Antimicrobial Guidebook – 2025 Edition

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Approved by:
Antimicrobial Stewardship Committee
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Acknowledgments:
Thanks to past and current staff of the Pharmacy Service and Infectious Diseases Section for preparing, compiling, and reviewing the materials contained in this pamphlet.

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Table of Contents

ID/ASP Contact Information

ASP/ID Pharmacist Sunday - Wednesday	Pager (415) 223 – 8046 or EXT 25269
ASP/ID Pharmacist Wednesday - Saturday	Pager (415) 223 – 8046 or EXT 23763
ID Fellow	Pager (415) 443 – 5151
HIV Pharmacist	EXT 24793
Outpatient Pharmacy	EXT 22708
Inpatient Pharmacy	EXT 22934 or 22935
Microbiology Lab	EXT 22267 or 23782
Lab Send Out	EXT 26583
Infection Control (6AM – 4:30PM)	EXT 26269
Occupational Health (8AM – 4:30PM)	Phone (415) 469 – 4411

ID Resources

SFVA Specific Guidelines on SFVA Intranet

- Isolation Instructions (type of isolation by organism), interpreting C. Diff testing results, rule out TB algorithm:
  - Infection Control - Algorithms - All Documents (sharepoint.com)
- SFVAMC Antibiogram:
  - SFVAMC SharePoint: Antibiograms
- Infection Control Manual:
  - Infection Control - IC Manual - All Documents (sharepoint.com)

UCSF Infectious Diseases Management Program:

- Guidelines for Empiric Antimicrobial Therapy
  - https://idmp.ucsf.edu/guidelines-empiric-antimicrobial-therapy
- Antimicrobial Dosing Guidelines
  - https://idmp.ucsf.edu/antimicrobial-dosing-guidelines

SFVA Specific Guidelines under Hospital Specific Guidelines on IDMP:

- VASF Antimicrobial Guidebook
  - Guidelines At VASF | Infectious Diseases Management Program at UCSF

ID Restricted Antimicrobial Prior Authorization Process

Several formulary antimicrobial medications are locally restricted to specialty services such as infectious diseases (ID) as part of ongoing antimicrobial stewardship measures to reduce collateral effects such as the emergence of antimicrobial resistance, *C. difficile* infection, and drug associated toxicities.

Antimicrobials restricted to the ID service are available to order by house staff BUT require prior approval by ID provider/ ASP pharmacist before processing pharmacist will release the medication order. If an order for an ID restricted agent is received without prior approval, pharmacist will make a reasonable attempt to contact prescribing provider/ ordering service.

ID/ASP Antimicrobial Approval Coverage:

- Monday – Sunday 8 am to 6:30 pm → Contact ASP Pharmacist (pager: 223-8046 or EXT 25269 or 23763)
- Monday – Sunday 6:30 pm to 10 pm & Holidays → Contact ID Fellow (pager: 415-443-5151)

Restricted agents ordered during off hours will be processed as one-time doses by pharmacy and reviewed for continuation by ID/ASP during business hours. Restricted antimicrobials may be continued when patients transfer units including antimicrobials initiated in the ICU prior to transfer.

Available Antimicrobials at SFVA

Shaded = Restricted to Infectious Diseases (ID) service
* = Restricted to indication and/or non-ID specialty service
NFDR=Pharmacy NFDR Consult required

ANTIBIOTICS
AMIKACIN LIPOSOME 590MG/8.4ML INHL SUSP NFDR
AMIKACIN SULFATE 250MG/ML INJ
AMOXICILLIN 125MG SUSP, 250MG CAP/SUSP, 500MG CAP
AMOXICILLIN/CLAV 500/125MG, 875/125MG TAB
AMOXICILLIN/CLAV 400/ 57MG / 5 ML PO SUSP
AMPICILLIN 500MG INJ/PO*, 1GM INJ, 2GM INJ *Consult Rx
AMPICILLIN /SULBACTAM 1.5GM INJ, 3GM INJ
AZITHROMYCIN 250MG TAB/SUSP, 600MG TAB; 500MG INJ
AZTREONAM 1GM, 2GM INJ*SEVERE PENICILLIN-ALLERGY, OTHER USES NEED ID APPROVAL
CEFACLOR 250MG, 500MG CAP
CEFADROXIL 500MG CAP
CEFAZOLIN 1GM, 2GM INJ*ID IF DOSE > Q 8H
CEFDINIR 300MG CAP
CEFEPIME 1GM, 2GM INJ *ICU, ED, HEM/ONC; PERI-OP NEUROSURG
CEFIDEROCOL 1GM INJ
CEFOXITIN 1GM INJ
CEFPODOXIME PROXETIL 100MG, 200MG TAB
CEFTAROLINE FOSAMIL 600MG INJ
CEFTAZIDIME 1GM; 2GM INJ
CEFTAZIDIME/AVIBACTAM 2.5GM INJ
CEFTOLOZANE/TAZOBACTAM 1.5GM INJ
CEFTRIAXONE 250MG, 2GM, 1GM INJ
CEFUROXIME AXETIL 250MG TAB
CEFUROXIME 0.75GM, 1.5GM INJ* OPHTHAMOLOGY
CEPHALEXIN 250MG, 500MG CAP; 250 MG/5ML SUSP NFDR
CHLORAMPHENICOL 1GM INJ
CIPROFLOXACIN 250MG, 500MG, 750MG TAB; 200MG, 400MG INJ* GI, x1 PRE-OP (restrictions for inpatient ONLY)
CIPROFLOXACIN 500MG/5ML SUSPNFDR* GI (restrictions for inpatient use ONLY)
CLARITHROMYCIN 250 MG (IP use); 500MG TAB
CLARITHROMYCIN 125 MG/ 5ML, 250MG/5ML SUSPNFDR
CLINDAMYCIN HCL 150MG CAP* ORAL SURG & ENT (service restrictions for Inpatient use ONLY)
CLINDAMYCIN 75MG/5ML ORAL SOLN *ORAL SURG & ENT (service restrictions for Inpatient use ONLY)
CLINDAMYCIN PHOS 600MG; 900MG INJ
COLISTIMETHATE (COLISTIN BASE 150MG) INJNFDR
DALBAVANCIN 500 MG INJ NFDR
DAPTOMYCIN 500MG INJ
DELAFLOXACIN 450 MG TAB NFDR
DICLOXACILLIN 250MG CAP
DOXYCYCLINE 20MG TAB*, 50MG TAB, 100MG TAB & INJ *VA DENTAL and DERM ONLY
DURLOBACTAM/SULBACTAM 1/1GM INJ
ERAVACYCLINE 50MG INJ
ERTAPENEM 500MG, 1GM INJ
ERYTHROMYCIN BASE 250MG TAB* COLORECTAL SX PPX
ERYTHROMYCIN ES 400MG/5ML PO SUSP; 500MG, 1GM INJ
FIDAXOMICIN 200MG TAB *orderable via CDI order menus
FOSFOMYCIN TROMETHAMINE 3GM SACHETNFDR
GENTAMICIN 10MG, 40 MG INJ
IMIPENEM-CILASTATIN 500MG INJ
IMIPEN/RELEBACT-CILASTATIN 1.25GM INJ
LEVOFLOXACIN 250MG, 500MG, 750MG TAB & INJ* HEM/ONC EXCEPT FOR PENICILLIN-ALLERGIC PTS W/ CAP
LINEZOLID 600MG TAB & INJ; 100MG/5ML SUSP,ORAL
MEROPENEM 500MG, 1GM, 2GM INJ
METRONIDAZOLE 250MG, 500MG TAB; 500MG INJ
MINOCYCLINE HCL 50MG, 100MG CAP* DERM
MINOCYCLINE HCL 100MG/VIL INJNFDR
MOXIFLOXACIN HCL 400MG TAB
MUPIROCIN 2% OINT
NAFCILLIN 1GM, 2GM INJ
NEOMYCIN SULFATE 500MG TAB
NITROFURANTOIN MONO/MACRO 100MG CAP
NORFLOXACIN 400MG TABNFDR
OFLOXACIN 200MG, 300MG, 400MG TABNFDR
PENICILLIN G BENZATHINE 1.2MU/2ML INJ
PENICILLIN G POTASSIUM 20 MU INJ
PENICILLIN G PROCAINE 1.2 MU TUBEX
PENICILLIN G SODIUM 5 MU INJNFDR
PENICILLIN VK 250MG, 500MG TAB
PENICILLIN VK 250MG/5ML SOLN
PIPERACILLIN TAZOBACTAM 2.25GM, 3.375GM, 4.5GM INJ*ICU, ED OR SINGLE PERI-PROCEDURAL DOSES
POLYMYXIN-B 500,000U INJ
RIFAXIMIN 550MG TABNFDR
STREPTOMYCIN 1GM INJ
SULFAMETHOX/TMP 80/16MG/ML INJ
SULFAMETHOX/TMP 200/40MG/5ML SUSP
SULFAMETHOX/TMP 400/80MG; 800/160MG TAB
TEDIZOLID 200 MG TABNFDR
TETRACYCLINE 250MG*, 500MG CAP* H. Pylori Treatment
TIGECYCLINE 50MG INJ
TRIMETHOPRIM 100MG TAB
TOBRAMYCIN SULFATE 40MG INJ; 300MG/5 ML PO SOLNNFDR
VANCOMYCIN HCL 125MG CAP* Outpatient restriction: NEED ID OK if dose exceeds 125MG QID X 10 days
VANCOMYCIN HCL 1GM INJ
VANCOMYCIN HCL 25MG/ML ORAL SOLN
ANTIFUNGALS
AMPHOTERICIN B CONVENTIONAL 50MG INJ
AMPHOTERICIN B LIPOSOME 50MG INJ
FLUCONAZOLE 50MG, 100MG, 150MG, 200MG TAB
FLUCONAZOLE 10MG/ML 40MG/ML PO SUSP
FLUCONAZOLE 200MG; 400MG INJ
FLUCYTOSINE 250MG, 500MG CAP
ISAVUCONAZONIUM SULFATE 186MG ORAL CAPNFDR
ISAVUCONAZONIUM SULFATE 372MG INJNFDR
ITRACONAZOLE 100MG CAP & 50MG/5ML ORAL SOLN
KETOCONAZOLE 200MG TAB* HEM/ONC, ENDO
MICAFUNGIN 50MG; 100MG INJ
POSACONAZOLE 100MG EC TAB* HEM/ONC
TERBINAFINE 250MG TAB
VORICONAZOLE, 50MG, 200MG TAB & 200MG INJ
VORICONAZOLE 200MG/5ML ORAL SUSPNFDR

ANTIVIRALS
ACYCLOVIR 200MG CAP, 400MG TAB, 800MG TAB
ACYCLOVIR 200 MG/ 5 ML ORAL SUSP[NFDR]
ACYCLOVIR 500MG, 1GM INJ
ADEFOVIR DIPIVOXIL 10MG TAB* *LIVER*
CIDOFOVIR 75MG/ML INJ
EMTRICITABINE 200MG/TAF 25MG TAB* for HIV PREP
EMTRICITABINE 200MG/TDF 300MG TAB* for HIV PREP
ENTECAVIR 0.5MG, 1MG TAB* *LIVER, RHEUM, HEM/ONC*
FAMCICLOVIR 125MG, 250MG, 500MG TAB* *DERM*
GANCICLOVIR 500MG CAP[NFDR] & 500MG INJ
LAMIVUDINE 100MG, 150MG, 300MG TAB **Liver*
LAMIVUDINE 50MG/5ML ORAL SOLN* *Liver*
LETERMOVIR 480 MG[NFDR] **HEM/ONC*
OSELTAMIVIR 30MG, 75MG CAP
OSELTAMIVIR 6MG/ML ORAL SUSP[NFDR]
REMDESIVIR 100MG INJ* Use *> 5 days Requires ID Approval*
TENOFOVIR ALAFENAMIDE (TAF) 25MG TAB* *Liver*
TENOFOVIR DISOPROXIL FUMARATE (TDF) 300MG TAB* *LIVER*
VALACYCLOVIR HCL 500 MG, 1GM TAB
VALGANCICLOVIR HCL 450MG TAB
ZANAMIVIR 5MG INHL
COVID-19
BARICITINIB 1MG, 2MG TAB[NFDR]
INV-MOLNUPIRAVIR 200MG ORAL CAP* EUA criteria for use
PAXLOVID = GOV-NIRMATRELVIR 150 MG TAB + GOV-RITONAVIR 100 MG TAB* Use *> 5 days Requires ID Approval*
REMDESIVIR 100MG INJ* Use *> 5 days Requires ID Approval*
TOCILIZUMAB 20 MG/ML INJ[NFDR]
MISCELLANEOUS ANTI-INFECTIVES
ALBENDAZOLE 200MG TAB
ATOVAQUONE 750MG/5ML ORAL SUSP
ATOVAQUONE 250MG/PROGUANIL HCL 100MG TAB
DAPSONE 25MG, 100MG TAB
CYCLOSERINE 250MG CAP
ETHAMBUTOL HCL 100MG, 400MG TAB
ETHIONAMIDE 250MG TAB
HYDROXYCHLOROQUINE 100MG, 200MG TAB*DERM, RHEUM
ISONIAZID 100MG, 300MG TAB & 50MG/5ML SYRUP[NFDR]
IVERMECTIN 3MG TAB[NFDR]*DERM
LACTOBACILLUS ACIDOPHILUS TAB
MEFLOQUIN 250MG TAB[NFDR]
NITAZOXANIDE 500MG TAB[NFDR]
PAROMOMYCIN SULFATE 250MG CAP[NFDR]
PEGINTERFERON ALFA-2A 180MCG/ML INJ* LIVER CLINIC
PENTAMIDINE ISETHIONATE 300MG/VI INJ
PRIMAQUINE PHOSPHATE 26.3MG TAB
PYRAZINAMIDE 500MG TAB
QUININE SULFATE 324MG CAP[NFDR]
RIFABUTIN 150MG CAP
RIFAMPIN 150MG, 300MG CAP
RIFAMPIN 600MG INJ**ONE-TIME FOR O.R. GRAFT SOAKING*
RIFAPENTINE 150MG TAB **VA LTBI CLINIC ONLY*
SULFADIAZINE 500MG TAB
TINIDAZOLE 500MG TAB[NFDR]

Antibiograms (Non-Urine and Urine)

Please note the following comments:

- All data is reported as percent fully susceptible
- First isolate per patient per organism is counted in the antibiogram
- 30 organisms are required to report susceptibilities on an antibiogram per CLSI guidelines. Some organisms were included in despite less than 30 organisms isolated
- When treating UTIs caused by *E. Coli*, *Klebsiella spp*., and *Proteus spp*., cefazolin can be used to predict results for the following oral agents: cephalexin (Keflex) and cefpodoxime (Vantin)
- Gentamicin susceptibilities for *enterococcus spp.* are for gram-positive synergy
- Non-urine coagulase-negative *staphylococcus* includes: *S. auricularis, S. capitis, S. haemolyticus, S. hominis, S. lugdunensis, S. simulans, S. ureilyticus, S. warneri*
- Urine coagulase-negative *staphylococcus* includes: *S. epidermidis, S. haemolyticus, S. lugdunensis, and S. warneri*
- Key: ESBL: Extended-spectrum beta-lactamase; CR: Carbapenem resistant; VRE: Vancomycin resistant enterococci; MR: Methicillin resistant; NA: Not available; R: Intrinsically resistant

Non-Urine Culture Antibiogram

	# Isolates	Ampicillin	Cefazolin	Ceftriaxone	Ertapenem	Piperacillin/ tazobactam	Cefepime	Ciprofloxacin	Levofloxacin	Gentamicin	Oxacillin	Sulfamethoxazole/ trimethoprim	Clindamycin	Doxycycline	Vancomycin	Linezolid	Daptomycin
Gram negative																	
Escherichia coli (ESBL 12%)	67	55	NA	81	100	94	81	70	69	90	R	NA	R	R	R	R	R
Klebsiella pneumoniae (ESBL 19%)	27	R	NA	89	100	96	89	89	85	100	R	NA	R	R	R	R	R
Proteus mirabilis	26	73	NA	73	100	100	73	69	86	95	R	73	R	R	R	R	R
*Pseudomonas aeruginosa (*CR 11%)	44	R	R	R	R	88	93	84	79	R	R	R	R	R	R	R	R
Gram positive																	
Enterococcus faecalis	72	100	R	R	R	100	R	NA	NA	82	NA	R	R	NA	99	100	100
Staphylococcus aureus	228	R	70	NA	NA	NA	NA	NA	NA	R	70	94	79	96	100	100	100
MSSA (70%)	159	R	100	NA	NA	NA	NA	NA	NA	R	100	97	81	96	100	100	100
MRSA (30%)	69	R	R	NA	NA	NA	NA	NA	NA	R	R	87	74	97	100	100	100
Coagulase-negative *staph (MR 52%)*	83	R	48	NA	NA	NA	NA	NA	NA	R	48	68	59	86	99	100	100
Staphylococcus epidermitis (MR 44%)	34	R	56	NA	NA	NA	NA	NA	NA	R	56	57	57	83	98	100	100

Urine Culture Antibiogram

	# Isolates	Amoxicillin/ clavulanate	Ampicillin	Cefazolin	Cefepime	Ceftriaxone	Ciprofloxacin	Ertapenem	Levofloxacin	Nitrofurantoin	Sulfamethoxazole /trimethoprim	Oxacillin	Vancomycin
Gram negative													
Enterobacter cloacae complex	45	R	R	R	96	R	89	96	89	60	87	R	R
Escherichia coli (ESBL 15%)	442	83	45	81	84	84	70	100	64	99	69	R	R
Klebsiella oxytoca (ESBL 7%)	30	97	R	90	93	90	100	100	100	87	97	R	R
Klebsiella pneumoniae (ESBL 13%)	142	94	R	85	86	85	84	100	80	49	79	R	R
Proteus mirabilis (CR 1%)	89	88	73	73	74	73	72	99	71	R	64	R	R
Pseudomonas aeruginosa (CR 15%)	67	R	R	R	82	R	83	R	73	R	R	R	R
Gram positive													
Enterococcus faecalis (VRE 0%)	108	100	100	R	R	R	R	R	NA	100	R	NA	100
Staphylococcus aureus (MRSA 39%)	44	NA	R	61	NA	NA	R	R	NA	100	84	61	100
Coagulase-negative *staphylococcus*	201	NA	R	54	NA	NA	R	R	NA	99	69	54	100

Spontaneous Bacterial Peritonitis (SBP)

Approximately 1/3 of cirrhotic patients have bacterial infections. Spontaneous bacterial peritonitis (SBP) is a common infection in this setting which occurs in the absence of an obvious source of infection. Presence of fever or hypothermia, chills, and localizing symptoms should raise suspicion for bacterial infection. Signs/symptoms specific to SBP are abdominal pain, tenderness on palpation +/- rebound tenderness, and ileus. However, typical symptoms may be absent in cirrhotic patients. Common pathogens include gut bacteria (*E. coli*, *Klebsiella spp.*) and *Streptococci spp*.

Diagnosis

- Diagnostic abdominal paracentesis for cell count and bacterial culture, even in absence of signs/symptoms of infection.
  - Culture ascitic fluid before initiating antibiotics.
- Polymorphonuclear (PMN) leukocyte count >250/mm^3 indicates SBP → Start empiric antibiotics.

