



Surgical and Interventional Radiology Antimicrobial Prophylaxis – Adult/Pediatric – Inpatient/Ambulatory/Emergency Department Clinical Practice Guideline

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Executive Summary

Guideline Overview

This document is intended to guide the use of antimicrobial selection and dosing for preoperative and preprocedural prophylaxis of surgical site infections.

Key Practice Recommendations

To provide antimicrobial prophylaxis recommendations for perioperative or preprocedural in patients undergoing surgical intervention or radiologic procedures.

Key Revisions (November 2017 Interim Review)

1. Addition of appendix describing preparation and administration of IV push antibiotics preoperatively

Key Revisions (July 2017 Interim Review)

1. Clarification of interventional radiology procedures and antimicrobial prophylaxis selection.

Key Revisions (2017 Periodic Review)

1. Addition of ciprofloxacin for cardiac procedures if risk of Gram-negative infections.
2. Removal of cefoxitin and cefotetan as options for colorectal surgery prophylaxis.
3. Addition of ampicillin-sulbactam as option in Head and Neck procedures.
4. Clarification of antibiotic selection for ERCP.
5. Adjustment of antibiotic selection for pediatric orthopedic spinal fusions.
6. Addition of maximum doses for all patients fewer than 40 kg.
7. Clarification that redosing interval information is for patients with non-normal renal function.

Companion Documents

[Treatment of Patients with Reported Allergies to \$\beta\$ -Lactam Antibiotics – Adult – Inpatient – Clinical Practice Guideline](#)

Scope

Disease Condition: This clinical practice guideline is intended to guide the use of perioperative antibiotics in adult and pediatric patients undergoing a surgical or interventional radiology procedure. Intraoperative redosing of antibiotics is also addressed.

Clinical Specialty: All medical specialties

Intended Users: Anesthesiologists, surgeons, nurse practitioners, physician assistants, primary care providers, cardiologists, hospitalists, pharmacists, and nurses

Objective

To provide guidance on selection of preoperative antimicrobials based on specified surgery or procedure with information on weight-based dosing and redosing intraoperatively.

Target Population

All patients undergoing surgery or procedure which is included in the guideline.

Interventions and Practices Considered

The clinical interventions and practices recommended in this guideline are intended for patients undergoing surgeries or procedures described in the guideline.

Major Outcomes Considered

- Proportion of patients receiving antimicrobials preoperatively or preprocedurally
- Number of postoperative infections
- Proportion of antimicrobials given within appropriate time window per SCIP guidelines

Methodology

Methods Used to Collect/Select the Evidence

Electronic database searches (i.e. PUBMED) were conducted and workgroup members queried to collect evidence for review; for the 2017 revision, clinical evidence dating back to January 2014 was reviewed. Major external guidelines were reviewed for new clinical information. Additionally, hand searches were performed within selected evidence for other relevant resources. Expert opinion, clinical experience, and regard for patient safety/experience were also considered during discussions of the evidence.

Methods Used to Formulate the Recommendations

All recommendations endorsed or developed by the guideline workgroup were reviewed and approved by other stakeholders or committees.

Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup a modified Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology. (Appendix E).¹

Rating Scheme for the Strength of the Evidence/Strength of the Recommendations:

See Appendix E for the rating scheme used within this document.

Recognition of Potential Health Care Disparities

No potential disparities identified.

Definitions

- (1) SSI – surgical site infection
- (2) MRSA – methicillin-resistant *Staphylococcus aureus*
- (3) MSSA – methicillin-sensitive *Staphylococcus aureus*
- (4) MRSE – methicillin-resistant coagulase-negative staphylococci
- (5) IR – interventional radiology
- (6) Wound classification²
 - i. Clean – An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tracts are not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage. Operative incisional wounds that follow non-penetrating (blunt) trauma should be included in this category if they meet the criteria.
 - ii. Clean-contaminated – Operative wounds in which the respiratory, alimentary, genital (male or female), or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category, provided no evidence of infection or major break in technique is encountered.
 - iii. Contaminated – Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered including necrotic tissue without evidence of purulent drainage (e.g., dry gangrene) are included in this category.
 - iv. Dirty (or infected) – Includes old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

Introduction³

Antimicrobial surgical prophylaxis may be considered primary (prevention of an initial infection), secondary (prevention of recurrence of a preexisting infection, or eradication (elimination of a

colonized organism to prevent infection development); this document presents guidelines for primary surgical prophylaxis with antimicrobials. Preoperative antimicrobial use is a component of a multifactorial approach (including basic infection-control strategy, surgical technique, OR environment, instrument sterilization, preoperative preparation, perioperative management) in preventing surgical site infections (SSIs). In surgical procedures with high rates of infection and clean procedures where infection carries severe consequences, antimicrobial prophylaxis may have benefit.



Table 1. Surgical prophylaxis antimicrobial dosing³

Antimicrobial	< 40 kg ^a	40 – 80 kg	81 – 120 kg	121 – 160 kg	> 160 kg
Ampicillin	50 mg/kg (max 2 g)	2 g			
Ampicillin-sulbactam	50 mg/kg of ampicillin component (max 3 g)	3 g			
Cefazolin	30 mg/kg (max 2 g)	2 g	3 g		
Cefepime	50 mg/kg (max 2 g)	2 g			
Cefotaxime	50 mg/kg (max 1 g)	1 g	2 g		
Cefoxitin	40 mg/kg (max 2 g)	2 g	3 g		
Ceftriaxone	50 mg/kg (max 1 g)	1 g	2 g		
Cefuroxime	50 mg/kg (max 1.5 g)	1.5 g	3 g		
Ciprofloxacin	10 mg/kg (max 400 mg)	400 mg		600 mg	800 mg
Clindamycin	10 mg/kg (max 600 mg)	600 mg	900 mg	1200 mg	
Fluconazole	6 mg/kg (max 400 mg)	400 mg			
Gentamicin	4 mg/kg ^b	5 mg/kg ^c			
Levofloxacin	10 mg/kg (max 500 mg)	500 mg			750 mg
Metronidazole^d	15 mg/kg (max 1 g)	500 mg		750 mg	
Moxifloxacin		400 mg			800 mg
Piperacillin-tazobactam	2-9 mos: 80 mg/kg 9 mos & older: 100 mg/kg (for both age groups, max 3000 mg piperacillin component)	3.375 g		4.5 g	
Vancomycin	15 mg/kg (max 1 g)	20 mg/kg (max 2000 mg)			2000 mg

^a Consult pediatric pharmacist for neonatal dosing

^b Use patient's dry weight or estimated dosing weight. If unavailable, may use weight estimate by growth chart and estimated curve

^c If patient's actual weight is more than 20% greater than ideal body weight, gentamicin dose is based on dosing weight where dosing weight (DW) is $DW = IBW + 0.4(\text{actual weight} - IBW)$.

^d Neonates weighing fewer than 1200 g should receive 7.5 mg/kg metronidazole dose

Table 2. Redosing intervals^{a,b 3,4}

Antimicrobial	Half-life in Adults with Normal Renal Function ^b	Intraoperative Redosing Interval Based on Renal Function			
		≥50 mL/min	30-49 mL/min	11-29 mL/min	≤10 mL/min or HD
Ampicillin	1-1.9 h	3 h	4 h	6 h	9 h
Ampicillin-sulbactam	0.8-1.3 h	3 h	4 h	6 h	12 h
Cefazolin	1.2-2.2 h	4 h	6 h	12 h	12 h
Cefepime ^c	2 h	4 h	8 h	≤ 59 mL/min or HD	
Cefotaxime	0.9-1.7 h	3 h	24 h	HD	
Cefoxitin	0.7-1.1 h	3 h in non-obese 2 h in obese	4 h in non-obese 3 h in obese	6 h in non-obese 4 h in obese	12 h in non-obese 8 h in obese
Ceftriaxone	5.4-10.9 h	No renal dose adjustment; redose at 24 h			
Cefuroxime	1-2 h	4 h	6 h	12 h	12 h
Ciprofloxacin	3-7 h	8 h	≤10 mL/min or HD		
Clindamycin	2-4 h	No renal dose adjustment; redose at 6 h			
Fluconazole	30 h	No renal dose adjustment; redose at 24 h			
Gentamicin	2-3 h	≥50 mL/min	<50 mL/min		
		Pediatrics: 12 h (for 4 mg/kg); Adults: 24 hr (for 5 mg/kg)		Consult OR Pharmacist	
Levofloxacin	6-8 h	No renal dose adjustment; redose at 24 h			
Metronidazole	6-8 h	No renal dose adjustment; redose at 6 h			
Moxifloxacin	8-15 h	No renal dose adjustment; redose at 24 h			
Piperacillin-tazobactam ^c	0.7-1.2 h	2 h	3 h	4 h	8 h
Vancomycin	4-8 h	≥100 mL/min	60-99 mL/min	30-59 mL/min	<30 mL/min
		8 h	12 h	24 h	Consult OR Pharmacist
		Pediatrics: If CrCL >50 mL/min, redose at 6 h due to increased clearance; if CrCL <50 mL/min, consult OR Pharmacist			

^a Redosing should be considered after significant blood loss.

^b Redosing interval is timed from the initiation of the preoperative dose. Patients with renal impairment or failure will have longer antimicrobial half-lives and therefore longer redosing intervals. For antimicrobials with a short half-life (e.g. cefazolin) in patients with normal renal function, redosing in the operating room is recommended at an interval of two times the half-life of the agent

^c If given for prophylaxis only, administer piperacillin-tazobactam, cefepime, or meropenem for prophylaxis over 30 minutes. If given for treatment, it is reasonable to continue prolonged infusions of piperacillin-tazobactam, cefepime, or meropenem at the redosing interval.

Table 3. Recommended administration times^{3,4}

Antimicrobial	Recommended Administration Time
Ampicillin	30 minutes; Do not push
Ampicillin-sulbactam	30 minutes; Do not push
Cefazolin	30 minutes; max rate 5 minutes Pediatrics: Infuse over 10-60 min at conc of 20 mg/mL
Cefepime	30 minutes
Cefotaxime	15-30 minutes at 20-60 mg/mL concentration; Do not push 3-5 minutes at 200 mg/mL concentration; Do not push
Cefoxitin	Adults 30 minutes; max rate over 3-5 minutes at concentration of 100 mg/mL Pediatrics 10-60 minutes at maximum concentration of 40 mg/mL 3-5 minutes at maximum concentration of 100 mg/mL
Ceftriaxone	30 minutes; Do not push
Cefuroxime	30 minutes; max rate 3-5 minutes
Ciprofloxacin	60 minutes; Do not push
Clindamycin	No faster than 30 mg/min or 1200 mg/hr; Do not push
Fluconazole	60-120 minutes; No faster than 200 mg/hr; Do not push
Gentamicin	< 250 mg: 30 minutes; Do not push ≥ 250 mg: 60 minutes; Do not push
Levofloxacin	≤ 500 mg: 60 minutes; Do not push > 500 mg: 90 minutes; Do not push
Metronidazole	30-60 minutes; Do not push
Moxifloxacin	60 minutes; Do not push
Piperacillin-tazobactam	30 minutes; Do not push
Vancomycin^a	Adults No faster than 1000 mg/60 minutes; Do not push Pediatrics At least 60 minutes; Do not push

^a It is not known whether starting the procedure (e.g. skin incision) prior to completion of the vancomycin infusion results in equivalent SSI reduction outcomes as infusing the entire dose prior to incision. The best practice is to infuse the entire dose prior to incision. However, based on pharmacokinetic evaluation, it may be acceptable to start the procedure after a minimum of two-thirds of the vancomycin dose has been infused in patients weighing fewer than 120 kg (the remainder of the dose should continue infusing as the procedure is in progress). For patients weighing 120 kg or more, the entire dose should be infused prior to incision. For any procedure utilizing the application of a tourniquet, the entire dose should be infused prior to tourniquet inflation.

