Perioperative medication management for Chronic Patients

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- Member of the Scientific Communication Committee of the Chinese Pharmaceutical Association
- Member of the Patient Education Committee of the Chinese Association of Pharmacists
- Expert on the Science Rumor Refutation Platform of Science Popularization Department of China Association for Science and Technology
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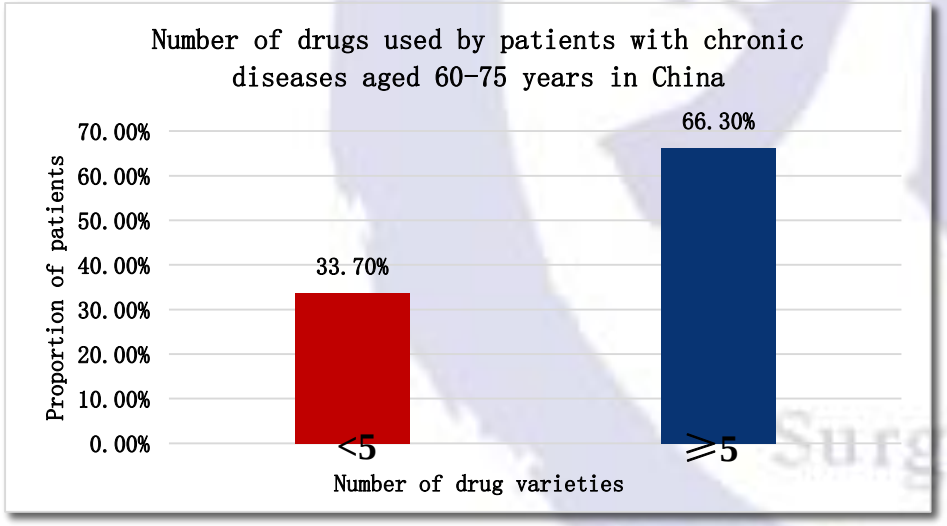
PART ONE

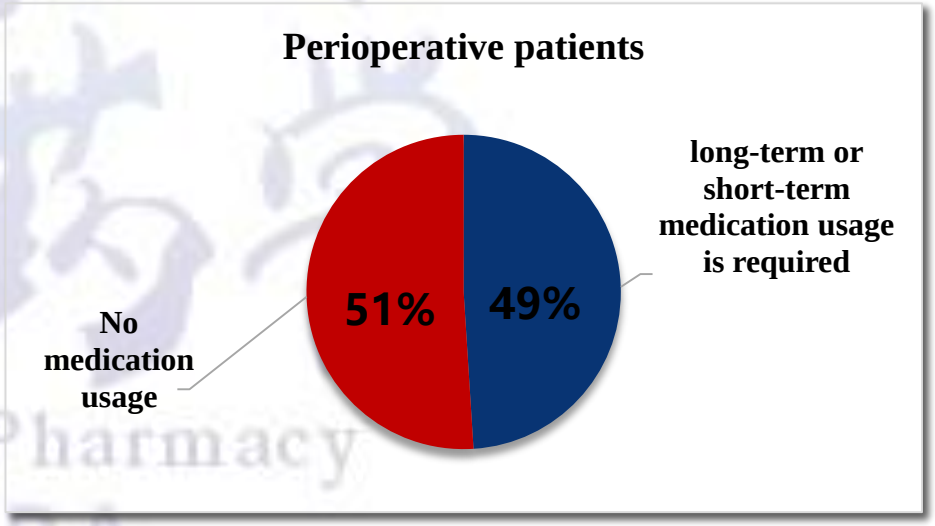
Background introduction

The current medication situation in patients with chronic diseases

- Chronic diseases including cardiovascular disease, chronic obstructive pulmonary disease (COPD), diabetes, malignant tumors and so on.
- Patients with chronic diseases often require long-term, multi-drug therapy. At least 50% of patients undergoing surgery take medications on a regular basis.
- The research showed that patients who took at least one medication for a chronic condition had a 2.7 times higher risk of developing surgical complications compared with patients who did not take any medication.

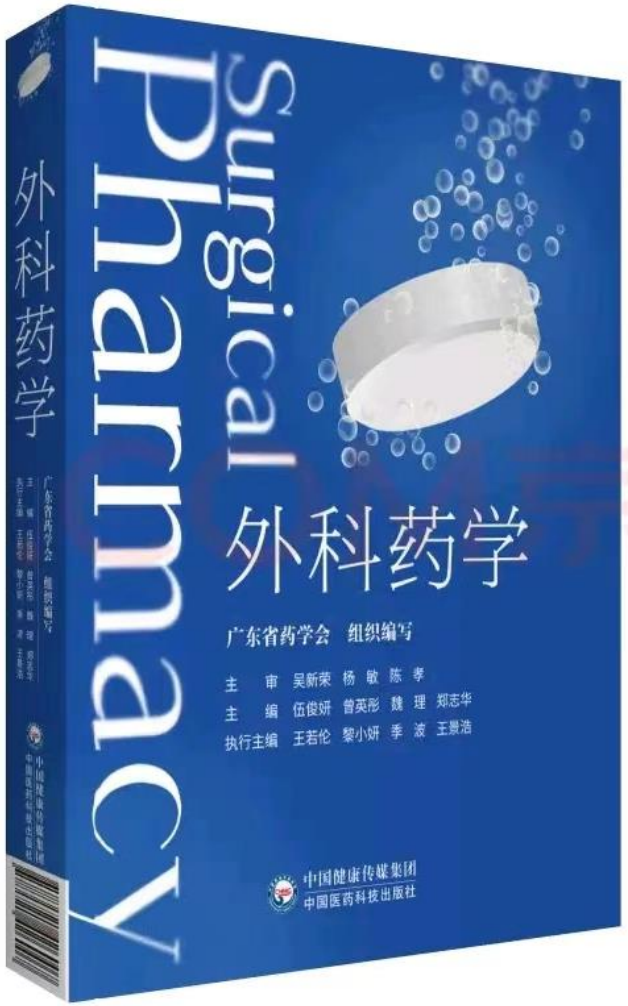


66.3% of patients aged 60-75 years with chronic diseases took more than 5 drugs



At least half of patients undergoing surgery take medications on a regular basis

Establishment of surgical pharmacy



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Ten consensuses on perioperative medication management

The management principle of chronic medications in perioperative period

Patient admission

Pharmaceutical care

A complete medication history should be obtained

Medication reconciliation

Should the chronic medications be continued during the perioperative period?

① Does discontinuation causes withdrawal syndrome or disease progression?

② Is medication absorption decreased during the perioperative period?

③ Whether it increases the risk of anesthesia or surgical complications.

④ Whether it is necessary for short-term use.

⑤ Whether drug-drug interactions can occur.

