

Antimicrobial Stewardship Strategy: Surgical antibiotic prophylaxis optimization

An audit of quality indicators for surgical antibiotic prophylaxis to identify areas that need improvement.



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Priority Level: **A**

Difficulty Level: **2**

Program Stage:

- Early
- ✓ Intermediate
- Advanced

Antimicrobial Stewardship

Outcomes:

- Clinical outcomes

For more information on these criteria and how they were developed, please see the [Antimicrobial Stewardship Strategy Criteria Reference Guide](#).

Description

This is an overview and not intended to be an all-inclusive summary. As a general principle, patients must be monitored by the health care team after changes to therapy resulting from recommendations made by the antimicrobial stewardship team.

Rationale

Appropriate administration of antibiotics in the perioperative period significantly reduces the incidence of surgical site infections for many types of surgery.¹

Optimizing surgical antibiotic prophylaxis involves two primary aspects:

- Ensuring that timely and appropriate antibiotics are administered as recommended (quality indicators) before and during surgery.
- Limiting prolonged use of antibiotic prophylaxis once the surgery is over.

These two stages often require different interventions to ensure best practice and ongoing levels of support.

Patients undergoing surgery in which antibiotic prophylaxis is recommended should receive the following:

- The appropriate agent(s) based on the type of surgery and patient characteristics (e.g., allergies).
- An appropriate weight-based dose.
- An initial dose administered at the appropriate time before the first incision (usually within 1 hour).
- Additional intraoperative doses when indicated (e.g., for prolonged surgeries and significant blood loss).

- A prophylactic course of post-operative antibiotics for no longer than 24 hours. (Prolonged administration of post-operative antibiotics is common, increases the risk of antibiotic adverse effects and resistance, and is a prime target for antimicrobial stewardship interventions.)

Guidelines for the use of antimicrobial surgical prophylaxis, developed by a number of key societies and agencies, summarize the current literature and provide a basis for standardizing practice.

Surgical antibiotic prophylaxis optimization should be considered part of a comprehensive, multimodal review of practices to prevent surgical site infections.

Implementation

Conduct institutional audits of adherence to some or all of the quality indicators (at a minimum: choice of agent, timing of preoperative dose and duration of post-operative prophylaxis) and take action to improve nonadherent practice.

Facilitate adherence to practice recommendations by providing service- and/or procedure-specific preprinted order forms and/or clinical pathways. Other options include automatic substitutions for drugs or doses, posters summarizing recommendations, automatic stop dates for post-operative prophylaxis, education for trainees etc.

Conduct periodic reviews to ensure ongoing compliance with process indicators.

Consider a formal policy and procedure outlining recommendations for the delivery of surgical antibiotic prophylaxis.

Incorporate questions about preoperative antibiotic delivery (e.g., Is an antibiotic required prior to surgery? Has it been administered?) into surgical safety checklists (also referred to as surgical “time outs” or “pre-op pauses”).

Experts in patient quality and safety and in infection prevention and control may already be involved in measures to reduce surgical site infections; individuals involved in stewardship can leverage their expertise and resources.

Advantages

- Optimizing surgical antibiotic prophylaxis is a high-impact intervention, and it is a good starting point for institutions beginning an antimicrobial stewardship program.
- Improvements in delivery of antibiotic prophylaxis may reduce the incidence of surgical site infections, lowering patient morbidity, mortality and costs.
- Limiting the duration of post-operative prophylactic antibiotic therapy may lead to reductions in antibiotic use and possibly in *Clostridium difficile* infection.
- Evaluation of and improvement in surgical antibiotic prophylaxis is usually readily supported by both administrators and practitioners, given the evidence of benefit and recommendations from government agencies and patient safety institutes.
- Optimizing the delivery of surgical antibiotic prophylaxis is an important patient safety goal and an obvious quality improvement target.
- A number of guidance documents—particularly the recent guidelines co-published by a number of key societies²—are available to support and inform practice. As well, many institutions in Canada and other countries have developed policies and recommendations for the selection of antimicrobials for specific surgeries. These may be adapted for an individual institution.

- An excellent example of a multidisciplinary project that will build relationships. Involves collaboration between pharmacists, nurses, nurse educators and directors, surgeons and anesthesiologists, infection prevention and control practitioners, and patient quality and safety administrative staff.
- Once practice has been optimized and improvements made (if necessary), only periodic monitoring and feedback to staff should be required.

Disadvantages

- Practice change may be difficult for surgeons (and anesthesiologists), particularly related to administration of the pre-operative dose and minimizing post-operative doses.
- This initiative may be resource-intensive at first. Time is needed to evaluate current practices; develop policies, guidelines, and supporting documents; and provide education.
- Clinical outcome data (i.e., reduction in surgical site infections) is often labour-intensive to measure and is multifactorial.

Requirements

- Resources to audit current practice of antimicrobial delivery (often a convenience sample, unless automated); communicate results and recommendations; participate in multidisciplinary meetings if improvement is required; and develop tools/standard order sets.
- Requires coordination and collaboration among various disciplines.

Associated Metrics

- Compliance with some or all of the following quality indicators:
 - Appropriate selection of recommended agent based on type of surgery.
 - Correct timing of initial dose in relation to initial incision.*
 - Administration of appropriate dose.
 - Intraoperative redosing when indicated.
 - Duration of post-operative antibiotic prophylaxis ≤ 24 hours.
- Automated anesthesiology records (if available) may facilitate electronic data collection of many indicators.
- Surgical site infection rates (advanced—an institution's infection prevention and control program may collect and report this data often for specific types of surgeries).

*The percentage of adults undergoing surgery for primary hip or knee joint replacement who receive an appropriately timed preoperative antibiotic dose is publicly reported in Ontario.

References

1. Bowater RJ, Stirling SA, Lilford RJ. Is antibiotic prophylaxis in surgery a generally effective intervention? Testing a generic hypothesis over a set of meta-analyses. *Ann Surg.* 2009;249(4):551-6.

2. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. American Society of Health-System Pharmacists (ASHP); Infectious Diseases Society of America (IDSA); Surgical Infection Society (SIS); Society for Healthcare Epidemiology of America (SHEA). Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm*. 2013;70(3):195–283. Available from: <http://www.ajhp.org/content/70/3/195.long>

Most recent guidelines on surgical prophylaxis; summarizes evidence and provides recommendations for dosing, timing and choice of antibiotic based on surgical procedure.

Additional Useful References

Select articles to provide supplemental information and insight into the strategy described and/or examples of how the strategy was applied; not a comprehensive reference list. URLs are provided when materials are freely available on the Internet.

- Matuschka PR, Cheadle WG, Burke JD, Garrison RN. A new standard of care: administration of preoperative antibiotics in the operating room. *Am Surg*. 1997;63:500–3.
- Goede WJ, Lovely JK, Thompson RL, Cima RL. Assessment of prophylactic antibiotic use in patients with surgical site infections. *Hosp Pharm*. 2013;48(7):560–7.

Example of an audit of surgical antibiotic prophylaxis to assess and improve practice.

- Braxton CC, Gerstenberger PA, Cox GG. Improving antibiotic stewardship. Order set implementation to improve prophylactic antimicrobial prescribing in the outpatient surgical setting. *J Ambulatory Care Manage*. 2010;33(2):131–40.

Describes use of a form to standardize antibiotic prophylaxis.

- Zvonar R, Roth V, Bush P. Practice changes to improve delivery of surgical antibiotic prophylaxis. *Healthc Q*. 2008;11(3 Spec No.):141–4. Available from: <https://www.longwoods.com/content/19664>

Example of an audit of surgical antibiotic prophylaxis to assess and improve practice.