Table 4. Surgical prophylaxis antimicrobial selection at UWHC

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
Cardiac	CABG procedures, valve repairs, and placement of temporary or permanent implantable cardiac devices (including ventricular assist devices)	Cefazolin OR Cefuroxime	Vancomycin + Cefazolin OR Cefuroxime	Vancomycin OR Clindamycin Consider addition of aztreonam if risk for Gram-negative infections	Vancomycin OR Clindamycin Consider addition of aztreonam if risk for Gram-negative infections
		Consider addition of vancomycin to regimen if risk of MRSE infection with implanted prosthetic material (if vancomycin is not already component of selected regimen)			
Cardiac Device Insertion	Permanent pacemaker, implantable cardioverter defibrillator, or cardiac resynchronization device	Cefazolin OR Cefuroxime	Vancomycin + Cefazolin OR Cefuroxime	Vancomycin OR Clindamycin Consider addition of aztreonam if risk for Gram-negative infections	Vancomycin OR Clindamycin Consider addition of aztreonam if risk for Gram-negative infections
		Consider addition of vancomycin to regimen if risk of MRSE infection with implanted prosthetic material (if vancomycin is not already component of selected regimen)			
	Cardiac catheterization or transesophageal echocardiogram	No antimicrobial prophylaxis recommended			
Thoracic	Noncardiac thoracic procedures include lobectomy, pneumonectomy, thoracoscopy, lung resection, thoracotomy, and video-assisted thoracoscopic surgery	Cefazolin OR Ampicillin-sulbactam	Vancomycin + Cefazolin OR Ampicillin-sulbactam	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
Gastroduodenal	Resection with or without vagotomy for gastric or duodenal ulcers, resection for gastric carcinoma, revision required to repair strictures of the gastric outlet, PEG insertion, perforated ulcer procedures, pancreaticoduodenectomy, and bariatric surgical procedures	Cefazolin	Vancomycin + Cefazolin	(1) Vancomycin OR Clindamycin + Gentamicin OR Ciprofloxacin (2) Moxifloxacin	Vancomycin OR Clindamycin + Gentamicin OR Ciprofloxacin OR Moxifloxacin
	Endoscopic Retrograde Cholangiopancreatography (ERCP)	Ceftriaxone	Ceftriaxone	Gentamicin	Gentamicin

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam <u>AND</u> history of MRSA (documented or reported)
Biliary Tract	Cholecystectomy, exploration of common bile duct, and choledochostomy	Cefazolin OR Ampicillin-sulbactam	Vancomycin + Cefazolin OR Ampicillin-sulbactam	Metronidazole + Ciprofloxacin OR Gentamicin	Vancomycin + Metronidazole + Ciprofloxacin OR Gentamicin
Appendectomy	Uncomplicated appendicitis	Cefoxitin OR Cefazolin and Metronidazole	Vancomycin + Cefoxitin OR Cefazolin and Metronidazole	Metronidazole + Ciprofloxacin OR Gentamicin	Vancomycin + Metronidazole + Ciprofloxacin OR Gentamicin
Small Intestine	Nonobstructed: incision or resection of the small intestine, enterectomy with or without intestinal anastomosis or enterostomy, intestinal bypass, and stricturoplasty	Cefazolin	Vancomycin + Cefazolin	Ciprofloxacin and Metronidazole	Vancomycin + Ciprofloxacin and Metronidazole
	Obstructed: incision or resection of the small intestine, enterectomy with or without intestinal anastomosis or enterostomy, intestinal bypass, and stricturoplasty	Cefazolin and Metronidazole OR Cefoxitin	Vancomycin + Cefazolin and Metronidazole OR Cefoxitin	Ciprofloxacin and Metronidazole	Vancomycin + Ciprofloxacin and Metronidazole
Hernia Repair	Hernioplasty and herniorrhaphy	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
Colorectal		Cefazolin and Metronidazole	Vancomycin + Cefazolin and Metronidazole	Levofloxacin and Metronidazole	Vancomycin + Levofloxacin and Metronidazole
Head and Neck	Clean: thyroidectomy and lymph node excisions	No antimicrobial prophylaxis recommended			
	Throat/oral cavity procedures	Ampicillin-sulbactam	Vancomycin + Ampicillin-sulbactam	Clindamycin	Vancomycin + moxifloxacin
	Other procedures needing only skin coverage	Cefuroxime	Vancomycin + Cefuroxime	Vancomycin	Vancomycin
Neurosurgery	Cerebrospinal fluid-shunting procedures	Cefuroxime	Vancomycin + Cefuroxime	Levofloxacin and Vancomycin	Levofloxacin and Vancomycin
	Elective craniotomy	Cefazolin OR Cefuroxime	Vancomycin + Cefazolin OR Cefuroxime	Vancomycin	Vancomycin
	Other, including implantation of intrathecal pumps	Cefazolin OR Cefuroxime	Vancomycin + Cefazolin OR Cefuroxime	Levofloxacin and Vancomycin	Levofloxacin and Vancomycin

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
Gynecological	Vaginal and abdominal (open and laparoscopic) hysterectomy	Cefoxitin OR Ampicillin-sulbactam	Vancomycin + Cefoxitin OR Ampicillin-sulbactam	(1) Vancomycin + Gentamicin OR Ciprofloxacin (2) Metronidazole + Gentamicin OR Ciprofloxacin	(1) Vancomycin + Gentamicin OR Ciprofloxacin (2) Vancomycin + Metronidazole + Gentamicin OR Ciprofloxacin
	HSG or chromotubation in patients with a history of pelvic infection or dilated fallopian tube	Dilated fallopian tubes: doxycycline 100 mg PO BID for 5 days History of pelvic infection: preoperative doxycycline			
	Surgical abortion	Doxycycline 100 mg PO one hour before surgery and 200 mg once after surgery OR metronidazole 500 mg PO BID for 5 days			
	Urogynecologic procedures	Cefoxitin OR Cefuroxime OR Ampicillin-sulbactam	Vancomycin + Cefoxitin OR Cefuroxime OR Ampicillin-sulbactam	Metronidazole + Gentamicin OR Ciprofloxacin	1) Vancomycin + Gentamicin OR Ciprofloxacin (2) Vancomycin + Metronidazole + Gentamicin OR Ciprofloxacin
	Vaginal and urethral sling	Cefoxitin OR Cefazolin + Metronidazole	Vancomycin + Cefazolin and Metronidazole OR Cefoxitin	Metronidazole + Gentamicin OR Ciprofloxacin	Vancomycin + Metronidazole and Gentamicin OR Ciprofloxacin
	Cesarean sections	Cefazolin	Vancomycin + Cefazolin	Clindamycin and Gentamicin	Vancomycin + Clindamycin and Gentamicin
Ophthalmic	Cataract extractions, vitrectomies, keratoplasties, intraocular lens implantation, glaucoma procedures, strabismus procedures, retinal detachment repair, laser in situ keratomileusis, and laser-assisted subepithelial keratectomy	Topical neomycin-polymixin B-gramicidin or topical fluoroquinolone (gatifloxacin or moxifloxacin): 1 drop every 5-15 minutes for 5 doses Optional at end of procedure: subconjunctival cefazolin 100 mg or intracameral cefazolin 1-2.5 mg or intracameral cefuroxime 1 mg (or vancomycin if IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam)			

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam <u>AND</u> history of MRSA (documented or reported)	
Orthopedic	Clean orthopedic procedures not involving implantation of foreign material : knee, hand, and foot procedures, arthroscopy, and other procedures without instrumentation or implantation of foreign materials	No antimicrobial prophylaxis recommended				
	Spinal procedures with or without instrumentation (including fusions, laminectomies, minimally invasive disk procedures) Hip fracture repair (including those requiring internal fixation) Total joint replacement (total hip, elbow, knee, ankle, or shoulder replacement)	Cefazolin OR Cefuroxime	Vancomycin + Cefazolin OR Cefuroxime	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin Consider addition of gentamicin if at risk for Gram-negative infections	
	Pediatric spinal fusions	Cervical and upper thoracic	Cefazolin OR Cefuroxime	Vancomycin OR Clindamycin + Cefazolin OR Cefuroxime	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
		Lower thoracic and lumbar	Cefepime AND Vancomycin for 24 hours, followed by Cefuroxime until drains removed	Cefepime AND Vancomycin for 24 hours, followed by Cefuroxime AND Vancomycin until drains removed	Vancomycin OR Clindamycin + Gentamicin	Vancomycin OR Clindamycin + Gentamicin
Urologic	Clean without entry into urinary tract	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	
	Clean with entry into urinary tract	Cefazolin	Vancomycin + Cefazolin	Ciprofloxacin OR Gentamicin \pm Clindamycin	Vancomycin + Ciprofloxacin OR Gentamicin \pm Clindamycin	

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
	Clean-contaminated with or without entry into the urinary tract	Cefazolin and Metronidazole OR Cefoxitin	Vancomycin + Cefazolin and Metronidazole OR Cefoxitin	Ciprofloxacin OR Gentamicin + Metronidazole OR Clindamycin	Vancomycin + Ciprofloxacin OR Gentamicin + Metronidazole OR Clindamycin
	Lower tract instrumentation with risk factors for infection, but without breach or incision of skin (e.g. stone removal)	Ciprofloxacin OR Gentamicin OR Cefazolin OR Trimethoprim-sulfamethoxazole \pm Ampicillin	Vancomycin (for known MRSA in urine) + Ciprofloxacin OR Gentamicin OR Cefazolin OR Trimethoprim-sulfamethoxazole \pm Ampicillin	Vancomycin \pm Ciprofloxacin OR Gentamicin OR Trimethoprim-sulfamethoxazole	Vancomycin \pm Ciprofloxacin OR Gentamicin OR Trimethoprim-sulfamethoxazole
	Clean without entry into urinary tract involving implanted prosthesis	Cefazolin \pm gentamicin OR Ampicillin-sulbactam	Vancomycin + Cefazolin \pm gentamicin OR Ampicillin-sulbactam	Vancomycin \pm Gentamicin OR Clindamycin \pm Gentamicin	Vancomycin \pm Gentamicin OR Clindamycin \pm Gentamicin
Vascular	Brachiocephalic procedures without implantation of prosthetic graft material (including carotid endarterectomy, brachial artery repair)	No antimicrobial prophylaxis recommended			
	Vascular procedures that involve implantation of prosthetic material and procedures with a higher risk of infection (aneurysm repair, thromboendarterectomy, vein bypass)	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
		Consider addition of vancomycin to regimen if risk of MRSE infection with implanted prosthetic material (if vancomycin is not already component of selected regimen)			
Plastic Surgery	Clean procedures without additional postoperative infection risk factors	No antimicrobial prophylaxis recommended			

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)	
	Clean procedures with risk factors, clean-contaminated procedures, or selected breast cancer procedures (breast implant exchange or other implant procedures)	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	
	Mastectomy or breast tissue expander procedure	Cefazolin and vancomycin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin	
Trauma	Open fractures	Type I and II	Cefazolin	Vancomycin + Cefazolin	Vancomycin	Vancomycin
		Type III	Ceftriaxone \pm Gentamicin	Vancomycin + Ceftriaxone \pm Gentamicin	Vancomycin and Gentamicin	Vancomycin and Gentamicin
	Fecal or farm related-injuries	Add metronidazole to the appropriate regimen for Type I, II, or III fracture				
	Penetrating abdominal wounds	Cefoxitin OR Cefuroxime and Metronidazole	Vancomycin + Cefoxitin OR Cefuroxime and Metronidazole	Vancomycin and Ciprofloxacin and Metronidazole	Vancomycin and Ciprofloxacin and Metronidazole	

Table 5. Interventional radiology prophylaxis antimicrobial selection

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam <u>AND</u> history of MRSA (documented or reported)
Vascular interventions	Diagnostic angiography, routine angioplasty, thrombolysis, arterial closure device placement, or arterial stent placement	No antimicrobial prophylaxis recommended			
	Arterial stent placement with high risk of infection	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
Endograft Placement	Aortic endograft, peripheral endograft	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
Superficial Venous Insufficiency Treatment	Endovascular thermal ablation, lower extremity sclerotherapy, ambulatory phlebectomy	No antimicrobial prophylaxis recommended			
	Upper extremity, torso, head/neck sclerotherapy	Cefazolin	Vancomycin and Cefazolin OR Clindamycin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
IVC Filter Placement		No antimicrobial prophylaxis recommended			
Central Venous Access	Central venous catheter placement: PICC line, tunneled and cuffed lines, non-tunneled/temporary lines, hemodialysis or pheresis lines)	No antimicrobial prophylaxis recommended			
	Central venous catheter: port placement	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin

Procedure			First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
Embolization and chemoembolization	Embolization of tumor and/or solid organ with the intent to create an infarct or there is a high likelihood of infarct	Hepatic artery embolization (HAE), bland embolization, and portal vein embolization (PVE)	Ampicillin-sulbactam OR Cefazolin and Metronidazole OR Cefoxitin OR Ampicillin and Gentamicin OR Ceftriaxone	Vancomycin + Ampicillin-sulbactam OR Cefazolin and Metronidazole OR Cefoxitin OR Ampicillin and Gentamicin OR Ceftriaxone	Vancomycin OR Clindamycin + Gentamicin + Metronidazole	Vancomycin OR Clindamycin + Gentamicin + Metronidazole
	Chemoembolization	Renal	Ceftriaxone	Vancomycin + Ceftriaxone		
Uterine Artery Embolization			Cefazolin OR Cefoxitin OR Clindamycin and Gentamicin OR Ampicillin-sulbactam	Vancomycin + Cefazolin OR Cefoxitin OR Clindamycin and Gentamicin OR Ampicillin-sulbactam	Vancomycin OR Clindamycin and Gentamicin	Vancomycin OR Clindamycin and Gentamicin
TIPS			Ceftriaxone OR Ampicillin-sulbactam	Vancomycin + Ceftriaxone OR Ampicillin-sulbactam	Vancomycin OR Clindamycin + Gentamicin	Vancomycin OR Clindamycin + Gentamicin

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
Gastrostomy and Gastrojejunostomy Tube Placement	Gastrostomy and gastrojejunostomy tube placement	No antimicrobial prophylaxis recommended			
	Decompressive gastrostomy tube placement	Cefazolin	Vancomycin + Cefazolin	(1) Vancomycin OR Clindamycin + Gentamicin OR Ciprofloxacin (2) Moxifloxacin	Vancomycin OR Clindamycin + Gentamicin OR Ciprofloxacin OR Moxifloxacin
Liver and Biliary Interventions	Biliary drainage	Ceftriaxone OR Ampicillin-sulbactam OR Cefoxitin OR Ampicillin and Gentamicin	Vancomycin + Ceftriaxone OR Ampicillin-sulbactam OR Cefoxitin OR Ampicillin and Gentamicin	Vancomycin OR Clindamycin + Gentamicin	Vancomycin OR Clindamycin + Gentamicin
Genitourinary	Percutaneous nephrostomy tube placement, tube exchange, ureteral stents	Cefazolin OR Ceftriaxone OR Ampicillin-sulbactam OR Ampicillin and Gentamicin	Vancomycin + Cefazolin OR Ceftriaxone OR Ampicillin-sulbactam OR Ampicillin and Gentamicin	Vancomycin and Gentamicin	Vancomycin and Gentamicin

