Guideline for Preoperative Medication Management

Purpose of Guideline: To provide guidance to physicians, advanced practice providers (APPs), pharmacists, and nurses regarding medication management in the preoperative setting.

Background:
Appropriate perioperative medication management is essential to ensure positive surgical outcomes and prevent medication misadventures.[1] Results from a prospective analysis of 1,025 patients admitted to a general surgical unit concluded that patients on at least one medication for a chronic disease are 2.7 times more likely to experience surgical complications compared with those not taking any medications. As the aging population requires more medication use and the availability of various nonprescription medications continues to increase, so does the risk of polypharmacy and the need for perioperative medication guidance.[2]

There are no well-designed trials to support evidence-based recommendations for perioperative medication management; however, general principles and best practice approaches are available. General considerations for perioperative medication management include a thorough medication history, understanding of the medication pharmacokinetics and potential for withdrawal symptoms, understanding the risks associated with the surgical procedure and the risks of medication discontinuation based on the intended indication.

Clinical judgement must be exercised, especially if medication pharmacokinetics are not predictable or there are significant risks associated with inappropriate medication withdrawal (eg, tolerance) or continuation (eg, postsurgical infection).[2]

Clinical Assessment:
Prior to instructing the patient on preoperative medication management, completion of a thorough medication history is recommended – including all information on prescription medications, over-the-counter medications, “as needed” medications, vitamins, supplements, and herbal medications. Allergies should also be verified and documented.

The following recommendations are intended as guidelines and not intended to replace clinical judgement, provider discretion, or special circumstances. Please consider a discussion with surgeon and or anesthesiologist for situations where one may deviate from the guideline. Examples for pharmacologic classes are not all inclusive so providers should review the drug class for any new additions or unlisted medications. If there are any combination products, you should reference each medication separately.

Quick Guide for Preoperative Medication Management

Medication Class	Examples	Page Number
CONTINUE up to and including the day of surgery:		
Alpha$_1$ Blockers	Doxazosin, prazosin, tamsulosin	4, 7
Alpha$_2$ Agonists	Clonidine, guanfacine, methyldopa	4
Antianxiety Agents	Alprazolam, buspirone, clonazepam	5
Antiarrhythmics	Amiodarone, digoxin, sotalol	4
Anticholinergics (inhaled)	Ipratropium, tiotropium	6
Anticholinesterase Inhibitors	Donepezil, memantine, rivastigmine	5
Antidepressants	Bupropion, fluoxetine, sertraline	6
Antiepileptic Agents	Carbamazepime, levetiracetam, phenytoin	5
Antigout Agents	Allopurinol, colchicine, febuxostat	7
Antihistamines	Cetirizine, fexofenadine, loratadine	7
Antipsychotics	Haloperidol, lurasidone, olanzapine	5, 6
Antiretroviral/antivirals	Abacavir, tenofovir, valacyclovir	4
Antispasmodic Agents	Oxybutynin, tolterodine	7
Aromatase Inhibitors	Anastrozole, exemestane, letrozole	5
Beta Blockers	Atenolol, carvedilol, metoprolol, propranolol	4
Beta$_2$ Agonists (inhaled)	Albuterol, salmeterol	6
Calcium Channel Blockers	Amlodipine, diltiazem, verapamil	4
Combined Oral Contraceptives	Estrogen and progestin components	5
Dopamine Agonists/ Anti-Parkinson Agents	Amantadine, carbidopa/levodopa, entacapone	5
GABA Agonists	Gabapentin, pregabalin	4
Glucocorticoids (systemic, inhaled)	Budesonide, fluticasone, prednisone	5, 7
H_2 Receptor Blockers	Cimetidine, famotidine, ranitidine	5
HMG-CoA Reductase Inhibitors	Atorvastatin, rosuvastatin, simvastatin	4
Leukotriene Inhibitors	Montelukast, zafirlukast	7
Mood Stabilizers	Lithium, valproic acid	6
Nitric Oxide/Vasodilators	Hydralazine, isosorbide, nitroglycerin	4
Opioids	Codeine, hydromorphone, morphine, tramadol	4
OTC Analgesics	Acetaminophen	4
OTC eye drops and nasal sprays	Artificial tears, saline nasal spray	7
Proton Pump Inhibitors	Esomeprazole, omeprazole, pantoprazole	5
Skeletal Muscle Relaxants	Baclofen, cyclobenzaprine, tizanidine	4
Thyroid Agents	Levothyroxine, methimazole, PTU	5
DISCONTINUE these medications one day prior to procedure:		
Antimigraine Agents	Eletriptan, rizatriptan, sumatriptan	7
Non-statin Lipid Lowering Agents	Cholestyramine, ezetimibe, fenofibrate	7
Theophylline	Theophylline	7
DISCONTINUE these medications on the day of procedure:		
ACE/ARB	Enalapril, lisinopril, losartan, valsartan	7
Direct Renin Inhibitors	Aliskiren	7
Diuretics	Furosemide, hydrochlorothiazide	8
MEDICATIONS WITH SPECIAL CONSIDERATIONS (see page for more information):		
Aminosalicylates	Sulfasalazine, mesalamine	8
Bisphosphonates	Alendronate, ibandronate, zoledronic acid	8
Immunosuppressants and Antirheumatic	Appendix A	9, 12