Tools and Resources

- Canadian Patient Safety Institute. Safer Healthcare Now! Prevent surgical site infections: getting started kit. Edmonton, AB: CPSI; August 2014. Available from: <http://www.patientsafetyinstitute.ca/en/toolsResources/Documents/Interventions/Surgical%20Site%20Infection/SSI%20Getting%20Started%20Kit.pdf>

Provides evidence-based recommendations for appropriate use of antimicrobial prophylaxis, including importance of timing, re-dosing and duration of use.

- Alexander JW, Solomkin JS, Edwards MJ. Updated recommendations for control of surgical site infections. *Ann Surg*. 2011;253:1082–93.

Comprehensive recommendations for prevention of surgical site infections, including delivery of antibiotic prophylaxis.

- Antimicrobial prophylaxis for surgery. Treat Guidel Med Letter. 2012;10:73–8.
Outlines principles and selection of antibiotic prophylaxis based on procedure.
- Scottish Intercollegiate Guidelines Network (SIGN). Antibiotic prophylaxis in surgery. Edinburgh: SIGN; 2008. SIGN publication no. 104. July 2008; updated April 2014. Available from: <http://www.sign.ac.uk/guidelines/fulltext/104/index.html>
Evidence-based guideline, including which surgical procedures warrant prophylaxis.
Quick reference guide provides a summary of recommendations.
Surgery-specific guides can be modified to incorporate local antibiotic recommendations.
- European Centre for Disease Prevention and Control. Systematic review and evidence-based guidance on perioperative antibiotic prophylaxis. Stockholm: ECDC; 2013. Available from: <http://ecdc.europa.eu/en/publications/Publications/Perioperative%20antibiotic%20prophylaxis%20-%20June%202013.pdf>
Thorough review of evidence surrounding perioperative prophylaxis with recommendations on five key aspects of surgical antibiotic prophylaxis.
- The Ottawa Hospital Education. Antibiotic ordering [video on the Internet]. Ottawa, ON: The Ottawa Hospital; 2015 Jun 17 [cited 2015 Nov 4]. Available from: <https://www.youtube.com/watch?v=WAFtKg2CnUU&feature=youtu>
Instructional video for ordering pre-operative antibiotics at The Ottawa Hospital.

Samples/Examples

- [Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis](#)
- [Example 2: The Ottawa Hospital - Surgical Prophylaxis Evaluation Form](#)
- [Example 3: Peterborough Regional Health Centre - Day Surgery \(Inpatient\) Elective Orthopaedic Admission Order Set](#)
- [Example 4: Providence Health Care, BC - Penicillin Allergy Algorithm for Surgical Patients](#)
- [Example 5: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Pre-op and Intra-op Dosing](#)
- [Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing](#)

These documents have been generously shared by various health care institutions to help others develop and build their antimicrobial stewardship programs. We recommend crediting an institution when adopting a specific tool/form/pathway in its original form.

Examples that contain clinical or therapeutic recommendations may not necessarily be consistent with published guidelines, or be appropriate or directly applicable to other institutions. All examples should be considered in the context of the institution’s population, setting and local antibiogram.

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Links with Other Strategies

- [Automatic stop orders](#)
- [Disease-specific treatment guidelines, pathways, algorithms and/or associated order forms](#)
- [Drug use evaluation/medication use evaluation](#)
- [Systematic antibiotic allergy verification](#)

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For further information

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis



MEDICAL STAFF RULES AND REGULATIONS RÈGLEMENTS RELATIFS AU PERSONNEL MÉDICAL

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

ISSUED BY / PRÉPARÉ PAR : Senior Vice-President, Medical Affairs, Quality and Patient Safety / Premier vice-président, Affaires médicales, Qualité et Sécurité des patients

DATE ISSUED / DATE DE DISTRIBUTION : 2003/07/22

APPROVED BY / APPROUVÉ PAR : Medical Advisory Committee / Comité médical consultatif

DATE REVIEWED / DATE D'EXAMEN : 2015/03/20

DATE REVISED / DATE DE RÉVISION : 2015/03/20

1. POLICY

PURPOSE/GOAL

To ensure all patients who undergo surgical procedures requiring pre-operative antibiotics receive the correct antibiotic(s) at the recommended dosage and time. This includes intra-operative redosing when required.

INTRODUCTION

Timely administration of appropriate antibiotics pre-operatively can significantly decrease the incidence of post-operative infection. In order to achieve optimal antibiotic concentrations in the serum and tissues, the antibiotic should be administered as close as possible (ideally within one half-hour) of initial skin incision. Administering antibiotics "on call to OR" often results in sub-optimal antibiotic levels due to transport delays or schedule changes. There is potential for improvement in timing when the anesthesiologist administers the antibiotic(s) before induction of anesthesia.

DOCUMENTATION

- A review of the surgical safety checklist including information regarding pre-operative prophylaxis will take place at the appropriate time.
- The anesthesiologist will indicate administered antibiotic dose and time on the anesthesia record.
- For antibiotics started prior to transfer to the OR (i.e. vancomycin, clindamycin), the nurse will indicate the administration time on the appropriate nursing

1. POLITIQUE

OBJECTIF/BUT

Pour veiller à ce que les patients qui subissent une intervention chirurgicale nécessitant l'administration préopératoire d'antibiotiques reçoivent le ou les bons antibiotiques à la posologie recommandée dans l'heure précédant l'incision initiale et, selon les besoins, la répétition de l'administration peropératoire.

INTRODUCTION

L'administration opportune des antibiotiques préopératoires appropriés peut réduire de façon significative l'incidence d'une infection postopératoire. Pour obtenir les concentrations optimales d'antibiotiques dans le sang et les tissus, l'antibiotique doit être administré le plus près possible du moment de l'incision initiale, de préférence dans les 30 minutes précédant l'intervention. Les antibiotiques administrés « à l'appel pour se rendre à la salle d'opération » résultent souvent en des taux inférieurs aux taux optimaux d'antibiotiques dans le système en raison des retards causés par le transport ou des changements à l'horaire des opérations. Le ou les antibiotiques peuvent être administrés à un moment plus opportun lorsqu'ils sont administrés par l'anesthésiologiste tout juste avant l'induction de l'anesthésie.

DOCUMENTATION

- L'infirmière de la salle d'opération examinera la liste de vérification préopératoire, y compris l'information relative à la prophylaxie opératoire.
- L'anesthésiologiste consignera au dossier la dose

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

documentation record.

2. DEFINITION: N/A

3. PROCEDURE

The procedure outlined below should be followed for pre-operative surgical prophylaxis (unless otherwise clinically indicated).

1. Pre-operative Antibiotic Orders

The attending surgeon or physician delegate will order pre-operative antibiotics for those procedures requiring prophylaxis, as recommended in Appendix I. Orders written as "pre-op" or "on call to OR" will be administered as per protocol (see #3). Doses should be selected based on patient's weight. (see Appendix II) Patients with a history of penicillin allergy can be assessed according to the algorithm in Appendix III.

2. Processing of Prophylactic Antibiotic Orders

Pre-op antibiotics (prepared by pharmacy) will be attached to the patient's chart, and sent with the patient to the OR. The pre-operative antibiotic(s) will be provided to the anesthesiologist to administer prior to induction of anesthesia. **Exceptions:** vancomycin and clindamycin are to be started on the ward, in the Surgical Day Care Unit (SDCU), or Same Day Admission Unit (SDA) due to longer infusion times.

