC/PAT¹</th>
<th>ECG</th>
<th>CXR²</th>
<th>CBC Ediff Plt</th>
<th>Coagulation Tests</th>
<th>T&amp;C⁴</th>
<th>Hgb A1c</th>
<th>Chem 6</th>
<th>K+</th>
<th>LFTs</th>
<th>TSH, Free T4</th>
<th>UA Total with Reflex to Culture</th>
<th>MRSA/MSSA Screen⁷</th>
<th>HCG UCG</th>
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</thead>
<tbody>
<tr>
<td>Coumadin/Warfarin</td>
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<td>Digoxin</td>
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<td>Dabigatran</td>
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<td>Apixaban/edoxaban</td>
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<tr>
<td>Anticipated IV contrast for procedure</td>
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<td>Types of Procedures⁶</td>
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<tr>
<td>Major vascular, peripheral vascular-including carotid</td>
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<td>Craniotomy</td>
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<td>Head/Neck surgery-major</td>
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<td>Major cerebral vascular</td>
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<td>Open abdominal cases</td>
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<td>Orthopedic surgery-major</td>
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<tr>
<td>Procedures with anticipated EBL &gt; 500 mL</td>
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<tr>
<td>Prolonged procedures with major fluid shifts and/or blood loss</td>
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<td>X</td>
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<tr>
<td>Spine surgery-major</td>
<td>X</td>
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<tr>
<td>Thoracotomy/flue resection/VATS</td>
<td>X</td>
<td>X</td>
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</tr>
</tbody>
</table>

¹ Appropriate for OPAC/PAT visit if also has ASA score of 3-4
² PA & Lateral CXR or equivalent radiologic examination
³ DOS = Day of Surgery
⁴ See Surgical Blood Order Schedule (SBOS) for maximum recommended blood volume per procedure
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⁶ Also refer to surgeon's preference list
⁷ If MRSA/MSSA Screen positive, order mupirocin/bactroban

*Preoperative screening and laboratory testing is unwarranted and may be harmful unless the patient has a specific clinical indication.*
**Perioperative Medication Management by Class**

Limited clinical trials data are available to guide medication management in the perioperative period. Therefore, perioperative medication management is largely based on estimating the risks and benefits of either continuing or discontinuing the medication and the urgency of the surgery or procedure being performed. Management must be tailored to the specific patient and procedure and should be based upon:

- The patient’s medication allergies and prior adverse reactions
- The patient’s medical problems/comorbidities
- The specific procedure being performed including anesthesia/analgesia management (e.g. neuraxial anesthesia).
- For specific recommendations on antiplatelets and anticoagulants with regional anesthesia while the catheter is in place and post-catheter removal see Appendix A.

**Anticoagulant/Antithrombotics**

Consider the procedure and need for *neuraxial anesthesia* when planning perioperative medication management.

**Oral Anticoagulant/Antithrombotic Medications**

- **Restart time depends on the procedure and risk for bleeding**

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Minimum Recommended Holding Time</th>
<th>Prior to Procedure</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antiplatelet medications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aspirin</td>
<td>Do not hold*</td>
<td>Patient- and procedure-specific decision should be made with patient and care team.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clopidogrel (Plavix®)</td>
<td>5 - 7 days *</td>
<td>7 days</td>
<td>Before holding any of these medications see OSUWMC Management of Antiplatelet Therapy in Patients with Arterial Stents Around the Time of Surgeries and Procedures guideline.</td>
<td></td>
</tr>
<tr>
<td>prasugrel (Effient®)</td>
<td>7 days*</td>
<td>10 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ticagrelor (Brilinta®)</td>
<td>5 days*</td>
<td>5 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vorapaxar (Zontivity®)</td>
<td>40 - 50 days</td>
<td>Contraindicated</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Direct Thrombin Inhibitor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dabigatran (Pradaxa®)</td>
<td>Elected procedures with a low bleeding risk</td>
<td></td>
<td>Depending on indication for anticoagulation, risk of bleeding with the procedure and renal function patient may require longer holding time and/or bridging.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CrCl &gt; 80 mL/min:</td>
<td></td>
<td>Check PTT or TT to verify</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 24 hours</td>
<td></td>
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<tr>
<td></td>
<td>CrCl 50 – 79 mL/min:</td>
<td></td>
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<tr>
<td></td>
<td>≥ 36 hours</td>
<td></td>
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<tr>
<td></td>
<td>CrCl 30 – 49 mL/min:</td>
<td></td>
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<tr>
<td></td>
<td>≥ 48 hours</td>
<td></td>
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<tr>
<td></td>
<td>CrCl 15 – 29 mL/min:</td>
<td></td>
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<tr>
<td></td>
<td>≥ 72 hours</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>CrCl &lt;15 mL/min:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 96 hours and normal PTT and TT</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Procedures at moderate - high bleeding risk</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CrCl &gt; 80 mL/min:</td>
<td>≥ 24 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrCl 50 – 79 mL/min:</td>
<td>≥ 36 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrCl 30 – 49 mL/min:</td>
<td>≥ 48 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrCl 15 – 29 mL/min:</td>
<td>≥ 72 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CrCl &lt;15 mL/min:</td>
<td>&gt; 96 hours and normal PTT and TT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication.

