Michael Garron Hospital
Antimicrobial Handbook 2024

The 2024 Michael Garron Antimicrobial Handbook for Adults has been produced by the Department of Pharmaceutical Services in consultation with Dr. Janine McCready, Dr. Christopher Kandel, Dr. Jeff Powis, and the Antimicrobial Stewardship Committee and other physician specialists. These guidelines have been approved by the Pharmacy and Therapeutics Committee and Medical Advisory Committee.

Preamble

1. The antimicrobial selections represent empiric treatment options for adults only. Treatments should be modified when culture results are available.

2. Antimicrobial choices are listed in the order of preference, where the first alternative listed is considered first-line and the rest are second or third options.

3. It is important to determine the patient's antibiotic and culture history in the last three months.

4.

TABLE OF CONTENTS

2023 ANTIBIOGRAM

2023 Antibiogram

North York General Hospital - Michael Garron Hospial - Scarborough Health Network - General, Birchmount & Centenary
% of isolates susceptible to acheivable serum concentration
Duplicate isolates within 30 days, surveillance and urine specimens excluded

	Total Isolates	Amikacin	Ampicillin	Cefazolin	Ceftazidime	Ceftriaxone	Ciprofloxacin*	Clindamycin	Cloxacillin	Erythromycin	Gentamicin	Meropenem	Penicillin	Piperacillin/tazobactam	Rifmapin†	Tobramycin	TMP/SMX	Vancomycin
Gram Positive																		
Coagulase Negative Staphlylococci	529			59%			73%	71%	59%	50%					97%		77%	100%
Enterococcus faecalis	310		99%	R				R									R	99%
Enterococcus faecium	68		43%	R				R									R	94%
Staphylococcus aureus	2178			84%			85%[1]	79%	84%	67%					100%[1]		97%	100%
MRSA	351			R			42%[1]	75%	R	39%					100%[1]		92%	100%
MSSA	1827			100%			92%[1]	80%	100%	73%					100%[1]		98%	100%
Streptococcus pneumoniae#	81																	
Meningitis interpretation	81					94%							88%					100%
Non-meningitis interpretation	81					100%							98%					100%
Viridans Streptococci	336					100%							88%					100%
Gram Negative																		
Citrobacter freundii	56	100%	R	R		R	95%				100%	98%		78%		100%	89%	
Citrobacter koseri	37	100%	R	83%		92%	97%				100%	100%		97%		97%	97%	
Enterobacter cloacae complex	219	100%	R	R		R	92%				97%	98%		R		96%	93%	
Escherichia coli	1144	100%	48%	72%		79%	69%				89%	99%		80%		89%	74%	
ESBL	240	100%	R	R		R	22%				82%	97%		R		73%	46%	
non ESBL	904	100%	60%	90%		99%	82%				92%	100%		98%		93%	82%	
Klebsiella aerogenes	59	100%	R	R		R	92%				100%	100%		R		100%	97%	
Klebsiella oxytoca	88	100%	R	51%		90%	97%				97%	100%		89%		97%	97%	
Klebsiella pneumoniae	487	100%	R	86%		89%	86%				98%	100%		89%		95%	90%	
ESBL	49	100%	R	R		R	14%				84%	98%		R		59%	37%	
non ESBL	438	100%	R	95%		99%	94%				99%	100%		98%		99%	96%	
Morganella morganii	49	100%	R	R		86%	86%				88%	100%		100%		94%	82%	
Proteus mirabilis	176	100%	82%	60%		98%	91%				96%	100%		98%		96%	89%	
Pseudomonas aeruginosa	815		R	R	81%	R	84%				R	88%		83%		100%	R	
Serratia marcescens	102	100%	R	R		93%	91%				99%	100%		98%		92%	99%	
Stenotrophomonas maltophilia	86	R	R	R	na	R					R	R		R		R	98%	

R= Considered inherently resistant

* Avoid use <18 yrs

† Should never be used as monotherapy as resistance can rapidly develop

Includes blood and csf

[1] Referenced from 2022, not available in 2023

2023 ICU ANTIBIOGRAM

2023 ICU Antibiogram

North York General Hospital - Michael Garron Hospial - Scarborough Health Network - General, Birchmount & Centenary