3. Antibiotic Administration

Unless otherwise specified, pre-operative antibiotics (including those ordered as "pre-op" or "on call to OR") will be administered in the OR by the anesthesiologist, or on the ward or in SDCU/SDA in the case of vancomycin or clindamycin. The pre-operative antibiotic(s) should be completely infused within 1 hour of surgical incision. (see recommended infusion times in Appendix IV). The surgeon is ultimately responsible for ensuring the administration of the required prophylactic antibiotic(s).

4. Administration of Additional Antibiotic Doses

For prolonged procedures, or where blood loss exceeds 1500 ml, the prophylactic antibiotic will be redosed as outlined in Appendix V. The surgeon is to request that the anesthesiologist administer any required additional doses.

d'antibiotique administrée et le moment de l'anesthésie.

- Dans le cas des antibiotiques dont l'administration a lieu avant le transfert à la salle d'opération (c.-à-d. la vancomycine, la clindamycine), l'infirmière inscrira le moment de l'administration au dossier de renseignements infirmier approprié.

2. DÉFINITION: S/O

3. PROCÉDURE

La procédure soulignée ci-dessous doit être suivie dans le cadre d'une prophylaxie chirurgicale préopératoire (sauf indication clinique contraire).

1. Ordonnance préopératoire d'antibiotiques

Le chirurgien en titre ou son délégué inscrira l'ordonnance des antibiotiques préopératoires dans le dossier du patient, ou selon le protocole clinique, pour les procédures nécessitant une prophylaxie. Les ordonnances indiquées « préopératoire » ou « à l'appel pour se rendre à la salle d'opération » seront administrées selon le protocole (voir le n° 3). Les posologies seront vérifiées en fonction du poids du patient (voir l'annexe I).

2. Traitement des ordonnances d'antibiotiques prophylactiques

Les antibiotiques préopératoires (préparés par la pharmacie) seront joints au dossier du patient et envoyés avec ce dernier à la salle d'opération. Les antibiotiques préopératoires seront remis à l'anesthésiologiste avant l'induction de l'anesthésie, **sauf les antibiotiques suivants :** la vancomycine et la clindamycine puisque ces antibiotiques doivent être administrés alors que le patient est dans sa chambre, dans l'Unité de chirurgie d'un jour ou dans l'Unité d'admission le jour de la chirurgie en raison de temps d'infusion plus longs.

3. Protocole relatif à l'administration d'antibiotiques

Sauf indication contraire, les antibiotiques préopératoires (y compris ceux dont l'ordonnance est « préopératoire » ou « à l'appel pour se rendre à la salle d'opération ») seront administrés dans la salle d'opération par l'anesthésiologiste, ou dans la chambre du patient, dans l'Unité de chirurgie d'un jour ou dans l'Unité d'admission le jour de la chirurgie lorsqu'il s'agit de vancomycine ou de clindamycine. En bout de ligne, il incombe au chirurgien de s'assurer de l'administration du ou des antibiotiques prophylactiques requis.

4. Administration supplémentaire d'antibiotiques

Dans le cas d'interventions longues ou lorsque le patient ou la patiente a perdu plus de 1 500 ml de sang, l'antibiotique prophylactique doit être administré de nouveau. L'équipe préopératoire doit informer le chirurgien lorsqu'un laps de temps

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4. RELATED POLICIES AND / OR LEGISLATIONS: N/A

Selected References

- Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm* 2013;70(3):195-283.
- Alexander JW, Solomkin JS, Edwards MJ. Updated recommendations for control of surgical site infections. *Ann Surg* 2011;253:1082–1093.
- *Safer Healthcare Now!* Prevent Surgical Site Infections Getting Started Kit. August 2014. Available from: www.saferhealthcarenow.ca
- Chopra T, Zhao JJ, Alangaden G, et al. Preventing surgical site infections after bariatric surgery: value of perioperative antibiotic regimens. *Expert Rev Pharmacoeconomics Outcomes Res.* 2010;10:317-28.
- Garey KW, Dao T, Chen H et al. Timing of vancomycin prophylaxis for cardiac surgery patients and the risk of surgical site infections *J Antimicrob Chemother* 2006;58:645-650.

de 3 ou 4 heures s'est écoulé depuis l'administration de la dose pré-opératoire de céfazoline (ou 8 à 12 heures pour la vancomycine). Le chirurgien doit demander à l'anesthésiologiste d'administrer les doses supplémentaires requises.

4. POLITIQUES OU RÈGLEMENTS CONNEXES: S/O

Bibliographie partielle

- Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm* 2013;70(3):195-283.
- Alexander JW, Solomkin JS, Edwards MJ. Updated recommendations for control of surgical site infections. *Ann Surg* 2011;253:1082–1093.
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ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE
PROPHYLAXIE CHIRURGICALE

APPENDIX I:

TOH RECOMMENDATIONS FOR PRE-OPERATIVE ANTIBIOTIC PROPHYLAXIS

PROCEDURE (Divisions listed alphabetically)	RECOMMENDED ANTIBIOTIC(S)	ALTERNATIVE FOR <i>SEVERE</i> PENICILLIN/ CEPHALOSPORIN ALLERGIC PATIENTS**
<p>** Notes:</p> <ul style="list-style-type: none"> – Cephalosporins are contraindicated in patients with true allergy to cephalosporins and/or severe life-threatening allergy to penicillins, defined as history of anaphylaxis, hypotension, urticaria (hives), laryngeal or angioedema, bronchoconstriction, and/or wheezing – For MRSA patients, use of vancomycin-containing alternative regimens are recommended as first line prophylaxis – For MRSA patients, addition of cefazolin (when no contraindications) to vancomycin is recommended for orthopedic, vascular, cardiac and neurosurgical procedures, and general surgery procedures when mesh is inserted – For patients already on antibiotics, give the pre-operative antibiotic(s) for prophylaxis in addition 		
CARDIAC SURGERY		
Coronary artery bypass	cefazolin	vancomycin
Valve repair/replacement	cefazolin	vancomycin
Cardiac transplantation	cefazolin	vancomycin
Implantation of cardiac devices (e.g., pacemaker, defibrillator, VADs)	cefazolin	vancomycin
Pericardectomy	cefazolin	vancomycin
ENT		
Tonsillectomy, adenoidectomy	None recommended	
Ear surgery		
• With implants	cefazolin	vancomycin
• No implants	None recommended	
Surgery involving incision through oral or pharyngeal mucosa	cefazolin + metronidazole	vancomycin + metronidazole
Head/neck surgery for cancer		
• Clean	cefazolin (optional)	(vancomycin)
• Clean/contaminated	cefazolin + metronidazole	vancomycin + metronidazole
Neck dissection	cefazolin (optional)	(vancomycin)

