Medicines Management Team
Pharmacy and Medicines Directorate
Westholme
Woodend Hospital
Queens Road
Aberdeen
AB15 6LS

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Enquiries to: MGPG
Extension: 56689
Direct Line: 01224 556689
Email: gram.mgpg@nhs.scot

Dear Colleagues

This guideline is currently under review by the author.

**Guideline For The Administration Of Medicines In The Peri-Operative Period, Version 3**

This document has been risk assessed by the author and deemed appropriate to be used during this review period. A copy of the risk assessment can be provided on request.

If you have any queries regarding this, please do not hesitate to contact the Medicines Guidelines and Policy Group (MGPG) email at gram.mgpg@nhs.scot

Yours sincerely

**Lesley Coyle**
**Chair of MGPG, NHSG**

NHS Grampian

# Guideline For The Administration Of Medicines In The Peri-Operative Period

| Co-ordinators: | Consultation Group: | Approver: |
|---|---|---|
| Pre-Operative Assessment Pharmacist | See Consultation list | Medicine Guidelines and Policies Group |

| Signature: | | Signature: |
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**Version 3**

**Executive Sign-Off**

**This document has been endorsed by the Director of Pharmacy and Medicines Management**

**Signature:** 

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**Lead Author/Co-ordinator:** Pre-Operative Assessment Pharmacist

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**Process Document: Policy, Protocol, Procedure or Guideline** Guideline

**Document application:** NHS Grampian

**Purpose/description:** This policy is designed to be used by pharmacy, nursing and medical staff at pre-assessment clinics in NHSG, to provide advice on stopping or changing regular medication prior to admission for a surgical procedure or investigation. The advice can also be used to guide medical, pharmacy and nursing staff on surgical wards.

**Responsibilities for implementation:**

**Organisational:** Chief Executive and Management Teams
**Corporate:** Senior Managers
**Departmental:** Heads of Service/Clinical Leads
**Area:** Line Managers
**Hospital/Interface services:** Divisional General Managers and Group Clinical Directors
**Operational Management Unit:** Unit Operational Managers
**Policy statement:** It is the responsibility of all staff to ensure that they are working to the most up to date and relevant policies, protocols procedures.
**Review:** This policy will be reviewed in three years or sooner if current treatment recommendations change

| | |
|---|---|
| **Responsibilities for review of this document:** | Pre-Operative Assessment Pharmacist |
| **Responsibilities for ensuring registration of this document on the NHS Grampian Information/ Document Silo:** | Pharmacist, Pharmacy and Medicines Directorate |
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**Revision History:**

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|---|---|---|---|
| Jan 2019 | May 2014 | Review of Introduction. | Page 4 |
| Jan 2019 | May 2014 | Addition of supporting evidence from UKCPA Handbook of Peri-Operative Medicines. | Multiple sections throughout guideline. |
| Jan 2019 | May 2014 | Consider commencing PPI or $H_2$-receptor antagonist in patients who are using antacids regularly. | 1.1 and 1.2 |
| Jan 2019 | May 2014 | Review of Drugs Affecting the Immune Response advice. | 1.9 |
| Jan 2019 | May 2014 | Addition of Movicol. | 1.10 |
| Jan 2019 | May 2014 | Linaclotide – Avoid in bowel surgery. | 1.11 |
| Jan 2019 | May 2014 | Colestyramine – Avoid on day of surgery. | 1.13 |
| Jan 2019 | May 2014 | Addition of Minoxidil. | 2.8 |
| Jan 2019 | May 2014 | Hydralazine and adrenaline interaction. | 2.8 |
| Jan 2019 | May 2014 | Addition of Alfuzosin. | 2.10 |
| Jan 2019 | May 2014 | Update to alpha blocker advice in cataract surgery after local discussion with Ophthalmology. | 2.10 |

| Revision Date | Previous Revision Date | Summary of Changes (Descriptive summary of the changes made) | Changes Marked* (Identify page numbers and section heading ) |
|---|---|---|---|
| Jan 2019 | May 2014 | Phenoxybenzamine – Discuss pre-operative management with anaesthetist/surgeon. | 2.10 |
| Jan 2019 | May 2014 | Addition of Lacidipine, Lercanidipine and Nicardipine. | 2.14 |
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| Jan 2019 | May 2014 | Removal of section.<br>2.8.1 Parenteral anticoagulant drugs. | 2.8.1 |
| Jan 2019 | May 2014 | Removal of section.<br>2.8.2 Oral anticoagulant drugs. | 2.8.2 |
| Jan 2019 | May 2014 | Removal of section.<br>2.9 Antiplatelet drugs. | 2.9 |
| Jan 2019 | May 2014 | Addition of Fluvastatin, Pravastatin and Rosuvastatin. | 2.17 |
| Jan 2019 | May 2014 | Addition of Ezetimibe. | 2.17 |
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| Jan 2019 | May 2014 | Addition of Zaleplon and Zolpidem. | 4.1 |
| Jan 2019 | May 2014 | Addition of Alprazolam, Clobazam, Clonazepam, Flurazepam, Loprazolam, Lormetazepam, Midazolam and Oxazepam. | 4.2 |
| Jan 2019 | May 2014 | Diazepam and Ketamine interaction. | 4.2 |
| Jan 2019 | May 2014 | Diazepam and Bupivacaine interaction. | 4.2 |
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| Jan 2019 | May 2014 | Addition of Clomipramine and Imipramine. | 4.5 |
| Jan 2019 | May 2014 | Review of Monoamine-Oxidase Inhibitors (MAOIs) advice. | 4.6 |
| Jan 2019 | May 2014 | Addition of Escitalopram, Fluvoxamine and Paroxetine. | 4.7 |
| Jan 2019 | May 2014 | SSRIs and Methylthioninium Chloride (Methylene Blue) interaction. | 4.7 |
| Jan 2019 | May 2014 | Addition of Madopar®, Madopar CR®, Sinemet®, Sinemet CR®, Half-Sinemet CR® and Stalevo®. | 4.17 |
| Jan 2019 | May 2014 | Removal of Ropinirole. | 4.17 |
| Jan 2019 | May 2014 | Levodopa and Metoclopramide and Prochlorperazine interaction. | 4.17 |
| Jan 2019 | May 2014 | Considerations to reduce risk from a NBM period. | 4.17 |
| Jan 2019 | May 2014 | Creation of new section.<br>4.18 Dopaminergic drugs – Dopamine agonists | 4.18 |
| Jan 2019 | May 2014 | Addition of Pramipexole, Ropinirole and Rotigotine. | 4.18 |
| Jan 2019 | May 2014 | Addition of Stalevo®. | 4.20 |
| Jan 2019 | May 2014 | Considerations to reduce risk from a NBM period. | 4.20 |
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| Jan 2019 | May 2014 | Removal of section.<br>6.1.1.2 Insulins (Twice daily dosing). | 6.1.1.2 |
| Jan 2019 | May 2014 | Removal of section.<br>6.1.1.2 Insulins (Long acting). | 6.1.1.2 |
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| Jan 2019 | May 2014 | Removal of section.<br>6.1.2.2 Biguanides. | 6.1.2.2 |
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| Jan 2019 | May 2014 | Review of Bisphosphonates advice. | 6.6 |
| Jan 2019 | May 2014 | Addition of Indoramin, Prazosin and Terazosin. | 7.3 |
| Jan 2019 | May 2014 | Update to alpha blocker advice in cataract surgery after local discussion with Ophthalmology. | 7.3 |
| Jan 2019 | May 2014 | Addition of Bethanechol. | 7.3 |
| Jan 2019 | May 2014 | Addition of Fesoterodine. | 7.4 |
| Jan 2019 | May 2014 | Review of Immunosuppressants advice. | 8.2 |
| Jan 2019 | May 2014 | Review of Rituximab advice. | 8.3 |
| Jan 2019 | May 2014 | Review of Drugs Which Suppress the Rheumatic Disease Process advice. | 10.2 |
| Jan 2019 | May 2014 | Addition of Leflunomide. | 10.2 |

*Changes marked should detail the section(s) of the document that have been amended, i.e. page number and section heading.

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NHS Grampian

## Introduction

Many patients presenting for surgery will be taking medication for the management of medical conditions unrelated to their need for surgical intervention. Many medicines can be continued safely peri-operatively but some medicines can interact with drugs used during anaesthesia or cause potentially fatal complications during surgery. However, the decision to discontinue these medicines pre-operatively can cause exacerbation of the underlying medical condition or precipitate an acute withdrawal syndrome. Therefore, decisions around which medicines to withhold pre-operatively and which to continue must be undertaken on an individual patient basis, with careful consideration of the planned surgical procedure and the indications for the medication.

These decisions should ideally be made in the Pre-Operative Assessment Clinic, to allow medication advice to be provided to the patient in sufficient time before their surgery, as some medicines must be stopped a number of days or weeks prior to a surgical procedure.

**The following is intended as a guide to indicate which medicines should preferably be continued and which should ideally be withheld (and when) prior to surgery.**

**It is NOT a protocol and where there is any doubt about the management of a medicine in the peri-operative period, advice can be sought from the Pre-Operative Assessment Pharmacist in Aberdeen Royal Infirmary (bleep 3715).**

This guideline is based on the most up to date evidence-base available for each medicine. Where there is little or no information regarding a particular medicine, information from the manufacturer has been sought or commonly accepted practice has been adopted.

For medicines that are to be continued peri-operatively, they can be given orally with sips of water. If a patient takes a large number of medicines each day then there is a need to prioritise which tablets are required to be given. It may be that some medicines will be suitable to withhold for a short period until the patient is on a greater fluid intake.

After major surgery, patients may be unable to take medication orally for a prolonged period of time. Continuation of routine medication is important and may require administration via an alternative route or the patient switched to an alternative agent with similar action.

**Care should be taken when changing to alternative formulations or routes of the same drug, particularly INTRAVENOUS TO ORAL as dosage can vary.**

**Contact your ward pharmacist or Medicines Information for guidance on the administration of medication in the post-operative period.**

## Objective of Guidance

The aim of this guidance is to provide evidence-based advice on which medicines should be continued and which drugs should be withheld, and when, during the peri-operative period.

