

## Perioperative Management of Chronic Medications in Noncardiac Surgery

The following chart provides information to help with decisions regarding stopping and restarting medications before and after noncardiac surgery. **Use clinical judgment and individualize decisions. Consider consulting prescriber to clarify individual's risk of stopping.** Keep in mind there is a lack of high-quality evidence for most recommendations. Also see our chart, *Managing Chronic Meds in Patients Undergoing Colonoscopy*.

**Abbreviations:** ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; DOAC = direct oral anticoagulant; IBD = inflammatory bowel disease; LMWH = low-molecular-weight heparin; TNF = tumor necrosis factor; VTE = venous thromboembolism

Drug Class	Pertinent Information or Resource
ACEI and ARBs	<ul style="list-style-type: none"> <li>Consider holding these meds up to 24 hours pre-op to limit the risk of hypotension [Evidence level B-1 and B-3].<sup>3,4</sup> But keep in mind that the safety of holding these meds in specific groups such as patients with heart failure or uncontrolled hypertension has not been examined.</li> <li>Restart with oral intake.<sup>1</sup> Monitor for postoperative hypertension.<sup>3</sup> If the patient cannot take oral meds, consider an appropriate parenteral agent for treatment of hypertension or heart failure.<sup>1</sup></li> </ul>
Anticoagulants, oral	<ul style="list-style-type: none"> <li>The decision to hold an anticoagulant before surgery or a procedure has several considerations: bleeding risk of the surgery/procedure; thrombosis risk of holding the anticoagulant; whether the surgery/procedure could be postponed until thrombotic risk is lower; how long before the surgery/procedure the anticoagulant should be stopped (if indicated); whether the anticoagulant needs to be bridged; and when it is likely safe to restart the anticoagulant.</li> <li>For general guidance on <b>duration of preprocedure washout</b>, if indicated, see our chart, <i>Comparison of Oral Anticoagulants</i>.             <ul style="list-style-type: none"> <li>For specifics on <b>duration of preprocedure DOAC (e.g., apixaban) washout based on procedural bleeding risk</b>, see our chart, <i>Managing Bleeding with Direct Oral Anticoagulants</i>. This chart also contains information to help in situations where a washout isn't feasible (e.g., emergency surgery), including labs to assess bleeding risk and reversal agents, such as clotting factors.</li> <li>Consider <b>restarting</b> DOACs the day after a minor procedure or two to three days after other procedures.<sup>29</sup> If the DOAC isn't held, consider delaying the dose until four to six hours post-procedure.<sup>32</sup> After surgery, consider need for VTE prophylaxis starting six to eight hours post-op, until the DOAC is restarted.<sup>30</sup> Before restarting rivaroxaban 15 or 20 mg tablets, ensure patients have good oral intake; these doses must be taken with food for full therapeutic effect.<sup>30,31</sup></li> <li>For help classifying surgical bleeding risk and patient thrombotic risk, see our chart, <i>Bridging Warfarin</i>,</li> <li>Thrombosis Canada's guidance on perioperative management of DOACs also includes examples of high bleeding-risk procedures (<a href="https://thrombosiscanada.ca/wp-content/uploads/2019/05/NOACs-DOACs-Perioperative-Management.pdf">https://thrombosiscanada.ca/wp-content/uploads/2019/05/NOACs-DOACs-Perioperative-Management.pdf</a>.)</li> </ul> </li> </ul>