**Consider the procedure and need for neuraxial anesthesia prior to holding anticoagulation medications.**
### Oral Anticoagulant/Antithrombotic Medications (Continued)

- **Restart time depends on the procedure and risk for bleeding**

#### Class

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Minimum Recommended Holding Time</th>
<th>Prior to Procedure</th>
<th>Additional Considerations</th>
</tr>
</thead>
</table>
| Factor Xa Inhibitors | apixaban (Eliquis®) | Elective procedures with a low bleeding risk
- CrCl ≥ 30 mL/min: ≥ 24 hours
- CrCl 15 – 29 mL/min: ≥ 36 hours
- CrCl <15 mL/min: ≥ 48 hours
- Procedures at moderate - high bleeding risk
- CrCl ≥ 30 mL/min: ≥ 48 hours
- CrCl < 30 mL/min: ≥ 72 hours | Minimum recommended time between last dose of antithrombotic and neuraxial catheter placement
- CrCl > 30 mL/min: 3 days
- CrCl < 30 mL/min: 5 days | Depending on indication for anticoagulation, risk of bleeding with the procedure and renal function patient may require longer holding time and/or bridging. |
| | rivaroxaban (Xarelto®) | | | |
| | edoxaban (Savaysa®) | | | |

#### NSAIDs

<table>
<thead>
<tr>
<th>NSAIDs</th>
<th>celecoxib (Celebrex®)</th>
<th>If holding other antiplatelets or anticoagulants, hold NSAID concurrently</th>
<th>No need to hold dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ibuprofen (Motrin®, Advil®)</td>
<td></td>
<td>If the decision is made to hold, the time to hold should be based upon 5 half-lives of specific NSAID. Contact Pharmacy for assistance. See Appendix A</td>
</tr>
<tr>
<td></td>
<td>meloxicam (Mobic®)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>naproxen (Aleve®, Naproxyn®)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Phosphodiesterase Inhibitors

<table>
<thead>
<tr>
<th>Phosphodiesterase Inhibitors</th>
<th>cilostazol (Pletal®)</th>
<th>Do not hold</th>
<th>48 hours*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dipyridamole-aspirin (Aggrenox®)</td>
<td>Do not hold*</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>dipyridamole (Persantine®)</td>
<td>Do not hold</td>
<td>48 hours*</td>
</tr>
<tr>
<td></td>
<td>pentoxifylline (Trental®)</td>
<td>Do not hold</td>
<td>Do not hold</td>
</tr>
</tbody>
</table>

#### Vitamin K Antagonist

<table>
<thead>
<tr>
<th>Vitamin K Antagonist</th>
<th>warfarin (Coumadin®, Jantoven®)*</th>
<th>0 - 5 days*</th>
<th>5 days, normalization of INR</th>
</tr>
</thead>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication.

^Consider the procedure and need for neuraxial anesthesia prior to holding anticoagulation medications.
## Intravenous or Subcutaneous Anticoagulant/Antithrombotic Medications

- **Restart time depends on the procedure and risk for bleeding**

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Minimum Recommended Holding Time</th>
<th>Prior to Procedure</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Minimum recommended time between last dose of antithrombotic and neuraxial catheter placement</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Holding Time</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Inpatients:</strong> No time restriction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Outpatients: 8 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8 hours</td>
</tr>
<tr>
<td><strong>Heparin and related medications</strong></td>
<td>unfractionated heparin (UFH) - subcutaneous</td>
<td>3 - 4 hours</td>
<td><strong>CrCl &gt; 30 mL/min:</strong> 24 hours</td>
<td><strong>Prophylaxis:</strong> 48 hours</td>
</tr>
<tr>
<td></td>
<td>5000 units q12h</td>
<td>3 - 4 hours</td>
<td><strong>CrCl ≤ 30 mL/min:</strong> 48 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5000 units q8h</td>
<td>3 - 4 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7500 units q8h</td>
<td>3 - 4 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>dalteparin (Fragmin®)</td>
<td>24 hours</td>
<td><strong>CrCl &gt; 30 mL/min:</strong> 24 hours</td>
<td><strong>Prophylaxis:</strong> 24 hours</td>
</tr>
<tr>
<td></td>
<td>therapeutic</td>
<td>24 hours</td>
<td><strong>CrCl ≤ 30 mL/min:</strong> 48 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>prothrombinex</td>
<td>12 hours</td>
<td><strong>CrCl &gt; 30 mL/min:</strong> 12 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>therapeutic</td>
<td>12 hours</td>
<td><strong>CrCl ≤ 30 mL/min:</strong> 24 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>prophylaxis</td>
<td>12 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>enoxaparin (Lovenox®)</td>
<td>24 hours</td>
<td><strong>CrCl &gt; 30 mL/min:</strong> 24 hours</td>
<td><strong>Prophylaxis:</strong> 24 hours</td>
</tr>
<tr>
<td></td>
<td>therapeutic</td>
<td>24 hours</td>
<td><strong>CrCl &lt; 30 mL/min:</strong> 72 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>prophylaxis</td>
<td>24 hours</td>
<td><strong>CrCl &lt; 30 mL/min:</strong> 72 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fondaparinux (Arixtra®)</td>
<td>3 days</td>
<td><strong>CrCl &gt; 50 mL/min:</strong> 4 days</td>
<td><strong>Prophylaxis:</strong> 4 days</td>
</tr>
<tr>
<td></td>
<td>therapeutic</td>
<td>3 days</td>
<td><strong>CrCl ≤ 50 mL/min:</strong> 5 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>prophylaxis</td>
<td>3 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>unfractionated heparin (UFH) - infusion</td>
<td>Hold 4-6 hours prior to procedures</td>
<td>4 hours if normal PTT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Argatroban</td>
<td>Rate &gt; 1.5 mcg/kg/min - hold 6 hours and recheck PTT</td>
<td></td>
<td>If neuroaxial anesthesia is needed, decision should be based upon discussion with the Anesthesiologist, surgical team, and pharmacy specialist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate 0.5 - 1.5 mcg/kg/min - hold 8 hours and recheck PTT</td>
<td></td>
<td>See Argatroban Dosing and Monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate &lt; 0.5 mcg/kg/min - hold for 12 hours and recheck PTT</td>
<td></td>
<td>Verify PTT is normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Hepatic and/or renal insufficiency may need to hold longer</em></td>
<td></td>
<td>Heparin should be resumed at the discretion of the surgeon/medical team when postoperative hemostasis deemed to be adequate</td>
</tr>
<tr>
<td></td>
<td>bivalirudin (Angiomax®)</td>
<td><strong>CrCl &gt;60 mL/min:</strong> Hold for 2 - 4 hours and recheck PTT</td>
<td></td>
<td>If neuroaxial anesthesia is needed, decision should be based upon discussion with the Anesthesiologist, surgical team, and pharmacy specialist</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>CrCl 10 – 60 mL/min:</strong> Hold for 4 - 6 hours and recheck PTT</td>
<td></td>
<td>See Bivalirudin Dosing and Monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermittent HD off-dialysis: (May need to hold longer)</td>
<td></td>
<td>Verify PTT is Normal</td>
</tr>
<tr>
<td></td>
<td>desirudin (Iprivask®)</td>
<td>24 hours</td>
<td>24 hours if normal PTT</td>
<td>Depending on indication may require longer holding time and/or bridging.</td>
</tr>
</tbody>
</table>
### Intravenous or Subcutaneous Anticoagulant/Antithrombotic Medications (Continued)