## Section 1: Gastrointestinal System

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 1.1 Antacids and simeticone | Aluminium Hydroxide Magnesium hydroxide (Maalox®, Asilone®) | Oral | May lead to aspiration in a fasting patient if given immediately prior to surgery. | Avoid in patients fasting prior to surgery.<br><br>Consider commencing PPI or $H_2$-receptor antagonist in patients who are using antacids regularly. | Over the counter antacids, for example, Rennie®, Setlers® etc. should also be avoided. |
| 1.2 Compound alginates and proprietary indigestion preparations | Gaviscon® Gaviscon Advance® Gastrocote® Peptac® | Oral | May lead to aspiration in a fasting patient if given immediately prior to surgery. | Avoid in patients fasting prior to surgery.<br><br>Consider commencing PPI or $H_2$-receptor antagonist in patients who are using antacids regularly. | Over the counter antacids, for example, Rennie®, Setlers® etc. should also be avoided. |
| 1.3 Antispasmodics and other drugs altering gut motility | Dicycloverine Mebeverine Hyoscine butylbromide | Oral | Contraindicated in paralytic ileus.[1] | Continue unless surgery involves risk of ileus, e.g. bowel surgery. | |
| 1.4 $H_2$-receptor antagonists | Ranitidine Famotidine Cimetidine Nizatidine | Oral | Cessation or omission of dose may worsen control of gastric acid, leading to potential for duodenal and gastric ulcers, functional dyspepsia, symptomatic GORD and increase risk of peri-operative gastric aspiration.[120] | Continue; ensure dose is given on morning of surgery.<br><br>Can be used pre-operatively to reduce gastric acid secretions, reduce risk of gastric pneumonitis and prevent stress-ulcer bleeding.[120]<br><br>In critically ill patients, $H_2$-receptor antagonists are more effective than proton pump inhibitors at lowering gastrointestinal bleeding.[120] | In poorly controlled acid reflux the dose may be increased on day of surgery on advice of anaesthetist. |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | May mask symptoms of gastric cancer.[120] | Ranitidine may be given by slow intravenous (IV) injection if patient is nil by mouth post operatively.<br><br>Avoid for 2 weeks prior to investigations for gastric cancers and *Helicobacter Pylori* or in patients who are undergoing endoscopic procedures.[120] | |
| 1.5 Chelates and complexes | Sucralfate<br>De-nol® | Oral | Use sucralfate with caution in patients on enteral feeds or with reduced gastric emptying as increased risk of bezoar formation.[1] | Preferably withhold sucralfate in surgery with increased risk of reduced gastric emptying or if patient is likely to need enteral feeds (withhold until eating normally). | |
| 1.6 Proton pump inhibitors | Omeprazole<br>Lansoprazole<br>Esomeprazole<br>Pantoprazole<br>Rabeprazole | Oral | Cessation or omission of dose may worsen control of gastric acid, leading to potential for duodenal and gastric ulcers, functional dyspepsia, symptomatic GORD and increase risk of peri-operative aspiration.[120]<br><br>May mask symptoms of gastric cancer.[120]<br><br>May need a reduced dose in liver impairment and following liver resection. | Continue; ensure dose is given on morning of surgery.<br><br>Can be used pre-operatively to reduce gastric acid secretions, reduce risk of gastric pneumonitis and prevent stress-ulcer bleeding.[120]<br><br>Omeprazole may be given by intravenous (IV) injection if patient is nil by mouth post operatively.<br><br>Avoid for 2 weeks prior to investigations for gastric cancers and *Helicobacter Pylori* or in patients who are undergoing endoscopic procedures.[120] | In patients with uncontrolled reflux, the BNF advises omeprazole 40mg orally the evening prior to surgery and 40mg 2-6 hours before surgery.[1] |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 1.7 Adsorbents and bulk forming drugs | Loperamide<br>Co-phenotrope | Oral | Contraindicated in ileus.[1]<br><br>Use with caution in patients prescribed opiates or ondansetron post operatively as may worsen constipation. | Continue in patients with ongoing diarrhoea, monitor regularly for constipation.<br><br>Avoid in bowel surgery. | Stop in patients with normal bowel motions, particularly those on opiates or ondansetron post operatively. |
| 1.8 Aminosalicylates | Mesalazine<br>Sulfasalazine<br>Olsalazine | Oral | Increased risk of blood dyscrasias post operatively.<br><br>May worsen condition if doses missed. | Continue; ensure dose is given on morning of surgery.<br><br>Monitor FBC. | |
| 1.9 Drugs affecting the immune response | Azathioprine<br>Ciclosporin<br>Mercaptopurine<br>Methotrexate<br>Adalimumab<br>Infliximab | Oral / SC / IV | Risk of worsening of condition if doses missed.<br><br>**Azathioprine**<br><br>Patients may be more susceptible to infections or develop more severe infections. [120]<br><br>**Methotrexate**<br><br>Several studies relating to patients with RA undergoing elective orthopaedic surgery have found no increase in the risk of post-operative infection or complications with continued methotrexate therapy. [73] [120] | **Azathioprine**<br><br>Continue.<br><br>Discontinue post-operatively if patient develops a significant systemic infection. [120]<br><br>**Methotrexate**<br><br>Methotrexate for the treatment of rheumatoid arthritis should not be routinely interrupted. However, decisions should be made on an individual basis taking into consideration other risk factors, including concomitant DMARDs and the procedure being undertaken. [120] | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | One large study found that the risk of post-operative infection following orthopaedic surgery was not increased when any of the conventional disease-modifying antirheumatic drugs (DMARDs) were being taken as monotherapy for RA. However, the risk of infection was significantly increased when more than one DMARD (or DMARD plus biologic agent or steroid) was being taken. [120]<br><br>Evidence for the peri-operative safety of methotrexate prescribed for other indications is unfortunately limited. [120]<br><br>**Mercaptopurine**<br><br>Mercaptopurine has not been shown to increase early post-operative complications. [120]<br><br>**Ciclosporin**<br><br>May increase risk of post-operative infection and renal toxicity, however, there is no evidence to support the need to discontinue therapy before or immediately after surgery. [120] | The decision to interrupt treatment requires balancing the risk of disease flare with the risk of infection. [120]<br><br>Consider impact of any concomitant DMARD and/or corticosteroid treatment for RA and the risk associated with disease flare if treatment interrupted. [120]<br><br>Close attention should be paid to peri-operative renal function, particularly in older patients, as dehydration and renal impairment may increase the risk of subsequent infection. [120]<br><br>Consider withholding methotrexate if post-operative infection occurs. [75]<br><br>**Mercaptopurine**<br><br>Continue.<br><br>As immunosuppressive therapy, consider stopping post-operatively if patient develops a significant systemic infection. [120]<br><br>**Ciclosporin**<br><br>Continue.<br><br>Carefully observe patient for deterioration of renal function and opportunistic infections in the peri-operative period. [120] | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | Discontinuation peri-operatively may cause ulcerative colitis flare. [120] | Monitoring of ciclosporin levels may be warranted. [120]<br><br>Avoid concomitant administration of NSAIDs due to the increased risk of nephrotoxicity. [120] | |
| 1.10 Laxatives | Laxido®<br>Movicol®<br>Lactulose<br>Senna<br>Docusate<br>Fybogel® | Oral | Some oral preparations require to be made up in water. Fluid intake is undesirable immediately prior to surgery due to the risk of aspiration. | Consider withholding Laxido and Fybogel on morning of surgery due to the fluid quantities required to administer.<br><br>Consider withholding as bowel prep plan may be in place prior to surgery. | |
| 1.11 Other drugs used in constipation | Linaclotide | Oral | Contraindicated in intestinal perforation or bowel obstruction and inflammatory diseases of the gastro-intestinal ( GI ) tract.[1] | Avoid in bowel surgery. | |
| 1.12 Management of anal fissure | Glyceryl trinitrate (GTN) ointment | Topical | Absorption of GTN ointment may potentiate side effects such as headache and hypotension. | Avoid on day of surgery. | |
| 1.13 Bile acid sequestrants | Colestyramine | Oral | Colestyramine must be made up in water therefore risk of aspiration if given on day of surgery. | Avoid on day of surgery. | |

## Section 2: Cardiovascular System

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 2.1 Cardiac Glycosides | Digoxin | Oral | Risk of arrhythmias, embolism, cardiac failure and poor tissue healing if omitted.<br><br>Good history of safe use for atrial fibrillation and congestive cardiac failure peri-operatively [2] | Continue. [2]<br><br>Ensure dose is given on morning of surgery. | |
| 2.2 Thiazide diuretics<br><br>2.3 Loop Diuretics | Indapamide<br>Bendroflumethiazide<br><br>Furosemide<br>Bumetanide | Oral | May cause hypokalaemia (correct pre-operatively if necessary) [2] [3] [4]<br><br>May cause hypokalaemia (correct pre-operatively if necessary) [2] [3] [4] | Continue. [2] [3] [4]<br><br>Ensure dose is given on morning of surgery.<br><br>Continue. [2] [3] [4]<br><br>Ensure dose is given on morning of surgery. | |
| 2.4 Potassium sparing diuretics,<br><br>Aldosterone antagonists<br><br>2.5 Potassium sparing diuretics with other diuretics | Spironolactone<br>Amiloride<br><br>Eplerenone<br><br>Co-amilofruse<br>Co-amilozide<br>Navispare® | Oral | Tissue damage and reduced kidney perfusion in immediate post-operative period may lead to hyperkalaemia (but no clear evidence) [3] [4] | Consider withholding dose on morning of surgery. [3] [4] | |
| 2.6 Anti-arrhythmic Drugs | Amiodarone<br>Flecainide<br>Dronedarone | Oral | Risk of arrhythmias greater than detrimental effects of continuing drug through surgery. [3]<br><br>Can prolong duration of action of non-depolarising neuromuscular blockers. [3] | Continue. [2] [3] [4] [5] [6]<br><br>Ensure dose is given on morning of surgery | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | Amiodarone – Risk of atropine resistant bradycardia, hypotension and pro-arrhythmic effect. More recent data suggests safe for use. Impractical to discontinue due to long half-life. [2] [3] [5] [6] | | |
| 2.7 Adrenoceptor blocking drugs | Atenolol<br>Metoprolol<br>Bisoprolol<br>Sotalol<br>Propranolol<br>Carvedilol | Oral | Patients at risk of coronary artery disease have substantially reduced mortality and cardiovascular events following discharge after non-cardiac surgery if beta blockers are continued. [8]<br><br>Beta blockers may counteract tachycardia and increased BP provoked by surgery and anaesthesia in patients with hypertension. [3]<br><br>Abrupt withdrawal may cause side-effects which may not manifest until 12-72 hours after discontinuation and may increase morbidity and mortality. [2] [5] [6]<br><br>Continuation of beta blockers is associated with a more stable haemodynamic profile, reduced incidence of arrhythmias, myocardial ischaemia and MI. [6]<br><br>Beta blockers may reduce the risk of major peri-operative cardiovascular events but increase the risk of bradycardia and hypotension needing treatment. [9] [10]<br>Increased risk of CVA if patients are over-treated with beta blockers or commenced on a beta blocker immediately prior to operation. [11] | Continue. [2] [3] [4] [5] [6] [7] [8] [9]<br><br>Ensure dose is given on morning of surgery<br><br>Consider reducing dose if patient is hypotensive or bradycardic. | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 2.8 Vasodilator antihypertensive drugs | Hydralazine<br><br>Minoxidil | Oral | No specific issues noted with hydralazine. [120]<br><br>Minoxidil can cause marked sodium and water retention which is important to consider peri-operatively. [120] However, the available evidence supports continuation of treatment. [120] | Continue. [4] [7] [120]<br><br>Ensure dose is given on morning of surgery.<br><br>Ensure electrolytes and fluid balance are monitored closely in patients taking minoxidil. [120] | In the intra-operative period, if patients managed with hydralazine exhibit hypotension, adrenaline should not be used owing to the potential for tachycardia to occur with concurrent hydralazine and adrenaline use. [120] |
| 2.9 Centrally acting antihypertensive drugs | Clonidine<br>Methyldopa<br>Moxonidine | Oral | Risk of severe rebound hypertension if clonidine is withdrawn suddenly. [2] [6]<br>Avoid abrupt withdrawal.[12] | Continue. [2] [4] [6] [7]<br><br>Ensure dose is given on morning of surgery. | |
| 2.10 Alpha Blockers | Alfuzosin<br>Doxazosin<br>Indoramin<br>Prazosin<br>Terazosin<br><br>Phenoxybenzamine | Oral<br><br>Oral | May cause intra-operative floppy iris syndrome. [1] [13] [120]<br><br>Patients may be at risk of hypertension if stopped. [120]<br><br>Patients may be at risk of acute urinary retention if stopped. [120]<br><br>Irreversible non-selective alpha blocker. Half-life 24 hours. | Continue, ensure dose is given on morning of surgery. [4] [7]<br><br>Recommended in literature to discontinue 1-2 weeks prior to cataract surgery due to risk of intra-operative floppy iris syndrome. [13] [120] However, due to risk of hypertension and symptoms of benign prostate hyperplasia when stopped, it has been decided locally, following discussions with Ophthalmology, that alpha blockers are to be continued as normal.<br><br>Discuss pre-operative management with anaesthetist/surgeon. | See also BNF section 7.3. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 2.11 ACE Inhibitors | Enalapril<br>Ramipril<br>Lisinopril<br>Perindopril | Oral | May intensify hypotensive effect of anaesthetics which may be less responsive to vasopressors. [2] [3] [5] [6] [14] [15] | Consider continuation if prescribed for cardiac failure. [7]<br>Consider reducing the dose if patient is persistently hypotensive. | |
| 2.12 Angiotensin receptor antagonists | Candesartan<br>Irbesartan<br>Losartan<br>Valsartan | Oral | Requirement for ephedrine to maintain BP more frequent when ACEI continued. [15]<br><br>Increased risk of renal impairment, especially if patient is dehydrated, hypotensive or being given other nephrotoxic drugs. [7]<br><br>Withholding doses may worsen control in patients with cardiac failure. | Consider omitting morning dose and or prior evening dose if prescribed for hypertension. [2] [5] [6] [7]<br><br>Consider withholding post operatively if patient is dehydrated, hypotensive or has been given nephrotoxic drugs (e.g. gentamicin). | |
| 2.13 Nitrates | Isosorbide<br>Mononitrate | Oral | Potential risk of Acute coronary syndrome (ACS) / worsening angina if stopped. [3] [7] | Continue. [3]<br><br>Ensure dose given on day of surgery. | |
| 2.14 Calcium Channel Blockers | Amlodipine<br>Felodipine<br>Lacidipine<br>Lercanidipine<br>Nicardipine<br>Nifedipine<br>Nimodipine<br>Diltiazem<br>Verapamil | Oral | Continuation is recommended for control of hypertension and angina, haemodynamic stability and reduction of ischaemic burden and to avoid withdrawal syndromes. [3] [4] [6] [7] [120]<br><br>Withdrawal may cause rebound hypertension and coronary vasospasm leading to an exacerbation of angina. [120] | Continue. [2] [3] [4] [5] [6] [7] [120]<br><br>Ensure dose given on day of surgery. | Verapamil may cause constipation.<br>Consider laxatives in patients on Verapamil and opioids and / or ondansetron post op as increased risk of constipation. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | Withdrawal may increase rate in patients treated for atrial fibrillation (AF).<br><br>May reduce cardiovascular morbidity and mortality in non-cardiac surgery. [9]<br><br>**Caution in severe left ventricular dysfunction (LVEF <40%).** [2] [5] [120] | Continue with caution if ejection fraction is below 40%. [120] Consider risks / benefits to withholding morning dose. | **Swallowing difficulties/enteral feeding considerations with modified release (MR) preparations:**<br><br>• Nifedipine – may cause rebound hypotension if switched to immediate release preparation. Use of immediate release preparations may also be associated with large variations in blood pressure and reflex tachycardia which can cause myocardial and cerebrovascular ischaemia. Switch to amlodipine. [120]<br>• Felodipine is only available as MR preparation so cannot be crushed. Switch to amlodipine. [120] |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 2.15 Other anti-anginal drugs | Nicorandil<br>Ivabradine<br>Ranolazine | Oral | Potential risk of ACS / worsening angina if stopped. [3] [7] | Continue. [3]<br><br>Ensure dose given on day of surgery. | |
| 2.16 Peripheral vasodilators and related drugs | Naftidrofuryl<br><br>Cilostazol | Oral | No known issues with naftidrofuryl.<br><br>Increased surgical bleeding risk with cilostazol. [18] | Continue naftidrofuryl.<br><br>If a patient is to undergo elective surgery and anti-platelet effect is not necessary, cilostazol should be stopped 5 days prior to surgery. [18] | |
| 2.17 Lipid regulating drugs | Atorvastatin<br>Fluvastatin<br>Pravastatin<br>Simvastatin<br>Rosuvastatin<br><br>Bezafibrate<br><br>Ezetimibe<br><br><br><br>Colestyramine | Oral | Statins have a plaque stabilising effect and therefore may be beneficial in preventing peri-operative myocardial infarction. [2] [120]<br><br>Statins may also reduce the inflammatory response to surgery. [2] [120]<br><br>Statin withdrawal has been associated with an increased risk of post-operative troponin release, myocardial infarction and cardiovascular death, compared with statin continuation. [16] [120]<br><br>Colestyramine requires to be made up in water. Fluid intake is undesirable immediately prior to surgery due to the risk of aspiration. | Statin therapy should be continued throughout the peri-operative period. [2] [9] [16] [120]<br><br>Continue bezafibrate.<br><br>Continue ezetimibe.<br><br><br><br>Avoid colestyramine on day of surgery. | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 2.18 Sympathomimetics | Midodrine | Oral | Concomitant treatment with sympathomimetics and other vasoconstrictive substances may cause a pronounced increase in blood pressure.[122]<br><br>Slowing of heart rate may occur after midodrine administration due to vagal reflex.[122] Caution is advised when midodrine is used concomitantly with agents that directly or indirectly reduce heart rate.[122] | Continue but advise anaesthetist of potential interactions. | |

