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PARC PREOPERATIVE MEDICATION GUIDELINES

Author: Genevieve D'souza, MD

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In general, the perioperative management of medications will most often require direct communication between surgery and anesthesiology often with input from cardiology or medicine. **The role of the PARC will be to facilitate the development of a perioperative plan in all at risk patients.**

Unless specifically stated below, patients should continue their daily medications with a sip of water even when NPO for surgery.

MEDICATION	CLINICAL CONCERN	DAY BEFORE SURGERY	MORNING OF SURGERY
CARDIOVASCULAR MEDICATIONS			
Beta Blockers	If doses missed perioperatively, risk of M.I. increases.	Take regularly scheduled doses.	Take regularly scheduled doses.
ACE inhibitors; ARBs, direct renin inhibitors	Can cause intra-operative hypotension	Do not take after 7 pm	Do not take.
Diuretics	Can cause hypovolemia and hypotension	Take regularly scheduled doses.	Do not take.
Potassium supplements	Hyperkalemia if diuretic stopped	Do not take if K ⁺ -wasting diuretic held (e.g. furosemide, HCTZ, torsemide, budesonide, chlorthalidone, indapamide, ethacrynate).	Do not take if K ⁺ -wasting diuretic held (e.g. furosemide, HCTZ, torsemide, budesonide, chlorthalidone, indapamide, ethacrynate).
Alpha 2 agonists	Rebound hypertension, withdrawal	Take regularly scheduled doses.	Take regularly scheduled doses.
Other antihypertensive medications		Take regularly scheduled doses unless specifically instructed preoperatively by prescriber or surgeon.	

MEDICATION	CLINICAL CONCERN	DAY BEFORE SURGERY	MORNING OF SURGERY
ENDOCRINE AGENTS			
Oral Hypoglycemics	Hypoglycemia	Take regularly scheduled doses. (Only exception is METFORMIN should be held for 24 hrs. prior to surgery.)	Do not take.
Insulin – Rapid acting or short acting insulin (regular, insulin lispro, insulin aspart, insulin glulisine)	Hypoglycemia	Take regularly scheduled doses.	Do not take.
Insulin – Intermediate acting insulins (e.g. NPH)	Hypoglycemia	Take regularly scheduled doses.	Take ½ of AM dose
Insulin – Long acting insulins (insulin glargine, insulin detemir)	Hypoglycemia	Take regularly scheduled doses.	Take regularly scheduled doses.
Insulin pump	Hypoglycemia	Continue SC insulin delivery at same rate.	For procedures < 2hrs, continue the basal rate. For longer procedures, convert to insulin infusion.
<p>Should be FIRST case of the day. Check labs in the morning of procedure (Blood glucose, Serum electrolytes and urine or serum Ketones)</p> <p>If the Blood glucose is > 250 mg/dl, administer rapid acting Insulin SC using child's usual sliding scale or correction factor.</p> <p>Correct Blood glucose to 150 mg/dl.</p> <p>Calculating correction factor: Divide 1500 by child's total daily dose (TDD). If the daily dose varies (i.e., use of sliding scales) use the average daily dose in the preceding week. The correction factor is 1 unit of Rapid acting Insulin will decrease the blood sugar by 30 mg/dl.</p>			
Glucocorticoids (e.g. prednisone, hydrocortisone, dexamethasone, methylprednisolone)	Hypotensive shock	Take regularly scheduled doses.	Take regularly scheduled doses.
DDAVP	Electrolyte abnormalities	Take regularly scheduled doses.	Take regularly scheduled doses.
PAIN MEDICATIONS			
Opioids	Abrupt withdrawal	Take regularly scheduled doses.	Take regularly scheduled
Tramadol	Seizures, drug interaction	Take regularly scheduled doses.	Do not take.