Agents		
Insulin	Detemir, glargine, lispro	9
Opioid Agonists-Antagonists/ Antagonists	Buprenorphine, buprenorphine-naloxone, naltrexone	8
Oral Antidiabetic Agents	Canagliflozin, metformin, glyburide	9,14
Oral Chemotherapy	Capecitabine, imatinib, sunitinib	9
Post-menopausal Hormone Therapy	Estrogens	8
Selective Estrogen Receptor Modulators	Raloxifene, tamoxifen	8
MEDICATIONS AFFECTING HEMOSTASIS:		
Anticoagulants	Apixaban, enoxaparin, heparin, warfarin	10
Antiplatelet Medications	Cilostazol, clopidogrel, prasugrel	10
Aspirin	Aspirin	10
NSAIDs	Ibuprofen, naproxen	10
Phosphodiesterase-5 Inhibitors	Sildenafil, tadalafil	11
Stimulants/Anti-ADHD Agents	Dextroamphetamine, methylphenidate	11
Vitamins and Supplements	Vitamins, herbals and supplements	11
Weight loss/CNS Stimulants	Phentermine	11
APPENDICES		
Appendix A: Immunosuppressant and Antirheumatic Agents		12
Appendix B: Monoamine Oxidase Inhibitors and Herbals		13
Appendix C: Management of Patients with Diabetes		14, 15
Appendix D: Management of NSAIDs and Antiplatelet Agents		16

SUPPLEMENTAL INFORMATION

Additional information can be found by accessing institutional and national guidelines listed below.

- Anticoagulation Management Homepage
- Breast Cancer Seed/Wire Anticoagulation Process
- Buprenorphine Recommendations for Perioperative Management (Guideline under “Pain Management”)
- Institutional Antiplatelet Algorithm (September 2016 Update) (under “Cardiovascular” section)
- Management of Anticoagulant Medications in the Periprocedural and Surgical Settings
- Ophthalmology Antithrombotic Management Protocol
- Preoperative Resources Homepage
- Use of Antithrombotic Medications in the Presence of Neuraxial Anesthesia

***CONTINUE** THESE MEDICATIONS UP TO AND **INCLUDING** THE **DAY OF PROCEDURE**:*
(Instruct patients to take with a small sip of water)

ANALGESICS (PAIN) AGENTS

Class	Examples	Considerations
GABA Agonists[3,4]	Gabapentin, pregabalin	These agents may be used to treat neuropathic pain
Opioids[5,6,7]	Codeine, fentanyl, hydromorphone, morphine, oxycodone, hydrocodone (including combination products), tramadol	*DEFER TO ANESTHESIA, CHRONIC PROVIDER, SURGEON AND PRE-OPERATIVE CLINIC PROVIDER*
Over the Counter Analgesics[5]	Acetaminophen	
Skeletal Muscle Relaxants[5]	Baclofen, cyclobenzaprine, metaxalone, methocarbamol, tizanidine	This class also includes benzodiazepines such as alprazolam, clonazepam and diazepam

CARDIOVASCULAR AGENTS

Class	Examples	Considerations
Alpha$_1$ Blockers	Terazosin, prazosin	Also see urinary agents for more information
Alpha$_2$ Agonists[5,9]	Clonidine, guanfacine, methyldopa	
Antiarrhythmic Agents[5]	Amiodarone, digoxin, dofetilide, dronedarone, flecainide, sotalol	
Beta Blockers[5,10,11]	Atenolol, carvedilol, metoprolol, labetalol, propranolol	***EXCEPTION**: Patients going for Stage 1 Deep brain stimulation (DBS) for treatment of tremor and who are taking beta blockers for the treatment of tremor should DISCONTINUE on day of surgery, if any questions regarding these instructions contact Neurosurgeon and prescribing physician*
Calcium Channel Blockers (CCB)[5]	Amlodipine, diltiazem, verapamil, nifedipine	
HMG-CoA Reductase Inhibitors (Statins)[5,9,11]	Atorvastatin, pravastatin, simvastatin, rosuvastatin	
Nitric Oxide/Vasodilators[12,13]	Hydralazine, isosorbide dinitrate, isosorbide mononitrate, minoxidil, nitroglycerin (all formulations)	

ANTIRETROVIRAL/ANTIVIRAL AGENTS[5,8]

Class	Examples	Considerations
Antiretrovirals	Abacavir, dolutegravir, efavirenz, emtricitabine, lamivudine, ritonavir, tenofovir	This list is not all-encompassing
Antivirals	Acyclovir, famciclovir, valacyclovir	

ENDOCRINE AGENTS

Class	Examples	Considerations
Aromatase Inhibitors[5]	Anastrozole, exemestane, letrozole	
Combined Oral Contraceptives (ie, Estrogen-containing)[5]		Consider risk of thromboembolism versus benefits of pregnancy prevention. Combined oral contraceptives may be continued in women with moderate to high risk of thromboembolism who could have difficulty complying with other forms of contraception. If the choice is made to discontinue, consider discontinuing 4 to 6 weeks prior to surgery.
Glucocorticoids (Systemic)[5,14]	Budesonide, dexamethasone, hydrocortisone, methylprednisolone, prednisolone, prednisone	
Thyroid Agents[5]	Levothyroxine, methimazole, propylthiouracil	

GASTROINTESTINAL AGENTS

Class	Examples	Considerations
H_2 Receptor Blockers[5]	Cimetidine*, Famotidine, Ranitidine	*May continue especially if risk for gastrointestinal ulcers or bleeding is high, however, monitor for potential drug interactions as cimetidine can alter the metabolism of several drugs[5]
Proton Pump Inhibitors[5]	Esomeprazole, lansoprazole, omeprazole, pantoprazole, rabeprazole	