## Section 3: Respiratory System

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 3.1 Selective Beta$_2$ agonists | Salbutamol<br>Salmeterol<br>Terbutaline | Inhaled | Worsening of Asthma / Chronic Obstructive Pulmonary Disease (COPD) if regular treatment discontinued. | Patients using regular long acting beta2 agonist therapy should continue up until and including the morning of surgery.<br><br>If patient is unable to use regular inhalers containing long acting beta$_2$ agonists or has poorly controlled asthma/COPD, consider using spacer device with inhaler.<br>Alternatively regular or as required nebulised salbutamol. | Long acting beta$_2$ agonists are often combined with steroids in inhalers. E.g. Seretide® or Symbicort®.<br><br>Monitor potassium peri-operatively. |
| 3.2 Antimuscarinic bronchodilators | Tiotropium<br>Ipratropium | Inhaled | Worsening of COPD if regular treatment discontinued | If patient is unable to use inhaler, consider switching to regular nebulised ipratropium. | Tiotropium and ipratropium should not be administered together due to risk of urinary retention. |
| 3.3 Theophylline | Nuelin SA®<br>Uniphyllin Continus®<br>Slo-Phyllin®<br><br>Aminophylline | Oral | Withdrawal of treatment may exacerbate asthma / COPD | Continue.<br><br>Ensure dose is given on morning of surgery<br><br>Consider aminophylline infusion in patients nil by mouth. Monitor levels closely. | Theophylline has a narrow therapeutic range and must be monitored closely. Avoid giving interacting medicines where possible |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 3.4 Corticosteroids (inhaled) | Beclometasone<br>Fluticasone<br>Budesonide | Inhaled | Withdrawal of treatment may exacerbate asthma / COPD | Patients using inhaled steroid therapy should continue up until and including the morning of surgery.<br><br>High dose (≥500microgram beclometasone, >750microgram fluticasone) may need extra cover - see Appendix 1 | Long acting beta$_2$ agonists are often combined with steroids in inhalers. E.g. Seretide® or Symbicort®.<br><br>Appendix 1 – Management of patients on long term corticosteroid treatment in the Peri-Operative period |
| 3.5 Leukotriene Receptor Antagonist | Montelukast | Oral | Withdrawal of treatment may exacerbate asthma / COPD | Continue.<br><br>Ensure doses are given as prescribed up until and including morning of surgery. | |
| 3.6 Antihistamines | Cetirizine<br>Loratadine<br>Chlorphenamine<br>Hydroxyzine<br>Fexofenadine | Oral | Patients may be on regular treatment to control allergies or skin complaints.<br><br>Withdrawal may exacerbate these conditions. | Continue<br><br>Ensure doses are given as prescribed up until and including morning of surgery. | |