Continue

- Conventional dosage regimen
- Adjust the dosage regimen

Discontinue

- Discontinue medication
- Change the route of administration or use alternative medications

The majority of medications can be resumed once the patient is able to tolerate oral intake.

Patient discharge medication education

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PART TWO

Perioperative management of chronic medications

1. Cardiovascular medications

Medications	Benefits	Risks	Recommendations	Additional considerations	Formulations/alternatives	Sources of evidence
α1-blockers	Prevention of postoperative urinary retention	Intraoperative floppy iris syndrome	Continue	-	-	Cohort study[36]
Diuretics	Maintain liquid balance	Hypovolemia, hypokalemia	For patients with controlled hypertension and stable circulation, it is recommended to stop using it once on the day of surgery. For patients with heart failure whose fluid balance is difficult to control, it is recommended to continue.	Monitor electrolyte and liquid balance	If fluid overload develops after diuretic withdrawal on the day of surgery, rapid intravenous diuresis can be administered	Randomized controlled trial、Cohort study[33-35]

1. Cardiovascular medications

Medications	Benefits	Risks	Recommendations	Additional considerations	Formulations/alternatives	Sources of evidence
β-blockers	Reduce the risk of cardiovascular events and death.	Bradycardia ,hypotension	Continue	Close monitoring of blood pressure and heart rate	Intravenous forms of β-blockers such as metoprolol, esmolol, and labetalol	Retrospective cohort study[15-20]
ACE inhibitors and angiotensin receptor blockers	Reduce the risk of postoperative hypertension	Hypotension	For the majority, it is advisable to discontinue on the morning of surgery. In cases of uncontrolled hypertension or heart failure, continued use may be necessary.	Long-term use of ACE inhibitors in patients can significantly enhance the inhibitory effect on drug circulation, leading to intraoperative hypotension.	-	RCT、meta-analysis、cohort study[21-29]
Calcium channel blockers	Improve the clinical outcomes of patients undergoing cardiac surgery	-	Continue	Combination with anesthetics metabolized by CYP3A4 may aggravate the inhibition of the cardiac conduction system	Diltiazem can be administered intravenously	Cohort study 、meta-analysis[30-32]

1、Cardiovascular medications

Medications	Benefits	Risks	Recommendations	Additional considerations	Formulations/alternatives	Sources of evidence
Statins	Prevent perioperative cardiovascular events and improve clinical outcomes	Increased risk of myopathy	Continue	The incidence and severity of adverse reactions are significantly increased when combined with CYP3A4 inhibitors. When combined with succinylcholine may result in an increased risk of myopathy.	-	Rcts[37-50]
Non-statin lipid-lowering agents	-	Niacin and fibric acid derivatives (gemfibrozil, fenofibrate) cause myopathy and rhabdomyolysis	Discontinued the day before surgery	Lipid-lowering agents that are bile sequestrants (cholestyramine and colestipol) interfere with bowel absorption of multiple medications that may be required perioperatively	-	Review[51]

Medications affecting hemostasis

◆ **Including vitamin K antagonists (VKAs), direct oral anticoagulants (DOACs) and antiplatelet agents.**

● **Benefits/Risks：**

- **Patients who have been taking anticoagulant drugs (anticoagulants and antiplatelet drugs) for a long time before surgery may face an increased risk of surgical bleeding if they continue to take them during the perioperative period, while discontinuing them may increase the risk of thromboembolic events.**
- **Considering that both bleeding and thromboembolic events have important adverse effects on patients' short-term and long-term outcomes, the decision on whether to stop or bridge the medication should be made based on the patient's bleeding and thromboembolic risks during the perioperative period, in combination with the type of drug.**

Procedural/surgical bleed risk stratification

TABLE 1 Risk stratification for procedural bleed risk as suggested by the ISTH Guidance Statement and BRIDGE Trial[5,22]

High bleeding risk procedures[a] (30-d risk of major bleed >2%)	Major surgery with extensive tissue injury Cancer surgery, especially solid tumor resection Major orthopaedic surgery, including shoulder replacement surgery Reconstructive plastic surgery Urologic or gastrointestinal surgery, especially anastomosis surgery Transurethral prostate resection, bladder resection, or tumor ablation Nephrectomy, kidney biopsy Colonic polyp resection Bowel resection Percutaneous endoscopic gastrotomy (PEG) placement, endoscopic retrograde cholangiopancreatography (ERCP) Surgery in highly vascular organs (kidneys, liver, spleen) Cardiac, intracranial, or spinal surgery Any major operation (procedure duration >45 min) Neuraxial anaesthesia[b]
Low/moderate bleeding risk procedures[c] (30-d risk of major bleed 0%-2%)	Arthroscopy Cutaneous/lymph node biopsies Foot/hand surgery Coronary angiography[d] Gastrointestinal endoscopy +/− biopsy Colonoscopy +/− biopsy Abdominal hysterectomy Laparoscopic cholecystectomy Abdominal hernia repair Hemorrhoidal surgery Bronchoscopy +/− biopsy Epidural injections
Minimal bleeding risk procedures[e] (30-d risk of major bleed ~0%)	Minor dermatologic procedures (excision of basal and squamous cell skin cancers, actinic keratoses, and premalignant or cancerous skin nevi) Opthalmological (cataract) procedures Minor dental procedures (dental extractions, restorations, prosthetics, endodontics), dental cleanings, fillings Pacemaker or cardioverter-defibrillator device implantation

[a]No residual anticoagulant effect at time of procedure (ie 4-5 drug half-life interruption preprocedure).
[b]Includes spinal and epidural anaesthesia, consider not only absolute MB event rate but catastrophic consequences of a MB.
[c]Some residual anticoagulant effect allowed (ie 2-3 drug half-life interruption preprocedure).
[d]Radial approach may be considered minimal bleed risk compared to femoral approach.
[e]Procedure can be safely done under full dose anticoagulation (may consider holding DOAC dose day of procedure to avoid peak anticoagulant effects).

Thromboembolic risk stratification

TABLE 2 Adapted American College of Chest Physicians (ACCP Guidelines) suggested risk stratification for patient-specific periprocedural thromboembolism[2,4]

Risk category	Mechanical heart valve	Atrial fibrillation	Venous thromboembolism
High (>10%/y risk of ATE or >10%/mo risk of VTE)	Any mechanical mitral valve Caged ball or tilting disc valve in mitral/aortic position Recent (<3 mo) stroke or TIA	$CHADS_2$ score of 5 or 6 CHA_2DS_2VASc score of 7 or more Recent (<3 mo) stroke or TIA Rheumatic valvular heart disease	Deficiency of protein C, protein S or antithrombin Antiphospholipid antibodies Multiple thrombophilias Associated with venal caval filter (Active cancer)[a]
Moderate (4%-10%/y risk of ATE or 4%-10%/mo risk of VTE)	Bileaflet AVR *with* major risk factors for stroke[b]	$CHADS_2$ score of 3 or 4 CHA_2DS_2VASc score of 5 or 6	VTE within past 3-12 mo Recurrent VTE Nonsevere thrombophilia Active cancer or recent history of cancer[c]
Low (<4%/y risk of ATE or <2%/mo risk of VTE)	Bileaflet AVR *without* major risk factors for stroke[b]	$CHADS_2$ score of 0-2 (and no prior stroke or TIA) CHA_2DS_2VASc score of 1-4	VTE more than 12 mo ago

[a]Consider pancreatic cancer, myeloproliferative disorders, brain tumor, gastric cancer.
[b]Atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age > 75 y.
[c]Within 5 y if history of cancer, excluding non-melanoma skin cancer.