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Minimum Recommended Holding Time</th>
<th>Prior to Procedure</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiplatelets</td>
<td>abciximab (Reopro®)9</td>
<td>12 hours</td>
<td>5 days</td>
<td>Platelet function may remain abnormal for up to 7 days post abciximab infusion due to irreversible platelet inhibition.</td>
</tr>
<tr>
<td></td>
<td>eptifibatide (Integrillin®)10</td>
<td>4 hours</td>
<td>24 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tirofiban (Aggrastat®)11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrombolytic</td>
<td>Therapeutic Alteplase (TPA®)</td>
<td>Minimum 48 hours for emergency procedures</td>
<td>Minimum 48 hours for emergency procedures</td>
<td></td>
</tr>
<tr>
<td>Catheter Clearance</td>
<td>No need to hold dose</td>
<td>No need to hold dose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication.

**Consider the procedure and need for neuraxial anesthesia prior to holding anticoagulation medications.**

### Antidepressants

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoamine Oxidase Inhibitors (MAOIs)</td>
<td>phenelzine (Nardil®)</td>
<td>Maintain control of psychiatric symptoms</td>
<td>Can cause hypertensive crisis when used with sympathomimetics. Can cause neuroleptic malignant syndrome when used with meperidine.</td>
<td>Continue</td>
<td>Clearly document to avoid both drug and food interactions during the procedure and hospitalization. Requires low tyramine diet.</td>
</tr>
<tr>
<td></td>
<td>selegiline (Emsam®)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Selective Serotonin Reuptake Inhibitors (SSRIs)</td>
<td>sertraline (Zoloft®)</td>
<td>Maintain control of psychiatric symptoms Avoid withdrawal syndrome</td>
<td>Increased bleeding risk due to inhibition of platelet aggregation</td>
<td>Continue</td>
<td>SSRI need to be discontinued for up to 3 weeks to be out of the system and clinical benefit may not occur for several weeks after reinitiating. Use methylene blue with caution because of risk of serotonin syndrome</td>
</tr>
<tr>
<td></td>
<td>paroxetine (Paxil®)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>citalopram (Celexa®)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Selective Serotonin and Norepinephrine Reuptake Inhibitors (SNRIs)</td>
<td>duloxetine (Cymbalta®)</td>
<td>Maintain control of psychiatric symptoms Avoid withdrawal syndrome</td>
<td>Increased bleeding risk due to inhibition of platelet aggregation</td>
<td>Continue</td>
<td>SNRI need to be discontinued for up to 3 weeks to be out of the system and clinical benefit may not occur for several weeks after reinitiating. Use methylene blue with caution because of risk of serotonin syndrome</td>
</tr>
<tr>
<td></td>
<td>Milnacipran (Savella®)</td>
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<tr>
<td></td>
<td>Venlafaxine (Effexor®)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Tricyclic Antidepressants</td>
<td>amitriptyline (Elavil®)</td>
<td>Maintain control of psychiatric symptoms Avoid withdrawal syndrome</td>
<td>May increase risk of arrhythmia in combination with some volatile anesthetics or sympathomimetics.</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>doxepin (Sinequan®)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>imipramine (Tofranil®)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lithium</td>
<td>Maintain control of psychiatric symptoms Avoid withdrawal syndrome</td>
<td>May increase risk for prolongation of muscle relaxant effects. May increase risk for nephrogenic diabetes insipidus and thyroid dysfunction.</td>
<td>Continue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication.
## Cancer Medications *