## Section 4: Central Nervous System

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.1 Hypnotics | Nitrazepam<br>Temazepam<br>Zaleplon<br>Zolpidem<br>Zopiclone | Oral | Continuation of benzodiazepines and benzodiazepine-like drugs during surgery is associated with increased sedation and risk of cumulative CNS depression as they provide an additive effect when co-administered with drugs which depress the central nervous system, such as anaesthetics. [120] Benzodiazepines can cause respiratory depression and have an additive effect on neuromuscular blocking agents. [120]<br><br>However, some benzodiazepines are licensed as premedication or induction agents for anaesthesia, therefore anaesthetists are trained in the use of benzodiazepines in combination with anaesthetics and other peri-operative sedative medicines and will adjust the dose of these drugs accordingly. [120]<br><br>Sudden discontinuation of benzodiazepines and benzodiazepine-like drugs is associated with withdrawal symptoms including anxiety, confusion, toxic psychosis, convulsions, delirium and rebound effects. [120]<br><br>Withdrawal symptoms from zolpidem and zopiclone are unlikely if treatment duration has been less than 4 weeks. [120] | Continue. [120]<br><br>Benzodiazepine and benzodiazepine-like drugs for night sedation can be safely administered the evening before surgery. [120]<br><br>Ensure anaesthetist is aware of type and dose of benzodiazepine the patient usually takes so, if necessary, they can adjust anaesthetic accordingly. [120]<br><br>Patients who are discharged on the day of surgery after having received an anaesthetic and who usually take benzodiazepines/benzodiazepine-like drugs should be advised of the potential of enhanced drowsiness and psychomotor effects. [120] | Consider parenteral benzodiazepines if nil by mouth (NBM) and patient experiences withdrawal. |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.2 Anxiolytics | Alprazolam<br>Chlordiazepoxide<br>Clobazam<br>Clonazepam<br>Diazepam<br>Flurazepam<br>Loprazolam<br>Lorazepam<br>Lormetazepam<br>Midazolam<br>Oxazepam | Oral | Continuation of benzodiazepines and benzodiazepine-like drugs during surgery is associated with increased sedation and risk of cumulative CNS depression as they provide an additive effect when co-administered with drugs which depress the central nervous system, such as anaesthetics. [120] Benzodiazepines can cause respiratory depression and have an additive effect on neuromuscular blocking agents. [120]<br><br>However, some benzodiazepines are licensed as premedication or induction agents for anaesthesia, therefore anaesthetists are trained in the use of benzodiazepines in combination with anaesthetics and other peri-operative sedative medicines and will adjust the dose of these drugs accordingly. [120]<br><br>Sudden discontinuation of benzodiazepines and benzodiazepine-like drugs is associated with withdrawal symptoms including anxiety, confusion, toxic psychosis, convulsions, delirium and rebound effects. [120]<br><br>Withdrawal symptoms can occur within a day after stopping short-acting benzodiazepines, such as alprazolam, lorazepam, lormetazepam, oxazepam and temazepam. [120] | Continue. [120]<br><br>Ensure doses are given as prescribed up until and including morning of surgery.<br><br>Ensure anaesthetist is aware of type and dose of benzodiazepine the patient usually takes so, if necessary, they can adjust anaesthetic accordingly. [120]<br><br>Patients who are discharged on the day of surgery after having received an anaesthetic and who usually take benzodiazepines/benzodiazepine-like drugs should be advised of the potential of enhanced drowsiness and psychomotor effects. [120] | Consider parenteral benzodiazepines if nil by mouth (NBM) and patient experiences withdrawal. |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | If a benzodiazepine is used for control of epilepsy, it must not be suddenly discontinued without putting an alternative treatment plan in place. [120]<br><br>Discontinuation of benzodiazepines in psychiatric patients with panic disorders should be avoided. [120]<br><br>Premedication with diazepam can lead to prolonged effects of ketamine and to reduced haemodynamic effects of ketamine. [120] Diazepam has also been reported to increase plasma levels of bupivacaine. [120]<br><br>Intravenous fentanyl has been shown to reduce metabolism of midazolam. [120] | | |
| 4.3 Antipsychotics | 1st generation<br>Haloperidol<br>Chlorpromazine<br><br>2nd generation<br>Olanzapine<br>Risperidone | Oral | Risk of extra-pyramidal symptoms during surgery but psychiatric disturbances if omitted. [2 7]<br><br>Can cause ECG changes, including prolonged QT interval. [25]<br><br>Risk of arrhythmias or hypotension preoperatively.<br><br>Long term therapy with major tranquilisers may prolong sedation, reduce seizure threshold and reduce anaesthetic requirements. [2 4 6] | Continue. [4 6 7 25]<br><br>Ensure doses are given as prescribed up until and including morning of surgery.<br><br>Unclear with first generation antipsychotics. [2] | Ensure preventative measures for VTE taken. [37] |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | Clozapine | Oral | Risk of extra-pyramidal symptoms , psychiatric disturbances if omitted [7] Discontinuation may cause severe withdrawal phenomena and disease relapse. [2] [25]<br><br>May cause hypotension. [2]<br><br>Risk of gastrointestinal hypo motility and life threatening bowel obstruction. [35] [39]<br><br>Contraindicated in paralytic ileus. [40] Increased risk of VTE. [37] | Check white cell count prior to surgery.<br><br>Consult Psychiatrist for advice on management of patients on clozapine. [2]<br><br>Withhold 12 hours before surgery.<br><br>Restart 12 hours after surgery if vital signs are stable. | May counteract the effects of adrenaline and noradrenaline. [40]<br><br>Increased risk of circulatory relapse with benzodiazepines. [40]<br><br>****Note****<br>**If omitted for 48 hours or longer then clozapine must be restarted at a low dose and titrated up to therapeutic level.** [40] |
| 4.4 Drugs used for mania and hypomania | Lithium (Priadel ® Camcolit®) | Oral | Lithium direct effects cause hazardous risks in surgery, especially when haemodynamic instabilities occur and renal excretion becomes impeded.<br><br>Prolongs the action of depolarising and non-depolarising muscle relaxants. However, this is not considered a sufficient reason to discontinue peri-operatively.<br><br>**Renal failure can precipitate or exacerbate lithium toxicity.** | Ideally continue unless risks outweigh benefits. [2] [6]<br><br>**Minor surgery** – Continue. [25]<br><br>**Major surgery** – Discuss with Psychiatrist. If discontinuation is required, stop 24-72 hours before surgery. Restart when haemodynamically stable and when U&Es in normal range and patient is able and allowed to drink. Check lithium level after 1 week. [4] | Lithium has a narrow therapeutic index.<br><br>Toxicity would be expected at levels over 1.5mmol/L (although can occur below this).<br><br>Emergency treatment of poisoning where levels are above 2mmol/L. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | **Hyponatraemia can precipitate or exacerbate lithium toxicity.**<br><br>No withdrawal effects from Lithium. If being withdrawn completely a gradual reduction will reduce risk of relapse. | **Monitoring of lithium levels is recommended peri-operatively in:**<br>• Renal impairment<br>• Significant concurrent disease<br>• Concurrent infection<br>• Significant change in sodium intake<br>• Significant change in fluid intake<br>• Treatment with drugs altering renal clearance of lithium<br>• Treatment with drugs likely to upset electrolyte balance. Patients experiencing polydipsia. | |
| 4.5 Tricyclic and related antidepressant drugs (TCA) | Amitriptyline<br>Clomipramine<br>Imipramine<br>Nortriptyline<br>Trazodone<br>Dosulepin | Oral | Withdrawal may exacerbate depression and cause withdrawal symptoms (see below). [7] [25] [26]<br><br>May increase risk of cardiac arrhythmias when pro-arrhythmic drugs are used peri-operatively, even in patients on long term therapeutic doses. [5]<br><br>Blocks uptake of noradrenaline. Cases of vasodilatation and hypotension resistant to phenylephrine, ephedrine and dopamine but responsive to large doses of noradrenaline reported. [5]<br><br>TCAs have a long half-life. Effects of therapy may continue for up to a week after cessation. [5] [6] | Should not be stopped unless there is a clear clinical reason. [2] [5] [6] [25] [26] [120]<br><br>Continue treatment throughout the peri-operative period. [2] [120]<br><br>Use safe anaesthetic technique.<br><br>Noradrenaline should be considered the vasopressor of choice in TCA related hypotension. [5] | If withdrawing treatment, drug must be withdrawn gradually. After courses of less than 8 weeks, reduce over 1-2 weeks. After courses of 6-8 months, reduce over 6-8 weeks. Reduce by a quarter of the treatment dose every 4-6 weeks if even more gradual withdrawal is required. [26] |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.6 Monoamine-oxidase inhibitors (MAOIs) | Irreversible MAOIs:<br>Phenelzine<br>Isocarboxazid<br>Tranylcypromine<br><br>Reversible MAOIs:<br>Moclobemide | Oral | MAOIs act by inhibition of the metabolic breakdown of noradrenaline and serotonin by the monoamine-oxidase enzyme. [120] Therefore the level of both these agents is increased at the receptor site. [120]<br><br>This leads to the following potential problems that increase the risks associated with surgery:<br><br>- Serotonin syndrome (SS) – a drug-induced condition that results from toxic levels of serotonin.<br><br>- Hypertensive crisis – potentially fatal and results from drug interactions causing massive release of stored noradrenaline. [2] [120]<br><br>**<u>Anaesthesia</u>**<br><br>**General anaesthesia**<br><br>With proper monitoring, certain general anaesthesia can be given safely with MAOIs, although occasional reactions have been reported. [120]<br><br>Inhalational anaesthetics (e.g. enflurane, isoflurane, nitrous oxide) are all safe in the presence of MAOIs. [120] | **Anaesthetist must be informed that patient is being treated with an MAOI.** [120]<br><br>**Use MAOI-safe anaesthetic technique.** [120] It is widely considered unnecessary to discontinue MAOIs before elective surgery if MAOI-safe anaesthesia is used. [5] [6]<br><br>**Avoid:**<br><br>- **Indirect-acting sympathomimetics**<br>- **Suxamethonium**<br>- **Pethidine, tramadol, ketamine and nefopam** [120]<br><br>If unable to use safe technique:<br><br>Discontinue irreversible MAOIs two weeks before surgery. [120] **This must be done in liaison with patient's psychiatrist and anaesthetist.** [120]<br><br>Stop reversible MAOIs 24 hours before surgery. [25]<br><br>There is the potential to switch patients on an irreversible MAOI to reversible MAOI two weeks before surgery which can then be stopped 24 hours before surgery. [120] **Again, this must be done in liaison with patient's psychiatrist.** [120]<br><br>Do not stop for local anaesthesia. [2] [4] [6] | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.7 Selective serotonin reuptake inhibitors (SSRIs) | Citalopram<br>Escitalopram<br>Fluoxetine<br>Fluvoxamine<br>Paroxetine<br>Sertraline | Oral | Withdrawal may exacerbate depression and lead to withdrawal symptoms including dizziness, sensory disturbances, sleep disturbances, agitation/anxiety, nausea/vomiting, tremor, confusion, sweating, headache, palpitations, emotional instability, irritability and visual disturbances. [120] Withdrawal symptoms may begin 24-72 hours after stopping drug and last as long as 1-2 weeks or more. [5 7 25 26] In some patients they may be severe and/or prolonged (2-3 months). [120] Abrupt withdrawal should be avoided. [120]<br><br>There have been reports of prolonged bleeding time and/or bleeding abnormalities with SSRIs. [120] Caution is therefore advised in patients taking SSRIs concomitantly with other drugs known to affect platelet function, e.g. antiplatelets, anticoagulants and NSAIDs. [25 120]<br><br>Risk of rare but potentially fatal serotonin syndrome (increased serotonin levels in the brain stem and spinal cord) if serotonergic antidepressants co-administered with other serotonergic drugs such as tramadol, oxycodone, fentanyl, pethidine, pentazocine, dextromethorphan. [4 25 30 31 120] The patient should be monitored closely and the possibility of serotonin toxicity should be considered in patients experiencing altered mental state, autonomic dysfunction and neuromuscular adverse effects. [120] | Should not be stopped unless there is a clear clinical reason. [2 5 25 26 120]<br><br>Continue treatment throughout the peri-operative period. [2 120] Ensure dose given on morning of surgery.<br><br>Use a serotonin free anaesthetic technique. [2 5 25 26]<br><br>If high dosage therapy is stopped, restart at a reduced dosage then gradually increase. [5] | If withdrawing treatment, drug must be withdrawn gradually. After courses of less than 8 weeks, reduce over 1-2 weeks. After courses of 6-8 months, reduce over 6-8 weeks. Reduce by a quarter of the treatment dose every 4-6 weeks if even more gradual withdrawal is required. [26]<br><br>Reinstating therapy at high doses may precipitate serotonin syndrome. [5] |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | Suggested diagnostic criteria include the presence of at least three of the following features: agitation, tremor, mental state changes (e.g. confusion, hypomania), myoclonus, hyperreflexia, fever, shivering, diarrhoea, diaphoresis, and in coordination. [31]<br><br>There have been case reports that describe serotonergic symptoms in patients given methylthioninium chloride (methylene blue) who are also taking a serotonergic antidepressant. [120] The MHRA advise that concomitant use of methylthioninium and drugs that enhance serotonergic transmission should be avoided. [120] However, if administration is necessary, the lowest possible dose should be used and the patient monitored for signs of CNS toxicity for up to 4 hours after administration. [120]<br><br>Tramadol can cause seizures and serotonergic antidepressants can reduce seizure threshold, therefore there is an increased risk of seizures in patients taking these drugs concomitantly. [120]<br><br>May cause hyponatraemia, address this pre-operatively [5] | | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.8 Serotonin and noradrenaline reuptake inhibitors (SNRIs) and other antidepressants | Mirtazapine<br>Venlafaxine<br>Duloxetine | Oral | Withdrawal may exacerbate depression and lead to withdrawal symptoms including dizziness, sensory disturbances, sleep disturbances, agitation/anxiety, nausea/vomiting, tremor, confusion, sweating, headache, palpitations, emotional instability, irritability and visual disturbances. [120] Withdrawal symptoms may begin 24-72 hours after stopping drug and last as long as 1-2 weeks or more. [5 7 25 26] In some patients they may be severe and/or prolonged (2-3 months). [120] Abrupt withdrawal should be avoided. [120]<br><br>Risk of rare but potentially fatal serotonin syndrome (increased serotonin levels in the brain stem and spinal cord) if serotonergic antidepressants co-administered with other serotonergic drugs such as tramadol, oxycodone, fentanyl, pethidine, pentazocine, dextromethorphan. [4 25 30 31 120] The patient should be monitored closely and the possibility of serotonin toxicity should be considered in patients experiencing altered mental state, autonomic dysfunction and neuromuscular adverse effects. [120]<br><br>Suggested diagnostic criteria include the presence of at least three of the following features: agitation, tremor, mental state changes (e.g. confusion, hypomania), myoclonus, hyperreflexia, fever, shivering, diarrhoea, diaphoresis, and in coordination. [31] | Should not be stopped unless there is a clear clinical reason. [2 5 25 26 120]<br><br>Continue treatment throughout the peri-operative period. [2 120] Ensure dose given on morning of surgery.<br><br>Use a serotonin free anaesthetic technique. [2 5 25 26]<br><br>If high dosage therapy is stopped, restart at a reduced dosage then gradually increase. [5] | Duloxetine is also used in the treatment of stress incontinence.<br><br>If withdrawing treatment, drug must be withdrawn gradually. After courses of less than 8 weeks, reduce over 1-2 weeks. After courses of 6-8 months, reduce over 6-8 weeks. Reduce by a quarter of the treatment dose every 4-6 weeks if even more gradual withdrawal is required. [26]<br><br>Reinstating therapy at high doses may precipitate serotonin syndrome. [5] |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | There have been case reports that describe serotonergic symptoms in patients given methylthioninium chloride (methylene blue) who are also taking a serotonergic antidepressant. [120] The MHRA advise that concomitant use of methylthioninium and drugs that enhance serotonergic transmission should be avoided. [120] However, if administration is necessary, the lowest possible dose should be used and the patient monitored for signs of CNS toxicity for up to 4 hours after administration. [120]<br><br>Tramadol can cause seizures and serotonergic antidepressants can reduce seizure threshold, therefore there is an increased risk of seizures in patients taking these drugs concomitantly. [120]<br><br>May cause hyponatraemia, address this pre-operatively [5] | | |
| 4.9 CNS stimulants | Atomoxetine<br>Dexamphetamine<br>Methylphenidate | Oral | Discontinuation may precipitate ADHD symptoms [27]<br><br>No withdrawal symptoms [27]<br><br>Risk of sudden blood pressure increase during surgery where halogenated anaesthetics used. [28]<br><br>Withdrawal may unmask severe depression. [28]<br><br>Serious adverse events, including sudden death, have been reported in concomitant use with clonidine. | Avoid methylphenidate on day of surgery [28]<br><br>Continue following surgery. | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.10 Anti-obesity drugs acting on the gastro-intestinal tract | Orlistat® | Oral | Can cause diarrhoea whilst patients are eating fatty meals (should be less of a problem in fasted patients). | Consider withholding dose on morning of surgery and day after surgery if patient has been experiencing diarrhoea. | Consider stopping where patient is having bowel surgery. |
| 4.11 Drugs used in nausea and vertigo | Cinnarizine<br>Cyclizine<br>Prochlorperazine<br>Domperidone<br>Metoclopramide<br>Ondansetron | Oral | No specific issues<br><br>Increased gastric motility with domperidone / metoclopramide.<br><br>Constipation with ondansetron. | Continue. | |
| 4.12 Non opioid analgesics | Paracetamol | Oral<br>IV | Risk of liver damage in underweight patients. [29]<br><br>Reduce frequency of administration in patients with renal failure. [29]<br><br>Reduce dose for patients with additional risk factors for hepatotoxicity (hepatocellular insufficiency, chronic alcoholism, chronic malnutrition, dehydration). [29] | Continue.<br><br>Reduce dose in underweight patients or children. [29]<br><br>Reduce frequency to a maximum of every six hours in patients with creatinine clearance less than 30mLs/min. [29]<br><br>Reduce maximum daily dose to 3g in those patients over 50kg with risk factors for hepatotoxicity. [29] | Check patient's weight on admission and amend dose appropriately for patients with low weight. |
| 4.13 Opioid analgesics | Dihydrocodeine<br>Tramadol<br>Morphine<br>Oxycodone | Oral | Tramadol lowers seizure threshold in patients with epilepsy.<br><br>Increased risk of serotonin syndrome if tramadol given with other serotonergic drugs. | Continue.<br><br>Give dose on morning of surgery. | Avoid tramadol in patients with a history of epilepsy and patients on SSRIs. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.14 Neuropathic pain | Amitriptyline<br>Nortriptyline<br>Gabapentin<br>Pregabalin | Oral | Amitriptyline - see section 4.5<br><br>No specific issues with gabapentin or Pregabalin. | Continue gabapentin and pregabalin. Give dose on morning of surgery | |
| 4.15 Antimigraine drugs | Sumatriptan<br>Rizatriptan<br>Pizotifen | Oral | Withdrawal of pizotifen may increase likelihood of migraine.<br><br>Nothing specific issues with for triptans. | Continue pizotifen prophylaxis prior to surgery.<br><br>Could give sumatriptan or rizatriptan to treat migraine on day of surgery. | Do not use aspirin in the treatment of migraine immediately prior to surgery. |
| 4.16 Antiepileptic drugs | Carbamazepine<br>Sodium valproate<br>Phenytoin<br>Lamotrigine<br>Phenobarbital | Oral | Abrupt withdrawal, particularly of benzodiazepines and barbiturates can precipitate severe rebound seizures, hypoxia and aspiration pneumonia [1] [2] [7]<br><br>Cardiac monitoring advised for IV Phenytoin [4]<br><br>May be a reduced requirement for general anaesthetic agents. [6]<br><br>Withdrawal syndromes associated with some agents [6] | Continue [2] [4] [6]<br>Ensure dose given on morning of surgery.<br><br>Consider different formulations if patient is nil by mouth | Appendix 2 – Alternative routes and dose adjustments for patients on antiepileptic medication |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.17 Dopaminergic drugs - Levodopa | Co-beneldopa (Madopar®, Madopar CR®)<br><br>Co-careldopa (Sinemet®, Sinemet CR®, Half-Sinemet CR®)<br><br>Levodopa + Carbidopa + Entacapone (Stalevo®) | Oral | Parkinson's disease patients are high risk surgical patients due to their increased risk of aspiration pneumonia and post-operative respiratory failure. [120]<br><br>Delaying or missing any doses in the peri-operative period can have a significant impact on the patient's disease management. [120]<br><br>Stopping any levodopa-containing antiparkinsonian preparations abruptly may precipitate neuroleptic malignant-like syndrome. [120] This can present with symptoms such as hyperpyrexia, rigidity, psychological abnormalities, confusion, rhabdomyolysis and can be fatal. [120] Patients taking large doses of levodopa are most at risk of development of neuroleptic malignant-like syndrome. [120]<br><br>Levodopa has a relatively short half-life (1.5 hours) and administration delays or missed doses can quickly cause immobility and pulmonary complications. [2 6 7 120]<br><br>There is a risk of blood pressure fluctuations and arrhythmias when levodopa therapies are continued peri-operatively. [4 120] Additionally, the following side effects can occur: agitation, anxiety, hallucination, confusion, dyskinesia, nausea, vomiting, diarrhoea and restless legs syndrome. [120] | Continue [2 4 6 7 120]<br><br>Ensure dose given on morning of surgery.<br><br>It is advisable to place Parkinson's disease patients first on the scheduled operating list. [120] This allows greater predictability towards operation time thus allowing the nil by mouth (NBM) period to be minimised. [120]<br><br>Maintain levodopa regimen as per the patient's normal treatment regimen and continue as close to the operation as possible, up to the point of anaesthetic induction. [120]<br><br>In post-operative nausea or vomiting, avoid metoclopramide and prochlorperazine.<br><br>Restart levodopa therapy as soon as possible post-operatively. [120]<br><br>If absorption likely to be impaired by vomiting or post-operative ileus or in surgery requiring a prolonged NBM period, advice should be obtained from Parkinson's disease specialist. [120] | Following surgery, different formulation options such as liquids or dispersible tablets may be appropriate. Contact ward pharmacist or Medicines Information for advice.<br><br>In patients who are NBM, contact Parkinson's disease specialist. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | However, the risk of worsening of Parkinson's disease symptoms from stopping therapy in the peri-operative period is greater than the risk of side effects from continuing therapy. [120]<br><br>Anti-emetics that antagonise central dopamine receptors, such as metoclopramide and prochlorperazine, should be avoided as they will exacerbate Parkinson's disease symptoms. [4] [120] | | |
| 4.18 Dopaminergic drugs – Dopamine agonists | Pramipexole<br>Ropinirole<br>Rotigotine | Oral | The half-life of dopamine agonists is variable. [120] Delayed administration or missing doses of dopamine agonists for longer than 6-12 hours may significantly worsen a patient's symptoms. [120] Risks associated include aspiration, speech problems, dysphagia and falls. [120] Rarely, neuroleptic malignant syndrome or related withdrawal syndromes may also occur. [120] These complications can cause significant patient distress and are potentially fatal. [120] | Continue [120]<br><br>Ensure dose given on morning of surgery.<br><br>It is advisable to place Parkinson's disease patients first on the scheduled operating list. [120] This allows greater predictability towards operation time thus allowing the nil by mouth (NBM) period to be minimised. [120] | Following surgery, different formulation options such as liquids or dispersible tablets may be appropriate. Contact ward pharmacist or Medicines Information for advice. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | Direct stimulation of dopamine receptors can cause a theoretical risk of peri-operative arrhythmias and postural hypotension. [120] The following adverse effects are also possible: nausea/vomiting, hallucinations, impulse control disorder and confusion. [120]<br><br>However, the risk of worsening of Parkinson's disease symptoms from stopping therapy in the peri-operative period is greater than the risk of side effects from continuing therapy. [120]<br><br>Anti-emetics that antagonise central dopamine receptors, such as metoclopramide and prochlorperazine, should be avoided as they will exacerbate Parkinson's disease symptoms. [4] [120] | Maintain dosing regimen as per the patient's normal treatment regimen and continue as close to the operation as possible, up to the point of anaesthetic induction. [120]<br><br>In post-operative nausea or vomiting, avoid metoclopramide and prochlorperazine.<br><br>Restart therapy as soon as possible post-operatively. [120]<br><br>If absorption likely to be impaired by vomiting or post-operative ileus or in surgery requiring a prolonged NBM period, conversion of the patient to a rotigotine patch may be appropriate but advice should be obtained from Parkinson's disease specialist. [120]<br><br>Patients prescribed and established on transdermal rotigotine patches should have these left in situ throughout the peri-operative period. [120] | In patients who are NBM, contact Parkinson's disease specialist. |
| 4.19 Monoamine oxidase (MAOI) B inhibitors | Selegiline<br>Rasagiline | Oral | MAOI-type drugs contraindicated with sympathomimetic and serotonergic drugs. [32] [120]<br><br>Avoid abrupt withdrawal due to the risk of neuroleptic malignant like syndrome. [1] [33]<br><br>**See section 4.6.** | Continue but use MAOI-safe anaesthetic technique.<br><br>**See section 4.6.** | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.20 Catechol-O-methyltransferase inhibitors | Entacapone<br>Tolcapone<br><br>Levodopa + Carbidopa + Entacapone (Stalevo®) | Oral | Omitted doses of COMT-inhibitors will reduce the effectiveness of prescribed levodopa preparations and therefore increase the risk of 'end-of-dose' motor fluctuations. [120]<br><br>Abrupt withdrawal of combination products of a COMT-inhibitor with levodopa (e.g. Stalevo®) may lead to an increase in Parkinson's disease symptoms or precipitate withdrawal syndromes which have been associated with fatalities, e.g. neuroleptic malignant-like syndrome.[1] [120]<br><br>Omitted doses of COMT-inhibitor and levodopa combination products may increase the risk of complications associated with Parkinson's disease, e.g. motor instability leading to falls, respiratory complications and dysphagia. [120]<br><br>COMT-inhibitors may potentiate the action of other drugs metabolised by COMT, e.g. adrenaline, noradrenaline. [120] | Continue [120]<br><br>Ensure dose given on morning of surgery.<br><br>It is advisable to place Parkinson's disease patients first on the scheduled operating list. [120] This allows greater predictability towards operation time thus allowing the nil by mouth (NBM) period to be minimised. [120]<br><br>Maintain dosing regimen as per the patient's normal treatment regimen and continue as close to the operation as possible, up to the point of anaesthetic induction. [120]<br><br>Restart therapy as soon as possible post-operatively. [120]<br><br>If absorption likely to be impaired by vomiting or post-operative ileus or in surgery requiring a prolonged NBM period, advice should be obtained from Parkinson's disease specialist. [120] | Following surgery, different formulation options such as liquids or dispersible tablets may be appropriate. Contact ward pharmacist or Medicines Information for advice.<br><br>In patients who are NBM, contact Parkinson's disease specialist. |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 4.21 Antimuscarinic drugs used in parkinsonism | Procyclidine<br>Orphenadrine | Oral | Risk of symptoms of drug induced Parkinsonism returning if stopped. | Continue | Reminder – patients may also be on Depot antipsychotics. Please check before discontinuing these drugs.<br><br>Avoid antimuscarinic drugs in bowel obstruction and post-operative urinary retention.[1] |
| 4.22 Drugs used in alcohol dependence | Acamprosate<br>Disulfiram | Oral | Disulfiram may prolong effect of benzodiazepines and opiates.[1] | Continue | Do not prescribe oral medicines containing alcohol, e.g. ranitidine liquid, oral morphine liquid |
| 4.23 Nicotine dependence | Bupropion<br>Nicotine replacement<br>Varenicline | Oral / topical | No specific issues<br><br>Discontinuation of NRT may cause nicotine withdrawal. | Continue | |
| 4.24 Opioid dependence | Methadone<br>Buprenorphine<br>Naltrexone | Oral | Continue methadone; also give adequate analgesia post operatively. [3][4]<br><br>Methadone patients may need increased anaesthetic doses.<br><br>Naloxone may cause opiate withdrawal symptoms. [4] | Continue methadone and buprenorphine [4]<br><br>Ensure dose given on morning of surgery | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | Naltrexone is an opiate antagonist; concomitant administration with opiates is not advisable due to increased likelihood of life-threatening opiate toxicity. [35] [36] | Opioid analgesia required for patients on naltrexone, larger doses than usual may be required and the patients must be closely monitored for signs of opiate toxicity. [35]<br>Consider using paracetamol and NSAIDs as first line therapy. | |
| 4.25 Drugs for dementia | Donepezil<br>Rivastigmine<br>Galantamine | Oral / Patch | Due to their mechanism of action, anticholinesterases may exaggerate succinylcholine type muscle relaxation during anaesthesia. [120] Additive effects should be expected if given with other anticholinesterases such as neostigmine, cholinergic drugs such as pilocarpine and neuromuscular blockers such as suxamethonium. [120]<br><br>Consideration should be given to the type of anaesthesia that will be used. [120] Some types of anaesthesia (e.g. regional anaesthesia) do not involve the use of muscle relaxants which removes the issue of potential interactions. [120]<br><br>Donepezil has an elimination half-life of 70 hours. [120] In order to completely deplete body stores of donepezil, therapy would need to be discontinued at least three weeks before surgery. [120] Stopping donepezil for this period of time may lead to loss of cognitive function which is only partially regained when therapy is resumed. [120] Donepezil should therefore not be stopped unless there is a clear clinical reason. [120] | For rivastigmine and galantamine, consider discontinuation if prolonged neuromuscular block is likely to present a problem, otherwise continue. [4] [41] [42] [44] [45] [46] [47] [49] [50]<br><br>Rivastigmine – omit evening dose the day before surgery and morning dose on the day of surgery. [48]<br><br>Galantamine – discontinue 1-2 days prior to surgery. [41] [43] [50]<br><br>For donepezil, alert anaesthetist that there is the potential of prolonged neuromuscular blockade. [120] If donepezil must be stopped, withdraw 2-3 weeks prior to planned surgery. [41] [42] [49] [120] | If rivastigmine is interrupted for more than several days, it should be re-initiated at 1.5mg twice daily and titrated up. [44]<br><br>If galantamine treatment is substantially interrupted, consider re-titrating dose. [50]<br><br>Galantamine not recommended for patients recovering from bladder or bowel surgery or with GI obstruction. [50] |

