



SURGICAL ANTIMICROBIAL PROPHYLAXIS RECOMMENDATIONS

I. TABLE OF CONTENTS

Introduction & Considerations	
Introduction	Considerations
Dosing and Re-dosing Guidelines	
Patients > 50 kg (Adult and Pediatric)	Patients ≤ 50 kg (Adult and Pediatric)
Surgical Antimicrobial Prophylaxis Guidelines by Procedure	
Breast and Axillary	Cardiothoracic
Gastrointestinal	Genitourinary
Head and Neck	Neurosurgical
Obstetrical and Gynecological	Ophthalmic
Orthopedic	Plastic Surgery
Radiology	Solid Organ Transplant
Thoracic (non-cardiac)	Vascular
Footnotes & References	
Footnotes	References

II. INTRODUCTION

The use of peri-operative antimicrobials has become an essential component of the standard of care for certain surgical procedures and can result in a reduced risk of post-operative infection when sound and appropriate principles are utilized. However, the benefit of antimicrobial prophylaxis must be weighed against the risks of toxic and allergic reactions, emergence of resistant bacteria, drug interactions, super-infection, and cost.

III. CONSIDERATIONS FOR ANTIMICROBIAL PROPHYLAXIS

Goal: Administer antimicrobial prophylaxis to achieve serum and tissue levels of antimicrobial at the time of incision and for the duration of the operation, that are in excess of the minimum inhibitory concentration (MIC) needed for organisms that may be encountered during the procedure.

- a. Antimicrobial prophylaxis should be administered if there is a risk of infection in the absence of a prophylactic agent; clean procedures rarely require prophylaxis unless high risk procedure, including implantation of prosthetic material.
 - i. Clean procedures are defined as those with no acute inflammation or transection of gastrointestinal, oropharyngeal, genitourinary, biliary, or respiratory tracts (elective cases, no technique break).
- b. The activity of the chosen prophylactic agent(s) should encompass the most common pathogens associated with the surgical procedure and consider local susceptibility data, but need not cover every likely pathogen.
- c. The prophylactic agent must be administered in a dose which provides an effective tissue concentration prior to incision / intra-operative bacterial contamination.
 - i. In most instances, a single intravenous dose of an antimicrobial agent provides adequate tissue concentrations around the time of anesthesia induction and throughout the operation.
 1. Antimicrobial agent infusion should begin 15-60 minutes before the incision with the exception of vancomycin, levofloxacin, ciprofloxacin, gentamicin, azithromycin and fluconazole. These infusions should begin 45-90 minutes before the incision and infused over 60-120 minutes as indicated for adults and pediatrics (See following tables).
 2. In adult patients, cefazolin (2 g if < 120 kg, 3 g if ≥ 120 kg) and vancomycin (1 g if < 80 kg, 1.5 g if ≥ 80 kg) dosing is based on weight. Adult patients < 50 kg should refer to Patients < 50 kg (Adult and Pediatric) Dosing recommendations for dosing. Weight-based dosing is recommended for all antibiotics in patients < 50 kg.
 3. Infusion duration and time to redosing for recommended prophylactic antimicrobials are summarized for adults and pediatrics.
 4. **All prophylactic antimicrobials should be discontinued after the intra-operative period, unless otherwise specified.**
 - a. Data have not supported subsequent doses after surgical closure and may increase the risk of *Clostridium difficile* and antimicrobial resistance.
 - b. A longer duration of antimicrobials may be indicated, if concomitant infection is present at the time of surgery.

BREAST AND AXILLARY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Excisional biopsies	None	Not recommended	Not recommended
Wire Localized Breast Biopsy, Re-excision lumpectomy, Sentinel (SLN) alone, Lumpectomy & SLN, Axillary Lymph Node Dissection, Mastectomy (Total or Modified Radical)	<i>S. aureus</i> <i>S. epidermidis</i>	Adult: Cefazolin OR Cefuroxime	Adult: Clindamycin OR Vancomycin

CARDIOTHORACIC PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Cardiac surgery with implants</p> <ul style="list-style-type: none"> • Aortic grafts • Prosthetic valves • TAVR (Open groin/Subclavian) <p>Deep Hypothermic Circulatory Arrest (DHCA)</p> <p><i>(Some procedures may be included in SCIP, and appropriate antibiotic selection is linked to hospital reimbursement)</i></p>	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p> <p>gram-negative bacilli</p>	<p><u>Adults:</u></p> <p>Vancomycin + Cefuroxime</p> <p>Continue post-op for 24-48 hours from OR or from chest closure in case of delayed chest closure.*</p> <p>Vancomycin dosing modification and duration: CrCl > 50 mL/min regardless of weight: Vancomycin 1 g IV q12h x3 doses CrCl ≤ 50 mL/min and weight ≤ 80 kg: Vancomycin 1 g IV q24h x1 dose CrCl ≤ 50 mL/min and weight ≥ 80 kg: Vancomycin 1.5 g IV q24h x1 dose</p> <p>Cefuroxime dosing modification: CrCl > 30 mL/min: 1.5 g IV q8h x5 doses CrCl 10-29 mL/min: 1.5 g IV q12h x3 doses CrCl < 10 mL/min: 1.5 g IV q24h x1 dose</p> <p>Note: for TAVR (Cath-based/Percutaneous): CrCl > 50 mL/min regardless of weight: Vancomycin 1 g IV q12h x1 dose CrCl ≤ 50 mL/min and weight ≤ 80 kg: Vancomycin 1 g IV q24h x1 dose CrCl ≤ 50 mL/min and weight ≥ 80 kg: Vancomycin 1.5 g IV q24h x1 dose</p> <p>Cefuroxime dosing modification: CrCl > 30 mL/min: 1.5 g IV q8h x2 doses CrCl 10-29 mL/min: 1.5 g IV q12h x1 dose CrCl < 10 mL/min: 1.5 g IV q24h x1 dose</p>	<p><u>Adults:</u></p> <p>Vancomycin + Gentamicin</p> <p>Continue vancomycin post-op for 24-48 hours; Gentamicin redosing not recommended given decreased excretion following cardiopulmonary bypass</p> <p><i>Alternative if SCr 2 mg/dL or CrCl < 40 mL/min:</i> Vancomycin + Levofloxacin</p> <p>Continue vancomycin post-op for 24-48 hours; Levofloxacin redosing not indicated given long half-life, especially with renal impairment</p> <p><i>Alternative to vancomycin if true vancomycin allergy (not infusion reaction):</i> Daptomycin</p> <p>Continue post-op for 24-48 hours</p> <p>*In case of delayed chest closure, total number of doses should be adjusted to reflect 48h from time of chest closure</p>
		<p><u>Pediatrics:</u></p> <p>Cefazolin</p>	<p><u>Pediatric:</u></p> <p>Clindamycin</p>

CARDIOTHORACIC PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Cardiac surgery without implants</p> <ul style="list-style-type: none"> CABG alone <p><i>(Some procedures may be included in SCIP, and appropriate antibiotic selection is linked to hospital reimbursement)</i></p>	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p>	<p>Adults:</p> <p>Vancomycin + Cefuroxime</p> <p>Continue post-op for 24-48 hours from OR or from chest closure in case of delayed chest closure.*</p> <p>Vancomycin dosing modification and duration: CrCl > 50 mL/min regardless of weight: Vancomycin 1 g IV q12h x3 doses CrCl ≤ 50 mL/min and weight ≤ 80 kg: Vancomycin 1 g IV q24h x1 dose CrCl ≤ 50 mL/min and weight ≥ 80 kg: Vancomycin 1.5 g IV q24h x1 dose</p> <p>Cefuroxime dosing modification: CrCl > 30 mL/min: 1.5 g IV q8h x5 doses CrCl 10-29 mL/min: 1.5 g IV q12h x3 doses CrCl < 10 mL/min: 1.5 g IV q24h x1 dose</p>	<p>Adults:</p> <p>Vancomycin + Gentamicin</p> <p>Continue vancomycin post-op for 24-48 hours; Gentamicin redosing not recommended given decreased excretion following cardiopulmonary bypass</p> <p><i>Alternative to gentamicin if SCr 2 mg/dL or CrCl < 40 mL/min:</i></p> <p>Vancomycin + Levofloxacin</p> <p>Continue vancomycin post-op for 24-48 hours; Levofloxacin redosing not indicated given long half-life, especially with renal impairment</p> <p><i>Alternative to vancomycin if true vancomycin allergy (not infusion reaction):</i></p> <p>Daptomycin</p> <p>Continue post-op for 24-48 hours</p> <p>*In case of delayed chest closure, total number of doses should be adjusted to reflect 48h from time of chest closure</p>

CARDIOTHORACIC PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Congenital heart repair procedures requiring an open sternum postoperatively	<i>S. aureus</i> <i>S. epidermidis</i> gram-negative bacilli	<u>Pediatrics:</u> Cefazolin	<u>Pediatric:</u> Clindamycin
		<u>Adults:</u> Cefazolin Continue post-op for 24 hours	<u>Adult:</u> <i>History of MRSA infection or colonization:</i> Vancomycin <i>Alternative to vancomycin if true vancomycin allergy (not infusion reaction):</i> Daptomycin Continue post-op for 24-48 hours
Pacemaker or AICD placement or revision <i>(Some procedures may be included in SCIP, and appropriate antibiotic selection is linked to hospital reimbursement)</i>	<i>S. aureus</i> <i>S. epidermidis</i>	<u>Pediatrics:</u> Cefazolin	<u>Pediatric:</u> Clindamycin
		(This cell is empty in the original image)	(This cell is empty in the original image)

