

Surgical Antibiotic Prophylaxis at SLCH

General Concepts and Guidance:

- Overview of guidance
 - **Table 1** lists recommended and alternative antibiotic agents for select procedure types
 - **Table 2** summarizes recommended dosing and re-dosing for antibiotic agents
 - **Appendix A** outlines indications and antibiotic agents for prophylaxis against endocarditis
- For at-risk procedures, data suggest **anti-MRSA therapy** is warranted pre-operatively in patients with *active* MRSA colonization. In patients without a recent MRSA nasal swab, it's reasonable to review culture data in Epic from the preceding few months (up to 6 months), acknowledging that colonization waxes and wanes overtime. NOTE: Data suggest vancomycin is less effective than cefazolin for preventing surgical site infections caused by MSSA and other non-MRSA pathogens.
- Depending on the procedure, culture results should also be reviewed for VRE and/or resistant gram-negative organisms. Patients with a history of colonization or infection with an organism not covered by recommendations in Table 1 may require targeted prophylaxis. Consult ASP/ID for recommendations.
- Patients with **Penicillin allergies** can safely receive a cephalosporin for surgical prophylaxis, and cefazolin, specifically, does not share a similar R1 side-chain with any other beta-lactam antibiotic.
- Patients with **Cephalosporin allergies** that are not cefazolin can still be considered candidates for cefazolin prophylaxis due to its dissimilar R1 side-chain. Alternative antibiotic(s) recommended for allergies are listed in Table 1 below.
- **Timing of preoperative antibiotics** is crucial to ensuring effective tissue concentrations at the time of initial surgical incision, and administration of antimicrobials after this initial surgical incision increases risk of surgical site infection. The recommended administration window of antibiotics preoperatively varies based on drug and infusion duration:

Antibiotics	Administration Window (from the START of the antibiotic infusion)	OR Infusion Time
Cephalosporins, ampicillin/sulbactam, piperacillin/tazobactam, aztreonam, carbapenems, clindamycin, gentamicin, metronidazole, & linezolid	0-60 minutes prior to initial surgical incision, but no earlier than 60 minutes	Cefazolin, cefepime, ceftioxin, carbapenems: 5-10 minutes Ceftriaxone, ampicillin sulbactam, aztreonam, gentamicin: 15 minutes Clindamycin, metronidazole, linezolid, piperacillin/tazobactam: 30 minutes
Vancomycin and ciprofloxacin	30-120 minutes prior to initial surgical incision, but no earlier than 120 minutes	IV infusion over 60 minutes at least

These recommendations do not establish a standard of care to be followed in every case. Each case is different and the individuals providing health care are expected to use their judgement in determining what is in the best interests of the patient based on the circumstances at the time.

Table 1. Antibiotic Prophylaxis for Surgical Procedures

SURGERY	PREFERRED ANTIBIOTIC	PREFERRED CEPHALOSPORIN ALLERGY	MRSA COLONIZATION / INFECTION*	VRE COLONIZATION / INFECTION	POST-OP PROPHYLAXIS DURATION
CARDIAC SURGERY					
All Cardiac Procedures	Cefazolin	Vancomycin or Clindamycin	Vancomycin or Clindamycin	Linezolid	≤ 24 - 48 h
GENERAL SURGERY / GASTROINTESTINAL					
Appendectomy (only if therapeutic agents are not initiated yet)	Cefoxitin OR Ceftriaxone + Metronidazole	Ciprofloxacin + Metronidazole	—	—	Non-perforated ≤ 24 h
Clean with risk (e.g. implant); clean contaminated/proximal GI (esophageal, stomach, proximal small bowel)	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	≤ 24 h
Contaminated or high risk for gram-negative colonization (biliary, distal small bowel, appendix, colon)	Cefoxitin	Ciprofloxacin + Metronidazole	—	—	≤ 24 h
G-tube placement	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	—	none
G-tube placement in patient with VP shunt	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	—	≤ 24 h
GYNECOLOGY					
Hysterectomy	Cefazolin	Clindamycin + Gentamicin	Vancomycin or Clindamycin + Gentamicin	Linezolid + Gentamicin	None
Laparotomy/laparoscopy with entry into bowel/vagina	Cefazolin	Clindamycin + Gentamicin	Vancomycin or Clindamycin + Gentamicin	Linezolid + Gentamicin	None
Other laparotomy (without entry into bowel/vagina)	None Required				
Other laparoscopy (without entry into bowel/vagina)	None Required				