NEUROMUSCULAR AGENTS

Class	Examples	Considerations
Anticholinesterase Inhibitors[17]	Donepezil, memantine, pyridostigmine, galantamine, rivastigmine	These agents may be used for the treatment of Alzheimer disease or myasthenia gravis
Antiepileptic Agents[17]	Carbamazepine, levetiracetam, phenytoin, valproic acid	
Dopamine Agonists and Other Anti-Parkinson Agents[13,17]	Amantadine, carbidopa/levodopa, entacapone	***EXCEPTION**: Patients going for Stage 1 DBS should DISCONTINUE these medications on day of surgery.*

PSYCHOTROPIC AGENTS

Class*	Generic (Brand) Examples	Considerations
Antianxiety agents and Benzodiazepines[5]	Alprazolam, clonazepam, diazepam, lorazepam, temazepam, buspirone	
Antipsychotics[5]	Haloperidol, lurasidone, olanzapine, risperidone, ziprasidone	Obtain baseline ECG if none available within the last 3 months. Use caution if these agents are combined with other QT

		prolonging medications.
MAOIs[5]	Patients taking these medications may need special instructions. Consider High Risk and may obtain Anesthesia Consultation –See MAOI Appendix B Generally may be continued pending 2 criteria: 1) Anesthesiologist is comfortable with use of MAO safe procedures 2) Psychiatrist believes temporary withdrawal of this medication will exacerbate or precipitate a depressive syndrome In the absence of either criteria, discontinue prior to surgery. Irreversible MAO antagonists may require 2 weeks after discontinuation of drug for normal MAO function to return. Therefore these medications should be tapered and discontinued two weeks before elective surgery. If MAOIs are continued, the patient must be prescribed a diet excluding food with high amounts of tyramine while inpatient to avoid precipitating a hypertensive crisis	
Mood Stabilizing Agents[5]	Lithium, levetiracetam, valproic acid/valproate	
SNRIs and Bupropion[5]	Bupropion (Wellbutrin) Desvenlafaxine (Khedezla, Pristiq) Duloxetine (Cymbalta) Levomilnacipran (Fetzima) Milnacipran (Savella) Venlafaxine (Effexor)	Generally continue these agents perioperatively. Consider risk versus benefit of increased bleeding risk. Withholding may result in a withdrawal syndrome. Consider discontinuing either antiplatelet agent or SSRI if patients are on concurrent therapy and procedure has a high bleeding risk (i.e. central nervous system procedures). Discontinuation requires tapering over at least 2 weeks.
SSRIs[5]	Citalopram (Celexa) Escitalopram (Lexapro) Fluoxetine (Prozac) Fluvoxamine (Luvox) Paroxetine (Paxil) Sertraline (Zoloft) Vilazodone (Viibryd) Vortioxetine (Brintellix)	
TCAs[5]	Amitriptylkine (Elavil, Levate) Clomipramine (Anafranil) Desipramine (Norpramin) Doxepin (Sinequan) Imipramine (Tofranil) Nortriptyline (Pamelor)	Generally continue these agents perioperatively, particularly in patients on higher doses. However, per package insert it is recommended to discontinue these prior to elective surgery when possible. If patient is high risk for perioperative arrhythmias consider tapering medication over a period of 7 to 14 days prior to surgery

*Consider varying half-lives of these agents and abrupt withdrawal could lead to a discontinuation syndrome including some of the following symptoms: anxiety, chills, dizziness, muscle aches.

PULMONARY AGENTS

Class	Examples	Considerations
Anticholinergic Agents (inhaled)[5]	Short-acting: ipratropium Long-acting: glycopyrrolate, tiotropium	Combination products available
Beta$_2$ Agonists (inhaled)[5]	Short-acting: albuterol, levalbuterol Long-acting: formoterol, salmeterol	Combination products available
Corticosteroids[5]	Systemic: prednisone, methyprednisolone	Combination products available

	Inhaled: budesonide, fluticasone	
Leukotriene Inhibitors[5]	Montelukast, zafirlukast	

URINARY AGENTS

Class	Examples	Considerations
Alpha$_1$ Adrenergic Blockers[5,18]	Alfuzosin, doxazosin, prazosin, silodosin, tamsulosin, terazosin	***EXCEPTION****: may consider discontinuation prior to cataract surgery due to the association with floppy iris syndrome. Discontinuation does not necessarily reduce risk. Discuss with the ophthalmologist.*
Antispasmodic Agents	Darifenacin, oxybutynin, tolterodine, solifenacin	

MISCELLANEOUS AGENTS

Class	Examples	Considerations
Antigout Agents[5]	Allopurinol, *colchicine, febuxostat, probenecid	**Hold colchicine if there is a concern for change in renal function*
Antihistamines	Cetirizine, chlorpheniramine, diphenhydramine, fexofenadine, loratadine	
OTC eye drops and nasal sprays	Artificial tears, ocean spray	Safe to continue unless otherwise directed by physician.

DISCONTINUE THESE MEDICATIONS ONE DAY PRIOR TO PROCEDURE:

Do NOT take these medications on the day before or the day of procedure to allow for drug elimination.

Class	Examples
Antimigraine Agents – "triptans"	Almotriptan, eletriptan, frovatriptan, naratriptan, rizatriptan, sumatriptan, zolmitriptan
Non-statin lipid lowering agents[5]	Cholestyramine, colestipol, ezetimibe, fenofibrate, gemfibrozil, niacin
Pulmonary Agents[5]	Theophylline

DISCONTINUE THESE MEDICATIONS ON THE DAY OF PROCEDURE:

Do not take these medications on the day of procedure.