CARDIOTHORACIC PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β-lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Heart transplant	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p> <p>gram-negative bacilli</p>	<p><u>Adults:</u></p> <p>Vancomycin + Cefuroxime</p> <p>Continue post-op for 48 hours from OR or from chest closure in case of delayed chest closure*.</p> <p>If definitive cultures are available, continue antibiotics and tailor regimen</p> <p>Vancomycin dosing modification and duration:</p> <p>CrCl > 50 mL/min regardless of weight: Vancomycin 1 g IV q12h x3 doses</p> <p>CrCl ≤ 50 mL/min and weight ≤ 80 kg: Vancomycin 1 g IV q24h x1 dose</p> <p>CrCl ≤ 50 mL/min and weight ≥ 80 kg: Vancomycin 1.5 g IV q24h x1 dose</p> <p>Cefuroxime dosing modification:</p> <p>CrCl > 30 mL/min: 1.5 g IV q8h x5 doses</p> <p>CrCl 10-29 mL/min: 1.5 g IV q12h x3 doses</p> <p>CrCl < 10 mL/min: 1.5 g IV q24h x1 dose</p>	<p><u>Adults:</u></p> <p>Vancomycin + Levofloxacin</p> <p>Continue post-op for 48 hours. If definitive cultures are available, continue antibiotics and tailor regimen</p> <p>Vancomycin dosing modification and duration:</p> <p>CrCl > 50 mL/min regardless of weight: Vancomycin 1 g IV q12h x3 doses</p> <p>CrCl ≤ 50 mL/min and weight ≤ 80 kg: Vancomycin 1 g IV q24h x1 dose</p> <p>CrCl ≤ 50 mL/min and weight ≥ 80 kg: Vancomycin 1.5 g IV q24h x1 dose</p> <p>Levofloxacin dosing modification:</p> <p>CrCl > 50 mL/min: Levofloxacin 500 mg IV q24h x2 doses</p> <p>CrCl ≤ 50 mL/min: Levofloxacin 500 mg IV q48h x1 dose</p> <p><i>Alternative to vancomycin if true vancomycin allergy (not infusion reaction):</i></p> <p>Daptomycin</p> <p>Continue post-op for 24-48 hours</p> <p>*In case of delayed chest closure, total number of doses should be adjusted to reflect 48h from time of chest closure</p>
		<p><u>Pediatrics:</u></p> <p>Cefazolin</p>	<p><u>Pediatric:</u></p> <p>Clindamycin</p>

CARDIOTHORACIC PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β-lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Left Ventricular Assist Device (LVAD)	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p> <p><i>Candida</i> spp.</p> <p>enteric gram-negatives</p>	<p><u>Adults:</u></p> <p>Vancomycin + Cefuroxime</p> <p>Vancomycin dosing modification and duration:</p> <p>CrCl > 50 mL/min regardless of weight: Vancomycin 1 g IV q12h</p> <p>CrCl ≤ 50 mL/min and weight ≤ 80 kg: Vancomycin 1 g IV q24h</p> <p>CrCl ≤ 50 mL/min and weight ≥ 80 kg: Vancomycin 1.5 g IV q24h</p> <p>Continue vancomycin for 48-hours from OR or from chest closure in case of delayed chest closure*.</p> <p>Start rifampin 600 mg PO/IV q24h, levofloxacin 500 mg PO/IV q24h and fluconazole 400 mg PO/IV q24h post-procedure and continue for 48 hours from OR or from chest closure in case of delayed chest closure*.</p> <p>If definitive cultures are available, continue antibiotics and tailor regimen</p>	<p><u>Adults:</u></p> <p>Vancomycin + Levofloxacin</p> <p>Continue vancomycin for 48-hours post-op. Start rifampin 600 mg PO/IV q24h, levofloxacin 500 mg PO/IV q24h and fluconazole 400 mg PO/IV q24h post-procedure and continue for 48 hours from OR or from chest closure in case of delayed chest closure*.</p> <p>*In case of delayed chest closure, total number of doses should be adjusted to reflect 48h from time of chest closure</p> <p>If allergies or intolerances to vancomycin, rifampin or fluconazole, consultation with Infectious Diseases is recommended.</p> <p>If definitive cultures are available, continue antibiotics and tailor regimen</p>
			<p><u>Pediatrics:</u></p> <p>Cefazolin</p>

GASTROINTESTINAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Appendectomy (non-perforated)	Enteric gram-negative bacilli Enterococci anaerobes (<i>Bacteroides</i> spp., <i>Clostridia</i>) <i>S. aureus</i>	<u>Adults:</u> Cefazolin + Metronidazole OR Cefoxitin	<u>Adults:</u> Clindamycin + Levofloxacin OR Clindamycin + Aztreonam <i>Reserve aminoglycoside-based regimens for patients with intolerance to alternative recommendations or history of documented multi-drug resistant pathogen. If risk factors for acute renal failure present, avoid aminoglycosides if alternative options available:</i> Clindamycin + Gentamicin
		<u>Pediatrics:</u> Cefoxitin OR Piperacillin-tazobactam	<u>Pediatrics:</u> Clindamycin + Gentamicin
Colon and anorectal procedures NOT requiring antibiotic prophylaxis: <ul style="list-style-type: none"> • Evaluation under anesthesia, fulguration of warts, high resolution anoscopy, dilation of stricture, anal biopsy • EUA for fistula placement of seton • Fistulotomy, simple (NOT a Surgisis plug or advancement flap), • Transanal resection of fibroepithelial or pedunculated polyp 	None	Prophylaxis Not Recommended	Prophylaxis Not Recommended

GASTROINTESTINAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Splenectomy	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin OR Cefuroxime	Adults: Clindamycin OR Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Cefuroxime OR Vancomycin
Colorectal Procedures Not limited to, but including the following: <ul style="list-style-type: none"> • Colon & rectal resection • High, complex fistula by Surgisis plug or advancement flap • Lateral sphincterotomy for anal fissure • Hemorrhoidectomy • Transanal resection for sessile polyp, villous adenoma, possible T1 malignancy • Rectal prolapse procedure (Altmeier or abdominal rectosigmoid resection/rectopexy) <i>(Some procedures may be included in SCIP, and appropriate antibiotic selection is linked to hospital reimbursement)</i>	Enteric gram-negative bacilli Enterococci anaerobes (<i>Bacteroides</i> spp., <i>Clostridia</i>) <i>S. aureus</i>	Adults: Cefazolin + Metronidazole OR Cefoxitin Optional oral regimens in combination with IV therapy: Neomycin 1,000 mg PO + Erythromycin base 1,000 mg PO; give at 19, 18, and 9h before surgery OR Neomycin 1,000 mg PO + Metronidazole 500 mg PO; give at 19, 18, and 9 h before surgery	Adults: Clindamycin + Levofloxacin OR Clindamycin + Aztreonam <i>Reserve aminoglycoside-based regimens for patients with intolerance to alternative recommendations or history of documented multi-drug resistant pathogen. If risk factors for acute renal failure present, avoid aminoglycosides if alternative options available:</i> Clindamycin + Gentamicin
		Pediatrics: Cefoxitin Optional oral regimens: Neomycin 20 mg/kg/dose PO + Metronidazole 10 mg/kg/dose PO OR Neomycin 20 mg/kg/dose + Erythromycin base 20 mg/kg/dose	Pediatrics: Cefazolin + Metronidazole OR Clindamycin + Gentamicin

GASTROINTESTINAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Esophageal, gastric surgery, G-tube; peg tube</p> <p>(See small bowel for gastric bypass and gastrectomy)</p> <p>ADULTS - Prophylaxis recommended for high risk patients, including diabetes, morbid obesity, cancer, gastric bleeding, gastric outlet obstruction, gastroduodenal perforation, esophageal obstruction, decreased gastric acidity or gastrointestinal motility, morbid obesity</p>	<p>Upper airway flora (aerobic, anaerobic Streptococci)</p> <p><i>S. aureus</i></p> <p>more rarely aerobic gram-negative bacilli</p>	<p>Adults:</p> <p>Cefazolin</p>	<p>Adults:</p> <p>Clindamycin</p> <p>OR</p> <p>Vancomycin</p>
		<p>Pediatrics:</p> <p>Cefazolin</p>	<p>Pediatrics:</p> <p>Clindamycin</p> <p>OR</p> <p>Vancomycin</p>
<p>Hepatic, biliary tract, pancreatic including cholecystectomy and gallbladder procedures, cystgastrostomy (see separate section for Pancreaticoduodenectomy)</p> <p>(excluding low-risk laparoscopic cholecystectomy*)</p> <p>*ADULTS – Prophylaxis recommended for high risk patients only, including age > 70 years, non-functioning gall bladder, emergency procedures, diabetes, acute cholecystitis, obstructive jaundice or common duct stones</p>	<p>Enteric gram-negative bacilli (e.g., <i>E. coli</i>, <i>Klebsiella</i>)</p> <p>Enterococci</p> <p><i>S. aureus</i></p> <p>anaerobes (<i>Bacteroides spp.</i>, <i>Clostridia</i>) common with stents, biliary obstruction</p>	<p>Adults:</p> <p>Cefuroxime + Metronidazole</p> <p>OR</p> <p>Cefoxitin</p>	<p>Adults:</p> <p>Clindamycin + Levofloxacin</p> <p>OR</p> <p>Clindamycin + Aztreonam</p> <p><i>Reserve aminoglycoside-based regimens for patients with intolerance to alternative recommendations or history of documented multi-drug resistant pathogen. If risk factors for acute renal failure present, avoid aminoglycosides if alternative options available:</i></p> <p>Clindamycin + Gentamicin</p>
		<p>Pediatrics:</p> <p>Cefoxitin</p> <p>OR</p> <p>Piperacillin-tazobactam (for biliary atresia repair)</p>	<p>Pediatrics:</p> <p>Clindamycin + Gentamicin</p>

GASTROINTESTINAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Pancreaticoduodenectomy	<p>Enteric gram-negative bacilli (e.g., <i>E. coli</i>, <i>Klebsiella</i>)</p> <p>Enterococci</p> <p><i>S. aureus</i></p> <p>anaerobes (<i>Bacteroides spp.</i>, <i>Clostridia</i>) common with stents, biliary obstruction</p>	<p><u>Adults</u></p> <p>Piperacillin-tazobactam</p>	<p><u>Adults</u></p> <p>Cefoxitin + Vancomycin</p> <p>OR</p> <p>Vancomycin + Aztreonam + Metronidazole</p>
Small bowel, gastric bypass, gastrectomy	<p>Enteric gram-negative bacilli</p> <p>Enterococci</p> <p>anaerobes (<i>Bacteroides spp.</i>, <i>Clostridia</i>)</p> <p><i>S. aureus</i></p>	<p><u>Adults:</u></p> <p>Cefazolin + Metronidazole</p> <p>OR</p> <p>Cefoxitin</p>	<p><u>Adults:</u></p> <p>Clindamycin + Levofloxacin</p> <p>OR</p> <p>Clindamycin + Aztreonam</p> <p><i>Reserve aminoglycoside-based regimens for patients with intolerance to alternative recommendations or history of documented multi-drug resistant pathogen. If risk factors for acute renal failure present, avoid aminoglycosides if alternative options available:</i></p> <p>Clindamycin + Gentamicin</p>
		<p><u>Pediatrics:</u></p> <p>Cefoxitin</p> <p>OR</p> <p>Piperacillin-tazobactam (for biliary atresia repair)</p>	<p><u>Pediatrics:</u></p> <p>Clindamycin + Gentamicin</p>

GASTROINTESTINAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Hernia repair (hernioplasty-prosthetic mesh repair of hernia; herniorrhaphy-suture repair of hernia)	<i>S. aureus</i> <i>S. epidermidis</i>	<u>Adults:</u> Cefazolin	<u>Adults:</u> Clindamycin OR Vancomycin
		<u>Pediatrics:</u> Cefazolin	<u>Pediatrics:</u> Clindamycin OR Vancomycin

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Urinary Tract Instrumentation*			
<p>Consider Prophylaxis <u>ONLY</u> in patients with risk factors: Cystography, urodynamic study, simple cystourethroscopy, shock wave lithotripsy</p> <p>Risk Factors Include</p> <ul style="list-style-type: none"> Poor functional status/frailty anatomic anomalies of urinary tract chronic steroid use immunocompromising condition or recent systemic chemotherapy 	Enteric gram-negative bacilli	<p><u>Adults:</u> TMP-SMX (Bactrim®) 1 DS PO, ideally 1-4 hrs prior</p> <p>OR</p> <p>Amoxicillin-clavulanate 875 mg PO, ideally 2-4 hrs prior</p> <p>OR</p> <p>Cefazolin</p>	<p><u>Adults:</u> Gentamicin 5 mg/kg IV x1 OR 120 mg IM</p> <p>OR</p> <p>Ciprofloxacin 500 mg PO 1-2 hrs prior or 400 mg IV</p>
		<p><u>Pediatrics:</u> Cefazolin</p>	<p><u>Pediatrics:</u> Cefoxitin</p> <p>OR</p> <p>Gentamicin \pm Ampicillin</p> <p>OR</p> <p>TMP-SMX (Bactrim®)</p>

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

<p>Prophylaxis recommended for: Ureterscopy ± stent placement Cystourethroscopy with manipulation including:</p> <ul style="list-style-type: none"> transurethral resection of bladder tumor and prostate, any biopsy, resection, fulguration, foreign body removal, urethral dilation or urethrotomy any ureteral instrumentation including catheterization or stent placement/removal submucosal injection (e.g., Botulinum toxin) <p>*The following procedures do not require infusion of IV antibiotics timed for 15-30 min prior, but can be given directly before the procedure, as they are intended for prevention for post-procedural UTI: bladder biopsy; botox injection; cystolitholapaxy; cystoscopy with fulguration, microplastique, bladder neck incision or retrograde pyelogram; hydrodistention; ureteral stent placement and removal; ureteroscopy.</p>	<p><i>E. coli</i> <i>Proteus</i> spp. <i>Klebsiella</i> spp.</p>	<p><u>Adults:</u> Cefazolin 2 g IV/IM; 3 g IV/IM if ≥ 120 kg</p>	<p><u>Adults:</u> Gentamicin 5 mg/kg IV x1 OR 120 mg IM OR TMP-SMX (Bactrim®) 1 DS PO x1 OR Ciprofloxacin 500 mg PO or 400 mg IV</p>
<p>Percutaneous nephrolithotomy (PCNL)</p> <p>High risk features include:</p> <ul style="list-style-type: none"> Positive urine culture within 2-4 weeks Residual stone with prior positive stone culture Current indwelling ureteral stent or nephrostomy tube Severe hydronephrosis Continuous intermittent catheterization Renal transplant or other severe immunocompromising condition Neurogenic bladder (with or without urinary diversion) Urinary Diversion Chronic indwelling catheters (Foley or SP tube) 	<p><i>S. aureus</i> <i>S. epidermidis</i> enteric gram-negative bacilli</p>	<p><u>Adults w/o high risk features</u> No antibiotics in days preceding PCNL Cefazolin prior to procedure Antibiotics should not be continued > 24 hours unless there is concern for post-procedural sepsis</p> <p><u>Adults w/high risk features:</u> Recommend early ID consultation in anticipation of PCNL Tailored oral antibiotics 3-5 days prior to PCNL, discuss w/ID if no oral option available Tailored IV antibiotic prophylaxis directly prior to procedure Antibiotics only to continue > 24 hrs after procedure for sepsis/complicated UTI due to residual infected stone</p>	<p><u>Adults:</u> Vancomycin + Gentamicin OR Clindamycin ± Gentamicin</p> <p>If patient allergic to gentamicin or has SCR > 1.5 mg/mL, use Aztreonam instead of gentamicin</p>
		<p><u>Pediatrics:</u> Cefazolin</p>	<p><u>Pediatrics :</u> Clindamycin + Gentamicin</p>

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

PROSTATE BIOPSY

<p>Prostate brachytherapy</p>	<p><i>S. aureus</i> <i>S. epidermidis</i> <i>Streptococci spp.</i></p>	<p>Adults: Cefazolin</p>	<p>Adults: Vancomycin OR Clindamycin</p>
<p>Transperineal prostate biopsy <i>Routine use of antibiotic prophylaxis is not recommended but can be used in select patients deemed at high risk of infectious complications</i></p>	<p>None</p>	<p>Adults: Cefazolin OR Cephalexin 1000 mg PO 1 hour prior to procedure</p>	<p>Adults: Doxycycline 100 mg PO 1 hour prior to the procedure</p>

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

<p>Transrectal prostate biopsy</p>	<p><i>E. coli</i></p> <p><i>Proteus</i> spp.</p> <p><i>Klebsiella</i> spp.</p>	<p>Adults: Rectal Swab Performed: <i>Ciprofloxacin</i> sensitive: Ciprofloxacin 500 mg PO 1 hour prior to procedure and 500 mg PO 12 hours after the first dose</p> <p>OR</p> <p>Levofloxacin 750 mg PO 1 hour prior to procedure</p> <p><i>TMP-SMX (Bactrim™)</i> sensitive: TMP-SMX 1 DS PO 1 hour before procedure and 1 DS 12 hours after the first dose</p> <p><i>Ciprofloxacin</i> resistant and <i>TMP-SMX</i> resistant: Cefazolin 2 g IM; 3 g IM if ≥ 120 kg</p> <p><i>Ciprofloxacin</i>, <i>TMP-SMX</i>, and <i>cefazolin</i> resistant: Ceftriaxone 1 g IM</p> <p>No Rectal Swab Performed: Gentamicin 120 mg IM + Ciprofloxacin 500 mg PO 1 hour prior to procedure and 500 mg PO 12 hours after the first dose</p> <p>OR</p> <p>Gentamicin 120 mg IM + Levofloxacin 750 mg PO 1 hour prior to procedure</p>	<p>Adults: Rectal Swab Performed: <i>Allergic or resistant to ceftriaxone, cefazolin, ciprofloxacin, & TMP-SMX:</i> Gentamicin 120 mg IM or 5 mg/kg IV x1 (ideal body weight)</p> <p>If isolated pathogen is resistant to ciprofloxacin, gentamicin, cefazolin, and ceftriaxone then antimicrobials should be chosen based on organism susceptibilities</p> <p>No Rectal Swab Performed: Cefazolin 2 g IM; 3 g IM if ≥ 120 kg + Ciprofloxacin 500 mg PO 1 hour prior to procedure and 500 mg PO 12 hours after the first dose</p> <p>OR</p> <p>Cefazolin 2 g IM; 3 g IM if ≥ 120 kg + Levofloxacin 750 mg PO 1 hour prior to procedure</p>
---	--	--	--

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

OPEN, LAPAROSCOPIC, ROBOTIC SURGERY

<p>Adrenalectomy, Retroperitoneal/pelvic lymphadenectomy without entering the urinary tract</p>	<p><i>S. aureus</i> <i>S. epidermidis</i> <i>Streptococci spp.</i></p>	<p>Adults: Cefazolin</p>	<p>Adults: Vancomycin</p>
<p>Circumcision</p>	<p>Staphylococci</p>	<p>Adults: None unless diabetes mellitus or other risk factors; then Cefazolin</p>	<p>Adults: Vancomycin</p>
		<p>Pediatrics: No antibiotic prophylaxis in healthy neonates; otherwise: Cefazolin or Amoxicillin</p>	<p>Pediatrics: Clindamycin</p>
<p>Genitourinary procedures involving small or large intestine Including urinary diversions, cystectomy with small bowel conduit, uretero-pelvic junction repair, colon conduits, radical cystectomy neobladder/ileostomy, etc</p>	<p><i>S. aureus</i> <i>S. epidermidis</i> Streptococci Enteric gram-negative bacilli</p>	<p>Adults: Cefuroxime + Metronidazole OR Cefoxitin Optional oral antimicrobials in combination with above prophylaxis recommendations: neomycin sulfate + erythromycin base OR neomycin sulfate + metronidazole</p>	<p>Adults: Levofloxacin 500 mg IV/PO + Metronidazole If history of MRSA infection or colonization: Vancomycin + Gentamicin Optional oral antimicrobials in combination with above prophylaxis recommendations: neomycin sulfate + erythromycin base OR neomycin sulfate + metronidazole</p>
		<p>Pediatrics: Cefoxitin</p>	<p>Pediatrics: Ampicillin-sulbactam OR Clindamycin + Gentamicin</p>