% of isolates susceptible to acheivable serum concentration

Duplicate isolates within 30 days, surveillance and urine specimens excluded

	Total Isolates	Amikacin	Ampicillin	Cefazolin	Ceftazidime	Ceftriaxone	Ciprofloxacin*	Clindamycin	Cloxacillin	Erythromycin	Gentamicin	Meropenem	Piperacillin/tazobactam	Rifmapin[r]	Tobramycin	TMP/SMX	Vancomycin
Gram Positive																	
Coagulase Negative Staphylococci	48			33%			43%	41%	33%	28%				96%		51%	100%
Enterococcus spp.	57		77%	R				R								R	100%
Staphylococcus aureus	231			83%			88%[1]	80%	83%	68%				100%[1]		100%	100%
MRSA	38			R				79%	R	29%						97%	100%
MSSA	193			100%				80%	100%	76%						100%	100%
Gram Negative																	
Enterobacter cloacae complex	59	100%	R	R		R	88%				97%	98%	R		95%	95%	
Escherichia coli	99	100%	31%	51%		60%	61%				86%	99%	59%		85%	59%	
ESBL	39	100%	R	R		R	21%				87%	97%	R		82%	37%	
non ESBL	60	100%	50%	83%		98%	87%				85%	100%	91%		87%	73%	
Klebsiella pneumoniae	103	100%	R	77%		82%	82%				95%	100%	81%		90%	86%	
Pseudomonas aeruginosa	184		R	R	59%	R	78%				R	77%	65%		98%	R	
Stenotrophomonas maltophilia	49	R	R	R	na	R					R	R	R		R	100%	

R= Considered inherently resistant

* Avoid use <18 yrs

[r] Should never be used as monotherapy as resistance can rapidly develop

[1] Referenced from 2022, not available in 2023

ALLERGIC REACTIONS

Table 1. Beta-lactam allergic reactions

REACTION/COMPLICATIONS	CLASSIFICATION OF IMMUNE RESPONSE	ONSET	RECOMMENDATIONS REGARDING BETA-LACTAM ANTIBIOTICS
Non-allergic Adverse Reactions ● Nausea/vomiting ● Diarrhea ● Headache	Idiopathic	Variable	✔
Delayed Mild Rash ● Mild to moderate rash without fever or involvement of internal organs or mucous membranes	Idiopathic	Varies	✔
"Immediate" Hypersensitivity Reaction ● Systemic **anaphylaxis** (bronchospasm, hypotension, angioedema) ● Hives (urticaria), Pruritus	Type I or IgE mediated	Minutes to hours	✔* *Consider ID/ASP consult for allergy testing*
Cytotoxic or Cytolytic Reaction ● Hemolytic anemia ● Cytopenia ● Nephritis	Type II – Antibody (usually IgG) mediated cell destruction	Days – weeks High doses	✖
Immune Complex ● Serum-sickness-like reaction ● Drug fever	Type III - Immune complex deposition and complement activation	7-21 days after initiation of drug	✖
Delayed Hypersensitivity Serious Cutaneous Adverse Reactions (SCAR) ● Drug –induced Hypersensitivity Syndrome or drug rash with eosinophilia and systemic symptoms (DRESS) ● (rash with fever and/or with involvement of internal organs, or mucous membranes) ● Stevens-Johnson Syndrome, Toxic Epidermal Necrolysis	Type IV (T cell mediated)	Days to weeks Upon re-challenge, symptoms usually within 24 hours	✖ *Consider infectious diseases consult*
Pseudoallergic reactions ● Include urticarial, hypotension, wheezing, flushing	Idiosyncratic	Variable, Usually within hours	✔ *Dependent on reaction Consider ID/ASP consult*

*For patients with a penicillin or amoxicillin allergy ANY cephalosporin or carbapenems can be used. Cephalosporins are widely and safely used, even in individuals with a history of penicillin allergy. Recent published data shows that the rate of cephalosporin-associated anaphylaxis or adverse reaction in penicillin-allergic patients is not significantly different than the rate of those with no drug allergy.