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Drug Class	Pertinent Information or Resource
Oral Anticoagulants, continued	<ul style="list-style-type: none"> <li>• If <b>regional anesthesia</b> is planned, see our chart, <i>Antithrombotic Management in Regional Anesthesia</i>, for guidance on stopping and restarting anticoagulants around epidurals or spinals.</li> <li>• <b>Bridging</b> may need to be considered for patients in whom warfarin therapy is interrupted. See our chart, <i>Bridging Warfarin</i>, for guidance in specific scenarios, including atrial fibrillation. DOACs generally do not need to be bridged. However, if surgery is postponed, or if there is a delay in restarting the DOAC post-op, bridging may be needed.<sup>30</sup> For patients whose DOAC indication is VTE prevention, VTE prophylaxis may be all that is needed.<sup>30</sup></li> <li>• Pre-op evaluation can be an opportunity to de-escalate or discontinue unneeded antithrombotic regimens. Our charts, <i>Combination Antithrombotic Therapy: FAQs</i> and <i>Venous Thromboembolism Prophylaxis</i>, might help you identify such patients.</li> </ul>
Antidepressants	<ul style="list-style-type: none"> <li>• Generally, continue antidepressants; abruptly stopping them can lead to withdrawal symptoms.<sup>1</sup></li> <li>• Consider bleeding risk with SSRI and SNRI antidepressants. <ul style="list-style-type: none"> <li>• If depression is stable and the patient is at high bleeding risk (e.g., elderly, clinically significant liver disease, antiplatelet or anticoagulant use, surgery with high bleeding risk), consider tapering and discontinuing before surgery.<sup>1,7</sup> For help, see our chart, <i>Common Oral Medications that May Need Tapering</i>.</li> <li>• If depression is unstable, consider switching to an antidepressant with lower bleeding risk (e.g., bupropion, mirtazapine).<sup>7</sup> For help, see our chart, <i>Choosing and Switching Antidepressants</i>.</li> </ul> </li> <li>• Screen for patients who may get methylene blue, a monoamine oxidase inhibitor, during procedures (e.g., for parathyroid imaging, colon staining) and discontinue SSRIs or SNRIs one to two weeks before surgery (five weeks for fluoxetine).<sup>8</sup></li> <li>• Restart with oral intake.<sup>1</sup> If patient received methylene blue, antidepressant may be restarted 24 hours after the last dose.<sup>15,26</sup> When restarting, if the previous dose was high and the washout was prolonged, it may be prudent to start with a low dose and retitrate.<sup>16</sup></li> </ul>
Antiplatelets  <i>Continued...</i>	<ul style="list-style-type: none"> <li>• The decision to hold an antiplatelet before surgery or a procedure has several considerations: bleeding risk of the surgery/procedure; thrombosis risk of holding the antiplatelet; whether the surgery/procedure could be postponed until thrombosis risk is lower; how long before the surgery/procedure the antiplatelet should be stopped (if indicated); whether the antiplatelet needs to be bridged; and when it is likely safe to restart the antiplatelet.</li> <li>• For general guidance on <b>duration of preprocedure washout</b>, if indicated, see our chart, <i>Comparison of Oral Antiplatelets</i>.</li> <li>• If <b>regional anesthesia</b> is planned, see our chart, <i>Antithrombotic Management in Regional Anesthesia</i>, for guidance on stopping and restarting antiplatelets.</li> <li>• <b>Bridging</b> may need to be considered for patients in whom antiplatelet therapy is interrupted. See our chart, <i>Bridging Antiplatelets in Stent Patients</i>.</li> </ul>