Medications affecting hemostasis

Medications	Timing of drug discontinuation prior to surgery	Whether bridging is necessary	Timing of postoperative medication retrieval
Warfarin	5 days (Minor dental, dermatologic, ophthalmologic procedure, pacemaker or ICD implantation are recommended to continue)	High risk of thromboembolism: Bridging with LMWN or heparin; Moderate risk of thromboembolism: Bridging based on clinical judgment; Low risk of thromboembolism: No bridging.	24 hours after surgery
Dabigatran	① CrCl ≥80mL/min： Low bleeding risk： 24 hours; High bleeding risk： 48 hours; ② CrCl : 50~80mL/min： Low bleeding risk： 36 hours; High bleeding risk： 72 hours; ③ CrCl : 30~50mL/min： Low bleeding risk： 48 hours; High bleeding risk： 96 hours;	No	24~72 hours after surgery
Rivaroxaban 、Apixaban 、Edoxaban	Low bleeding risk： 24 hours; Low bleeding risk： 48 hours;	No	24~48 hours after surgery

Medications affecting hemostasis

Medications	Timing of drug discontinuation prior to surgery	Whether bridging is necessary	Timing of postoperative medication retrieval
Aspirin（ASA）	7 days (Elective non-cardiac surgery, coronary artery bypass grafting, PCI, minor dental, dermatologic, or ophthalmologic procedure are recommended to continue)	Low molecular weight heparin can be selected for bridging.	After the risk of bleeding is reduced
$P2Y_{12}$ inhibitors（clopidogrel、prasugrel）	5 days (Minor dental, dermatologic, or ophthalmologic procedure are recommended to continue)	No	After the risk of bleeding is reduced
Ticagrelor	3~5 days (Minor dental, dermatologic, or ophthalmologic procedure are recommended to continue)	No	After the risk of bleeding is reduced
Dipyridamole	2 days	No	After the risk of bleeding is reduced
Cilostazol	2~3 days	No	After the risk of bleeding is reduced

ICD: Implantable Cardioverter Defibrillator

2. Gastrointestinal Medications

Medications	Benefits	Risks	Recommendations	Additional considerations	Formulations/alternatives	Sources of evidence
Proton pump inhibitors (PPIs)	Reduces surgical patients' increased risk of stress-induced ulcers (SU). Decreased risk of gastric acid aspiration and potential pulmonary injury.	Patients with a history of gastrointestinal ulcers or bleeding have an increased risk of developing SU.	Continue	Potential drug-drug interactions with medications that require an acidic environment for dissolution.	PPIs for injection	Consensus statement[53]、RCT[54]
Histamine 2 Receptor Antagonist (H_2RA)	Reduces surgical patients' increased risk of stress-induced ulcers (SU). Decreased risk of gastric acid aspiration and potential pulmonary injury.	Patients with a history of gastrointestinal ulcers or bleeding have an increased risk of developing SU.	Continue	Some may alter pharmacokinetics of drugs metabolized by CYP450 enzymes		

3. Pulmonary Medications

Medications	Benefits	Risks	Recommendations	Additional considerations	Formulations/alternatives	Sources of evidence
Inhaled β2 agonists and anticholinergics	Reduce the incidence of postoperative pulmonary complications	Discontinuing medication can increase the risk of bronchospasm and cardiopulmonary complications.	Continue	Caution in patients with known cardiovascular diseases, arrythmias, hypokalemia, hyperthyroidism, and seizure history	The drugs can be administered through a nebulizer or in the circuit of the ventilator when use of metered-dose inhalers is not possible	Consensus statement[53]、Retrospective study[58]、RCT[59]
Inhaled glucocortico-ids	Maintain optimal lung functions	The abrupt withdrawal of the medication may pose a risk of adrenal insufficiency	Continue	Common adverse effects include oropharyngeal candidiasis, xerostomia, and dysphonia	The drugs can be administered through a nebulizer or in the circuit of the ventilator when use of metered-dose inhalers is not possible	Guideline[60]、Consensus statement[53]

4. Medications for diabetes

Medications	Benefits	Risks	Recommendations	Formulations/ alternatives
Metformin	Enhance glycemic management	Iactic acidosis and idney hypoperfusion	**Minor surgery:** Continue before surgery, but do not take metformin on the morning of surgery. **Medium and large-scale surgeries:** Refer to insulin.	Insulin
Alpha-glucosidase inhibitors		Increased gas production and gastrointestinal discomfort		
Sulfonylureas, Glinides		Hypoglycemia		
Thiazolidinediones		Fluid retention and ongestive heart failure		
DPP-4 inhibitors		-		
GLP-1 agonists		Adverse GI effects, such as nausea and vomiting		
SGLT-2 inhibitors	-	Urogenital infections, acute kidney injury, dehydration, and hypotension	Canagliflozin, dapagliflozin, and empagliflozin should each be discontinued at least 3 days before surgery. Ertugliflozin should be discontinued at least 4 days before surgery. And substituted with insulin.	