I. SBP Empiric Treatment: Expected duration 5-7 days

SBP Infection	Empiric Therapy
Community Acquired[+]	Ceftriaxone 1 gm IV q24h
Nosocomial[++]	Piperacillin/tazobactam^* 4.5 gm IV q6h
Septic shock; History of ampicillin-resistant *enterococcus* infection; IV antibiotic use and hospitalization within prior 90 days; Positive MRSA nasal swab or prior MRSA infection	Piperacillin/tazobactam^* 4.5 gm IV q6h **PLUS** Vancomycin IV (see pages 44-45 for dosing)
History of Vancomycin-Resistant *Enterococcus* spp. (VRE)	Piperacillin/tazobactam^* 4.5 gm IV q6h **PLUS** Daptomycin* 10 mg/kg IV q24h

[+] Present at or acquired within the first 48 hours of admission [++] Acquisition of infection >48 hours after admission

^ If patient received > 48 hours of piperacillin/tazobactam within the prior 60 days, consider empiric meropenem*

* Contact ASP PharmD (preferred) or ID fellow for approval (EXCEPTION: pip/tazo may be used in ICU without ID prior approval)

II. SBP Prophylaxis

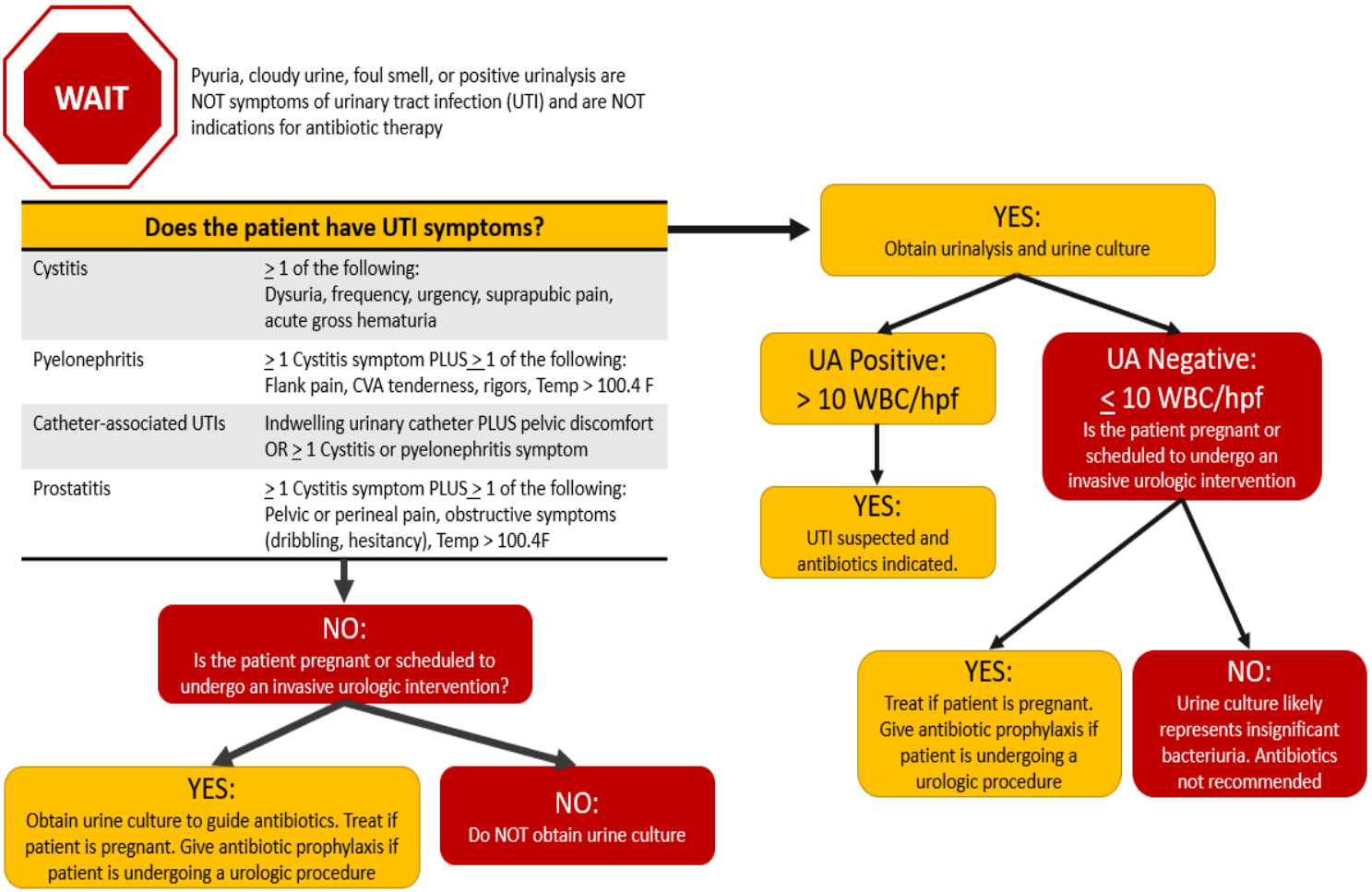
Prophylaxis Criteria	Antibiotic Therapy	Duration
Primary Prophylaxis Advanced cirrhosis without prior episode of SBP and Acute upper gastrointestinal hemorrhage	**Preferred**: Ceftriaxone 1 gm IV Q24H **Alterative initial agent/ PO step down**: Ciprofloxacin* 500 mg PO q12h Sulfamethoxazole-trimethoprim 1 DS PO tab q12h	7 days
Primary Prophylaxis Low ascitic protein (<1.5 g/dL) AND • Renal dysfunction (Cr ≥ 1.2 mg/dL, BUN ≥ 25 mg/dL, or Serum Na ≤ 130 mEq/L OR • Liver failure (CTP ≥ 9, total bilirubin ≥ 3 mg/DL)	**Preferred**: Ciprofloxacin* 500 mg PO Q24H **Alternative:** Sulfamethoxazole-trimethoprim 1 DS PO tab daily	Long term
Secondary Prophylaxis Prior episode of SBP	**Preferred**: Ciprofloxacin* 500 mg PO Q24H **Alternatives:** Sulfamethoxazole-trimethoprim 1 DS PO tab daily Rifaximin[#] 400 mg PO TID (preferred) or 550 mg PO BID	Long term

[#] Place pharmacy NFDR consult *Contact ASP PharmD (preferred) or ID fellow for inpatient use

References: 1. Biggins, Scott W., et al. "Diagnosis, evaluation, and management of ascites, spontaneous bacterial peritonitis and hepatorenal syndrome: 2021 practice guidance by the American Association for the Study of Liver Diseases." Hepatology 74.2 (2021): 1014-1048.

Urinary Tract Infections (UTI)

Diagnosis



Common Causative Organisms

E. coli, Proteus spp., Klebsiella spp. Pseudomonas spp. (if at least 1 risk factor^ present)

^Pseudomonal risk factors include: hospitalization within the last 30 days AND received IV antibiotics, history of prior pseudomonal infection, immunocompromised (uncontrolled HIV, transplant, etc.)

Uncomplicated vs complicated UTI

- Uncomplicated: UTI in a patient with a normal GU tract and no recent instrumentation
- Complicated: UTI in the presence of an anatomic abnormality, functional abnormality, recent GU instrumentation, or foreign material (e.g., ureteral stent)

Clinical Pearls

- When results are available, treatment should be tailored based on culture data
- Asymptomatic bacteriuria does not require antibiotic therapy for most patients. Antibiotics are only indicated for:
    - Pregnancy: cystitis treatment
    - Urological procedure: 1 dose prior to procedure and 1 to 2 doses after
- Catheter associated UTIs (CAUTI) require change in catheter and then may be treated based on site of infection
- Lower cefepime doses are used to treat Pseudomonal UTIs compared to systemic pseudomonal infections due to high urinary concentration (85% of unchanged drug excreted via urine)

Empiric Outpatient UTI Treatment (CPRS Ambulatory Care Order Menu Available)

Diagnosis	Preferred Treatment	Duration
Uncomplicated cystitis	Cephalexin 500 mg PO q12h	7 days
	Nitrofurantoin 100 mg PO q12h	Male: 7 days Female: 5 days
	Ciprofloxacin 500 mg PO q12h (*pseudomonas* risk^)	7 days
CAUTI	Cefpodoxime 200 mg PO q12h	Prompt symptom resolution: 7 days Delayed response: 10 - 14 days
	Sulfamethoxazole-trimethoprim 1 DS PO q12h	
	Ciprofloxacin 500 mg PO q12h (*pseudomonas* risk^)	
Pyelonephritis or complicated UTI	Ceftriaxone 1 gm x1 IM, then Cefpodoxime 200 mg PO q12h	10 – 14 days
	Sulfamethoxazole-trimethoprim 1 DS PO q12h	10 - 14 days
	Ciprofloxacin 500 mg PO q12h (*pseudomonas* risk^)	7 days
Epididymitis	Levofloxacin* 500 mg PO daily	10 days
	If concerned about sexually transmitted chlamydia and gonorrhea ADD: Doxycycline 100 mg PO BID x7 days AND one-time dose of IM ceftriaxone: Total body weight < 150 kg: ceftriaxone 500 mg IM x1 Total body weight ≥ 150 kg: ceftriaxone 1000 mg IM x1	
Acute bacterial prostatitis	Sulfamethoxazole-trimethoprim 1 DS PO q12h	14 days
	Ciprofloxacin 500 mg PO q12h	
Chronic prostatitis	Consider consulting urology service	

Empiric Inpatient UTI Treatment

Diagnosis	Preferred Treatment	Duration
Community acquired uncomplicated cystitis	Cephalexin 500 mg PO q12h	7 days
	Nitrofurantoin 100 mg PO q12h	Male: 7 days Female: 5 days
	Ciprofloxacin* 500 mg PO q12h (*pseudomonas* risk^)	7 days
Community acquired pyelonephritis or complicated UTI	Ceftriaxone 1 gm IV q24h	All IV or step down to PO fluroquinolone: 7 days PO Step down to beta-lactam or sulfa-trimethoprim: 10 - 14 days
	Cefepime* 2 gm IV q12h (*pseudomonas* risk^)	
Healthcare associated complicated or uncomplicated UTI	Ertapenem 1 gm IV q24h	Prompt symptom resolution: 7 days Delayed response: 10 - 14 days
	Cefepime* 2 gm IV q12h (*pseudomonas* risk^)	
CAUTI	Ceftriaxone 1 gm IV q24h	Prompt symptom resolution: 7 days Delayed response: 10 - 14 days
	Cefepime* 2 gm IV q12h (*pseudomonas* risk^)	
Acute bacterial Prostatitis	Sulfamethoxazole-trimethoprim 1 DS PO q12h	14 days
	Ciprofloxacin* 500 mg PO q12h	

*Contact ASP Pharmacist (preferred) or ID fellow to approve use outside of ICU

^Pseudomonal risk factors include hospitalization within the last 30 days AND received IV antibiotics, history of prior pseudomonal infection, immunocompromised (uncontrolled HIV, transplant, etc.)

References:
1. Gupta, Kalpana, et al. "International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases." Clinical infectious diseases 52.5 (2011): e103-e120.
2. Hooton, Thomas M., et al. "Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America." Clinical infectious diseases 50.5 (2010): 625-663.

Community Acquired Pneumonia (CAP)

Diagnosis

Requires the presence of clinical features (cough, fever, sputum production, pleuritic chest pain) AND chest infiltrate demonstrated on imaging

Common Causative Organisms

Streptococcus pneumoniae, Mycoplasma pneumoniae, Chlamydia pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Respiratory viruses

Outpatient Empiric CAP Treatment

Previously healthy **AND** no antibiotics in the past 3 months	Doxycycline 100 mg PO BID (preferred) **OR** Amoxicillin 1 gm PO TID (alternative)
Antibiotic use in prior 3 months **OR** Presence of co-morbidities • Immunosuppression • Chronic heart, lung, liver, or renal disease • Diabetes mellitus • Alcoholism • Malignancy • Asplenia	**Combination Therapy (preferred):** Doxycycline 100 mg PO BID **PLUS** Amoxicillin 1 gm PO TID **OR** Cefpodoxime 200 mg PO BID **Monotherapy (alternative)** Levofloxacin* 750 mg PO daily

* Contact ASP PharmD (preferred) or ID fellow for approval unless patient has severe penicillin allergy

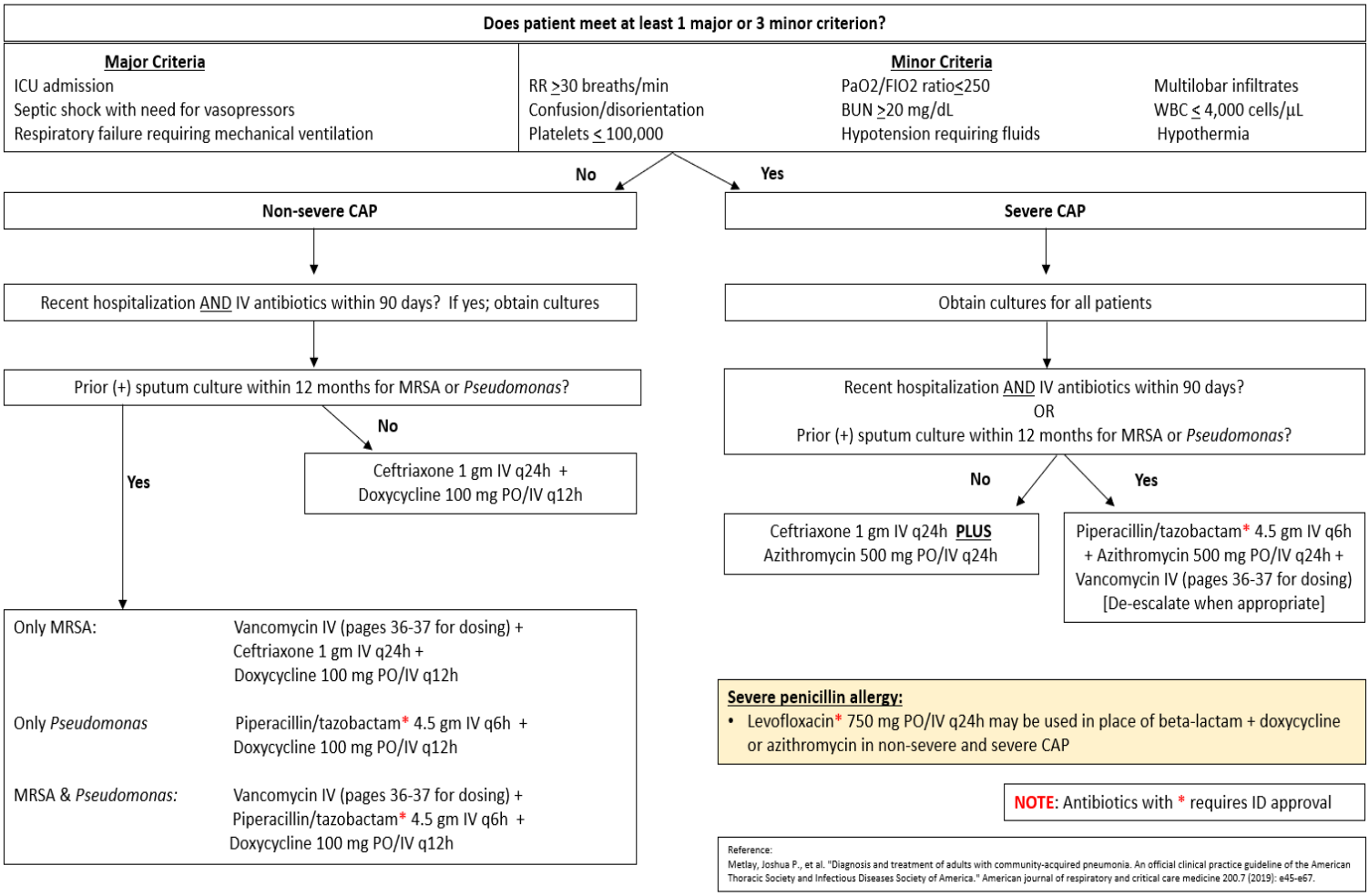
Suggested Duration of Therapy

- Patients should be treated for a minimum of 5 days
- Most patients are treated for 5-7 days

Clinical Pearls

- Routine sputum cultures and urine antigen tests are not recommended
- Consider testing for influenza and COVID-19 if patient exhibits flu-like symptoms during periods of high flu and SARS-CoV-2 activity
- Signs and symptoms of CAP may be lacking or altered in elderly patients
- Cough and chest X-ray abnormalities may take up to 6 weeks to improve and are NOT a valid reason to extend antibiotic courses

Inpatient Empiric CAP Treatment



Suggested Duration of Therapy

- Patients should be treated for a minimum of 5 days unless the patient has confirmed MRSA or *Pseudomonas aeruginosa* infection in which case the minimum duration is 7 days
- Azithromycin 500 mg PO/IV q24h x **3 doses** is sufficient for atypicals; if *legionella* is suspected treat for 7 days
- Patient should be afebrile for 48-72h, and should have no more than 1 of the following before stopping antibiotics:
  - Heart rate > 100 beats/min
  - Respiratory rate > 24 breaths/min
  - Systolic blood pressure < 90 mmHg
  - Arterial O2 saturation < 90%
  - Altered mental status

Clinical Pearls

- Sputum cultures should be obtained for hospitalized patients with severe CAP or when strong risk factors for MRSA or *Pseudomonas* are identified
- MRSA nares should be obtained if empiric vancomycin therapy is initiated for pneumonia to assist with de-escalation (strong negative predictive value)
- For suspected influenza, obtain nasopharyngeal swabs for influenza antigen testing and respiratory virus DFA; if patient is hospitalized, place on droplet precautions until tests are negative, and treat with oseltamivir 75 mg PO bid for 5 days (reduce dose in renal insufficiency). ICU patients, immunocompromised patients, and obese patients may require higher doses and/or prolonged therapy.

References: Metlay, Joshua P., et al. "Diagnosis and treatment of adults with community-acquired pneumonia. An official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America." American journal of respiratory and critical care medicine 200.7 (2019): e45-e67.

Hospital Acquired Pneumonia (HAP) and Ventilator Associated Pneumonia (VAP)

Antibiotic dosing for HAP/VAP (refer to IV antimicrobial dosing section for renal dose adjustments and vancomycin dosing/monitoring guidance)

- Piperacillin/tazobactam (pip/tazo) 4.5 gm IV q6h
- Cefepime 2 gm IV q8h
- Ceftriaxone 2 gm IV q24h
- Vancomycin 20 mg/kg IV one-time loading dose + maintenance dose targeting AUC 500-600 mg*h/L
- Aztreonam 2 gm IV q8h
- Levofloxacin 750 mg IV/PO q24h

Empiric Treatment WITH respiratory culture gram stain results available (i.e., BAL, tracheal aspirate, sputum, etc.)

Diagnosis	Antibiotic Regimens	Alternative Drug(s)	Comments	Expected Duration
HAP and VAP **With gram stain available within 72 hours**	Start: pip/tazo* OR ceftriaxone +/- vancomycin *Consider ceftriaxone: if no risk factors for Pseudomonas (see comments), short duration of intubation (i.e., < 5 days), hemodynamically stable* **Respiratory cultures should be collected for ALL patients with suspected VAP (and intubated pts with suspected HAP) prior to starting antibiotics.** Antibiotics should be tailored based on respiratory culture gram stain findings: • Gram positive rods: ceftriaxone • Gram positive cocci (GPC) in pairs/chains: ceftriaxone • GPC in clusters: vancomycin • Gram negative rods (GNRs): ceftriaxone or pip/tazo$^{\Delta}$ • No organisms: ceftriaxone. Stop antibiotics if concern for pneumonia is low. $^{\Delta}$If ceftriaxone was chosen based on considerations above, continue ceftriaxone. Broaden to cefepime if patient is hemodynamically unstable or clinically worsening.	Mild-moderate penicillin allergy: Cefepime* +/- vancomycin Severe penicillin allergy: Aztreonam OR Levofloxacin* +/ Vancomycin^ Antibiotics based on respiratory culture gram stain findings for patients with severe allergy precluding use of a cephalosporin: • GP rods: vancomycin • GPC in pairs/chains: levofloxacin • GPC in clusters: vancomycin • GNRs: aztreonam* or levofloxacin • No organisms: vancomycin + aztreonam* or levofloxacin. Stop antibiotics if concern for pneumonia is low.	**Consider coverage for MRSA and/or *Pseudomonas aeruginosa* in patients with:** respiratory isolation of these organisms or receipt of parenteral antibiotics within 90 days, admitted from skilled nursing or other long term care facility after at least one week stay. If these organisms are not isolated from clinical cultures (e.g. blood cultures), deescalate antibiotics. **Consider withholding empiric vancomycin in patients with** neg MRSA nares culture within prior **7** days. Stop vancomycin at 48 hours if MRSA nares culture/PCR is negative and/or no MRSA isolated from clinical cultures. **A positive MRSA nares culture/PCR** indicates that the patient is colonized with MRSA. Patients with a positive MRSA nares culture/PCR should be initiated on empiric anti-MRSA therapy (vancomycin). However, antibiotics should be tailored to respiratory gram stain & culture results. Stop vancomycin at 48 hours if no MRSA isolated from clinical cultures. **Antibiotic use at the time of respiratory culture collection may decrease gram stain yield**. Contact ID pharmacy/ID consult with questions. **For patients with known respiratory colonization with multidrug resistant organisms (MDRO)** consider empiric coverage of these organisms pending culture results	7 days

*Contact ASP Pharmacist or ID Fellow for approval (pip/tazo and cefepime do not need approval in the ICU)

Empiric Treatment <u>WITHOUT</u> respiratory culture gram stain results available

Diagnosis	Antibiotic Regimens	Alternative Drug(s)	Comments	Expected Duration
HAP Hemodynamically stable NOT on high-flow nasal cannula Including patients with HAP due to aspiration	<u>Start</u>: Ceftriaxone Consider pip/tazo OR cefepime if risk factors for *Pseudomonas* (see comments) or Risk factors for *Pseudomonas* or resistant GNRs: Pip/tazo	<u>Mild-moderate penicillin allergy:</u> Cefepime* <u>Severe penicillin allergy:</u> Aztreonam OR levofloxacin*	**Consider empiric vancomycin if** clinical concern for MRSA pneumonia (e.g., necrotizing pneumonia on imaging). If starting vancomycin, collect MRSA nares culture/PCR. **Consider coverage for MRSA and/or *Pseudomonas aeruginosa* in patients with** respiratory isolation of these organisms or receipt of parenteral antibiotics within 90 days, admitted from skilled nursing or other long term care facility after at least one week stay. If these organisms are not isolated from clinical cultures (e.g. blood cultures), deescalate antibiotics.	7 days
VAP and HAP <u>with</u> ICU level care/ High-flow nasal cannula	Start: pip/tazo* OR ceftriaxone +/- vancomycin *<u>Consider ceftriaxone</u>: if no risk factors for Pseudomonas (see comments), short duration of intubation (i.e., < 5 days), hemodynamically stable*	<u>Mild-moderate penicillin allergy:</u> Cefepime* +/- vancomycin <u>Severe penicillin allergy:</u> Aztreonam OR Levofloxacin* +/ Vancomycin^	**Consider withholding empiric vancomycin in patients with** neg MRSA nares culture within prior **7** days. **Consider coverage for MRSA and/or *Pseudomonas aeruginosa* in patients with** respiratory isolation of these organisms or receipt of parenteral antibiotics within 90 days, admitted from skilled nursing or other long term care facility after at least one week stay. If these organisms are not isolated from clinical cultures (e.g., blood cultures), deescalate antibiotics. **Stop vancomycin at 48 hours if** admission MRSA nares is negative and/or no MRSA isolated from clinical cultures	7 days

*Contact ASP Pharmacist or ID Fellow for approval (pip/tazo and cefepime do not need approval in the ICU)

<u>Role and Interpretation of Methicillin-Resistant S. aureus (MRSA) Nares Results in Context of Hospital-Acquired and Ventilator-Associated Pneumonia (HAP/VAP)</u>

Collecting a MRSA nares culture/PCR is recommended for all patients initiating anti-MRSA therapy (e.g. vancomycin) for suspected HAP or VAP.

How to interpret a <u>negative</u> MRSA nares result in patient with possible HAP/VAP:

A negative MRSA nares culture or PCR indicates the patient is less likely to be colonized with MRSA. Multiple studies indicate that a negative MRSA nares culture or PCR carries a high negative predictive value for MRSA pneumonia (> 95%),[3-6] even when collected prior to onset of pneumonia.[3,5] If a patient's MRSA nares is negative, their likelihood of having MRSA pneumonia is exceedingly low and anti-MRSA therapy (e.g. vancomycin) can reasonably be discontinued or withheld.

How to interpret a <u>positive</u> MRSA nares result in patient with possible HAP/VAP:

A positive MRSA nares culture or PCR indicates that the patient is colonized with MRSA. Patients with a known positive MRSA nares culture/PCR who develop a HAP or VAP should be initiated on antibiotics including empiric anti-MRSA therapy (e.g. vancomycin). However, antibiotics should be tailored to respiratory gram stain & culture results. Stop vancomycin at 48 hours if no MRSA isolated from clinical cultures. If a patient's MRSA nares culture or PCR results positive after the patient has been started on antibiotics to treat HAP/VAP, no change in therapy is recommended (in other words – no need to add empiric anti-MRSA therapy) provided the patient is stable and clinically improving.