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Antiplatelets, continued	<ul style="list-style-type: none"> <li>For help with perioperative decisions in patients with coronary artery disease, see our chart, <i>Dual Antiplatelet Therapy for Coronary Artery Disease</i>.</li> <li>Our chart, <i>Combination Antithrombotic Therapy: FAQs</i>, might also help inform decisions regarding your patient.</li> </ul>
Blood Pressure Meds	<ul style="list-style-type: none"> <li>Continue beta-blockers, calcium channel blockers, and clonidine.<sup>1,2,6</sup></li> <li>See ACEI and ARBs, above, and Diuretics, below.</li> </ul>
Corticosteroids	<ul style="list-style-type: none"> <li>Try to taper to &lt;10 to 15 mg/day prior to surgery to reduce infection risk [Evidence Level B-3].<sup>9,10</sup></li> <li>Patients taking more than prednisone 5 mg or its equivalent for more than three weeks <b>may</b> need stress doses of hydrocortisone, especially those on doses &gt;20 mg/day.<sup>1,5,18,19,28</sup></li> </ul>
Diabetes Meds	<ul style="list-style-type: none"> <li>See our chart, <i>Perioperative Management of Diabetes</i>, for information regarding management of home antidiabetic regimens in preparation for and after surgery or procedures, including oral agents, injectables, subcutaneous insulin, and insulin pumps. Treatment of glucose excursions is also reviewed.</li> </ul>
Disease-Modifying Anti-rheumatics (DMARDs), <b>Biologic</b>	<ul style="list-style-type: none"> <li>Evidence regarding holding these immunocompromising agents (infliximab, adalimumab [<i>Humira</i>], etanercept [<i>Enbrel</i>]) to reduce complications comes from observational studies in joint replacement and IBD.<sup>12</sup> There is less evidence for newer biologics.<sup>12</sup></li> <li>In <b>rheumatic disease</b>, hold before hip or knee arthroplasty.<sup>14</sup> For other surgeries, individualize decisions.<sup>12</sup> For surgeries with low-risk of complications (i.e., endoscopic procedure, dermatologic surgery, breast biopsy, or eye surgery), consider continuing.<sup>12,20</sup></li> <li>Most studies did not find increased infection risk in patients being treated with anti-TNF agents for <b>IBD</b>.<sup>12</sup> Individualize decisions.<sup>21</sup> Consider patient's response to treatment and urgency of surgery.<sup>28</sup></li> <li>If the decision is made to hold an <b>injectable biologic</b>, consider scheduling surgery around the time the held dose would have been due, and restarting two to four weeks later, assuming no infection or healing problems.<sup>11,28</sup> For <b>tofacitinib</b> (<i>Xeljanz</i>), stop seven days prior to surgery, and consider restarting two weeks post-op, assuming no infection or healing problems.<sup>11</sup></li> </ul>
Disease-Modifying Anti-rheumatics (DMARDs), <b>Non-Biologic</b>  <i>Continued...</i>	<ul style="list-style-type: none"> <li>Experts recommend continuation of <b>hydroxychloroquine</b> and <b>sulfasalazine</b>.<sup>11,22</sup></li> <li><b>Leflunomide</b> is associated with impaired wound healing, but a washout requires advanced planning.<sup>22</sup> See product labeling for instructions on using cholestyramine to hasten elimination.</li> <li>Level B evidence suggests low-dose <b>methotrexate</b> is usually safe to continue.<sup>22</sup></li> <li>In <b>non-severe lupus</b> patients undergoing hip or knee arthroplasty, hold azathioprine, cyclosporine, tacrolimus, or mycophenolate, but continue these in <b>severe lupus</b>.<sup>14</sup> For other surgeries or rheumatic diseases, individualize</li> </ul>

