

## INTRODUCTION

The antimicrobial surgical prophylaxis guideline establishes evidence-based standards for surgical prophylaxis at UCSF Medical Center and UCSF Benioff Children's Hospital San Francisco. The protocol has been adapted from published consensus guidelines from the American Society of Health-System Pharmacists (ASHP), Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), Centers for Disease Control and Prevention (CDC), and the Surgical Infection Society (SIS) for use at UCSF with input from the Antimicrobial Stewardship Program, the Infectious Diseases Management Program, the Department of Anesthesiology, and the surgical departments.

## PRINCIPLES OF ANTIMICROBIAL SURGICAL PROPHYLAXIS

- This guideline is focused on clean and clean-contaminated surgeries
- Prophylaxis should be targeted against most likely pathogens, taking into consideration type of surgery and local epidemiology
- Administer correctly—goal is for adequate tissue concentration at the time of risk
  - Administer within 60 minutes before the incision
  - For vancomycin and fluoroquinolones, the ideal timing is to start the infusion 60-120 minutes prior to incision
- Give dose before the tourniquet goes up, if applicable
- Confirm with the surgeon at the Time-out or earlier since occasionally antibiotics need to be delayed until after culture
- In clean and clean-contaminated surgeries, discontinue antibiotics after the surgical incision is closed unless the patient has a documented or suspected infection. In pancreatic transplantation, continuation of antibiotics until duodenal cultures result is an exception.

### Patients with existing infections

- The appropriate antibiotic to treat the underlying infection should be chosen on a case-by-case basis
- Continue the antibiotic to treat infection
- If spectrum of activity does not cover the usual organisms covered by routine prophylaxis for that type of case, add the routine prophylactic agent
  - Antibiotic spectrum guidance: <https://idmp.ucsf.edu/content/antibiotic-stewardship-and-spectrum-guide>
- Ensure dose is given at appropriate time to achieve maximal tissue levels at time of incision
- Duration should be determined by the duration for the existing infection

### Patients known to be colonized with methicillin-resistant *Staphylococcus aureus* (MRSA)

- Can consider addition of vancomycin to prophylaxis, especially if implant is being placed. Standard prophylaxis (e.g. cefazolin) should still be provided as this affords superior surgical site infection prevention for methicillin-sensitive *Staphylococcus aureus* (MSSA).

**Patients with recent history of resistant organisms**

- Data is limited
- Take into account:
  - Timing of infection
  - Location of infection
  - Prior treatment
  - Planned procedure
  - Organism

**Patients with penicillin allergy**

- Take an antibiotic history
  - Exact details of reaction, description of rash (if present)
  - Timing of reaction
  - Reason for antibiotic prescription
  - Other antibiotics received since then (also review the EMR to see whether the patient has received other antibiotics)
- Severe beta-lactam allergy: Do not re-challenge
  - Immediate-type hypersensitivity: Hives, angioedema, wheezing, anaphylaxis
  - Late reactions: Hemolytic anemia, thrombocytopenia, serum sickness, drug reaction with eosinophilia, Stevens Johnson syndrome (SJS)/Toxic epidermal necrolysis (TEN)
- When to re-challenge or use alternative  $\beta$ -lactam
  - Okay if patient had history of maculopapular rash (no hives, wheezing, anaphylaxis)
  - Okay if history of other drug intolerances like nausea

**DOSING AND RE-DOSING INTERVALS**

- In addition to the re-dosing intervals suggested below, consider immediate re-dosing in patients who have > 1.5 L of blood loss (>25ml/kg or > 30% blood volume loss for patients < 40kg) within a short time frame and those with severe burns.
  - Restart the re-dosing clock if this is done
  - Do not re-dose vancomycin or gentamicin for blood loss