References:

1) Johansson SG, Bieber T, Dahl R, et al. Revised nomenclature for allergy for global use: Report of the Nomenclature Review Committee of the World Allergy Organization, October 2003. J Allergy Clin Immunol 2004; 113:832.
2) Pichler WJ. Delayed drug hypersensitivity reactions. Ann Intern Med 2003; 139:683.
3) *Weiss,* ME, Adkinson, NF. Immediate hypersensitivity reactions to penicillin and related antibiotics. Clin Allergy 1988; 18:515.
4) Macy et al. Adverse reactions associated with oral and parental use of cephalosporins: A retrospective population-based analysis. JACI 2015; 135:745-52
5) Macy E, Blumenthal KG. Are cephalosporins safe for use in penicillin allergy without prior allergy evaluation. Allergy Clin Immunol Pract 2018;6:82-9.
6) Macy E et al. Association between removal of a warning against cephalosporin use in patients with penicillin allergy and antibiotic prescribing. JAMA Network Open 2021; 4(4): e218367.

ANTIBIOTIC DOSING GUIDELINE FOR ADULTS WITH RENAL DYSFUNCTION

Note: The dosing recommendations are not intended for treatment of endocarditis or central nervous system infections.

DRUG	USUAL ADULT DOSE	DOSE/INTERVAL ADJUSTMENT FOR RENAL FUNCTION CREATININE CLEARANCE (CRCL) ML/MIN		
	CrCL >50	**30-49**	**10-29**	**< 10**
Acyclovir (IV)	5-10 mg/kg IV q8h	25-49 mL/min: 5-10mg/kg q12h	10-24mL/min: : 5-10mg/kg q24h	2.5-5 mg IV q24h
Acyclovir (PO) Genital herpes	400 mg PO TID	NO CHANGE		200 mg PO BID
Acyclovir (PO) Varicella Zoster	800 mg PO 5x/day	NO CHANGE	800mg PO TID	800 mg PO BID
Aminoglycosides	Refer to aminoglycoside dosing guidelines for conventional & extended interval dosage regimens.			
Amoxicillin	500 mg PO TID	NO CHANGE	BID	daily
Amoxicillin/Clavulanic Acid PO	875/125 mg PO BID	NO CHANGE	Not recommended	
	500/125 mg PO TID	NO CHANGE	BID	daily
Amoxicillin/Clavulanic Acid IV	1000 mg/200 mg IV Q8H	NO CHANGE	1000 mg/200 mg followed by 500 mg/100 mg Q12H	1000 mg/200 mg followed by 500 mg/100 mg Q24H
Amphotericin B (liposomal)	3-6 mg/kg IV q24h	NO CHANGE		
Ampicillin	2 g IV q4-6h	q8h	q12h	q12h
Azithromycin	500 mg IV/PO q24h	NO CHANGE		
Caspofungin	70 mg IV on Day 1, then 50 mg IV q24h	NO CHANGE		
Cefadroxil	500 mg PO BID	NO CHANGE	Q24H	Q36H
Cefazolin	1-2g IV q8h	NO CHANGE	: q12h	q24h
Cefoxitin	2 g IV q6h	q8h	q12h	1g IV q24h
Ceftazidime	2 g IV q8h	NO CHANGE	q12h	1g IV q24h
Ceftriaxone	1 g IV q24h	NO CHANGE		
Cefuroxime axetil (PO)	500 mg PO q12h	NO CHANGE		q24h