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GYNECOLOGY (CONTINUED)					
Colporrhaphy or procedure with complete transection of vagina	Cefazolin	Clindamycin + Gentamicin	Vancomycin or Clindamycin + Gentamicin	Linezolid + Gentamicin	None
Other common gynecologic procedures (exam under anesthesia, vaginoscopy, hymenectomy, cervical tissue excision, cystoscopy, endometrial biopsy, hysteroscopy (operative & diagnostic), IUD insertion, gynecologic D&C): NO ANTIBIOTIC PROPHYLAXIS RECOMMENDED					
HEAD AND NECK / ENT					
Tonsillectomy, adenoidectomy, tympanostomy tubes	none	none	none	none	none
Clean-contaminated or with placement of prosthesis	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	≤ 24 h
NEUROSURGERY					
All neurologic surgical procedures	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	≤ 24 h
Lumbar spine (incision near rectum)	Cefazolin OR Cefepime	Ciprofloxacin	Vancomycin + Cefepime	Linezolid + Cefepime	≤ 24 h
OPHTHAMOLOGY					
All endophthalmic procedures	Intravitreal Cefazidime + Intravitreal Vancomycin				
Intraocular surgical procedures	Intracameral Cefuroxime				
Perioperative globe perforation	None or Cefazolin IV x1 dose				

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ORTHOPEDIC					
Spinal fusion (idiopathic)	Cefazolin	Vancomycin OR Clindamycin	Vancomycin	Linezolid	≤ 24 h
Spinal fusion (neuromuscular)	Cefepime +/- Vancomycin	Vancomycin + Ciprofloxacin	Vancomycin + Cefepime	Linezolid + Cefepime	≤ 24 h
Lumbar spine (including myelo repair, detethering, discectomy, fusion, baclofen pump, etc.)	Cefazolin OR Cefepime	Ciprofloxacin	Vancomycin + Cefepime	Linezolid + Cefepime	≤ 24 h
All others	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	≤ 24 h
PLASTIC					
Clean wounds (Craniosynostosis, Breast reconstruction/reduction, Tissue expanders, Peripheral nerve/Facial animation, congenital nevus > 1.5 hrs)	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	≤ 24 h
Cleft lip	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	≤ 24 h
Intraoral/Maxillofacial (Cleft palate, Le fort fracture, mandible fracture, orbital fracture, alveolar bone graft, rhinoplasty)	Ampicillin / sulbactam	Clindamycin + Ciprofloxacin	Vancomycin + Ampicillin/ Sulbactam	Ampicillin/ Sulbactam	≤ 24 h

*In patients colonized with MRSA, Clindamycin susceptibility should be confirmed prior to using Clindamycin as pre-operative prophylaxis. Please call the microbiology lab within 7 days of the positive result to request susceptibility testing.