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Orthognathic (jaw) surgery	cefazolin + metronidazole	vancomycin + metronidazole
Mandibular fractures fixation	cefazolin + metronidazole	vancomycin + metronidazole
Mastoidectomy	cefazolin + metronidazole (optional)	(vancomycin + metronidazole)
Septoplasty/septorhinoplasty <ul style="list-style-type: none"> • Simple • Complex, including grafts 	None recommended cefazolin	vancomycin
FESS (functional endoscopic sinus surgery)	None recommended	
Thyroidectomy, parathyroidectomy	None recommended	
Laser surgery (larynx/hypopharynx)	None recommended	
GENERAL SURGERY		
Appendectomy	cefazolin + metronidazole	gentamicin + metronidazole + vancomycin*
PEG tube insertion	cefazolin	vancomycin
Gastroduodenal surgery	cefazolin	vancomycin + gentamicin
Pancreaticoduodenectomy	cefazolin	vancomycin + gentamicin
Roux-en-Y bariatric	cefazolin	vancomycin + gentamicin
Small bowel surgery	cefazolin + metronidazole	gentamicin + metronidazole + vancomycin*
Colorectal surgery	cefazolin + metronidazole	gentamicin + metronidazole + vancomycin*
Laparotomy or laparoscopy not entering any viscus	None recommended	
Penetrating abdominal trauma	cefazolin + metronidazole	gentamicin + metronidazole + vancomycin*
Ruptured viscus (contaminated; treatment)	ceftriaxone/metronidazole	gentamicin + metronidazole + vancomycin*
Biliary surgery (open)	cefazolin	vancomycin + gentamicin
Cholecystectomy <ul style="list-style-type: none"> • open • laparoscopic 	cefazolin None recommended (cefazolin if high risk)	vancomycin + gentamicin (vancomycin + gentamicin)
ERCP <ul style="list-style-type: none"> • if biliary obstruction 	None recommended cefazolin (optional)	(gentamicin)
Endoscopic drainage of pancreatic pseudocyst	cefazolin	gentamicin
PTC (Percutaneous transhepatic cholangiography)	cefazolin	gentamicin
Breast surgery <ul style="list-style-type: none"> • for cancer • with implant • reduction 	cefazolin cefazolin cefazolin (optional)	vancomycin vancomycin (vancomycin)
Axillary dissection age > 70	cefazolin	vancomycin
Hernia repair (with or without	cefazolin	vancomycin

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mesh)		
Nissen fundoplication	None recommended (cefazolin if high risk)	(vancomycin)
Hepatic resection	cefazolin	vancomycin
Splenectomy	None recommended	
Hemorrhoidectomy	None recommended	
*alternative is gentamicin with clindamycin, although coverage is less reliable compared with gentamicin + vancomycin + metronidazole		
NEUROSURGERY		
Craniotomy	cefazolin	vancomycin
Spinal surgery	cefazolin	vancomycin
CSF shunt placement	cefazolin	vancomycin
EVD/ICP monitor placement	cefazolin	vancomycin
Intrathecal pump placement	cefazolin	vancomycin
Transsphenoidal pituitary/ endonasal skull base surgery	cefuroxime	levofloxacin
Carotid endarterectomy		
<ul style="list-style-type: none"> • Involving prosthetic material • No prosthetic material 	cefazolin	vancomycin
	None recommended	
Peripheral nerve surgery	None recommended	
OBSTETRICS & GYNECOLOGY		
Hysterectomy (vaginal, abdominal & laparoscopic)	cefazolin	gentamicin + vancomycin
Surgically induced abortion (incl. missed abortion)	doxycycline 100 mg orally 1 hour before procedure and 200 mg after procedure	
Incomplete abortion	None recommended	
Caesarean section	cefazolin NB: to be given regardless if/when pt recd GBS antibiotic prophylaxis	gentamicin + vancomycin (or gentamicin + clindamycin*)
Laparoscopic surgery (no entry into uterus or vagina)	None recommended	
Hysteroscopy (diagnostic/operative)	None recommended	
Transcervical intrauterine procedures	None recommended	
Urogynecologic procedures for incontinence or prolapse	cefazolin	gentamicin + vancomycin
Urodynamic studies	None recommended	

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

* vancomycin preferred; clindamycin may be used in emergent (unplanned) C-sections if insufficient time for vancomycin administration		
ORTHOPEDIC SURGERY		
Arthroplasty (new or revision)	cefazolin	vancomycin
Closed fracture repair	cefazolin	vancomycin
Spinal surgery	cefazolin	vancomycin
Arthroscopic procedures		
• with implant insertion	cefazolin	vancomycin
• without implant insertion	None recommended	
Knee, hand & foot procedures		
• involving instrumentation or implantation of foreign material	cefazolin	vancomycin
• no foreign material	None recommended	
PLASTIC SURGERY		
Superficial skin/mucosal excisions	None recommended	
Facial surgery with implant	cefazolin (optional)	(vancomycin)
Reconstructive limb surgery with possible contamination	cefazolin + gentamicin +/- metronidazole	gentamicin + clindamycin
Surgery involving insertion of prosthetic material	cefazolin	vancomycin
Breast surgery		
• for cancer	cefazolin	vancomycin
• with implant	cefazolin	vancomycin
• reduction	cefazolin (optional)	(vancomycin)
THORACIC SURGERY		
VATS	cefazolin	vancomycin
Thoracotomy / Sternotomy procedures	cefazolin	vancomycin
• Pulmonary resections		
• Lung volume reduction		
• Pleurectomy/decortication		
• Bullectomy		
• Rib/chest wall resection/reconstruction		
• Mediastinal tumor removal		
Neck incision	cefazolin	vancomycin
• Tracheal/bronchial resection		
• Thymectomy		

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

• Zenker's diverticulum resection		
Tracheostomy	None recommended	
EBUS (endobronchial ultrasound)	No data (consider cefazolin)	(vancomycin)
Esophagoscopy, bronchoscopy, incl dilation, stent placement, foreign body removal	None recommended	
Esophagectomy	cefazolin + metronidazole	vancomycin + metronidazole ± gentamicin or ciprofloxacin
Laparotomy/laparoscopy: • Diaphragm surgeries • Hiatus Hernia/myotomy • Nissen Fundoplication	cefazolin cefazolin None recommended (cefazolin if high risk)	vancomycin vancomycin (vancomycin)
Chest tube insertion • for pneumothorax • for trauma, residual space	None recommended cefazolin	vancomycin
J-tube insertion	cefazolin	vancomycin
UROLOGY		
<i>Endourologic procedures</i>		
Cystoscopy Urodynamic studies Urethral dilatation Stent removal	cefazolin IV, gentamicin IM or IV, oral ciprofloxacin or cotrimoxazole (Septra) (high risk only#)	gentamicin, ciprofloxacin or cotrimoxazole
Ureteroscopy • for tumour or diagnosis (no manipulation) • for stones or high risk#	None recommended cefazolin	gentamicin or ciprofloxacin
TURP	cefazolin	gentamicin or ciprofloxacin
Transrectal prostatic biopsy (TRUS) OR Transrectal placement of fiducial markers pre-radiation	oral ciprofloxacin & oral cotrimoxazole (Septra) Use ceftriaxone 1 gm IM or IV for patients with history of hospitalization or fluoroquinolone use in previous 6 months	gentamicin (IM or IV)
Transurethral resection of bladder tumours	cefazolin (high risk only#)	gentamicin or ciprofloxacin
Stent insertion	cefazolin	gentamicin or ciprofloxacin

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

ESWL	cefazolin	gentamicin or ciprofloxacin
Hydrodistension	cefazolin (high risk only#)	gentamicin or ciprofloxacin
Cystetrograde pyelogram	cefazolin (high risk only#)	gentamicin or ciprofloxacin
Open and MIS Procedures		
Retropubic prostatectomy (simple or radical)	cefazolin	gentamicin + vancomycin
Cystectomy/ileal conduit/neobladder	cefazolin + metronidazole	vancomycin + gentamicin + metronidazole
Urethroplasty	cefazolin	gentamicin + vancomycin
Implantation of prosthetic devices	cefazolin	gentamicin + vancomycin
Brachytherapy	cefazolin	gentamicin + vancomycin
Percutaneous nephrolithotomy (PCNL)	cefazolin	gentamicin + vancomycin
Vasectomy	None recommended	
Kidney transplant	cefazolin	vancomycin
Nephrectomy	cefazolin (optional)	(vancomycin)
# high risk patients include patients with urinary catheterization, indwelling stents and nephrostomy tubes, and transplant patients		
VASCULAR SURGERY		
Abdominal/thoracoabdominal aneurysm repair		
<ul style="list-style-type: none"> • open • endovascular 	cefazolin cefazolin	vancomycin vancomycin
Lower limb revascularization surgery	cefazolin	vancomycin ± gentamicin
Limb amputation for ischemia	cefazolin ± metronidazole	vancomycin ± gentamicin ± metronidazole
Carotid endarterectomy or brachial artery repair		
<ul style="list-style-type: none"> • Involving prosthetic material • No prosthetic material 	cefazolin None recommended	vancomycin
AV fistula creation	None recommended	
AV graft insertion	cefazolin	vancomycin
Thrombectomy	None recommended	
Percutaneous transluminal angioplasty	None recommended	

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

APPENDIX II:

DOSING OF CEFAZOLIN AND VANCOMYCIN

The recommended dose of cefazolin and vancomycin for pre-operative prophylaxis should be based on patient weight as outlined in the Table below.