4. Medications for diabetes

<table>
<tr><th>Medications</th><th>Benefits</th><th>Risks</th><th>Recommendations</th></tr>
<tr><td>Insulin</td><td>Enhance glycemic management and reduce the duration of preoperative preparation</td><td>Hypoglycemia</td><td>
<table>
<tr><td>Minor surgery</td><td>Adjust insulin dosage on the day of surgery.</td></tr>
<tr><td>Medium and large-scale surgeries</td><td>Adjust insulin dosage on the day of surgery.
Intraoperative IV insulin infusion.</td></tr>
<tr><td>Emergency surgery</td><td>IV insulin infusion should be administered preoperatively and intraoperatively.</td></tr>
</table>
Adjustment of insulin dosage:
Insulin, intermediate acting: Decrease dose by 50% on morning of surgery and consider 25% dose reduction on evening before surgery.
Insulin, long-acting: Administer 60%-80% of usual dose the evening before surgery (or the morning of surgery, if normally taken in the morning) in those with type 2 diabetes and those prone to hypoglycemia.
Insulin, premixed: If fasting hyperglycemia (>200 mg/dL), use half the usual dose of premixed insulin on the morning of surgery; otherwise, do not administer and give half the dose of the intermediate or long acting component as intermediate or long-acting insulin.
Insulin, short-/rapid acting: May use on the morning of surgery for urgent treatment of hyperglycemia.
</td></tr>
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5. Other endocrine Medications

Medications	Benefits	Risks	Recommendations	Formulations/ alternatives	Sources of evidence
Glucocorticoid	Reduce the risk of adrenocortical insufficiency or crisis, recurrence or worsening of the underlying disease.	Sudden discontinuation of treatment can cause adrenocortical insufficiency or crisis, or result in a recurrence or worsening of the underlying disease.	Continue chronic corticosteroid treatment before and on the day of surgery. Patients receiving longer-term, higher-dose therapy might need supplemental dosing intraoperatively and postoperatively.	Intravenous use of hydrocortisone substitution	Expert consensus[67, 70,74-76]

Type of surgery	On the day of the surgery	Postoperation
Major surgery (such as thoracic and abdominal surgery, craniotomy, etc.)	**Discontinue oral GCs on the day of surgery**, and administer 100 mg of hydrocortisone intravenously before anesthesia. Continue to administer 100 mg of hydrocortisone intravenously every 8 hours post-anesthesia until 24 hours.	On the first day after the surgery, the dose can be reduced by 50% successively every day until the maintenance dose is reached.
Medium-sized surgery (such as joint replacement, laparoscopic cholecystectomy, etc.)	**Discontinue oral GCs on the day of surgery**, and administer hydrocortisone 50-75 mg intravenously before anesthesia. Continue to administer 50 mg of hydrocortisone intravenously every 8 hours post-anesthesia for 24 hours.	On the first day after the surgery, the dose can be reduced by 50% successively every day until the maintenance dose is reached.
Minor surgery (such as inguinal hernia repair, etc.)	**Continue taking GCs on the day of surgery**, and administer hydroxycorticosteroids intravenously preoperatively at a dose of 25-50mg.	The daily replacement dose can be restored on the first day after the surgery.

5. Other endocrine Medications

Medications	Benefits	Risks	Recommendations	Additional considerations	Formulations/alternatives	Sources of evidence
Bisphosph-onates	Reduce the risk of osteoporosis	The use of bisphosphonates has been associated with osteonecrosis of the jaw in patients undergoing dental surgery	Withholding bisphosphonates only on the morning of surgery	Preventive use of antibiotics before oral surgery can prevent osteomyelitis and promote healing in the infected area.	-	Expert consensus [67,80,81]
Thyroid Medications	Avoid the possible risk of thyroid storm in the perioperative period	Thyroid storm in the perioperative period	Continue both thyroid replacement and antithyroid medications before and on the day of surgery.	-	Thyroxine (T4) has a long half-life, and patients on chronic T4 therapy who are unable to take oral medication for several days do not need parenteral T4. Patients who are unable to take oral medications can be quickly prepared by combining iodine, beta-receptor blockers, dexamethasone, and/or cholestyramine.	Expert consensus [67,79]

5. Other endocrine Medications

Medications	Benefits	Risks	Recommendations	Formulations/alternatives	Sources of evidence
Colchicine	Preventing Gout flare	Gastrointestinal reactions, myalgia, myasthenia, myelosuppression	Be held on the morning of surgery	Should an acute gouty flare occur in a postoperative patient unable to tolerate oral medications, intraarticular steroids or systemic steroids can be used.	Controlled study[124]
Allopurinol	Control uric acid levels	Skin allergy, myelosuppression	Continue	-	Observational study[125]
Febuxostat	Control uric acid levels	Abnormal liver function, Cardiovascular adverse events	Continue	-	Retrospective study[126]
Benzbromarone	Control uric acid levels	Abnormal liver function	Continue	-	Review[127]

6. Medications for Psychiatric Diseases: Antianxiety agents

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Formulations/alternatives	Sources of evidence
Benzodiazepi-nes	Relieve preoperative anxiety	Abrupt withdrawal of chronic benzodiazepines can lead to an excitatory state with hypertension, agitation, delirium, and seizures.	Continue	Opioids and other CNS depressants-additive CNS depression	Parenteral forms of benzodiazepines	Guideline[82]
Buspirone	Reduce the shivering threshold intraoperatively in conjunction with dexmedetomidine	Serotoninergic effect	Continue	Serotoninergic medications-serotonin syndrome Opioids and other CNS depressants-additive CNS depression	Parenteral forms of benzodiazepines	Guideline[82]

6. Medications for Psychiatric Diseases: Antidepressant medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Selective serotonin reuptake inhibitors (SSRIs): Citalopram, fluoxetine, fluvoxamine, paroxetine, Sertraline	Avoid discontinuation syndrome	Hyponatremia due to SIADH (especially in advanced age, volume depletion, use with diuretics)	Continue	QT prolonging drugs (halogenated volatiles, ondansetron, methadone, metronidazole)-arrhythmias Serotoninergic drugs (meperidine, methadone, ondansetron, dolasetron, palonosetron)-serotonin syndrome Metoclopramide-extrapyramidal reactions and NMS Coagulation altering medications-risk of bleeding	Guideline[82]
Serotonin-norepinephrine reuptake inhibitors (SNRIs): Venlafaxine, Duloxetine	Avoid discontinuation syndrome	May worsen hypertension, tachycardia	Continue	QT prolonging drugs (halogenated volatiles, ondansetron, methadone, metronidazole)-arrhythmias Serotoninergic drugs (meperidine, methadone, ondansetron, dolasetron, palonosetron)-serotonin syndrome Metoclopramide-extrapyramidal reactions and NMS Coagulation altering medications-risk of bleeding	Guideline[82]

SIADH: syndromeofinappropriateantidiuretichormonesecretion

6. Medications for Psychiatric Diseases: Antidepressant medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Mirtazapine	Avoid discontinuation syndrome	Increased hyponatremia, anticholinergic side effects, seizure, somnolence Increased risk of bleeding with warfarin	Continue	Serotoninergic drugs (meperidine, methadone, ondansetron, dolasetron, palonosetron)-serotonin syndrome QT prolonging drugs (halogenated volatiles, ondansetron, methadone, metronidazole)-arrhythmias Benzodiazepines-CNS depression	Guideline[82]
Bupropion	-	Decreased seizure threshold	Continue	Oxycodone, propranolol, codeine, ondansetron, carvedilol, tramadol, several antiarrhythmic medications, metoclopramide, metoprolol-increased levels of medications (bupropion is a CYP2D6 inhibitor) Seizure thresholdelowering medications (systemic steroids, lidocaine, -cillin antibiotics, antihistamines, neostigmine, promethazine, bupivacaine, glycopyrrolate, scopolamine, TCAs)-risk of seizure	Guideline[82]