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TRANSPLANT (SOLID ORGAN)					
Heart	Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	Linezolid	Open chest: Cefazolin After closure: ≤ 24 h
Kidney	Cefazolin	Vancomycin OR Clindamycin + Aztreonam	—	—	≤ 24 h
Liver	Piperacillin/tazobactam	Vancomycin OR Clindamycin + Gentamicin	Vancomycin OR Clindamycin + Gentamicin	Linezolid + Ceftriaxone	≤ 48 h
Lung	Predetermined by Transplant ID and pharmacy prior to listing See recommendations in transplant folder				CF: 2 weeks Non-CF: 7-10 days
UROLOGIC					
Clean with entry into urinary tract	Cefazolin	Gentamicin +/- Clindamycin	Gentamicin +/- Clindamycin	Linezolid + Gentamicin	≤ 24 h
Clean contaminated	Cefoxitin	Clindamycin + Gentamicin	Clindamycin + Gentamicin	Linezolid + Gentamicin	≤ 24 h
Implanted prosthesis	Cefazolin +/- Gentamicin	Vancomycin OR Clindamycin +/- Gentamicin	Vancomycin OR Clindamycin +/- Gentamicin	Linezolid + Gentamicin	≤ 24 h
Lower tract instrumentation with risk factors for infection (includes transrectal prostate biopsy)	Cefazolin	Gentamicin +/- clindamycin	Gentamicin +/- clindamycin	Linezolid + Gentamicin	≤ 24 h

Table 2: Dosing & Re-dosing for Perioperative Antibiotic Prophylaxis

For cases exceeding 6 hours, after 3 prophylactic antibiotic doses are given at this increased frequency based on renal function (1 preoperative & 2 intraoperative), utilize standard renally adjusted dosing intervals.

Additional consideration for re-dosing can be discussed when there is excessive blood loss.

See next page of this document for further information regarding re-dosing in certain situations.

ANTIBIOTIC	DOSE	MAX DOSE	RE-DOSING INTERVAL IN OR ONLY (in hours) FOR 2 DOSES AFTER PRE-OP DOSE			
			CrCl ≥50	CrCl 30-49	CrCl 10-29	CrCl <10 or iHD
Ampicillin-Sulbactam	50 mg/kg ampicillin	2000 mg of ampicillin	4	4	8	12
Aztreonam	30 mg/kg	2000 mg	4	4	8	12
Cefazolin	30 mg/kg	<120kg: 2000 mg ≥120 kg: 3000 mg ^{^^}	4	4	12	24
Cefepime	50 mg/kg	2000 mg	4	6	8	12
Cefoxitin	40 mg/kg	2000 mg	2	4	8	12
Ceftriaxone	50 mg/kg	2000 mg	12	12	24	24
Ciprofloxacin	10 mg/kg	400 mg	8	8	12	12
Clindamycin	10 mg/kg	900 mg	6	6	6	6
Gentamicin	4 mg/kg (AdjBW if obese)	—	For surgical procedures >12 hours duration, contact pharmacy for patient specific re-dosing recommendations.			
Linezolid	10 mg/kg	600 mg	8	8	8	8
Metronidazole	15 mg/kg or 30 mg/kg for appendectomy Neonates <1200 gm: 7.5 mg/kg	500 mg 1500 mg for appendectomy	8 N/A if using 30 mg/kg	8 N/A if using 30 mg/kg	8 N/A if using 30 mg/kg	8 N/A if using 30 mg/kg
Piperacillin-tazobactam	75 mg/kg piperacillin	3000 mg of piperacillin	2	2	4	6
Vancomycin	15 mg/kg	1500 mg	For surgical procedures >5 hours duration, contact pharmacy for patient specific re-dosing recommendations.			

Dosing & Re-dosing for Perioperative Antibiotic Prophylaxis

1. For cases exceeding 6 hours

- It is suggested to re-dose at the indicated interval for up to 3 consecutive doses (including pre-operative dose) then proceed with manufacturer recommended dosing intervals.
- The redosing interval should be measured from the time of preoperative dose administration.
- Redosing may need to occur earlier if there has been extensive blood loss during the procedure.
- See Table 2 for re-dosing intervals based on renal function

2. Surgical prophylaxis for patients already receiving therapeutic antibiotics pre-operatively for the treatment of an infection