Recommended Dosing of Cefazolin and Vancomycin

DRUG	RECOMMENDED DOSE			
CEFAZOLIN	1 GRAM if WEIGHT < 60 kg	2 GRAMS if WEIGHT 60 - 119 kg	3 GRAMS if WEIGHT ≥ 120 kg	
VANCOMYCIN	1 GRAM if WEIGHT < 90 kg	1.5 GRAMS if WEIGHT 90 - 129 kg	2 GRAMS if WEIGHT 130 - 149 kg	2.5 GRAMS if WEIGHT ≥ 150 kg

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

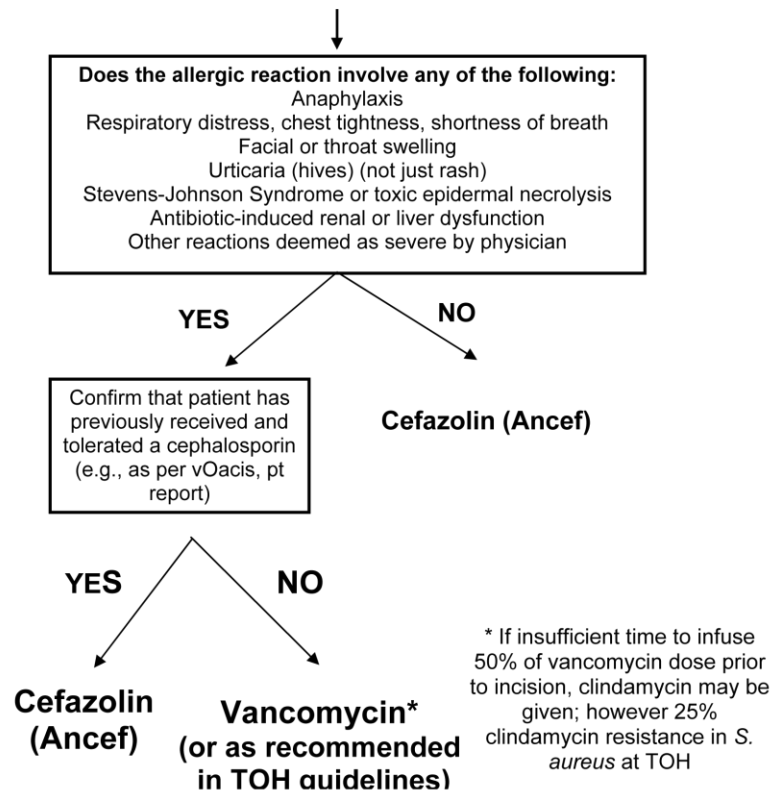
ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS
ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE
PROPHYLAXIE CHIRURGICALE

APPENDIX III:

PENICILLIN ALLERGY ASSESSMENT ALGORITHM

Note: addition of vancomycin recommended for orthopedic, vascular, cardiac and neurosurgery if patient known to be colonized with MRSA

Patient reports serious penicillin allergy



Please refer to Surgical Antibiotic Prophylaxis Recommendations to check if additional antibiotics are required when vancomycin is ordered

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

APPENDIX IV:

RECOMMENDATIONS FOR ADMINISTRATION OF USUAL PERI-OPERATIVE ANTIBIOTIC AGENTS

Usual Prophylactic Antibiotics and Recommended Infusion Time

ANTIBIOTIC	RECOMMENDED INFUSION TIME
Ampicillin	15 minutes
Cefazolin 1-2 g (syringe)	3 to 5 minutes
Cefazolin 3 g (bag)	10 to 15 minutes
Cefazolin/metronidazole premixed bag	20 minutes
Metronidazole	20 minutes
Clindamycin *	30 minutes
Gentamicin ≤ 100 mg	15 minutes
Gentamicin > 100 mg	30 minutes
Vancomycin ≤ 1000 mg *	60 minutes
Vancomycin 1001 - 1500 mg *	90 minutes
Vancomycin 1501 - 2000 mg *	120 minutes
Vancomycin > 2000 mg*	150 minutes

*To be started by nurse on the ward or in SDCU/SDA.

Decrease vancomycin infusion rate if patient experiences flushing, hypotension, rash or dyspnea.

For more information, please refer to The Ottawa Hospital Parenteral Drug Therapy Manual.

ADDENDUM

- i) Due to the brevity of the procedures, ampicillin and gentamicin ordered pre-op for urological surgery will be administered by the nurse on the ward or in SDCU/SDA as close as possible to surgery
- ii) In cases where multiple antibiotics are ordered pre-op (e.g. metronidazole & gentamicin), the drug with the longer infusion time is to be infused first by the nurse on the ward or in SDCU/SDA. Note: the pre-mixed combination of cefazolin and metronidazole should be sent to the OR for administration by the anesthesiologist as per protocol

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Example 1: The Ottawa Hospital - Medical Staff Rules and Regulations. Administration of Pre-operative Antibiotics for Surgical Prophylaxis (continued)

ADMINISTRATION OF PRE-OPERATIVE ANTIBIOTICS FOR SURGICAL PROPHYLAXIS ADMINISTRATION PRÉOPÉRATOIRE D'ANTIBIOTIQUES DANS LE CADRE D'UNE PROPHYLAXIE CHIRURGICALE

APPENDIX V:

INTRA-OPERATIVE ANTIBIOTIC REDOSING CHART

Re-administer prophylactic antibiotic:

- at time intervals outlined below (i.e. when the duration of surgical procedure exceeds 2 half-lives of the drug) or
- in the event of **significant blood loss** (\geq one third of blood volume, avg. 1500 mL).

Drug	Dose	Redose Interval (time from last dose*)
Ampicillin	2 g	2-3 hours**
Cefazolin	1g if wt < 60 kg 2g if wt 60-119 kg 3g if wt \geq 120 kg	3-4 hours**
Cefuroxime	1.5 g	3-4 hours**
Clindamycin	600-900 mg	6 hours
Gentamicin	Redosing not required	
Metronidazole	500 mg	8 hours
Vancomycin	1g if wt < 90 kg 1.5g if wt 90-129 kg 2g if wt 130-149 kg 2.5g if wt \geq 150 kg	8-12 hours†

*interval to the first intraoperative dose is based on time of preoperative dose (not cut time)

** redosing is not generally required if creatinine clearance or eGFR < 30 mL/min

† vancomycin redosing is not required if creatinine clearance or eGFR < 60 mL/min

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Example 2: The Ottawa Hospital - Surgical Prophylaxis Evaluation Form