6. Medications for Psychiatric Diseases: Antidepressant medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Tricyclic antidepressants (TCAs) : amitriptyline, doxepin, Clomipramine	Avoid discontinuation syndrome	Anticholinergic side effects Cardiac toxicity Withdrawal when abruptly discontinued	Continue	Epinephrine, norepinephrine, and dobutamine-increased blood pressure Indirect sympathomimetics (ephedrine)-unpredictable surge of epinephrine and norepinephrine QT prolonging medications (volatile anesthetics, ondansetron, granisetron, palonosetron, dolasetron, metronidazole)-arrhythmias CNS depressants-additive CNS depression Metoclopramide-extrapyramidal reactions Serotoninergic opioids (tramadol)-serotonin syndrome NSAIDs-risk of bleeding, including intracranial hemorrhage Anticholinergic medications (glycopyrrolate, scopolamine, prochlorperazine)-additive anticholinergic effects Extensively metabolized by liver CYP enzymes(2C19/2D6)	Guideline[82]
Monoamine oxidase inhibitors (MAOI) : Moclobemide	-	Hypertensive crisis Serotonin syndrome	Continue	Tyramine-free diet preoperatively Indirect sympathomimetics (ephedrine)-hypertensive crisis (ABSOLUTE contraindication) Serotoninergic opiates (meperidine, methadone, tramadol)-serotonin syndrome (ABSOLUTE contraindication) Serotoninergic antiemetics (ondansetron, granisetron, palonosetron, dolasetron)-possible serotonin syndrome Cocaine and epinephrine-containing local anesthetics-hypertensive crisis Beta blockers (metoprolol, propranolol)-bradycardia Opioids-increased opioid toxicity Droperidol-QT prolongation, torsade de pointes, cardiac arrest	Guideline[82]

6. Medications for Psychiatric Diseases: Mood stabilizing medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Lithium	Lithium decreases release of neurotransmitters and may prolong the effect of neuromuscular blockers.	Narrow therapeutic window High risk of toxicity with volume depletion and decreased renal function Associated with nephrogenic diabetes insipidus Lowers seizure threshold Discontinuation associated with risk of suicide	Minor procedures: continue Major procedures: hold for 72 hours before surgery	Serotoninergic medications (meperidine, fentanyl, morphine, oxycodone, hydrocodone, ondansetron, palonosetron, granisetron, dolasetron, methadone, buprenorphine, oxymorphone, hydromorphone, tramadol)-serotonin syndrome Nondepolarizing muscle relaxants/succinylcholine-potentiation of action Diuretics, ACE-Is/ARBs, diltiazem, verapamil, metronidazole, lactulose-lithium toxicity Dopamine-2 antagonists (prochlorperazine, haloperidol, promethazine, droperidol, antipsychotics)-extrapyramidal symptoms	Guideline[82]

6. Medications for Psychiatric Diseases: Antipsychotic medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
First-generation antipsychotics: Chlorpromaz-ine, Decafenazine, haloperidol, phenazine	Avoid discontinuation syndrome	Anticholinergic, α-adrenergic, antihistamine effect QT prolongation Orthostatic hypotension Anticholinergic effects with concomitant use of other anticholinergic drugs	Continue	CNS depressants (opioids, benzodiazepines, antihistamines, sedatives or hypnotics)-additive CNS depression QT prolonging drugs (halogenated anesthetics, methadone, vasopressin, ondansetron)-torsade de pointes Metoclopramide-extrapyramidal symptoms	Guideline[82]
Second-generation antipsychotics: Aripiprazole, Paliperidone, Risperidone, Olanzapine, quetiapine, Ziprasidone	Avoid discontinuation syndrome	Dysregulation of body temperature Severe hyperglycemia, with hyperosmolar coma, ketoacidosis α-adrenergic antagonism, Significant QT prolongation Orthostatic hypotension	Continue	CNS depressants (opioids, benzodiazepines)-additive CNS depression QT prolonging drugs (halogenated anesthetics, methadone, vasopressin, ondansetron)-torsade de pointes Metoclopramide-extrapyramidal symptoms Some of them avoid using CYP3A4, CYP2D6, or CYP1A2 inhibitors concomitantly.	Guideline[82]

6. Medications for Psychiatric Diseases: Attention deficit hyperactivity disorder medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Methylphenidate	-	Sympathomimetic cardiovascular side effects Lowers seizure threshold	Hold on the day of surgery	Halogenated anesthetics-increased risk of sudden blood pressure/heart rate increases	Guideline[82]
Tomoxetine	-	Sympathomimetic cardiovascular side effects	Hold on the day of surgery	CYP2D6 inhibitors (bupropion, tricyclic antidepressants, paroxetine, fluoxetine, desvenlafaxine)-increased risk of toxicity of atomoxetine Concurrent use with MAOIs within 2 weeks of use may result in serotonin syndrome	Guideline[82]

7. Medications for Neurologic Diseases: Anticonvulsant Medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Carbamazepine, oxcarbamazepine	-	Side effects include hypotension, AV block, cardiac dysrhythmias, hepatic and renal toxicity, hyponatremia, and hypocalcemia	Continue	Strong CYP3A4 inducer Opioids, tramadol/ tapentadol, serotoninergic antiemetics (Ondansetron/dolasetron/ palonosetron/granisetron)-serotonin syndrome and respiratory depression Nondepolarizing muscle relaxants-decreased duration of action	Consensus Statement[94-96]
Levetiracetam	Avoid breakthrough seizures	Risk of thrombocytopenia; pancytopenia	Continue	Benzodiazepines, opiates-increased CNS depression	Consensus Statement[94-96]
Valproate sodium	Avoid breakthrough seizures	Anemia and cytopenia	Continue	Propofol d increased sedation/cardiorespiratory depression; lower propofol dosage may be required	Consensus Statement[94-96]
Pregabalin	Avoid breakthrough seizures	Edema	Continue	Opioids, benzodiazepines, or other CNS depressants-additive CNS depression	Consensus Statement[94-96]