Intra-abdominal Infections (IAI)

- Intra-abdominal infections are those contained within the peritoneal cavity or retroperitoneal space.
- May be generalized or localized, complicated or uncomplicated, and community or healthcare-associated

Possible Intra-abdominal Infection Etiologies[1]	Clinical Risk Factors Identifying Patients at High Risk[2,3,6]
• Peptic ulcer perforation • Perforation of a gastrointestinal organ • Appendicitis • Endometritis secondary to intrauterine device • Bile peritonitis • Pancreatitis • Operative contamination • Diverticulitis • Cholecystitis • Intestinal neoplasms • Secondary to peritoneal dialysis	Patients with ≥ 1 of the following: • High severity of illness (APACHE II score ≥ 15) • Severe sepsis or septic shock • Diffuse, generalized peritonitis • Delayed initial source control > 24 hours • Inability to achieve adequate source control Patients with ≥ 2 of the following: • Advanced age (> 70 years of age) • Malignancy • Significant cardiovascular compromise • Significant liver disease or cirrhosis • Significant renal disease • Hypoalbuminemia

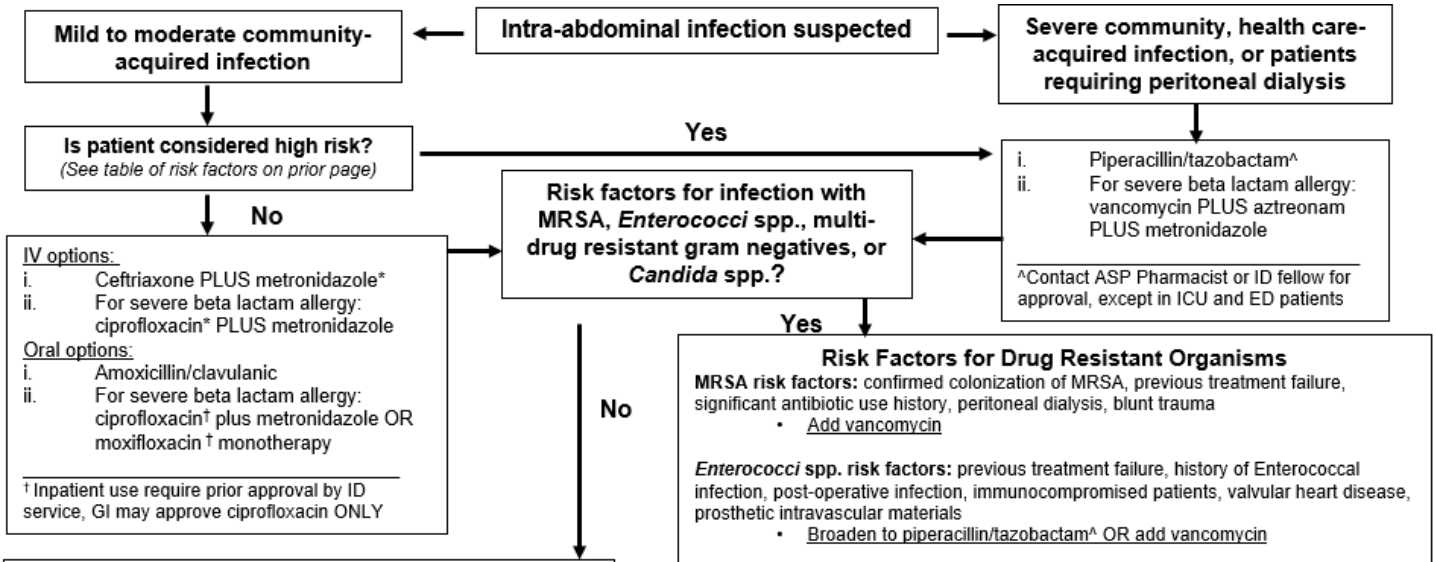


Table 2 - Initial Adult Dosages of Antibiotics for Empiric Treatment of Intra-abdominal Infections[a]

Azole

Fluconazole 12 mg/kg (max 800 mg) PO or IV on day 1, followed by 6 mg/kg (max 400 mg) PO or IV every 24 h

B-lactam/B-lactamase Inhibitors

Amoxicillin/clavulanic acid 875/125 mg PO every 12 h
Aztreonam 2 g IV every 8 h
Ceftriaxone 2 g IV every 24 h
Ertapenem 1 gm IV every 24 h
Piperacillin/tazobactam *(restricted)* 4.5 g IV every 6 h

Fluoroquinolones *(restricted)*

Ciprofloxacin 500 mg PO every 12 h
Ciprofloxacin 400 mg IV every 12 h
Moxifloxacin 400mg PO/IV every 24 h

Metronidazole 500 mg PO or IV every 12 h

Micafungin 100 mg IV every 24 h

Vancomycin 15 mg/kg IV every 12 h (consider consulting pharmacy for dosing recommendations)

a) Dosages are based on normal renal and hepatic function
b) Contact ASP Pharmacist or ID fellow for restricted drug approval

Antimicrobial Duration

Consider use of clinical parameters such as fever, leukocytosis, adequacy of GI function, source control achievement to determine antibiotic duration. Consider limiting duration to 5-7 days if definitive source control procedure is not performed.

Condition	Duration
Patients after receiving adequate source control	4 days
Critically ill patients after receiving adequate source control	8 days
Complicated appendicitis patients after undergoing appendectomy	24-48 hours

Clostridioides difficile **Infection (CDI)**

Order menus available for ambulatory care, inpatient, ED, and CLC

Clinical Definition	Supportive Clinical Data
Asymptomatic colonization	Positive *C. difficile* PCR (only) **WITHOUT** diarrhea, ileus, or colitis
Active infection	Diarrhea (3+ unformed stools within 24 hours) **AND** either - Positive *C. difficile* PCR **AND** positive toxin A/B **OR** - Presence of pseudomembranous colitis on colonoscopic or histopathologic exam
Recurrent infection	Active infection that occurs within 8 weeks after completing treatment of prior CDI episode
Fulminant	Active infection **PLUS** hypotension, shock, ileus, megacolon, or perforation

CDI Treatment Regimens	
Initial episode	Vancomycin 125 mg PO q6h for 10 days **OR** Fidaxomicin 200 mg PO q12h for 10 days <u>for patients at increased risk of CDI recurrence</u>: • Age > 65 years old, immunosuppression, history of inflammatory bowel disease • Concomitant antibiotic use during CDI treatment
1st Recurrence	Fidaxomicin 200 mg PO q12h for 10 days
≥ 2nd Recurrence	<u>Vancomycin taper</u>: Vancomycin 125mg PO q6h x14 days, then 125mg PO q12h x7 days, then 125mg PO daily x7 days, then 125mg PO every other day x7 days, then 125mg every 3rd day x14 days **<u>PLUS</u>** ID or GI consult for fecal microbiota transplant (FMT) evaluation (i.e., VOWST)
Fulminant	Vancomycin oral solution 500mg PO q6h • If ileus is present, add metronidazole 500mg IV q8h and consider Vancomycin 500 mg in 100 mL normal saline given as a retention enema q6h • Therapy should be followed by a vancomycin taper (see above) • ID or GI and surgical consultation should be obtained for severely ill patients
CDI Prophylaxis Agents	
Vancomycin 125 mg PO q12h	<u>Must meet ALL</u> of the following criteria: • Recurrent episode of CDI within the past 6 months • Patient requires treatment with antibiotics (beta-lactams, quinolones, or clindamycin) not directed against CDI in the inpatient setting • No history of vancomycin allergy Initiate as soon as possible and continue until antibiotics not directed against CDI are discontinued
VOWST™ (FMT) ID or GI section approval is required Place pharmacy non-formulary drug consult (PADR)	<u>Must meet ALL</u> of the following criteria: • At least 2nd recurrent CDI (3rd CDI episode overall) within previous 12 months • At least one CDI episode was treated with fidaxomicin, unless not tolerated or contraindicated • Is able to start VOWST within 2 to 4 days after completing of current CDI treatment Patients are <u>ineligible if ONE</u> of the following criteria are met: • Asymptomatic C. difficile colonization (i.e., patient is not on therapy for active CDI prior to VOWST) • ANC < 500 cells/m^3 • Is likely to require systemic antibiotics or pre-op antibiotics within 8 weeks after VOWST treatment • Inability to use magnesium citrate or polyethylene glycol or take VOWST prior to first meal of day <u>Pretreatment</u>: • Take 296 mL magnesium citrate 8 hours prior to first dose of VOWST ○ If renal impairment, prescribe 250 mL polyethylene glycol <u>Treatment</u>: • Avoid eating or drinking, except for small amounts of water, for at least 8 hours prior to first dose • Take 4 capsules of VOWST™ PO on an empty stomach prior to 1st meal of day once daily x 3 days

<u>Clinical Pearls</u>

- If an inciting antimicrobial is suspected discontinue the agent as soon as possible.
- The use of antimotility agents (loperamide, etc.) should be avoided.
- If severe or fulminant disease is suspected, initiate empiric treatment while awaiting assay results. If the assay is negative, use clinical judgment when deciding if therapy should be discontinued.
- Use caution with high dose oral/rectal vancomycin (500mg Q6H) in patients with renal insufficiency, as significant absorption can occur in the setting of colitis and systemic accumulation could lead to ototoxicity, nephrotoxicity, or other adverse effects.
- Always wash hands with soap and water after examining a patient with suspected/confirmed *C. difficile*, as alcohol-based sanitizers do NOT kill spores.
- Fidaxomicin and vancomycin PO are ONLY orderable through the CDI order menus (inpatient, CLC, ED, and ambulatory care)

Guidelines for Blood Culture Identification (BCID) 2 Data

What is BCID2?

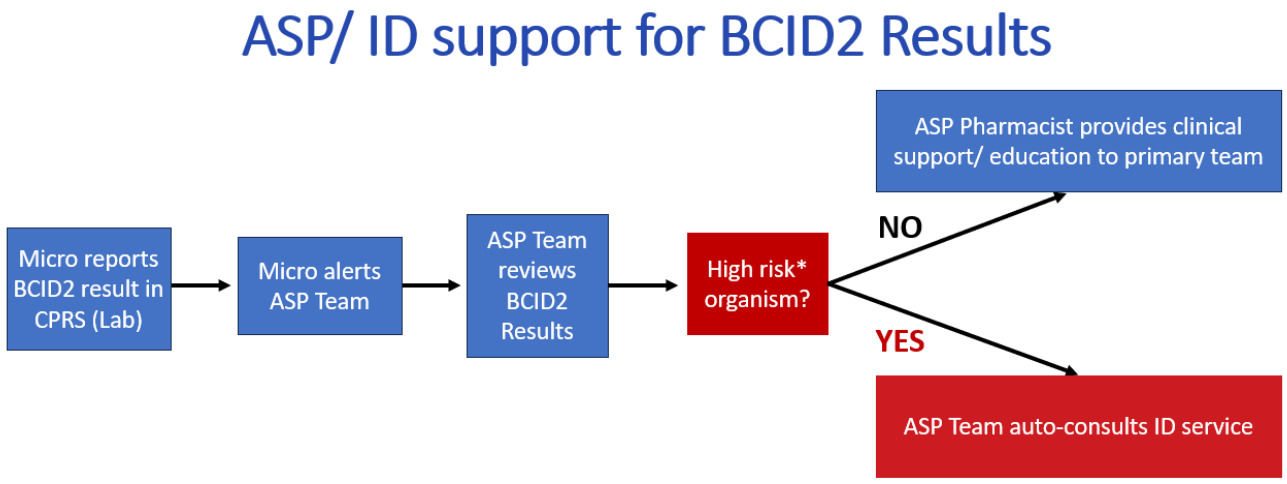
The BioFire® FilmArray® Blood Culture Identification Panel (BCID) 2 is a test used to rapidly identify pathogens by amplifying DNA through PCR. This laboratory method helps identify organisms and resistance genes from positive blood cultures. **Table 1** lists the bacterial and fungal pathogens, and resistance genes detected by the BCID2 panel.

Table 1: BCID2 Pathogen and Resistance Gene Panel

Gram-Positive Bacteria	Gram-Negative Bacteria	Yeast	Resistance Genes
Enterococcus faecalis *Enterococcus faecium* *Listeria monocytogenes* *Staphylococcus* genus - *Staphylococcus aureus* - *Staphylococcus epidermidis* - *Staphylococcus lugdunensis* *Streptococcus* genus - *Streptococcus agalactiae* - *Streptococcus pneumoniae* - *Streptococcus pyogenes*	*Acinetobacter baumannii complex* *Bacteroides fragilis* *Enterobacterales* Order - *Enterobacter cloacae complex* - *Escherichia coli* - *Klebsiella aerogenes* - *Klebsiella oxytoca* - *Klebsiella pneumoniae* group - *Proteus spp.* - *Salmonella spp.* - *Serratia marcescens* *Haemophilus influenzae* *Neisseria meningitidis* *Pseudomonas aeruginosa* *Stenotrophomonas maltophilia*	*Candida albicans* *Candida auris* *Candida glabrata* *Candida krusei* *Candida parapsilosis* *Candida tropicalis* *Cryptococcus neoformans/gatti*	Carbapenemases - IMP - KPC - OXA-48-like - NDM - VIM Colistin Resistance - mcr-1 ESBL - CTX-M Methicillin-resistance - mecA/C - mecA/C and MREJ (MRSA) Vancomycin Resistance - vanA/B

How is BCID2 incorporated into clinical practice?

The microbiology lab notifies clinicians of positive blood culture gram-stain results immediately after they are performed. Afterwards, the BCID2 assay is performed for rapid identification. BCID2 results are typically available in CPRS within 2 hours. When blood culture gram stain and BCID2 results are known, current antimicrobial therapy should be evaluated considering the clinical picture and adjusted to the most appropriate single agent if possible. Recommended empiric antibiotic therapies for BCID2 results are outlined in **Tables 2-4** for gram-positive bacteria, gram-negative bacteria, and fungi. The Antimicrobial Stewardship Team developed these recommendations based on an analysis of the institutional antibiogram and IDSA Clinical Guidelines. Contact the ASP Pharmacist for alternative recommendations if patient is not a candidate for first line therapy. All dosing recommendations assume normal renal or hepatic function, pleas adjust dosing accordingly.



***High risk organisms:** *Staphylococcus aureus, Enterococcus spp.,* fungi, and carbapenem resistant organisms

How reliable are BCID2 results?

The BCID2 test is highly accurate in monomicrobial bacteremia (99% sensitivity and 99.8% specificity), but in the rare incidence of polymicrobial bacteremia it may be less accurate. Therefore, polymicrobial gram stain results and BCID2 results with multiple organisms detected should be interpreted with caution. On the other hand, certain infections may be polymicrobial in nature and the isolation of a single pathogen from blood cultures, while allowing narrowing of therapy, should not result in over-narrowing. An example would be complicated intra-abdominal infections where anaerobes are frequently present and therapy active against these pathogens should generally be included until definitive cultures of the site of infection have returned.

BCID2 identification is limited to the pathogens and resistance genes listed on the panel (**Table 1**). If a positive blood culture results in a negative BCID2 report, please contact ASP Pharmacist or ID team for guidance. Occasionally, the detection of a resistance gene does not equate to confirmation of resistance when susceptibility testing is performed. Standard susceptibility testing is required to determine final antimicrobial susceptibility and should be used to guide final therapy decisions. When full susceptibility results become available, therapy should be adjusted to the narrowest spectrum appropriate agent.

References:
1. Rhoads DD, Pournaras S, Leber A, et al. Multicenter Evaluation of the BIOFIRE Blood Culture Identification 2 Panel for Detection of Bacteria, Yeasts, and Antimicrobial Resistance Genes in Positive Blood Culture Samples. *J Clin Microbiol* 2023; 61(6): e0189122.
2. IDSA 2023 Guidance on the Treatment of Antimicrobial Resistant Gram-Negative Infections (idsociety.org)

Table 2: Gram-Positive Bacteria

Bacterial Marker	Result	Interpretation	Preferred Therapy/ Comments
Enterococcus faecalis *VanA/B*	Detected Not Detected	*Enterococcus faecalis* Not-VRE	Ampicillin 2 gm IV q4h Infectious diseases (ID) service auto-consulted per hospital policy
Enterococcus faecalis *VanA/B*	Detected Detected	*Enterococcus faecalis* VRE (uncommon)	Ampicillin 2 gm IV q4h ID service auto-consulted per hospital policy
Enterococcus faecium *VanA/B*	Detected Not Detected	*Enterococcus faecium* Not-VRE (uncommon)	Vancomycin* IV one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring ID service auto-consulted per hospital policy
Enterococcus faecium *VanA/B*	Detected Detected	*Enterococcus faecium* VRE	Daptomycin^ 10-12 mg/kg IV q24h ID service auto-consulted per hospital policy
Listeria monocytogenes	Detected	*Listeria monocytogenes*	Ampicillin 2 gm IV q4h
Staphylococcus *S. aureus* *S. epidermidis, S. lugdunensis* MREJ and *mecA/C*	Detected Detected Not Detected N/A	Possible Methicillin-susceptible *S. aureus* (MSSA)	Vancomycin* IV one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring) Presume MRSA until final susceptibilities available due to high incidence of underdetection with this species ID service auto-consulted per hospital policy
Staphylococcus *S. aureus* *S. epidermidis, S. lugdunensis* MREJ and *mecA/C*	Detected Detected Not Detected Detected	Methicillin-resistant *S. aureus* (MRSA)	Vancomycin* IV one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring) ID service auto-consulted per hospital policy
Staphylococcus *S. epidermidis* *S. aureus, S. lugdunensis* *mecA/C*	Detected Detected Not Detected Not Detected	Methicillin-susceptible *Staphylococcus epidermidis (*MSSE)	1 of 2 blood culture sets positive: likely contaminant • Do not start antibiotics • If severely ill and on antibiotics, continue current therapy until definitive results become available 2 of 2 blood culture sets positive: possible infection Cefazolin 2 gm IV q8h
Staphylococcus *S. epidermidis* *S. aureus, S. lugdunensis* *mecA/C*	Detected Detected Not Detected Detected	Methicillin-resistant *Staphylococcus epidermidis* (MRSE)	Blood culture results: 1 of 2 sets positive: likely contaminant • Do not start antibiotics • If severely ill and on antibiotics, continue current therapy until definitive results become available 2 of 2 sets positive: possible infection Vancomycin* IV one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring

Bacterial Marker	Result	Interpretation	Preferred Therapy/ Comments
Staphylococcus *S. lugdunensis* *S. aureus, S. epidermidis* *mecA/C*	Detected Detected Not Detected Not Detected	Methicillin-susceptible *Staphylococcus lugdunensis*	Cefazolin 2 gm IV q8h Consider ID consult Although a coagulase-negative species, infections are more like *S. aureus*. If 1 of 2 blood culture sets positive, may be a contaminant, but favor treatment and repeating blood cultures
Staphylococcus *S. lugdunensis* *S. aureus, S. epidermidis* *mecA/C*	Detected Detected Not Detected Detected	Methicillin-resistant *Staphylococcus lugdunensis*	Vancomycin* IV one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring Consider ID consult Although a coagulase-negative species, infections are more like *S. aureus*. If 1 of 2 blood culture sets positive, may be a contaminant, but favor treatment and repeating blood cultures
Staphylococcus *S. aureus, S. epidermidis,* *S. lugdunensis*	Detected Not detected Not detected	Presumed methicillin-resistant Coagulase-negative *Staph spp*. not listed on BCID2 panel *mecA* not reported for species not on BCID 2 panel (ex: *S. hominis*)	1 of 2 blood culture sets positive: likely contaminant • Do not start antibiotics • If severely ill and on antibiotics, continue current therapy until definitive results become available 2 of 2 blood culture sets positive: possible infection Vancomycin* IV one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring
Streptococcus spp. *S. agalactiae* (Group B) *S. pneumoniae* *S. pyogenes* (Group A)	Detected Detected Not Detected Not Detected	*S. agalactiae* (Group B)	Penicillin G 3 million units IV q4h or Ceftriaxone 2 gm IV q24h
Streptococcus spp. *S. agalactiae (Group B)* *S. pneumoniae* *S. pyogenes (Group A)*	Detected Not Detected Detected Not Detected	*S. pneumoniae*	Non-CNS infection: Ceftriaxone 2 gm IV q24h CNS infection: Ceftriaxone 2 gm IV q12h + Vancomycin* one-time loading dose + maintenance dose (see pages 44-45 for dosing and monitoring
Streptococcus spp. *S. agalactiae (Group B)* *S. pneumoniae* *S. pyogenes (Group A)*	Detected Not Detected Not Detected Detected	*S. pyogenes (Group A)*	Penicillin G 3 million units IV q4h or Ceftriaxone 2 gm IV q24h
Streptococcus spp. *S. agalactiae (Group B)* *S. pneumoniae* *S. pyogenes (Group A)*	Detected Not Detected Not Detected Not Detected	*Streptococcus spp*. not listed on BCID2 panel	1 of 2 blood culture sets positive: likely contaminant • Consider withholding antibiotics • If severely ill and on antibiotics, continue current therapy until definitive results become available 2 of 2 blood culture sets positive: possible infection Ceftriaxone 2 gm IV q24h

* Contact team pharmacist/ inpatient pharmacy for assistance with vancomycin target achievement (AUC and/or trough)
^ Contact ASP Pharmacist or ID fellow is unavailable for antibiotic approval

Table 3: Gram-Negative Bacteria

Bacterial Marker	Result	Interpretation	Preferred Therapy/ Comments
Acinetobacter calcoaceticus-baumannii complex IMP, KPC, NDM, VIM CTM-X	Detected Not Detected Not Detected	*Acinetobacter calcoaceticus-baumannii* complex	Ampicillin-sulbactam 3 gm IV q6h
Acinetobacter calcoaceticus-baumannii complex IMP, KPC, NDM, VIM CTM-X	Detected Detected Not Detected	Presumed carbapenem-resistant *Acinetobacter calcoaceticus-baumannii* complex	KPC: Ampicillin-sulbactam 3 gm IV q4h + Minocycline^ 200 mg IV/PO q12h IMP, NDM, or VIM: Ampicillin-sulbactam 3 gm IV q4h + Minocycline^ 200 mg IV/PO q12h + Cefiderocol^ 2 gm IV q6h ID service auto-consulted per policy
Acinetobacter calcoaceticus-baumannii complex IMP, KPC, NDM, VIM CTM-X	Detected Not Detected Detected	Presumed beta-lactamase producing *Acinetobacter calcoaceticus-baumannii* complex	Meropenem^ 2 gm IV q8h
Bacteroides fragilis	Detected	*Bacteroides fragilis* (anaerobe)	Metronidazole 500 mg IV/PO q8h
Haemophilus influenzae	Detected	*Haemophilus influenzae*	Ampicillin-sulbactam 3 gm IV q6h