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## COMMONLY USED IV DRUG DOSING AND ADMINISTRATION

ADULTS	Ampicillin-sulbactam <sup>#</sup>	Cefazolin	Ceftriaxone	Clindamycin	Gentamicin	Levofloxacin	Metronidazole	Piperacillin-tazobactam	Vancomycin
<b>Initial dose</b>									
<b>≥ 40 kg</b>	3 g	40-120 kg: 2 g > 120 kg: 3 g	2 g	900 mg	5 mg/kg*	500 mg	500 mg	Standard: 3.375 g P aeruginosa: 4.5 g	40-80 kg: 1 g ≥ 80 kg: 1.5 g
<b>&lt; 40 kg adult</b>	1.5 g	1 g	1 g	600 mg	2.5 mg/kg*	500 mg	500 mg	Standard: 3.375 g P aeruginosa: 4.5 g	750 mg
<b>Admin</b>	15 min IVPB	IVP over 3-5 mins	IVP over 3-5 mins	15 min IVPB	30 min IVPB	60 min IVPB	30 min IVPB	30 min IVPB	60 min/1 g IVPB
<b>Intraoperative redosing interval, h</b>	CrCl (>30): 2 CrCl (10-30): 6 CrCl (<10): Do not redose	CrCl (>30): 4 CrCl (10-30): 6 CrCl (<10): Do not redose	12	6	None	None	12	2	CrCl > 30: 12 CrCl ≤ 30: None
<b>When to start standard dosing</b>	After 3 doses	After 3 doses	After 2 doses	After 3 doses	Already standard	Already standard	Already standard	After 3 doses	Already standard
<b>Standard dosing interval</b>	q6h	q8h	q24h	q8h	q24h	q24h	Q12h	q8h	q12h
<b>Compatibility issues</b>	No	No	Ca++ containing solutions (incl LR) → possible precipitation 1. No Y-site 2. Flush line with normal saline or use alt solution	No	Propofol → Δ emulsion integrity 1. No Y-site 2. Flush line with normal saline	Propofol → free oil formation 1. No Y-site 2. Flush line with normal saline	Propofol → Δ fat globule size 1. No Y-site 2. Flush line with normal saline	Vecuronium → precipitation 1. No Y-site 2. Flush line with normal saline	No

<sup>#</sup>Note: Adult dosing for combination antibiotics is based on *total* drug product e.g. 3 g ampicillin-sulbactam = 2 g ampicillin + 1 g sulbactam

\*Use ideal body weight, max dose = 400 mg

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## APPENDIX A. RECOMMENDED PROPHYLAXIS AGENTS BY ADULT OR PROCEDURE

	Recommended Agents	Severe $\beta$ -Lactam Allergy
<b>CARDIAC</b>		
CABG	Cefazolin	Vancomycin
Cardiac Device Insertion (pacemaker) and valves	Cefazolin	Vancomycin
Ventricular Assist Device	MRSA nares (-): Cefazolin MRSA nares (+): Cefazolin + Vancomycin	Vancomycin
<b>THORACIC</b>		
Thoracotomy, Pneumonectomy, Lobectomy	Cefazolin	Vancomycin
VATS	Cefazolin	Vancomycin
<b>GENERAL SURGERY</b>		
<b>GASTRODUODENAL—No suspected infection</b>		
Entry into lumen of GI tract (bariatric)	Cefazolin	Vancomycin + levofloxacin
Pancreatoduodenectomy (with or without stent)	Piperacillin/tazobactam	Levofloxacin + metronidazole
Without entry into GI tract (anti-reflux)	Cefazolin	Vancomycin + levofloxacin
<b>BILIARY—No suspected infection</b>		
Open-Biliary (no infection)	Cefazolin	Levofloxacin + metronidazole
<b>Laparoscopic- Biliary</b>		
-Low Risk	None	None
-High Risk (no infection)	Cefazolin	Levofloxacin + metronidazole
<b>INTESTINE—No suspected infection</b>		
Appendectomy (uncomplicated)	Cefazolin if > 8h from ceftriaxone; give metronidazole if not administered in the ED	Ciprofloxacin + metronidazole
Nonobstructed small intestine	Cefazolin	Clindamycin + levofloxacin
Hernia Repair	Cefazolin	Vancomycin
Colorectal	Preop mechanical bowel prep + neomycin/metronidazole PO x 3 doses (metronidazole allergy: substitute erythromycin) Periop ceftriaxone + metronidazole	Preop mechanical bowel prep + neomycin/metronidazole PO x 3 doses Periop levofloxacin + metronidazole