7. Medications for Neurologic Diseases: Anticonvulsant Medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Formulations/ alternatives	Sources of evidence
Topiramate	Avoid breakthrough seizures	Risk of hyperchloremic, non-anion gap metabolic acidosis due to low bicarbonate levels	Continue	Opioids, benzodiazepines, metoclopramide, antihistamines, tramadol, ketamine, scopolamine additive CNS depression	-	Consensus Statement[94-96]
Lamotrigine	Avoid breakthrough seizures	Rash, irritability	Continue	No anesthetic interactions	-	Consensus Statement[94-96]
Phenytoin	Avoid breakthrough seizures	Narrow therapeutic index Class Ib antiarrhythmic Hypotension and arrhythmias with rapid infusion	Continue	Neuromuscular receptor blockers-decreased duration of action Opioids, benzodiazepines-additive CNS depression Decreased efficacy of clonazepam, fentanyl, hydrocodone, oxycodone, dexamethasone, corticosteroids, buprenorphine, tramadol, acetaminophen, midazolam QT prolonging drugs (methadone, halogenated volatile anesthetics, ondansetron)-torsade de pointes Induces CYP3A4 and CYP2C9	Injection-form of phenytoin	Consensus Statement[94-96]

7. Medications for Neurologic Diseases: Parkinson Disease

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Formulations/ alternatives	Sources of evidence
Anticholinergic agents (trihexyphenidyl)	Avoid Parkinson's symptoms	Anticholinergic side effects	Continue	Anticholinergic drugs (promethazine, phenothiazines prochlorperazine, glycopyrrolate, scopolamine)-potentiation of anticholinergic effects	-	Consensus Statement[94-96]
Amantadine	Avoid Parkinson's symptoms and increase in neurological/ psychiatric symptoms	Anticholinergic side effects	Continue	Anticholinergic drugs (promethazine, phenothiazines prochlorperazine, glycopyrrolate, scopolamine)-potentiation of anticholinergic effects	-	Consensus Statement[94-96]
Carbidopa/ Levodopa	Avoid Parkinson's symptoms	Orthostatic hypotension can occur after dosing; increased risk of cardiac complications	Continue	Antidopaminergic antiemetics (metoclopramide, haloperidol, chlorpromazine, promethazine, prochlorperazine)-decreased efficacy carbidopa/levodopa	Carbidopa-levodopa oral disintegrating tablets. Crushed and administered via a feeding tube.	Consensus Statement[94-96]

7. Medications for Neurologic Diseases: Parkinson Disease

Medications	Benefits	Risks	Recomm-endations	Perioperative medication interactions	Formulations /alternatives	Sources of evidence
Dopamine agonists (bromocriptine, pramipexole, rotigotine)	Avoid Parkinson's symptoms	Risk of postoperative delirium, hypotension, myocardial infarction Risk of delirium, postural hypotension, hypertension, dyskinesia, first degree AVB	Continue	Antidopaminergic antiemetics (metoclopramide, haloperidol, chlorpromazine, promethazine, prochlorperazine)-decreased efficacy of bromocriptine Diuretics, ACEIs, insulin and other oral antidiabetic agents-risk of hypoglycemia Haloperidol, metoclopramide - exacerbation of PD symptoms	Rotigotine Transdermal Patch	Consensus Statement[94-96]
Monoamine Oxidase inhibitors	Avoid Parkinson's symptoms	Risk of hypoglycemia	Continue	Indirect adrenergic agents (eg, ephedrine)-contraindicated due to severe HTN Serotoninergic opioids (meperidine, methadone, tramadol)-contraindicated due to risk of serotonin syndrome and opioid toxicity Any narcotic-CNS and respiratory depression Serotonergic antiemetics (ondansetron/dolasetron/palonosetron/granisetron)-serotonin syndrome Atropine, isoproterenol can cause hypertensive crisis	-	Consensus Statement[94-96]
COMT inhibitors ((Entacapone, tocapone)	Avoid Parkinson's symptoms	Associated with hypotension, syncope, delirium, psychosis, dyskinesias, discolored urine Risk of liver injury	Continue	Sympathetic stimulants (epinephrine, norepinephrine, isoproterenol, dobutamine, dopamine)-tachycardia, hypertension, and arrhythmias Concurrent use with warfarin can increase the INR by 13%	-	Consensus Statement[94-96]

7. Medications for Neurologic Diseases: Myasthenia Gravis Medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Formulations/ alternatives	Sources of evidence
Acetylcholin-esterase inhibitors (Pyridostigm-ine and neostigmine)	Avoid reactivating or exacerbating autoimmune diseases	May worsen bradycardia Muscarinic side effects (increased bronchial secretions may worsen bronchospastic disease)	Continue	Succinylcholine-increased duration of action Nondepolarizing neuromuscular blockers-unpredictable or insufficient reversal of due to maximal inhibition of acetylcholinesterase β-blockers-enhanced bradycardic effect	Neostigmine injection	Consensus Statement[94-96]
Azathioprine	Avoid reactivating or exacerbating autoimmune diseases	May cause cytopenias, elevated liver function tests	Continue	No anesthetic interactions	-	Consensus Statement[94-96]
Mycophenol-ate	Avoid reactivating or exacerbating autoimmune diseases	Increased risk of blood dyscrasias, infection	Continue	No anesthetic interactions	-	Consensus Statement[94-96]

7. Medications for Neurologic Diseases: Myasthenia Gravis Medications

Medications	Benefits	Risks	Recommendations	Perioperative medication interactions	Sources of evidence
Cyclosporine	Avoid reactivating or exacerbating autoimmune diseases	Increased risk of infection, hyperkalemia and hypomagnesemia, anemia, nephrotoxicity, and hepatotoxicity	Continue	Nondepolarizing neuromuscular blockers may be potentiated Systemic lidocaine-increased lidocaine toxicity due to decreased clearance Opioids-increased risk of opioid toxicity and respiratory depression Benzodiazepines-increased sedative effects NSAIDs-increased risk of nephrotoxicity	Consensus Statement[94-96]
Tacrolimus	Avoid reactivating or exacerbating autoimmune diseases	Increased risk of infection, hypertension, neurotoxicity, nephrotoxicity, hyperkalemia, QT prolongation, and pure red cell aplasia	Continue	Synergistic effect seen with other drugs that increase QT prolongation (sevoflurane, ondansetron) Fentanyl, tramadol, methadone, diazepam, alprazolam, dexamethasone, lidocaine, omeprazole-increased risk of tacrolimus toxicity (tacrolimus is a CYP3A4 substrate)	Consensus Statement[94-96]
Methotrexate	Avoid reactivating or exacerbating autoimmune diseases	Increased risk of infection, liver, bone marrow toxicity	Continue	No anesthetic interactions	Consensus Statement[94-96]