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

<p>Penile prosthesis insertion, removal, & revision</p>	<p><i>Staphylococci spp.</i> Enteric gram-negative bacilli</p>	<p>Adults: Cefazolin + Gentamicin + Fluconazole OR Vancomycin + Gentamicin + Fluconazole</p> <p>Antibiotics should not be continued > 24 hours post-operatively unless there is concern for sepsis</p>	<p>Adults: <i>History of MRSA infection or colonization AND SCr > 1.5 mg/dL:</i> Vancomycin + Aztreonam + Fluconazole</p>
<p>Testicular implants</p>	<p><i>Staphylococci spp.</i> <i>Enteric gram-negative bacilli</i></p>	<p>Adults: Cefazolin + Gentamicin OR Vancomycin + Gentamicin</p>	<p>Adults: <i>History of MRSA infection or colonization AND SCr > 1.5 mg/dL:</i> Vancomycin + Aztreonam</p>
<p>Implanted prosthetic devices Artificial urinary sphincter and sacral nerve stimulators</p>	<p>Staphylococci enteric gram-negative bacilli</p>	<p>Adults: Cefazolin + Gentamicin OR Vancomycin + Gentamicin</p>	<p>Adults: Vancomycin + Aztreonam</p>
		<p>Pediatrics: Cefazolin + Gentamicin</p>	<p>Pediatrics: Cefoxitin OR Ampicillin-sulbactam OR Vancomycin + Gentamicin</p>

GENITOURINARY PROCEDURES

Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the most recent urologic source (urine culture, stone culture, etc) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was >1 year ago, standard prophylaxis should be utilized

<p>Vaginal urologic surgery Including urethral sling, fistulae repair, urethral diverticulectomy, urethropexy</p> <p>Open or laparoscopic procedure involving entry into the urinary tract Including urethroplasty; stricture repair including urethrectomy. Nephrectomy, partial or otherwise, urethrectomy, pyeloplasty, radical prostatectomy, partial cystectomy</p>	<p>Enteric gram-negative bacilli.</p> <p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p> <p><i>Streptococci spp.</i> (vaginal surgery mostly)</p>	<p>Adults:</p> <p>Cefazolin</p>	<p>Adults:</p> <p>Levofloxacin 500 mg IV/PO</p> <p>If history of MRSA infection or colonization:</p> <p>Vancomycin + Aztreonam</p>
		<p>Pediatrics:</p> <p>Cefazolin</p>	<p>Pediatrics:</p> <p>Cefoxitin</p> <p>OR</p> <p>Ciprofloxacin</p>
<p>Vasectomy</p>	<p><i>Staphylococci spp.</i></p> <p>Enteric gram-negative bacilli</p>	<p>NOTE: Some experts do not recommend prophylaxis for all vasectomy cases. Prophylaxis may be considered based on complexity of procedure and comorbidities of patient.</p> <p>Adults:</p> <p>Cefazolin</p>	<p>Adults:</p> <p>History of MRSA infection or colonization:</p> <p>Vancomycin + Aztreonam</p>
<p>Inguinal and scrotal cases Including radical orchiectomy, reversals, varicolectomy, hydrocelectomy</p>	<p><i>Staphylococci spp.</i></p> <p>Enteric gram-negative bacilli</p>	<p>Adults:</p> <p>Cefazolin</p>	<p>Adults:</p> <p>History of MRSA infection or colonization:</p> <p>Vancomycin + Aztreonam</p>
		<p>Pediatrics:</p> <p>Cefazolin</p>	<p>Pediatrics:</p> <p>Clindamycin</p>
<p>Medoidioplasty</p>	<p><i>S.aureus</i></p> <p><i>Streptococcus</i></p>	<p>Adults:</p> <p>Cefazolin</p>	<p>Adults:</p> <p>Clindamycin</p>

OBSTETRICAL AND GYNECOLOGICAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β-lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Cesarean section	Enteric gram-negative bacilli Anaerobes Group B Streptococci Enterococci	<p>Adult:</p> <p>Not in Labor: Cefazolin</p> <p>In Labor (contractions with cervical dilation or membrane rupture): Cefazolin + Azithromycin 500 mg IV</p> <p>*Re-dose cefazolin during c-section for patients when peri-partum hemorrhage reaches 1,500ml and patient continue to have bleeding. Patient could receive an addition second intra-operative dose 4-hours after the first re-dose if closure has not occurred yet.</p> <p>Redosing of azithromycin, clindamycin or gentamicin is not recommended for patients with blood loss.</p>	<p>Not in Labor: <i>GBS screen negative or GBS screen positive and clindamycin sensitive:</i> Clindamycin + Gentamicin 5 mg/kg IV x 1 (adjusted body weight) <i>GBS screen positive and clindamycin resistant:</i> Vancomycin + Gentamicin 5 mg/kg IV x 1 (adjusted body weight)</p> <p>In Labor (contractions with cervical dilation or membrane rupture): <i>GBS screen negative, or GBS screen positive and clindamycin sensitive, or GBS unknown:</i> Clindamycin + Azithromycin 500 mg IV + Gentamicin 5 mg/kg IV x 1 (adjusted body weight) <i>GBS screen positive and clindamycin resistant:</i> Vancomycin + Azithromycin 500 mg IV + Gentamicin 5 mg/kg IV x 1 (adjusted body weight)</p>
Vaginal hysterectomy Abdominal hysterectomy Laparoscopic or robotic hysterectomy (including supracervical hysterectomy) Urogynecology procedures including those involving mesh Enterocele repair	Enteric gram-negative bacilli Anaerobes Group B Streptococci Enterococci	<p>Adult:</p> <p>Cefazolin + Metronidazole</p>	<p>Adult:</p> <p>Clindamycin + Gentamicin 5 mg/kg IV x1 (if pregnant, use adjusted body weight; otherwise, use ideal body weight) OR Clindamycin + Aztreonam</p>

OBSTETRICAL AND GYNECOLOGICAL PROCEDURES			
<p>Hysterosalpingogram or Chromotubation (In patients with no history of PID, HSG can be performed without prophylactic antibiotics. If HSG shows dilated fallopian tubes, antibiotic prophylaxis should be given)</p>	Chlamydia	<p><u>No history of PID:</u> No antibiotics <u>History of PID:</u> Doxycycline 100 mg PO x1 <u>Dilated fallopian tubes:</u> Doxycycline 100 mg PO BID x5 days</p>	
<p>MVA Suction D&C procedures D&E procedures</p>	Anaerobes	<p><u>Adult:</u> Doxycycline 100 mg PO one hour before procedure OR Azithromycin 1 g prior to procedure</p>	
Cerclage	<p>Enteric gram-negative bacilli Anaerobes Group B Streptococci Enterococci</p>	<p><u>Planned:</u> Prophylaxis Not Recommended <u>Emergent:</u> Ampicillin-sulbactam</p>	<p><i>Emergent:</i> Cefazolin <i>Emergent:</i> Clindamycin + Gentamicin 5 mg/kg IV x 1 (if pregnant, use adjusted body weight; otherwise, use ideal body weight) OR Clindamycin + Aztreonam</p>
<p>Laparoscopy or laparotomy that is not accompanied by hysterectomy Conization of cervix Vulvectomy (simple) Laser treatment to vulva or perineum Cystocele and rectocele repair Perineorrhaphy WITHOUT mesh</p>	None	Prophylaxis Not Recommended	Prophylaxis Not Recommended

HEAD AND NECK PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^u	Alternative regimen ^u See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Clean, non-contaminated procedures (i.e., thyroidectomy, lymph node excision)	None	Not recommended Select clean non-contaminated procedures may confer higher risk for infection and warrant prophylaxis (such as Cefazolin) per surgeon discretion.	Not recommended
Clean contaminated head and neck surgery (incision through oral, pharyngeal, or nasal mucosa) ^o	Oral anaerobes enteric gram-negative bacilli <i>S. aureus</i> <i>S. epidermidis</i> viridans streptococci	Adults: Ampicillin-sulbactam	Adults: Cefazolin + Metronidazole OR Levofloxacin + Metronidazole
		Pediatrics: Ampicillin-sulbactam	Pediatrics: Clindamycin
Clean procedure with insertion of a prosthesis (including BAHA hearing device)	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin	Adults: Clindamycin OR Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin
Skull base, lateral or posterior approach procedures (including cochlear implants)	<i>S. aureus</i> <i>S. epidermidis</i> <i>S. pneumoniae</i>	Adults: Cefuroxime OR Ampicillin-sulbactam	Adults: Clindamycin
		Pediatrics: Cefuroxime	Pediatrics: Clindamycin

HEAD AND NECK PROCEDURES

<p>Skull base, anterior approach including transphenoidal surgery for pituitary tumors</p>	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p> <p>gram-negative bacilli</p>	<p><u>Adults:</u></p> <p>Ampicillin-sulbactam</p> <p>If history of MRSA infection or colonization:</p> <p>+ Vancomycin</p>	<p><u>Adults:</u></p> <p>Ceftriaxone</p> <p>+ Metronidazole</p> <p><i>If history of MRSA infection or colonization:</i></p> <p>+ Vancomycin</p> <p>Vancomycin</p> <p>+ Aztreonam</p> <p>+ Metronidazole</p>
		<p><u>Pediatrics:</u></p> <p>Clindamycin</p> <p>+ Cefuroxime</p>	<p><u>Pediatrics:</u></p> <p>Vancomycin</p>