MEDICATION	CLINICAL CONCERN	DAY BEFORE SURGERY	MORNING OF SURGERY																																																																																
NSAIDs *Note: Short acting NSAIDs like ibuprofen may be safely given up through the night before surgery. The following NSAIDs have limited to no antiplatelet effects and do not need to be held prior to surgery. <ul style="list-style-type: none"> <input type="checkbox"/> Etodolac <input type="checkbox"/> Meloxicam <input type="checkbox"/> Nabumetone 	Bleeding	Hold for at least 3 half lives prior to surgery. Surgeon may allow NSAID use up through morning of surgery. If surgeon has not advised the patient to continue taking the medication, then proceed to the following: <ul style="list-style-type: none"> <input type="checkbox"/> If surgery is planned to take place before the minimum time to hold, the surgeon should be notified and the patient should be advised to stop taking the drug. <input type="checkbox"/> If patient reports that holding the medication will be problematic, the surgeon should be called for alternative pain management. Alternatives include either a short acting NSAID (e.g. ibuprofen) or an NSAID with limited to no platelet activity (see first column on left). 																																																																																	
		<table border="1"> <thead> <tr> <th>NSAID</th> <th>Brand name</th> <th>Half-life (hours)</th> <th>Hold for at least</th> </tr> </thead> <tbody> <tr> <td>Diclofenac</td> <td>Voltaren, Cataflam</td> <td>2</td> <td>Morning of</td> </tr> <tr> <td>Diclofenac XR</td> <td>Voltaren XR</td> <td>n/a</td> <td>Day before and of</td> </tr> <tr> <td>Etodolac*</td> <td>Lodine</td> <td>7.3</td> <td>Don't hold</td> </tr> <tr> <td>Fenoprofen</td> <td>Nalfon</td> <td>3</td> <td>Morning of</td> </tr> <tr> <td>Flurbiprofen</td> <td>Ansaid</td> <td>5.7</td> <td>17 hours</td> </tr> <tr> <td>Ibuprofen</td> <td>Advil, Motrin</td> <td>2</td> <td>Morning of</td> </tr> <tr> <td>Indomethacin</td> <td>Indocin</td> <td>4.5</td> <td>14 hours</td> </tr> <tr> <td>Ketoprofen</td> <td></td> <td>2.1</td> <td>Morning of</td> </tr> <tr> <td>Ketoprofen ER</td> <td></td> <td>5.4</td> <td>16 hours</td> </tr> <tr> <td>Ketorolac</td> <td>Toradol</td> <td>6</td> <td>18 hours</td> </tr> <tr> <td>Meclofenamate</td> <td></td> <td>1.3</td> <td>Morning of</td> </tr> <tr> <td>Mefenamic acid</td> <td>Ponstel</td> <td>2</td> <td>Morning of</td> </tr> <tr> <td>Meloxicam*</td> <td>Mobic</td> <td>20</td> <td>Don't hold</td> </tr> <tr> <td>Nabumetone*</td> <td>Relafen</td> <td>22.5</td> <td>Don't hold</td> </tr> <tr> <td>Naproxen</td> <td>Naprosyn, Anaprox</td> <td>17</td> <td>2 days preop</td> </tr> <tr> <td>Oxaprozin</td> <td>Daypro</td> <td>50</td> <td>3 weeks preop</td> </tr> <tr> <td>Piroxicam</td> <td>Feldene</td> <td>50</td> <td>3 weeks preop</td> </tr> <tr> <td>Sulindac</td> <td>Clinoril</td> <td>7.8</td> <td>24 hours</td> </tr> <tr> <td>Tolmetin</td> <td></td> <td>7</td> <td>21 hours</td> </tr> </tbody> </table>		NSAID	Brand name	Half-life (hours)	Hold for at least	Diclofenac	Voltaren, Cataflam	2	Morning of	Diclofenac XR	Voltaren XR	n/a	Day before and of	Etodolac*	Lodine	7.3	Don't hold	Fenoprofen	Nalfon	3	Morning of	Flurbiprofen	Ansaid	5.7	17 hours	Ibuprofen	Advil, Motrin	2	Morning of	Indomethacin	Indocin	4.5	14 hours	Ketoprofen		2.1	Morning of	Ketoprofen ER		5.4	16 hours	Ketorolac	Toradol	6	18 hours	Meclofenamate		1.3	Morning of	Mefenamic acid	Ponstel	2	Morning of	Meloxicam*	Mobic	20	Don't hold	Nabumetone*	Relafen	22.5	Don't hold	Naproxen	Naprosyn, Anaprox	17	2 days preop	Oxaprozin	Daypro	50	3 weeks preop	Piroxicam	Feldene	50	3 weeks preop	Sulindac	Clinoril	7.8	24 hours	Tolmetin		7	21 hours
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Celecoxib		Take regularly scheduled doses.	Take regularly scheduled doses.																																																																																
NEUROLOGIC MEDICATIONS																																																																																			
Benzodiazepines	Abrupt withdrawal can result in agitation, HTN, delirium and seizures.	Take regularly scheduled doses.	Take regularly scheduled doses.																																																																																