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Drug Class	Pertinent Information or Resource
Non-biologic DMARDs, continued	<p>decisions. For surgeries with low-risk of complications (i.e., endoscopic procedure, dermatologic surgery, breast biopsy, or eye surgery), consider continuing.<sup>12,20</sup></p> <ul style="list-style-type: none"> <li>Individualize decisions in <b>IBD</b> patients.<sup>21</sup> Consider continuing cyclosporine, azathioprine, 6-mercaptopurine, and methotrexate in IBD.<sup>12,21,28</sup> Some IBD experts hold on the day of surgery, and resume the next day.<sup>28</sup></li> <li>If the decision is made to hold the non-biologic DMARD, stop one week prior to surgery.<sup>14</sup> Restart three to five days post-op, assuming no infection or healing problems.<sup>14</sup></li> </ul>
Diuretics	<ul style="list-style-type: none"> <li>Stop diuretics in most patients the day of surgery to minimize the risk of hypokalemia and hypovolemia.<sup>1</sup> <ul style="list-style-type: none"> <li>Hypotension is more common in patients taking diuretics with ACEIs/ARBs, even when the ACEI/ARB is held.<sup>1</sup></li> </ul> </li> <li>Heart failure patients may need parenteral diuretics.<sup>1</sup></li> <li>Consider restarting the diuretic when oral fluid intake is established.<sup>1</sup></li> </ul>
Estrogen (replacement therapy or oral contraceptives)	<ul style="list-style-type: none"> <li>Consider stopping four weeks before surgery, weighing surgery-related VTE risk vs risk of pregnancy or symptoms.<sup>23</sup></li> <li>If not stopped, ensure appropriate VTE prophylaxis.<sup>23</sup></li> <li>Restart when mobility is restored.<sup>1</sup></li> </ul>
Fibrates	<ul style="list-style-type: none"> <li>Due to rhabdomyolysis risk, hold beginning the day before surgery, and restart with oral intake.<sup>1</sup></li> </ul>
H2-Blockers	<ul style="list-style-type: none"> <li>Continue.<sup>24</sup> Give with sip of water on morning of surgery.<sup>24</sup></li> </ul>
Immunosuppressives (also see DMARDs, above)	<ul style="list-style-type: none"> <li>Continue immunosuppressives for <b>transplant</b> patients. Consult patient's transplant center. Some might switch sirolimus or everolimus (stronger immunosuppressives) to tacrolimus or cyclosporine for two to three months before elective surgery, then switch back once the wound has healed.<sup>13</sup></li> </ul>
Niacin	<ul style="list-style-type: none"> <li>Due to rhabdomyolysis risk, hold beginning the day before surgery, and restart with oral intake.<sup>1</sup></li> </ul>
NSAIDs	<ul style="list-style-type: none"> <li>Stop <b>diclofenac, ibuprofen, indomethacin, or ketoprofen</b> the day before the procedure.<sup>17</sup></li> <li>Stop <b>celecoxib, diflunisal, naproxen, or sulindac</b> two to three days before the procedure.<sup>17</sup></li> <li>Stop <b>meloxicam, nabumetone, or piroxicam</b> ten days before the procedure.<sup>17</sup></li> </ul>
Osteoporosis Medications	<ul style="list-style-type: none"> <li>Hold <b>oral bisphosphonates</b> perioperatively due to difficulty administering appropriately.<sup>23</sup> (Some institutions hold oral bisphosphonates during all hospital admissions.)</li> <li>Hold <b>raloxifene</b> beginning three days before surgery (due to VTE risk), and restart once patient is fully ambulatory.<sup>25,27</sup></li> </ul>

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Drug Class	Pertinent Information or Resource
Proton Pump Inhibitors	<ul style="list-style-type: none"><li>• Continue.<sup>24</sup> Give with sip of water on morning of surgery.<sup>24</sup></li></ul>
Statins	<ul style="list-style-type: none"><li>• In patients scheduled for noncardiac surgery, continue a statin if the patient is currently receiving one.<sup>2</sup></li><li>• In patients scheduled for vascular surgery, it is reasonable to start a statin perioperatively.<sup>2</sup></li><li>• Consider starting a statin perioperatively in patients with an indication for one.<sup>2</sup> To help identify these patients, see our charts, <i>2018 ACC/AHA Cholesterol Guidelines</i> (U.S. subscribers) and <i>Canadian Dyslipidemia Recommendations and FAQs</i>.</li></ul>

*Users of this resource are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and internet links in this article were current as of the date of publication.*

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## Levels of Evidence

In accordance with our goal of providing Evidence-Based information, we are citing the **LEVEL OF EVIDENCE** for the clinical recommendations we publish.

Level	Definition	Study Quality
<b>A</b>	Good-quality patient-oriented evidence.*	1. High-quality RCT 2. SR/Meta-analysis of RCTs with consistent findings 3. All-or-none study
<b>B</b>	Inconsistent or limited-quality patient-oriented evidence.*	1. Lower-quality RCT 2. SR/Meta-analysis with low-quality clinical trials or of studies with inconsistent findings 3. Cohort study 4. Case control study
<b>C</b>	Consensus; usual practice; expert opinion; disease-oriented evidence (e.g., physiologic or surrogate endpoints); case series for studies of diagnosis, treatment, prevention, or screening.	

\***Outcomes that matter to patients** (e.g., morbidity, mortality, symptom improvement, quality of life).

**RCT** = randomized controlled trial; **SR** = systematic review

[Adapted from Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. *Am Fam Physician* 2004;69:548-56. <http://www.aafp.org/afp/2004/0201/p548.pdf>]

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