Cephalexin	500 mg PO q6h	NO CHANGE		q12h
Ciprofloxacin (IV)	400 mg IV q12h	NO CHANGE	q24h	
Ciprofloxacin (PO)	500-750 mg PO BID	NO CHANGE	daily	
Clarithromycin	500 mg PO BID	NO CHANGE	daily	
Clindamycin (IV)	600-900 mg IV q8h	NO CHANGE		
Clindamycin (PO)	300-450 mg PO q6h	NO CHANGE		
Cloxacillin (IV)	2 g IV q4h	NO CHANGE		
Cloxacillin (PO)	500 mg PO q6h	NO CHANGE		
Co-trimoxazole (IV) (Trimethoprim [TMP]/ Sulfamethoxazole [SMX]) (non- PJP treatment)	8-10 mg of TMP component/kg IV in 2-4 divided doses (10-15 mL IV q6-12h)	NO CHANGE	50% of dose IV/PO in 2-4 divided doses	Not recommended
Co-trimoxazole (PO) (non-PCP treatment)	1 DS tab PO q12h	NO CHANGE	50% of dose (1 SS) PO q12h	Not recommended*
Co-trimoxazole (IV) for P.jirovecii (carinii) treatment	15-20 mg TMP/kg IV divided q8h	NO CHANGE	50% of dose IV/PO in 2-4 divided doses	5-10 mg TMP/kg IV/PO in 1-2 divided doses
Co-trimoxazole (PO) for P.jirovecii (carinii) treatment DS = (Trimethoprim [TMP] 160 mg/ Sulfamethoxazole [SMX] 800 mg)	2 DS tabs PO q8h	NO CHANGE	50% of dose IV/PO in 2-4 divided doses	
Doxycycline	100 mg PO q12h	NO CHANGE		
Ertapenem	1 g IV q24h	NO CHANGE	500mg IV q24h	
Ethambutol	15-25 mg/kg PO q24h (Max 2.5 g/day)	NO CHANGE	q36h	q48h
Fluconazole (IV/PO)	200-400 mg IV/PO q24h	50% of dose IV/PO q24h		25% of dose IV/PO q24h
Flucytosine	25mg/kg PO q6h	q12-24h		q24-48h
Isoniazid	5 mg/kg PO q24h (max 300 mg)	NO CHANGE		

Itraconazole	100-200 mg PO q12-24h	NO CHANGE		
Linezolid	600 mg IV/PO q12h	NO CHANGE		
Meropenem	500 mg IV q6h	500mg IV q8h	500mg IV q12h	500mg IV q24h
Metronidazole	500 mg IV/PO q12h *C. difficile*: 500 mg IV/PO q8h	NO CHANGE		
Moxifloxacin	400 mg IV/PO q24h	NO CHANGE		
Nitrofurantoin macrocrystals (Macrobid®)	100 mg PO BID	Not recommended in CrCl <40 mL/min		
Nitrofurantoin	50 - 100 mg Enteral q6h (for feeding tube administration)	Not recommended in CrCl <40 mL/min		
Oseltamivir (Treatment dose)	75 mg PO BID x 5 days	30-60 mL/min: 30mg PO BID x 5 days	30mg PO daily x 5 days	not recommended
Oseltamivir (Prophylaxis dose)	75 mg PO daily	30-60 mL/min: 30mg PO daily	30mg PO q48h	not recommended
Penicillin G (IV)	4 Million Units (MU) IV q4-6h	q8h		q12h
Penicillin V (PO)	600 mg PO QID	NO CHANGE		TID
Piperacillin/ Tazobactam (non-pneumonia)	3.375g IV q6h	41-50 mL/min: NO CHANGE 20-40 mL/min: 2.25g q6h <20 mL/min: 2.25g q8h		
Pyrazinamide	15-30 mg/kg PO q24h (max 2 g q24h)	NO CHANGE		50-100% dose PO q24h
Rifampin (TB dosing)	10 mg/kg PO q24h (max 600 mg q24h)	NO CHANGE		5 mg/kg PO q24h
Tigecycline	100 mg IV load, then 50 mg IV q12h	NO CHANGE		
Vancomycin (IV)	Refer to Vancomycin dosing guidelines			
Vancomycin (PO) (for C.difficile treatment)	125 mg PO q6h	NO CHANGE NEEDED		
Voriconazole (IV)	6 mg/kg IV q12h x 2 doses, then 4 mg/kg IV q12h	Not recommended due to accumulation of vehicle		

Voriconazole (PO)	200-300 mg PO BID	NO CHANGE

***** Please consult with Infectious diseases or pharmacist to discuss therapeutic alternatives.

References:

1. Blondel-Hill E, Fryters S, editors. Bugs and Drugs. Edmonton: Capital Health; 2006.
2. Micromedex Healthcare Series. Thomson Micromedex. http://www.thomsonhc.com/ (accessed May 1, 2007).
3. Aronoff GR, Bennett WB, Berns JS, et al. Drug Prescribing in Renal Failure: Dosing Guidelines for Adults, Fourth Edition. Philidelphia, PA: American College of Physicians. 2002.