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Minimum Recommended Holding Times</th>
<th>Additional Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEGF Inhibitor</td>
<td>bevacizumab (Avastin&lt;sup&gt;®&lt;/sup&gt;)</td>
<td>At least 4 weeks prior to the procedure per the package insert, although based on pharmacokinetics, at least 6 weeks is desired in most cases</td>
<td>Wait at least 4 weeks postoperatively or until wound is healed to start</td>
</tr>
<tr>
<td></td>
<td>ramucirumab (Cyramza&lt;sup&gt;®&lt;/sup&gt;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ziv-Aflibercept (Zaltrap&lt;sup&gt;®&lt;/sup&gt;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>regorafenib (Stivarga&lt;sup&gt;®&lt;/sup&gt;)</td>
<td>2 weeks</td>
<td></td>
</tr>
</tbody>
</table>

| Tyrosine Kinase Inhibitors | axitinib (Inlyta<sup>®</sup>) | 24 hours                           | Consider holding these medications based upon the indication for the medication, procedure, and risk for wound healing. |
|                            | cabozantinib (Cometriq<sup>®</sup>) | 28 days                            | Hold ibritinib 3 - 7 days after the procedure depending on the risk of bleeding with the procedure |
|                            | ibritinib (Imbruvica<sup>®</sup>) | 3 - 7 days                          |                                             |
|                            | olaratumab (Lartruvo<sup>®</sup>) | No data Consult Clinical Pharmacy Specialist |                                             |
|                            | pazopanib (Votrient<sup>®</sup>) | 7 days                             |                                             |
|                            | ponatinib (Iclusig<sup>®</sup>) | 7 days                             |                                             |
|                            | sorafenib (Nexavar<sup>®</sup>) | 6 days                             |                                             |
|                            | sunitinib (Sutent<sup>®</sup>) | 2 - 3 weeks                         |                                             |

| Asparaginase derivative    | pegaspargase (Oncaspar<sup>®</sup>) | Fibrinogen should be checked preoperatively if given within 4 weeks of the procedure. For fibrinogen < 100 mg/dL consider cryoprecipitate. |                                             |

## Cancer/Immunomodulation Medications *

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Minimum Recommended Holding Time</th>
<th>Risks of Continuation</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunomodulator (IMiDs)</td>
<td>Lenalidomide (Revlimid&lt;sup&gt;®&lt;/sup&gt;)</td>
<td>Minor Surgery: Stop 1 day before</td>
<td>Wound healing, bleeding to secondary to thrombocytopenia/concurrent antiocoagulation, increased risk of thrombosis if aspirin/anticoagulant</td>
<td>Minor Surgery: Resume at least 7 days after surgery</td>
</tr>
<tr>
<td></td>
<td>Pomalidomide (Pomalyst&lt;sup&gt;®&lt;/sup&gt;)</td>
<td>Ortho, GI or GU Surgery: Stop 1 week before</td>
<td></td>
<td>Ortho, GI or GU Surgery: Follow up with Multiple Myeloma physician before resuming</td>
</tr>
<tr>
<td></td>
<td>Thalidomide (Immunoprin&lt;sup&gt;®&lt;/sup&gt;)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Discontinuation/continuation or holding times for procedures must be determined by the attending physician for each case.
# Cardiovascular and Antihypertensives