NEUROSURGICAL PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Craniotomy VP shunts & other prosthetic material Spine implantable devices <i>(Some procedures may be included in SCIP, and appropriate antibiotic selection is linked to hospital reimbursement)</i>	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin	Adults: Vancomycin
		Pediatrics: TMP-SMX (Bactrim™)	Pediatrics: Cefazolin OR Vancomycin
Discography (Intradiscal antimicrobial prophylaxis is not endorsed by the UMHS Pharmacy and Therapeutics Committee and should not be used.)	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin	Adults: Clindamycin <i>If history of MRSA infection or colonization:</i> Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin
Skull base, anterior approach including transphenoidal surgery for pituitary tumors	<i>S. aureus</i> <i>S. epidermidis</i> gram-negative bacilli	Adults: Ampicillin-sulbactam If history of MRSA infection or colonization: + Vancomycin	Adults: Ceftriaxone + Metronidazole If history of MRSA infection or colonization: + Vancomycin Vancomycin + Aztreonam + Metronidazole
		Pediatrics: Clindamycin + Cefuroxime	Pediatrics: Vancomycin
Skull base, lateral or posterior approach procedures	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Ampicillin-sulbactam OR Cefuroxime	Adults: Clindamycin
		Pediatrics: Clindamycin + Cefuroxime	Pediatrics: Vancomycin

OPHTHALMIC PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Ophthalmic procedures	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p> <p>Streptococci</p> <p>enteric gram-negative bacilli</p> <p><i>Pseudomonas</i> spp.</p>	<p>Minimal evidence supporting routine use of prophylactic antibiotics for ophthalmic surgery. Discretion advised regarding drug choice, duration, or route of administration.</p>	<p>Gentamicin</p> <p>OR</p> <p>Tobramycin</p> <p>OR</p> <p>Ciprofloxacin</p> <p>OR</p> <p>Gatifloxacin</p> <p>OR</p> <p>Levofloxacin</p> <p>OR</p> <p>Neomycin-Gramicidin-Polymixin B</p> <p>Administer multiple drops topically over 2-72 hrs</p>

ORTHOPEDIC PROCEDURES

Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Total joint replacement (Arthroplasty)</p> <p>Implantation of prosthetic material (e.g., intramedullary nails, screw, plates, wires)</p> <p>Hip fracture repair</p>	<p><i>S. aureus</i></p> <p><i>S. epidermidis</i></p>	<p><u>Adults:</u></p> <p><i>S. aureus</i> nasal screen:</p> <ul style="list-style-type: none"> - Negative for MRSA - Positive for MSSA - Not performed and in the absence of history of MRSA carriage or infection <p>Cefazolin</p> <p><i>S. aureus</i> nasal screen:</p> <ul style="list-style-type: none"> - Positive for MRSA - Not performed, but patient has history of MRSA carriage or infection <p>Vancomycin + Cefazolin</p> <p>Antibiotic prophylaxis should be discontinued within 24 hours following surgery</p> <p><u>Pediatrics:</u></p> <p>Cefazolin</p> <p>History of MRSA carriage or infection: Vancomycin + Cefazolin</p>	<p><u>Adults:</u></p> <p>Vancomycin</p> <p><i>Alternative to vancomycin if true vancomycin allergy (not infusion reaction):</i></p> <p>Daptomycin</p> <p><u>Pediatrics:</u></p> <p><i>History of MRSA carriage or infection:</i></p> <p>Vancomycin</p> <p><i>Without history of MRSA carriage or infection:</i></p> <p>Clindamycin</p>

ORTHOPEDIC PROCEDURES

<p>Open Fracture Repair (Includes upper and lower extremity open fractures)</p>	<p><i>S. aureus</i></p> <p><i>Streptococcus</i></p> <p><i>gram-negative rods</i></p>	<p><u>Adults:</u> <i>Type I or II open fracture:</i> Cefazolin Extensive soil exposure (e.g., farming accident) + Metronidazole</p> <p><i>Type III open fracture:</i> Ceftriaxone Extensive soil exposure (e.g., farming accident) + Metronidazole</p> <p>Antibiotic prophylaxis should be provided for 24 hours but may be extended to 48 hours if needed.</p>	<p><u>Adults:</u> <i>Type I or II open fracture</i> Vancomycin</p> <p><i>Type III open fracture</i> Vancomycin + Aztreonam</p> <p>Antibiotic prophylaxis should be provided for 24 hours but may be extended to 48 hours if needed.</p>
		<p><u>Pediatrics:</u> <i>Type I or II open fracture:</i> Cefazolin Extensive soil exposure (e.g., farming accident) + Metronidazole</p> <p><i>Type III open fracture:</i> Ceftriaxone Extensive soil exposure (e.g., farming accident) + Metronidazole</p> <p>Antibiotic prophylaxis should be provided for 24 hours but may be extended to 48 hours if needed.</p>	<p><u>Pediatrics:</u> <i>Type I or II open fracture:</i> History of MRSA carriage or infection Vancomycin</p> <p><i>Without history of MRSA carriage or infection:</i> Clindamycin</p> <p><i>Type III open fracture:</i> History of MRSA carriage or infection Vancomycin + Aztreonam</p> <p><i>Without history of MRSA carriage or infection:</i> Clindamycin + Aztreonam</p> <p>Antibiotic prophylaxis should be provided for 24 hours but may be extended to 48 hours if needed.</p>

ORTHOPEDIC PROCEDURES

<p>Spinal procedure, with or without instrumentation</p>	<p><i>S. aureus</i></p> <p><i>Coagulase negative staphylococci</i></p> <p><i>Gram negative bacilli</i></p>	<p><u>Adults:</u></p> <p><i>S. aureus</i> nasal screen:</p> <ul style="list-style-type: none"> - Negative for MRSA - Positive for MSSA - Not performed and in the absence of history of MRSA carriage or infection <p>Cefazolin</p> <p><i>S. aureus</i> nasal screen:</p> <ul style="list-style-type: none"> - Positive for MRSA - Not performed, but patient has history of MRSA carriage or infection <p>Vancomycin + Cefazolin</p> <p>Antibiotic prophylaxis should be discontinued within 24 hours following surgery</p>	<p><u>Adults:</u></p> <p>Vancomycin</p> <p><i>Alternative to vancomycin if true vancomycin allergy (not infusion reaction):</i></p> <p>Daptomycin</p>
		<p><u>Pediatrics:</u></p> <p>Cefazolin</p> <p>History of MRSA carriage or infection:</p> <p>Vancomycin + Cefazolin</p>	<p><u>Pediatrics:</u></p> <p><i>History of MRSA carriage or infection</i></p> <p>Vancomycin</p> <p><i>Without history of MRSA carriage or infection:</i></p> <p>Clindamycin</p>
<p>Sports Medicine (Orthopaedic Surgeries)</p> <p>Implantation of interference screws, suture anchors, permanent sutures, etc.</p>	<p><i>S. aureus</i></p> <p><i>Streptococcus</i></p>	<p><u>Adults:</u></p> <p>Cefazolin</p> <p>History of MRSA infection or colonization:</p> <p>+ Vancomycin</p>	<p><u>Adults:</u></p> <p>Clindamycin OR Vancomycin</p>
		<p><u>Pediatrics:</u></p> <p>Cefazolin</p>	<p><u>Pediatrics:</u></p> <p>Clindamycin OR Vancomycin</p>

REFERENCES

1. Bratzler DW, et al. [Am J Health-Syst Pharm 2013; 70:195-283.](#)
2. Schweizer ML et al. [JAMA 2015; 313:2162-2171.](#)
3. Rodriguez L et al. [J Trauma Acute Care Surg 2013;77:400-408.](#)

PLASTIC SURGERY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Breast reconstruction (without implants), cosmetic procedures (excluding blepharoplasty), large hand dissections* , phalloplasty, vaginoplasty, and general reconstructive procedures involving medium/large flaps or tissue expanders *Open fractures: see Orthopedic Surgery guidelines	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin	Adults: Clindamycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin
Breast procedures with implants	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin If history of MRSA infection or colonization: + Vancomycin	Adults: Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin
Cleft lip and palate repair, or facial procedures that transect oral, nasal (see rhinoplasty below), or pharyngeal mucosa	Oral anaerobes enteric gram-negative bacilli <i>S. aureus</i> <i>S. epidermidis</i> viridans streptococci	Adults: Ampicillin-sulbactam	Adults: Cefazolin + Metronidazole Levofloxacin + Metronidazole
		Pediatrics: Ampicillin-sulbactam	Pediatrics: Clindamycin

PLASTIC SURGERY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Rhinoplasty/Septorhinoplasty	<i>S. aureus</i> <i>S. epidermidis</i> <i>C. acnes</i>	<p>NOTE: Some experts do not recommend prophylaxis for all procedures. Prophylaxis may be considered based on complexity of procedure and comorbidities of patient.</p> <p>Adults: Ampicillin-sulbactam OR Cefazolin</p>	<p>Adults: Clindamycin</p>
		<p>Pediatrics: Ampicillin-sulbactam OR Cefazolin</p>	<p>Pediatrics: Clindamycin</p>
Open cranial vault reconstruction	<i>S. aureus</i> <i>S. epidermidis</i> Oral flora <i>P. aeruginosa</i>	<p>Pediatrics: Pre-operative: Piperacillin-tazobactam Post-operative: Ampicillin-sulbactam</p>	<p>Pediatrics: Pre-operative: Clindamycin + Gentamicin OR Clindamycin + Aztreonam Post-operative: Clindamycin</p>
Endoscopic craniofacial procedures and strip craniectomy	<i>S. aureus</i> <i>S. epidermidis</i>	<p>Pediatrics: Cefazolin</p>	<p>Pediatrics: Clindamycin</p>

