

SURGICAL ANTIMICROBIAL PROPHYLAXIS - SCH

PRACTICE GUIDELINE [®]

DOCUMENT SUMMARY/KEY POINTS

- Judicious use of antibiotics is essential to minimise adverse effects, minimise the emergence of antibiotic-resistant organisms, ensure availability of effective antibiotics in the future and to control costs
- Prophylaxis should be considered where there is a significant risk of infection (e.g. immunocompromised patients, including newborns) or where postoperative infection, even if uncommon, would have severe consequences
- Risk factors for wound infections include, abdominal case, procedures over 2 hours, co morbidities, contamination and obesity
- Antibiotic prophylaxis should be administered so that the antibiotic is present in the tissues of the wound in inhibitory concentrations beginning just before the initial incision and lasting at least through the duration of the operation.
- IV antibiotics should be administered OR completed within 60 minutes of surgical incision.
- A second dose may be necessary where there is a delay in starting the operation, surgery is prolonged beyond half the usual therapeutic dosing interval or where there is substantial blood loss.
- Single-dose prophylaxis is usually sufficient. If antimicrobial prophylaxis is continued postoperatively, the duration should be less than 24 hours.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
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Team Leader:	SCH Staff Specialist, Dept Head	Area/Dept: Immunology & Infectious Diseases

CHANGE SUMMARY

- This document replaces SCH.C.20.09 Surgical Antimicrobial Prophylaxis:
- Updated antimicrobial recommendations, dosing and timing in line with the ASHP clinical practice guidelines for antimicrobial prophylaxis in Surgery 2013
- Inclusion of advice for MRSA decolonisation protocols in line with current SCH guidelines
- Antimicrobial recommendations for patients with penicillin allergy

READ ACKNOWLEDGEMENT

- All clinical staff prescribing and administering antimicrobials for surgical prophylaxis should read and acknowledge this document.

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1 Rationale

Judicious use of antibiotics is essential to minimise adverse effects, minimise the emergence of antibiotic-resistant organisms, ensure availability of effective antibiotics in the future and to control costs.

These guidelines are for prophylactic use of antibiotics prior to surgery (i.e. before infection takes place) as distinct from their use in treatment of early infection (e.g. removal of perforated appendix).

2 Recommendations

Indications: Classification and consideration of risk factors

Prophylaxis should be considered where there is a significant risk of infection (eg immunocompromised patients, including newborns) or where postoperative infection, even if uncommon, would have severe consequences (e.g. infection associated with a prosthetic implant). The Centers for Disease Control have identified criteria for increased risk of wound infection. Table A may also be used as a guide, any case with 2 or more of these risk factors will have approximately a 10% risk of wound infection.

Table A: Risk Factors for Wound Infection

Risk Factor
<ul style="list-style-type: none"> • Abdominal case • Duration of operation over 2 hours • Medical diagnoses • Contamination at operation • Obesity

Surgical procedures can also be classified according to the level of microbial contamination routinely associated with that procedure and the likelihood of infection (See Table B). In general, antibiotic prophylaxis is indicated in all procedures in the categories of “clean contaminated”, “contaminated” or “dirty”. Prophylaxis for “clean” procedures is not generally indicated (e.g. insertion of central line, hernia repair without prosthesis) unless specific risk factors or circumstances that are associated with greater risk or consequence of infectious complications exist.³

Table B: Microbial Contamination by Surgical Type

Classification	Criteria	Risk of Infection
Clean	Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in aseptic technique; respiratory, GI, biliary and GU tracts not entered	Less than 2 %
Clean-contaminated	Urgent or emergency case that is otherwise clean; elective opening of respiratory, GI, biliary or GU tract with minimal spillage (e.g. appendectomy) not encountering infected urine or bile; minor break in aseptic technique	Less than 10 %
Contaminated	Non-purulent inflammation; gross spillage from GI tract; entry into biliary or GU tract in the presence of infected bile or urine; major break in aseptic technique; penetrating trauma < 4hrs old; chronic open wounds to be grafted or covered	~ 20 %
Dirty	Purulent inflammation (eg abscess); preoperative perforation of respiratory, GI, biliary or GU tract; penetrating trauma > 4hrs old	~ 40 %

Limitations of Prophylactic Use

Antibiotic prophylaxis cannot be relied upon to overcome poor surgical technique. Surgeons should continue to make every effort to minimise damage to tissues, overcome excessive soiling (eg. irrigation of wounds prior to closure), perform adequate debridement and minimise handling of prosthetic material.

General Principles

Excessive duration of antibiotics for prophylaxis and treatment of surgical infection appears to be the principal reason for “inappropriate” administration in surgical practice.⁴ There is good evidence in the research literature to support strong recommendations regarding the appropriate timing and duration of surgical antibiotic prophylaxis.^{5,6}

Timing of Antimicrobial administration

Antibiotic prophylaxis should be administered so that the antibiotic is present in the tissues of the wound in inhibitory concentrations beginning just before the initial incision and lasting at least through the duration of the operation.