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
</table>
| **ACE Inhibitors, ARBs, Neprilysin inhibitor/ARB, and Renin Inhibitors**<sup>12</sup> | aliskiren (Tekturna<sup>®</sup>)
candesartan cilexetil (Atacand<sup>®</sup>)
enalapril (Vasotec<sup>®</sup>)
irbesartan (Avapro<sup>®</sup>)
lisinopri (Zestril<sup>®, Prinivil®</sup>)
losartan (Cozaar<sup>®</sup>)
quinarpril (Accupril<sup>®</sup>)
ramipril (Altace<sup>®</sup>)
valsartan (Diovan<sup>®</sup>)
sacubitril-valisartan (Entresto<sup>®</sup>) | Blood pressure control | Intraoperative hypotension | Hold 24 hours prior to surgical procedure |  |
| **Alpha Blocker** | doxazosin (Cardura<sup>®</sup>)
terazosin (Hytrin®)
tamsulosin (Flomax®) | Blood pressure control | Hypotension | Continue |  |
| **Alpha 2 Agonists** | clonidine (Catapress<sup>®</sup>)
methylbiga (Aldomet<sup>®</sup>) | Blood pressure and heart rate control | Hypotension | Continue |  |
| **Antiarrhythmics** | amiodarone (Cordarone<sup>®</sup>)
dronedarone (Multaq<sup>®</sup>)
dofetilide (Tikosyn®)
sotalol (Betapace<sup>®</sup>, Betapace AF<sup>®</sup>) | Suppress arrhythmia | Induce arrhythmia QT prolongation | Continue | Consider obtaining baseline preoperative 12-lead ECG in patients with changes in renal function (sotalol, dofetilide). Consider monitoring potassium and magnesium (sotalol and dofetilide). Minimize medications that prolong QT interval. |
| **Beta-Blockers**<sup>13</sup> | metoprolol (Lopressor<sup>®, Toprol XL®</sup>)
carvedilol (Coreg<sup>®</sup>)
atenolol (Tenormin<sup>®</sup>)
bisoprolol (Zebeta<sup>®</sup>, Ziac<sup>®</sup>) | Less cardiac ischemia | Hypotension Bradycardia | Continue | If beta-blocker is combined with thiazide diuretic, e.g. atenolol-chlorothalidone, then treat as a beta-blocker and usually continue. Ideally, initiation of beta-blocker therapy should be long enough in advance to assess safety and tolerability before surgery. |
<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Channel Blockers</td>
<td>Dihydropyridine: amlodipine (Norvasc®)</td>
<td>Blood pressure</td>
<td>Hypotension – some of these drugs have a long half-life</td>
<td>Continue</td>
<td>If blood pressure or heart rate is too low, then hold 24 hours prior to surgical procedure.</td>
</tr>
<tr>
<td></td>
<td>nifedipine (Procardia®, Adalat®, Plendil®)</td>
<td>Heart rate control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-dihydropyridine: diltiazem (Cardizem®)</td>
<td>Blood pressure</td>
<td>Hypotension</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>verapamil (Calan®, Isoptin®)</td>
<td>Heart rate control</td>
<td>Bradycardia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digoxin</td>
<td>digoxin (Lanoxin®)</td>
<td>Lower heart rate</td>
<td>Induce arrhythmia</td>
<td>Continue</td>
<td>Consider obtaining digoxin level prior to surgical procedure. Consider obtaining potassium and magnesium prior to surgical procedure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Less heart failure</td>
<td>Toxicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ivabradine</td>
<td>ivabradine (Corlanor®)</td>
<td>Lower heart rate</td>
<td>Induce arrhythmia</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>Diuretics</td>
<td>chlorthalidone (Thalitone®)</td>
<td>Avoid fluid overload</td>
<td>Hypotension</td>
<td>Do not take on day of procedure</td>
<td>Continue diuretics in diuretic-dependent heart failure patients. If a thiazide diuretic is combined with a beta-blocker, e.g. atenolol-chlorthalidone, then treat as a beta-blocker and usually continue.</td>
</tr>
<tr>
<td></td>
<td>furosemide (Lasix®)</td>
<td></td>
<td>Hypokalemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>torsemide (Demadex®)</td>
<td></td>
<td>Hyperkalemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>bumetanide (Bumex®)</td>
<td></td>
<td>Hyponatremia</td>
<td></td>
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<tr>
<td></td>
<td>hydrochlorothiazide (Micozide®)</td>
<td></td>
<td>Hypernatremia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>metolazone (Zaroxolyn®)</td>
<td></td>
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<tr>
<td></td>
<td>spironolactone (Aldactone®)</td>
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<tr>
<td></td>
<td>triamterene/hydrochlorothiazide (Dyazide®, Maxzide®)</td>
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</tr>
<tr>
<td>Nitric Oxide Vasodilators</td>
<td>isosorbide dinitrate (Isordil®)</td>
<td>Blood pressure</td>
<td>Hypotension</td>
<td>Continue</td>
<td>Consider risks of hypotension versus hypertension when making decisions to either give or hold anti-hypertensives</td>
</tr>
<tr>
<td></td>
<td>isosorbide mononitrate (Imdur®)</td>
<td>Angina control</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>hydralazine (Apresoline®)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>minoxidil (Loniten®)</td>
<td></td>
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</tr>
<tr>
<td>Potassium</td>
<td>potassium chloride (K-Dur®, Klor-con®)</td>
<td>Avoid hypokalemia</td>
<td>Hyperkalemia</td>
<td>Do not take on day of procedure</td>
<td>If the patient will be receiving a diuretic, then continue potassium.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Irritation of esophagus or stomach</td>
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<td></td>
</tr>
</tbody>
</table>
**Cardiovascular and Antihypertensives (continued)**

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statin</td>
<td>atorvastatin (Lipitor®)</td>
<td>Lower risk of thrombotic stroke and myocardial infarction</td>
<td>Rhabdomyolysis</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pravastatin (Pravachol®)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>rosuvastatin (Crestor®)</td>
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<tr>
<td></td>
<td>simvastatin (Zocor®)</td>
<td></td>
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</tr>
<tr>
<td>Non-Statin Lipid-Lowering Medications</td>
<td>Cholestyramine (Questran®)</td>
<td>Cholestyramine can sequester other medications</td>
<td>Fibrate-induced rhabdomyolysis</td>
<td></td>
<td>Do not take on day of procedure</td>
</tr>
<tr>
<td></td>
<td>ezetimibe (Zetia®)</td>
<td></td>
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<tr>
<td></td>
<td>fenofibrate (Tricor®)</td>
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<td></td>
<td>gemfibrozil (Lopid®)</td>
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<td></td>
<td>niacin (Niaspan®)</td>
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<td></td>
<td>Fish oil (&gt; 3 grams/day)</td>
<td></td>
<td>Increased risk of bleeding</td>
<td>Hold for 7 days prior to procedure</td>
<td>May consider continuing in patients treated for very high triglycerides.</td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medications

**Corticosteroids and Glucocorticoids**

- For relative potencies of corticosteroids please see the OSUWMC Pharmacy Intranet site
- Examples: prednisone (Deltasone®), methylprednisolone (Medrol®, Medrol Dosepak®), dexamethasone (Decadron®)
  - Plan for stress dose in patients who have been taking immunosuppressants or immunomodulators for an extended period of time.
- If receiving steroids for transplant immunosuppression, consider consulting transplant team for specific recommendations

This table applies to patients with adrenal suppression caused by exogenous steroids. For patients with endogenous adrenal failure consult the patient’s endocrinologist for steroid management. (Note: patients with primary adrenal insufficiency will require mineralocorticoids perioperatively with oral fludrocortisones, higher doses of hydrocortisone, or liberal use of saline solutions)