CARDIOVASCULAR AGENTS[5,20]

Class	Examples	Considerations
Angiotensin Converting Enzyme Inhibitors (ACE-I)/ Angiotensin II Receptor Blockers (ARB)	ACE: benazepril, lisinopril, enalapril, ramipiril ARB: losartan, valsartan, candesartan, irbesartan	If dosed in the evening hold evening dose night prior to surgery. Do not take the night before or day of surgery.
Direct Renin Inhibitors	Aliskiren and its combination products	
Diuretics[5]	Bumetanide, furosemide, hydrochlorothiazide, triamterene,	If using for heart failure it is important to consider volume status for perioperative

	spironolactone*	management, which should be optimized preoperatively whenever possible. *Spironolactone: continue at previous dose if taken for aldosteronism.

MEDICATIONS WITH SPECIAL CONISDERATIONS:

A specialty consult may be recommended.

ANALGESICS (PAIN) AGENTS

Class	Examples	Considerations
Opioid Agonists-Antagonsist/ Antagonists[5,6]	Naltrexone*, buprenorphine*, buprenorphine-naloxone*	*DEFER TO ANESTHESIA, CHRONIC PROVIDER, SURGEON AND PRE-OPERATIVE CLINIC PROVIDER* *Naltrexone: if opioid will be needed intra procedure consider Anesthesia consult and holding oral naltrexone for three days and injectable naltrexone for 28 days preoperatively *Buprenorphine: depending on dose and type of surgery, it may be weaned down, stopped or continued (Guideline: Recommendations for Perioperative Buprenorphine Management- reference "Pain Management")

ENDOCRINE AGENTS/AMINOSALICYLATES

Class	Examples	Considerations
Aminosalicylates[16,19]	Sulfasalazine, mesalamine	Routinely this medication is held day of surgery. May continue after discussion with preoperative provider if risk of flare is greater than the risk of bleeding
Bisphosphonates[5,21]	Alendronate, ibandronate, risedronate, zoledronic acid	Routinely this medication is held day of surgery. Oral and maxillofacial surgeons concerned about osteonecrosis of the jaw may wish to recommend alternate directions.
Postmenopausal hormone therapy[5]	Estrogens	Hold on day of surgery if low risk VTE. In women undergoing procedures with high risk of VTE consider discontinuing hormone therapy 4 to 6 weeks prior to surgery. The risks for temporary discontinuation of hormone therapy are usually discomfort, hot flashes and menopausal symptoms.
Selective Estrogen Receptor Modulators (SERMs)[5]	Tamoxifen, raloxifene	Routinely this medication is held day of surgery. For prevention of cancer or osteoporosis consider discontinuing medication for 4 weeks for surgical procedures associated with a moderate or high risk of VTE. If used for cancer treatment, discuss with the treating oncologist.

ENDOCRINE AGENTS

<table>
<tr><th>Class</th><th>Examples</th><th>Considerations</th></tr>
<tr><td>Insulins</td><td colspan="2">Please refer to FMLH protocol for perioperative management of patients with diabetes. Order finger stick on arrival for day of surgery. Please note that if the surgical start time is delayed, the anesthesiologist assigned to the case needs to be contacted regarding blood sugar monitoring and IV placement.

<table>
<tr><th>Examples</th><th>Recommendations</th></tr>
<tr><td>Short Acting Insulins
(e.g. Humalog, Novolog, Regular, Apidra)</td><td>HOLD</td></tr>
<tr><td>NPH Insulin</td><td>Take ½ of usual morning dose</td></tr>
<tr><td>Pre-Mixed Insulins
(e.g. Humulin or Novolog mix 70/30 or 75/25)</td><td>Take ⅓ of usual morning dose</td></tr>
<tr><td>Long Acting Insulins
Insulin glargine (e.g. Lantus, Toujeo*, Basaglar)
Insulin detemir (e.g. Levemir)
Insulin degludec (e.g. Tresiba*)</td><td>Take usual dose, unless having hypoglycemic episodes, then decrease dose by 20%
*Toujeo and Tresiba dose reduction must be done THREE days in advance</td></tr>
<tr><td>Insulin Pump</td><td>See Flow Sheet (Appendix C)</td></tr>
</table>
(Reference Appendix C)</td></tr>
</table>

ORAL ANTIDIABETIC AGENTS

See Peri-Operative Management of Patients with Diabetes flow sheet (Appendix C)

Class	Examples	Considerations
Oral Antidiabetics	Acarbose, glyburide, glipizide, repaglinide, saxagliptin, linagliptin, metformin, pioglitazone	Do **NOT** take oral diabetes medications on the day of procedure
SGLT2-Inhibitors	Canagliflozin, dapagliflozin, empagliflozin, ertugliflozin	Hold three days prior to surgery

ORAL CHEMOTHERAPY

Consult with treating oncologist

Examples: capecitabine (Xeloda), sunitinib (Sutent), imatinib (Gleevec)

MISCELLANEOUS AGENTS

Class	Examples	Considerations
Immunosuppressant and Antirheumatic Agents[15,16]	Adalimumab, infliximab, methotrexate, sulfasalazine (See Appendix A)	DO NOT stop any immunosuppressant medications without discussing with the prescribing physician, pre-operative consultant or prescribing subspecialist as they will be able to make the best recommendations. • *Patients with organ transplants should be continued on immunosuppressant medications unless directed otherwise by transplant physician. It should be noted that sirolimus (Rapamune) is associated with significant wound healing problems. Continuation vs substitution vs interruption of therapy should be discussed with the prescribing transplant physician.* • *For patients with other inflammatory diseases (eg. rheumatoid arthritis, Crohn's disease), discuss the risk vs benefit of continuing vs interrupting the immunosuppressant medication with the prescribing physician, preoperative consultant or prescribing subspecialist.*