Bacterial Marker	Result	Interpretation	Preferred Therapy/ Comments
Neisseria meningitidis (encapsulated)	Detected	*Neisseria meningitidis*	Ceftriaxone 2 gm IV q12h
Pseudomonas aeruginosa IMP, KPC, NDM, VIM CTM-X	Detected Not Detected Not Detected	*Pseudomonas aeruginosa*	Piperacillin-tazobactam^ 4.5 gm IV q6h or Cefepime^ 2 gm IV q8h
Pseudomonas aeruginosa IMP, KPC, NDM, VIM CTM-X	Detected Detected Not Detected	Presumed carbapenem-resistant *Pseudomonas aeruginosa*	KPC: Ceftazidime-avibactam^ 2.5 gm IV q8h IMP, NDM, VIM: Cefiderocol^ 2 gm IV q6h ID service auto-consulted per policy
Pseudomonas aeruginosa IMP, KPC, NDM, VIM CTM-X	Detected Not Detected Detected	Presumed beta-lactamase producing *Pseudomonas aeruginosa*	Non-CNS: Meropenem^ 1 gm IV q8h CNS: Meropenem^ 2 gm IV q8h
Stenotrophomonas maltophilia	Detected	*Stenotrophomonas maltophilia*	TMP/SMX 5 mg/kg (of TMP component) IV/PO q12h + Levofloxacin^ 750 mg IV/PO q24h
The following guidelines are in reference to BCID2 results positive for the *Enterobacterales* order Results and interpretation for resistance genes are grouped separately (see last 3 rows of this table)			
Bacterial Marker	**Result**	**Interpretation**	**Preferred Therapy/ Comments**
Enterobacterales *Enterobacter cloacae* complex *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus spp., Salmonella spp., Serratia marcescens*	Detected Detected Not Detected	*Enterobacter cloacae* complex	Ertapenem 1 gm IV q24h Inducible AmpC beta-lactamase producer – carbapenems are drug of choice
Enterobacterales *Escherichia coli* *Enterobacter cloacae complex, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus spp., Salmonella spp., Serratia marcescens*	Detected Detected Not Detected	*Escherichia coli*	Ceftriaxone 2 gm IV q24h
Enterobacterales *Klebsiella aerogenes* *Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus spp., Salmonella spp., Serratia marcescens*	Detected Detected Not Detected	*Klebsiella aerogenes*	Ertapenem 1 gm IV q24h Inducible AmpC beta-lactamase producer – carbapenems are drug of choice
Enterobacterales *Klebsiella oxytoca* *Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella pneumoniae* group, *Proteus spp., Salmonella spp., Serratia marcescens*	Detected Detected Not Detected	*Klebsiella oxytoca*	Ceftriaxone 2 gm IV q24h
Enterobacterales *Klebsiella pneumoniae* group *Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca*, *Proteus spp., Salmonella spp., Serratia marcescens*	Detected Detected Not Detected	*Klebsiella pneumoniae group*	Ertapenem 1 gm IV q24h Antibiogram 2024: 19% of isolates were ESBL positive and may not be mediated through CTM-X gene
Enterobacterales *Proteus spp.* *Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Salmonella spp., Serratia marcescens*	Detected Detected Not Detected	*Proteus spp.*	Ceftriaxone 2 gm IV q24h

Bacterial Marker	Result	Interpretation	Preferred Therapy/ Comments
Enterobacterales *Salmonella spp.* *Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus spp., Salmonella spp.*	Detected Detected Not Detected	*Salmonella spp.*	Ceftriaxone 2 gm IV q24h
Enterobacterales *Serratia marcescens* *Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Proteus spp., Serratia marcescens*	Detected Detected Not Detected	*Serratia marcescens*	Ertapenem 1 gm IV q24h
Enterobacterales *Enterobacter cloacae* complex *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus spp., Salmonella spp., Serratia marcescens*	Detected Not Detected	*Enterobacterales* organism not listed on BCID2 panel	Ertapenem 1 gm IV q24h Consider ID consult
Enterobacterales Any species **Resistance genes:** CTM-X IMP, KPC, NDM, VIM, OXA-48 -like mcr-1	Detected Detected Detected Not Detected Not Detected	Presumed Beta-lactamase producing (ESBL) *Enterobacterales*	Ertapenem 1 gm IV q24h
Enterobacterales Any species **Resistance genes:** CTM-X IMP, KPC, NDM, VIM, OXA-48 -like mcr-1	Detected Detected Not Detected Detected Not Detected	Presumed Carbapenem resistant *Enterobacterales*	ID service auto-consulted per policy
Enterobacterales Any species **Resistance genes:** CTM-X IMP, KPC, NDM, VIM, OXA-48 -like mcr-1	Detected Detected Not Detected Not Detected Detected	Presumed Colistin resistant *Enterobacterales*	If mcr-1 is the only resistance gene identified, continue empiric therapy for isolated organisms If more than 1 resistance gene present, consider ID consult for guidance

^Contact ASP Pharmacist for antibiotic approval

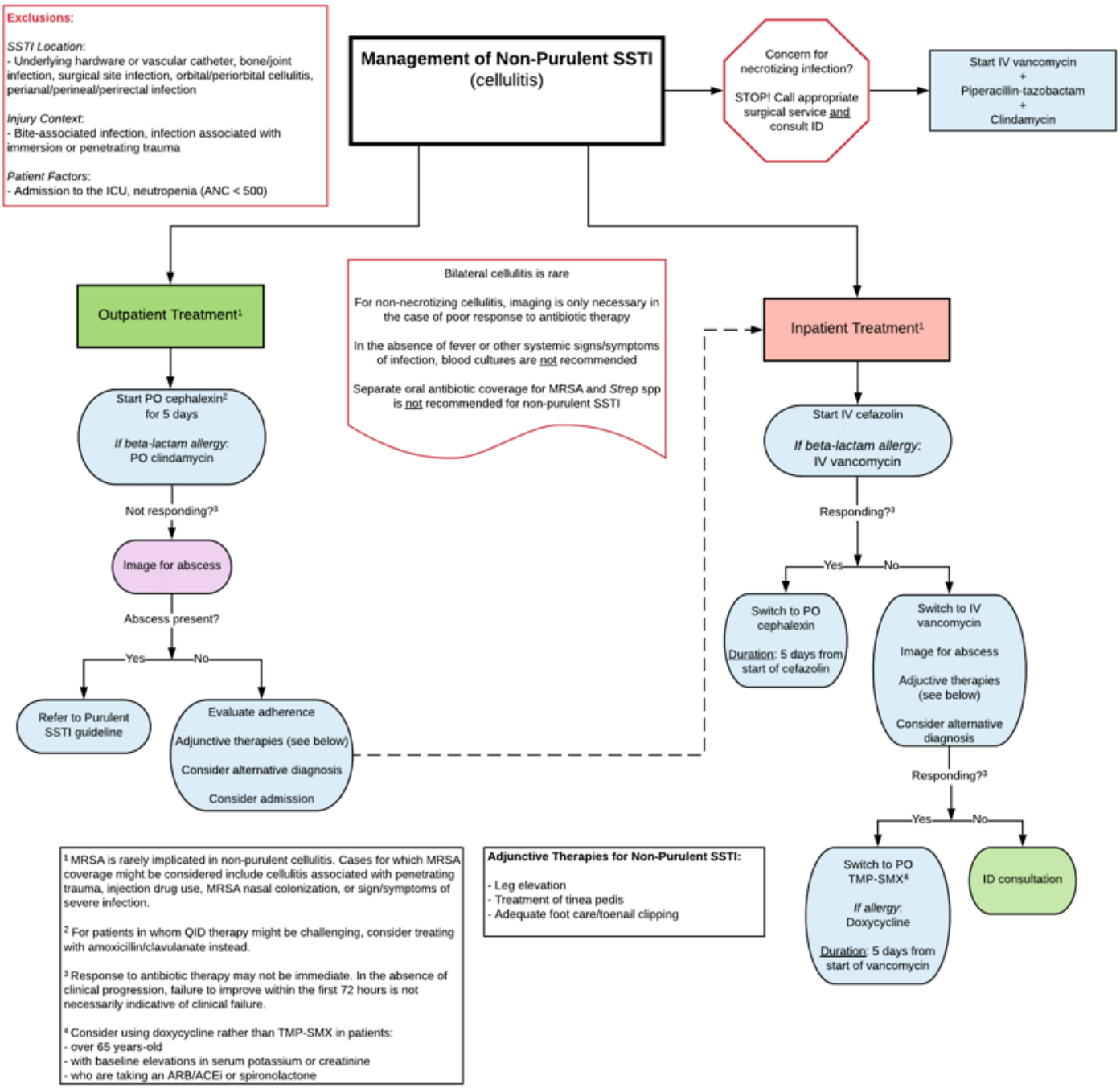
Table 4: Fungal Pathogens

Bacterial Marker	Result	Interpretation	Preferred Therapy/ Comments
Candida albicans	Detected	*Candida albicans*	Fluconazole 12 mg/kg IV/PO once, then 6 mg/kg q24h IV/PO
Candida auris	Detected	*Candida auris*	Micafungin 100 mg IV q24h
Candida glabrata	Detected	*Candida glabrata*	Micafungin 100 mg IV q24h
Candida krusei	Detected	*Candida krusei*	Micafungin 100 mg IV q24h
Candida parapsilosis	Detected	*Candida parapsilosis*	Micafungin 100 mg IV q24h
Candida tropicalis	Detected	*Candida tropicalis*	Micafungin 100 mg IV q24h
Cryptococcus neoformans/gatti	Detected	*Cryptococcus neoformans/gatti*	Amphotericin B (liposomal) 3-4 mg/kg IV q24h +/- flucytosine 25 mg/kg PO q6h

All fungal pathogens isolated in the blood will trigger an automatic ID consult per hospital policy

Non-Purulent Skin and Soft Tissue Infections (SSTI)

Order menu available for inpatient and ED



[1] MRSA is rarely implicated in non-purulent cellulitis. Cases for which MRSA coverage might be considered include cellulitis associated with penetrating trauma, injection drug use, MRSA nasal colonization, or sign/symptoms of severe infection.

[2] For patients in whom QID therapy might be challenging, consider treating with amoxicillin/clavulanate instead.

[3] Response to antibiotic therapy may not be immediate. In the absence of clinical progression, failure to improve within the first 72 hours is not necessarily indicative of clinical failure.

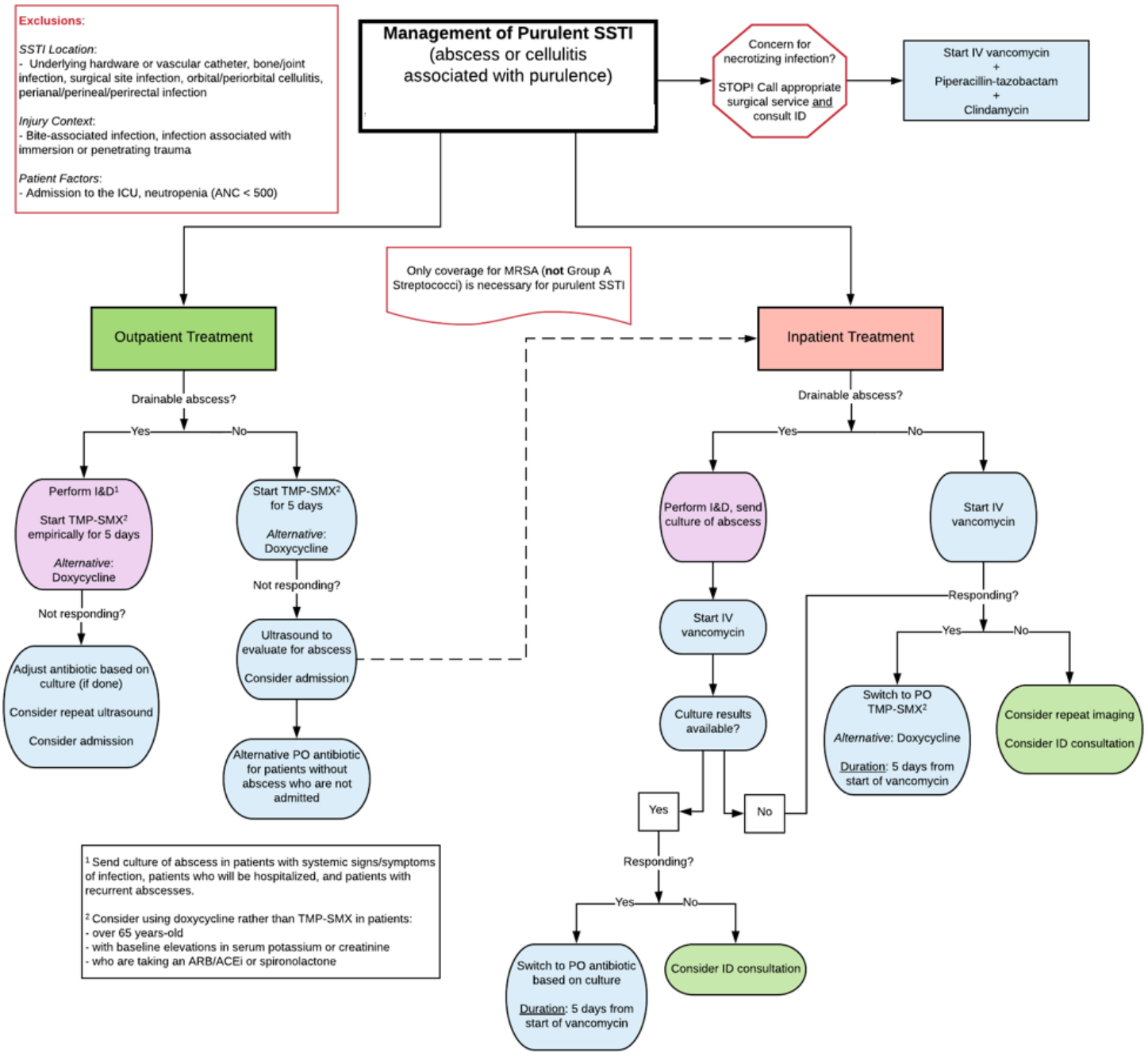
[4] Consider using doxycycline rather than TMP-SMX in patients:
- over 65 years-old
- with baseline elevations in serum potassium or creatinine
- who are taking an ARB/ACEi or spironolactone

Adjunctive Therapies for Non-Purulent SSTI:

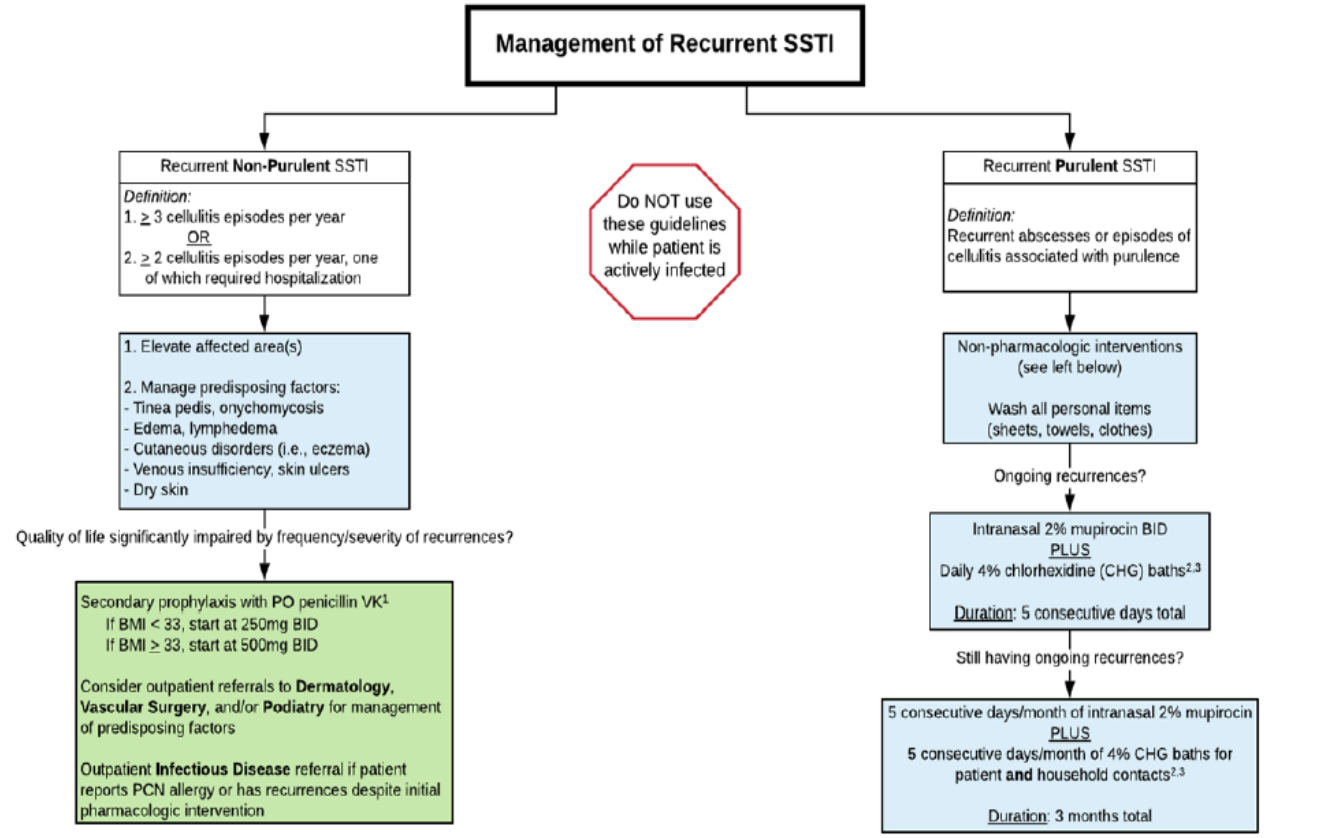
- Leg elevation
- Treatment of tinea pedis
- Adequate foot care/toenail clipping

Purulent Skin and Soft Tissue Infections (SSTI)

Order menu available for inpatient and ED



Recurrent Skin and Soft Tissue Infections (SSTI)



Non-Pharmacologic Interventions for Recurrent Purulent SSTI

Bathing Practices:
- Perform regular bathing and cleaning of hands
- Avoid reusing/sharing personal items (razors, towels)
- Avoid loofahs in the bath or shower

Laundering/Cleaning:
- Wash clothes regularly (bleach/hot water not necessary)
- Regularly clean high-touch surfaces (toilets, baths, phones, etc)
- Change towels daily

Skin Care:
- Cover draining wounds with clean, dry bandages
- Use pump or pour formats (not jars) if sharing moisturizer/lotion
- Keep fingernails trimmed

Injection Drug Use Guidance:
- Wash hands before injection and sterilize injection sites
- Do not share needles, do not lick needles

[1]The optimal duration of penicillin prophylaxis is unknown. Recommend continuing for 1 year, then continuing for life if patient fails off therapy.

[2] Chlorhexidine (CHG) exclusions:
- Avoid in patients with CHG allergy or sensitivity
- Avoid in patients with chronic, severe, generalized skin breakdown
- Avoid in patients receiving phototherapy or Sorafenib
- High-dose chemotherapy: avoid on the day of and for 24hr after infusions
- Full body radiation: avoid on the day of treatment
- Focal radiation: avoid irradiated areas on the day of treatment

[3]For CHG intolerant or CHG allergic patients, instead use twice weekly dilute bleach baths (1/4 cup per bath)

Vaccines for Adults With Splenectomy

The following vaccines (in addition to any age-appropriate vaccines) are recommended for asplenia patients:

Highly Recommended Vaccines		May Consider for Specific Populations	
• COVID-19 • Hib • Influenza • Meningococcal (conjugate & serogroup B)	• Pneumococcal (conjugate, 20-valent) • RSV • Tdap • Zoster	• Hepatitis A (HAV) • Hepatitis B (HBV) • HPV	• MMR • Mpox • Varicella

Timing of Vaccine Administration Relative to Splenectomy

Pre-operation	Post-operation
• Complete vaccination **> 2 weeks prior** to procedure. • For vaccination series with **multiple doses**: **INITIATE ~10-12 weeks prior** to splenectomy, so recommended series can be COMPLETED > 2 weeks prior to procedure.	• If vaccination series cannot be initiated prior to splenectomy, **start at least 14 days after surgery** or prior to discharge, whichever comes first • If vaccines were administered **prior to postoperative day 14** (sooner than 2 weeks post-operative): **Repeat the vaccines 8 weeks AFTER the initial doses** were given. • Patients receiving other immunosuppressive treatment following splenectomy: The vaccination schedule is further modified. For example, **resumption of vaccines ~3 months after treatment** has been reported.

Vaccination Schedule

Highly Recommended Vaccines		
Dose #1	**Dose #2**	**Boosters**
COVID-19	See Clinical Guidance for COVID-19 Vaccination for up-to-date recommendations. Local guidance can be found SFVAHCS COVID-19 Vaccine Resources	
HAEMOPHILUS B CONJUGATE (Hib)	N/A	N/A
INFLUENZA (1 dose annually)	N/A	N/A
MENINGOCOCCAL OLIGOSACCHARIDE CONJUGATE [MenACWY-CRM] (MENVEO)	≥ 8 weeks after dose 1	Every 5 years (off-label for ages >55)
MENINGOCOCCAL B [MenB-4C] (BEXSERO)	≥ 4 weeks after dose 1	1 year after completion of primary series, then every 2-3 years thereafter
PNEUMOCOCCAL 1. Received PCV 20 → series completed 2. Vaccine naïve → administer PCV 20 3. Received PPSV 23 only → administer PCV 20	N/A series completed after PCV 20	N/A
RSV [**age ≥75,** or **age 60-74 + risk factor**]	N/A	N/A
DIPHTHERIA / PERTUSSIS / TETANUS (Tdap)	N/A	Every 10 years
ZOSTER RECOMBINANT (Shingrix) [**age > 50**]	2-6 months after dose 1	N/A
Additional Vaccines to Consider		
Dose #1	**Dose #2**	**Dose #3**
HEPATITIS A (HAVRIX) †	6-12 months after dose 1	N/A
HEPATITIS B RECOMBINANT (ENGERIX-B) ‡	1 month after dose 1	6 months after dose 1
PAPILLOMAVIRUS HUMAN 9-VALENT (GARDASIL 9)	≥ 4 weeks after dose 1	≥ 4 weeks after dose 2
MPOX*	4 weeks after dose 1	N/A
MEASLES, MUMPS, AND RUBELLA (MMR)	>1 month after dose 1 in select patients	N/A
VARICELLA VIRUS (VARIVAX)	> 4-8 weeks after dose 1	N/A

*Service restricted

†**Risk factors for HAV:** International travelers, men who have sex with men, and individuals who use/inject illicit drugs, with occupational risk for exposure, who anticipate close contact with an international adoptee, and experiencing homelessness.