SURGICAL PROPHYLAXIS EVALUATION FORM 2012

PATIENT # _____ AGE _____ SEX M F

PT WEIGHT: _____ KG BMI: _____ CAMPUS: Civic General

SURGICAL DIVISION: Neuro Ortho GenSx Vascular Thoracics

DATE OF SURGERY: _____

PROCEDURE: _____

PRE OP DRUG/DOSE: _____

ANTIBIOTIC ALLERGIES & REACTION: _____

TIME OF PRE OP ADMIN _____

TIME OR STARTS: _____ TIME OR ENDS: _____ DURN OF OR: _____

TIME BETWEEN DOSE AND START OF OR: _____

INTRA OP DOSE GIVEN? _____ TIME: _____

IF NO INTRA OP DOSE GIVEN: SURGEON: _____

ANESTHESIOLOGIST NAME: _____

FOR ORTHO PTS ONLY: TIME OF TOURNIQUET INFLATION: _____

POST OP ABX REGIMEN: _____ 1 g 2 g 3 g X _____

ANTIBIOTIC IRRIGATION? CEFAZOLIN BACITRACIN

EBL: _____

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Example 4: Providence Health Care, BC - Penicillin Allergy Algorithm for Surgical Patients

Suspected Penicillin Allergy in Patients Undergoing Surgery

This algorithm is meant to help surgeons, anesthesiologists, nurses, and pharmacists clarify reported penicillin allergy in the context of peri-operative antibiotic prophylaxis.

KEY MESSAGES

- Cephalosporins may be prescribed to patients with reported penicillin allergy if physicians use the clinical decision support algorithm below.
- If the reaction to penicillin occurred more than 10 years ago, the likelihood of a reaction to cephalosporin is low due to diminished IgE levels.¹
- Only 10% of all patients who report a penicillin allergy are diagnosed as skin-test positive.² Of those who are skin-test positive, there is only a 2% cross-reactivity rate with cephalosporins for patients who have a true penicillin allergy² (i.e. 0.2% of all patients reporting allergy).
- Overall there is less than a 1 in 100,000 risk of anaphylaxis with a cephalosporin in patients reporting a penicillin allergy.¹

ASSESS THE TYPE OF REACTION TO PENICILLIN

Stevens Johnson Syndrome
OR
Toxic Epidermal Necrolysis

Do NOT administer beta-lactam.
Consider alternative antibiotic.
For vancomycin please make note on OR booking form.

Anaphylaxis within past 10 years (dyspnea, facial swelling, shock, immediate hives)

Referral to allergist for preoperative testing.
Do NOT administer beta-lactam.
Consider alternative antibiotic.
For vancomycin please make note on OR booking form.

Anaphylaxis more than 10 years ago

Proceed with administering cephalosporin in a monitored perioperative setting. Consider referral to allergist for preoperative testing.
Consider physician supervision for first dose depending on clinical history.

Unknown reaction
OR
Patient unable to recall

Non-severe reaction:
• Delayed rash (more than 24 hrs from taking drug)
• Itching
• GI intolerance

Proceed with administering cephalosporin in a monitored perioperative setting.
Consider physician supervision for first dose depending on clinical history.

References

(1) Sullivan, et al. Skin testing to detect penicillin allergy; Journal of Allergy and Clinical Immunology, Vol 68, 1981. (2) Solensky, et al. Drug allergy: an updated practice primer; Annals of Allergy, Asthma & Immunology, Vol 105, Oct 2010 (3) Apter, et al. Is there cross-reactivity between penicillins and cephalosporins?; The American Journal of Medicine, Vol 115, April 2006



Approved by the Antimicrobial Stewardship Subcommittee
Approved by the PHC P&T Committee 2014



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Example 5: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Pre-op and Intra-op Dosing



Table 1. Surgical Prophylaxis – Pre-op and Intra-op Dosing

(For surgical procedures and choice of antibiotic, pre-op dose & post-op dosing, see Table 2)

Pre-op Dose	Pre-op Dose Time	Intra-op Dosing (If duration of procedure exceeds 2 half-lives of the antibiotic OR if there is excessive blood loss (>1500mL))	What to do when the pre-op antibiotic dose has been given, but the surgery is delayed
*Cefazolin 2 g IV over 15-30 min Consider a 3 g pre-op dose if: <ul style="list-style-type: none"> patient > 120 kg AND procedure anticipated to be > 5 h 	0-60 min prior to skin incision	If procedure anticipated to be > 3 h and CrCl \geq 30 mL/min: Cefazolin 1 g Q2H starting at 2 h OR 2 g Q4H starting at 4 h If CrCl < 30mL/min: Cefazolin 1 g Q6H starting at 6 h	If CrCl \geq 30 mL/min and > 2 hours have passed since the pre-op dose, then re-dose with 2g IV x 1 If CrCl < 30mL/min and > 6 h have passed since pre-op dose, re-dose with 2g IV x 1 dose if > 6h have passed.
Ciprofloxacin 500 mg PO (Sterilization of urine for G-U procedures. <i>E.coli</i> resistance 25%.)	At least 2 hours prior to procedure	Not applicable	If \geq 4 hours have passed since the pre-op dose, then re-dose with 500 mg PO (give with minimal sips of water)
Clindamycin 600 mg IV (over 30 min)	0-60 min prior to skin incision	If procedure > 3 h: Clindamycin 600 mg IV Q6H starting at 6 h	If > 2 hours have passed since pre-op dose, then re-dose with 600mg IV
Co-trimoxazole 1 DS tab PO (160 mg TMP / 800 mg SMX) (Sterilization of urine for G-U procedures. <i>E. coli</i> resistance 25%.)	At least 2 hours prior to procedure	Not applicable	If > 6 hours have passed since the pre-op dose, then re-dose with 1 DS tab PO (give with minimal sips of water)
Ertapenem 1 g IV over 30 min	0-60 min prior to skin incision	Not applicable	If \geq 6 hours have passed since the pre-op dose, then re-dose with 1 g IV
Gentamicin IV over 30 min 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	0-60 min prior to skin incision	If \geq 6 hours have passed since initial pre-op dose , then re-dose with 2 mg/kg dosing weight* (rounded off to the nearest 20 mg)	If \geq 6 hours have passed since initial pre-op gentamicin dosing, then re-dose with gentamicin IV 2 mg/kg* (rounded off to the nearest 20 mg)
Metronidazole 500 mg IV over 30 min	0-60 min prior to skin incision	If procedure > 12 h: Metronidazole 500 mg at 12 h x 1 dose only	If \geq 6 hours have passed since initial pre-op metronidazole dosing, then re-dose with 500 mg IV

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Example 5: Sunnybrook Health Sciences Centre - Surgical Prophylaxis –Pre-op and Intra-op Dosing (continued)



Pre-op Dose	Pre-op Dose Time	Intra-op Dosing (If duration of procedure exceeds 2 half-lives of the antibiotic OR if there is excessive blood loss (>1500mL))	What to do when the pre-op antibiotic dose has been given, but the surgery is delayed
Vancomycin as per body weight: < 100 kg: 1 g IV over 60 min 100-119 kg: 1.5 g over 90 min ≥ 120 kg: 2 g IV over 2 h	60-120 min prior to skin incision	If ≥ 6 hours have passed since initial pre-op dose, then repeat the same dose	If ≥ 6 hours have passed since the pre-op dose, then repeat the same dose

**Orders for pre-op cefazolin less than 2 g are to be automatically converted to 2 g (as per MAC-approved Auto-Sub policy)*

*Gentamicin dosing weight is based on the patient's actual body weight unless obese (patient's actual weight is > 30% above ideal body weight). The dosing weight for obese patients = IBW + 0.4(Actual weight – IBW).
IBW (male) = 50kg + 2.3kg(each inch > 5 feet); IBW (female) = 45.5kg + 2.3kg (each inch > 5 feet); (1 inch = 2.5cm)