MEDICATIONS AFFECTING HEMOSTASIS

ANTICOAGULANTS

For these agents refer to the following institutional guidelines:

Management of Anticoagulant Medications in the Periprocedural and Surgical Settings
Use of Antithrombotic Medications in the Presence of Neuraxial Anesthesia
Ophthalmology Antithrombotic Management Protocol
Breast Cancer Seed/Wire Anticoagulation Process

Examples: apixaban, rivaroxaban, enoxaparin, heparin, warfarin

Note: where "3 days" is referenced as a duration to stop an Rx in the above guidelines please exercise a 72 hour stop time from last dose when instructing a patient in the perioperative setting

ANTIPLATELET AGENTS[5]

For patients with coronary stents, refer to the Institutional Antiplatelet Algorithm (September 2016 Update), under the cardiovascular section, or Appendix D. Except for emergent settings, the ideal recommendation is to delay surgery and continue therapy for coronary stent thrombosis for at least the minimum recommended duration for each stent type.

Generic Name	Brand Name	Recommendation
Aspirin/ Dipyridamole ER	Aggrenox	Stop 7 to 10 days before surgery
Aspirin[5,22]		Stop 7 days prior to non-cardiovascular surgery with the following considerations and ***EXCEPTIONS:*** • *For patients with coronary stents: most patients should remain on low-dose aspirin through surgery unless the surgical bleeding risk is considered too high.* • *Patients scheduled to undergo intracranial or carotid endartectomy should continue to take aspirin* • *In patients taking aspirin for secondary prevention for diagnoses other than CAD, discuss the risk versus benefits with patient, surgeon and prescribing subspecialist.*
Cilostazol	Pletal	Stop at least 5 days before surgery Note: claudication symptoms may recur when medication stopped, but once cilostazol reinitiated post-operatively patient should respond
Clopidogrel	Plavix	Stop at least 5 days before surgery ***EXCEPTIONS:*** *may consider continuing in perioperative period for peripheral artery and carotid procedures as bleeding risk appears low*
Dipyridamole	Persantine	Stop at least 2 days before surgery
Non-steroidal anti-inflammatory drugs (NSAIDS) including COX-2 inhibitors[5]	Advil, Aleve, Ibuprofen, naproxen	Stop 7 days prior to surgery *Discontinuation of NSAIDS fewer than 7 days prior to surgery may be allowed based on specific medication pharmacokinetic profiles. Recommendations to continue beyond a 7 day period should be made in collaboration with physician.*
Prasugrel	Effient	Stop at least 7 days before surgery
Ticagrelor	Brilinta	Stop 3-5 days before surgery

*Generally will resume 24 hours after procedure or when surgical hemostasis has been achieved

PSYCHOTROPIC AGENTS

Class	Examples	Recommendation

Stimulants/ Anti-ADHD Agents[5]	Dextroamphetamine, methylphenidate, modafinil	Hold the day of surgery

VITAMINS AND SUPPLEMENTS[5]

Class	Examples	Recommendation
Supplements/Herbals	Berberine, mohimbe, ginseng *(See appendix B)*	Discontinue all vitamins, supplements and herbals 7 days prior to surgery
Vitamins	Multivitamin, cholecalciferol, thiamine	

*Circumstances may require continuation of certain vitamins/supplements (i.e. cholecalciferol or calcium when continued for a deficiency). Discuss with preoperative clinic provider for any deviations from guideline.

MISCELLANEOUS AGENTS

Class	Examples	Recommendation
Phosphodiesterase Type 5 Inhibitors*	Sildenafil, tadalafil, vardenafil	Hold 72 hours prior to surgery **recommendations are only for patients with ED (for pulmonary hypertension defer to prescribing physician)*
Weight Loss/CNS Stimulants	Phentermine (Adipex-P, Fastin, Lomaria), Qsymia*	Discontinue 7 days prior to surgery **Contains topiramate and has potential to potentiate seizures with abrupt withdrawal. Even in those without a seizure disorder, consider holding for a shorter duration when dealing with combinations of topiramate.*

APPENDIX A: Immunosuppressant and Antirheumatic agents

Guideline for Peri-Operative Management of Antirheumatic Medication in Elective Surgery[15]*