‡**Risk factors for HBV:** Infants born to mothers with HBV, individuals who inject drugs or share needles, sex partners of individuals with HBV, men who have sex with men, individuals who live with someone who has HBV, health care and public safety workers exposed to blood on the job, and people on dialysis.

Beta-Lactam Test Dosing Protocol

WHAT IS BETA-LACTAM TEST DOING?

A formalized process for evaluating patients with reported beta-lactam allergies. Those that are determined as low risk for an adverse reaction with a different beta-lactam antibiotic from their initial allergy, will receive a one-time test dose (10% of their full treatment dose) of an alternative beta-lactam under observation. If the patient tolerates this, they will receive a full dose (100% of treatment dose) 30 minutes later. If the patient tolerates both doses, they will continue on this antibiotic to treat their infection.

WHY ARE WE DOING THIS?

- Cross-Reactivity rates between different beta-lactam antibiotics are low. Therefore, patients with true penicillin or cephalosporin allergies can still receive many other cephalosporins and carbapenems
- By evaluating patients through a thorough allergy assessment, we can identify patients at low risk of having an adverse reaction with alternative beta-lactams which will allow the patient to receive a more effective, less toxic, and/or less costly antibiotics to treat their infections.

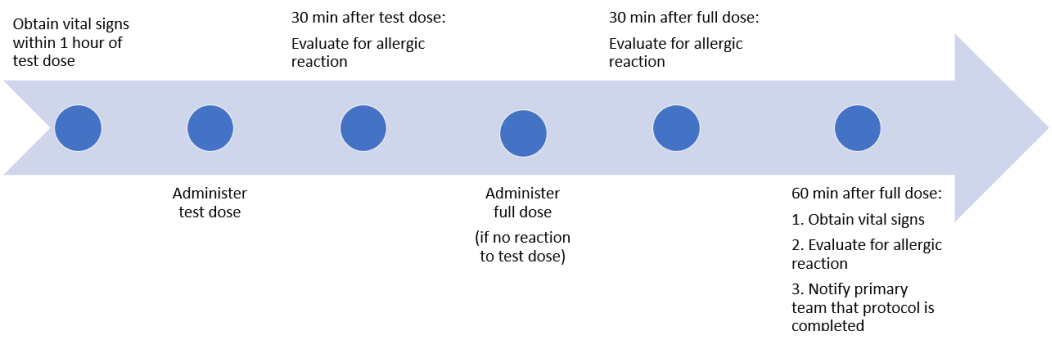
HOW ARE WE DOING THIS?

- A new order set is available to standardize the test dose, full dose, assessment, and monitoring
- Primary team can order Beta-Lactam Test Doses via the order set for eligible inpatients with a reported beta-lactam allergy AND an active infection in which a beta-lactam is indicated for treatment
- Case will be review by ID Pharmacist (pager: 415-223-8046) prior to proceeding
- Test doses will be conducted Monday through Friday from 10:00 to 14:00
- For patients with a history of severe, IgE mediated reactions, test doses should be administered in the TCU. All other patients may undergo this protocol outside of the TCU.
- If possible, systemic beta-blocker doses should be held for 24 hours prior to test dose
- Monitoring nurse will use new CPRS template to document vital signs obtained after doses

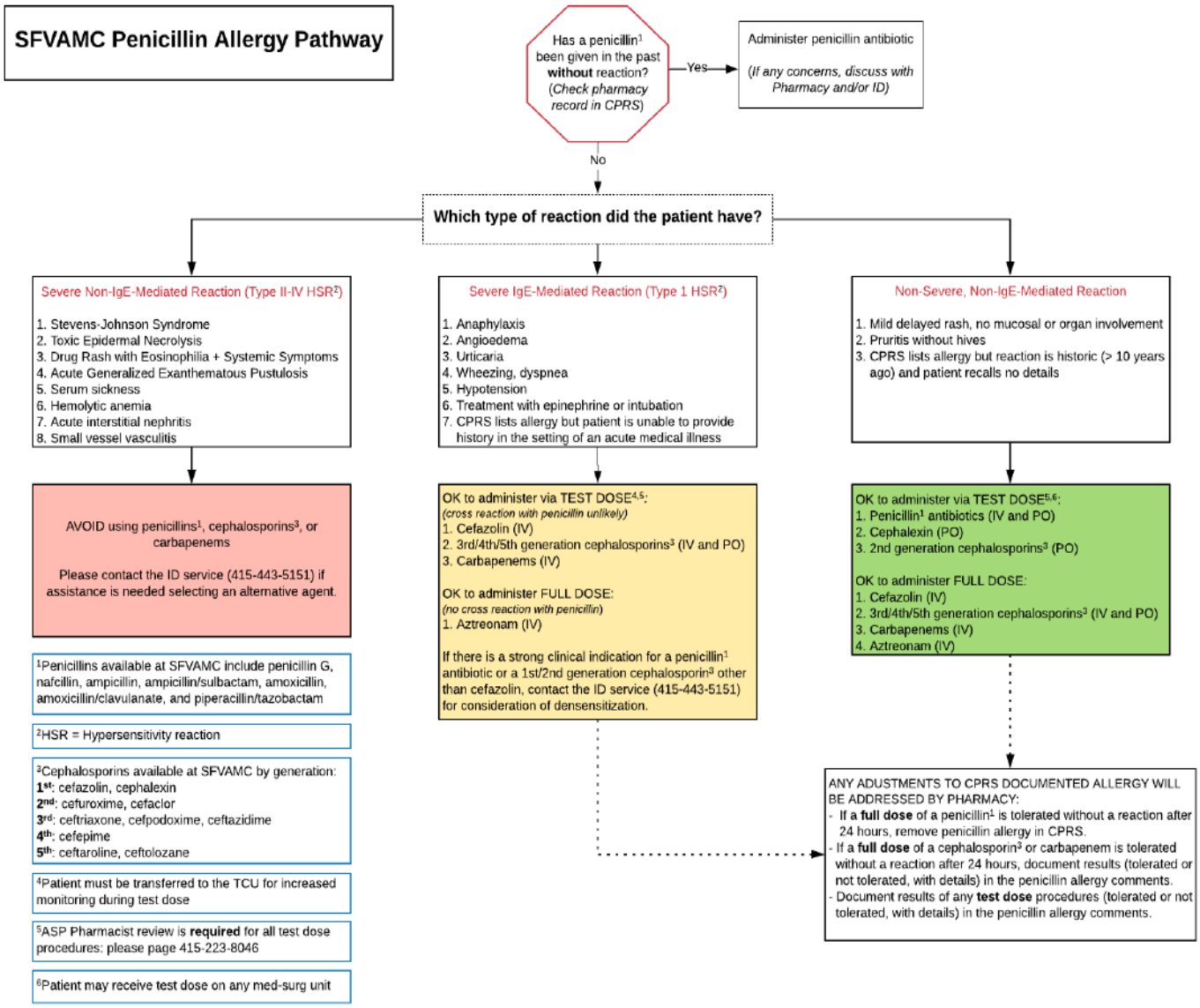
WHAT MEDICATIONS ARE NEEDED FOR THIS PROCESS?

- Order set available for inpatient use
- Pharmacy will send the antibiotic test dose and the **Rescue Medication Kit** that will include:
    - Epinephrine 0.3 mg pen x1
    - 0.9% NS 1 L bag x1
    - Diphenhydramine 50 mg vial x1
    - Methylprednisolone 125 mg vial x1
    - Glucagon 1 mg vial x1
    - Albuterol 0.083% 3 mL vials x2
- The full dose may be located in the pyxis machine or will be delivered by pharmacy

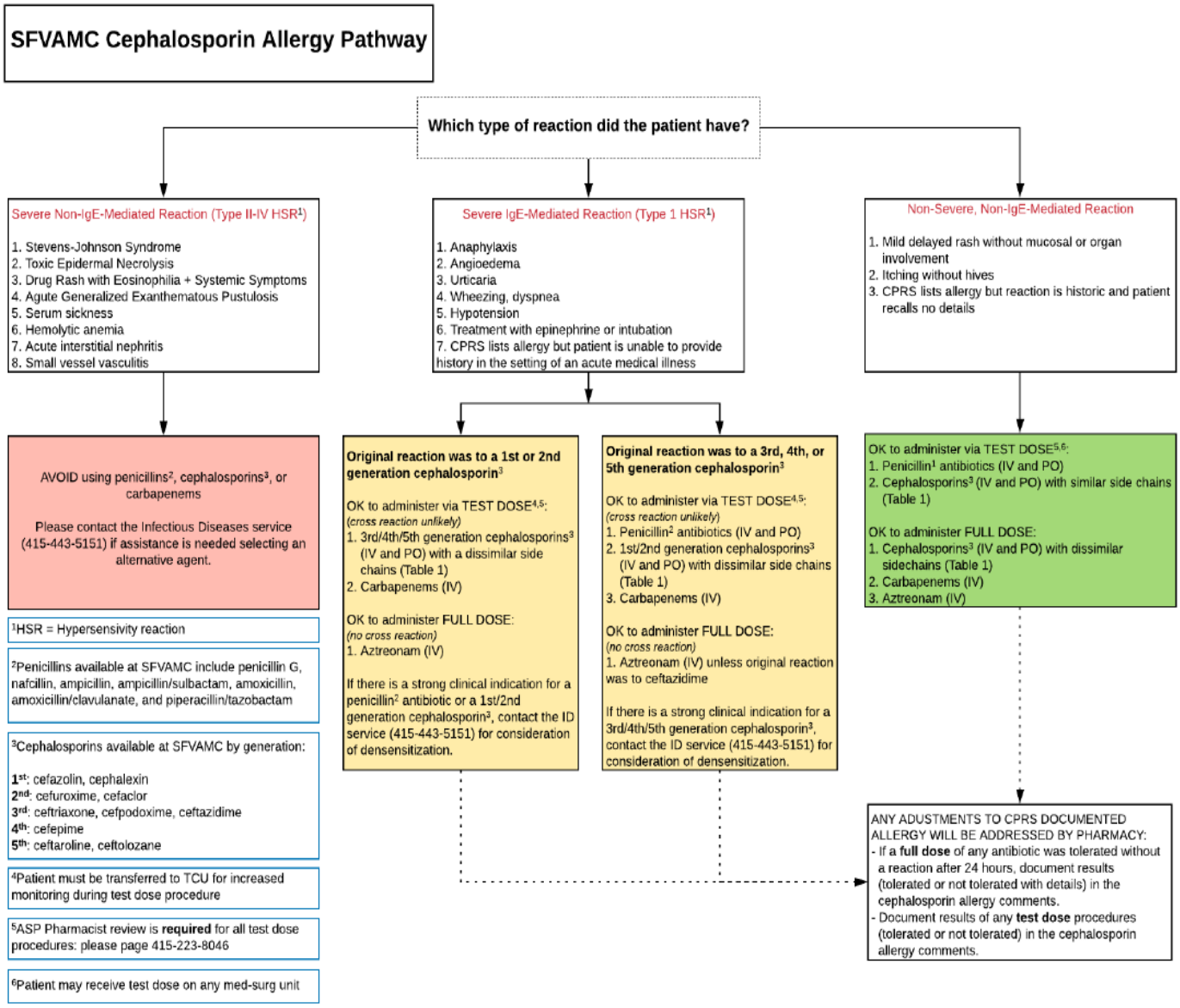
Overview of Beta-Lactam Test Dose Protocol



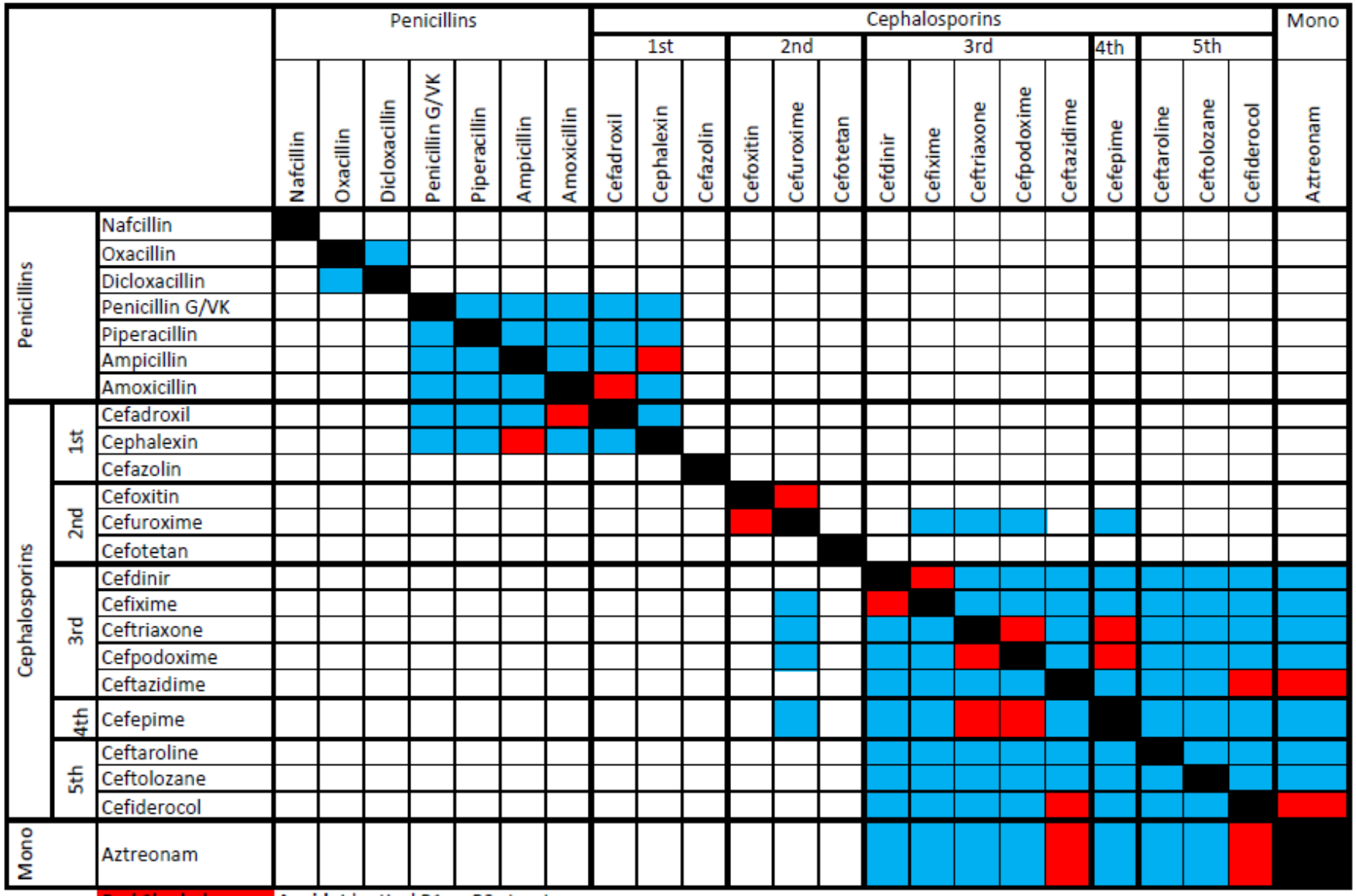
Penicillin Allergy Pathway for Beta-Lactam Test Dose



Cephalosporin Allergy Pathway for Beta-Lactam Test Dose



Beta-Lactam Cross Reactivity Table



Adapted from Zagursky RJ et al. Allergy Clin Immunol Pract (2017)6: 72-81

Inpatient Management of COVID-19

Scenario	Recommendation
Asymptomatic	Supportive care
Mild symptoms[1] , does not require O_2	Paxlovid (nirmatrelvir + ritonavir) x 5 days[2] • If contraindication to Paxlovid[3], Remdesivir x 3 days
Requires O_2 via NC	Remdesivir x 5 days[4] • If persistently ≥ 3-4L O_2 add dexamethasone • If rapidly increasing O_2 ≥ 3-4L & systemic inflammation[5] add baricitinib[6] (preferred) or tocilizumab[7] if contraindication to baricitinib
Requires O_2 via high-flow or non-invasive mechanical ventilation	Dexamethasone plus baricitinib[6] (preferred) or tocilizumab[7] if contraindication to baricitinib May consider remdesivir x 5 day course for select patients[4] • If started prior to progressing to high-flow or non-invasive mechanical ventilation • Immunocompromised patients not started on remdesivir
Requires invasive mechanical ventilation	Dexamethasone plus baricitinib[6] (preferred) or tocilizumab[7] if contraindication to baricitinib • For patients who started on remdesivir and progressed to requiring mechanical ventilation, may consider continuing remdesivir to complete 5 day treatment course

Remdesivir, Paxlovid, molnupiravir, and baricitinib are ONLY orderable through the COVID-19 order menu for inpatient use

[1]Symptomatic COVID-19 infection is defined as the presence of one or more of the following:
- Fever, chills, cough, shortness of breath, fatigue, muscle aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, diarrhea

[2]**Paxlovid** use beyond 5 days requires ID approval. Please page ID (443-5151) if a longer course is indicated

- eGFR ≥ 60 mL/min: nirmatrelvir 300 mg with ritonavir 100 mg PO BID x 5 days
- eGFR 30 - 59 mL/min: nirmatrelvir 150 mg with ritonavir 100 mg PO BID x 5 days
- eGFR < 30 mL/min and iHD*: nirmatrelvir 300 mg with ritonavir 100 mg PO on day 1, then nirmatrelvir 150 mg with ritonavir 100 mg PO daily x 4 days
    - iHD: when scheduled dose falls on a dialysis day, administer after dialysis

*Dosing for patients with eGFR < 30 mL/min or iHD is not recommended according to the manufacturer; however, the risk of toxicity is likely to be minimal with a 5-day course of treatment. Recommendations are based on retrospective data in a limited number of patients.

[3]**Paxlovid** is contraindicated with drugs that are highly dependent on CYP3A for clearance. Many drug-drug interactions can be safely managed. However, some interactions cannot and may result in serious adverse reactions (ex. Amiodarone) or treatment failure with Paxlovid (ex. St John's Wort). The following resource can be utilized to assess for drug interactions Liverpool COVID-19 Drug Interactions website

[4]**Remdesivir** use longer than 5 days requires ID approval. Please page ID (443-5151) if a longer course is indicated

[5]Systemic Inflammation is defined as an elevation of ≥ 1 of the following: CRP, D-dimer, LDH, or ferritin

[6]**Baricitinib** should be continued for up to 14 days or until hospital discharge, whichever comes first. Patients should not receive both tocilizumab and baricitinib. Baricitinib must be approved by ID (443-5151). If patients have any of the following contraindications to baricitinib, consider using tocilizumab instead:
- eGFR < 15 mL/min or on renal replacement therapy (CRRT, HD, PD)
- Absolute neutrophil count < 500
- Platelets < 50,000 / mm3
- AST/ ALT exceeding 5 times the upper limit of normal
- Active tuberculosis (TB), bacterial, fungal, or viral infection aside from COVID-19

[7]**Tocilizumab** one time-dose may be considered for inpatients that do not qualify for baricitinib. Patients should not receive both tocilizumab and baricitinib. Tocilizumab must be approved by the ID (443-5151). Contraindications to tocilizumab include:
- History of or high risk for gastrointestinal perforation
- Absolute neutrophil count < 500
- Platelets < 50,000 / mm3
- AST/ ALT exceeding 5 times the upper limit of normal
- Active tuberculosis (TB), bacterial, fungal, or viral infection aside from COVID-19

Guidelines for Procalcitonin Use

WHAT IS PROCALCITONIN

- Procalcitonin is a biomarker that has been used to aid in diagnosis of bacterial infection or sepsis
- May be used to guide antibiotic treatment decisions but **should be used in conjunction with laboratory findings** and **should not overrule clinical judgement**

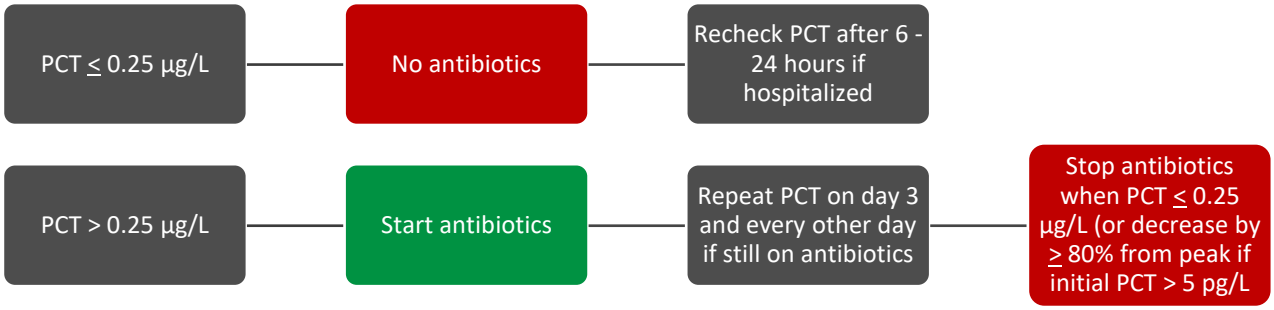
INDICATIONS

WHEN IS PROCALCITONIN RECOMMENDED	WHEN IS PROCALCITONIN NOT RECOMMENDED
Decision making about discontinuation of antimicrobials in: • Non-critically ill ICU patients • Hospitalized for lower respiratory tract infections	Severely immunocompromised (solid organ transplant patients, BMT patients, cancer patients receiving active treatment, HIV positive patients with CD4 <200, patients receiving immunosuppressive drugs other than prednisone)

HOW DO YOU USE PROCALCITONIN?