ANTIBIOTIC DOSING GUIDELINES FOR ADULTS REQUIRING RENAL REPLACEMENT THERAPY (CVVHDF and IHD)

Note: The dosing recommendations are not intended for treatment of endocarditis or central nervous system infections

*Loading dose not generally required if antimicrobial initiated prior to starting CVVHDF
**Only given on hemodialysis days

+Dosing after IHD means space dosing so that one dose is given after hemodialysis (NOT a supplemental dose). (i.e. for a drug dosed q12h: on hemodialysis days, if patient is dialyzed in the morning, give dose at noon after dialysis and next dose at midnight).

DRUG	Recommended Dose for IHD	Dose after IHD	LOADING DOSE*	Recommended Dose for CVVHDF
Acyclovir (IV)	2.5-5 mg/kg IV q24h	Yes	None required	5-10 mg/kg IV q12-24h
Aminoglycosides	Refer to aminoglycoside dosing guidelines	Yes	Yes	Refer to aminoglycoside dosing guidelines
Amoxicillin	500 mg PO q24h	Yes	None required	500 mg PO q8-12h
Amoxicillin/clavulanate (PO)	500/125 mg PO q24h	Yes	None required	500/125 mg PO q12h
Amoxicillin/clavulanate (IV)	1000 mg IV x1 dose then 500 mg IV q12h	No	None required	Limited data
Amphotericin B (liposomal)	3-5 mg/kg IV q24h (No Adjustment Needed)	No	None required	3-5 mg/kg IV q24h (No Adjustment Needed)
Ampicillin	2 g IV q12h	Yes	2 g	2 g IV q6h
Azithromycin	500 mg IV/PO q24h (No Adjustment Needed)	No	None Required	500 mg IV/PO q24h (No Adjustment Needed)
Caspofungin	70 mg IV x 1 dose then 50 mg q24h (No Adjustment Needed)	No	70 mg	70 mg IV x 1 dose then 50 mg q24h (No Adjustment Needed)
Cefazolin	1 g IV q24h ***or*** 2 g IV post hemodialysis**	Yes	2 g	2g IV q12h
Ceftazidime	1 g IV q24h ***or*** 2 g IV post-hemodialysis	Yes	2 g	2g IV q12h
Ceftriaxone	1-2 g IV q24h (No Adjustment Needed)	No	2 g	1-2 g IV -24h (No Adjustment Needed)
Cefuroxime	500 mg Q12h	Yes	None	Limited data

			required	
Ciprofloxacin	400 mg IV q24h 500 mg PO q24h	Yes	None Required	400 mg IV q12-24h 500 mg PO q12-24h
Clindamycin (IV)	600-900 mg IV q8h (No Adjustment Needed)	No	None Required	600-900 mg IV q8h (No Adjustment Needed)
Co-trimoxazole (PO) (non- PCP treatment) DS = (Trimethoprim [TMP] 160 mg/ Sulfamethoxazole [SMX] 800 mg)	1 DS PO q24h	Yes	None required	1 DS PO q24h (Dose dependent on indication: Consult Pharmacy)
Co-trimoxazole (IV) (PCP treatment)	5-10 TMP mg/kg IV q24h	No	None required	10-15 TMP mg/kg/day divided q12h
Daptomycin	10 mg/kg IV post hemodialysis	Yes	None required	6 mg/kg IV q24h
Doxycycline	100 mg IV/PO q12h (No Adjustment Needed)	No	None required	100 mg IV/PO q12h (No Adjustment Needed)
Ertapenem	500 mg IV q24h	Yes	None required	1000 mg IV q24h
Ethambutol	15-25 mg/kg PO q24h	Yes	None required	12-20 mg/kg PO q24h
Fluconazole	400-800 mg IV/PO loading dose, then 100-400 mg IV/PO q24h (No Adjustment Needed)	Yes	800 mg	100-400 mg IV/PO q24h (No Adjustment Needed)
Isoniazid	300 mg PO q24h post hemodialysis	Yes	None required	300 mg PO q24h
Linezolid	600 mg IV/PO q12h (No Adjustment Needed)	Yes	None Required	600 mg IV/PO q12h (No Adjustment Needed)
Meropenem	500-1000 mg IV q24h	Yes	None required	Non-CNS infections: 500mg IV q6h CNS infections : 2g IV q8h
Metronidazole	500 mg IV/PO q12h *C. difficile*: 500 mg IV/PO q8h (No Adjustment Needed)	Yes	None Required	500 mg IV/PO q12h *C. difficile*: 500 mg IV/PO q8h (No Adjustment Needed)
Moxifloxacin	400 mg IV/PO q24h (No Adjustment Needed)	No	None Required	400 mg IV/PO q24h (No Adjustment Needed)
Oseltamivir (Treatment dose)	Limited data 30 mg PO post-IHD x 3 doses	Yes	None Required	Limited data 75 mg PO BID
Oseltamivir (Prophylaxis dose)	Limited data 30 mg PO post every other-IHD	Yes	None Required	Limited Data 30 mg PO daily