RADIOLOGY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β-lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Any ARTERIAL OR VENOUS intervention that involves the hepatobiliary or reproductive systems.</p> <ul style="list-style-type: none"> Hepatic arterial embo for hepatic trauma, suspected hemobilia, Y-90 <u>treatment</u> (not mapping), TACE, or bland embo. Any hepatic arterial embo in a transplanted liver or any liver at high-risk for ischemia (occluded/stenotic portal vein, etc). TIPS/DIPS Placement BRTO/BATO/PARTO/CARTO Portal vein embolization Uterine artery embo IVC filter retrieval with bowel penetration <p>Biliary Interventions</p> <ul style="list-style-type: none"> PTC Biliary drain check/change Biliary stent placement Cholecystostomy tube placement Cholecystostomy tube check/change Gallbladder cryo- and chemical ablation Biliary endoscopy <p>Thermal ablation of the liver</p>	<p><u>Skin Flora</u>: <i>S. aureus, S. epidermis</i></p> <p><u>GI Flora</u>: Enteric gram-negative bacilli, anaerobes</p>	<p><u>Adults</u>:</p> <p>Cefuroxime + Metronidazole</p> <p>OR</p> <p>Cefoxitin</p> <p><u>Patients with known multi-drug resistant (MDR) bacteria colonization</u>: Consider discussing with ID regarding tailored IV antibiotic prophylaxis.</p>	<p><u>Adults</u>:</p> <p>Clindamycin + Gentamicin</p> <p><i>Alternative if any allergy to gentamicin</i> OR <i>SCr 2 mg/dL OR CrCl < 40 mL/min:</i> Clindamycin + Aztreonam</p>
		<p><u>Pediatrics</u>:</p> <p>Cefoxitin</p>	<p><u>Pediatrics</u>:</p> <p>Clindamycin + Gentamicin</p> <p><i>Alternative if any allergy to gentamicin</i> OR <i>SCr 2 mg/dL OR CrCl < 40 mL/min:</i> Clindamycin + Aztreonam</p>

RADIOLOGY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β-lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Any ARTERIAL EMBOLIZATION involving the GU system</p> <ul style="list-style-type: none"> Prostate artery embolization Renal embolization with > 70% of the kidney expected to be embolized. <p>GU Interventions</p> <ul style="list-style-type: none"> PCN placement or check/change/conversion NUS placement or check/change/conversion UDC placement or check/change/conversion <p>Thermal ablation of the kidney with treatment zone including the collecting system</p> <p>Suprapubic Tube Placement</p>	<p><u>Skin Flora:</u> <i>S. aureus, S. epidermis</i></p> <p><u>GU Flora:</u> <i>E. coli, Proteus, Klebsiella</i></p>	<p>Prophylaxis of genitourinary procedures that enter the urinary tract should include coverage of likely pathogens as well as organisms from the <i>most recent urologic source</i> (urine culture, stone culture, etc.) within the preceding year, regardless of prior antimicrobial treatment. If the most recent positive urologic source culture was > 1 year ago, standard prophylaxis should be utilized</p> <p><u>Adults:</u> Cefuroxime OR Cefoxitin</p> <p><u>Patients with known multi-drug resistant (MDR) bacteria colonization:</u> Consider discussing with ID regarding tailored IV antibiotic prophylaxis.</p>	<p><u>Adults:</u> Clindamycin ± Gentamicin</p> <p><i>Alternative if any allergy to gentamicin</i> OR <i>SCr 2 mg/dL</i> OR <i>CrCl < 40 mL/min:</i> Clindamycin + Aztreonam</p>
		<p><u>Pediatrics:</u> Cefoxitin</p>	<p><u>Pediatrics:</u> Clindamycin + Gentamicin</p> <p><i>Alternative if any allergy to gentamicin</i> OR <i>SCr 2 mg/dL</i> OR <i>CrCl < 40 mL/min</i> Clindamycin + Aztreonam</p>

RADIOLOGY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Renal Arterial Embolization with < 70% of the kidney expected to be embolized	<u>Skin Flora:</u> <i>S. aureus, S. epidermis</i> <u>GU Flora:</u> <i>E. coli, Proteus, Klebsiella</i>	NOT USUALLY INDICATED; consider in the following instances: <ul style="list-style-type: none"> Immunosuppressed patient Plan to leave sheath in place Adults: Cefuroxime OR Cefoxitin	Adults: Clindamycin ± Gentamicin <i>Alternative if any allergy to gentamicin</i> OR <i>SCr 2 mg/dL</i> OR <i>CrCl <40 mL/min:</i> Clindamycin + Aztreonam
		NOT USUALLY INDICATED; consider in the following instances: <ul style="list-style-type: none"> Immunosuppressed Plan to leave sheath in place Pediatrics: Cefoxitin	Pediatrics: Clindamycin + Gentamicin <i>Alternative if any allergy to gentamicin</i> OR <i>SCr 2 mg/dL</i> OR <i>CrCl <40 mL/min:</i> Clindamycin + Aztreonam
Any ARTERIAL, VENOUS, OR DIALYSIS angio or intervention with plan for covered stent placement, overnight lysis, or plan to leave sheath in place. <ul style="list-style-type: none"> Any of these interventions that may result in placement of a covered stent, overnight lysis, or plan to leave the sheath in place. Distal splenic artery embolization for trauma or aneurysm with > 70% of the spleen expected to be embolized Partial Splenic Embolization for hypersplenism AVF or AVG Declots 	<u>Skin Flora:</u> <i>S. aureus, S. epidermis</i>	Adults: Cefazolin <i>If history of MRSA infection or colonization:</i> Vancomycin	Adults: Vancomycin OR Clindamycin
		Pediatrics: Cefazolin <i>If history of MRSA infection or colonization:</i> Vancomycin	Pediatrics: Vancomycin OR Clindamycin
Lung Ablation PleurX Placement			

RADIOLOGY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
<p>Any ARTERIAL, VENOUS, OR DIALYSIS angio or intervention with NO plan for covered stent placement, overnight lysis, or plan to leave sheath in place.</p> <ul style="list-style-type: none"> • Arterial, venous, or dialysis surveillance, recanalization, angioplasty, and bare metal stent placement. • Any arterial embolization <u>not involving a solid organ</u>. Includes bronchial artery embo, GDA embo, Y-90 <u>mapping</u> (not treatment), GI bleed embo (not if hemobilia is suspected), bariatric embo, genicular artery embo, or other visceral artery embo. • Proximal splenic artery embo • Distal splenic artery embo or splenic artery aneurysm embo with < 70% of the spleen expected to be embolized • IVC filter placement and IVC filter retrievals with NO bowel penetration. • Superficial Vein Ablation / Sclerotherapy • TIPS/DIPS check (no stent extension or relining). • Embo or sclero of vascular anomaly not involving the hepatobiliary, splenic, renal, GI, or GU systems. <p>Line placements and exchanges</p> <p>Thermal ablations of bone or kidney (treatment zone cannot include the collecting system)</p> <p>Gastrostomy/gastrojejunostomy placement/exchange, Jejunostomy exchanges</p> <p>Paracentesis, Thoracentesis</p> <p>Pain interventions not requiring needle passage through bowel, liver, or kidneys.</p>	<p><u>Skin Flora</u>: <i>S. aureus</i>, <i>S. epidermis</i></p>	<p><u>NOT USUALLY INDICATED</u>; consider in the following instances:</p> <ul style="list-style-type: none"> • Immunosuppressed • Plan to place covered stent, overnight lysis, or plan to leave sheath in place <p>Adults: Cefazolin</p> <p><u>If history of MRSA infection or colonization</u>: Vancomycin</p>	<p>Adults: Vancomycin OR Clindamycin</p>
		<p><u>NOT USUALLY INDICATED</u>; consider in the following instances:</p> <ul style="list-style-type: none"> • Immunosuppressed • Plan to place covered stent, overnight lysis, or plan to leave sheath in place <p>Pediatrics: Cefazolin</p> <p><u>If history of MRSA infection or colonization</u>: Vancomycin</p>	<p>Pediatrics: Vancomycin OR Clindamycin</p>

RADIOLOGY PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Embolization or sclerosis of vascular anomalies involving the hepatobiliary, splenic, renal, GI, or GU systems	Variable	Physician choice based on end-organ involvement	
Biopsy	Variable	Not usually indicated; consider in the following instances: immunosuppressed, needle trajectory traversing colonized organ system/fluid collection. Physician choice based on biopsy location.	
Abscess drain placement in patients receiving antibiotics and drain placement into a presumed sterile fluid collection (pleural effusion, hematoma, lymphocele, seroma)	Variable	Not usually indicated consider in the following instances: immunosuppressed, needle trajectory traversing colonized organ system/fluid collection. Antibiotics must be infusing or have finished infusing within 1 hour of procedure start. Physician choice based on biopsy location and/or presumed organism.	