<table>
<thead>
<tr>
<th>Dose/Duration of Corticosteroid</th>
<th>Adrenal Reserves</th>
<th>Usual Choice</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3 weeks duration</td>
<td>Likely has adequate cortisol reserves in adrenal glands</td>
<td>Continue usual dose of corticosteroid on the morning of the procedure and afterwards</td>
<td>For hypotension unresponsive to intravenous fluid boluses treat with hydrocortisone sodium succinate (Solu-Cortef®, A-Hydrocort®) 50-75 mg IV Q8H x3 during postoperative period or equivalent alternate corticosteroid</td>
</tr>
<tr>
<td>Dose equivalent to 5 mg/day or less or 10 mg every other day of prednisone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dose equivalent to 5 - 20 mg/day prednisone for more than 3 weeks</td>
<td>May or may not be adequate reserve cortisol in adrenal glands</td>
<td>Adrenal reserves testing is expensive, time consuming and unreliable in this setting. Most patients will not need “stress dose” corticosteroids and should continue usual doses of corticosteroids on the morning of the procedure and afterwards. However, for major procedures consider hydrocortisone sodium succinate (Solu-Cortef®, A-Hydrocort®) 50-75mg IV Q8H x3 during postoperative period or equivalent alternate corticosteroid</td>
<td>If patient has not received stress dose corticosteroids and develops hypotension unresponsive to intravenous fluid boluses treat with hydrocortisone sodium succinate (Solu-Cortef®, A-Hydrocort®) 50-75 mg IV Q8H x3 during postoperative period or equivalent alternate corticosteroid</td>
</tr>
<tr>
<td>Dose greater than or equal to 20 mg/day prednisone for three weeks or more and patients with Cushingoid appearance</td>
<td>Likely has minimal reserve cortisol available in adrenal glands</td>
<td>Should usually receive “stress dose” corticosteroids, e.g. hydrocortisone sodium succinate (Solu-Cortef®, A-Hydrocort®) 50-75 mg IV Q8H x3 during postoperative period or equivalent alternate corticosteroid</td>
<td></td>
</tr>
</tbody>
</table>

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## Diabetes Medications

- See OSUMC *Perioperative / Periprocedure Glucose Management* guideline

### Disease Modifying Antirheumatic Drugs (DMARD)

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMARD</td>
<td>methotrexate (Trexall®)</td>
<td>Avoid disease flares</td>
<td>Myeloid immunosuppression</td>
<td>If normal renal function ok to continue in perioperative period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hydroxychloroquine (Plaquenil®)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>sulfasalazine (Azulfidine®)</td>
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<td></td>
<td>azathioprine (Imuran®)</td>
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<tr>
<td></td>
<td>leflunomide (Arava®)</td>
<td></td>
<td>Stop 2 weeks prior to procedures, resume when wound fully healed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Gastrointestinal Medications

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antacids</td>
<td>calcium carbonate, aluminum hydroxide (AlternaGEL®, AluCap®, Alu-Tab®, Amphojel®)</td>
<td>Temporary neutralization of stomach acid</td>
<td>Additional matter in the stomach</td>
<td>Do not take on day of procedure</td>
<td>May substitute H2 blocker or PPI</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td>mesalamine (Pentasa®, Asacol®), balsalazide (Colazal®)</td>
<td>Avoid flare of irritable bowel disease</td>
<td></td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td>H2 Blockers</td>
<td>cimetidine (Tagamet®), famotidine (Pepcid®), ranitidine (Zantac®)</td>
<td>Reduction in stomach acid and GERD symptoms, Avoid rebound hyperacidity</td>
<td></td>
<td>Continue</td>
<td>If on cimetidine, consider replacing with other H2 blocker due to multiple drug interactions.</td>
</tr>
<tr>
<td>Proton Pump Inhibitors</td>
<td>esomeprazole (Nexium®), lansoprazole (Prevacid®), omeprazole (Prilosec®), pantoprazole (Protonix®)</td>
<td>Reduction in stomach acid and reflux symptoms, Avoid rebound hyperacidity</td>
<td></td>
<td>Continue</td>
<td></td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication.*
Genitourinary Medications

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Recommended Holding Time</th>
<th>Risk of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPH</td>
<td>alfuzosin (Uroxatral®)</td>
<td>Less postoperative urinary retention</td>
<td>Hypotension</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>doxazosin (Cardura®)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>dutasteride (Avodart®)</td>
<td></td>
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<tr>
<td></td>
<td>finasteride (Proscar®)</td>
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<tr>
<td></td>
<td>tamsulosin (Flomax®)</td>
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<tr>
<td></td>
<td>terazosin (Hytrin®)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Urinary Analgesics &amp; Anesthetics</td>
<td>Pentosane polysulfate sodium (Elmiron®)</td>
<td>5-7 days</td>
<td>Bleeding</td>
<td>Hold for 5-7 days prior to procedure</td>
<td></td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication

Herbal Agents

- There is no evidence herbal medications improve surgical outcomes and there are theoretical reasons these agents may increase perioperative morbidity and the exact purity of some herbal medications is unclear
- Stop the following agents 7 days prior to procedures because of the potential increased risk of bleeding
  - Aloe, Burdock root, Chamomile, Chondroitin, Dong quai, Evening primrose, Flaxseed, Fish oil, Garlic, Ginger, Ginkgo, Ginseng, Glucosamine, Green tea, Hu Zhang, Melatonin, Saw palmetto, Tumeric, Vitamin A and E
- The above list in not all inclusive - Consult pharmacy if there are any concerns with additional herbal agent