## Section 5: Infections

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 5.1 Antibacterial drugs | Rifampicin | Oral | Rifampicin reduces plasma concentration of midazolam. [51]<br><br>Orally administered midazolam is ineffective during rifampicin treatment. [51] | May require increased doses of midazolam or use alternative benzodiazepine for patients on rifampicin. | |
| | Linezolid | | Linezolid is a weak monoamine-oxidase inhibitor, therefore may have similar drug interactions peri-operatively to MAOI antidepressants (see section 4.6). [52] | Use MAOI-safe anaesthetic technique for patients taking linezolid (see section 4.6). | |
| | Erythromycin | | Erythromycin reduced clearance of intravenously administered midazolam by 54%. [53]<br><br>Hepatic enzyme inducing drugs may increase the metabolism of isoflurane. | Prescription of midazolam for patients receiving erythromycin should be avoided or the dose of midazolam should be reduced by 50% to 75%. [53] | |
| | Isoniazid | | Administration of isoniazid in human patients may increase the metabolism of enflurane and increase serum fluoride ion concentrations to levels that may transiently impair renal function. [54] | Continue isoniazid with caution. | |
| 5.2 Antifungal drugs | Fluconazole<br>Itraconazole | Oral | No known issues. | Continue. | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 5.3 Antiviral drugs | HIV medications<br>Aciclovir<br>Ganciclovir<br>Valganciclovir | Oral/IV | Midazolam interacts with protease inhibitors - increased risk of respiratory depression. [2]<br><br>Potential adverse effects of drug withdrawal include drug resistance and worsening of condition. [7] | Continue HIV therapy. [2] [7]<br><br>Protease inhibitors interact with midazolam – avoid. | |