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Lithium		Take regularly scheduled doses.	Take regularly scheduled doses. Close monitoring of volume and electrolyte status. Preop CHEM 7 required within 30 days.
Monamine Oxidase Inhibitors (MAOI's) <input type="checkbox"/> Isocarboxazid <input type="checkbox"/> Phenezine <input type="checkbox"/> Tranylcypromine Agents With mild MAOI effects <input type="checkbox"/> Selegiline <input type="checkbox"/> Rasagiline <input type="checkbox"/> Linezolid - antibiotic	Drug interactions with anesthesia medications can result in severe hypertension or serotonin syndrome	Take through morning of surgery. Anesthesiologist must be informed of the need to use MAOI safe anesthesia or to discontinue the medication for 2 weeks prior to surgery. MAOI safe anesthesia = avoid ephedrine, meperidine, and dextromethorphan. Phenylephrine is OK.	
Pyridostigmine	Muscarinic side effects	Take regularly scheduled doses. Preadmission RN to leave note on chart to remind surgeon to resume ASAP post-op and consult neurologist if oral doses will not be feasible post-op.	Take regularly scheduled doses. Restart when hemodynamically stable. Parenteral substitutions are available. For IM substitution give 1/10th the usual oral dose and for IV substitution give 1/30th the usual dose.
Antiseizure medications	Breakthrough seizures	Take regularly scheduled doses unless specifically instructed preoperatively by prescriber or surgeon.	
RHEUMATOLOGIC AGENTS			
Probenecid	Probenecid interacts with numerous perioperative medications.	Take regularly scheduled doses.	Do not take.
HERBALS			
Gingko, Garlic, or Ginseng	Bleeding	Do not take 7 days prior to surgery.	Do not take.
Ephedra	Tachycardia and hypertension, MI, stroke, hemodynamic instability, and drug-drug interactions with some psychiatric medications	Do not take 7 days prior to surgery.	Do not take.

MEDICATION	CLINICAL CONCERN	DAY BEFORE SURGERY	MORNING OF SURGERY
Kava	Sedation and potentiation of anesthetic medications, and its use is associated with concerns about withdrawal, tolerance, and addiction	Do not take 7 days prior to surgery.	Do not take.
Saw Palmetto	Intraoperative floppy iris syndrome during ophthalmic (e.g. cataract) surgery	Do not take 7 days prior to surgery	Do not take.
All other unlisted herbals and Vitamin E containing supplements (For a list of some common herbals please see attachment)	Coagulation disorders, sedation, unknown complications.	Do not take 7 days prior to surgery	Do not take.

MEDICATION	CLINICAL CONCERN	BEFORE SURGERY
ANTIPLATELETS		
Aspirin alone	Bleeding	Prescriber and surgeon must decide.
Clopidogrel	Bleeding	Cardiology and surgeon should collaborate to decide whether to give or hold. If hold, requires 5 days.
Dipyridamole	Bleeding	Cardiology and surgeon must decide. If hold, requires 2 days
Ticlopidine	Bleeding	Cardiology and surgeon should collaborate to decide whether to give or hold. If hold, requires 7 days
Prasugrel	Bleeding	Cardiology and surgeon should collaborate to decide whether to give or hold.

MEDICATION	CLINICAL CONCERN	BEFORE SURGERY
ANTICOAGULANTS		
Warfarin	Bleeding	Cardiology and surgeon should collaborate to decide whether to give or hold. If hold, may require bridging therapy for 7 days prior.
Enoxaparin	Bleeding	Surgeon must advise patient on when last dose should be administered. Hold for 12-24h, depending on renal function.
Fondaparinux	Bleeding	Surgeon must advise patient on when last dose should be administered. Hold for 24-48h, depending on renal function.