8、Other Antirheumatic Medications

Medications	Benefits	Risks	Recommendations	Formulations/alternatives	Sources of evidence
Nonsteroidal antiinflammatory drugs (NSAIDs)	Continue using controlled symptoms. Paracetamol can reduce the need for sevoflurane anesthesia, promote anesthesia recovery, and delay the time at which patients require postoperative pain medication.	Increase the bleeding risk perioperatively Renal toxicity Deleterious cardiovascular effects	Discontinued 3 days before surgery Ibuprofen should be discontinued 24 hours before surgery. Non-acetylated NSAIDs (such as diflunisal, magnesium trisalate, and bisalbate) can be continued during the perioperative period.	Intravenous preparations of ketorolac, ibuprofen and acetaminophen	Literatures[130-132]
disease-modifying antirheumatic drug(DMARDs): methotrexate (MTX), leflunomide, hydroxychloroquine, apremilast, and/or sulfasalazine	Aviod a flare-up of disease activity	Increase the risk of infection by affecting the immune response	Continue Patients with severe or recurrent infections or a history of previous infection of artificial joints may discontinued these drugs prior to surgery.	-	Guidelines[128,129]
Biologic DMARDs (Rituximab)	Aviod a flare-up of disease activity	Increased risk of infection	Withhold the biologic medication and plan the elective surgery at the end of the dosing cycle for that specific medication.*	For patients with severe SLE undergoing THA or TKA, continuing belimumab and planning surgery in the last month of the dosing cycle of rituximab.	Guideline[128,129]
Janus kinase inhibitors (Tofacitinib)	Aviod a flare-up of disease activity	Increased risk of infection	Discontinued 3 days before surgery.	-	Guideline[128,129]

9. Antineoplastic Medications

Medications	EMA Recommendations		FDA Recommendations		NMPA Recommendations		Micromedex/Lexicomp Recommendations	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Anlotinib	-	-	-	-	Patients scheduled for major surgery should discontinue the medication.	Should not be restarted until external wound healing is complete	-	-
Apatinib	-	-	-	-	Discontinue 30 days preoperatively.	Avoid the use within 30 days postoperatively .	-	-
Axitinib	Discontinue 24 hours prior to surgery	Should not be restarted until external wound healing is complete	Discontinue 24 hours prior to surgery	Should not be restarted until external wound healing is complete	-	-	Discontinue 48 hours prior to surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.
Cabozantinib	Discontinue 28 days prior to surgery	Should not be restarted until external wound healing is complete	Discontinue 28 days prior to surgery	Should not be restarted until external wound healing is complete	-	-	Discontinue 3 weeks prior to surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively

9. Antineoplastic Medications

Medications	EMA Recommendations		FDA Recommendations		NMPA Recommendations		Micromedex/Lexicomp Recommendations	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Everolimus	-	Should not be restarted until external wound healing is complete	-	-	-	-	Discontinue 1 week before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.
Fruquintinib	-	-	-	-	Patients scheduled for major surgery should discontinue the medication	Should not be restarted until external wound healing is complete	-	-
Ibrutinib	Discontinue 3 -7 days before surgery	Restart 3-7 days after surgery	Discontinue 3 -7 days before surgery	Restart 3-7 days after surgery	-	-	Discontinue 3 -7 days before surgery	Restart 3-7 days after surgery
Nintedanib	-	Restart 4 weeks after major surgery	-	-	-	-	-	Restart 4 weeks after abdominal surgery

9. Antineoplastic Medications

Medications	EMA Recommendations		FDA Recommendations		NMPA Recommendations		Micromedex/Lexicomp Recommendations	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Pazopanib	Discontinue 7 days before surgery	Should not be restarted until external wound healing is complete	Discontinue 7 days before surgery	Should not be restarted until external wound healing is complete	-	-	Discontinue 7 days before surgery	Should not be restarted until external wound healing is complete
Ponatinib	-	-	Discontinue 7 days before major surgery	Should not be restarted until external wound healing is complete	-	-	Discontinue 7 days before surgery	Should not be restarted until external wound healing is complete
Regorafenib	-	Should not be restarted until external wound healing is complete	Discontinue 14 days before surgery	Should not be restarted until external wound healing is complete	-	-	Discontinue 14 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.
Lenvatinib	Discontinue	Should not be restarted until external wound healing is complete	Discontinue 6 days before surgery	Should not be restarted until external wound healing is complete	-	-	Discontinued 1 week before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.

9. Antineoplastic Medications

Medications	EMA Recommendations		FDA Recommendations		NMPA Recommendations		Micromedex/Lexicomp Recommendations	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Sorafenib	Discontinue	Should not be restarted until external wound healing is complete	Discontinue	Should not be restarted until external wound healing is complete	-	-	Discontinue 14 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.
Sunitinib	Discontinue	Should not be restarted until external wound healing is complete	Discontinue	Should not be restarted until external wound healing is complete	-	-	Discontinue 21 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.
Tivozanib	Discontinue	Should not be restarted until external wound healing is complete	Discontinue 24 days before surgery	Should not be restarted until external wound healing is complete	-	-	Discontinue 24 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.
Vandetanib	-	-	Discontinue	Should not be restarted until external wound healing is complete	-	-	Discontinue 30 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.

9. Antineoplastic Medications

Medications	EMA Recommendations		FDA Recommendations		NMPA Recommendations		Micromedex/Lexicomp Recommendations	
	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
Bevacizumab	Discontinue 28 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 28 days postoperatively.	Discontinue 28 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 28 days postoperatively.	-	-	Discontinue 28 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 28 days postoperatively.
Ramucirumab	Discontinue 28 days before surgery	Should not be restarted until external wound healing is complete	Discontinue 28 days before surgery	Should not be restarted until external wound healing is complete, which is typically around 2 weeks postoperatively.	-	-	Discontinue 28 days before surgery	Should not be restarted until external wound healing is complete

03

PART THREE

Cases discussion

Case 1

General Data	Male, 89 years old.
Chief Complaint	He was diagnosed with Parkinson's disease over 20 years ago, presented with rambling speech for 5 months, and aggravated with falls for 20 days.
Physical Examination	Confused and drowsy. Uncooperative during physical examination. Petechiae and ecchymoses are scattered on the skin throughout the body. There is a sigmoid curve in the spine. Muscle tone is elevated in all limbs, with the left lower limb flexed and the left hip joint limited in movement.
Laboratory Data	ACTH(8am) 6.21pg/ml、ACTH(4pm) 20.00pg/ml、ACTH(0am) 27.40pg/ml COR(8am) 14.6nmol/L、COR(4pm) 34.5nmol/L、COR(0am) 43.3nmol/L The hip joint CT shows: a fracture of the left femoral neck.
Diagnosis	1. Metabolic encephalopathy; 2. Type II respiratory failure; 3. Left hip fracture of th neck of the femur; 4. Parkinson's disease; 5. Dementia.
Surgery	Left Total Hip Arthroplasty
Preoperative medication	Pramipexole 0.75mg qd, Levodopa/Benserazide 0.125g tid, Entacapone 0.2g tid, Dexamethasone 0.75mg qd

Continue/discontinue ?