## Section 6: Endocrine System

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 6.1 Thyroid Hormones | Levothyroxine<br>Liothyronine | Oral | Due to long half-life of levothyroxine, a missed dose is unlikely to have a clinical effect. [2] | Continue. [2] | |
| 6.2 Antithyroid drugs | Carbimazole<br>Propylthiouracil | Oral | Risk of arrhythmias if discontinued | Continue. | |
| 6.3 Corticosteroids | Prednisolone<br>Dexamethasone<br>Hydrocortisone<br>Fludrocortisone | Oral / IV/ Inhaled | Risk of addisonian crisis if long term steroids stopped suddenly.<br><br>Risk of deterioration of condition if steroids stopped. | See Appendix 1.<br><br>**Patients on long term steroids must be given doses promptly. If steroid is not in stock, it must be obtained urgently.** | Appendix 1 – Management of patients on long term corticosteroid treatment in the Peri-Operative period |
| 6.4 Oestrogens and Hormone Replacement Therapy (HRT) | See current BNF | Oral / Topical | Risk of recurrence of menopausal symptoms if HRT stopped. [58]<br><br>Likely to increase risk of post-operative VTE, but not well quantified [58]<br><br>VTE risk still increased up to 90 days post-surgery [2] [4] | Minor surgery:<br><br>Continue HRT, thromboprophylaxis not necessary. [58]<br><br>Major surgery:<br><br>Continue HRT, but with thromboprophylaxis [58]<br><br>In major surgery with prolonged immobility, consider discontinuation 4 weeks prior to surgery. [2] [4] | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | | Stop raloxifene at least 1 week pre-operatively for moderate to major surgery. [2] | |
| 6.5 Male sex hormones and antagonists | Testosterone<br>Finasteride<br>Dutasteride<br>Cyproterone | Oral / Topical / IM | Cyproterone may increase risk of thromboembolism. | Continue.<br><br>Consider thromboprophylaxis for patients on cyproterone. [59] | |
| 6.6 Bisphosphonates | Alendronate<br>Risedronate<br>Ibandronic Acid<br>Strontium | Oral | Must be taken with large volume of water therefore will not be suitable for fasted patient on day of surgery.<br><br>Strontium associated with increased risk of VTE. [62] | If weekly bisphosphonate tablet is due on the day of surgery, it should be taken the day before or the day after surgery instead. [60] [61]<br><br>Ensure adequate thromboprophylaxis used for patients on strontium. [62] | |

## Section 7: Obstetrics, Gynaecology & Urinary Tract

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 7.1 Combined Oral Contraceptives (COCs)s) | Microgynon®<br>Logynon®<br>Marvelon®<br>Cilest®<br>Ovranette®<br>Evra® patches<br>NuvaRing® | Oral | Estimated 3-4 fold increased risk of VTE peri-operatively if continued (risk same for newer COCs). [58] [70]<br><br>Risk of unplanned pregnancy if stopped. [58] | Major surgery (and leg surgery), prolonged immobilisation, smoker, over 35 years of age:<br><br>Consider risks and either continue, but with thromboprophylaxis or change to different form of contraception, either non-hormonal contraception or progestogen-only pill four weeks prior to surgery and for two weeks after surgery. [58] [117]<br><br>Minor surgery:<br><br>Consider thromboprophylaxis. [58] | |
| 7.2 Progestogen Only Contraceptives (POPs) | Cerazette®<br>Femulen®<br>Noriday®<br>Micronor®<br>Depo-Provera® Injection<br>Nexplanon®<br>Intra-uterine system – Mirena® | Oral | No evidence of increased VTE risk. [58] | No need to discontinue during surgery. [58] | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 7.3 Drugs for urinary retention | Alfuzosin<br>Doxazosin<br>Indoramin<br>Prazosin<br>Tamsulosin<br>Terazosin | Oral | May cause intra-operative floppy iris syndrome. [1] [13] [120]<br><br>Patients may be at risk of hypertension if stopped. [120]<br><br>Patients may be at risk of acute urinary retention if stopped. [120] | Continue, ensure dose is given on morning of surgery. [4] [7]<br><br>Recommended in literature to discontinue 1-2 weeks prior to cataract surgery due to risk of intra-operative floppy iris syndrome. [13] [120] However, due to risk of hypertension and symptoms of benign prostate hyperplasia when stopped, it has been decided locally, following discussions with Ophthalmology, that alpha blockers are to be continued as normal. | See also section 2.10. |
| | Bethanechol | Oral | Mimics effects of acetylcholine therefore will prolong action of depolarising neuromuscular blockers (e.g. suxamethonium) and antagonise non-depolarising neuromuscular blockers.[121] | Continue, but advise anaesthetist of drug interaction(s). | |
| 7.4 Drugs for urinary frequency, enuresis and incontinence | Oxybutynin<br>Solifenacin<br>Tolterodine<br>Fesoterodine | Oral | Contraindicated in paralytic ileus<br><br>Contraindicated in patients with bladder outflow obstruction (may precipitate retention) [63] [64] [65] | Continue, but use with caution in bowel surgery. | May contribute to post-operative confusion and constipation. |

## Section 8: Malignant Disease

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 8.1 Cytotoxic drugs | Various | | | Patient specific | Contact oncology/ haematology for advice |
| 8.2 Immunosuppressants | Azathioprine<br>Ciclosporin<br>Mercaptopurine<br>Methotrexate<br>Mycophenolate<br>Tacrolimus | Oral/IV | Risk of relapse in condition if doses omitted.<br><br>May be used following organ transplantation, risk of rejection if doses missed.<br><br>Risk of more severe post-op infections in immunosuppressed patients.<br><br>**Azathioprine**<br><br>Patients may be more susceptible to infections or develop more severe infections. [120]<br><br>**Methotrexate**<br><br>Several studies relating to patients with RA undergoing elective orthopaedic surgery have found no increase in the risk of post-operative infection or complications with continued methotrexate therapy. [73] [120] | **When prescribed for prevention of organ transplant rejection, immunosuppressant therapy must be continued peri-operatively. Ensure no doses missed. Alternative formulations should be used in patients who are nil by mouth.** [4] **Seek advice from specialist.**<br><br>For all other indications:<br><br>**Azathioprine**<br><br>Continue.<br><br>Discontinue post-operatively if patient develops a significant systemic infection. [120]<br><br>**Methotrexate**<br><br>Methotrexate for the treatment of rheumatoid arthritis should not be routinely interrupted. However, decisions should be made on an individual basis taking into consideration other risk factors, including concomitant DMARDs and the procedure being undertaken. [120] | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | One large study found that the risk of post-operative infection following orthopaedic surgery was not increased when any of the conventional disease-modifying antirheumatic drugs (DMARDs) were being taken as monotherapy for RA. However the risk of infection was significantly increased when more than one DMARD (or DMARD plus biologic agent or steroid) was being taken. [120]<br><br>Evidence for the peri-operative safety of methotrexate prescribed for other indications is unfortunately limited. [120]<br><br>**Mercaptopurine**<br><br>Mercaptopurine has not been shown to increase early post-operative complications. [120]<br><br>**Ciclosporin**<br><br>May increase risk of post-operative infection and renal toxicity, however, there is no evidence to support the need to discontinue therapy before or immediately after surgery. [120] | The decision to interrupt treatment requires balancing the risk of disease flare with the risk of infection. [120]<br><br>Consider impact of any concomitant DMARD and/or corticosteroid treatment for RA and the risk associated with disease flare if treatment interrupted. [120]<br><br>Close attention should be paid to peri-operative renal function, particularly in older patients, as dehydration and renal impairment may increase the risk of subsequent infection. [120]<br><br>Consider withholding methotrexate if post-operative infection occurs. [75]<br><br>**Mercaptopurine**<br><br>Continue.<br><br>As immunosuppressive therapy, consider stopping post-operatively if patient develops a significant systemic infection. [120]<br><br>**Ciclosporin**<br><br>Continue.<br><br>Carefully observe patient for deterioration of renal function and opportunistic infections in the peri-operative period. [120] | |

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 8.3 Monoclonal Antibodies | Rituximab | IV | Risk of worsening of condition if doses missed.<br><br>Patients may be more susceptible to infections or develop more severe infections. [67] [68] | Delay surgery until 3 months after last rituximab infusion. | |
| 8.4 Other immunomodulating drugs | Interferon<br>Thalidomide<br>Lenalidomide | IV / Oral | Risk of relapse in condition if doses omitted.<br><br>Increased risk of VTE for patients on lenalidomide or thalidomide. [69] [70] [71] | Continue.<br><br>Ensure thromboprophylaxis used. | |
| 8.5 Hormone antagonists | Anastrozole<br>Letrozole<br>Tamoxifen | Oral | Increased VTE risk (40% of these cases occurred within 3 months of surgery or following immobility). [72] | Treatment for breast cancer - continue treatment (unless risk clearly outweighs risk of interrupting treatment).<br><br>Patient should receive appropriate thromboprophylaxis measures. [2] [72]<br><br>In treatment of anovulatory infertility or if long term immobility expected post-operatively, stop tamoxifen 6 weeks before surgery and restart only when patient is fully mobile. | |

## Section 9: Nutrition and Blood

| Drug Group/Class | Drug Examples | Route | Risk/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 9.1 Calcium Supplements | Calcichew®<br>Calcichew D3 Forte®<br>Calfovit®<br>Adcal D3® | Oral | Some preparations dissolved in water.<br><br>Absorption may be delayed. | | |
| 9.2 Phosphate binding agents | Lanthanum<br>Aluminium<br>Sevelamer | Oral | Absorption may be delayed. | Avoid if patient fasted. | |

## Section 10: Musculoskeletal & Joint Diseases

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 10.1 Non-steroidal anti-inflammatory drugs | Ibuprofen<br>Diclofenac<br>Naproxen<br>Celecoxib<br>Mefenamic acid<br>Meloxicam | Oral | May increase peri-operative bleed risk if continued.<br><br>May compromise pain control if discontinued. May also reduce peri-operative requirements for anaesthesia and analgesics. [6]<br><br>Discontinuation of NSAID monotherapy is rarely indicated. [2]<br><br>Widely published evidence for use with regional anaesthesia. [6] | Continue if low bleed risk (including regional anaesthesia).<br><br>If discontinuation is required:<br><br>• Long acting NSAIDs – stop 3 days before surgery. [4]<br><br>• Short acting NSAIDs – stop 1 day before surgery. [4] | |
| 10.2 Drugs which suppress the rheumatic disease process | Azathioprine<br>Ciclosporin<br>Hydroxychloroquine<br>Leflunomide<br>Methotrexate<br>Penicillamine<br>Sulfasalazine | Oral / SC | May exacerbate condition if doses missed. Withholding for 4 weeks or more was associated with rheumatoid arthritis flare. [74]<br><br>Active rheumatoid arthritis is associated with an increased risk of post-operative complications, including infection, and may compromise participation in rehabilitation. [120]<br><br>**Azathioprine**<br><br>Patients may be more susceptible to infections or develop more severe infections. [120] | The decision to interrupt immunosuppressant therapy must be made on an individual patient basis, balancing the risk of disease flare with the risk of infection. [120]<br><br>**Azathioprine**<br><br>Continue.<br><br>Discontinue post-operatively if patient develops a significant systemic infection. [120] | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | **Methotrexate**<br><br>Several studies relating to patients with RA undergoing elective orthopaedic surgery have found no increase in the risk of post-operative infection or complications with continued methotrexate therapy. [73] [120]<br><br>One large study found that the risk of post-operative infection following orthopaedic surgery was not increased when any of the conventional disease-modifying antirheumatic drugs (DMARDs) were being taken as monotherapy for RA. However the risk of infection was significantly increased when more than one DMARD (or DMARD plus biologic agent or steroid) was being taken. [120]<br><br>Evidence for the peri-operative safety of methotrexate prescribed for other indications is unfortunately limited. [120]<br><br>**Hydroxychloroquine**<br><br>No association with increased risk of post-operative infection or wound healing complications. [120] | **Methotrexate**<br><br>Methotrexate for the treatment of rheumatoid arthritis should not be routinely interrupted. However, decisions should be made on an individual basis taking into consideration other risk factors, including concomitant DMARDs and the procedure being undertaken. [120]<br><br>The decision to interrupt treatment requires balancing the risk of disease flare with the risk of infection. [120]<br><br>Consider impact of any concomitant DMARD and/or corticosteroid treatment for RA and the risk associated with disease flare if treatment interrupted. [120]<br><br>Close attention should be paid to peri-operative renal function, particularly in older patients, as dehydration and renal impairment may increase the risk of subsequent infection. [120]<br><br>Consider withholding methotrexate if post-operative infection occurs. [75]<br><br>**Hydroxychloroquine**<br><br>Continue. | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| | | | **Ciclosporin**<br><br>May increase risk of post-operative infection and renal toxicity, however, there is no evidence to support the need to discontinue therapy before or immediately after surgery. [120]<br><br>Discontinuation peri-operatively may cause rheumatoid arthritis flare. [120]<br><br>**Leflunomide**<br><br>There is limited and conflicting data relating to peri-operative risk of leflunomide. [120]<br><br>Patients taking leflunomide may be at increased risk of infection and infections may be more severe in nature. [77] [120]<br><br>Leflunomide has a long half-life (approximately 2 weeks). [120] | **Ciclosporin**<br><br>Continue.<br><br>Carefully observe patient for deterioration of renal function and opportunistic infections in the peri-operative period. [120]<br><br>Monitoring of ciclosporin levels may be warranted. [120]<br><br>Avoid concomitant administration of NSAIDs due to the increased risk of nephrotoxicity. [120]<br><br>**Leflunomide**<br><br>Consider interruption of therapy for procedures carrying an increased risk of infection. [120]<br><br>Stop leflunomide in severe post-operative infection. [77] [120]<br><br>See product literature for washout procedure. [77] [120] | |