IV antibiotics should be administered OR completed within 60 minutes of **surgical incision**. Medications such as vancomycin require a slower infusion and care must be taken to ensure infusions are administered over the recommended duration to limit risk of adverse effects to the patient

Duration of Antimicrobial Use

In general, a **single dose** of a parenteral drug immediately preoperatively is all that is required.

A **second dose** may be necessary under the following circumstances:

- A delay in starting the operation
- Surgery is prolonged beyond one half of the usual therapeutic dosing interval after the initial dose

(E.g. cefazolin has a usual dosing interval of 8 hours, so a second dose should be given after 4 hours)

- Substantial blood loss

The practice of continuing prophylactic antibiotics until surgical drains have been removed is not endorsed or supported by evidence.¹

Choice of Antibiotic

In general, antimicrobials should be chosen based on the most likely infecting organism(s) rather than the most prevalent contaminating organism(s). There is no evidence to indicate that eradication of all potential pathogens is necessary to achieve efficacy.

The choice of antimicrobial agents should take into account:

1. The anatomical site of surgery
2. Local factors: the organisms causing infections within the institution and their patterns of susceptibility

The recommendations for choice of antibiotic should be regularly reviewed to take into account new research evidence as well as any changes in local susceptibilities and infection rates.

The SCH recommendations for antimicrobial prophylaxis in children are listed in Table C. Patients with congenital cardiac lesions requiring antimicrobial prophylaxis for prevention of Subacute Bacterial Endocarditis should be treated in line with recommendations in Therapeutic Guidelines: Endocarditis.

Table C: Choice of Antibiotic^{2,3,7,8,9}

Type of Surgery	Indications	Drug	Penicillin Allergy
HEAD & NECK	If oral or pharyngeal mucosa traversed or if insertion of prosthetic material	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g)	clindamycin 10mg/kg/dose (Up to 600mg) OR vancomycin ^B 15 mg/kg/dose (Up to 1g)
THORACIC (non-cardiac)	If oesophageal or bronchial mucosa traversed		
ABDOMINAL Gastro-duodenal	High risk: eg Pyloromyotomy or Percutaneous endoscopic gastrostomy	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g)	clindamycin 10mg/kg/dose (Up to 600mg) AND gentamicin ^F OR vancomycin ^B 15mg/kg/dose (Up to 1g) AND gentamicin ^F
Small bowel and colorectal	All operations involving an incision into the small bowel, large bowel and rectum	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g) AND metronidazole ^C 12.5mg/kg/dose (Up to 500mg)	gentamicin ^F AND metronidazole 12.5mg/kg/dose (Up to 500mg)
Biliary tract	Clean contaminated	cefazolin ^{A,B} 30mg/kg/dose (Up to 2 g)	clindamycin 10mg/kg/dose (Up to 600mg) AND gentamicin ^F

Appendicectomy ^G		cefazolin ^{A,B} 30mg/kg/dose (Up to 2g) AND metronidazole ^C 12.5mg/kg/dose (Up to 500mg)	gentamicin ^F AND metronidazole 12.5mg/kg/dose (Up to 500 mg)
VASCULAR	Implanted device: e.g. Portacath	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g)	clindamycin 10mg/kg/dose (Up to 600mg) OR vancomycin ^B 15mg/kg/dose (Up to 1g)
ORTHOPAEDIC SURGERY	-Insertion of prosthesis -Internal fixation of fractures <i>Allow 5 minutes after antibiotic administration before tourniquet application</i>	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g)	clindamycin 10mg/kg/dose (Up to 600mg) OR vancomycin ^B 15mg/kg/dose (Up to 1g)
NEURO SURGERY	-“Clean” procedures (e.g. elective craniotomy) - Insertion of prosthetic material (eg CSF shunt) -Prolonged procedures; re-explorations, microsurgery	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g)	clindamycin 10mg/kg/dose (Up to 600mg) OR vancomycin ^B 15mg/kg/dose (Up to 1g)
CARDIAC SURGERY	Open heart surgery, especially for congenital heart disease with or without placement of prosthetic heart valves or prosthetic intravascular or intracardiac materials	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g)	clindamycin 10mg/kg/dose (up to 600mg) OR vancomycin ^B 15mg/kg/dose (Up to 1g)
UROLOGY	Major urinary tract reconstruction involving bowel ⁶	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g) AND metronidazole ^C 12.5mg/kg/dose (Up to 500mg)	gentamicin ^F AND metronidazole 12.5mg/kg/dose (max dose 500mg)
	Complex reconstructive operation +/- insertion of prosthesis ⁶	cefazolin ^{A,B} 30mg/kg/dose (Up to 2g) AND gentamicin ^F	clindamycin 10mg/kg/dose (Up to 600 mg) AND gentamicin ^F
NEONATAL	Prophylaxis should be considered in most cases as there is a significant risk of infection in newborns (who are immunocompromised)	Antimicrobials as per the site of surgery above at an appropriate neonatal dose See RHW Newborn Care Centre Clinical resources	