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing



Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
APPENDECTOMY			
All patients	Metronidazole 500 mg <u>Plus</u> Cefazolin 2 g*	Metronidazole 500 mg <u>Plus</u> Gentamicin 5 mg/kg*	• No antibiotic • Note: If appendix or intestine gangrenous or perforated, start treatment course
BREAST			
High risk patients only - Recent neoadjuvant chemotherapy or radiation therapy - Prosthetic material or mesh - Re-operation or recent prior breast surgery - Reconstruction surgeries - Operation duration ≥ 2 hours - Immunocompromised patients (diabetics, steroids, etc)	Cefazolin 2 g*^	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	No antibiotic
CARDIAC			
All patients	Cefazolin 2 g*^	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	Cefazolin 1 g Q8H x 3 OR Vancomycin 1 g Q12H x 2 (no post-op doses if GFR <60)
COLORECTAL			
All patients	Metronidazole 500 mg <u>Plus</u> Cefazolin 2 g*	Metronidazole 500 mg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing (continued)

Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing
(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
GASTRODUODENAL			
High risk patients only (decreased gastric acidity and GI motility) - Obstruction - Hemorrhage - Gastric ulcer or malignancy - Therapy with H2 blocker or PPI - Morbid obesity	Cefazolin 2 g*	Clindamycin 600 mg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing (continued)

Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
HAND (continued)			
Simple Clean Procedures: - Clean simple soft tissue lacerations - Open flexor tendon injuries	No antibiotics	No antibiotics	No antibiotics
HEAD AND NECK (MAJOR)			
Clean procedures: - no incision of the oral or pharyngeal mucosa - no implantation of prosthetic material - exceptions (no antibiotics): - thyroidectomy - parotidectomy - submandibular gland excision - all of above with no neck dissections and/or skull base involvement	Cefazolin 2 g*	Clindamycin 600 mg	<u>Oncology patients</u> Cefazolin 1 g Q8H x 3 OR Clindamycin 600 mg Q8H x 3 <u>Benign patients</u> No antibiotic
Clean-contaminated procedures: - Require penetration of the oral or pharyngeal mucosa - Complex resection with reconstruction procedures - Revision and salvage surgeries	Cefazolin 2 g* Plus Metronidazole 500 mg	Clindamycin 600 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	<u>Oncology patients</u> 1. Cefazolin 1 g Q8H x 3 Plus Metronidazole 500 mg Q12H x 2 OR 2. Clindamycin 600 mg Q8H x 3 (Gentamicin – No post-op doses) <u>Benign patients</u> No antibiotic

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing (continued)

Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
HEPATIC PANCREATIC BILIARY TRACT (HPB)			
Minor Procedures (e.g., Cholecystectomy) - High risk patients only - Age > 70 - Acute cholecystitis - Non-functioning gall bladder - Obstructive jaundice - Common bile duct stones	Cefazolin 2 g*	Clindamycin 600 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic for most patients Exceptions: - Acute Cholecystitis: 2-5 days - Emphysematous acute cholecystitis: 5-7 days - Gangrene or perforated gallbladder: Course of treatment with a broad spectrum antibiotic
Major Procedures	Metronidazole 500 mg Plus Cefazolin 2 g*	Clindamycin 600mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic
HERNIA REPAIR			
High risk patients only - Prosthetic material or mesh - age ≥ 70 - Immune compromised patients (diabetes, neoplasm, HIV/AIDS) - Corticosteroid use - Recurrent repairs - Operative time ≥ 2 hours - Routine use of drainage and prostheses	Cefazolin 2 g**	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	No antibiotic

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing (continued)

Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing
(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
NEUROSURGERY			
Craniotomy Clean, non-implant	Cefazolin 2 g ⁺	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	No antibiotic
Craniotomy - Clean-contaminated - Crosses sinuses or naso/oropharynx - Emergency surgery - Operation ≥ 2 hours - CSF leakage - Subsequent operation Transsphenoidal surgery - All patients	Cefazolin 2 g ⁺	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	No antibiotic
CSF Shunting	Cefazolin 2 g ⁺	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	Cefazolin 1 g Q8H x 3 OR Vancomycin 1 g Q12H x 2 (<u>no post-op</u> doses if GFR <60)

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Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
OBSTETRICS & GYNAECOLOGY			
Abortion, first trimester	<ul style="list-style-type: none"> - Chlamydia - positive or suspected - Previous pelvic inflammatory disease, gonorrhoea or multiple sex partners <p>1 hr pre-op: Azithromycin 1 g po OR Doxycycline 200 mg po</p> <p>If bacterial vaginosis positive or suspected <u>ADD</u> Metronidazole 500 mg po</p> <p><i>All other patients:</i> Cefazolin 2 g*</p>	<ul style="list-style-type: none"> - Chlamydia - positive or suspected - Previous pelvic inflammatory disease, gonorrhoea or multiple sex partners <p>Azithromycin 1 g po OR Doxycycline 100 mg po either given 1 h pre-op</p> <p>If bacterial vaginosis positive or suspected, <u>ADD</u> Metronidazole 500 mg po</p> <p><i>All other patients:</i> Clindamycin 600 mg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)</p>	If azithromycin or doxycycline was given pre-op, no post-op dosing required

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Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing
(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
OBSTETRICS & GYNAECOLOGY (continued)			
<ul style="list-style-type: none"> - Radical and total hysterectomy (abdominal, laparoscopic or vaginal) - Caesarean section <ul style="list-style-type: none"> - Administer antibiotics prior to skin incision NOT after cord clamping - Vulvectomy with or without lymphadenectomy - Vaginectomy - Urogynecological procedures <ul style="list-style-type: none"> - Laparoscopic Burch - 2-Team sling 	Cefazolin 2 g*	Clindamycin 600 mg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic
Endometriosis involving large and/ or small bowel only	Metronidazole 500 mg <u>Plus</u> Cefazolin 2 g*	Metronidazole 500 mg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic
ORAL AND MAXILLOFACIAL			
No oral or sinus cavity involvement	Cefazolin 2 g*	Clindamycin 600 mg	No antibiotic
<ul style="list-style-type: none"> - Oral cavity or sinus cavity involvement - Comminuted and compounded fractures - Implants/prostheses; bone graft orthognathic 	Cefazolin 2 g* <u>Plus</u> Metronidazole 500 mg	Clindamycin 600 mg	No antibiotic

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing (continued)

Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing
(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
ORAL AND MAXILLOFACIAL (continued)			
<ul style="list-style-type: none"> - Gunshot wound - Animal or human bite injuries - Grossly contaminated and dirty injury 	Cefazolin 2 g* Plus Metronidazole 500 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	Clindamycin 600 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	Cefazolin 1 g Q8H x 3 Plus Metronidazole 500 mg Q12H x 2 OR Clindamycin 600 mg Q8H x 3 <u>(Gentamicin – No post-op doses)</u> For injuries present longer than 6 hours, consider an ID consult to determine appropriate antibiotic duration
ORTHOPEDIC			
Major procedures: <ul style="list-style-type: none"> - Difficult fracture reconstruction - total hip & knee replacement - other procedures requiring prophylaxis 	Cefazolin 2 g**	Clindamycin 600 mg OR Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	Cefazolin 1 g Q8H x 3 OR Clindamycin 600 mg Q8H x 3 OR Vancomycin 1 g Q12H x 2 <u>(no post-op doses if GFR <60)</u>
Minor procedures: <ul style="list-style-type: none"> - arthroscopy - procedures not involving implantation or prosthetic material 	No antibiotics		
SPINE			
<ul style="list-style-type: none"> - Fusion - Decompression - Instrumentation 	Cefazolin 2 g**	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	No antibiotic