| Drug Group/Class | Drug Examples | Route | Risks/Cautions/Contraindications | Recommendations | Notes |
|---|---|---|---|---|---|
| 10.3 Gout and cytotoxic induced hyperuricemia | Allopurinol<br>Febuxostat<br>Probenecid | Oral | Risk of recurrence of gout if omitted. | Continue. | Reduce allopurinol dose or discontinue if post-operative renal dysfunction occurs. |
| 10.4 Drugs that enhance neuromuscular transmission | Pyridostigmine<br>Neostigmine | Oral | Pyridostigmine antagonises the effect of non-depolarising muscle relaxants (e.g. pancuronium and vercuronium). [81]<br><br>Pyridostigmine may prolong the effect of depolarising muscle relaxants (e.g. suxamethonium). [81]<br><br>Cessation may exacerbate symptoms of myasthenia gravis. | Be aware of interaction and avoid use of interacting drugs.<br><br>If cessation of pyridostigmine is required miss one to two doses prior to surgery (based on half-life of 3-4 hours). | |
| 10.5 Skeletal muscle relaxants | Baclofen<br>Dantrolene<br>Tizanidine | Oral | Severe withdrawal effect when baclofen or tizanidine stopped abruptly. [82] [83]<br><br>Baclofen may prolong effects of fentanyl anaesthesia. [82]<br><br>Baclofen stimulates gastric acid secretion. [82]<br><br>Dantrolene may potentiate the effects of non-depolarising muscle relaxants. [84]<br><br>Cessation of these medicines leaves patient without treatment for spasticity. | Continue. | Caution: Some patients receive baclofen by intrathecal pump. Check prior to surgery. |

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## Consultation List

| | |
|---|---|
| Dr A Bayliss | Consultant Anaesthetist, SCD for Theatres, ARI |
| Dr P Bourke | Consultant Anaesthetist, Pre-Assessment, ARI |
| Mr D Boddie | Consultant Orthopaedics, ARI |
| Mr C Brewis | Consultant Ear/Nose/Throat, ARI |
| Dr M Cairns | Consultant Gynaecology, ARI |
| Mr N Cohen | Consultant Urology, ARI |
| Dr K Cranfield | Consultant Anaesthetist, Woodend Hospital |
| Mr I Depasquale | Consultant Plastic Surgery, ARI |
| Mr H El-Shafi | Consultant Cardiothoracic, ARI |
| Frances Ferguson | Pharmacist Team Leader, Surgical |
| Lesley Giblin | Lead Clinical Pharmacist, Dr Gray's Hospital |
| Dr A Harvey | Consultant Anaesthetist, Acute Pain, ARI |
| Mr A Johnstone | Consultant Orthopaedics, ARI |
| Mr M Kamel | Consultant Neurosurgery, ARI |
| Dr Z Knezevic-Woods | Consultant Anaesthetist, Cardiac and CICU, ARI |
| Dr M Kumar | Consultant Anaesthetist, Obstetrics, ARI |
| Ms M Kumarasamy | Consultant Ophthalmology, ARI |
| Mr R McIntyre | Consultant General Surgery, Dr Gray's Hospital |
| Dr D McKendrick | Consultant Anaesthetist, Dr Gray's Hospital |
| Ms A McKinley | Consultant General Surgery, ARI |
| Mr J Milburn | Consultant SHDU, ARI |
| Mr R Morrison | Consultant Maxillofacial Surgery, ARI |
| Mr E Munro | Consultant Vascular, ARI |
| Dr K Sim | Consultant Anaesthetist, GICU, ARI |
| Mr C Smart | Consultant Orthopaedics, Dr Gray's Hospital |
| Ms E Smyth | Consultant Breast Surgery, ARI |

## Appendix 1 – Management of Patients on Long-term Corticosteroid Treatment in the Peri-Operative Period

| Scenario | Course of action<br>Minor Surgery | Course of action<br>Moderate Surgery | Course of action<br>Major Surgery |
|---|---|---|---|
| Patients on long term steroid therapy less than or equal to prednisolone 5mg daily (or equivalent – see below) [85] | Continue steroid therapy, ensure **double** dose given on day of surgery. [85] [86] | Continue steroid therapy, ensure double dose given on day of surgery. | If in doubt, cover with parenteral hydrocortisone as in the box below. |
| Patients on long term steroid therapy greater than prednisolone 5mg daily (or equivalent) [85] | Continue steroid therapy, ensure **double** dose given on day of surgery. [85]<br><br>In addition, give hydrocortisone (sodium succinate) 25mg IV at induction. [85] [86] [87] | Continue steroid therapy; ensure doses throughout peri-operative period if possible. [85] [86] [87]<br><br>Give 50mg hydrocortisone IV at induction.<br><br>Give 25mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85] | Continue steroid therapy; ensure doses throughout peri-operative period if possible. [85] [86] [87]<br><br>Give 100mg hydrocortisone IV at induction.<br><br>Give 50mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85]<br><br>Recommence usual steroid dose following cessation of IV hydrocortisone. (BNF) |
| Patients with more than 3 courses of oral steroids in last 6 months | In addition, give hydrocortisone (sodium succinate) 25mg IV at induction. [85] [86] [87] | Give 50mg hydrocortisone IV at induction.<br><br>Give 25mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85] | Give 100mg hydrocortisone IV at induction.<br><br>Give 50mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85] |

| Scenario | Course of action<br>Minor Surgery | Course of action<br>Moderate Surgery | Course of action<br>Major Surgery |
|---|---|---|---|
| Patients on high dose inhaled steroids<br>Management of chronic asthma: British National Formulary<br>- 1000micrograms of inhaled Beclometasone twice daily<br>- 1000micrograms of inhaled Budesonide twice daily<br>- 500micrograms of inhaled Fluticasone propionate twice daily<br>- 400micrograms of inhaled Mometasone furoate twice daily | Give hydrocortisone (sodium succinate) 25mg IV on day of surgery. | Give 50mg hydrocortisone IV at induction.<br><br>Give 25mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85] | Give 100mg hydrocortisone IV at induction.<br><br>Give 50mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85] |
| Patients with Addison's disease or Hypopituitarism on glucocorticoid replacement therapy (most will be on hydrocortisone, but some may be on cortisone acetate, prednisolone or dexamethasone).<br><br>**ALWAYS consult with Endocrinology (see below for contact details).**<br><br>**'Hydrocortisone Not in Stock' is not an acceptable PAR (Prescription and Administration Record) entry for patients on replacement steroids.** | Give DOUBLE the usual oral dose of glucocorticoid on the morning of surgery. Parenteral hydrocortisone is not required if surgery is straightforward.<br><br>Double dose of oral steroids for 24 hours then return to usual dose. [88] | Give 50mg hydrocortisone IV at induction.<br><br>Give 25mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days. [85] | Give 100mg hydrocortisone IV at induction.<br><br>Give 50mg IV hydrocortisone 6 hourly on day of surgery, taper down over next 1-2 days.<br><br>**Continue to obtain specialist advice from Endocrinology.** |

## Steroid equivalence (oral)

Equivalent anti-inflammatory doses corticosteroids (relative to prednisolone 5mg dose). In practice, this table also provides a useful guide to glucocorticoid potency.

| | |
|---|---|
| Prednisolone 5mg | Betamethasone 750micrograms |
| | Cortisone acetate 25mg |
| | Deflazacort 6mg |
| | Dexamethasone 750micrograms |
| | Hydrocortisone 20mg |
| | Methylprednisolone 4mg |
| | Triamcinolone 4mg |

**Specialist advice from Endocrinology is always available at Aberdeen Royal Infirmary:**

| | |
|---|---|
| 09.00 to 21.00 | Endocrinology Registrar on bleep 2476 |
| 21.00 to 09.00 | Endocrinology Consultant on-call can be contacted via ARI Switchboard |

## Appendix 2 – Alternative Routes and Dose Adjustments for Patients on Antiepileptic Medication

Patients on antiepileptic medication must have their medication continued if possible to reduce the likelihood of seizures. If, for any reason, a patient cannot receive their anticonvulsants, contact the Neurology Registrar on bleep 3141 or via switchboard.

| Medication | Alternative routes available | Dosage adjustments / Plan if patient nil by mouth (NBM) |
|---|---|---|
| Carbamazepine (standard release) tablets | Liquid<br><br>Suppositories – short term use only. Maximum of 7 days. | If giving liquid (via NG or PEG tube), use the same total daily dose but smaller, more frequent doses may be required (e.g. twice daily tablets changed to three times daily liquid). [89]<br><br>If giving suppositories, 125mg suppository is equivalent to 100mg tablet. [90] Max 250mg four times daily. [90] |
| Carbamazepine (modified release) tablets | Liquid<br><br>Suppositories – short term use only. Maximum of 7 days. | If giving liquid (via NG or PEG tube), use the same total daily dose but smaller, more frequent doses may be required (e.g. twice daily tablets changed to three times daily liquid). [90]<br><br>If giving suppositories, 125mg suppository is equivalent to 100mg tablet. [90] Max 250mg four times daily. [90] |
| Gabapentin capsules | No liquid or parenteral alternative available. | Capsules may be opened, dissolved in water and given immediately via NG or PEG tube. [91]<br><br>If patient NBM, contact on call Neurology Registrar on page 3141 for advice. |
| Pregabalin capsules | Liquid<br><br>No parenteral alternative available. | If liquid unavailable capsules may be opened, dissolved in water and given immediately via NG or PEG tube. [91]<br><br>If patient NBM, contact on call Neurology Registrar on page 3141 for advice. |

| Medication | Alternative routes available | Dosage adjustments / Plan if patient NBM |
|---|---|---|
| Lamotrigine tablets | Dispersible tablets<br><br>No liquid or parenteral alternative available. | Dose for dispersible tablets is equivalent to dose for standard tablets. Can be dissolved in water and given via NG or PEG tube. [91]<br><br>If patient NBM, contact on call Neurology Registrar on page 3141 for advice. |
| Levetiracetam tablets | Liquid<br><br>Solution for IV infusion | Dose for liquid is equivalent to dose for tablets. [92]<br><br>If patient NBM, give by parenteral route. IV dose is equivalent to oral dose. |
| Phenobarbital tablets | Liquid<br><br>No parenteral alternative available. | Dose for liquid is equivalent to dose for tablets.<br><br>If patient NBM, contact on call Neurology Registrar on page 3141 for advice. |
| Phenytoin capsules / tablets | Capsules<br><br>Liquid<br><br>Solution for IV injection or infusion<br><br>IM injection | Capsules can be opened, dissolved in water and given immediately via NG or PEG tube. Standard practice in Neurology.<br><br>If giving liquid, 100mg capsule is equivalent to 92mg of liquid. Serum monitoring is advised. [93]<br><br>IV dose is equivalent to oral dose capsules, but not liquid (100mg of infusion is equivalent to 92mg of liquid). Serum monitoring is advised. [94]<br><br>IV route preferred but if giving by IM route, increase oral dose by 50%. When returning to oral, reduce oral dose by 50% for the length of time IM route was used before returning to usual oral dose. [94] |
| Topiramate | No liquid or parenteral alternative available. | If patient NBM, contact on call Neurology Registrar on page 3141 for advice. |
| Sodium valproate | Liquid<br><br>Solution for IV injection or infusion | Dose for liquid is equivalent to dose for enteric coated and modified release tablets. [95]<br><br>If patient NBM, give by parenteral route. IV dose is equivalent to oral dose. [96] |