Penicillin G	2 Million Units (MU) IV q6h	Yes	None Required	2-3 MU IV q4h
Piperacillin/tazobactam	2.25 g IV q8h	Yes	None Required	2.25-3.375 g IV q6h
Pyrazinamide	25-35 mg/kg PO x1 and then post HD	Yes	Yes	20-35 mg/kg PO q24h
Rifampin	Not Adjustment Needed	No	None required	Not Adjustment Needed
Tigecycline	100 mg IV x 1 dose then 50 mg q12h (No Adjustment Needed)	No	100 mg	100 mg IV x 1 dose then 50 mg q12h (No Adjustment Needed)
Vancomycin	Refer to vancomycin HD dosage guidelines	Yes	15-20 mg/kg	Consult Pharmacy

References:

1. Heintz BH et al. Antimicrobial Dosing Concepts and Recommendations for Critically Ill Adult Patients Receiving Continuous Renal Replacement Therapy or Intermittent Hemodialysis. Pharmacotherapy 2009;29(5):562-577.
2. Aronoff GR, Bennett WB, Berns JS, et al. Drug Prescribing in Renal Failure: Dosing Guidelines for Adults, Fourth Edition. Philidelphia, PA: American College of Physicians. 2002.
3. CDC Seasonal Influenza (Flu) Antiviral Medications: Summary for Clinicians. Available from: http://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm
4. The Renal Pharmacists Network – personal communication Re: oseltamivir dosing in high-flux hemodialysis.
5. Micromedex Healthcare Series. Thompson Micromedex. http://www.thomsonhc.com (accessed Feb 16, 2012).
6. Trotman RL et al. Antibiotic dosing in critically ill patients receiving continuous renal replacement therapy. CID 2005; 41:1159–66
7. Eylet RF et al. Pharmacokinetics of ertapenem in critically ill patients receiving continuous venovenous hemodialysis or hemodiafiltration. Antimicr Agents Chemother 2014;58(3):1320-6.
8. Yeh E and Brown G. Dosing recommednations for continuous venovenous hemodiafiltration with AN69 filter membranes and Prismaflex Dialyzers. Can J Hosp Pharm 2009; 62(6): 457-63.

ADULT WEIGHT-BASED ANTIMICROBIAL DOSING

ANTIMICROBIAL	WEIGHT (kg)	CrCl ≥ 50	CrCl 25-49	CrCl 10-24	CrCl < 10
PENICILLINS					
Ampicillin	< 100	2g q6h[a]	2g q8h	2g q12h	2g q24h
	≥ 100	2g q6h[b]	2g q8h	2g q12h	2g q24h
Cloxacillin	< 100	2g q4h	No dosage adjustment necessary		
	≥ 100	3g q4h			
Penicillin G	< 100	4mU q4h	2mU q4h	2mU q8h	1mU q8h
	≥ 100	4mU q4h	3mU q4h	3mU q8h	2mU q8h
Piperacillin/tazobactam		**CrCl ≥ 40**	**CrCl 20–40**	**CrCl < 20**	
	< 100	3.375g q6h	2.25g q6h*	2.25g q8h*	
	≥ 100	4.5g q6h	3.375g q6h*	2.25g q6h*	
CEPHALOSPORINS					
		CrCl ≥ 35		**CrCl 10-34**	**CrCl < 10**
Cefazolin	< 100	1g q8h		500mg q12h*	500mg q24h*
	≥ 100	2g q8h		1g q12h*	1g q24h*
		CrCl > 50	**CrCl 30-50**	**CrCl 10-29**	**CrCl < 10**
Ceftazidime	< 100	1g q8h	1g q12h	1g q24h	500mg q24h*
	≥ 100	2g q8h	2g q12h	2g q24h	1g q24h*
Ceftriaxone	< 100	1g q24h[c]	No dosage adjustment necessary		
	≥ 100	2g q24h[d]			
CARBAPENEMS					