Procedure		First Line	History of MRSA (documented or reported)	Patients with IgE-mediated or severe reaction to β -lactam	Patients with IgE-mediated or severe reaction to β -lactam AND history of MRSA (documented or reported)
Tumor Ablation	Liver	Ampicillin-sulbactam	Vancomycin + Ampicillin-sulbactam	Vancomycin	Vancomycin
	Renal	Ceftriaxone	Vancomycin + Ceftriaxone		
	Bone	Cefazolin	Vancomycin + Cefazolin		
Percutaneous Abscess Drainage		Cefoxitin OR Ceftriaxone OR Ampicillin-sulbactam	Vancomycin AND Cefoxitin OR Ceftriaxone OR Ampicillin-sulbactam	Gram-positive coverage: Vancomycin OR Clindamycin Gram-negative coverage: Gentamicin	Gram-positive coverage: Vancomycin OR Clindamycin Gram-negative coverage: Gentamicin
Percutaneous Biopsy	Transrectal percutaneous biopsy	Gentamicin 80 mg IV/IM and Ciprofloxacin 250 mg BID PO for five days OR Ciprofloxacin 500 mg BID PO for four days (starting the day before the biopsy)			
Percutaneous vertebroplasty		Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin
Pulmonary Arteriovenous Malformations	Pulmonary arteriovenous malformation embolization	Cefazolin	Vancomycin + Cefazolin	Vancomycin OR Clindamycin	Vancomycin OR Clindamycin

Recommendations

- 1 Principles of antimicrobial surgical prophylaxis³
 - 1.1 The antimicrobial chosen for surgical prophylaxis should: (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.1.1 possess activity to likely surgical site pathogens;
 - 1.1.2 be given at an appropriate dosage and time to achieve adequate concentrations during the time period of potential contamination;
 - 1.1.3 be safe;
 - 1.1.4 be administered for the shortest period possible.
 - 1.2 Antimicrobials should have the narrowest spectrum of activity to achieve efficacy (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.2.1 Cefazolin is the prophylactic antimicrobial of choice for most surgical procedures (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 1.2.1.1 Clindamycin is not recommended as the preferred alternative due to broad anaerobic spectrum (increasing *C. difficile* infection risk) and lack of efficacy in 35% or more of patients at UWHC (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.3 Routine use of vancomycin prophylaxis is not recommended for any procedure (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.3.1 Vancomycin may be considered for patients with known MRSA colonization or at high risk for MRSA/MRSE colonization without surveillance data (e.g. recent hospitalizations, nursing home residents, hemodialysis patients) or patients who have received more than 48 hours of therapeutic beta-lactam antibiotics (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 1.3.2 Vancomycin is inferior to cefazolin in preventing SSIs caused by MSSA^{5,6}
 - 1.3.2.1 Vancomycin is not recommended as monotherapy in patients who can tolerate a cephalosporin (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.3.3 Vancomycin may be considered for monotherapy when the patient cannot tolerate a beta-lactam due to IgE-mediated reaction or severe non-IgE-mediated reaction (e.g. hemolysis, Stevens Johnson Syndrome, toxic epidermal necrolysis) (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 1.3.3.1 Vancomycin is preferred over clindamycin in these clinical situations (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 1.4 Antimicrobial intravenous administration is preferred for most procedures as this produces rapid and predictable serum concentrations (*UW Health Strong Recommendation, Very Low Level of Evidence*)
 - 1.4.1 The first dose of antimicrobial should be given within 60 minutes of the first surgical incision (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 1.4.2 The full dose of the antimicrobial should be infused prior to surgical incision. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 1.4.3 Vancomycin and fluoroquinolones should be given within 120 minutes of the first surgical incision (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 1.4.3.1 For vancomycin, it is not known whether starting the procedure (e.g. skin incision) prior to completion of the vancomycin infusion results in equivalent SSI reduction outcomes as infusing the entire dose prior to incision. The best practice is to infuse the entire dose prior to incision. However, based on pharmacokinetic evaluation, it may be acceptable to start the procedure after a minimum of two-thirds of the vancomycin dose has been infused in patients weighing fewer than 120 kg (the remainder of the dose should continue infusing as the procedure is in progress). For patients weighing 120 kg or more, the entire dose should be infused prior to tourniquet inflation. For any procedure utilizing the application of a tourniquet, the entire dose should be infused prior to incision. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

- 1.5 Patients receiving therapeutic antimicrobials for a remote infection prior to surgery should also be given antimicrobial prophylaxis before surgery to ensure adequate serum and tissue antimicrobial tissue levels with pathogen activity (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.5.1 If the therapeutic antimicrobial is appropriate for surgical prophylaxis, administering an additional dose 60 minutes prior to incision is sufficient
- 1.6 Dosing adjustment in adult obesity
 - 1.6.1 Patients weighing 120 kg or more should receive 3 g doses of cefazolin for antimicrobial prophylaxis (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 1.6.2 Patients weighing 20% above ideal body weight who are receiving gentamicin, should be dosed using an aminoglycoside dosing weight (ideal body weight plus 40% of the difference between the actual and ideal weights) (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 1.6.3 Perioperative antimicrobial dosing in obesity is poorly defined. As perioperative antimicrobial prophylaxis is limited to fewer than 48 hours, risks of adverse drug events associated with higher doses is low and while the benefit associated with higher drug doses is not known, the suspected benefit likely outweighs risk of adverse events. Higher antimicrobial doses may be reasonable in obese patients. (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 1.7 Pediatric patients should receive weight-based antimicrobial doses (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 1.7.1 Pediatric patients weighing more than 40 kg should receive weight-based doses unless the dose exceeds the recommended adult dose
- 1.8 Surgical prophylaxis antimicrobials should be redosed if the procedure duration exceeds two half-lives of the antimicrobial or there is excessive blood loss to ensure adequate serum and tissue concentrations. (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 1.8.1 The initial, intraoperative redosing interval is measured from the time of the preoperative dose.
 - 1.8.2 Redosing may be appropriate in clinical scenarios where the antimicrobial half-life is shortened (e.g. extensive burns, blood loss). (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 1.8.3 Redosing may not be necessary in clinical scenarios where the antimicrobial half-life is prolonged (e.g. renal insufficiency or failure). (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 1.8.4 Excessive blood loss is defined as the loss of 20% or more of estimated total blood volume.⁷ If this blood loss occurs in a time period of longer than halfway through the redosing interval of the antimicrobial, the antimicrobial should be redosed at the usual redosing interval. (*UW Health Weak/conditional Recommendation, Moderate Quality of Evidence*)
 - 1.8.5 Rapid, excessive blood loss is defined as the loss of 20% or more of estimated total body blood volume in a time period shorter than one-half of the normal intraoperative redosing interval for that antibiotic.⁷ Antimicrobial redosing should occur when rapid, excessive blood loss occurs. (*UW Health Weak/conditional Recommendation, Moderate Quality of Evidence*)
 - 1.8.6 Careful consideration is recommended for antimicrobials with higher toxicity risks (e.g. vancomycin, aminoglycosides) to ensure safety with these agents when requiring multiple doses. Consultation with the OR pharmacist may be advised in these cases. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 1.8.7 Antimicrobial redosing should not occur more than four times during a prolonged operative case without excessive blood loss. If the case exceeds four redosing intervals, additional dosing should follow recommendations outlined in the [Renal Function-based Dose Adjustments – Adult – Inpatient Clinical Practice Guidelines](#). (*UW Health Strong Recommendation, Low Quality of Evidence*)

- 1.9 Antimicrobial prophylaxis duration should be fewer than 24 hours for most procedures.^{8,9} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 1.9.1 In clean and clean-contaminated procedures, it is reasonable to further limit antimicrobial prophylaxis to no additional doses after the surgical incision is closed in the operating room, even in the presence of a drain.¹⁰ (*UW Health Weak/conditional Recommendation, Moderate Quality of Evidence*)
- 1.9.2 Antimicrobial prophylaxis of up to 48 hours for cardiothoracic procedures (with mediastinal tubes) effectiveness is unclear (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 1.10 Topical antimicrobial should not be used for surgical prophylaxis as safety and efficacy has not been established (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

Surgical Antimicrobial Prophylaxis

2 Cardiac procedures

- 2.1 Patients undergoing cardiac procedures should receive antimicrobial prophylaxis^{3,11} (*UW Health Strong Recommendation, High Quality of Evidence*)
- 2.1.1 Includes CABG procedures, valve repairs, and placement of temporary or permanent implantable cardiac devices (including ventricular assist devices)³
- 2.2 Pathogens³
- 2.2.1 Most common pathogens: *S. aureus*, coagulase-negative staphylococcus
- 2.2.2 Less common pathogens: *Propionibacterium acnes*, *Enterobacter* species, *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Acinetobacter* species
- 2.3 Antimicrobial selection
- 2.3.1 Adults
- 2.3.1.1 First-line agents: cefazolin or cefuroxime¹¹⁻¹⁹ (*UW Health Strong Recommendation, High Quality of Evidence*)
- 2.3.1.2 MRSA agents for documented MRSA or history of MRSA or risk for MRSE with implanted prosthetic material: add vancomycin to the regimen^{3,20,21} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 2.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin^{3,20,21} (*UW Health Strong Recommendation, Moderate Quality of Evidence*) and aztreonam (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 2.3.1.3.1 It is reasonable to consider aztreonam if risk for Gram-negative infections.
- 2.3.2 Pediatrics
- 2.3.2.1 First-line agents: cefazolin or cefuroxime: cefazolin or cefuroxime³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 2.3.2.2 MRSA agents for documented MRSA or history of MRSA or risk for MRSE with implanted prosthetic material: add vancomycin to the regimen³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 2.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 2.3.3 In patients who have received 48 hours or more of antibiotic therapy with *Staphylococcus* or *Streptococcus* activity, it is reasonable to administer vancomycin (in addition to other preoperative antibiotics) preoperatively for clean and clean-contaminated procedures²² (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 2.3.4 Prolonged antimicrobial prophylaxis may be considered for an open chest surgery (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

3 Cardiac device insertion procedures

- 3.1 Patients undergoing cardiac implantable device insertion (e.g. permanent pacemaker, implantable cardioverter defibrillator, cardiac resynchronization device) should receive antimicrobial prophylaxis^{3,23} (*UW Health Strong Recommendation, High Quality of Evidence*)
- 3.1.1 Adults
- 3.1.1.1 First-line agents: cefazolin or cefuroxime³ (*UW Health Strong Recommendation, High Quality of Evidence*)
- 3.1.1.2 MRSA agents for documented MRSA or history of MRSA or risk for MRSE with implanted prosthetic material: add vancomycin to the regimen³ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 3.1.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin³ (*UW Health Strong Recommendation, Moderate Level of Evidence*) or aztreonam (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 3.1.1.4 It is reasonable to consider aztreonam if risk for Gram-negative infections.
- 3.1.2 Pediatrics
- 3.1.2.1 First-line agents: cefazolin or cefuroxime³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 3.1.2.2 MRSA agents for documented MRSA or history of MRSA or risk for MRSE with implanted prosthetic material: add vancomycin to the regimen³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 3.1.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 3.1.3 In patients who have received 48 hours or more of antibiotic therapy with *Staphylococcus* or *Streptococcus* activity, it is reasonable to administer vancomycin preoperatively (in addition to other preoperative antibiotics) for clean and clean-contaminated procedures²² (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 3.2 Patients undergoing cardiac catheterization or transesophageal echocardiogram should not receive antimicrobial prophylaxis^{3,24} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

4 Thoracic procedures

- 4.1 Patient undergoing thoracic procedures should receive antimicrobial prophylaxis (*UW Health Strong Recommendation, Moderate Quality of Evidence*)^{21,25-28}
- 4.1.1 Noncardiac thoracic procedures include lobectomy, pneumonectomy, thoracoscopy, lung resection, thoracotomy, and video-assisted thoracoscopic surgery
- 4.2 Pathogens³
- 4.2.1 SSI: *S. aureus*, *S. epidermidis*
- 4.2.2 Postoperative pneumonia: *Streptococcus* species, *Staphylococcus* species, *H. influenzae*, *E. cloacae*, *K. pneumoniae*, *Acinetobacter* species, *P. aeruginosa*, *M. catarrhalis*, and *Candida* species
- 4.3 Antimicrobial selection
- 4.3.1 Adults
- 4.3.1.1 First-line agents: cefazolin or ampicillin-sulbactam³ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 4.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen³ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 4.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 4.3.2 Pediatrics

- 4.3.2.1 First-line agents: cefazolin or ampicillin-sulbactam³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 4.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 4.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

5 Gastroduodenal procedures

- 5.1 Patients undergoing gastroduodenal procedures who are at highest risk of postoperative gastroduodenal should receive antimicrobial prophylaxis^{3,29-32} (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 5.1.1 Includes resection with or without vagotomy for gastric or duodenal ulcers, resection for gastric carcinoma, revision required to repair strictures of the gastric outlet, PEG insertion, perforated ulcer procedures, pancreaticoduodenectomy, and bariatric surgical procedures
 - 5.1.2 Highest risk patients are those with increased gastric pH, gastroduodenal perforation, decreased gastric motility, gastric outlet obstruction, gastric bleeding, morbid obesity or cancer
 - 5.1.3 Antimicrobial prophylaxis may not be required when the intestinal tract lumen is not entered (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 5.2 Pathogens³
 - 5.2.1 Coliforms (*E. coli*, *Proteus* species, *Klebsiella* species), staphylococci, streptococci, enterococci, and *Bacteroides* species
- 5.3 Antimicrobial selection
 - 5.3.1 Adults
 - 5.3.1.1 First-line agents: cefazolin³ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 5.3.1.1.1 Ceftriaxone or gentamicin may be considered for ERCP.^{33,34} (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 5.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen³ (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 5.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin plus gentamicin, aztreonam, or ciprofloxacin³ (*UW Health Strong Recommendation, Moderate Quality of Evidence*) or moxifloxacin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 5.3.2 Pediatrics
 - 5.3.2.1 First-line agents: cefazolin³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 5.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 5.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin plus gentamicin, aztreonam, or ciprofloxacin³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*) (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 5.3.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients.