## Appendix 3 – Risks Associated with Herbal / Alternative Medicines During Surgery and Anaesthesia

The information in this appendix is in relation to **herbal remedies and alternative medicines, excluding homeopathic medicines**. It is commonly accepted that due to the nature of homeopathy, **homeopathic remedies pose no risk during the peri-operative period**.

| Herbal Remedy / Alternative Medicine | Route | Risks | Recommendation |
|---|---|---|---|
| Black Cohosh | Oral | Reports of liver dysfunction reported with Black Cohosh.[97]<br>Bradycardia, altered clotting time are other possible effects. | Stop 14 days prior to surgery. |
| Camomile | Oral | Potent cytochrome P450 enzyme inhibitor.<br>Can impair effectiveness of other drugs when administered concurrently.<br>Sedative effects noted from 6oz cup of tea.<br>Long term consumption may have cumulative effects. [106] | Stop 14 days prior to surgery. [106] |
| Chaparral | Oral | Known to cause severe acute hepatitis. [99] | Stop 14 days prior to surgery. |
| Coenzyme Q10 | Oral | May lower blood pressure and blood sugar.<br>May interact with blood thinners and thyroid medication.<br>Avoid in kidney disease, liver disease and CCF. [100] | Stop 14 days before surgery. [101] |
| Dandelion Root | Oral | Theoretically may increase risk of bleeding.<br>May lower blood sugar levels.<br>Diuretic, so may cause electrolyte disturbance.<br>Increases gastric acid. [102] | Stop 14 days prior to surgery. |

| Herbal Remedy / Alternative Medicine | Route | Risks | Recommendation |
|---|---|---|---|
| Devil's Claw | Oral | May increase bleed risk.<br><br>May lower blood sugar levels.<br><br>May alter levels of gastric acid.<br><br>Individuals with heart disease, abnormal heart rhythm or gallstones should consult their health care provider before taking Devil's Claw. [103] | Stop 14 days prior to surgery. |
| Dong Quai | Oral | Known to prolong prothrombin time (and increase INR). May interact with coumarins. [99]<br><br>May have oestrogen-like effects. [104] | Stop 14 days prior to surgery. |
| Echinacea | Oral | Chronic use (over 8 weeks) linked with immunosuppression. Use with immunosuppressants contraindicated. Long term use may result in poor wound healing and infection.<br><br>May decrease the effectiveness of ciclosporin and steroids.<br><br>May potentiate barbiturate toxicity.<br><br>Avoid with known hepatotoxic drugs. [98] [99] [105] [106] | Stop 14 days prior to surgery. [99] |
| Ephedra (Ma Huang) | Oral | Herbal precursor to ephedrine and therefore a potent stimulant, particularly when combined with caffeine.<br><br>May cause hypertension, refractory hypotension, palpitations, tachycardia, CVAs and seizures.<br><br>May affect CV function by causing hypersensitivity myocarditis, characterised by cardiomyopathy with myocardial lymphocyte and eosinophil infiltration. | Stop at least 24 hours before surgery. [98] [99] |

| Herbal Remedy / Alternative Medicine | Route | Risks | Recommendation |
|---|---|---|---|
| | | Case reports of MI, myocarditis, fatal cardiac arrhythmias, acute hepatitis, mania, psychosis, nephrolithiasis, anxiety, tremors and insomnia.<br><br>Long term use may cause depletion of catecholamine stores and contribute to peri-operative haemodynamic instability.<br><br>Concern about inhibition of the complement pathway in vitro.<br><br>May cause ventricular arrhythmias with volatile anaesthetics. [5] [98] [99] [105] [106] | |
| Evening Primrose Oil | Oral | Reduces platelet aggregation. Can interact with antiplatelet or anticoagulant drugs to increase risk of bleeding.<br><br>May also reduce seizure threshold. [98] [108] | Stop 14 days prior to surgery. |
| Feverfew | Oral | Inhibits platelet aggregation. Can interact with antiplatelet or anticoagulant drugs to increase risk of bleeding.<br><br>Use caution in administering with drugs that increase serotonin.<br><br>Abrupt discontinuation can cause rebound headache or joint / muscle stiffness and pain. [98] [109] | Stop 14 days prior to surgery. |
| Garlic | Oral | Increases bleeding risk.<br><br>Inhibits platelet aggregation irreversibly in a dose dependent fashion. Increases INR. Chronic or excessive doses can also reduce haemoglobin production.<br><br>Potential for epidural haematoma with epidural or spinal anaesthesia. Report of spontaneous epidural haematoma and post-op bleeding. | Stop 14 days prior to surgery. [98] [99] [106] |

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| | | Enhances effect of antiplatelets and anticoagulants.<br>Has a hypoglycaemic activity so may potentiate hypoglycaemic agents.<br>Has marginal antihypertensive effect. [5] [98] [99] [105] [107] | |
| Ginger | Oral | May impair platelet function and inhibit platelet aggregation, increasing bleed risk.<br>Potential for epidural haematoma with epidural or spinal anaesthesia.<br>Caution with antiplatelet and anticoagulant medicines.<br>May affect blood pressure.<br>May affect blood glucose (hyperglycaemia).<br>Potent agonist at the serotonin receptor in GI tract (anti-nausea effect). [5] [98] [99] [105] | Stop 14 days prior to surgery. [98] |
| Gingko Biloba | Oral | Inhibits platelet activating factor. Can decrease blood viscosity and erythrocyte aggregation. Several cases of bleeding reported.<br>Potential for epidural haematoma with epidural or spinal anaesthesia.<br>Alters vasoregulation, modulates neurotransmitter and receptor activity.<br>May cause prolonged sedation with barbiturate anaesthetics.<br>Lowers seizure threshold. Can reduce effectiveness of carbamazepine, phenytoin and phenobarbital in epileptic patients. [5] [98] [99] [105] [106] [107] | Stop at least 36 hours before surgery but preferably two weeks. [98] [99] |

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|---|---|---|---|
| Ginseng | Oral | Increases bleeding risk.<br><br>Decreases therapeutic effect of coumarins, inhibits platelet adhesiveness and antagonises platelet activating factor. Case report of a patient with stable INR starting Ginseng and INR being reduced.<br><br>May also cause hypertension. Can cause significant changes in heart rate and BP during anaesthesia.<br><br>Lowers post-prandial glucose in patients with or without type 2 diabetes (may cause unintended hypoglycaemia especially in fasted patients).<br><br>Increased glucocorticoid synthesis.<br><br>Can potentiate GABA and increase serotonin.<br><br>Anecdotal reports of nervousness and insomnia due to CNS stimulatory effects.<br><br>Avoid concurrent administration with MAOIs.<br><br>May have weak oestrogenic effects causing mastalgia and vaginal bleeding in some patients. [5] [98] [99] [105] [106] [107] | Stop 7 days before surgery. [98] [99] |
| Glucosamine (+/- Chondroitin) | Oral | May increase bleed risk, particularly when antiplatelet medicines or warfarin co-prescribed.<br><br>May raise blood pressure and blood sugar.[99] [116] | Stop 14 days prior to surgery. [99] |
| Goldenseal | Oral | Inhibits cytochrome P450 3A4. May lead to barbiturate and benzodiazepine toxicity and excessive post-operative sedation.<br><br>May cause sodium depletion (due to diuretic effect). [99] [107] | Stop 14 days prior to surgery.[99] |

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| Guar Gum | Oral | Has caused oesophageal and small bowel obstructions. [99] | Avoid in bowel surgery.<br>Stop 5 days prior to surgery. |
| Hops | Oral | Acts as a mild depressant on higher nerve centres, may have additive effects with other CNS depressants avoid in depressive states.<br><br>May cause increased drowsiness with anaesthetic agents.<br><br>Potentially interacts with drugs metabolized by the cytochrome P450 liver enzyme system.<br><br>Contains substances with estrogenic activity. [110] | Stop 14 days prior to surgery. [110] |
| Horse Chestnut | Oral | Contains coumarin constituents. Can interact with anticoagulants and antiplatelet to increase risk of bleeding.<br><br>Can cause liver or kidney damage.<br><br>Can turn urine red. [98] | Stop 14 days prior to surgery. [98] |
| Kava Kava | Oral | Increases bleeding risk. Inhibits COX and thromboxane synthesis leading to antiplatelet effects. May interact with antiplatelet / anticoagulant agents.<br><br>Potentiates CNS depressants resulting in prolonged sedation. May act as a sedative hypnotic / anxiolytic by potentiating GABA transmission. May prolong sedation associated with anaesthesia, particularly barbiturate anaesthetics.<br><br>Dose dependent effects on CNS including antiepileptic, neuroprotective and local anaesthetic properties.<br><br>Can impair motor function. | Stop 7-14 days prior to surgery. [106] |

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|---|---|---|---|
| | | Inhibits dopamine and monoamine oxidase uptake. May interact with levodopa to potentiate Parkinson's symptoms.<br><br>Continuous heavy use can cause changes in blood chemistry and pulmonary hypertension.<br><br>No evidence of potential for dependency, although long term use may have abuse potential, with addiction, tolerance and withdrawal. [5] [98] [99] [105] [106] [107] | |
| Liquorice | Oral | Contains coumarin and inhibits platelet aggregation.<br><br>Can cause hypertension, arrhythmias and sodium retention.<br><br>May also cause hypokalaemia (which can be magnified by diuretic use).<br><br>Inhibits cytochrome CYP 3A4 in vitro so may affect the metabolism of drugs. [99] | Stop 14 days prior to surgery. |
| Milk Thistle | Oral | May interfere with breakdown blood thinning agents and benzodiazepines.<br><br>May lower blood sugar levels.<br><br>Not advised with phenothiazines, e.g. prochlorperazine. [99] [111] [112] | Stop 14 days prior to surgery. [99] |
| Omega 3 Fish Oils | Oral | May inhibit platelet aggregation. Increased bleed risk. [99] | Stop 14 days prior to surgery. [99] |
| Passion Flower | Oral | May increase bleeding risk.<br><br>Primary component has benzodiazepine receptor activity.<br><br>Possible additive effects with other CNS depressants. | Stop 14 days prior to surgery. |

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| | | Reports of hepatotoxicity and pancreatic toxicity.<br><br>No evidence of potential for dependency. [98] [113] | |
| Red Clover | Oral | May potentiate the effects of blood thinners.<br><br>May lower blood sugar.[114] | Stop 14 days prior to surgery. |
| Saw Palmetto | Oral | Thought to act similarly to finasteride (thought to have anti-oestrogenic activity and antiandrogenic activity).<br><br>Potential for additive effects with other hormonal treatments.<br><br>Can cause hypertension and GI disturbances.<br><br>One report of severe intra operative bleeding.<br><br>Theoretically interacts with phenylephrine and noradrenaline.[98] [99] [107] | Stop 14 days prior to surgery. [99] |
| St John's Wort | Oral | Inhibits serotonin reuptake, weakly inhibits MAOI (A&B) and inhibits dopamine and noradrenaline reuptake. Also has a high affinity for GABA receptors.<br><br>Serotonin syndrome may occur when given with other serotonergic drugs.<br><br>Potent inducer of cytochrome P450 enzymes so interacts with warfarin, digoxin, theophylline, ciclosporin, anticonvulsant and antiretroviral drugs.<br><br>Induces cytochrome P450 3A4, affecting the metabolism of a number of drugs used peri-operatively, including midazolam, alfentanil, lidocaine, calcium channel blockers and serotonin antagonists.<br><br>May potentiate or prolong action of anaesthetic agents. [5] [105] [98] [99] | Stop 5 days prior to surgery (based on half-life). [98] [99] |

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| Valerian | Oral | Inhibits the degradation and reuptake of GABA. May cause excessive smooth muscle relaxation and sedation through interactions with GABA receptors.<br><br>Causes sedation, may potentiate sedative effects of benzodiazepines and barbiturates. Increases barbiturate induced sleep.<br><br>Contraindicated with barbiturates (potentiates effects of barbiturates).<br><br>Risk of benzodiazepine-like withdrawal, so in long term users, taper the dose several weeks prior to surgery. Benzodiazepines can be used to treat withdrawal symptoms.<br><br>Can cause cardiac disturbances and liver toxicity. [5] [98] [99] [105] [106] [107] | Consider stopping prior to surgery. [99]<br><br>Taper dose gradually over two weeks if stopping.<br><br>Aim to have stopped 7 days prior to surgery. [99]<br><br>Monitor for withdrawal effects on admission and treat with benzodiazepines if necessary. |
| Vitamin E | Oral | High doses may increase likelihood of bleeding. [115] | Stop 14 days prior to surgery. |