- If the antibiotic the patient is receiving is the SAME as the preferred drug for surgical prophylaxis, re-dose the antibiotic prior to incision if the time since last dose is greater than the intra-op re-dosing interval listed in Table 2 above.
- If the antibiotic is DIFFERENT than the preferred agent for surgical prophylaxis (i.e. patient receiving cefepime, but cefazolin is the preferred agent for surgical prophylaxis for the given procedure), still administer standard pre-operative antibiotic(s) for surgical prophylaxis timed appropriately based on the OR infusion time listed in Table 2 above.
- For patients already receiving therapeutic vancomycin or an aminoglycoside who also need them as surgical prophylaxis, contact pharmacy for patient-specific recommendations regarding timing of pre-operative dose or re-scheduling of current regimen.
- For patients with appendicitis who are started on therapeutic ceftriaxone and metronidazole (or cefoxitin), who later undergo an appendectomy, no additional pre-op prophylaxis is warranted as there is limited benefit of surgical prophylaxis in a patient already infected undergoing source control. The therapeutic agents already initiated should be re-dosed based on standard therapeutic intervals, and continued at those same intervals post-operatively for complicated appendicitis. Uncomplicated appendicitis require no post-operative antibiotics.

3. For patients with renal insufficiency

- Please contact the clinical pharmacist or pharmacy department for re-dose interval selection, as it may need to be given less frequently intra-operatively.

4. Surgical prophylaxis that unintentionally has been administered too early due to unanticipated surgery delays

- Cefazolin may be re-dosed 5-10 minutes prior to incision due to its large therapeutic index
- All other antibiotics should be re-dosed based on the intra-op re-dosing interval listed in Table 2 on the previous page

Appendix A: Subacute Bacterial Endocarditis Prophylaxis

PATIENT POPULATION/RISK FACTORS	ORAL ANTIBIOTIC (PREFERRED)	IM/IV ANTIBIOTIC (UNABLE TO TAKE ORAL)	TIMING
DENTAL PROCEDURE INVOLVING MANIPULATION OF GINGIVAL TISSUE OR PERIAPICAL REGION OF TEETH OR PERFORATION OF ORAL MUCOSA			
<ol style="list-style-type: none"> 1. Previous infective endocarditis 2. Prosthetic valve or material <ul style="list-style-type: none"> • Includes left ventricular assist devices and valve repair with devices (e.g., annuloplasty, rings, clips) 3. Heart transplant recipients with valvopathy 4. Congenital heart disease (CHD) <ul style="list-style-type: none"> • Unrepaired cyanotic CHD including palliative shunts/conduits • Completely repaired CHD with prosthetic material/device within 6 mos of procedure • Repaired CHD with residual defects at site or adjacent to site of prosthetic material/device • Pulmonary artery valve or conduit placement (e.g., Melody valve, Contegra conduit) 	<p>Amoxicillin 50 mg/kg (max 2 g) or Cephalexin 50 mg/kg (max 2 g)</p> <p><i>Penicillin/cephalosporin allergy:</i> Azithromycin 15 mg/kg (max 500 mg) or Doxycycline 2.2 mg/kg (max 100 mg)</p>	<p>Ampicillin 50 mg/kg (max 2 g)</p> <p><i>Penicillin allergy:</i> Cefazolin 50 mg/kg (max 1 g)</p>	<p>Single dose 30-60 min before procedure</p> <p>No post-op doses</p>
<ul style="list-style-type: none"> • Implantable cardiac devices (e.g., pacemaker) • Septal defect closure devices with full closure • Peripheral vascular grafts/patches (e.g., HD graft) • Coronary artery or other vascular stents • CNS ventriculoatrial shunts • Vena cava filters • Pledgets 	<p>No antibiotic prophylaxis recommended</p> <p><i>No data has proven benefit for preventing SBE for other non-cardiac indications (e.g., prosthetic joint, asplenia)</i></p>		
DENTAL PROCEDURE INVOLVING ANESTHETIC INJECTIONS INTO NONINFECTED TISSUE, RADIOGRAPHS, PLACEMENT OR ADJUSTMENT OF PROSTHODONTIC OR ORTHODONTIC APPLIANCES OR BRACKETS, SHEDDING OF PRIMARY TEETH, BLEEDING FROM TRAUMA TO LIPS OR ORAL MUCOSA			
All patients	No antibiotic prophylaxis recommended		