- A. Cefazolin is a 1st generation cephalosporin which is the agent of choice for most procedures because it is effective against most organisms encountered in surgery; has a relatively long duration of action (usual dosing interval is 8 hourly); and is relatively cheap. Re-dosing should occur at 4 hours if the wound remains open at that time.
- B. Vancomycin should be substituted for Cefazolin in the regimens listed above where:
- Patient undergoing prosthetic cardiac valve, joint or vascular surgery where the procedure is a re-operation
 - Vancomycin may be considered in children known to be colonised with MRSA. There is little evidence supporting the use of vancomycin for routine perioperative antimicrobial prophylaxis. Mupirocin use has been studied in children colonised with MRSA and shown to be efficacious in reducing colonisation. See SCH Clinical Business Rule: MRSA & Staphylococcus Screening and Decolonisation Protocol for management options.
- C. Metronidazole is effective against both gram positive and negative anaerobes. The half-life is 6-14 hours, with the usual dosing interval being 8 hourly (Redose at 4 hours if the wound remains open at that time).
- D. Current expert consensus recommendation is to give cefazolin within 60 minutes of surgical incision, Single-dose prophylaxis is usually sufficient. If antimicrobial prophylaxis is continued postoperatively, the duration should be less than 24 hours. There is currently no evidence to support continuing antimicrobial prophylaxis until chest and mediastinal drainage tubes are removed.²
- E. Procedures not involving bowel and performed in the context of sterile urine do NOT require prophylactic antibiotics.³ For patients who temporarily require an indwelling catheter (and who have documented sterile urine pre-operatively) the use of antibiotics to cover the period of catheterisation is not recommended.¹
- F. Gentamicin is dosed according to age and weight and comorbidities including renal function and the use of other nephrotoxic medications. See [Once daily Gentamicin Guideline-SCH](#). For non-neonatal patients with no risk factors the following may be administered once per 24 hours:
Infants and children under 10 years should be given 7.5mg/kg/dose (maximum dose: 360mg)
Children over 10 years old should be given 6mg/kg (max dose 360 mg)
- G. This document addresses surgical perioperative prophylaxis rather than treatment of established infection. For complicated intra-abdominal infections, such as perforated appendicitis, antibiotic therapy with ampicillin, gentamicin and metronidazole in combination should be commenced at time of diagnosis. Antibiotic therapy is generally required for 4-7 days, unless it is difficult to achieve source control.⁹ Due to risk of gentamicin toxicity, antibiotics should be changed (if required beyond 72 hours) to single-agent IV piperacillin-tazobactam or oral amoxicillin-clavulanate, depending on clinical progress. For more information discuss with Infectious Diseases team and see
- a. [Empiric antibiotic guideline -SCH](#)
 - b. [Therapeutic Guideline: Antibiotic: Peritonitis due to perforated viscus](#)
 - c. [Once daily gentamicin guideline -SCH](#)
- H. There is a history of an immediate (IgE-mediated) hypersensitivity reaction to penicillin, such as urticaria, angioedema or anaphylaxis. Patients who report a penicillin allergy should be asked specific details about the nature of the reaction, the timing and the outcome. If this does not suggest hypersensitivity, cefazolin can be used where indicated. For more information see [Therapeutic Guidelines: Antibiotic : Antimicrobial Hypersensitivity](#)

3 References

1. Therapeutic Guidelines: Antibiotic, 14th edition, 2010, Therapeutic Guidelines Limited, Melbourne, Victoria
2. American Society of Health-System Pharmacists (ASHP) Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery. Am J Health-Syst Pharm 2013;70:195
3. Woods RK, Dellinger EP. Current Guidelines for Antibiotic prophylaxis of surgical wounds. American Family Physician 1998;57(11):2731-2740
4. Wittman DH, Schein M. Let us shorten antibiotic prophylaxis and therapy in surgery. The American Journal of Surgery 1996;172(suppl 6A):26S-32S.
5. Classen DC, Scott Evans R, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical wound infection. NEJM 1992;326:281-286.
6. Wenzel RP. Preoperative antibiotic prophylaxis. NEJM 1992;326:337-339.
7. Committee on Antimicrobial agents, Canadian Infectious Disease Society; Waddell and Rotstein. Antimicrobial Prophylaxis in Surgery. CMAJ 1994;151(7):925-931.
8. Bratzler DO, Houck PM, for the Surgical Infection Prevention Guideline Writers Workgroup. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. The American Journal of Surgery 2005; 189:395-404.
9. Solomkin JS, Mazuski JE, Bradley JS, Rodvold KA, Goldstein EJC, Baron EJ, et al. Diagnosis and Management of Complicated Intra-abdominal Infection in Adults and Children: Guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. Clinical Infectious Diseases. 2010 Jan. 15;50(2):133-64.

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