(UW Health Weak/conditional Recommendation, Very Low Quality of Evidence)

6 Biliary tract procedures

- 6.1 Patients undergoing open biliary tract and high-risk laparoscopic biliary tract procedures should receive antimicrobial prophylaxis^{3,35} (UW Health Strong Recommendation, Moderate Quality of Evidence)
 - 6.1.1 Antimicrobial prophylaxis is probably not needed for patients undergoing laparoscopic cholecystectomy for biliary colic and low- or moderate-risk cholecystitis.^{36,37} (UW Health Strong Recommendation, High Quality of Evidence)
 - 6.1.2 Includes cholecystectomy, exploration of common bile duct, and choledochenterostomy
 - 6.1.3 Risk factors in laparoscopic biliary tract procedures include emergency procedure, diabetes, anticipated duration longer than 120 minutes, risk of intraoperative gall bladder rupture, age over 70 years, open cholecystectomy, risk of laparoscopic conversion to open, episode of biliary colic within thirty days preceding the procedure, reintervention in less than a month for noninfectious complications of prior biliary operation, acute cholecystitis, anticipated bile spillage, jaundice, pregnancy, nonfunctioning gall bladder, and immunosuppression
 - 6.1.4 It may be reasonable to give antimicrobial prophylaxis to patients receiving low-risk laparoscopic biliary tract procedures as all risk factors cannot be determined preoperatively (UW Health Weak/conditional Recommendation, Very Low Quality of Evidence)
- 6.2 Pathogens³
 - 6.2.1 Most common pathogens: *E. coli*, *Klebsiella* species
 - 6.2.2 Less common pathogens: Gram-negative organisms, staphylococci, streptococci, enterococci
- 6.3 Antimicrobial selection
 - 6.3.1 Adults
 - 6.3.1.1 First-line agents: cefazolin, ceftiofex, cefotetan, ceftriaxone, ampicillin-sulbactam³ (UW Health Strong Recommendation, Moderate Quality of Evidence)
 - 6.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 6.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin plus gentamicin, aztreonam, or ciprofloxacin; or metronidazole plus gentamicin or ciprofloxacin³ (UW Health Strong Recommendation, Moderate Quality of Evidence)
 - 6.3.2 Pediatrics
 - 6.3.2.1 First-line agents: cefazolin, ceftiofex, cefotetan, ceftriaxone, ampicillin-sulbactam³ (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 6.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 6.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin plus gentamicin, aztreonam, or ciprofloxacin; or metronidazole plus gentamicin or ciprofloxacin³ (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 6.3.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients.

(UW Health Weak/conditional Recommendation, Very Low Quality of Evidence)

7 Appendectomy procedures

- 7.1 Patients undergoing appendectomy should receive antimicrobial prophylaxis^{3,38-41} (UW Health Strong Recommendation, High Quality of Evidence)
 - 7.1.1 Includes complicated and uncomplicated appendicitis
- 7.2 Pathogens³
 - 7.2.1 Most common pathogens: anaerobic and aerobic Gram-negative enteric organisms including *B. fragilis* and *E. coli*
 - 7.2.2 Less common pathogens: aerobic and anaerobic streptococci, *Staphylococcus* species, *Enterococcus* species. Infrequent: *P. aeruginosa*.
- 7.3 Antimicrobial selection
 - 7.3.1 Adults
 - 7.3.1.1 First-line agents: Cefoxitin or cefotetan or cefazolin and metronidazole³ (UW Health Strong Recommendation, High Quality of Evidence)
 - 7.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 7.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: clindamycin plus gentamicin or aztreonam or ciprofloxacin; or metronidazole plus gentamicin or ciprofloxacin³ (UW Health Strong Recommendation, Moderate Quality of Evidence)
 - 7.3.2 Pediatrics
 - 7.3.2.1 First-line agents: Cefoxitin or cefotetan or cefazolin and metronidazole^{3,39} (UW Health Strong Recommendation, High Quality of Evidence)
 - 7.3.2.1.1 Ceftriaxone 50 mg/kg/day daily, and metronidazole 30 mg/kg/day daily are reasonable for pediatric patients
 - 7.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 7.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: clindamycin plus gentamicin or aztreonam or ciprofloxacin; or metronidazole plus gentamicin or ciprofloxacin (ciprofloxacin or levofloxacin)^{3,39} (UW Health Strong Recommendation, Moderate Quality of Evidence)
 - 7.3.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients. (UW Health Weak/conditional Recommendation, Very Low Quality of Evidence)

8 Small intestine procedures

- 8.1 Patients undergoing small intestine procedures (or small bowel surgery) should receive antimicrobial prophylaxis³ (UW Health Strong Recommendation, Very Low Quality of Evidence)
 - 8.1.1 Includes incision or resection of the small intestine, enterectomy with or without intestinal anastomosis or enterostomy, intestinal bypass, and stricturoplasty
 - 8.1.2 Does not include small-to-large bowel anastomosis
- 8.2 Pathogens³
 - 8.2.1 Most common pathogens: aerobic Gram-negative enteric organisms (particularly *E. coli*)
 - 8.2.2 Additional pathogens: Streptococci, *Staphylococcus* species, *Enterococcus* species
- 8.3 Antimicrobial selection for patients without obstruction³
 - 8.3.1 Adults and pediatrics

- 8.3.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 8.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 8.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: metronidazole plus gentamicin or ciprofloxacin or aztreonam (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 8.4 Antimicrobial selection for patients with obstruction³
 - 8.4.1 Adults and pediatrics
 - 8.4.1.1 First-line agents: Cefoxitin or cefotetan or cefazolin and metronidazole (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 8.4.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 8.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: metronidazole plus gentamicin or ciprofloxacin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 8.4.1.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

9 Hernia repair

- 9.1 Patients undergoing hernia repair should receive antimicrobial prophylaxis^{3,42,43} (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 9.1.1 Includes hernioplasty and herniorrhaphy
- 9.2 Pathogens³
 - 9.2.1 Streptococci, *Staphylococcus* species, *Enterococcus* species, MRSA
- 9.3 Antimicrobial selection
 - 9.3.1 Adults³
 - 9.3.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 9.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 9.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 9.3.2 Pediatrics³
 - 9.3.2.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 9.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 9.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

10 Colorectal procedures

- 10.1 Patients undergoing colorectal procedures should receive antimicrobial prophylaxis^{3,44-46} (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 10.1.1 Prophylaxis should be parental (*UW Health Strong Recommendation, High Quality of Evidence*)

- 10.1.2 Prophylaxis should be oral if mechanical bowel preparation is also performed preoperatively (*UW Health Strong Recommendation, High Quality of Evidence*)
- 10.2 Pathogens³
- 10.2.1 Organisms of the bowel lumen: *B. fragilis*, other obligate anaerobes, *E.coli*
- 10.3 Antimicrobial selection³
- 10.3.1 Adults
- 10.3.1.1 First-line agents: Cefazolin and metronidazole, , , ampicillin-sulbactam, ceftriaxone and metronidazole (*UW Health Strong Recommendation, High Quality of Evidence*)
- 10.3.1.1.1 Cefazolin and metronidazole may provide better aerobic and anaerobic coverage compared to ceftiofloxacin, cefotetan, or ampicillin/sulbactam.⁴⁷⁻⁴⁹
- 10.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 10.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: clindamycin and gentamicin, aztreonam and levofloxacin, or metronidazole and gentamicin or levofloxacin; add vancomycin for Gram-positive coverage (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 10.3.1.4 Oral regimens: neomycin and metronidazole or erythromycin; given as three doses over approximately ten hours the afternoon and evening before the procedure and after mechanical bowel preparation (*UW Health Strong Recommendation, High Level of Evidence*)
- 10.3.1.4.1 Combination oral and intravenous prophylaxis may be considered (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 10.3.2 Pediatrics
- 10.3.2.1 First-line agents: Cefazolin and metronidazole, ceftiofloxacin, cefotetan, ampicillin-sulbactam, ceftriaxone and metronidazole, or ertapenem (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 10.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 10.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: clindamycin and gentamicin, aztreonam and levofloxacin, or metronidazole and gentamicin or levofloxacin; add vancomycin for Gram-positive coverage (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 10.3.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 10.3.2.4 Oral regimens: neomycin and metronidazole or erythromycin; given as three doses over approximately ten hours the afternoon and evening before the procedure and after mechanical bowel preparation (*UW Health Strong Recommendation, Very Low Level of Evidence*)
- 10.3.2.4.1 Combination oral and intravenous prophylaxis may be considered (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 10.3.3 Metronidazole plus aztreonam is not recommended as this combination provides no aerobic Gram-positive activity⁵⁰ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

11 Head and neck procedures

- 11.1 Patients undergoing clean surgical procedures of the head and neck should not receive antimicrobial prophylaxis^{3,51} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 11.1.1 Includes thyroidectomy and lymph node excisions
- 11.2 Patients undergoing clean surgical procedures of the head and neck with placement of prosthetic material should receive preoperative antimicrobial prophylaxis³ (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.3 Antimicrobial prophylaxis may be considered for patients undergoing clean-contaminated procedures of the head and neck.^{3,52} (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
- 11.3.1 Includes procedures involving incision through the oral or pharyngeal mucosa (e.g. parotidectomy, submandibular gland excision, rhinoplasty, complicated tumor debulking, mandibular fracture repair)
- 11.3.2 Patients undergoing tonsil or adenoid surgery or functional endoscopic sinus procedures should not receive antimicrobial prophylaxis⁵³⁻⁵⁵ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 11.4 Pathogens³
- 11.4.1 Normal flora of mouth and oropharynx: Streptococci species, oral anaerobes (*Bacteroides* species excepting *B. fragilis*), *Peptostreptococcus* species, *Prevotella* species, *Fusobacterium* species, *Veillonella* species, Enterobacteriaceae, staphylococci
- 11.4.2 Normal nasal flora: *Staphylococcus* species and *Streptococcus* species
- 11.5 Antimicrobial selection for patients throat or oral cavity procedures³
- 11.5.1 Adults and pediatrics
- 11.5.1.1 First-line agents: ampicillin-sulbactam (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.5.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.5.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: clindamycin or moxifloxacin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.5.1.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.6 Antimicrobial selection for patients undergoing procedures needing skin flora coverage only (not entering throat or oral cavity)³
- 11.6.1 Adults and pediatrics
- 11.6.1.1 First-line agents: Cefuroxime (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.6.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 11.6.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12 Neurosurgery procedures

- 12.1 Patients undergoing elective craniotomy and cerebrospinal fluid-shunting procedures should receive antimicrobial prophylaxis^{3,56-59} (*UW Health Strong Recommendation, High Quality of Evidence*)
- 12.2 Patients undergoing intrathecal pump placement should receive antimicrobial prophylaxis³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

12.3 Pathogens³

12.3.1 Most common: Gram-positive bacteria, *S. aureus*, coagulase-negative staphylococci

12.3.2 Less common: *P. acnes*, Gram-negative bacteria

12.4 Antimicrobial selection

12.4.1 Adults³

12.4.1.1 First-line agents: cefazolin (*UW Health Strong Recommendation, High Quality of Evidence*) or cefuroxime (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin with or without levofloxacin (*UW Health Strong Recommendation, Very Low Quality of Evidence*) or levofloxacin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.2 Pediatrics³

12.4.2.1 First-line agents: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*) or cefuroxime (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*) and levofloxacin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

12.4.3 It is reasonable to administer vancomycin to patients who have received 48 hours or more of antimicrobial therapy with *Staphylococcus* or *Streptococcus* species activity preoperatively²² (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

13 Cesarean delivery

13.1 Patients undergoing cesarean delivery should receive antimicrobial prophylaxis^{3,60,61} (*UW Health Strong Recommendation, High Quality of Evidence*)

13.2 Pathogens³

13.2.1 Polymicrobial and include aerobic streptococcus, Gram-negative aerobes (particularly *E. coli*), Gram-negative anaerobic bacilli (particularly *B. bivus*), anaerobic cocci (*Peptostreptococcus* species, *Peptococcus* species), *Ureaplasma urealyticum*, *Staphylococcus* species, enterococci