SUSPECTED RESPIRATORY INFECTION IN STABLE PATIENTS

- Not critically ill or high-risk (e.g., CAP PSI $\leq$ IV / CURB 65 $\geq$ 2, COPD GOLD > 111)
- Not severely immunocompromised (other than corticosteroids)
- No other concomitant infection requiring antibiotics



SUSPECTED SEPSIS IN CRITICALLY ILL PATIENTS

- Not severely immunocompromised (other than corticosteroids)
- Not on antibiotics for chronic bacterial infection (e.g., endocarditis, osteomyelitis)

LIMITATIONS

- Serum procalcitonin may be elevated due to non-infectious causes based on various patient factors
- The time course of bacterial infection and type of infectious process may impact the serum procalcitonin level

References

1. Samsudin, Intan, and Samuel D Vasikaran. "Clinical Utility and Measurement of Procalcitonin." The Clinical biochemist. Reviews vol. 38,2 (2017): 59-68.
2. Huang, David T et al. "Procalcitonin-Guided Use of Antibiotics for Lower Respiratory Tract Infection." *The New England journal of medicine* vol. 379,3 (2018): 236-249. doi:10.1056/NEJMoa1802670
3. Kamat, Ishan S et al. "Procalcitonin to Distinguish Viral From Bacterial Pneumonia: A Systematic Review and Meta-analysis." *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America* vol. 70,3 (2020): 538-542. doi:10.1093/cid/ciz545
4. Daubin, Cédric et al. "Procalcitonin algorithm to guide initial antibiotic therapy in acute exacerbations of COPD admitted to the ICU: a randomized multicenter study." *Intensive care medicine* vol. 44,4 (2018): 428-437. doi:10.1007/s00134-018-5141-9

AmpC β-Lactamases Mediated-Resistance

Background:

Production of β-lactamase is one of the main mechanisms of how microbes can confer beta-lactam antibiotic resistance. AmpC β-Lactamase-Producing Enterobacteriaceae are gram-negative bacteria which produce β-lactamases through induction of the AmpC pathway. When the AmpC gene is induced (expressed), susceptibility of beta-lactam antibiotics is limited.

Resistance mechanism of AmpC includes:

- Plasmid-mediated resistance (ex: *Klebsiella pneumoniae*, *E. coli, Salmonella* spp.)
- Non-inducible chromosomal resistance due to mutations (ex: *E. coli*, *Shigella* spp., *Acinetobacter baumannii*)
- Inducible resistance (ex: *Enterobacter cloacae, Citrobacter freundii*)

What makes inducible resistance different from other resistance mechanism?

Inducible resistance is species and antibiotic dependent. Certain bacterial isolates such as *Hafnia alvei, Enterobacter cloacae, Citrobacter freundii, Citrobacter youngae, Klebsiella aerogenes* (*Enterobacter aerogenes*), *Yersinia enterocolitica* (collectively known by acronym HECK-Yes) are well known to have AmpC inducible resistance. HECK-Yes isolates may initially test as susceptible to certain beta-lactam antibiotics and 3rd generation cephalosporins, however non-susceptibility to these agents may occur after treatment is initiated.

- Strong Inducers of AmpC: Aminopenicillins, 1st generation cephalosporins, cefoxitin, cefotetan
- Weak Inducers of AmpC: Piperacillin/tazobactam, aztreonam, 3rd generation cephalosporins (Ceftazidime, ceftriaxone, cefotaxime)

HECK-Yes and Empiric/Definitive Antibiotic Therapy:

Due to exposure of beta-lactams which can induce resistance in HECK-Yes isolates, IDSA recommends avoiding antibiotics known to be strong and weak inducers of AmpC in HECK-Yes pathogens including piperacillin/tazobactam, aztreonam, and 3rd generation cephalosporins (ceftriaxone, cefotaxime, ceftazidime).

"HECK-Yes" ***Hafnia alvei*** ***Enterobacter cloacae*** ***Citrobacter freundii or Citrobacter youngae*** ***Klebsiella aerogenes (Enterobacter aerogenes)*** ***Yersinia enterocolitica***	
Consider for Empiric/Definite Antimicrobial Therapy	Ertapenem Cefepime (MIC ≤ 2) Fluroquinolones Trimethoprim/Sulfamethoxazole
Avoid	Aminopenicillins, 1st generation cephalosporins, cefoxitin, cefotetan Piperacillin/tazobactam Aztreonam 3rd generation cephalosporins (ceftriaxone, cefotaxime, ceftazidime)

References:

1. Enterobacterales Bloodstream Infection Adult IV to PO Step-Down Guideline. Infectious Diseases Management Program at UCSF. https://idmp.ucsf.edu/content/enterobacterales-bloodstream-infection-adult-iv-po-step-down-guideline. Published 2022. Accessed April 9, 2022.
2. https://www.idstewardship.com/heck-yes-get-amped-updates-ampc-harboring-bacteria/. Published 2022. Accessed April 9, 2022.
3. Pranita T, Aitken S, Bonomo R, Mathers A, van Duin D, Clancy C. IDSA Guidance on the Treatment of Antimicrobial-Resistant Gram-Negative Infections: Version 2.0. Idsociety.org. https://www.idsociety.org/practice-guideline/amr-guidance-2.0/#. Published 2022. Accessed April 9, 2022.

Antibiotic Spectrum of Activity

- Good activity = reliable coverage; often a good empiric drug option (depends on infectious etiology)
- Moderate activity = inconsistent coverage; may be treatment option in certain cases; confirm susceptibility
- Poor activity = Unreliable coverage; not a treatment option for this pathogen
- Enteric gram-negative rods = *Escherichia Coli, Proteus spp., Klebsiella ssp.*
- Anaerobes = GI: *Bacteroides Fragilis;* Oral: Peptostreptococci
- Atypicals = *Legionella spp., Mycoplasma pneumoniae, Chlamydia pneumoniae*

Antibiotic	Good Activity	Moderate Activity	Poor Activity
Penicillin	Most streptococci Anaerobes oral Treponema palladium	Enterococci	Everything else
Nafcillin	MSSA Streptococci		Everything else
Amoxicillin Ampicillin	Enterococci Streptococci Anaerobes oral	Enteric gram-negative rods Haemophilus	Everything else
Amoxicillin-clavulanate (Augmentin) Ampicillin-sulbactam (Unasyn)	Enterococci Streptococci Haemophilus Anaerobes GI and oral Enteric gram negative rods Acinetobacter (Unasyn)	MSSA	MRSA Pseudomonas ESBL and AmpC producers
Piperacillin-Tazobactam (Zosyn)	Pseudomonas Enterococci Streptococci Anaerobes GI and oral Enteric gram negative rods	MSSA	MRSA ESBL and AmpC producers
Cefazolin Cephalexin	MSSA Streptococci Anaerobes oral Enteric gram-negative rods (URINE ONLY)	Enteric gram-negative rods (outside of URINE)	MRSA Enterococci Pseudomonas ESBL and AmpC producers Anaerobes GI
Ceftriaxone Cefpodoxime	Streptococci Anaerobes oral Enteric gram-negative rods	MSSA	MRSA Enterococci Pseudomonas ESBL and AmpC producers Anaerobes GI
Cefepime	Pseudomonas Enteric gram-negatives Anaerobes oral	MSSA AmpC producers Acinetobacter	MRSA Enterococci ESBL producers Anaerobes GI
Ceftazidime	Pseudomonas Enteric gram-negative rods		Everything else
Ceftaroline	MSSA, MRSA Streptococci Anaerobes oral Enteric gram-negative rods	Enterococci	Pseudomonas Anaerobes GI ESBL and AmpC producers
Ertapenem	Enteric gram-negative rods ESBL producers MSSA Streptococci Anaerobes GI and oral	AmpC producers	MRSA Enterococci Pseudomonas

Antibiotic	Good Activity	Moderate Activity	Poor Activity
Meropenem	Pseudomonas Enteric gram-negative rods ESBL producers MSSA Streptococci Anaerobes GI and oral	AmpC producers Acinetobacter Enterococci	MRSA
Aztreonam	Pseudomonas Enteric gram negative rods	Acinetobacter	Gram positive organisms Anaerobes GI and oral ESBL and AmpC producers
Vancomycin Dalbavancin Daptomycin Linezolid	MRSA MSSA Streptococci C. Difficle (Vancomycin PO) Enterococci Anaerobes oral	M. tuberculosis (Linezolid)	Gram negative organisms Anaerobes GI
Ciprofloxacin	Pseudomonas Enteric gram negative rods ESBL and AmpC producers	MSSA	Anaerobes GI and oral Streptococci Enterococci
Levofloxacin Moxifloxacin	Streptococci Enteric gram negative rods ESBL and AmpC producers Pseudomonas (Levofloxacin) Haemophilus Anaerobes oral Anaerobes GI (Moxifloxacin)	MSSA	Enterococci Anaerobes GI (Levo) Pseudomonas (Moxi)
Gentamicin Tobramycin Amikacin	Enteric gram negative rods ESBL and AmpC producers	Pseudomonas Enterococci (Gentamicin)	Gram-positive organisms Anaerobes GI and oral
Doxycycline Minocycline	MRSA, MSSA Atyipicals	Streptococci Anaerobes oral Enteric gram negative rods (Minocycline)	Enterococci Anaerobes GI Enteric gram negative rods (Doxycycline)
Azithromycin	Atypicals H. Pylori	Enteric gram-negative rods Streptococci Anaerobes oral	Everything else
Metronidazole	Anaerobes GI	C. Difficle H. Pylori	Everything else
Nitrofurantoin	Enteric gram-negative rods ESBL producer	Staphylococci spp. Enterococci	Everything else
Fosfomycin	E. Coli ESBL E. Coli	Pseudomonas Proteus and Klebsiella Enterococci	Everything else
Sulfamethoxazole-trimethoprim (Bactrim)	MSSA, MRSA Streptococci Enteric gram negative rods ESBL and AmpC producers Stenotrophomonas Pneumocystis jirovecii	Strep Pnemoniae	Pseudomonas Enterococci Anaerobes GI and oral
Clindamycin	Streptococci	MSSA, MRSA Anaerobes oral	Enterococci Gram negatives Anaerobes GI

Reference: Adapted from Sanford Guide Web Edition: Sanford Guide: Antibacterial Agents: Spectra of Activity

IV Antimicrobial Dosing

- Renal adjustments based on creatine clearance (mL/min) unless stated otherwise
- For weight-based doses, use ideal body weight (IBW) unless…
  - Total body weight (TBW) is less than IBW, use TBW
  - TBW is > 120% of IBW, use adjusted body weight (adjBW)

Acyclovir	> 50	25-50	10-25	< 10	iHD	CRRT
Non-CNS HSV infections	5 mg/kg q8h	5 mg/kg q12h	5 mg/kg q24h	2.5 mg/kg q24h	2.5 mg/kg x1 now, then qPM	5 mg/kg q24h
- HSV meningitis - VZV infections	10 mg/kg q8h	10 mg/kg q12h	10 mg/kg q24h	5 mg/kg q24h	5 mg/kg x1 now, then qPM	10 mg/kg q12h
Amikacin	Refer to "Aminoglycoside dosing and therapeutic monitoring" on pages 42-43					
Amphotericin B Liposomal	No renal dose adjustments					
Fungal infections	5 mg/kg q24h (round to nearest 25 mg)					
Mold prophylaxis	3 mg/kg q24h (round to nearest 25 mg)					
+Hydration & pre-medications	0.9% NaCl 500-1000 mL IV pre- and post-infusion Give 1 hour prior to infusion: acetaminophen 500-650 mg PO/IV and diphenhydramine 25-50 mg PO/IV					
Ampicillin	> 50	10-50	< 10	iHD	CRRT	
- Meningitis - Endovascular infection - Bone & joint infection	2 gm q4h	2 gm q6h	1 gm q8h	2 gm q12h	2 gm q6h	
Uncomplicated infection	2 gm q6h	1 gm q6h	1 gm q12h	2 gm qPM	2 gm q8h	
Ampicillin-Sulbactam (Unasyn®)	≥ 30	15-30	< 15	iHD	CRRT	
Standard dose	3 gm q6h	3 gm q12h	3 gm q24h	3 gm q12h	3 gm q6h	
Carbapenem-resistant *Acinetobacter*	3 gm q4h	3 gm q8h	3 gm q12h	3 gm q12h	3 gm q4h	
Azithromycin	No renal dose adjustments					
Severe community-acquired pneumonia	500 mg q24h					
Non-severe community-acquired pneumonia	500 mg x1, then 250 mg q24h					
Aztreonam	> 50	31-50	10-30	<10	iHD	CRRT
Meningitis	2 gm q6h	2 gm q8h	2 gm q12h	1 gm q12h	2 gm x1 now, then qPM	2 gm q12h
UTI	1 gm q8h	1gm q8h	1 gm q12h	1 gm q24h		
All other indications (incl. when combined with Avycaz®)	2 gm q8h	2 gm q8h	2 gm q12h	1 gm q12h		
Cefazolin	> 30	10-29	< 10	iHD	CRRT	
- Uncomplicated SSTI - UTI	1 gm q8h	1 gm q12h	1 gm q24h	2 gm x1 then 2 gm post HD or 2 gm/ 2 gm/ 3 gm post HD	2 gm q12h	
All other indications	2 gm q8h	2 gm q12h				
Surgical prophylaxis	Weight < 120 kg = 2 gm per dose Weight ≥ 120 kg = 3 gm per dose					
Cefepime	> 60	30-60	10-29	< 10	iHD	CRRT
- Severe infections - CNS - Febrile Neutropenia - Pseudomonas	2 gm q8h	2 gm q12h	2 gm q24h	1 gm q24h	2 gm post HD 3x week	1 gm q8h
Non-severe infections	2gm q12h	2 gm q24h	1 gm q24h	500 mg q24h	1 gm on day 1, then 500 mg IV qPM OR 500 mg post HD 3x week	1 gm q8h
Cystitis	1 gm q12h	1 gm q24h	500 mg q24h	500 mg q24h		

Cefiderocol	>120	60-119	30-59	15-29	<15	iHD	CRRT
All indications	2 gm q6h	2 gm q8h	1.5 gm q8h	1 gm q8h	750 mg q8h	750 mg q12h	Based on effluent rate: ≤ 2L/hr = 1.5 gm q12h 2.1-3 L/hr = 2 gm q12h 3.1 – 4 L/hr = 1.5 gm q8h > 4 L/hr = 2 gm q8h

Ceftaroline	> 50	31-50	15-30	< 15	iHD	CRRT
Standard dose	600 mg q8h	400 mg q8h	300 mg q8h	200 mg q8h	200 mg q8h	600 mg q12h
SSTIs	600 mg q12h	400 mg q12h	300 mg q12h	200 mg q12h	200 mg q12h	400 mg q12h

Ceftazidime	> 50	31-50	15-30	< 15	iHD	CRRT
Standard dose	2 gm q8h	2 gm q12h	2 gm q24h	1 gm q24h	1 gm IV x1 now and post-HD	2 gm IV q12h

Ceftazidime-Avibactam (Avycaz®)	> 50	31-50	16-30	6-15	≤ 5	iHD	CRRT
Standard dose	2.5 gm q8h	1.25 gm q8h	0.94 gm q12h	0.94 gm q24h	0.94 gm q48h	0.94 gm qPM	2.5 gm q8h

Ceftolozane-Tazobactam (Zerbaxa®)	>50	30-50	15-29	< 15	iHD	CRRT
Standard dose	1.5 gm q8h	750 mg q8h	375 mg q8h	No data	750 mg x1, then 150 mg q8h	No data
Severe infection	3 gm q8h	1.5 gm q8h	750 mg q8h		2.25 gm x1, then 450 mg q8h	

Ceftriaxone	No renal dose adjustment
Mild infections (cystitis) and/or TBW < 50 kg	1 gm q24h
Standard dose	2 gm q24h
Meningitis and Enterococcal endocarditis (synergy)	2 gm q12h

Ciprofloxacin	> 50	30-50	< 30	iHD	CRRT
Standard dose	400 mg q12h		400 mg q24h	400 mg qPM	400 mg q12h
- Pseudomonas - Severe infection	400 mg q8h	400 mg q12h	400 mg q24h		

Clindamycin	No renal dose adjustment
Standard dose	600 mg q8h
Necrotizing SSTI, Group A streptococcus, or TBW > 120 kg	900 mg q8h

Colistin	**No renal dose adjustment**
Standard dose	5 mg/kg x1 loading dose, then contact ID/ASP Pharmacist for maintenance dose

Dalbavancin	≥ 30	< 30	iHD
SSTI	1500 mg x1	1000 mg x1	1500 mg x1
Severe Infection	1500 mg on day 1 and 8	1000 mg on day 1 and 8	1500 mg on day 1 and 8

Daptomycin	≥ 30	< 30	iHD	CRRT
Mild to moderate infection	4-6 mg/kg q24h	4-6 mg/kg q48h	4-6 mg/kg IV q48h (evening)	8-10 mg/kg q48h
Severe infection	8-10 mg/kg q24h	8-10 mg/kg q48h	8-10 mg/kg IV q48h (evening)	6 mg/kg q24h
Enterococcal infection	10 - 12 mg/kg q24h	10-12 mg/kg q48h	10-12 mg/kg IV q48h (evening)	6 mg/kg q24h

Doxycycline	No renal dose adjustment)
Standard dose	100 mg q12h

Eravacycline	No renal dose adjustment	Severe hepatic impairment	Strong CYP3A4 Inducer
Standard dose	1 mg/kg q12h	1 mg/kg q12 x2 doses, then 1 mg/kg q24	1.5 mg/kg q12h

Ertapenem	≥ 30	<30	iHD	CRRT
Standard dose	1 gm IV q24h	500 mg IV q24h	500 mg IV x1 then qPM or 1 gm post HD 3x week	1 gm IV q24h

Fluconazole	> 50	10-50	< 10	iHD	CRRT
Oropharyngeal infection	100 mg q24h	50% of target dose q24h	25% of target dose q24h	100 mg x1 now, then post-HD	200 mg q24h
Esophageal infection	200 mg q24h			200 mg x1 now, then post-HD	400 mg q24h
Systemic/ Severe infections	≤ 80 kg: 400 mg q24h 81-100 kg: 600 mg q24h > 100 kg: 800 mg q24h			400 mg x1 now, then post-HD	800-1200 mg per day, divided q12-24h

Ganciclovir	> 70	50-69	25-49	10-24	< 10 and iHD	CRRT
CMV treatment	5 mg/kg q12h	2.5 mg/kg q12h	2.5 mg/kg q24h	1.25 mg/kg q24h	1.25 mg/kg 3x weekly (post HD if HD)	2.5-5 mg/kg q12-24h
CMV prophylaxis	2.5 mg/kg q12h	2.5 mg/kg q24h	1.25 mg/kg q24h	0.625 mg/kg q24h	0.625 mg/kg 3x weekly (post HD if HD)	No data

Gentamicin	Refer to "Aminoglycoside dosing and therapeutic monitoring" on pages 42-43

Imipenem-Cilastatin	> 60	30-60	15-30	< 15	iHD	CRRT
- Standard dose - Nocardia	500 mg q6h	250 mg q6h	250 mg q8h	Use alternative agent	500 mg q12h	No data
Nontuberculous mycobacteria	1 gm q12h	500 mg q12h	250 mg q12h			

Imipenem-Cilastatin-Relebactam (Recarbrio®)	> 90	60-90	30-60	15-30	< 15	iHD	CRRT
Standard dose	1.25 gm q6h	1 gm q6h	750 mg q6h	500 mg q6h	No data	500 mg q6h	No data

Isavuconazole	No renal dose adjustment
All indications	372 mg q8h x 6 doses, then 372 mg q24h

Levofloxacin	> 50	20-49	< 20	iHD	CRRT
- UTI - Epididymitis	500 mg q24h	500 mg x1, then 250 mg q24h	500 mg x1, then 250 mg q48h	500 mg x1, then 250 mg q48h	750 mg IV x1, then 250 mg q24h
- Pseudomonas - Other indications	750 mg q24h	750 mg q48h	750 mg x1, then 500 mg q48h	750 mg x1, then 500 mg q48h	750 mg IV x1, then 500 mg q24h

Linezolid	No renal dose adjustment
All indications	600 mg IV q12h

Meropenem	> 50	26-50	10-25	< 10	iHD	CRRT
- Standard dose - *Pseudomonas*	1 gm q8h	1 gm q12h	500 mg q12h	500 mg q24h	500 mg x1, then QPM	1 gm q8h
- Meningitis - *Acinetobacter*	2 gm q8h	2 gm q12h	1 gm q12h	1 gm q24h	1 gm x1, then QPM	1 gm q8h

Metronidazole	≥ 10	< 10	iHD and CRRT
Standard dose	500 mg q8h	500 mg q12h	500 mg q8h
Intra-abdominal infection	500 mg q12h		500 mg q12h
C. difficile infection	500 mg q8h		500 mg q8h

Micafungin	No renal dose adjustment
Standard dose	100 mg q24h
Esophageal candidiasis	150 mg q24h
Neutropenia Antifungal Prophylaxis	50 mg or 100 mg q24h

Minocycline	No renal dose adjustment
Standard dose	200 mg once, then 100 mg q12h
- Carbapenem-resistant - *Acinetobacter* - *Stenotrophomonas maltophilia*	200 mg q12h

Nafcillin	No renal dose adjustment
Meningitis and severe infections (ex: endocarditis)	2 gm q4h
Uncomplicated infection	1 gm q6h

Penicillin G	> 50	10-50	< 10	iHD	CRRT
- Neurosyphilis - Meningitis - Prosthetic Joint	4 million units q4h	3 million units q4h	3 million units q6h	2 million units q6h	3 million units q4h
- Endovascular - Bacteremia	3 million units q4h	3 million units q6h	2 million units q6h	2 million units q8h	3 million units q6h
Other indications	3 million units q6h	2 million units q6h	1 million units q6h	2 million units q12h	2 million units q6h

Piperacillin-Tazobactam (Zosyn®)	> 40	20-40	< 20 and iHD	CRRT
- Pseudomonas - Severe infections	4.5 gm q6h	4.5 gm q8h	4.5 gm q12h	4.5 gm q8h
Standard dose	4.5 gm q8h	3.375 gm q8h	4.5 gm q12h	
Sepsis loading dose	4.5 gm once			

Remdesivir	No renal dose adjustment
COVID-19 infection	200 mg x1, then 100 mg q24h

Rifampin	No renal dose adjustment
Mycobacterial infections	600 mg q24h
Prosthetic device infections	300 mg q12h
Endocarditis	300 mg q8h

Sulfamethoxazole-Trimethoprim (Bactrim®)*	**> 30**	**15-30**	**< 15**	**iHD**	**CRRT**
- Systemic GNR infections - *Nocardia*	10 mg/kg/day divided q6-12h	5 mg/kg/day divided q6-12h	2.5 mg/kg q24h	2.5-5 mg/kg x1 now and qPM	5-7.5 mg/kg/day divided q12h
- *Pneumocystis* pneumonia - CNS infections	15-20 mg/kg/day divided q6-12h	7.5-10 mg/kg/day divided q12-24h	4-5 mg/kg q24h	5-10 mg/kg x1 now and qPM	10-15 mg/kg/day divided q6-12h
***Note:**	Calculated dose is based on **trimethoprim** component. IBW is preferred dosing weight. Use TBW if less than IBW and adjBW if TBW > 120% of IBW.				