REFERENCES:

1 Muluk V, Macpherson DS. Perioperative Medication Management. UpToDate.com (v25) – last updated Jul 12, 2012

2 Douketis JD et al. Perioperative Management of Antithrombotic Therapy. Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. [CHEST 2012;141 \(2 suppl\): e326S-e350S.](#)

3 http://ether.stanford.edu/secure/Pediatric/Safety%20Beat/2013_June.html

4 http://chpnyc.org/services/BI_Anesthesiology/herbPatient.pdf

Natural supplements and herbs that may cause bleeding problems:

Agrimony, alfalfa, aniseed, arnica, artemesia, asafoetica, bishop's weed, bladderwrack, bochu, bogbean, boldo, bromelains, burdock, capsicum, cassio, celery seed, chamomile, Chinese wolfberry, chondroitin, cloe, cod liver oil, coltsfoot, dandelion ,danshen (salvia) , devil's claw, dihydroepiandrosteroe (DHEA) ,dong quai (angelica) ,fenugreek ,feverfew, fish oil, flax seed, gamma linoleic acid ,garlic ,ginger, ginkgo ,ginseng ,glucosamine ,horse chestnut ,horseradish ,licorice ,meadowsweet, melatonin ,mellilot ,nattokinase , onion, pantethine, papain (papaya extract),,parsley ,passionflower ,policosanol ,poplar ,prickly ash ,quassia ,red clover ,resveratrol, sea buckthorn, sweet clover, sweet woodruff ,tonka beans, turmeric ,vinpocetine ,vitamin E ,wild carrot ,wild lettuce ,willow bark

Common anesthesia/surgery related adverse effects of Herbals

- **Vitamin E** -Vitamin E has anti-platelet properties and inhibits vital clot formation.
- **Garlic** (*allium sativum*), **Ginger, Alfalfa, Cayenne, Papaya, Feverfew, Chamomile, Dong Quai root, Willow bark, Goldenseal, Guarana, Horse Chestnut and Bilberry** Tablets/Supplements also have anti-platelet properties and may inhibit vital clot formation. .
- **Ginkgo, Ginkgo biloba, & Selenium** are powerful anti-coagulants. It is considered to be 3 times stronger than Vitamin E.
- **Ginseng** may cause rapid heartbeat/and or high blood pressure in some individuals as well as coagulation disruption.
- **St. John's Wort, Yohimbe, ("The natural Viagra®") and Licorice root** have a mild *monoamine oxidase* (MAO) inhibitory effect and may intensify the effects of anesthesia.
- **Melatonin** decreases the amount of anesthesia needed for surgery.
- **Kava Kava, Hawthorn, Lemon verbena, Muwort, Lavender and Valerian/Valerian Root:** (taken to promote relaxation and sleep) have tranquilizing properties and should *not* be combined with other sedative agents.
- **Echinacea** may have a severe impact on the liver when general anesthesia is used. It also has some coagulation disruption properties.
- **Ma Huang (aka Ephedra):** Used by many people for weight loss and is a major component of most weight loss supplements) has been **associated with more than 800 adverse health effects including DEATH.** It is an amphetamine-like compound with the potential for stimulating the central nervous system and heart.
In large doses ephedrine causes nervousness, headaches, insomnia, dizziness, palpitations, skin flushing, tingling and vomiting (Lawrence Review, 1989). The Handbook of Nonprescription Drugs notes that "The principal adverse effects of ephedrine are CNS stimulation, nausea, tremors, tachycardia [rapid heartbeat], and urinary retention." (APhA 1986).
- **Gotu Kola** has a stimulant effect as well.
- **Ackee fruit** as well as, **Alfalfa, Aloe, Argimony, Barley, Bitter melon, Burdock root, Carrot oil, Chromium, Coriander, Dandelion root, Devil's club, Eucalyptus, Fenugreek seeds, Fo-ti, Garlic, Ginseng, Grape seed, Guayusa, Gmena, Juniper, Nem seed oil, Onions, Periwinkle, Yellow root** alter the blood glucose level.