SOLID ORGAN TRANSPLANT PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Kidney transplant	<i>S. aureus</i> <i>S. epidermidis</i> enteric gram-negative bacilli	Adults: Cefazolin	Adults: Vancomycin + Aztreonam
		Pediatrics: Cefazolin	Pediatrics: Vancomycin + Aztreonam
Liver transplant	Enteric gram-negative bacilli (e.g., <i>E. coli</i> , <i>Klebsiella</i>) Enterococci <i>S. aureus</i> anaerobes (<i>Bacteroides</i> , <i>Clostridia</i>)	Adults: Piperacillin-tazobactam	Adults: Vancomycin + Aztreonam
		Pediatrics: Piperacillin-tazobactam	Pediatrics: Vancomycin + Aztreonam
Pancreas transplant and Pancreas-Kidney Transplant	Enteric gram-negative bacilli (e.g., <i>E. coli</i> , <i>Klebsiella</i>) <i>S. aureus</i> anaerobes (<i>Bacteroides</i> , <i>Clostridia</i>)	Adults: Cefoxitin + Fluconazole	Adults: Vancomycin + Aztreonam
Laparoscopic Living Donor Nephrectomy	Staphylococci enteric gram-negative bacilli	Adults: Cefazolin 2 g IV/IM; 3 g if \geq 120 kg	Adults: Vancomycin + Aztreonam
Living Donor Liver	Enteric gram-negative bacilli (e.g., <i>E. coli</i> , <i>Klebsiella</i>) Enterococci <i>S. aureus</i> anaerobes (<i>Bacteroides</i> , <i>Clostridia</i>) common with stents, biliary obstruction	Adults: Cefoxitin	Adults: Clindamycin + Aztreonam
For Heart Transplant see Cardiothoracic guideline For Lung Transplant see Thoracic (non-cardiac) guideline			

THORACIC (NON-CARDIAC) PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a <i>See footnote</i> for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Esophagectomy	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin	Adults: Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin
Lung transplant	<i>S. aureus</i> aerobic gram-negative bacilli	Adults: Vancomycin + Cefepime All antimicrobials should be discontinued 48 hours post-operatively or until cultures are available	Adults: Vancomycin + Aztreonam All antimicrobials should be discontinued 48 hours post-operatively or until cultures are available
Misc. thoracic procedures	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin	Adults: Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin

VASCULAR PROCEDURES			
Nature of operation	Likely pathogens	Recommended regimen ^a	Alternative regimen ^a See footnote for optimal approach in patients with β -lactam allergies: almost all patients with penicillin allergies, including anaphylaxis, can receive cephalosporin-based prophylaxis
Open, aortic aneurysm repair Aortic and peripheral aneurysm repair with endovascular stent graft Arterial bypass with prosthetic graft	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin If history of MRSA infection or colonization or if severe β -lactam allergy: Vancomycin	Adults: Clindamycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin
AV grafts (with prosthetic) & fistulas (no prosthetic) with skin flap for vein transposition	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin If history of MRSA infection or colonization or if severe β -lactam allergy: Vancomycin	Adults: Clindamycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin
Carotid endarterectomy with prosthesis or patch	<i>S. aureus</i> <i>S. epidermidis</i>	Adults: Cefazolin If history of MRSA infection or colonization: Vancomycin	Adults: Clindamycin OR Vancomycin
		Pediatrics: Cefazolin	Pediatrics: Clindamycin OR Vancomycin

VASCULAR PROCEDURES			
Carotid endarterectomy without prosthesis or patch	None	Not recommended	Not recommended
Fistulas (no prosthetic) without skin flaps for vein transposition Varicose vein ablation (laser or radio frequency) Vena cava filter placement	None	Not recommended	Not recommended
Lower extremity amputation for ischemia Phlebectomy of varicose veins, stripping of varicose veins, ligation of varicose veins (e.g., Saphenous Vein stripping or ligation)	<i>S. aureus</i> <i>S. epidermidis</i> enteric gram-negative bacilli <i>Clostridia</i> spp.	<u>Adults:</u> Cefazolin	<u>Adults:</u> Clindamycin OR Vancomycin
		<u>Pediatrics:</u> Cefazolin	<u>Pediatrics:</u> Clindamycin OR Vancomycin
Thromboendarterectomy without bypass Arterial bypass with vein graft	<i>S. aureus</i> <i>S. epidermidis</i>	<u>Adults:</u> Cefazolin If history of MRSA infection or colonization or if severe β -lactam allergy: Vancomycin	<u>Adults:</u> Clindamycin OR Vancomycin
		<u>Pediatrics:</u> Cefazolin	<u>Pediatrics:</u> Clindamycin OR Vancomycin

PATIENTS > 50 kg (ADULT AND PEDIATRIC) PRE-OP AND INTRAOPERATIVE ANTIBIOTIC DOSING				
Antimicrobial	Pre-operative dose^Δ Pre-operative dose does not require adjustment for renal dysfunction	Intraoperative re-dosing* Omit second re-dose in those with CrCl < 50 mL/min or on hemodialysis	IV push	Infusion
Ampicillin	2 g	2 g every 2 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Ampicillin/sulbactam	3 g	3 g every 2 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Aztreonam	2 g	2 g every 4 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Cefazolin	2 g if < 120 kg, 3 g if ≥ 120 kg	2 g (3 g if ≥ 120 kg) every 4 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Cefuroxime	1.5 g	1.5 g every 4 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Cefoxitin	2 g	2 g every 2 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Cefepime	2 g	2 g every 4 hours for 2 re-doses	3-5 min [∇]	30 min ^δ
Clindamycin	900 mg	900 mg every 6 hours for 2 re-doses	Not Recommended	30 min ^δ
Daptomycin	6 mg/kg ^ζ	Not Recommended	2 min	30 min ^δ
Piperacillin/tazobactam	4.5 g	4.5 g every 2 hours for 2 re-doses	Not Recommended	30 min ^δ
Metronidazole	500 mg	Not Recommended	Not Recommended	30 min ^δ
Ceftriaxone	2 g	Not Recommended	3-5 min [∇]	30 min ^δ
Gentamicin	5 mg/kg ^ε (ideal body weight)	Not Recommended	Not Recommended	30 min - 60 min
Vancomycin	1 g if < 80 kg, 1.5 g if ≥ 80 kg	1 g (1.5 g if ≥ 80 kg) every 8 hours for 2 doses	Not Recommended	60 – 120 min
Levofloxacin	500 mg	Not Recommended	Not Recommended	60 min ^δ
Ciprofloxacin	400 mg	Not Recommended	Not Recommended	60 min ^δ
Fluconazole	400 mg	Not Recommended	Not Recommended	120 min ^δ

PATIENTS ≤50 kg (ADULT AND PEDIATRIC) PRE-OP AND INTRAOPERATIVE ANTIBIOTIC DOSING RECOMMENDATIONS^{5,8}

Antibiotic Dose	Recommended Concentration	Infusion Time	Patient Weight in kg											Intraoperative Redosing Interval	
			< 5	5-7.49	7.5-9.9	10-14.9	15-19.9	20-24.9	25-29.9	30-34.9	35-39.9	40-44.9	45-50		> 50
Ampicillin 50 mg/kg (Ampicillin/Sulbactam dosed on ampicillin) max: 2000 mg	1 g/10 mL	Maximum of 200 mg/min	USE MG/KG DOSING	375 mg	500 mg	750 mg	1000 mg	1250 mg	1500 mg	1750 mg	2000 mg	2000 mg	2000 mg	REFER TO >50 kg DOSING RECOMMENDATIONS	q2h x2 redoses
Aztreonam 30 mg/kg max: 2000 mg	1 g/10 mL	IVP 3-5 minutes		225 mg	300 mg	450 mg	600 mg	750 mg	750 mg	1000 mg	1000 mg	1000 mg	1500 mg		q4h x2 redoses
Cefazolin (non-cardiac/redoses) 30 mg/kg max: 2000 mg	1 g/10 mL	IVP 3-5 minutes		225 mg	300 mg	450 mg	600 mg	750 mg	750 mg	1000 mg	1000 mg	1000 mg	1500 mg		q4h x2 redoses
*Cefazolin (cardiac/SBE**) 50 mg/kg max: 2000 mg	1 g/10 mL	IVP 3-5 minutes		375 mg	500 mg	750 mg	1000 mg	1250 mg	1500 mg	1750 mg	2000 mg	2000 mg	2000 mg		q4h x2 redoses w/non-cardiac redose value (30 mg/kg)
Cefepime 50 mg/kg max: 2000 mg	1 g/10 mL	3-5 minutes		375 mg	500 mg	750 mg	1000 mg	1250 mg	1500 mg	1750 mg	2000 mg	2000 mg	2000 mg		q4h x2 redoses
Cefotaxime 50 mg/kg max: 2000 mg	1 g/10 mL	3-5 minutes		375 mg	500 mg	750 mg	1000 mg	1250 mg	1500 mg	1750 mg	2000 mg	2000 mg	2000 mg		q3h x2 redoses
Cefoxitin 40 mg/kg max: 2000 mg	1 g/10 mL	3-5 minutes		300 mg	400 mg	600 mg	800 mg	1000 mg	1250 mg	1500 mg	1500 mg	2000 mg	2000 mg		q2 x2 redoses
Ceftriaxone 50 mg/kg max: 2000 mg	40 mg/mL	3-5 minutes		375 mg	500 mg	750 mg	1000 mg	1250 mg	1500 mg	1750 mg	2000 mg	2000 mg	2000 mg		None
Cefuroxime 50 mg/kg max: 1500 mg	1 g/10 mL	3-5 minutes		375 mg	500 mg	750 mg	1000 mg	1500 mg	1500 mg	1500 mg	1500 mg	1500 mg	1500 mg		q4h x2 redoses
Ciprofloxacin 10 mg/kg max: 400 mg	2 mg/mL	Minimum of 60 minutes		75 mg	100 mg	150 mg	200 mg	250 mg	300 mg	350 mg	400 mg	400 mg	400 mg		None
Clindamycin (non-cardiac/redoses) 10 mg/kg max: 900 mg	20 mg/mL	Maximum of 30 mg/min		75 mg	100 mg	150 mg	200 mg	250 mg	300 mg	350 mg	400 mg	450 mg	500 mg		REFER TO q6h x2 redoses