Tigecycline	**No renal dose adjustment**	**Severe hepatic impairment**
Standard dose	100 mg x1, then 50 mg q12h	100 mg x1, then 25 mg q12h
Tobramycin	Refer to "Aminoglycoside dosing and therapeutic monitoring" on pages 42-43	
Vancomycin	Refer to "Empiric vancomycin dosing and monitoring" on pages 44-45	
Voriconazole	≥ 50	< 50
- All infections	6 mg/kg q12h x 2 doses, then 4 mg/kg q12h	Avoid: IV vehicle accumulates; consider PO

PO Antimicrobial Dosing

- Renal adjustments based on creatine clearance (mL/min) unless stated otherwise
- For weight-based doses, use ideal body weight (IBW) unless…
  - Total body weight (TBW) is less than IBW, use TBW
  - TBW is > 120% of IBW, use adjusted body weight (adjBW)

Acyclovir	≥ 25	10-24	< 10	iHD
Herpes simplex (HSV), initial episode	400 mg TID	200 mg TID	200 mg BID	200 mg BID
HSV treatment, recurrent immunosuppressed	400 mg TID	200 mg TID	200 mg BID	200 mg BID
HSV treatment, recurrent immunocompetent	800 mg BID x 5 days or 800 mg TID x 2 days	200 mg TID	200 mg BID	200 mg BID
HSV suppression or prophylaxis	400 mg PO BID	200 mg BID	200 mg BID	200 mg BID
Herpes zoster treatment	800 mg PO 5 x daily	800 mg TID	400 mg BID	400 mg BID
Varicella zoster (VZV) uncomplicated infection	800 mg PO 5 x daily	800 mg TID	400 mg BID	400 mg BID
VZV prophylaxis, immunocompromised	800 mg BID or 200 mg 3 to 5 x daily	200 mg TID	200 mg BID	200 mg BID
Amoxicillin	≥ 30	10-29	< 10	iHD
Cystitis	500 mg TID	500 mg BID	500 mg daily	500 mg daily
Prosthetic joint chronic suppression	1 gm TID or BID	500 mg BID	500 mg daily	500 mg daily
All other infections	1 gm TID	1 gm BID	500 mg BID	500 mg BID
Amoxicillin-Clavulanate (Augmentin®)	≥ 30	10-29	< 10	iHD
All indications	875/125 mg BID	500/125 mg BID	500/125 mg daily	500/125 mg qPM
Atovaquone	No renal dose adjustment			
Pneumocystis jirovecii pneumonia treatment	750 mg BID			
Pneumocystis jirovecii pneumonia prophylaxis	1500 mg daily			
Azithromycin	Dose (no renal dose adjustment)			
Non-severe pneumonia	500 mg on day 1, then 250 mg daily			
Severe pneumonia	500 mg daily			
Cefpodoxime	≥ 30		< 30	iHD
Standard dose	200 mg BID		200 mg daily	200 mg qPM
Skin and soft tissue infection	400 mg BID		400 mg daily	200 mg qPM
- Uncomplicated cystitis - Streptococcal pharyngitis	100 mg BID		100 mg daily	100 mg qPM
Cefuroxime axetil	≥ 30	10-29	< 10	iHD
Standard dose	500 mg BID	250 mg BID	250 mg daily	250 mg daily
Cephalexin	≥ 30	15-29	< 15	iHD
Standard dose	500 mg QID or 1,000 mg PO TID	500 mg BID	500 mg daily	500 mg qPM
- Uncomplicated cystitis - Streptococcal pharyngitis	500 mg BID	250 mg BID	250 mg daily	250 mg qPM
Ciprofloxacin	> 50	30-50	< 30	iHD
Standard dose	500 mg PO BID		500 mg daily	500 mg QPM
- Pseudomonas infection - Blood stream infection	750 mg BID	500 mg BID		

Clindamycin	No renal dose adjustment			
Standard dose	450 mg q8h			
Skin and Soft Tissue infection (SSTI)	Weight-Based (using total body weight): 60 – 90kg: 300mg PO q8h 90 – 120kg: 450mg PO q8h 120 – 180kg: 450mg PO q6h >180 kg: 600mg PO q6h			
Dapsone	No renal dose adjustment			
Pneumocystis jirovecii pneumonia prophylaxis or treatment	100 mg daily			
Doxycycline	No renal dose adjustment			
Standard dose	100 mg BID			
Post-exposure sexually transmitted infection prophylaxis (Doxy-PEP)	200 mg PRN within 24-72 hr after condomless sex			
Ethambutol	>30		< 30	iHD
Tuberculosis	15 mg/kg daily		20-25 mg/kg 3 x weekly	20-25 mg/kg post-HD
Fluconazole	> 50	10-50	< 10	iHD
Oropharyngeal infection	100 mg daily	50% of target dose daily	25% of target dose daily	100 mg post-HD
Esophageal infection	200 mg daily			200 mg post-HD
Systemic/ Severe infection	≤ 80 kg: 400 mg daily 81-100 kg: 600 mg daily > 100 kg: 800 mg daily			400 mg post-HD
Fosfomycin	> 50		< 50	
Uncomplicated cystitis, female	3 gm x1 dose			
Complicated cystitis	3 gm every 2 days x 3 doses		3 gm every 3 days x 3 doses	
Isavuconazole	No renal dose adjustment			
All indications	372 mg PO q8h x 6 doses, then 372 mg daily			
Isoniazid	No renal dose adjustment			
Prevention of tuberculosis	300 mg daily			
Treatment of tuberculosis	300 mg daily or 15 mg/kg TBW (up to 900 mg) 2-3 times weekly			
Levofloxacin	> 50	20-49	< 20	iHD
- UTI	500 mg daily	500 mg x1, then 250 mg daily	500 mg x1, then 250 mg q48h	500 mg x1, then 250 mg q48h
- Epididymitis				
- Pseudomonas	750 mg daily	750 mg q48h	750 mg x1, then 500 mg q48h	750 mg x1, then 500 mg q48h
- Other indications				
Linezolid	No renal dose adjustment			
Tuberculosis	600 mg or 300 mg daily			
All other indications	600 mg BID			
Metronidazole	> 10		< 10	iHD
Standard dose	500 mg TID		500 mg BID	500 mg TID
Intra-abdominal infection	500 mg BID			500 mg BID
C. Difficile	500 mg TID			500 mg TID
Minocycline	No renal dose adjustment			
Standard dose	200 mg once, then 100 mg q12h			
- Carbapenem-resistant -*Acinetobacter*	200 mg q12h			
- *Stenotrophomonas maltophilia*				
Molnupiravir (Lagevrio®)	No renal dose adjustment			
COVID-19 infection treatment	800 mg BID			
Moxifloxacin	No renal dose adjustment			
Standard dose	400 mg daily			

Nirmatrelvir and Ritonavir (Paxlovid®)	eGFR ≥ 60	eGFR 30 -59	eGFR < 30 and iHD
Mild to Moderate COVID-19 infection	Nirmatrelvir 300 mg + Ritonavir 100 mg BID	Nirmatrelvir 150 mg + Ritonavir 100 mg BID	Nirmatrelvir 300 mg + Ritonavir 100 mg x1, then Nirmatrelvir 150 mg + Ritonavir 100 mg daily

Nitrofurantoin	> 40	40-30	< 30 and iHD
Cystitis treatment	100 mg BID	100 mg BID Safe for short term use, ≤7 days	Avoid use

Oseltamivir	> 60	31-60	11-30	≤ 10	iHD	CRRT
Influenza treatment	75 mg BID	30 mg BID	30 mg daily	Avoid use	30 mg post-HD	75 mg BID
Influenza prophylaxis	75 mg daily	30 mg daily	30 mg q48h	Avoid use	30 mg after every other HD session	30 mg daily

Penicillin VK	No renal dose adjustment
Standard dose	500 mg QID
Cellulitis, long term suppression	250 to 500 mg BID

Posaconazole	No renal dose adjustment
Standard dose	300 mg BID x 2 doses, then 300 mg daily

Rifabutin	> 30	< 30
Standard dose	300 mg daily	150 mg daily if toxicity occurs

Rifampin	No renal dose adjustment
Mycobacterial infections	600 mg daily
Prosthetic device infections	300 mg BID
Endocarditis	300 mg TID

Sulfamethoxazole-Trimethoprim (Bactrim®)*	> 30	15-30	< 15	iHD
UTI or prostatitis	1 DS tab BID	1/2 DS tab BID	1/2 DS tab daily	1/2 DS tab qPM
SSTI (Weight based dosing using total body weight)	(Ideally ≥5mg/kg/day) 60-90kg: 1 DS tab PO q8h 90-120kg: 2 DS tabs PO q12h 120-180kg: 2 DS tabs PO q8h >180kg: 2 DS tabs PO q6h	(Ideally ≥2.5mg/kg/day) 60-90kg: ½ DS tab PO q8h 90-120kg: 1 DS tab PO q12h 120-180kg: 1 DS tab PO q8h >180kg: 1 DS tab PO q6h	1 DS tab daily	1 DS tab qPM
Pneumocystis jirovecii prophylaxis	1 DS tab daily or 3 x week	1/2 DS tab daily or 3 x week		1/2 DS tab qPM or 3 x week

*DS = double strength (800 mg sulfamethoxazole and 160 mg trimethoprim)

Tedizolid	No renal dose adjustment
Standard dose	200 mg daily

Valacyclovir	≥ 50	30-50	10-29	< 10	iHD
- HSV systemic infection - VZV treatment	1 gm TID	1 gm BID	1 gm daily	500 mg daily	500 mg qPM
HSV genital, initial	1 gm BID		1 gm daily		
HSV genital, recurrent	500 mg BID or 1 gm daily		500 mg daily		
VZV prophylaxis	500 mg BID		500 mg daily		

Voriconazole	No renal dose adjustment
Standard dose	6 mg/kg BID x 2 doses, then 4 mg/kg BID

Aminoglycoside Dosing and Therapeutic Drug Monitoring

High Dose Extended Interval Dosing Strategy (Preferred dosing strategy if no exclusions)

Exclusions: gram-positive synergy (e.g., enterococcal endocarditis), unstable renal function, burn, pregnant, or trauma patient

Select Agent

Amikacin	Gentamicin or Tobramycin

Calculate an Initial Dose

Use IBW unless….

Patient weights less than IBW, use total body weight

Patient weighs > 120% IBW, use adjusted body weight

Amikacin 15 mg/kg	Gentamicin or Tobramycin 7 mg/kg

Draw Post-Dose Level

Draw level 6-14 hours AFTER infusion ends	Draw level 6-14 hours after infusion STARTS

Plot the level on the appropriate nomogram and adjust dosing interval accordingly

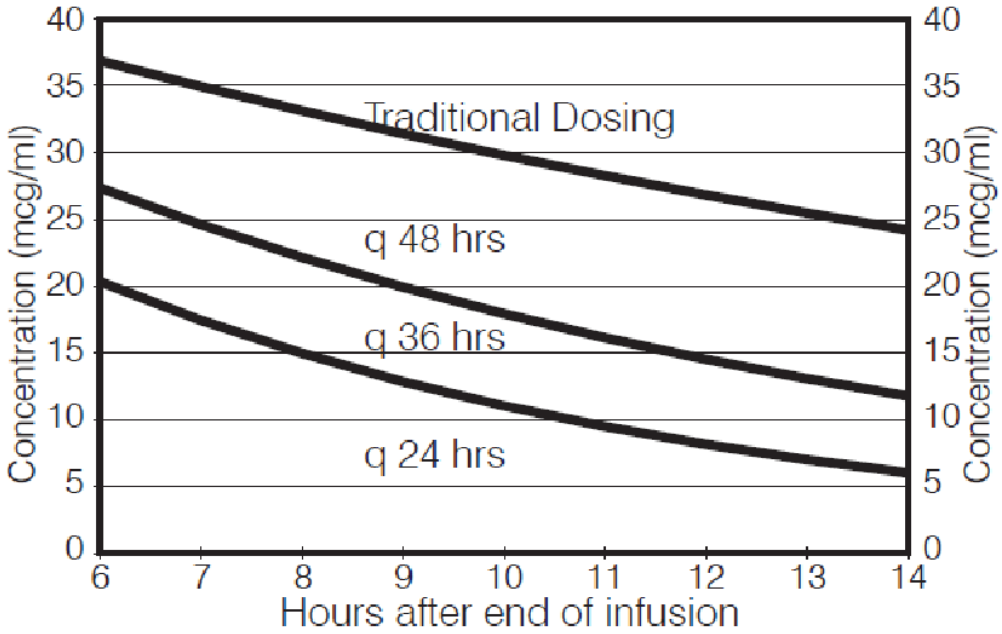
Barnes-Jewish nomogram	Hartford Hospital nomogram

If aminoglycoside therapy is expected to continue, order a steady state trough level after 4th dose

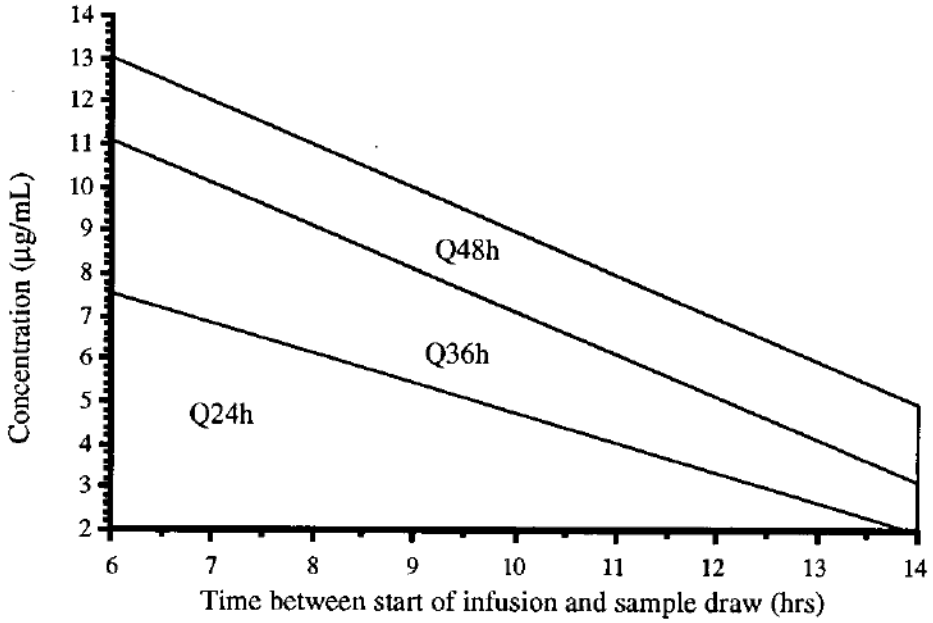
- Goal tobramycin/gentamicin trough of <1 mcg/mL
- Goal amikacin trough of <4-8 mcg/mL

Repeat post-dose level if there are significant changes in renal function or volume status

Barnes Jewish Nomogram: Amikacin 15 mg/kg



Hartford Hospital Nomogram: Gentamicin/ Tobramycin 7 mg/kg



Conventional Dosing Strategy (Utilize if there is an exclusion to High Dose-Extended Interval Dosing)

1. Use IBW unless….
    a. Patient weights less than IBW, use total body weight
    b. Patient weighs > 120% IBW, use adjusted body weight
2. Calculate the initial dose

Tobramycin and gentamicin	1 - 2.5 mg/kg (round to nearest 20 mg)
Amikacin	5 - 7.5 mg/kg (round to nearest 125 mg)

3. Select a dosing interval based on the patient's creatinine clearance

Creatinine Clearance (mL/min)	Suggested Dosing Interval
> 60	Q8h
40-59	Q12h
20-39	Q24h
< 20	Dose by level

4. Once at steady state (~ 4th dose in patients with stable renal function), draw a trough level 30 min prior to the next infusion and a peak level 30 minutes after the infusion has ended.

Indication	Desired Peak		Desired Trough	
	Gent/Tobra	Amikacin	Gent/Tobra	Amikacin
Pneumonia	8 – 10	25 – 35	< 1	< 4 – 8
Cellulitis, intra-abdominal, neutropenia, osteomyelitis, pyelonephritis	6 – 8	25 – 35	< 1	< 4 – 8
Cystitis or gram-positive synergy	3 – 5	20 – 25	< 1	< 4 – 8

5. Adjust the regimen as necessary and obtain repeat levels every 24 hours until at goal
    a. Peak in range and trough elevated: extend the dosing interval
    b. Peak above goal range and trough in range: decrease dose
    c. Peak below goal range and trough in range: increase dose, possibly extend interval
6. Once peak and trough goals are achieved, order follow up trough level after 4th dose

Empiric Vancomycin Dosing

Step 1: Determine vancomycin indication

Step 2: Determine pharmacokinetic targets based on indication

Infection Type	Mild or Moderate	Severe (non-CNS)	CNS infection
AUC (mg*h/L)	400-500	500-600	N/A
Trough (mcg/mL)*	10-20	10-20	15-20
Peak (mcg/mL)^	30-40	30-40	N/A

*Troughs < 10 may reduce antibiotic efficacy and > 20 may cause adverse reactions
^Target peak is an arbitrary number and does NOT represent therapeutic effectiveness

- Mild infections: cellulitis without systemic signs of infection, uncomplicated UTI
- Moderate infection: cellulitis with systemic signs of infection, complicated UTI
- Severe infection (Non-CNS): Pneumonia, bacteremia, endocarditis, sepsis, osteomyelitis
- CNS infections: Meningitis

Step 3: Calculate loading dose (consider in severe infections to attain therapeutic levels sooner)

- 20-35 mg/kg total body weight (TBW) if BMI 18.5 – 29 kg/m^2
- 20-25 mg/kg TBW if BMI $\geq$ 30 kg/m^2
- Max 2000 mg per dose; round to nearest 250 mg increment

Step 4: Calculate maintenance dose

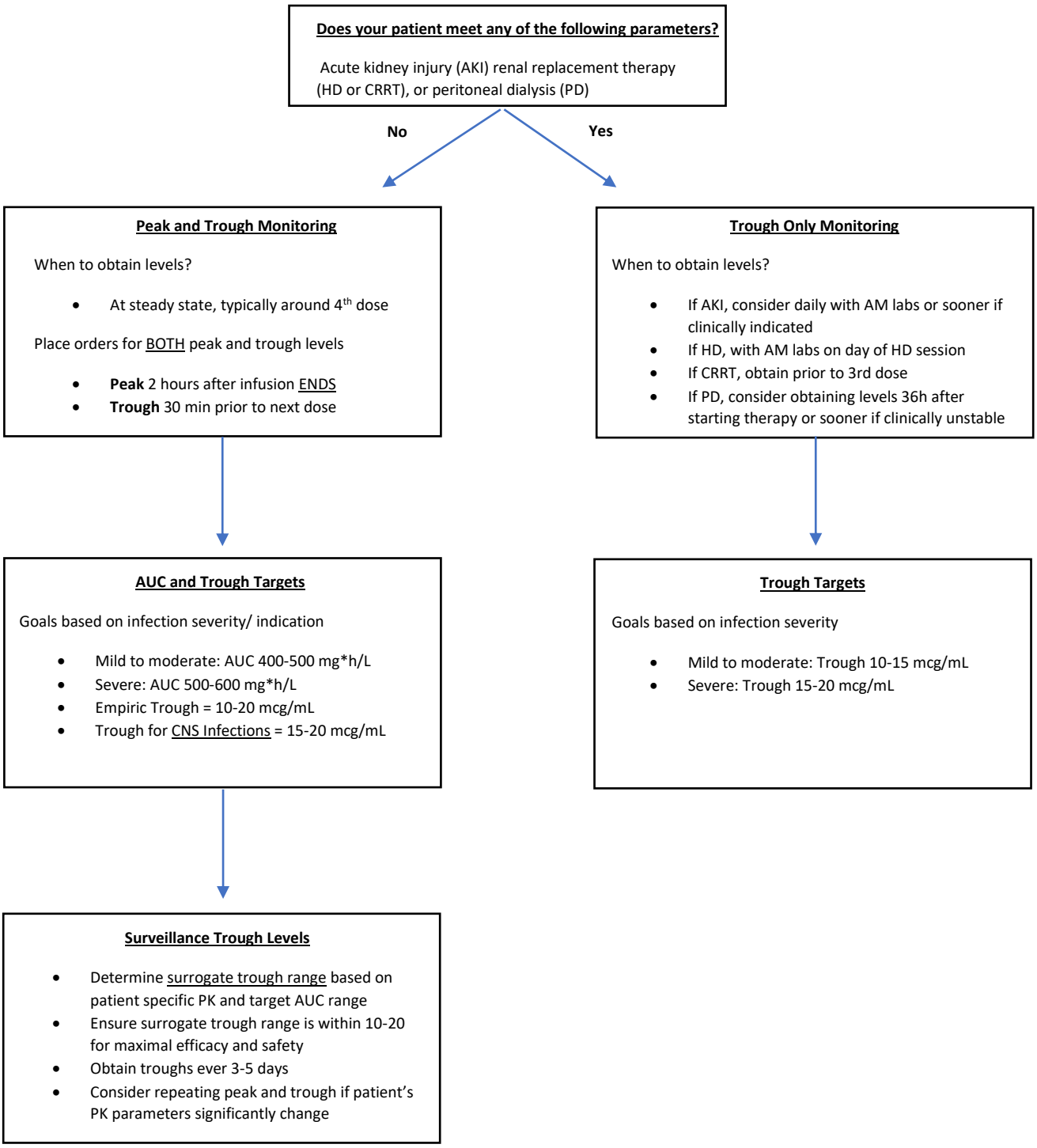
- 15 mg/kg TBW
- Max 2000 mg per dose; round to nearest 250 mg increment

Step 5: Determine maintenance dose administration frequency

- Contact team pharmacist and/or inpatient pharmacy for assistance with AUC target achievement

Estimated Creatinine Clearance (mL/min)	Dosing Interval to Consider
$\geq$100	q8h
80 - 99	q8h* or q12h
50 – 79	q12h
25-49	q24h
HD, PD, or CRRT	Contact pharmacist for assistance

Vancomycin Monitoring



Prioritize trough range of 15-20 mcg/L as efficacy parameter in patients with CNS infections such as meningitis or patients with enterococcal endocarditis. Consider consulting the infectious diseases service for assistance in managing these patients.