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	Recommended Agents	Severe $\beta$ -Lactam Allergy
<b>HEAD &amp; NECK</b>		
Clean, including tympanostomy tube placement	None	None
Clean, neck dissection or prosthesis placement (except tympanostomy tube)	Cefazolin	Clindamycin
FESS	Cefazolin	Clindamycin
Tonsillectomy	Ampicillin	Clindamycin
Clean-contaminated except FESS and tonsillectomy	Ampicillin/sulbactam (cefazolin/metronidazole if non-severe PCN allergy)	Clindamycin/levofloxacin
<b>NEUROSURGERY</b>		
Elective craniotomy & CSF Shunting-Primary	Cefazolin	Vancomycin
Implantation of Intrathecal Pumps-Primary	Cefazolin	Vancomycin
Revision craniotomy	Cefazolin + Vancomycin	Vancomycin
Skull base with dural resection	Ceftriaxone (2 g IV q12H) + metronidazole	Aztreonam 2 g + metronidazole + vancomycin
<b>ORTHOPEDIC and SPINE</b>		
Clean operations of hand, knee, foot (without implantation of foreign material), $\leq 30$ min	None	None
Clean operations of hand, knee, or foot (with foreign material), $> 30$ min	Cefazolin	Vancomycin
Laminectomy or primary spinal fusion	Cefazolin	Vancomycin
Spinal fusion (revision)	Cefazolin + vancomycin	Vancomycin
Spinal fusion (revision involving sacrum)	Cefazolin + vancomycin + gentamicin	Vancomycin + gentamicin
Arthroplasty for femoral neck fracture	Cefazolin + (vancomycin if deemed high risk for drug-resistant organisms)	Vancomycin
Implantation of internal fixation devices (nails, screws, wires)	Cefazolin	Vancomycin
Total joint replacement	Cefazolin	Vancomycin
Total joint replacement- Revision	Cefazolin + vancomycin (Cefazolin + clindamycin for a vancomycin allergy)	Vancomycin
<b>PLASTIC SURGERY</b>		
Routine prophylaxis	Cefazolin	Clindamycin
Approach through oral cavity	Ampicillin/sulbactam	Clindamycin

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	Recommended Agents	Severe $\beta$ -Lactam Allergy
<b>TRANSPLANTATION</b>		
Heart, Lung, Heart-Lung	Cefazolin	Clindamycin
Kidney	Cefazolin	Clindamycin
Liver	Piperacillin-tazobactam	Vancomycin + Aztreonam
Pancreas & Kidney-Pancreas	Cefazolin +/- fluconazole (if high risk of fungal infection)	Vancomycin + levofloxacin +/- fluconazole (if high risk of fungal infections)
<b>UROLOGY</b>		
Lower tract instrumentation with risk of infection (incl TURP)	Cephalexin (cefazolin if PO dose not given in preop)	Trimethoprim-sulfamethoxazole
Clean without entry into urinary tract	Cefazolin	Clindamycin
Clean without entry into urinary tract + prosthesis	Cefazolin + gentamicin	Vancomycin + gentamicin
Clean with entry into urinary tract	Cefazolin	Clindamycin + gentamicin
Clean-contaminated	Ceftriaxone + metronidazole	Levofloxacin + metronidazole
Complex stones/stents/upper tract instrumentation	Treat based on clinical judgement and culture data	
Upper tract instrumentation	Cephalexin (cefazolin if PO dose not given in preop)	Trimethoprim-sulfamethoxazole
Vaginal surgery	Cefazolin	Clindamycin + gentamicin
<b>VASCULAR</b>	Cefazolin (+ vancomycin if MRSA colonization or graft/wound infection)	Vancomycin