13.3 Antimicrobial selection^{3,62}

13.3.1 First-line agent: cefazolin (*UW Health Strong Recommendation, High Quality of Evidence*)

13.3.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

13.3.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: clindamycin and gentamicin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

14 Hysterectomy

- 14.1 Patients undergoing hysterectomy should receive antimicrobial prophylaxis^{3,63-65} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 14.1.1 Includes vaginal and abdominal (open and laparoscopic) hysterectomies
- 14.2 Pathogens³
 - 14.2.1 Usually polymicrobial: enterococci, aerobic Gram-negative bacilli, *Bacteroides* species
- 14.3 Antimicrobial selection
 - 14.3.1 Adults³
 - 14.3.1.1 First-line agents: cefazolin, cefoxitin, cefotetan, or ampicillin-sulbactam (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 14.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 14.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin and gentamicin or aztreonam or ciprofloxacin; or metronidazole and gentamicin or ciprofloxacin (*UW Health Strong Recommendation, Low Quality of Evidence*)

15 Gynecologic procedures

- 15.1 Patients with a history of pelvic infection or findings of dilated fallopian tubes undergoing hysterosalpingography (HSG) or chromotubation should receive antimicrobial prophylaxis^{66,67} (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 15.1.1 Patients with without a history of pelvic infection or dilated fallopian tubes who are undergoing HSG or chromotubation should not receive preoperative antimicrobial prophylaxis^{66,67} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 15.2 Patients undergoing surgical abortion should receive antimicrobial prophylaxis^{66,68} (*UW Health Strong Recommendation, High Quality of Evidence*)
- 15.3 Patients undergoing urogynecologic procedures, including those involving mesh should receive antimicrobial prophylaxis (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 15.4 Patients undergoing the following procedures should not receive should not receive antimicrobial prophylaxis: non-vaginal, non-intestinal laparoscopy or laparotomy including tubal sterilization; sonohysterography; hysteroscopic surgery; IUD insertion; or endometrial biopsy^{66,69-74} (*laparoscopy and laparotomy, sonohysterography, hysteroscopy, endometrial ablation: UW Health Strong Recommendation, Moderate Quality of Evidence; IUD insertion: UW Health Strong Recommendation, High Quality of Evidence; endometrial biopsy: UW Health Strong Recommendation, Low Quality of Evidence*)
- 15.5 Mechanical bowel preparation is not recommended in patients undergoing gynecologic procedures^{66,75} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 15.6 Pathogens⁶⁶
 - 15.6.1 Endogenous flora of skin or vagina including Gram-positive cocci, possibly fecal flora (anaerobic bacteria and Gram-negative aerobes) if incisions are near perineum or groin
- 15.7 Antimicrobial selection for HSG or chromotubation in patients with a history of pelvic infection or dilated fallopian tubes⁶⁶ (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 15.7.1 Patients with a history of pelvic infection: preoperative doxycycline
 - 15.7.2 Patients with dilated fallopian tubes: doxycycline 100 mg PO BID for 5 days postoperatively
- 15.8 Antimicrobial selection in patients undergoing surgical abortion⁶⁶ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

- 15.8.1 Doxycycline (100 mg PO one hour before procedure and 200 mg PO after surgery) or metronidazole 500 mg PO BID for 5 days
- 15.9 Antimicrobial selection in patients undergoing urogynecologic procedures⁶⁶ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 15.9.1 First-line agents: cefoxitin, ampicillin-sulbactam, or ceftazidime
 - 15.9.2 MRSA agents for documented MRSA or history of MRSA: vancomycin
 - 15.9.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: metronidazole and gentamicin or fluoroquinolone clindamycin and gentamicin or fluoroquinolone or aztreonam
- 15.10 Antimicrobial selection in patients undergoing vaginal or urethral sling procedures⁷⁶ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 15.10.1 First line agents: Cefoxitin or ceftazidime plus metronidazole
 - 15.10.2 MRSA agents for documented MRSA or history of MRSA: vancomycin
 - 15.10.3 Agents for patients with IgE-mediated reaction or severe non-IgE mediated reaction to β -lactam: gentamicin or ciprofloxacin plus metronidazole

16 Ophthalmic procedures

- 16.1 Antimicrobial prophylaxis may be reasonable in patients undergoing ophthalmic procedures given the consequences of postoperative bacterial endophthalmitis despite the lack of well-controlled trials evaluating preoperative antimicrobial prophylaxis^{3,77-80}
 - 16.1.1 Includes cataract extractions, vitrectomies, keratoplasties, intraocular lens implantation, glaucoma procedures, strabismus procedures, retinal detachment repair, laser in situ keratomileusis, and laser-assisted subepithelial keratectomy
- 16.2 Pathogens³
 - 16.2.1 Most common: *Staphylococcus* species, primarily *S. epidermidis*
 - 16.2.2 Less common: *S. aureus*, *Streptococcus* species, *Enterococcus* species, *P. acnes*, *Corynebacterium* species, *Serratia* species, *Klebsiella* species, *P. mirabilis*, *P. aeruginosa*
- 16.3 Antimicrobial selection³
 - 16.3.1 Adults and pediatrics
 - 16.3.1.1 First-line agents
 - 16.3.1.1.1 Topical neomycin-polymixin B-gramicidin or fourth-generation topical fluoroquinolone (gatifloxacin or moxifloxacin) given as one drop every 5-15 minutes for five doses⁸¹⁻⁸⁴ (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 16.3.1.1.2 Optional at end of procedure ceftazidime 100 mg by subconjunctival injection or intracameral ceftazidime 1-2.5 mg or intracameral cefuroxime 1 mg^{77,78,85-90} (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 16.3.1.2 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam:
 - 16.3.1.2.1 Topical neomycin-polymixin B-gramicidin or fourth-generation topical fluoroquinolone (gatifloxacin or moxifloxacin) given as one drop every 5-15 minutes for five doses⁸¹⁻⁸⁴ (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 16.3.1.2.2 Topical vancomycin (20 mcg/mL) given as irrigating fluid^{91,92} (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

17 Orthopedic procedures

- 17.1 Patients undergoing clean orthopedic without instrumentation or implantation of foreign materials should not receive antimicrobial prophylaxis^{3,93-97} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

- 17.1.1 Includes knee, hand, and foot procedures, arthroscopy, and other procedures without instrumentation or implantation of foreign materials
- 17.2 Patients undergoing spinal procedures (with or without instrumentation) should receive antimicrobial prophylaxis^{3,98-101} (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 17.2.1 Includes fusions, laminectomies, minimally invasive disk procedures
- 17.3 Patients undergoing hip fracture repair should receive antimicrobial prophylaxis^{3,102,103} (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 17.3.1 Includes internal fixation procedures
- 17.4 Patients undergoing total joint replacement should receive antimicrobial prophylaxis^{3,104} (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 17.4.1 Includes total hip, elbow, knee, ankle, or shoulder replacement
- 17.5 Preoperative mupirocin decolonization protocols decrease overall SSI and should be given to MRSA- or MSSA-colonized patients^{3,105-107} (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 17.6 Pathogens³
 - 17.6.1 Skin flora including *S. aureus*, Gram-negative bacilli, coagulase-negative staphylococci, β -hemolytic streptococci
- 17.7 Antimicrobial selection for patients undergoing spinal procedures (with or without instrumentation)
 - 17.7.1 Adults³
 - 17.7.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, High Quality of Evidence*) or cefuroxime (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen¹⁰⁰ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 17.7.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin¹⁰⁰ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 17.7.2 Pediatrics^{3,108,109}
 - 17.7.2.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*) or cefuroxime (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.3 Pediatric spinal fusions: upper thoracic and cervical
 - 17.7.3.1 First-line agent: cefazolin or cefuroxime (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.3.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.3.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.4 Pediatric spinal fusions: lower thoracic and lumbar
 - 17.7.4.1 First-line agent: cefepime and vancomycin for 24 hours, followed by cefuroxime until drains removed (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.7.4.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

- 17.7.4.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin with gentamicin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 17.7.5 It is reasonable to administer vancomycin to patients who are undergoing repeat spinal fusions
- 17.7.6 It is reasonable to administer vancomycin to patients who have received 48 hours or more of antimicrobial therapy with *Staphylococcus* or *Streptococcus* species activity preoperatively²² (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 17.8 Antibiotic selection for patients undergoing hip fracture repair
 - 17.8.1 Adults³
 - 17.8.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, High Quality of Evidence*) or cefuroxime (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.8.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 17.8.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 17.8.2 Pediatrics³
 - 17.8.2.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*) or cefuroxime (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.8.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.8.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 17.9 Antibiotic selection for patients undergoing total joint replacement
 - 17.9.1 Adults³
 - 17.9.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Low Quality of Evidence*) or cefuroxime¹¹⁰ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.9.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen¹¹¹ (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 17.9.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 17.9.2 Pediatrics³
 - 17.9.2.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*) or cefuroxime (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 17.9.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin or clindamycin to the regimen (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 17.9.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

18 Urologic procedures

- 18.1 Patients undergoing clean urologic procedures without risk factors should receive no antimicrobial prophylaxis³ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 18.2 Patients undergoing lower urinary tract instrumentation with risk factors for infection should receive antimicrobial prophylaxis^{3,112-114} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 18.2.1 Urologic-specific preoperative risk factors: anatomic anomalies of the urinary tract, urinary obstruction, urinary stone, preoperative UTI, and indwelling or externalized catheters
- 18.2.2 Urologic operation-specific risk factors: length of post-operative catheterization, mode of irrigation (open versus closed), and postoperative pyuria
- 18.3 Patients undergoing clean urologic procedures without entry into the urinary tract should receive antimicrobial prophylaxis³ (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.4 Patients undergoing clean urologic procedures with entry into the urinary tract should receive antimicrobial prophylaxis³ (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.5 Patients undergoing clean-contaminated procedures of the urinary tract should receive antimicrobial prophylaxis as recommended for elective colorectal surgery^{3,115-121} (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 18.6 Pathogens³
- 18.6.1 Most common: *E. coli*
- 18.6.2 Less common: other Gram-negative bacilli, enterococci, *S. aureus*, coagulase-negative *Staphylococcus* species, Group A *Streptococcus* species
- 18.7 Antimicrobial selection for patients undergoing lower urinary tract instrumentation with risk factors for infection without breach or incision of skin³
- 18.7.1 Adults
- 18.7.1.1 First-line agent: ciprofloxacin (oral or IV), gentamicin, cefazolin, or trimethoprim-sulfamethoxazole with or without ampicillin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.7.1.2 MRSA agents for documented MRSA or history of MRSA in the urine: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.7.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin with or without ciprofloxacin, gentamicin, or trimethoprim-sulfamethoxazole (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.7.2 Pediatrics
- 18.7.2.1 First-line agent: gentamicin, cefazolin, or trimethoprim-sulfamethoxazole with or without ampicillin or ciprofloxacin (oral or IV). (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.7.2.1.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.7.2.2 MRSA agents for documented MRSA or history of MRSA in the urine: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.7.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin with or without ciprofloxacin, gentamicin, or trimethoprim-sulfamethoxazole (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.8 Antimicrobial selection for patients undergoing clean urologic procedures without entry into the urinary tract³

- 18.8.1 Adults
 - 18.8.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 18.8.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 18.8.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 18.8.2 Pediatrics
 - 18.8.2.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 18.8.2.2 MRSA agents for documented MRSA or history of MRSA: vancomycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 18.8.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.9 Antimicrobial selection for patients undergoing clean urologic procedures **with** entry into the urinary tract and breach of the skin³
 - 18.9.1 Adults
 - 18.9.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 18.9.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 18.9.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: ciprofloxacin or gentamicin with or without clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 18.9.2 Pediatrics
 - 18.9.2.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 18.9.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 18.9.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: gentamicin or ciprofloxacin with or without clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 18.9.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 18.10 Antimicrobial selection for patients undergoing clean-contaminated urologic procedures **with** entry into the urinary tract and breach of the skin³
 - 18.10.1 Adults
 - 18.10.1.1 First-line agent: cefazolin and metronidazole or cefoxitin (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 18.10.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 18.10.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: ciprofloxacin or gentamicin with

metronidazole or clindamycin (*UW Health Strong Recommendation, Low Quality of Evidence*)

18.10.2 Pediatrics

18.10.2.1 First-line agent: cefazolin and metronidazole or ceftiofur (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

18.10.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

18.10.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: gentamicin or ciprofloxacin with metronidazole or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

18.10.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative fluoroquinolone dose is quite small, fluoroquinolones are not the first choice in pediatric patients. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

18.11 In patients with a history of urinary tract infections caused by *Enterococcus* species, it may be reasonable to add to add ampicillin to the prophylactic regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

18.12 Clindamycin poorly penetrates the urinary tract and use in urologic procedures is to cover for skin flora

19 Vascular procedures

19.1 Patients undergoing brachiocephalic procedures without implantation of prosthetic graft material should receive no antimicrobial prophylaxis^{3,122} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

19.1.1 Includes carotid endarterectomy, brachial artery repair

19.2 Patients undergoing vascular procedures that involve implantation of prosthetic material and procedures with a higher risk of infection should receive antimicrobial prophylaxis^{3,123-126} (*UW Health Strong Recommendation, Low Quality of Evidence*)