Hormonal Medications

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hormonal medications</td>
<td>oral contraceptives</td>
<td>Avoid unplanned pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hormone replacement therapy</td>
<td>Decrease postmenopausal symptoms</td>
<td>Increased risk of Venous Thromboembolism</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>anastrozole (Arimidex®)</td>
<td></td>
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<tr>
<td></td>
<td>exemestane (Aromasin®)</td>
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<td></td>
<td>letrozole (Femara®)</td>
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<tr>
<td></td>
<td>raloxifene (Evista®)</td>
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<tr>
<td></td>
<td>tamoxifen (Nolvadex®)</td>
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<td></td>
<td>toremifene (Fareston®)</td>
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<tr>
<td>Selective estrogen receptor modulator</td>
<td>raloxifene (Evista®)</td>
<td></td>
<td></td>
<td></td>
<td>Stop 4 weeks prior to procedures for patients at moderate/high risk of VTE</td>
</tr>
</tbody>
</table>

Investigational Medications

1. Summary protocol procedures are on the "Pharmacy Intranet".
   a. Provides study name and #, location of investigational medication, and protocol link.
   b. Procedures include drug preparation, dose, storage/stability parameters, randomization process, and more.
2. For Non-Oncology studies:
   a. A “Drug Order Form,” (customized paper Rx) will be faxed to the pharmacy executing the study.
   b. For additional protocol information such as inclusion/exclusion criteria the Investigational Drug Services (IDS) can provide this during business hours or the study coordinator can after IDS hours of operation. The study team is responsible for ensuring the patient meets all criteria before and during their enrollment.
3. For Oncology studies:
   a. Treatment plans including the pertinent investigational medications are available in Beacon (IHIS).
   b. The protocol can be found in OnCore
# Pulmonary Medications

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Cholinergics</td>
<td>ipratropium (Atrovent®HFA)</td>
<td>Reduced risk of postoperative pulmonary complications in patients with reactive airway disease</td>
<td>Anti-cholinergic side effects</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>tiotropium (Spiriva HandiHaler®)</td>
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<tr>
<td></td>
<td>albuterol (Proventil® or Ventolin®HFA)</td>
<td></td>
<td>Tachycardia</td>
<td>Continue</td>
<td></td>
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<tr>
<td></td>
<td>formoterol (Foradil®, Perforomist®)</td>
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<tr>
<td></td>
<td>salmeterol (Serevent®)</td>
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<tr>
<td>Beta-Agonists</td>
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<tr>
<td></td>
<td>bosentan (Tracleer®)</td>
<td>Avoid withdrawal, rebound pulmonary hypertension</td>
<td>Hypotension</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>macitentan (Opsumit®)</td>
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<td></td>
<td>ambrisentan (Letairis®)</td>
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<tr>
<td>Endothelin receptor antagonists</td>
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<tr>
<td></td>
<td>fluticasone (Flovent®)</td>
<td>Improved control of reactive airway disease</td>
<td>Thrush</td>
<td>Continue</td>
<td></td>
</tr>
<tr>
<td>Inhaled Glucocorticoids</td>
<td>montelukast (Singulair®)</td>
<td></td>
<td>Improved control of asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>zafirlukast (Accolate®)</td>
<td></td>
<td>No known perioperative adverse effects</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>zileuton (Zyflo®)</td>
<td></td>
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<tr>
<td>Leukotriene Inhibitors</td>
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<tr>
<td></td>
<td>epoprostenol (Flolan®, Veletri®)</td>
<td></td>
<td>Hypotension</td>
<td></td>
<td>Consult to cardiovascular anesthesia is required.</td>
</tr>
<tr>
<td>Inhaled Prostacyclin/ analogues</td>
<td></td>
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<td></td>
<td>iloprost (Ventavis®)</td>
<td></td>
<td>Hypotension</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>treprostinil (Tyvaso®)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Oral Prostacyclin/ analogues</td>
<td>treprostinil (Orenitram®)</td>
<td></td>
<td>Hypotension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral prostaoyclin receptor (IP) agonist</td>
<td>Selexipag (Uptravi®)¹⁴</td>
<td>Avoid withdrawal, rebound pulmonary hypertension</td>
<td>Hypotension, Anemia</td>
<td>Continue</td>
<td>Interruption for ≥ 3 days, will need to re-titrte</td>
</tr>
<tr>
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<tr>
<td>Phosphodiesterase (PDE5) inhibitors</td>
<td>sildenafil (Revatio®)</td>
<td>Hypotension</td>
<td></td>
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<tr>
<td></td>
<td>tadalafil (Adcirca®)</td>
<td></td>
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</tr>
<tr>
<td>Soluble guanylate cyclase stimulator</td>
<td>Riociguat (Adempas®)¹⁶</td>
<td>Hypotension</td>
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<tr>
<td>Subcutaneous Prostacyclin/ analogues</td>
<td>treprostinil (Remodulin®)</td>
<td></td>
<td>Hypotension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theophylline</td>
<td>theophylline (Theodur®)</td>
<td></td>
<td>Arahythmia, Neurotoxicity</td>
<td>Hold 24 hours before procedures</td>
<td></td>
</tr>
</tbody>
</table>

*Patient- and procedure-specific decision should be made with patient and care team whether to hold medication.
## Substance Abuse