Class/Medication Examples	Perioperative Recommendation
DMARDs	CONTINUE these medications through surgery
Methotrexate	
Sulfasalazine	
Hydroxychloroquine	
Leflunomide	
Biologic Agents	Recommendations should consider risk of flares with medication interruption and benefits from improved wound healing and lower infection risk. Discuss with prescribing subspecialist. In general, STOP these medications prior to surgery and schedule surgery at the end of the dosing cycle. RESUME medications at minimum 14 days after surgery in the absence of wound healing problems, surgical site infection, or systemic infection.*Tofacitinib should be STOPPED 7 days prior to surgery. *Schedule surgery based on the first withheld dose of the biologic agent. For example, adalimumab and infliximab should be given one week after the first withheld dose of medication. Adalimumab is usually dosed every 2 weeks (i.e. infusions on week 0, 2, 4, etc) so the patient would receive their week 0 dose, hold their week 2 dose and then schedule surgery sometime during week 3. They would then resume their medication during week 6 based on patient factors. In contrast, infliximab is usually dosed every 8 weeks (i.e. infusions on week 0, 8, 16, etc.) so the patient would receive their week 0 dose, hold their week 8 dose and then schedule surgery sometime during week 9. They would then resume infusions for week 16 based on patient factors. Different biologic agents have different recommended times to schedule surgery. Each agent should be looked up separately to determine the best scheduling date. For more information please see the ACR 2017 Guideline for the Perioperative Management of Antirheumatic Medications.*
Adalimumab (Humira)	
Etanercept (Enbrel)	
Golimumab (Simponi)	
Infliximab (Remicade)	
Abatacept (Orencia)	
Certolizumab (Cimzia)	
Rituximab (Rituxan)	
Tocilizumab (Actemra)	
Anakinra (Kineret)	
Secukinumab (Cosentyx)	
Ustekinumab (Stelara)	
Belimumab (Benlysta)	
Tofacitinib (Xeljanz)*	
Severe SLE Medication Management	CONTINUE these medications in the perioperative period.
Mycophenolate mofetil	
Azathioprine	
Cyclosporine	
Tacrolimus	
Not-Severe SLE Medication Management	DISCONTINUE these medications 1 week prior to surgery.
Mycophenolate mofetil	
Azathioprine	
Cyclosporine	
Tacrolimus	

DMARDs= disease-modifying antirheumatic drugs, SLE= systemic lupus erythematosus

- Patients with organ transplants should be continued on immunosuppressant medications unless directed otherwise by transplant physician. *Sirolimus (Rapamune) is associated with significant wound healing problems. Continuation vs substitution vs interruption should be discussed with the prescribing transplant physician.*

Multiple Sclerosis[23]

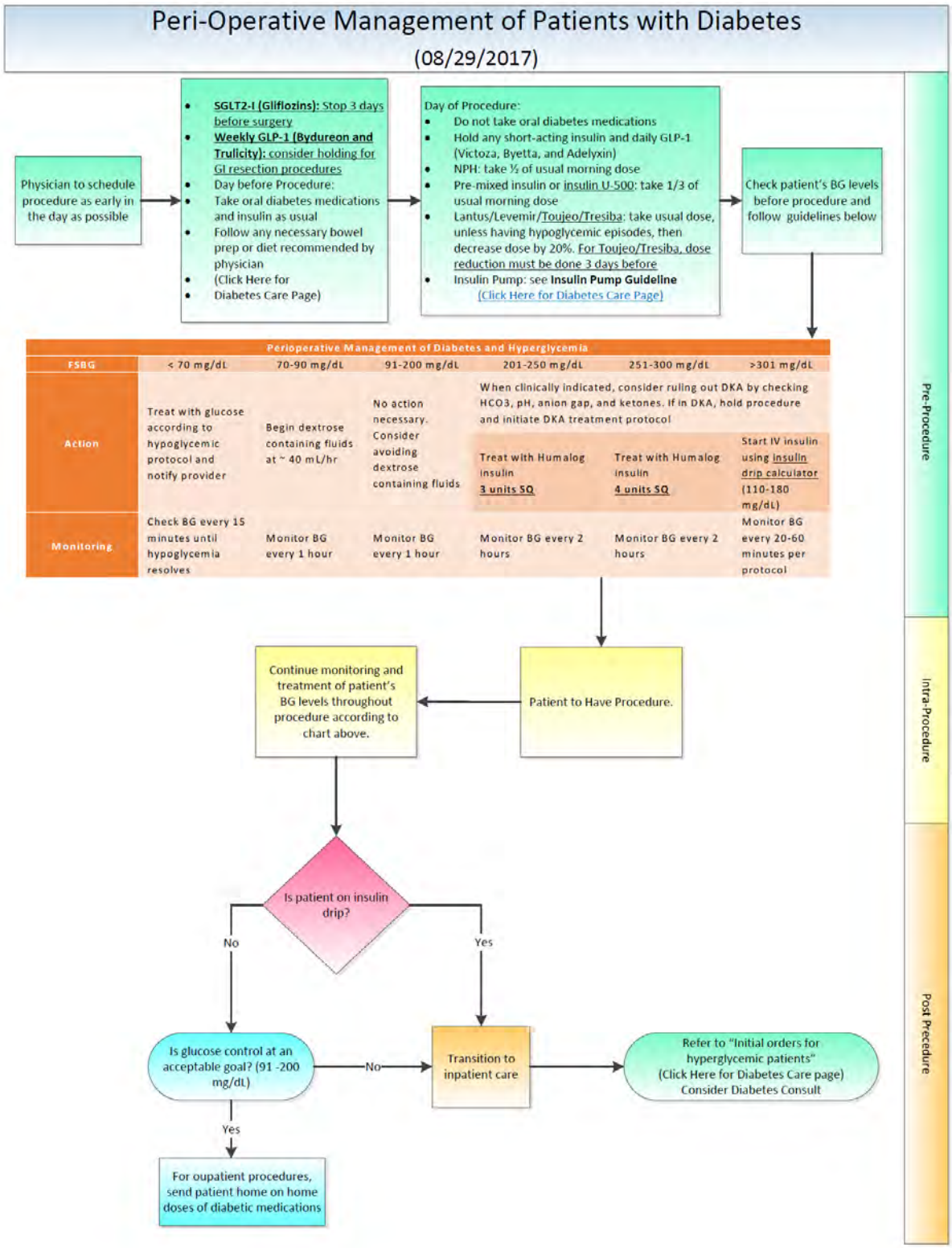
Medications used to treat multiple sclerosis or its complications may have anesthetic implications and perioperative recommendations should be discussed with Anesthesia and the prescribing physician.