Recommendations for Preoperative Anticoagulation Management based on type of surgery or procedure

Prolonged, complex, and major surgery is much more likely to cause significant bleeding problems than short, simple, and minor surgical procedures.

Low bleeding risk procedures — Most patients can undergo low risk surgical procedures (eg, cataract surgery, coronary arteriography, venography, joint aspiration, dental procedures such as tooth extraction and root canal, minor skin procedures, arthrocentesis, bone marrow biopsy) without alteration of their anticoagulation regimen. In such patients, oral anticoagulation can be continued at or below the low end of the therapeutic range (eg, INR 1.7 to 2.3).

High bleeding risk procedures — More complex or high risk surgical procedures (eg, open-heart surgery, abdominal vascular surgery, intracranial or spinal surgery, major cancer surgery, urologic procedures) require discontinuation of oral anticoagulation, followed by temporary perioperative coverage with unfractionated [heparin](#) or LMW heparin in those patients who are at high risk of thromboembolism.

Gastroenterologic procedures — Management of anticoagulation in patients undergoing gastroenterologic procedures (eg, endoscopy with or without mucosal biopsy), as with any other surgery or procedure, is anchored on the estimated risk for bleeding associated with the procedure and the estimated thromboembolic risk if the patient temporarily stops anticoagulation. In general, diagnostic procedures are low-risk, whereas therapeutic procedures are high-risk. In low risk procedures, anticoagulation can continue. In high risk procedure, anticoagulation should be held per protocol.

For low-risk procedures, the American Society of Gastrointestinal Endoscopy (ASGE) guidelines suggest making no changes in anticoagulation. We suggest that elective procedures be delayed if the INR or prothrombin time is in the supratherapeutic range.

- Bridge therapy is not required for patients at low-risk for thromboembolism. (AT LPCH, we need to defer to cardiology about bridging therapy).
- For patients at high-risk for thromboembolism, we suggest bridge therapy

Dental or excisional cutaneous procedures — In patients undergoing dental extraction, [warfarin](#) anticoagulation is associated with a minimal risk of serious bleeding if the INR is within the therapeutic range just prior to the contemplated surgery. The use of [aspirin](#), NSAIDS, or Cox-2 selective inhibitors for analgesia should be avoided.

SO WHEN DO WE STOP THEM:.....

ACCP advises to temporarily stop [warfarin/Coumadin](#) beginning about **5 days before surgery**.

- The ACCP suggests **against** bridging therapy in patients at **low risk** for thromboembolism with mechanical heart valves, VTE, or atrial fibrillation. (Defer to cardiology at LPCH)
- Patients at **high risk** for thromboembolism **should** receive bridging therapy
- Patients at **intermediate risk** should be considered on a **case-by-case basis** for bridging anticoagulation, according to risk of surgical bleeding and the risk of thrombosis.

For patients receiving **high-dose intravenous unfractionated heparin** as bridging therapy, ACCP suggests stopping the heparin infusion **4-6 hours prior to surgery**, no closer.

For patients receiving **low-molecular weight heparin (e.g., enoxaparin/Lovenox)** as bridging therapy ACCP suggests giving the last dose of LMWH (e.g., enoxaparin/Lovenox) **24 hours before surgery**.

What is the risk-stratification scheme

DVT/PE low risk patients are > 12 months out from their last DVT/PE and have no other major risk factors (mainly thrombophilia or cancer)

- **Atrial fibrillation low risk patients** with no prior history of stroke/TIA.
- **Mechanical valve low risk patients** are those with bileaflet aortic valves with no atrial fibrillation, and no other risk factors for stroke (diabetes, hypertension, age > 75, etc.)

Anyone else is **at least at intermediate risk** for thromboembolism during interruption of warfarin/Coumadin therapy, and deserves strong consideration for bridging anticoagulation.

Please see the weblink below for pharmacological data on other new anticoagulant and antithrombotic agents .

<http://www.apsf.org/newsletters/html/2012/spring/pdf/anticoagulant%20table.pdf>

References:

1. <http://www.uptodate.com/contents/management-of-anticoagulation-before-and-after-elective-surgery>
2. Douketis JD et al. Perioperative Management of Antithrombotic Therapy. Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. [CHEST 2012;141 \(2 suppl\): e326S-e350S.](#)