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Example 6: Sunnybrook Health Sciences Centre - Surgical Prophylaxis – Antibiotic Choice and Pre-op and Post-op Dosing (continued)

Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing
(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
THORACIC			
Pulmonary resection only	Cefazolin 2 g**	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	No antibiotic
TRAUMA (ORTHOPEDECS)			
Gun shot fracture wound	Cefazolin 2 g**	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	Cefazolin 1 g Q8H x 6 OR Vancomycin 1 g Q12H x 4 (<u>no post-op</u> doses if GFR <60)
Gun shot fracture wound <i>with</i> - large soft tissue defects or cavitary lesions AND/OR - fracture of the extremities (about the hand, foot and ankle)	Cefazolin 2 g** <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	1. Cefazolin 1 g Q8H x 6 <u>Plus</u> Gentamicin 5 mg/kg x 1 dose only at 1000 h on post-op day #1 (rounded off to the nearest 50 mg) OR 2. Vancomycin 1 g Q12H x 2 (<u>no post-op</u> doses if GFR <60) <u>Plus</u> Gentamicin 5 mg/kg x 1 dose at 1000 h on post-op day #1 (rounded off to the nearest 50 mg)

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Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
TRAUMA (ORTHOPEDECS) (continued)			
Gun shot fracture wound <i>with</i> - large soft tissue defects or cavitary lesions AND/OR - fracture of the extremities (about the hand, foot and ankle) PLUS - gross contamination of the wound and environment - occurred in rural/wooded area - grossly dirty skin and clothes - bowel communication	Cefazolin 2 g* Plus Metronidazole 500 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg Plus Metronidazole 500 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	1. Cefazolin 1 g Q8H x 6 Plus Metronidazole 500 mg Q12H x 4 Plus Gentamicin 5 mg/kg x <u>1 dose at 1000 h</u> <u>on post-op day #1</u> (rounded off to the nearest 50 mg) OR 2. Vancomycin 1 g Q12H x 4 (no post-op doses if GFR <60) Plus Metronidazole 500 mg Q12H x 4 Plus Gentamicin 5 mg/kg x <u>1 dose at 1000 h</u> <u>on post-op day #1</u> (rounded off to the nearest 50 mg) For patients with signs or symptoms of infection, consult Infectious Diseases.
TRAUMA (ABDOMEN)			
Penetrating abdominal trauma hollow viscus injury	Metronidazole 500 mg Plus Cefazolin 2 g*	Metronidazole 500 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	1. Metronidazole 500 mg Q12H x 2 Plus Cefazolin 1 g Q8H x 3 OR 2. Metronidazole 500 mg Q12H x 2 (Gentamicin – No post-op doses)
Penetrating abdominal trauma Non-hollow viscus injury	Metronidazole 500 mg Plus Cefazolin 2 g*	Metronidazole 500 mg Plus Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	No antibiotic

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Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing
(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
URINARY DIVERSION PROCEDURES INVOLVING BOWEL SEGMENTS (assuming all patients have urine culture performed and all positive urine culture patients are treated before surgery)			
- ileal conduit procedures or procedures involving bowel segments Oral AND IV antibiotics	Metronidazole 500 mg <u>Plus</u> Cefazolin 2 g*	Metronidazole 500 mg <u>Plus</u> Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)	1. Metronidazole 500 mg Q12H x 2 <u>Plus</u> Cefazolin 1 g Q8H x 3 OR 2. Metronidazole 500 mg Q12H x 2 (Gentamicin – No post-op doses)

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Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
UROLOGY (assuming all patients have urine culture performed and all positive urine culture patients are treated before surgery)			
<ul style="list-style-type: none"> - TURP and retropubic total prostatectomy - transrectal and core biopsy of the prostate - ureteroscopy & percutaneous stone surgery - implantation of prosthetic device - impaired immune status - other open and laparoscopy procedures - clean-contaminated procedures (open and/or entry via urinary tract) <ul style="list-style-type: none"> > all patients - clean procedures (no urinary tract entry) <ul style="list-style-type: none"> > high risk patients only <ul style="list-style-type: none"> - advanced age - poor nutritional status - diabetes mellitus - smoking, - obesity - infection at a remote site - colonization <p>oral OR IV antibiotics</p>	<p>1. Oral antibiotics: to be given 1-2 hrs pre-op: Ciprofloxacin 500 mg OR Co-trimoxazole DS 1 tab (<i>E. coli</i> resistance to above agents is 25%).</p> <p>OR</p> <p>2. IV Antibiotics: Cefazolin 2 g^{*,^} With or without: Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg)</p>	<p>1. Oral antibiotics: to be given 1-2 hrs pre-op: Ciprofloxacin 500 mg OR Co-trimoxazole DS 1 tab OR</p> <p>2. IV Antibiotics: Gentamicin 5 mg/kg dosing weight* (rounded off to the nearest 50 mg) With or without either: Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg OR Clindamycin 600 mg</p>	<p>1. Oral antibiotics: Ciprofloxacin 500 mg po BID x 2 OR Co-trimoxazole DS 1 tab po BID x 2 OR</p> <p>2. IV Antibiotics: No penicillin allergy: Cefazolin 1 g Q8H x 3 For penicillin allergy: Vancomycin Q12H x 2 if CrCl ≥ 60 (no post-op doses if CrCl < 60) Dose as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg OR Clindamycin 600 mg Q8H x 3</p>

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Table 2. Surgical Prophylaxis – Choice of Antibiotic by Procedure and Pre-op / Post-op Dosing

(For timing of pre-op dose and for intra-op dosing, see Table 1)

Patient Selection	Pre-op IV Antibiotic		Post-op Antibiotic Dosing
	Standard Regimen	Penicillin Allergy	
UROLOGY (continued)			
<ul style="list-style-type: none"> - ureteroscopy - cystoscopy - open and laparoscopy procedures - clean (no urinary tract entry) - exception: high risk patients – see above risk factors 	No antibiotic (assuming all patients have urine culture performed and all positive urine culture patients are treated before surgery)	No antibiotic (assuming all patients have urine culture performed and all positive urine culture patients are treated before surgery)	No antibiotic (assuming all patients have urine culture performed and all positive urine culture patients are treated before surgery)
VASCULAR SURGERY			
<ul style="list-style-type: none"> - Lower limb amputation - Abdominal and lower limb vascular surgery - Procedures involving groin incision or prosthetic material - Carotid endarterectomy and brachial arterial repair with prosthetic graft only 	Cefazolin 2 g ⁺	Vancomycin as per body weight: 1 g for < 100 kg 1.5 g for 100-119 kg 2 g for ≥ 120 kg	Cefazolin 1 g Q8H x 3 OR Vancomycin 1 g Q12H x 2 (no post-op doses if GFR <60)

*Orders for pre-op cefazolin less than 2 g are to be automatically converted to 2 g (as per MAC-approved Auto-Sub policy)

+ For patients weighing > 120kg, may consider giving cefazolin 3g if the duration of surgery is anticipated to be >5h
 ^ May consider using vancomycin for patients known to be colonized with MRSA
 * Gentamicin dosing weight is based on the patient's actual body weight unless obese (patient's actual weight is > 30% above ideal body weight (IBW). The dosing weight for obese patients = IBW + 0.4(Actual weight – IBW).
 IBW (male) = 50kg + 2.3kg (each inch > 5 feet); IBW (female) = 45.5kg + 2.3kg (each inch > 5 feet); (1 inch = 2.5cm)

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