19.2.1 Includes aneurysm repair, thromboendarterectomy, vein bypass

19.3 Pathogens³

19.3.1 *S. aureus*, *S. epidermidis*, enteric Gram-negative bacilli

19.4 Antimicrobial selection³

19.4.1 Adults

19.4.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Low Quality of Evidence*)

19.4.1.2 MRSA agents for documented MRSA or history of MRSA or risk for MRSE with implanted prosthetic material: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Level of Evidence*)

19.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

19.4.2 Pediatrics

19.4.2.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

19.4.2.2 MRSA agents for documented MRSA or history of MRSA or risk for MRSE with implanted prosthetic material: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

19.4.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Low Quality of Evidence*)

19.4.3 Rifampin may be considered for soaking vascular stents for placement in dirty, contaminated tissue.¹²⁷ If rifampin soak is utilized, use should be limited to one vial. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

20 Heart transplantation

20.1 Patients receiving heart transplantation should receive antimicrobial prophylaxis^{3,128-130}

20.2 Pathogens³

20.2.1 Most common: *Staphylococcus* species

20.2.2 Less common: *Enterococcus faecalis*, coagulase-negative staphylococci, *Enterococcus* species, *Enterobacteriaceae* species, *P. aeruginosa*, *S. maltophilia*

20.3 Antimicrobial selection³

20.3.1 Adults

20.3.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

20.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

20.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*) and ciprofloxacin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

20.3.2 Pediatrics

20.3.2.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

20.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

20.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

21 Lung and heart-lung transplantation

21.1 Patients receiving lung or heart-lung transplantation should receive antimicrobial prophylaxis^{3,128,129,131} (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

21.1.1 Antimicrobial prophylaxis regimens should be adjusted to include coverage for potential bacterial or fungal pathogens isolated by pre-operative culture from either the recipient's airway or donor lung¹³²⁻¹³⁴

21.1.2 End-stage cystic fibrosis patients should receive antimicrobials based on pre-transplant culture and sensitivity

21.2 Pathogens³

21.2.1 *P. aeruginosa*, *Candida* species, *S. aureus*, enterococci, coagulase-negative staphylococci, *B. cepacia*, *E. coli*, *Klebsiella* species

21.3 Antimicrobial selection

21.3.1 Adults

21.3.1.1 Heart first-line agent: cefuroxime and vancomycin (*UW Health Weak Recommendation, Very Low Quality of Evidence*)

21.3.1.2 Lung first-line agent: ceftriaxone (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

21.3.1.3 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

21.3.1.4 Lung transplant agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: moxifloxacin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

21.3.2 Pediatrics

21.3.2.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

- 21.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 21.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 21.3.3 It may be reasonable to extend the duration of antimicrobial prophylaxis beyond 48 hours (*UW Health Weak/conditional Recommendation, Very Low Level of Evidence*)

22 Liver transplantation

- 22.1 Patients receiving liver transplant should receive antimicrobial prophylaxis^{3,135-137} (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 22.1.1 Routine selective bowel decontamination is not recommended¹³⁸ (*UW Health Strong Recommendation, High Quality of Evidence*)
 - 22.1.2 It is reasonable to provide postoperative antifungal prophylaxis to patient according to the [UWHealth Antifungal Prophylaxis in Liver Transplant Recipients Clinical Practice Guideline](#).¹³⁹
- 22.2 Pathogens³
 - 22.2.1 Aerobic Gram-negative bacilli (*E. coli*, *Klebsiella* species, *Enterobacter* species, *A. baumannii*, *Citrobacter* species), *S. aureus*, coagulase-negative staphylococci, *Candida* species
- 22.3 Antimicrobial selection³
 - 22.3.1 Adults¹⁴⁰⁻¹⁴²
 - 22.3.1.1 First-line agent: Piperacillin-tazobactam or ceftriaxone and ampicillin (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 22.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
 - 22.3.1.3 Documented history of vancomycin-resistant *Enterococcus* (VRE): ceftriaxone and daptomycin (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
 - 22.3.1.4 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam and **no** history of VRE: gentamicin or aztreonam and vancomycin (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
 - 22.3.1.5 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam and VRE history: gentamicin or aztreonam and daptomycin. (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 22.3.1.6 High risk for *Candida* infection: fluconazole (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 22.3.2 Pediatrics^{143,144}
 - 22.3.2.1 First-line agent: Piperacillin-tazobactam or cefotaxime and ampicillin (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 22.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 22.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin: vancomycin or clindamycin and gentamicin or aztreonam or ciprofloxacin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 22.3.2.3.1 While the risk of tendon rupture or tendonitis secondary to single-dose preoperative ciprofloxacin is quite small, ciprofloxacin is not the first choice in pediatric patients (*UW*

Health Weak/conditional Recommendation, Very Low Quality of Evidence)

23 Kidney transplantation

23.1 Patients receiving kidney transplant should receive antimicrobial prophylaxis^{3,145} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

23.2 Pathogens³

23.2.1 *Staphylococcus* species, *Enterococcus* species, *E. coli*, *Enterobacter* species, *Klebsiella* species, *P. aeruginosa*, *Candida* species

23.3 Antimicrobial selection

23.3.1 Adults^{3,146-149}

23.3.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

23.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

23.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin and gentamicin or aztreonam or ciprofloxacin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

23.3.2 Pediatrics

23.3.2.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

23.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

23.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin and gentamicin or aztreonam or ciprofloxacin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

23.3.2.4 High risk for *Candida* infection: fluconazole (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

24 Pancreas transplantation

24.1 Patients receiving pancreas transplant (alone or in combination with kidney) should receive antimicrobial prophylaxis.³ (*UW Health Strong Recommendation, Low Quality of Evidence*)

24.2 Selective bowel decontamination is recommended prior to pancreas transplant (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

24.3 It is reasonable to provide antifungal prophylaxis to patient perioperatively at time of pancreas transplant due to enteric anastomosis (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

24.4 Pathogens³

24.4.1 *Staphylococcus* species, *Enterococcus* species, *E. coli*, *Enterobacter* species, *Klebsiella* species, *P. aeruginosa*, *Candida* species

24.5 Antimicrobial Selection

24.5.1 Adults^{3,129,139,150,151}

24.5.1.1 First-line agent: Ceftriaxone, ampicillin, and fluconazole (*UW Health Strong Recommendation, Low Quality of Evidence*)

24.5.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)

24.5.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: gentamicin, vancomycin, and fluconazole (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)

25 Plastic surgery

- 25.1 Antimicrobial prophylaxis is not recommended for patients undergoing clean procedures without additional postoperative infection risk factors¹⁵²⁻¹⁵⁹ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 25.2 It may be reasonable to provide antimicrobial prophylaxis to patients undergoing clean procedures with risk factors (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 25.2.1 Risk factors include: age extremes, nutritional status, obesity, diabetes, tobacco use, coexistent remote body-site infection, altered immune response, corticosteroid therapy, recent surgical procedure, length of preoperative hospitalization, colonization
- 25.3 Patients undergoing clean-contaminated or breast cancer procedures should receive antimicrobial prophylaxis¹⁶⁰⁻¹⁶² (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 25.4 Pathogens³
- 25.4.1 Most common: *S. aureus*, staphylococci, streptococci
- 25.4.2 Procedures involving macerated and moist environments, below the waist, or in diabetic patients have higher rates of Gram-negative organisms: *P. aeruginosa*, *S. marcescens*, *E. coli*, *Klebsiella* species, *P. mirabilis*
- 25.5 Antimicrobial selection undergoing clean procedures with risk factors, clean-contaminated procedures, or breast cancer procedures³
- 25.5.1 Adults
- 25.5.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 25.5.1.1.1 For mastectomy or breast tissue expander procedure add vancomycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 25.5.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 25.5.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 25.5.2 Pediatrics
- 25.5.2.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 25.5.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 25.5.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

26 Open fractures

- 26.1 Patients with open fractures should receive preoperative antibiotics^{163,164} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 26.2 Pathogens^{163,164}
- 26.2.1 All open fractures: Gram-positive organisms
- 26.2.2 Type III fractures: Gram-positive and Gram-negative organisms
- 26.2.3 Fecal or farm-related injuries: clostridial species
- 26.3 Antimicrobial selection^{163,164}
- 26.3.1 Adults and pediatrics
- 26.3.1.1 First-line agents:
- 26.3.1.1.1 Type I and II fractures: cefazolin (*UW Health Strong Recommendation, Low Quality of Evidence*)

- 26.3.1.1.2 Type III fractures: ceftriaxone with or without gentamicin (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 26.3.1.1.3 Fecal or farm-related injuries: Add metronidazole for *Clostridium* species and other anaerobic coverage (*UW Health Weak/conditional Recommendation, Very Low Level of Evidence*)
- 26.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 26.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

27 Penetrating abdominal wounds

- 27.1 Patients with penetrating abdominal trauma should receive preoperative antibiotics^{165,166} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 27.2 Pathogens^{165,166}
 - 27.2.1 Aerobes and anaerobes
- 27.3 Antimicrobial selection¹⁶⁵⁻¹⁷⁰
 - 27.3.1 First-line agents: cefoxitin (*UW Health Strong Recommendation, Moderate Level of Evidence*) or cefuroxime and metronidazole (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 27.3.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 27.3.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin and ciprofloxacin and metronidazole (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 27.3.4 Aminoglycosides should not be utilized due to altered pharmacokinetics including subtherapeutic aminoglycoside levels in patients with increased volume of distribution secondary to aggressive fluid resuscitation^{171,172} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
 - 27.3.5 In patients with hemorrhagic shock, it may be reasonable to increase antimicrobial dose two- to three-fold and to repeat dosing after transfusion of every ten units of blood^{165,166,172} (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)

Interventional Radiology Prophylaxis

28 Vascular interventions

- 28.1 Antimicrobial prophylaxis is not recommended for patients undergoing diagnostic angiography, routine angioplasty, thrombolysis, arterial closure device placement, or arterial stent placement¹⁷³⁻¹⁷⁵ (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 28.2 Antimicrobial prophylaxis may be considered for patients at high risk of infection undergoing arterial stent placement¹⁷⁵⁻¹⁷⁷ (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
- 28.2.1 High risk includes: cases or repeat intervention within seven days, prolonged indwelling arterial sheath, prolonged duration of procedure
- 28.3 Pathogens¹⁷³
- 28.3.1 *S. aureus*, *S. epidermidis*
- 28.4 Antimicrobial selection for patients at high risk of infection undergoing arterial stent placement¹⁷³
- 28.4.1 Adults
- 28.4.1.1 First-line agent: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 28.4.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 28.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 28.4.2 Pediatrics
- 28.4.2.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 28.4.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 28.4.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

29 Endograft placement

- 29.1 Antimicrobial prophylaxis is probably recommended in patients undergoing endograft placement^{173,178,179} (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 29.1.1 Includes aortic and peripheral placement
- 29.2 Pathogens¹⁷³
- 29.2.1 *S. aureus*, *S. epidermidis*
- 29.3 Antimicrobial selection¹⁷³
- 29.3.1 Adults and pediatrics
- 29.3.1.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 29.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 29.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

30 Superficial venous insufficiency treatment

- 30.1 Antimicrobial prophylaxis is not recommended for patients undergoing lower-extremity superficial venous insufficiency treatment (includes endovascular thermal ablation,

- sclerotherapy, and ambulatory phlebectomy).^{173,180,181} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 30.2 Antimicrobial prophylaxis is recommended for patients undergoing sclerotherapy of upper extremity.^{182,183} (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
- 30.3 Pathogens: *S. aureus*, *S. epidermidis*
- 30.4 Antimicrobial selection (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 30.4.1 First-line agent: cefazolin
 - 30.4.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen or use clindamycin as single agent
 - 30.4.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin

31 Inferior vena cava (IVC) filter placement

- 31.1 Antimicrobial prophylaxis is not recommended for patients undergoing IVC filter placement.^{173,184} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

32 Central venous catheter placement

- 32.1 Antimicrobial prophylaxis is not recommended for patients undergoing central venous catheter placement including PICC line, tunneled and cuffed lines, non-tunneled and temporary lines, or hemodialysis or pheresis lines.^{173,176} (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 32.2 Antimicrobial prophylaxis may be considered in patients undergoing venous catheter placement at high risk of infection including port placement.^{173,185} (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)
 - 32.2.1 Includes immunocompromised patients who require catheter placement before chemotherapy or patients with a history of catheter infection
- 32.3 Pathogens¹⁷³
 - 32.3.1 *S. aureus*, *S. epidermidis*
- 32.4 Antimicrobial selection for patients undergoing central venous catheter placement at high risk of infection including port placement.¹⁷³
 - 32.4.1 Adults and pediatrics
 - 32.4.1.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 32.4.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 32.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

33 Embolization and chemoembolization

- 33.1 Patients undergoing tumor and/or solid organ embolization with the intent to create an infarct or there is a high likelihood of infarct should receive antimicrobial prophylaxis.^{173,186,187} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)
- 33.2 It is reasonable to provide antimicrobial prophylaxis to patients undergoing chemoembolization.^{173,188,189} (*UW Health Strong Recommendation, Very Low Level of Evidence*)
- 33.3 Pathogens¹⁷³
 - 33.3.1 *S. aureus*, *Streptococcus* species, *Corynebacterium* species, enteric flora
- 33.4 Antimicrobial selection¹⁷³
 - 33.4.1 Adults and pediatrics
 - 33.4.1.1 First-line agent choice (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 33.4.1.1.1 Hepatic artery embolization (HAE), bland embolization, portal vein embolization (PVE): ampicillin/sulbactam or cefazolin and

metronidazole or cefoxitin or ampicillin and gentamicin or ceftriaxone

33.4.1.1.2 Renal or splenic embolization: ceftriaxone

33.4.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

33.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin with gentamicin plus metronidazole (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