HIV Antiretroviral Dosing

Nucleoside/TIDE Reverse Transcriptase Inhibitors (N(t)RTIs)

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Abacavir (Ziagen[å]) **Note:** Generic tablet is available	Tablet: 300 mg Oral solution: 20 mg/mL	300 mg PO BID or 600mg PO once daily	Hepatic and renal	No dosage adjustment in renal insufficiency Child-Pugh Class — Dose A — 200mg PO BID (use oral soln) B or C — Contraindicated
Emtricitabine (Emtriva™)	Capsule: 200 mg Oral solution: 10mg/mL	200 mg PO once daily or 240mg (24 mL) oral soln once daily	Renal	CrCl (mL/min) — Capsule — Soln 30-49 — 200 mg q48h — 120 mg q24h 15-29 — 200 mg q72h — 80 mg q24h <15 — 200 mg q96h — 60 mg q24h HD — 200 mg q24h# — 240 mg q24h# #Take dose after HD session on dialysis days
Lamivudine (Epivir®) **Note:** Generic products are available	Tablets: 100 mg, 150 mg, 300 mg Oral solution: 5 mg/mL, 10 mg/mL	150 mg PO BID or 300 mg PO once daily	Renal	CrCl (mL/min) — Dose 15-29 — 150 mg x1, then 100 mg q24h 5-14 — 150 mg x1, then 50 mg q24h <5 — 50 mg x1, then 25 mg q24h HD — 50 mg x1, then 25 mg q24h post HD on HD days
Tenofovir Alafenamide (TAF) (Vemlidy®)	Tablet: 25mg	25 mg PO daily	Renal	CrCl (mL/min) — Dose <15 and not on HD — Not recommeded HD — 25 mg q24h; post HD session on HD days Child-Pugh Class — Dose B or C — Not recommended
Tenofovir disoproxil fumarate (TDF) (Viread®) **Note:** Generic product is available	Tablets: 150 mg, 200 mg, 250 mg, 300 mg Oral powder: 40 mg/1 gm	300 mg PO once daily 7.5 level scoops of oral powder PO once daily (dosing scoop dispensed with each bottle; one level scoop contains 1 gm of oral powder) Mix oral powder with 2-4 ounces of soft food that does not require chewing. **Do not mix oral powder with liquid.**	Renal	CrCl (ml/min) — Dose 30-49 — 300 mg q48h 10-29 — 300 mg BIW (i.e., q 72-96 hours) <10 not on HD — No recommendation HD — 300 mg every 7 days post HD

Nucleoside/TIDE reverse transcriptase inhibitors co-formulations

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Abacavir / Lamivudine (Epzicom®)	Tablet: 600 mg abacavir/ 300 mg lamivudine	1 tablet once daily	Renal	Not recommended in patients with CrCl< 30 mL/min Child-Pugh Class — Dose A — Dose adjust Abacavir and use individual drugs B or C — Contraindicated
Tenofovir alafenamide (TAF)/ Emtricitabine (Descovy®)	Tablet: 25 mg tenofovir AF/ 200 mg emtricitabine	1 tablet once daily	Renal	CrCl (mL/min) — Dose < 30 and not on HD — Not recommended < 30 and on HD — 1 tablet once daily; take after HD on HD days Concomitant administration with: Rifamycins not recommended
Tenofovir disoproxil fumarate (TDF) / Emtricitabine (Truvada®)	Tablet: 300 mg tenofovir DF/ 200 mg emtricitabine	1 tablet once daily	Renal	CrCl (mL/min) — Dose 30-49 — 1 tablet q48h < 30 or on HD — Not recommended

Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs)

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Doravirine (Pifeltroâ)	Tablet: 100 mg	100 mg PO once daily	Hepatic	No dosage adjustment with renal impairment. Has not been studied in ESRD or on HD Child-Pugh Class — Dose A or B — No dosage adjustment C — Not studied Concomitant administration with: Rifampin — Contraindicated Rifabutin — Doravirine 100mg PO BID Rifapentine — Contraindicated
Efavirenz (Sustivaâ) **Note:** Generic product is available	Capsules: 50 mg, 200 mg Tablet: 600 mg	600 mg PO once daily, at or before bedtime	Hepatic and renal	No dosage adjustment necessary in renal impairment. Caution with impaired hepatic function Concomitant administration with: Rifampin — No dosage adjustment Rifabutin — ↑ Rifabutin dose 450-600 mg per day Rifapentine — No dosage adjustment

Etravirine (Intelence[å])	Tablets: 25 mg, 100 mg, 200mg	200 mg PO BID Take following a meal	Hepatic	No dose adjustment necessary in renal impairment <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C No dose recommendation <u>Concomitant administration with</u>: Rifampin Do not co-administer Rifabutin Do not coadminister if with PI/r If without PI/r, use rifabutin 300mg once daily Rifapentine Do not co-administer
Nevirapine (Viramune[å]) **Note:** Generic products are available	Tablet: 200 mg Extended-release tablet: 400 mg Oral suspension: 10 mg/mL	200 mg PO once daily for 2 weeks, then 200 mg PO BID thereafter* or 400 mg XR once daily *Repeat lead-in period if therapy is discontinued for >7 days	Hepatic and renal	On hemodialysis, an additional 200mg dose following each dialysis treatment is recommended <u>Child-Pugh Class</u> <u>Dose</u> A No dosage adjustment B or C Contraindicated <u>Concomitant administration with</u>: Rifampin Do not co-administer Rifabutin No dosage adjustment Rifapentine Do not co-administer
Rilpivirine (Edurant[å])	Tablet: 25 mg	25 mg PO once daily	Hepatic	No dosage adjustment necessary in renal impairment <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C No dose recommendation <u>Concomitant administration with</u>: Rifampin Contraindicated Rifabutin ↑ Rilpivirine 50mg once daily Rifapentine Contraindicated

Fixed-dose combinations containing NON-NUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITOR plus Two NRTIs

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Doravirine/ Lamivudine/ Tenofovir DF (Delstrigo[å])	Tablet: 100 mg doravirine/ 300 mg lamivudine/ 300 mg tenofovir DF	1 tablet once daily	Hepatic and renal	Not recommended if CrCl <50 mL/min <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C Not studied
Efavirenz/ Emtricitabine/ Tenofovir DF (Atripla[å])	Tablet: 600 mg efavirenz/ 200 mg emtricitabine/ 300 mg tenofovir DF	1 tablet once daily	Hepatic and renal	Not recommended if CrCl <50 mL/min Caution with impaired hepatic function

Efavirenz/ Lamivudine/ Tenofovir DF (Symfiâ)	Tablet: 600 mg efavirenz/ 300mg lamivudine/ 300 mg tenofovir DF	1 tablet once daily on an empty stomach, preferably at bedtime	Hepatic and renal	Not recommended if CrCl <50 mL/min Not recommended with moderate to severe hepatic impairment. Caution with mild hepatic impairment
Efavirenz/ Lamivudine/ Tenofovir DF (Symfi Loâ)	Tablet: 400 mg efavirenz/ 300mg lamivudine/ 300 mg tenofovir DF	1 tablet once daily on an empty stomach, preferably at bedtime	Hepatic and renal	Not recommended if CrCl <50 mL/min or if on HD Not recommended with moderate to severe hepatic impairment. Caution with mild hepatic impairment
Rilpivirine/ Emtricitabine/ Tenofovir DF (Compleraâ)	Tablet: 25 mg rilpivirine/ 200 mg emtricitabine/ 300 mg tenofovir DF	1 tablet once daily with a meal	Hepatic and renal	Not recommended CrCl <50 mL/min <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C No dose recommendation
Rilpivirine/ Emtricitabine/ Tenofovir AF (Odefseyâ)	Tablet: 25 mg rilpivirine/ 200 mg emtricitabine/ 25 mg tenofovir AF	1 tablet once daily with a meal	Hepatic and renal	Not recommended CrCl <30 mL/min who are not receiving chronic HD On Chronic HD: 1 tablet once daily. On HD days, take after dialysis <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C No dose recommendation

Protease Inhibitors

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Atazanavir (Reyatazâ)	Capsules: 100mg, 150 mg, 200 mg, 300 mg Pediatric powder: 50 mg packet	<u>ARV-naive:</u> Atazanavir 300mg plus ritonavir 100mg once daily or Atazanavir 400mg once daily <u>ARV-experienced:</u> Atazanavir 300mg plus ritonavir 100mg once daily	Hepatic	<u>ARV-naïve on HD:</u> Atazanavir 300mg plus ritonavir 100mg once daily <u>ARV-experienced on HD:</u> ATV and ATV/ritonavir not recommended <u>Child-Pugh Class</u> <u>Dose</u> A No dosage adjustment B ATV 300mg unboosted for naive C Not recommended <u>Concomitant administration with</u>: Efavirenz Atazanavir 400 mg plus ritonavir 100mg once daily Tenofovir DF Atazanavir 300 mg plus ritonavir 100mg once daily
Atazanavir/ Cobicistat (Evotazâ)	Tablet: 300mg co-formulated with cobicistat 150 mg	One tablet once daily	Hepatic and renal	<u>If used with Tenofovir DF:</u> Not recommended if CrCl < 70mL/min Not recommended with hepatic impairment <u>Concomitant administration with</u>: Rifampin Contraindicated Rifabutin Do not co-administer Rifapentine Do not co-administer
Darunavir (Prezistaâ)	Tablets: 75 mg, 150 mg, 600 mg, 800 mg	<u>ARV-naïve or no DRV mutations:</u> 800 mg plus 100 mg RTV once daiy	Hepatic	Mild to moderate hepatic impairment: No dose adjustment Severe hepatic impairment: Not recommended

	Oral suspension: 100 mg/mL	ARV-experienced with one or more DRV mutations: 600 mg plus 100 mg RTV twice daily		
Darunavir/ Cobicistat (Prezcobix[å])	Tablet: 800 mg darunavir/ 150 mg cobicistat	One tablet once daily ARV-experienced with one or more DRV mutations: Not recommended	Hepatic and renal	If used with Tenofovir DF: Not recommended if CrCl < 70mL/min Child-Pugh Class — Dose A or B — No dosage adjustment C — Not recommended Concomitant administration with: Rifampin — Contraindicated Rifabutin — Do not co-administer Rifapentine — Do not co-administer
Ritonavir (Norvir[å])	Capsule: 100 mg (soft gelatin) Tablet: 100 mg Oral solution: 80 mg/mL Oral powder: 100mg single packet	Primarily used for "boosting" and in combination with other PI's 100 mg to 400 mg per day in 1 to 2 divided doses (refer to other PIs for specific dosing recommendations)	Hepatic	Refer to recommendations for the primary PI for hepatic dose adjustment

Fixed-dose combinations containing PROTEASE INHIBITOR plus Two NRTIs

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Darunavir/ Cobicistat/ Emtricitabine/ Tenofovir AF (Symtuza®)	Tablet: 800 mg darunavir/ 150 mg cobicistat/ 200 mg emtricitabine/ 10 mg tenofovir AF	1 tablet once daily	Hepatic and renal	CrCl <30 mL/min – not recommended On chronic HD: 1 tablet PO once daily. On HD days, administer after HD Not recommended in severe hepatic impairment

CHEMOKINE CO-RECEPTOR ANTAGONIST

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Maraviroc (Selzentry®)	Tablets: 150 mg, 300 mg	Depends on presence of concomitantly administered medications: • 150 mg BID with strong CYP3A inhibitors (with or without CYP3A inducers)including PIs (except TPV/r) • 300mg BID with NRTIs, T-20, TPV/r, NVP, and non-strong CYP3A inhibitors or inducers • 600mg BID with CYP3A inducers, including EFV, ETR, etc. (without a CYP3A inhibitor)	Hepatic and renal	No dosage recommendation with hepatic impairment. Maraviroc concentrations will likely be increased **CrCl <30 mL/min or on HD:** Without potent CYP3A4 inhibitors or inducers: Maraviroc 300mg twice daily; if postural hypotension occurs, reduce to maraviroc 150 mg twice daily With potent CYP3A4 inhibitors or inducers: Not recommended

CD4 Post-attachment Inhibitor

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Ibalizumab (Trogarzo®)	Single-dose 2-mL vial containing 200 mg/1.33 mL (150 mg/mL) of ibalizumab	Loading: A single dose of 2,000 mg diluted IV infusion over 30 minutes Maintenance: 800mg diluted IV infusion over 15 minutes OR IV push every 2 weeks Missed dose: If maintenance dose is missed by 3 days or more beyond scheduled dosing day, administer a loading dose of 2000 mg as soon as possible. Resume maintenance dose every 2 weeks thereafter	Not well defined	No dosage recommendation in renal or hepatic impairment

gp-120-directed attachment inhibitor

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Fostemsavir (Rukobia®)	Tablet: 600mg extended release	600mg PO BID	Hepatic and renal	No dosage adjustment required with renal impairment or those on HD No dosage adjustment required with mild to severe hepatic impairment Concomitant administration with: Rifampin Contraindicated Rifabutin Without PI/r, no dosage adjustment With PI/s, use rifabutin 150mg PO once daily Rifapentine Do not co-administer

Integrase Strand transfer INHIBITORs (INSTI)

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Bictegravir	Only available as a component of fixed-dose combination **BIKTARVY**[â]	BIKTARVY: One tablet PO once daily	Hepatic	Refer to BIKTARVY for details
Cabotegravir	Tablet: **(Vocabria[â]) =** 30 mg* *Must be obtained from manufacturer for oral lead-in and oral bridging during administration of Cabenuva (CAB IM/RPV IM) Long-acting injectable: **Apretude**[â] = individual product for IM long-acting pre-exposure prophylaxis (CAB IM) • 600-mg/3-mL vial **Cabenuva**[â] (CAB IM and RPV IM) = co-packaged intra-muscular long-acting regimen • 400-mg/2-ml vial or 600-mg/3-ml vial	Vocabria 30mg once daily Apretude Loading dose: CAB 600mg/3mL IM monthly for 2 months Continuation phase: CAB 600mg/3mL IM q8 weeks See CABENUVA for dosing information	Hepatic	No dosage adjustment necessary for mild to moderate renal impairment For severe renal impairment or on HD, increase monitoring for adverse events Child-Pugh Class Dose A or B No dosage adjustment C No recommendation CAB PO and concomitant administration with: Rifampin Contraindicated Rifabutin No dosage adjustment Rifapentine Contraindicated CAB IM and concomitant administration with: Rifampin Contraindicated Rifabutin Contraindicated Rifapentine Contraindicated

Dolutegravir (Tivicay[â])	Tablet: 10 mg, 25 mg, 50 mg Tablet for suspension: 5 mg	<u>ARV-naïve or treatment-experienced but integrase strand inhibitor-naïve (INSTI-naïve):</u> 50 mg PO once daily <u>INSTI-experienced with certain known or clinically suspected INSTI-resistance:</u> 50 mg PO BID	Hepatic and renal	No dosage adjustment necessary with renal impairment. <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C Not recommended <u>ARV- or INSTI- naïve and concomitant administration with</u>: Rifampin ↑ Dolutegravir 50 mg BID (only if no INSTI mutation) Rifabutin No dosage adjustment Rifapentine Do not co-administer
Elvitegravir	Only available as a component of a fixed-dose combination known as either **Genvoya[â]** (elvitegravir/cobicistat/emtricitabine/TAF) **Stribild[â]** (elvitegravir/cobicistat/emtricitabine/TDF)	**Genvoya[â]** One tablet PO once daily **Stribild[â]** One tablet PO once daily	Hepatic and renal	<u>Concomitant administration with</u>: Rifampin Contraindicated Rifabutin Do not co-administer Rifapentine Do not co-administer
Raltegravir (Isentress[â])	Tablet: 400 mg Chewable tablets: 25 mg, 100 mg Powder for oral suspension: 100 mg single-use packet High dose tablet: 600 mg	<u>Regular tablet</u>: 400 mg PO BID <u>High dose tablet</u>: ARV-naïve or ARV-experienced with virologic suppression on a regimen containing RAL 400mg twice daily: 1200 mg PO once daily	Hepatic	No dosage adjustment necessary in renal insufficiency. No dosage adjustment with mild to moderate hepatic insufficiency No recommendation with severe hepatic insufficiency <u>Concomitant administration with</u>: Rifampin *Raltegravir 800mg BID (*standard tablet only) Rifabutin No dosage adjustment Rifapentine Do not co-administer with once daily Rifapentine

Fixed-dose combinations containing INTEGRASE STRAND TRANSFER INHIBITOR plus One NRTI

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Dolutegravir/ Rilpivirine (Juluca®)	Tablet: 50 mg dolutegravir/ 25 mg rilpivirine	1 tablet once daily with food	Hepatic	No dosage adjustment with renal insufficiency Monitor for adverse effects when CrCl < 30 mL/min <u>Child-Pugh Class</u> <u>Dose</u> A or B No dosage adjustment C No dose recommendation <u>Concomitant administration with</u>: Rifampin Contraindicated Rifabutin ↑ Rilpivirine 50 mg once daily Rifapentine Contraindicated

Fixed-dose combinations containing INTEGRASE STRAND TRANSFER INHIBITOR plus One NRTI

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Dolutegravir/ Lamivudine (Dovato®)	Tablet: 50 mg dolutegravir/ 300 mg lamivudine	1 tablet once daily	Hepatic and renal	Not recommended if CrCl <30 mL/min Child-Pugh Class — Dose A or B — No dosage adjustment C — No dose recommendation ARV- or INSTI- naïve and concomitant administration with: Rifampin — ↑ Dolutegravir 50 mg BID (only if no INSTI mutation) Rifabutin — No dosage adjustment Rifapentine — Do not co-administer

Fixed-dose combinations containing INTEGRASE STRAND TRANSFER INHIBITORS plus Two NRTIs

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Bictegravir/ Emtricitabine/ Tenofovir AF (Biktarvy[å])	Tablet: 50 mg bictegravir/ 200 mg emtricitabine/ 25 mg tenofovir AF	1 tablet once daily	Hepatic and renal	CrCl <30 mL/min – not recommended On chronic HD: 1 tablet PO once daily. On HD days, administer after HD Child-Pugh Class — Dose A or B — No dosage adjustment C — Not recommended Concomitant administration with: Rifampin — Contraindicated Rifabutin — Do not co-administer Rifapentine — Do not co-administer
Elvitegravir/ cobicistat/ Emtricitabine/ Tenofovir AF (Genvoya[å])	Tablet: 150 mg elvitegravir/ 150 mg cobicistat/ 200 mg emtricitabine/ 10 mg tenofovir AF	1 tablet once daily	Hepatic and renal	CrCl <30 mL/min and not on chronic HD: Not recommended On chronic HD: 1 tablet PO once daily. On HD days, administer after HD No dosage adjustment necessary in mild-moderate hepatic impairment Not recommended in severe hepatic impairment
Elvitegravir/ cobicistat/ Emtricitabine/ Tenofovir DF (Stribild[å])	Tablet: 150 mg elvitegravir/ 150 mg cobicistat/ 200 mg emtricitabine/ 300 mg tenofovir DF	1 tablet once daily	Hepatic and renal	Initial use not recommended with CrCl < 70 ml/min Continued use not recommended with CrCl < 50 ml/min No dosage adjustment necessary in mild-moderate hepatic impairment Not recommended in severe hepatic impairment
Dolutegravir/ Abacavir/ Lamivudine (Triumeq[å])	Tablet: 50 mg dolutegravir/ 600mg abacavir/ 300 mg lamivudine	1 tablet once daily	Hepatic and renal	Not recommended CrCl <30 mL/min Child-Pugh class A: dose adjust abacavir and use individual drugs Contraindicated for Child-Pugh class B and C

LONG-ACTING INJECTABLE containing INTEGRASE STRAND TRANSFER INHIBITOR and NNRTI

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Cabotegravir IM/ Rilpivirine IM (Cabenuva[å])	Available as part of the co-packaged intramuscular long-acting regimen (CAB IM and RPV IM) **(CABENUVA[å])** 600 mg/900 mg kit contains: CAB 600 mg/3 mL vial and RPV 900 mg/3 mL vial **(CABENUVA[å])** 400 mg/600 mg kit contains: CAB 400 mg/2 mL vial and RPV 600 mg/2 mL vial	Monthly Dosing Loading dose: CAB 600mg/3mL IM x 1 dose and RPV 900mg/3 mL IM x 1 dose Continuation phase: CAB 400mg/2mL IM and RPV 600mg/2mL every 4 weeks Every 2-month Dosing Loading dose: CAB 600mg/3mL IM monthly and RPV 900mg/3 mL IM monthly for 2 doses Continuation phase: CAB 600mg/3mL IM and RPV 900mg/3mL every 8 weeks	Hepatic	No dosage adjustment necessary for mild to moderate renal impairment For severe renal impairment or on HD, increase monitoring for adverse events Child-Pugh Class — Dose A or B — No dosage adjustment C — No dose recommendation Concomitant administration with: Rifampin — Contraindicated Rifabutin — Contraindicated Rifapentine — Contraindicated

CAPSID INHIBITOR

Drug	Dosage Forms	Dose	Excretory Route	Dosage Adjustment in Renal Insufficiency and Hemodialysis
Lenacapavir (Sulenca[å])	Tablets: 300 mg Injection in a dosing kit containing: 2 single-dose vials each containing 463.5 mg/1.5 ml (309mg/mL) of lenacapavir	Initiation with one of two options followed by once every 6-months maintenance dosing. Initiation Option 1 Day 1: 927 mg by SQ injections and 600mg orally Day 2: 600mg orally Initiation Option 2 Day 1: 600mg orally Day 2: 600mg orally Day 8: 300mg orally Day 15: 927 mg SQ injections Maintenance 927 mg SQ injections every 6 months (26 weeks) from the date of the last injection +/- 2 weeks Missed dose: If more than 28 weeks since last injection, then restart initiation from Day 1 using either Option 1 or Option 2	Hepatic	No dosage adjustment required with renal impairment. Lenacapavir has not been studied in patients with ESDR (estimated creatinine clearance less than 15 mL per minute). No dosage adjustment required with mild or moderate hepatic impairment. Lenacapavir has not been studied in patients with severe hepatic impairment. Concomitant administration with: Rifampin — Contraindicated Rifabutin — Do not co-administer Rifapentine — Do not co-administer