APPENDIX B: Peri-Operative Management of Monoamine Oxidase Inhibitors (MAOIs)[5]

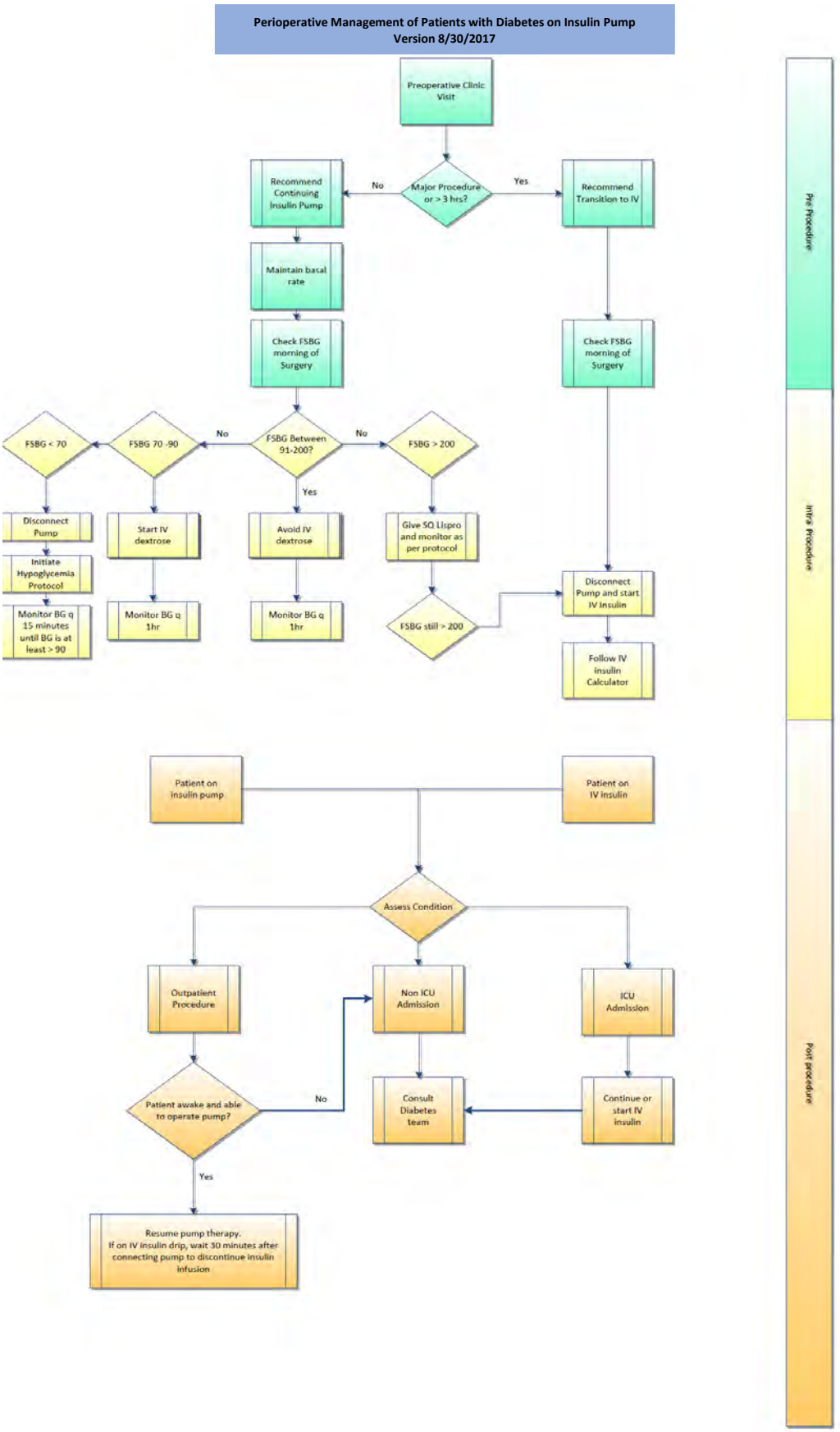
**This information is included for completeness to list medications that can act as MAO inhibitors. You should use clinical judgement to determine if a medication should be continued or stopped.*