PATIENTS ≤50 kg (ADULT AND PEDIATRIC) PRE-OP AND INTRAOPERATIVE ANTIBIOTIC DOSING RECOMMENDATIONS^{5,8}

Antibiotic Dose	Recommended Concentration	Infusion Time	Patient Weight in kg											Intraoperative Redosing Interval		
			< 5	5-7.49	7.5-9.9	10-14.9	15-19.9	20-24.9	25-29.9	30-34.9	35-39.9	40-44.9	45-50		> 50	
*Clindamycin (cardiac/SBE** in PCN allergy) 20 mg/kg max: 900 mg	20 mg/mL	Maximum of 30 mg/min	USE MG/KG DOSING	150 mg	200 mg	300 mg	400 mg	500 mg	600 mg	700 mg	800 mg	900 mg	900 mg		Q6h x2 redoses w/non-cardiac redose value (10 mg/kg)	
Co-trimoxazole 5 mg/kg TMP Not in infants <2 months max: 160 mg TMP	80 mg SMX: 16 mg TMP/mL 5 ml vial Max conc 1:10	Minimum of 30 minutes		37.5 mg	50 mg	75 mg	100 mg	125 mg	150 mg	160 mg	160 mg	160 mg	160 mg	160 mg		Q6h x2
Fluconazole 6 mg/kg max: 400 mg	2 mg/mL	Maximum of 200 mg/hour		40 mg	50 mg	75 mg	100 mg	135 mg	165 mg	200 mg	225 mg	250 mg	285 mg		None	
Gentamicin/ Tobramycin 5 mg/kg max: 250 mg	10 mg/mL	Minimum of 30 minutes		USE MG/KG DOSING If patient is receiving systemic aminoglycoside therapy prior to surgery, consult OR pharmacist to determine appropriate timing and necessity of peri-operative dosing											None	
Levofloxacin 10 mg/kg max: 750 mg	5 mg/mL	Minimum of 60 minutes		75 mg	100 mg	150 mg	200 mg	250 mg	300 mg	350 mg	400 mg	450 mg	500 mg		None	
Metronidazole 15 mg/kg (dosing rounded to be divisible by 5) max: 500 mg	5 mg/mL	Minimum of 30 minutes		100 mg	150 mg	200 mg	300 mg	375 mg	450 mg	500 mg	500 mg	500 mg	500 mg		None	
Piperacillin/ Tazobactam 100 mg/kg based on Piperacillin max: 3000 mg	100 mg/mL	Minimum of 30 minutes		750 mg	1000 mg	1500 mg	2000 mg	2500 mg	3000 mg	3000 mg	3000 mg	3000 mg	3000 mg	3000 mg		Q2h x2 redoses
Vancomycin (cardiac - Pediatrics) 10 mg/kg max: 1000 mg	1 g/100 mL	Minimum of 60 minutes		USE MG/KG DOSING If patient is receiving systemic vancomycin therapy prior to surgery, consult OR pharmacist to determine appropriate timing and necessity of peri-operative dosing											Q12h x2 redoses	
Vancomycin (non-cardiac & all procedures for adult patients) 15 mg/kg max: 1000 mg	1 g/100 mL	Minimum of 60 minutes		USE MG/KG DOSING If patient is receiving systemic vancomycin therapy prior to surgery, consult OR pharmacist to determine appropriate timing and necessity of peri-operative dosing											Q8h x2 redoses	

IV. FOOTNOTES

- ² Low-risk allergies include: pruritus without rash, remote (>10 years) unknown reaction, patient denies allergy but is on record, mild/severe rash with no other symptoms (see exceptions in 'severe non-IgE reactions below), urticaria/hives with no other symptoms. See [β-lactam allergy evaluation and empiric guidance](#) for further information.
- ³ High-risk allergies include: respiratory symptoms, angioedema, cardiovascular symptoms/syncope/passing out, arrhythmia, anaphylaxis. **If a patient has a high-risk allergy to penicillins, they may receive cefazolin, cefoxitin, or cefuroxime.** See [β-lactam allergy evaluation and empiric guidance](#) for further information.
- ⁴ Severe non-IgE reactions that are contraindications to further beta-lactam use (**except aztreonam, which can be used unless the reaction was to ceftazidime or cefiderocol**) unless approved by Allergy: organ damage (kidney, liver), drug-induced immune-mediated anemia/thrombocytopenia/leukopenia, rash with mucosal lesions (Stevens Johnson Syndrome/Toxic Epidermal Necrosis), rash with pustules (acute generalized exanthematous pustulosis), rash with eosinophils and organ injury (DRESS – drug rash eosinophilia and systemic symptoms), rash with joint pain, fever, and myalgia (Serum Sickness). See [β-lactam allergy evaluation and empiric guidance](#) for further information.
- ⁵ Beta-lactam antibiotics include the following antibiotic classes: penicillins, cephalosporins, carbapenems, aztreonam
- α Refer to Pre-op and Intraoperative Antibiotic Dosing Recommendations Guidelines
- Guideline includes infusion duration and time to intra-operative redosing
 - All prophylactic antimicrobials should be discontinued after the intra-operative period, unless otherwise specified
 - Adult patients < 50 kg should receive antibiotic dosing based on ≤ 50 kg guideline
 - Pediatrics patients > 50 kg should receive antibiotic dosing based on > 50 kg guideline
 - Use mg/kg dosing for patients < 5 kg
 - SIP operative pediatrics procedures include: cardiac, ventriculoperitoneal shunts, and spinal surgery
- * Redosing should occur with the same initial dose, with the exception of cefazolin and clindamycin when used in cardiac/SBE prophylaxis
- ** SBE prophylaxis, ACC/AHA 2008 guideline update on valvular heart disease
- π Adapted from [Clinical Infectious Diseases 2004;38:1706-15 and Am J Health-Syst Pharm 2013;70.](#)
- γ Reconstituted dose injected directly into vein or via running IV fluids (only if IV piggyback not available).
- δ Intermittent IV infusion.
- ε Gentamicin dose should be based on ideal body weight unless actual body weight is less than ideal body weight. Use alternative to gentamicin in adult patients if SCr ≥ 2 mg/dL or CrCL < 40 mL/min, unless otherwise specified.
- ζ Daptomycin should be dosed on actual body weight except in patients with BMI ≥ 35 kg/m², in which case adjusted body weight should be used.
- λ Infusion Timing:
- Infusions should begin 15-60 minutes prior to incision for all antimicrobial agents unless listed below:
 - Levofloxacin, ciprofloxacin, vancomycin, gentamicin, azithromycin, and fluconazole, which should begin 45-90 minutes prior to incision.
 - If pre-operative antibiotics have already been administered but incision has been delayed more than 60 minutes beyond the maximum dosing window (i.e., beta-lactam antibiotics started >2 hours prior to incision), consider pre-operative re-dosing for all antibiotics except vancomycin and aminoglycosides. For vancomycin and aminoglycosides, please contact pharmacy to determine if re-dosing is appropriate.
- ξ Patients receiving systemic antibiotics prior to procedure should still receive the standard pre-operative antimicrobial prophylaxis with appropriate timing of administration as outlined in the UMHS surgical antimicrobial prophylaxis guidelines. Given the risk of nephrotoxicity, in patients receiving vancomycin or aminoglycosides prior to procedure who need these agents for pre-operative antimicrobial prophylaxis, please consult pharmacy to see if treatment doses can be rescheduled such that administration begins 45-90 minutes prior to incision.
- Σ In patients with known colonization or infection with drug-resistant pathogens, the standard pre-operative antimicrobial prophylaxis should generally still be administered unless otherwise specified in procedure-specific guidelines. Please contact the ID approval pager (adults: 30780; pediatrics: 36149) to discuss the case if concerned about: history of a multidrug-resistant organism (e.g., ESBL-producing organism, carbapenem-resistant Enterobacteriaceae, etc.) at the site of the procedure in the previous year OR history of MRSA colonization in the previous year.
- Ω Deviations may be appropriate for staged procedures. For example, in TMJ replacement cases ampicillin/sulbactam prior to the intra-oral portion of the procedure followed by cefazolin prior to the neck incision.

V. ADDITIONAL REFERENCES

- Milstone A. et al. Timing of Preoperative Antibiotic Prophylaxis: A modifiable risk factor for deep surgical site infections after pediatric spinal fusion. [Pediatr Infect Dis J. 2008 Aug;27\(8\):704-8.](#)
- Kids’ Campaign 2007 Pediatric Webcast Series: Reduce Surgical Complications and Prevent Surgical Site Infections. 5 Million lives Campaign/
- Bratzler DW., Houch PM. Antimicrobial Prophylaxis for Surgery: An Advisory Statement from the National Surgical Infection Prevention Project. [Am J Surg. 2005 Apr;189\(4\):395-404.](#)
- American Academy of Pediatrics: Antimicrobial Prophylaxis in Pediatric Surgical Patients. [Pediatrics. 1984 Sep;74\(3\):437-9.](#)
- Bratzler DW, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. [Am J Health Syst Pharm. 2013 Feb 1;70\(3\):195-283.](#)

Antimicrobial Subcommittee Approval: 08/2018, 07/2020, 10/2020, 01/2024	Originated: 04/2009
P&T Approval: 10/2018, 08/2020, 11/2020, 04/2021, 07/2021, 11/2022, 08/2023, 02/2024	Last Revised: 02/2024
<p>Revision History:</p> <ul style="list-style-type: none"> 08/2020: Revised OB/GYN section 10/2020: Revised Urology section 11/2020: Revised Gastrointestinal section 03/2021: Revised allergy wording, Orthopedic, Plastics, and Cardiothoracic sections 04/2021: Adjusted rhinoplasty/septorhinoplasty and vasectomy recommendations 12/2021: Revised Orthopedic section 03/2022: Revised dosing recommendations for patients ≤ 50 kg 10/2022: Added Radiology, updated allergy wording 11/2022: Revised pediatric vancomycin, gentamicin/tobramycin dosing 01/2023: Adjusted allergy wording, revised beta-lactam footnote 03/2023: Removed redosing recommendation for piperacillin-tazobactam during liver transplant 08/2023: Revised Gastrointestinal section 02/2024: Revised Cardiothoracic section 	

The recommendations in this guide are meant to serve as treatment guidelines for use at Michigan Medicine facilities. If you are an individual experiencing a medical emergency, call 911 immediately. These guidelines should not replace a provider’s professional medical advice based on clinical judgment, or be used in lieu of an Infectious Diseases consultation when necessary. As a result of ongoing research, practice guidelines may from time to time change. The authors of these guidelines have made all attempts to ensure the accuracy based on current information, however, due to ongoing research, users of these guidelines are strongly encouraged to confirm the information contained within them through an independent source.

If obtained from a source other than med.umich.edu/asp, please visit the webpage for the most up-to-date document.