Medications for Parkinson Disease

Medications	Benefits	Risks	Recommendations
Dopamine agonists (bromocriptine, pramipexole, rotigotine)	Avoid Parkinson's symptoms	Risk of postoperative delirium, hypotension, myocardial infarction Risk of delirium, postural hypotension, hypertension, dyskinesia, first degree AVB	**Continue**
Carbidopa/ Levodopa	Avoid Parkinson's symptoms	Orthostatic hypotension can occur after dosing; increased risk of cardiac complications	**Continue**
COMT inhibitors ((Entacapone, tocapone)	Avoid Parkinson's symptoms	Associated with hypotension, syncope, delirium, psychosis, dyskinesias, discolored urine Risk of liver injury	**Continue**

Glucocorticoid

Medications	Recommendations
Glucocorticoid	**Continue chronic corticosteroid treatment before and on the day of surgery.** **Patients receiving longer-term, higher-dose therapy might need supplemental dosing intraoperatively and postoperatively.**

Type of surgery	On the day of the surgery
Medium-sized surgery (such as joint replacement, laparoscopic cholecystectomy, etc.)	**Discontinue oral GCs on the day of surgery**, and administer hydrocortisone 50-75 mg intravenously before anesthesia. Continue to administer 50 mg of hydrocortisone intravenously every 8 hours post-anesthesia for 24 hours.

Case 1

Pharmaceutical advice

- It is recommended to continue using Parkinson's disease medication during the perioperative period.
- The oral GCs was discontinued on the day of surgery, and administer hydrocortisone 50-75 mg intravenously before anesthesia. Continue to administer 50 mg of hydrocortisone intravenously every 8 hours post-anesthesia for 24 hours.

Case 2

General Data	Female, 59 years old. Weight: 65kg
Chief Complaint	She has had a pelvic mass for over a month.
Past History	High blood pressure, atrial fibrillation; had coronary artery stent implantation.
Physical Examination	T. 36.1℃，P. 61次/分，R. 20次/分，BP. 134/85mmHg
Laboratory Data	Cr 89umol/L（CCr 72.1mL/min），AST 18U/L，ALT 29U/L
Diagnosis	1. Pelvic mass; 2. Uterine fibroids.
Surgery	Laparotomy Total Hysterectomy and Bilateral Oophorectomy
Preoperative medication	Nifedipine Controlled-Release Tablets 30mg qd, Irbesartan 150mg qd, Rivaroxaban 15mg qn, Metoprolol Sustained-Release Tablets 23.75mg qd

Continue/discontinue ?

Cardiovascular medications

Medications	Benefits	Risks	Recommendations
β-blockers	Reduce the risk of cardiovascular events and death.	Bradycardia ,hypotension	Continue
ACE inhibitors and angiotensin receptor blockers	Reduce the risk of postoperative hypertension	Hypotension	For the majority, it is advisable to discontinue on the morning of surgery. In cases of uncontrolled hypertension or heart failure, continued use may be necessary.
Calcium channel blockers	Improve the clinical outcomes of patients undergoing cardiac surgery	-	Continue

Assessing bleeding risk

Low/moderate bleeding risk procedures[c] (30-d risk of major bleed 0%-2%)	Arthroscopy Cutaneous/lymph node biopsies Foot/hand surgery Coronary angiography[d] Gastrointestinal endoscopy +/- biopsy Colonoscopy +/- biopsy Abdominal hysterectomy Laparoscopic cholecystectomy Abdominal hernia repair Hemorrhoidal surgery Bronchoscopy +/- biopsy Epidural injections

✓ **Low/moderate bleeding risk**

Assessing thromboembolic risk

Low (<4%/y risk of ATE or <2%/mo risk of VTE)	Bileaflet AVR *without* major risk factors for stroke[b]	$CHADS_2$ score of 0-2 (and no prior stroke or TIA) CHA_2DS_2VASc score of 1-4

✓ The patient has a CHA2DS2-VASc score of 3, indicating that she is at **low risk for thromboembolism.**

Medications affecting hemostasis

Medications	Timing of drug discontinuation prior to surgery	Whether bridging is necessary	Timing of postoperative medication retrieval
Rivaroxaban、Apixaban、Edoxaban	Low bleeding risk：24 hours; High bleeding risk：48 hours;	No	24~48 hours after surgery

Pharmaceutical advice

- **It is recommended that patients continue taking nifedipine controlled-release tablets and metoprolol extended-release tablets, and discontinue taking irbesartan on the day of surgery. After surgery, irbesartan can be restarted based on the patient's blood pressure condition.**

- **It is recommended to stop rivaroxaban 1 day before surgery, without bridging, and to restart rivaroxaban at least 24 hours after surgery based on the patient's condition.**

Case 3

General Data	Male, 17 years old. Weight: 117.9kg
Chief Complaint	He has had an internal fixation for a fracture of the right tibia over a year.
Physical Examination	T. 36.3℃，P. 93次/分，R. 19次/分，BP. 119/77mmHg
Diagnosis	1. Right tibial fracture post-operatively; 2. Bipolar disorder; 3. Schizophrenia.
Surgery	Removal of Internal Fixation Device after Right Tibial Fracture Surgery
Preoperative medication	Escitalopram 20mg qd, Olanzapine 20mg qn, Lithium carbonate 0.25g tid, Valproate sodium 0.5g tid

Continue/discontinue ?

Medications for Psychiatric Diseases

Medications	Recommendations
Citalopram	Continue
Olanzapine	Continue
Lithium	Minor procedures: continue Major procedures: hold for 72 hours before surgery
Valproate sodium	Continue

Pharmaceutical advice

- **It is recommended that patients continue taking Escitalopram, Olanzapine, Lithium carbonate, Valproate sodium.**

Case 3

Postoperative medication	The patient received an analgesic pump (ketorolac tromethamine injection, palonosetron hydrochloride injection, and sufentanil citrate injection)

Medication interactions

① **Escitalopram+ketorolac tromethamine→ Increase the risk of bleeding**

② **Lithium carbonate+ketorolac tromethamine→Lithium toxicity**

③ **Escitalopram+Lithium carbonate+palonosetron hydrochloride+sufentanil citrate→Serotonin syndrome**

Pharmaceutical advice

- **There is no absolute contraindication for the interaction between the oral antipsychotic medication and the analgesic pump medication in this patient. Be sure to monitor for the above adverse reactions.**

04

PART FOUR

Conclusion

Obtain the patient's complete medication history, assess the potential benefits and risks of continuing or discontinuing the medication, whether there may be perioperative medication interactions, and make a cautious decision on whether to continue the medication.

Preoperative

Intraoperative

- ✓ **Monitoring for potential drug interactions during the perioperative period.**
- ✓ **Monitoring for adverse drug reactions.**

Postoperative

- ✓ **Assess the timing of resume for chronic medications.**
- ✓ **Prevent surgical complications.**
- ✓ **Medication review.**
- ✓ **Patient discharge medication education**

Thank You