33.4.2 It may be reasonable to administer extended oral antibiotic prophylaxis based on tissue necrosis (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

34 Uterine artery embolization

34.1 It may be reasonable to provide antimicrobial prophylaxis to patients undergoing uterine artery embolization^{173,190-192} (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)

34.2 Pathogens¹⁷³

34.2.1 *S. aureus*, *S. epidermidis*, *Streptococcus* species, *E. coli*

34.3 Antimicrobial selection¹⁷³

34.3.1 Adults and pediatrics

34.3.1.1 First-line agent: cefazolin, cefoxitin, clindamycin and gentamicin, or ampicillin-sulbactam (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

34.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen or clindamycin and gentamicin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

34.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin and gentamicin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

35 Transjugular Intrahepatic Portosystemic Shunt (TIPS) creation

35.1 It is reasonable to provide antimicrobial prophylaxis to patients undergoing TIPS creation^{173,193,194} (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

35.2 Pathogens¹⁷³

35.2.1 *S. aureus*, *S. epidermidis*, *Corynebacterium* species, biliary pathogens, enteric Gram-negative rods, anaerobes, *Enterococcus* species

35.3 Antimicrobial selection¹⁷³

35.3.1 Adults

35.3.1.1 First-line agent: ceftriaxone, ampicillin-sulbactam (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

35.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

35.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin with gentamicin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

36 Fluoroscopically guided gastrostomy and gastrojejunostomy tube placement

36.1 No antimicrobial prophylaxis is recommended for patients undergoing gastrostomy or gastrojejunostomy placement.^{33,34,173,195,196} (*UW Health Strong Recommendation, Low Quality of Evidence*)

36.2 It is reasonable to provide antimicrobial prophylaxis to patients undergoing decompressive gastrostomy tube placement or percutaneous endoscopic gastrostomy (PEG) tube

placement by “pull” technique.^{33,34,173,197} (*UW Health Strong Recommendation, Moderate Level of Evidence*)

36.3 Pathogens¹⁷³

36.3.1 *S. epidermidis*, *S. aureus*, *Corynebacterium* species

36.4 Antimicrobial selection¹⁷³

36.4.1 Adults and pediatrics

36.4.1.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)

36.4.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

36.4.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin and gentamicin or ciprofloxacin; moxifloxacin. (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

37 Liver and biliary interventions

37.1 Patients undergoing liver and biliary interventions should receive antimicrobial prophylaxis^{173,176,198} (*UW Health Strong Recommendation, Moderate Quality of Evidence*)

37.2 Pathogens¹⁷³

37.2.1 More common: *Enterococcus* species, *Candida* species, Gram-negative aerobic bacilli, *S. viridans*, *E. coli*, *Clostridium* species

37.2.2 Advanced biliary disease including hepatolithiasis: *Klebsiella* species, *Pseudomonas* species, *Bacteroides* species

37.3 Antimicrobial selection

37.3.1 It is reasonable to select antimicrobial based on culture information, if known (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

37.3.2 Adults^{173,176,198}

37.3.2.1 First-line agent: ceftriaxone, ampicillin-sulbactam, cefoxitin, ampicillin, gentamicin, or ciprofloxacin (*UW Health Strong Recommendation, Low Quality of Evidence*)

37.3.2.1.1 Ciprofloxacin, gentamicin, or ceftriaxone may be considered for ERCP.^{33,34} (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

37.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

37.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin with gentamicin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

37.3.3 Pediatrics¹⁷³

37.3.3.1 First-line agent: ceftriaxone, ampicillin-sulbactam, cefoxitin, ampicillin and gentamicin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

37.3.3.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

37.3.3.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin with gentamicin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

38 Genitourinary procedures

- 38.1 Antimicrobial prophylaxis is not indicated for patients undergoing routine tube change who are neither obstructed nor infected^{173,199} (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 38.2 It is reasonable to provide antimicrobial prophylaxis to patients undergoing genitourinary procedures^{173,200} (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 38.2.1 Includes percutaneous nephrostomy tube placement, tube exchange, ureteral stents
- 38.3 Pathogens¹⁹⁹
 - 38.3.1 *E. coli*, *Proteus* species, *Klebsiella* species, *Enterococcus* species
- 38.4 Antimicrobial selection¹⁷³
 - 38.4.1 It is reasonable to select antimicrobial based on culture information, if known (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 38.4.2 Adults and pediatrics
 - 38.4.2.1 First-line agent: cefazolin, ceftriaxone, ampicillin-sulbactam, ampicillin and gentamicin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 38.4.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
 - 38.4.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin and gentamicin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

39 Tumor Ablation

- 39.1 Antimicrobial prophylaxis may be reasonable in patients undergoing percutaneous tumor ablation^{173,201} (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 39.2 Pathogens¹⁷³
 - 39.2.1 *S. aureus*, *S. epidermidis*, *Streptococcus* species, *E. coli*
 - 39.2.2 Previous bilioenteric anastomosis: *E. coli*, *Proteus* species, *Klebsiella* species, *Enterococcus* species
- 39.3 Antimicrobial selection¹⁷³
 - 39.3.1 Adults and pediatrics
 - 39.3.1.1 First-line agents (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 39.3.1.1.1 Liver: ampicillin-sulbactam
 - 39.3.1.1.2 Bone: cefazolin
 - 39.3.1.1.3 Renal: ceftriaxone
 - 39.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Strong Recommendation, Low Quality of Evidence*)
 - 39.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
 - 39.3.2 It may be reasonable to administer extended oral antibiotic prophylaxis based on tissue necrosis (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

40 Percutaneous abscess drainage

- 40.1 Patients undergoing percutaneous abscess drainage should receive antimicrobial prophylaxis^{173,199} (*UW Health Strong Recommendation, Low Level of Evidence*)
 - 40.1.1 Patients undergoing these procedures typically are receiving therapeutic antimicrobial treatment prior to procedure
- 40.2 Pathogens¹⁷³
 - 40.2.1 Skin flora: *S. epidermidis*, *S. aureus*, *Corynebacterium* species
 - 40.2.2 Intracavitary: Gram-negative bacteria, *Enterococcus* species, *E. coli*, *B. fragilis*, other anaerobes

- 40.3 Antimicrobial selection¹⁷³
- 40.3.1 Adults and pediatrics
- 40.3.1.1 First-line agents: cefoxitin, ampicillin-sulbactam, ceftriaxone (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 40.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 40.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 40.3.1.3.1 Gram-positive coverage: vancomycin or clindamycin
- 40.3.1.3.2 Gram-negative coverage: aminoglycoside

41 Percutaneous biopsy

- 41.1 Patients undergoing nontransrectal percutaneous biopsy should not receive antimicrobial prophylaxis^{173,199} (*UW Health Strong Recommendation, Low Quality of Evidence*)
- 41.2 Patients undergoing transrectal percutaneous biopsy should receive antimicrobial prophylaxis^{173,202,203} (*UW Health Strong Recommendation, High Quality of Evidence*)
- 41.3 Pathogens¹⁷³
- 41.3.1 Gram-negative bacteria, *Enterococcus* species, *E. coli*, *B. fragilis*, other anaerobes
- 41.4 Antimicrobial selection^{173,199,202}
- 41.4.1 Adults
- 41.4.1.1 First-line agents: 80 mg gentamicin IV/IM AND ciprofloxacin PO twice daily for 5 days or ciprofloxacin PO twice daily for 4 days starting the day before the biopsy (*UW Health Strong Recommendation, Low Quality of Evidence*)

42 Percutaneous vertebroplasty

- 42.1 It is reasonable to provide antimicrobial prophylaxis to patients undergoing percutaneous vertebroplasty^{173,201,204} (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 42.2 Pathogens¹⁷³
- 42.2.1 Skin flora: *S. epidermidis*, *S. aureus*, *Corynebacterium* species
- 42.3 Antimicrobial selection^{173,201}
- 42.3.1 Adults
- 42.3.1.1 First-line agents: cefazolin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 42.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 42.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Strong Recommendation, Very Low Quality of Evidence*)
- 42.3.2 Pediatrics
- 42.3.2.1 First-line agents: cefazolin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 42.3.2.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)
- 42.3.2.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

43 Pulmonary Arteriovenous Malformations

- 43.1 It is reasonable to provide antimicrobial prophylaxis to patients undergoing pulmonary arteriovenous malformation embolization.²⁰⁵ (*UW Health Strong Recommendation, Very Low Quality of Evidence*)

43.2 Pathogens

43.2.1 *S. aureus, S. epidermidis*

43.3 Antimicrobial selection

43.3.1 Adults and pediatrics

43.3.1.1 First-line agent: cefazolin (*UW Health Weak/conditional Recommendation, Low Quality of Evidence*)

43.3.1.2 MRSA agents for documented MRSA or history of MRSA: add vancomycin to the regimen (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

43.3.1.3 Agents for patients with IgE-mediated reaction or severe non-IgE-mediated reaction to β -lactam: vancomycin or clindamycin (*UW Health Weak/conditional Recommendation, Very Low Quality of Evidence*)

UW Health Implementation

Potential Benefits and Harms of Implementation

- Identification and standardization of appropriate antimicrobial prophylaxis for surgeries and procedures.
- Administration of antimicrobials with potential side effects with specific antimicrobials.
- No antimicrobial administration with potential infection associated with a surgery or procedure.

Pertinent UWHealth Policies and Procedures

None identified.

Patient Resources

None identified.

Guideline Metrics

- Proportion of patients receiving appropriate antimicrobials with correct time frame as defined by SCIP measures
- Proportion of surgical site infection

Implementation Plan/Clinical Tools

1. Guideline will be posted on U-Connect in a dedicated location for Clinical Practice Guidelines.
2. Release of the guideline will be advertised in the Physician/APP Briefing newsletter.
3. Content and hyperlinks within clinical tools, documents, or Health Link related to the guideline recommendations will be reviewed for consistency and modified as appropriate.

Order Set

All preoperative order sets reference this guideline.

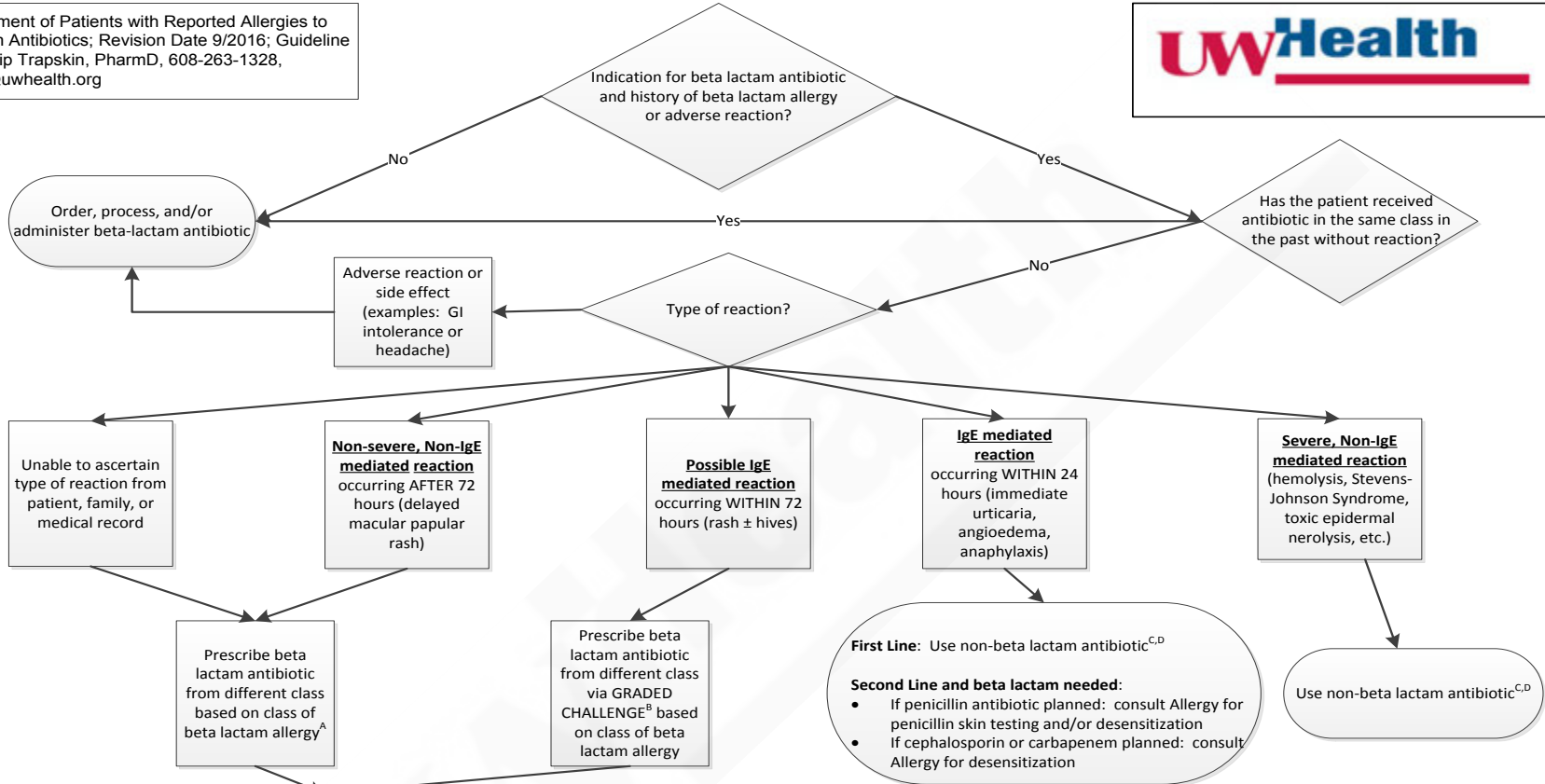
Disclaimer

Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician's judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