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Benefits of Continuation</th>
<th>Risks of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking Cessation</td>
<td>Nicotine replacement products (gum, lozenge, patch, nasal spray, inhaler, etc.)&lt;sup&gt;17&lt;/sup&gt;</td>
<td>Maintain abstinence from smoking to reduce smoking-related complications</td>
<td>Vasospams</td>
<td>Per surgeon’s preference</td>
<td>Likely safe for continuation: lack of evidence from human studies that NRT increases risk of post-op complications (healing or cardiovascular). NRT may yield positive cotinine test</td>
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<td>Varenicline (Chantix&lt;sup&gt;®&lt;/sup&gt;)&lt;sup&gt;18,19&lt;/sup&gt;</td>
<td>Maintain abstinence from smoking to reduce smoking-related complications</td>
<td></td>
<td>Continue</td>
<td>Use methylene blue with caution because of risk of hypertensive reactions</td>
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<tr>
<td>Bupropion (Zyban&lt;sup&gt;®&lt;/sup&gt;)&lt;sup&gt;20&lt;/sup&gt;</td>
<td>Maintain abstinence from smoking to reduce smoking-related complications</td>
<td>Decreased seizure threshold (doses &gt; 450 mg/day)</td>
<td>Continue</td>
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<td></td>
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<tr>
<td>Opioid/Alcohol Use Deterrents</td>
<td>Acamprosate (Campral&lt;sup&gt;®&lt;/sup&gt;)&lt;sup&gt;21&lt;/sup&gt;</td>
<td>Maintain abstinence from alcohol intake</td>
<td>None</td>
<td>Continue</td>
<td></td>
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<tr>
<td>Naltrexone (Revia&lt;sup&gt;®&lt;/sup&gt;, Vivitrol&lt;sup&gt;®&lt;/sup&gt;)&lt;sup&gt;22,23&lt;/sup&gt;</td>
<td>Maintain abstinence from alcohol intake or opioid use</td>
<td>Inadequate perioperative pain control with opioid analgesics (ex. Hydromorphone, fentanyl, remifentanil) Induction of opioid withdrawal upon administration of opioids</td>
<td>Oral: Hold 5 days IM: Contact prescribing physician</td>
<td>Consider regional analgesia or the use of non-opioid analgesics if clinically appropriate IM formulation may take at least 4 weeks to be eliminated from body Naltrexone should be restarted at the discretion of the prescribing chronic pain management/substance use physician</td>
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<tr>
<td>Buprenorphine (Subutex&lt;sup&gt;®&lt;/sup&gt;) Buprenorphine/naloxone (Suboxone&lt;sup&gt;®&lt;/sup&gt;) Buprenorphine patch (Butrans&lt;sup&gt;®&lt;/sup&gt;)&lt;sup&gt;24-26&lt;/sup&gt;</td>
<td>Maintain abstinence from opioid use: Control chronic pain</td>
<td>Inadequate perioperative pain control with opioid analgesics (ex. Hydromorphone, fentanyl, remifentanil)</td>
<td>Continue unless patient was otherwise instructed by the prescribing physician</td>
<td>Consider regional analgesia or the use of non-opioid analgesics if clinically appropriate If held, restarting may be deemed “re-initiation” depending on length of hold Recommend to alert surgeon</td>
<td></td>
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</tbody>
</table>

For other products which contain any of the above ingredients but are not listed in the table, recommend following the perioperative management guidance for the agent which is most restrictive.
TNF alpha inhibitors

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Recommended Holding Time</th>
<th>Risk of Continuation</th>
<th>Usual Management</th>
<th>Additional Considerations*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>abatacept (Orencia®)</td>
<td>Stop 2 weeks prior to procedures</td>
<td>Myelol/immunosuppression</td>
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<td>Resume when the wound is fully healed</td>
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<td></td>
<td>adalimumab (Humira®)</td>
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<td>anakinra (Kineref®)</td>
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<td>certolizumab (Cimzia®)</td>
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<td>etanercept (Enbrel®)</td>
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<td>golimumab (Simponi®)</td>
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<td>infliximab (Remicade®)</td>
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<td>rituximab (Rituxan®)</td>
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<td>tocilizumab (Actemra®)</td>
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</tbody>
</table>

Other medications to continue BEFORE and ON the MORNING of the procedure:
- Alzheimer and dementia medications
- Anti-psychotics
- Anti-seizure medications
- Anti-Parkinson’s medications
- Antibiotics*
- Anxiolytics benzodiazepines
- Gout medications
  - Allopurinol (Zyloprim®)
  - Colchicine (Colcrys®, Mitigare®)
- HIV medications
- Mupirocin (Bactroban®) nasal ointment
- Myasthenia Gravis medications
  - Notify Anesthesia pre-operatively
- Thyroid medications**
- Transplant immunosuppression***

* Unless otherwise directed by Surgeon or Proceduralist
** Can be held up for 5 - 7 days postoperatively if patient is NPO
*** Sirolimus (Rapamune®), everolimus (Zortress®, Afinitor®), Temsirolimus (Torisel®) may be associated with impaired wound healing, but there are no formal recommendations for holding suggest consulting with the prescriber.
References


3. Effient® (prasugrel hydrochloride) [package insert]. Indianapolis, IN; Eli Lilly and Company; Revised January 2011.


7. The Ohio State University Wexner Medical Center. Argatroban Dosing and Monitoring. Revised October 2016.

8. The Ohio State University Wexner Medical Center. Bivalirudin Dosing and Monitoring. Revised October 2016.


10. Integrilin® (eptifibatide) [package insert]. Whitehouse Station, NJ; Merck Sharp & Dohme Corp; Revised April 2014.

11. Aggrastat® (tiroxiban) [package insert]. Somerset, NJ; Medicure Pharma, Inc; Revised 2016


14. Upravi® (selexipag) [package insert]. South San Francisco; Actelion Pharmaceuticals US, Inc; Revised December 2015.


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Guideline Approved


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