<table>
<tr><th colspan="2">MAOI Medications
Non-selective MAO-A and MAO-B Inhibitors</th><th colspan="2">Selected Herbal/Alternative Medicine Products—
Selective MAO-A Inhibitors</th></tr>
<tr><th>Generic Name</th><th>Brand name examples</th><th>Name</th><th>Comments</th></tr>
<tr><td>Isocarboxazid</td><td>Marplan</td><td>Resveratrol</td><td>Found in skin of red grapes</td></tr>
<tr><td>Isoniazid</td><td>Generic only</td><td>Berberine</td><td>Found in many herbs (e.g. goldenseal)</td></tr>
<tr><td>Linezolid</td><td>Zyvox</td><td colspan="2">Selected Herbal/Alternative Medicine Products—
Non-selective MAO-A and MAO-B Inhibitors</td></tr>
<tr><td>Phenelzine</td><td>Nardil</td><td>Name</td><td>Comment</td></tr>
<tr><td>Procarbazine</td><td>Matulane</td><td>Curcumin</td><td>Found in tumeric</td></tr>
<tr><td>Tranylcypromine</td><td>Parnate</td><td>Harmala alkaloids</td><td>Found in tobacco, Syrian rue, passion flower, ayahausca, tribulus terrestris</td></tr>
<tr><td colspan="2">MAOI Medications
Selective MAO-B Inhibitors</td><td>Rhodiola Rosea</td><td>Active constituents unknown</td></tr>
<tr><td>Generic Name</td><td>Brand name examples</td><td colspan="2">Selected Herbal/Alternative Medicine Products—
Selective MAO-B Inhibitors</td></tr>
<tr><td>Rasagiline</td><td>Azilect</td><td>Name</td><td>Comment</td></tr>
<tr><td>Selegiline</td><td>Eldepryl, Emsam (patch), Zelapar</td><td>Catechin</td><td>Found in tea plant, cocoa, cat’s claw</td></tr>
<tr><td colspan="2" rowspan="11">**Various tryptamine and phenethylamine/ amphetamine derivatives such as amphetamine and methamphetamine may also have weak to strong MAOI effects at high doses</td><td>Desmethoxyyangonin</td><td>Found in kava</td></tr>
<tr><td>Epicathechin</td><td>Found in tea plant, cocoa, cat’s claw</td></tr>
<tr><td>Fo-Ti</td><td>Active constituents unknown</td></tr>
<tr><td>Hydroytyrosol</td><td>Found in olive oil</td></tr>
<tr><td>Piperine</td><td>Found in pepper</td></tr>
<tr><td colspan="2">Selected Herbal/Alternative Medicine Products—
Selectivity Unknown</td></tr>
<tr><td>Name</td><td>Comment</td></tr>
<tr><td>Myristicin</td><td>Found in nutmeg, parsley, dill</td></tr>
<tr><td>Siberian ginseng</td><td rowspan="3">Active constituents unknown</td></tr>
<tr><td>Yerba mate</td></tr>
<tr><td>Yohimbe</td></tr>
</table>

APPENDIX C: Peri-Operative Management of Patients with Diabetes flow sheets



APPENDIX C: Peri-Operative Management of Patients with Diabetes flow sheets



APPENDIX D: Peri-Operative Management of Non-steroidal anti-inflammatory drugs (NSAIDS) and Antiplatelet agents

NSAIDS[5]

Some experts recommend discontinuation based on half-life of the specific NSAID, however evidence shows that this correlates poorly with COX inhibition and effects on platelet aggregation. One study showed that healthy individuals receiving ibuprofen for one week had normal platelet function within 24 hours after the last dose. Still, the relationship between intra- and post-operative bleeding is not well-defined. Platelet function normalizes within 3 days of discontinuing most NSAIDs.

Perioperative Recommendations if using pharmacokinetics to guide discontinuation[24]

Drug (Brand)	Half-life (hr)	5 half-lives (hr)	Discontinuation (Days)
Celecoxib (Celebrex)*	11	55	3
Choline magnesium trisalicylate#	9-17	45-85	2-4
Diclofenac (Voltaren, Cataflam)	2.3	11.5	1
Diflunisal#	8-12	40-60	2-3
Etodolac(Lodine)*	6.4-8.4	32-42	2
Fenoprofen (Nalfon)	3	15	1
Flurbiprofen (Ansaid)	4.7-5.7	23.5-28.5	2
Ibuprofen (Advil, Motrin)	2	10	1
Indomethacin (Indocin)	2.6-11.2	13-56	2
Ketoprofen	3-7.5	15-37.5	2
Ketorolac (Toradol)	5	25	2
Mefenamic Acid (Ponstel)	2	10	1
Meloxicam (Mobic)*	15-22	75-110	5
Nabumetone (Relafen)	24	120	5
Naproxen (Aleve, Anaprox, Naprosyn)	12-17	60-85	4
Oxaprozin (Daypro)	41-55	205-275	12
Piroxicam (Feldene)	50	250	11
Salsalate (Disalcid)#	3.5->16	17.5->80	1-4
Sulindac	16.4	82	4
Tolmetin	2-5	10-25	2

*COX-2 selectivity: etodolac>meloxicam>celecoxib

#Nonacetylated NSAIDs (eg, diflunisal, choline magnesium trisalicylate, salsalate) do not have an antiplatelet effect and can be continued in the perioperative period based on Physician discretion.

Antiplatelet therapy recommendations for patients with recent cardiac procedures treated with DAPT^[22]

PCI	Time since PCI	Recommendation
Balloon angioplasty	<14 days	Delay elective or non-urgent surgery#
	>14 days	Stop $P2Y_{12}$* and proceed to the operating room with aspirin%
Bare Metal Stent	<30 days	Delay elective or non-urgent surgery
	≥30 days	Stop $P2Y_{12}$* and proceed to the operating room with aspirin%
Drug-eluting stent	<90 days	Delay elective or non-urgent surgery
	90-180 days	Surgery may be considered (Class IIb recommendation&)
	≥180 days	Stop $P2Y_{12}$* and proceed to the operating room with aspirin%

^Dual Antiplatelet Therapy

#if surgery cannot be delayed (i.e. neurosurgical procedures), suggestion is to defer surgery for at least 48 hours s/p angioplasty

*$P2Y_{12}$- stop clopidogrel, prasugrel, and ticagrelor five, seven, and three to five days, respectively prior to elective non cardiac surgery. Clopidogrel should be restarted with a loading dose once high risk of bleeding has resolved

%Continue aspirin 81mg daily throughout periprocedural period including the day of and the day after procedure

&Class IIb recommendation- Benefit ≥ Risk, may/might be reasonable, usefulness/effectiveness is unknown

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Approval Dates: pending, updated October 2014, revised October 2019, approved November 2019 [System P&T]

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Authors and Resources for Appendix C

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