Appendix A. Antimicrobial selection in patients with reported β-lactam allergy or intolerance (from [Treatment of Patients with Reported Allergies to Beta-Lactam Antibiotics – Adult – Inpatient – Clinical Practice Guideline](#))



From: Treatment of Patients with Reported Allergies to Beta-Lactam Antibiotics; Revision Date 9/2016; Guideline Contact Philip Trapskin, PharmD, 608-263-1328, PTrapskin@uwhealth.org



Penicillin Allergy
 - First Line: Cephalosporin
 - Second Line: Carbapenem

Cephalosporin Allergy
 - First Line: Penicillin
 - Second Line: Carbapenem

Carbapenem Allergy
 - First Line: Penicillin or Cephalosporin

Aztreonam Allergy
 - First Line: Penicillin or Cephalosporin
 - Second Line: Carbapenem

** Use beta lactam with different side chain (See Table 1)
 ** If use of beta lactam from same class is desired, consult Allergy

Footnotes

^A May give via graded challenge if reaction history was recent

^B Graded challenge: use oral challenge if oral therapy is desired; use IV challenge if IV therapy is desired

- Graded challenges are intended for patients with low probability of an immediate allergic reaction. Patients must be able to report symptoms and use a call light
- Patients do not need to increase their level of care during a graded challenge
- Use Acudose cabinet and Crash Cart stock, if needed, for anaphylaxis medications (epinephrine, diphenhydramine, albuterol nebs) during graded challenges
- Patients should be monitored for immediate hypersensitivity reactions (hives, clearing of throat, coughing, dyspnea, abdominal pain, uneasiness) for up to 60 minutes after the full dose is administered

^C Do not use aztreonam in ceftazidime-allergic or ceftolozane-allergic patients

^D If no alternatives are available, aztreonam may be considered for Gram-negative infections

Appendix B. UW Health Anesthesia Table for OR Antibiotics: Preparation and consideration for IV push administration

From: [Surgical and Interventional Radiology Antimicrobial Prophylaxis Clinical Practice Guideline](#)

Last reviewed: 11/2017

Contact information: Philip Trapskin, PharmD; (608)-263-1328, PTrapskin@uwhealth.org

All antibiotics should be prepared prior to case, labeled appropriately, and discarded if unused.

Appropriate labeling consists of:

- (1) Name and concentration (strength) of the medication or solution;
- (2) Volume/amount (if not apparent from the container);
- (3) Diluent name and volume (if not apparent from the container);
- (4) Expiration date (if it is not to be used within 24 hours); and
- (5) Time of expiration (if it is fewer than 24 hours)

Do not use 0.9% sodium chloride flushes for drug dilution and product preparation.¹

Drug	Reconstitution	Intravenous (IV) Push Time
Ampicillin 1 g^{2,3}	Reconstitute each vial with 7.4 mL sterile water for injection	<ul style="list-style-type: none"> • Administer doses less than 500 mg over 3 to 5 minutes • Administer doses of 1-2 g over 10-15 minutes • More rapid administration may result in seizures
Ampicillin 2 g^{2,3}	Reconstitute each vial with 14.8 mL sterile water for injection	<ul style="list-style-type: none"> • Administer doses less than 500 mg over 3 to 5 minutes • Administer doses of 1-2 g over 10-15 minutes • More rapid administration may result in seizures
Ampicillin/ sulbactam 1.5 g (Unasyn)^{2,3}	Reconstitute each vial with 3.2 mL of sterile water for injection. Reconstituted solution should be diluted further in 0.9% sodium chloride (normal saline) to yield a concentration between 3 and 45 mg/mL (ampicillin sodium 2 to 30 mg/mL and sulbactam sodium 1 to 15 mg/mL).	Administer by slow IV push over 10 to 15 minutes
Ampicillin/ sulbactam 3 g (Unasyn)^{2,3}	Reconstitute each vial with 6.4 mL of sterile water for injection. Reconstituted solution should be diluted further in 0.9% sodium chloride (normal saline) to yield a concentration between 3 and 45 mg/mL (ampicillin sodium 2 to 30 mg/mL and sulbactam sodium 1 to 15 mg/mL).	Administer by slow IV push over 10 to 15 minutes
Cefazolin 1 g^{2,3}	Reconstitute each 1 g vial with 7.5 mL sterile water for injection	<ul style="list-style-type: none"> • Administer by slow IV push over 3 to 5 minutes • Thrombophlebitis can occur • Diluted solution should be translucent and yellow
Cefazolin 2 g^{2,3}	<ul style="list-style-type: none"> • Cefazolin 2 gram DUPLEX[®] bag system: directions to reconstitute • Or use two 1 gram vials: instructions above 	<ul style="list-style-type: none"> • Duplex bag: administer over 30 to 60 minutes • Vials: administer each 1 g dose by slow IV push over 3 to 5 minutes
Cefazolin 3 g^{2,3}	Use three 1 gram vials; instructions above	Administer each 1 g dose by slow IV push over 3 to 5 minutes

Drug	Reconstitution	Intravenous (IV) Push Time
Cefepime 1 g ²⁻⁴	Reconstitute each 1 g vial with 10 mL sterile water for injection or 0.9% sodium chloride (normal saline). Reconstituted solution should be diluted further in 0.9% sodium chloride (normal saline) to yield a concentration between 1 and 40 mg/mL.	<ul style="list-style-type: none"> Administer by slow IV push over 5 minutes. Localized phlebitis can occur
Cefepime 2 g ²⁻⁴	Reconstitute each 2 g vial with 10 mL sterile water for injection or 0.9% sodium chloride (normal saline). Reconstituted solution should be diluted further in 0.9% sodium chloride (normal saline) to yield a concentration between 1 and 40 mg/mL.	<ul style="list-style-type: none"> Administer by slow IV push over 5 minutes. Localized phlebitis can occur
Ceftriaxone 1 g ^{2,3,5-7}	Reconstitute each vial with 9.6 mL sterile water for injection or 0.9% sodium chloride (normal saline)	<ul style="list-style-type: none"> Administer by slow IV push over 3 to 5 minutes in adult patients or IV push only in patients 12 years of age and older Do not administer simultaneously with calcium-containing solutions (e.g. Lactated Ringer's or Hartmann solution), products, or continuous calcium-containing infusions (e.g. parenteral nutrition) in the same IV line or Y-site due to risk of precipitate formation
Ceftriaxone 2 g ^{2,3,5,6}	Reconstitute each vial with 19.2 mL sterile water for injection or 0.9% sodium chloride (normal saline)	<ul style="list-style-type: none"> Administer by slow IV push over 5 minutes in adult patients IV push only in patients 12 years of age and older Do not administer simultaneously with calcium-containing solutions (e.g. Lactated Ringer's or Hartmann solution), products, or continuous calcium-containing infusions (e.g. parenteral nutrition) in the same IV line or Y-site due to risk of precipitate formation
Cefoxitin 1 g ^{2,3}	Reconstitute each 1 g vial with 10 mL sterile water for injection	Administer by slow IV push over 3 to 5 minutes
Cefoxitin 2 g ^{2,3}	Reconstitute each 2 g vial with 10 mL sterile water for injection	Administer by slow IV push over 3 to 5 minutes
Cefoxitin 3 g ^{2,3}	Reconstitute a 1 g vial and a 2 g vial each with 10 mL of sterile water for injection	<ul style="list-style-type: none"> Administer each 1 g dose by slow IV push over 3 to 5 minutes. Administer each 2 g dose by slow IV push over 3 to 5 minutes.
Cefuroxime 1.5 g and 3 g ^{2,3}	Reconstitute each 1.5 gram vial with 16 mL of sterile water for injection. Shake gently.	<ul style="list-style-type: none"> Administer each 1.5 g dose by slow IV push over 3 to 5 minutes. Local thrombophlebitis can occur.
Clindamycin 600 mg, 900 mg or 1200 mg bag ^{2,3,8}	Provided as a premade bag in the OR pharmacies	Cannot be administered by IV push. Administer no faster than 30 mg/min. Do not exceed 1,200 mg/hour.
Doxycycline 100 mg ^{2,3,8}	Either use 100 mL minibag plus bag or, if unavailable, reconstitute vial with 10 mL sterile water for injection or 0.9% sodium chloride and further dilute to 100 mL.	Cannot be administered by IV push. Must be given over 1 hour. If 100 mL bag is not available, obtain from pharmacy.
Gentamicin 40 mg/mL vials ^{2,3,8}	Dilute dose in 50 mL to 100 mL of 0.9% normal saline. Obtain product from pharmacy if bags unavailable. Maximum concentration < 10 mg/mL.	Cannot be administered by IV push. Doses less than 250 mg may be given over 30 minutes, doses greater than 250 mg administer over 60 minutes.

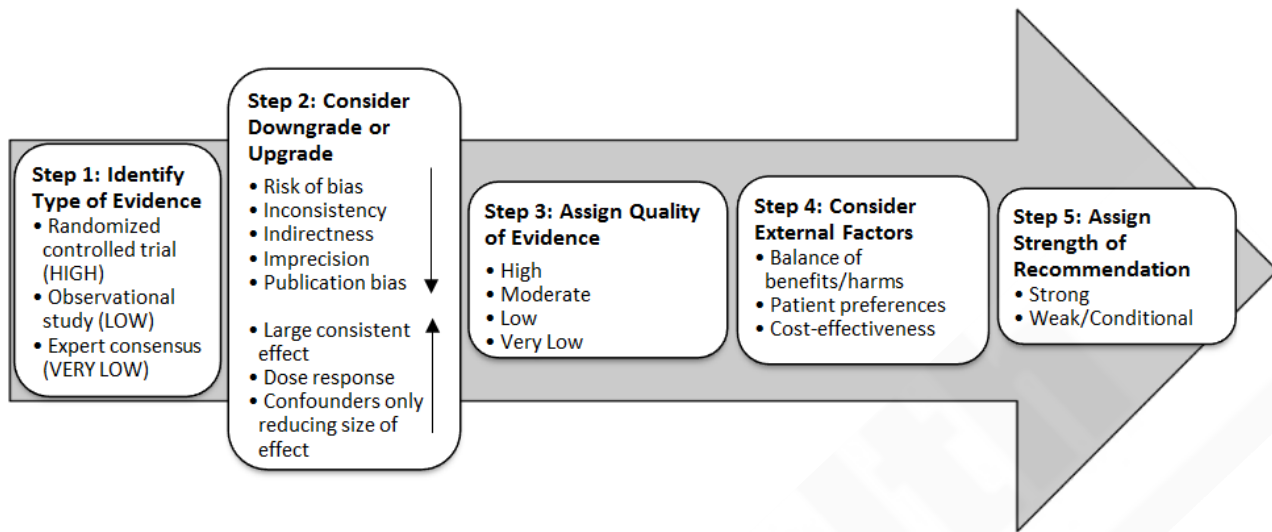
Drug	Reconstitution	Intravenous (IV) Push Time
Piperacillin/ Tazobactam 3.375 g (Zosyn)^{2,3,8}	Either use 100 mL minibag plus bag, advantage vial with advantage bag, or contact pharmacy for product. Reconstitute vial with 15 mL sterile water for injection or 0.9% sodium chloride and further dilute to 50 to 150 mL. Maximum recommended volume per dose of sterile water for injection is 50 mL.	Cannot be administered by IV push. Administer over at least 30 minutes.
Piperacillin/ Tazobactam 4.5 g (Zosyn)^{2,3,8}	Either use 100 mL minibag plus bag, if unavailable contact pharmacy for product. Reconstitute vial with 20 mL sterile water for injection or 0.9% sodium chloride and further dilute to 50-150 mL. Maximum recommended volume per dose of sterile water for injection is 50 mL.	Cannot be administered by IV push. Administer over at least 30 minutes.
Vancomycin^{2,3,8}	Use bags provided by pharmacy.	Cannot be administered by IV push. Must use infusion pump to prevent systematic histamine release and hypotension. Administer 500 mg to 1 gram doses over 60 minutes, 1.5 gram doses over 90 minutes, and 2 gram doses over 120 minutes.

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Appendix C. Evidence Grading Scheme

Figure 1. GRADE Methodology adapted by UWHealth¹



GRADE Ranking of Evidence

High	We are confident that the effect in the study reflects the actual effect.
Moderate	We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.
Low	The true effect may differ significantly from the estimate.
Very Low	The true effect is likely to be substantially different from the estimated effect.

GRADE Ratings for Recommendations For or Against Practice

Strong	The net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.
Weak/conditional	Recommendation may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.

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