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## APPENDIX B. RECOMMENDED PROPHYLAXIS AGENTS BY OB/GYN PROCEDURE

OB-GYN	Recommended Agents	Severe $\beta$ -Lactam Allergy
Vaginal Delivery w/ manual placenta removal	Cefoxitin	Clindamycin
Cesarean Delivery	Cefazolin <u>MRSA colonized</u> : consider vancomycin x 1, in addition to above <u>Ruptured membranes or in labor at time of C-section</u> : Add Azithromycin 500 mg IV x 1 <u>Vaginal hand</u> : Standard prophylaxis as above <u>Stat C-section</u> : Standard prophylaxis as above	Clindamycin + gentamicin
Vaginal packing	No targeted prophylaxis unless another indication for prophylaxis exists	
Uterine balloon	Cefoxitin	Clindamycin
Laceration repair (3 <sup>rd</sup> or 4 <sup>th</sup> degree only)	Cefoxitin 1g IV	Clindamycin
Hysterectomy (vaginal or abdominal), urogynecology procedures (+/- mesh)	Cefazolin +/- metronidazole	Clindamycin + gentamicin
Hysteroscopy, laparoscopy, laparotomy	None	
Hysterosalpingogram, endometrial biopsy	Doxycycline 100 mg po twice daily x 5 days if hx of PID or dilated fallopian tubes	
Medical abortion	None	
Induced abortion/D+E/ D+C/manual uterine inspection (including Laminaria placement)	Doxycycline 200 mg po prior to procedure	Doxycycline 200 mg po prior to procedure
With fetal demise (any gest age)	Add metronidazole 500 mg q8H x 2 doses	Add metronidazole 500 mg q8h x 2 doses
Ultrasound (USIC), history-indicated cerclage (HIC), or laparoscopic-assisted abdominal cerclage	None	
Physical exam-indicated cerclage (PEIC)	Consider cefazolin + indomethacin	Consider clindamycin + indomethacin
Transabdominal cerclage (TAC)	Cefazolin	Clindamycin
Cystoscopy alone	<u>Low risk</u> : no antibiotics required <u>High risk</u> : TMP/SMX 160/800 DS (+ urine culture, pre-op catheter, prosthetic material)	
Cystoscopy with manipulation or upper tract instrumentation (e.g. ureteroscopy)	TMP/SMX 160/800 DS x1	
Cystoscopy with open surgery	Cefazolin	Clindamycin + gentamicin
Risk of colorectal injuries	Preoperative mechanical bowel prep + neomycin/metronidazole PO x 3 doses Perioperative ceftriaxone + metronidazole	Preoperative mechanical bowel prep + neomycin/metronidazole PO x 3 doses Perioperative levofloxacin + metronidazole
PUBS/IUT/RFA/Thoracoamniotic shunt/vesicoamniotic shunt/amnioreduction/ECV/laser ablation in TTTS, FETO (fetal endoscopic balloon occlusion), myelomeningocele repair/open fetal surgery	Cefazolin	Clindamycin

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## APPENDIX C. RECOMMENDED PROPHYLAXIS AGENTS BY IR PROCEDURE

	Recommended agent	Severe $\beta$ -lactam allergy
Angiography, angioplasty, thrombolysis, arterial closure device placement, stent placement, superficial venous insufficiency treatment, IVC filter placement	None	N/A
Central venous access	None	None
Chemoembolization, ablation, embolization, or radioembolization where sphincter of Oddi is not intact (eg, history of biliary reconstructive surgery)	Moxifloxacin 400 mg daily x 3 days prior and 11 days post-procedure	
Embolization, ablation, radioembolization, and chemoembolization of liver (if intent to create infarction or high likelihood of infarction)	Ampicillin/sulbactam	Levofloxacin
Endograft placement	None	None
Gastrostomy tube placement	Cefazolin	Levofloxacin
Percutaneous abscess drainage, on antibiotics	Continue directed therapy for the existing infection	
Percutaneous abscess drainage, not on antibiotics	Discuss with primary service whether antibiotics should be given (if active signs of infection) or held until after cultures obtained	
Percutaneous nephrostomy tube placement or change	Cefazolin	Levofloxacin
Renal ablation, embolization	Cefazolin	Levofloxacin
Uterine Artery Embolization (UAE)	Cefazolin	Levofloxacin
TIPS creation	Cefazolin	Levofloxacin
Tube check/change (hepatic, biliary)	Cefazolin	Levofloxacin

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