Ertapenem	< 100	1g q24h	1g q24h	500mg q24h*	500mg q24h*
	≥ 100	1g q24h	1g q24h	1g q24h*	500mg q24h*
Meropenem	< 100	500mg q6h	500mg q8h	500mg q12h*	500mg q24h
	≥ 100	1g q6h	1g q8h	1g q12h*	1g q24h
	CNS penetration	2g q8h	2g q12h	1g q12h	1g q24h
FLUOROQUINOLONES					
Ciprofloxacin	< 100	400mg q12h		400mg q24h	200mg q24h*
	≥ 100	600mg q12h		600mg q24h	300mg q24h*
Moxifloxacin	All weights	400mg q24h	No dosage adjustment necessary		
MISCELLANEOUS					
Fluconazole	< 100	400mg q24h	200mg q24h*		
	≥ 100	800mg q24h	400mg q24h*		
Linezolid	< 150	600mg q12h	No dosage adjustment necessary		
	≥ 150	600mg q8-12h			
		CrCl ≥ 30		**CrCl < 30**	
Daptomycin	Use TBW	4-6 mg/kg q24h		q48h	

**Give loading dose as if normal renal function x 1, then decrease dose per protocol*

[a] *Use 2g q4h for endocarditis and meningitis*

[b] *Use same dose q4h for endocarditis and meningitis*

[c] *Use 2g q24h for endocarditis*

[d] *Use same dose q12h for meningitis*

TBW: Total body weight (kg)

References

1. Abdullahi M, Annibale B, Capoccia D et al. The eradication of Helicobacter pylori is affected by body mass index (BMI). Obes Surg 2008; 18:1450-1454.
2. Bauer LA, Edwards WA, Dellinger EP et al. Influence of weight on aminoglycoside pharmacokinetics in normal weight and morbidly obese patients. Eur J Clin Pharmacol 1983; 24(5):643-7.
3. Bearden DT, Rodvold KA. Dosage adjustments for antibacterials in obese patients applying clinical pharmacokinetics. Clin Pharmacokinet 2000; 38(5):415-26.
4. Bhalodi AA, Papasavas PK, Tishler DS, et al. Pharmacokinetics of intravenous linezolid in moderately to morbidly obese adults. Antimicrob Agents Chemother 2013; 57(3):1144-9.
5. Blouin RA, Kolpek JH, Mann HJ. Influence of obesity on drug disposition. Clin Pharm 1987; 6(9):706-14.
6. Bosma RJ, Krikken JA, HJoman van der Heide JJ, de Jong PE, Navis GJ. Obesity and renal hemodynamics. Contrib Nephrol 2006; 151:184-202.
7. Cheymol G. Effects of obesity on pharmacokinetics implications for drug therapy. Clin Pharmacokinet 2000; 39(3):215-31.
8. Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. Nephron 1976; 16 (1):31-41.
9. Dellit TH, Owens RC, McGowan JE et al. Infectious diseases society of America and the society for healthcare epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Clin Infect Dis 2007; 44:159-77.
10. Demirovic JA, Pai AB, Pai MP. Estimation of creatinine clearance in morbidly obese patients. Am J Health-Syst Pharm 2009; 66:642-8.
11. Dionne RE, Bauer LA, Gibson GA et al. Estimating creatinine clearance in morbidity obese patients. Am J Hosp Pharm 1981; 38(6):841-4.
12. Erstad BL. Which weight for weight-based dosage regimens in obese patients? Am J Health Syst Pharm 2002; 59(21):2105-10.
13. FalagasME, Athanasoulia AP, Peppas G, Karageorgopoulos DE. Effect of body mass index on the outcome of infections: a systematic review. Obes Rev 2009; 10:280-89.
14. Falagas ME, Karageorgopoulos DE. Adjustment of dosing of antimicrobial agents for bodyweight in adults. Lancet 2010; 375:248-251.
15. Falagas ME, Kompoti M. Obesity and infection. Lancet Infect Dis 2006; 6:438-46.
16. Green B, Duffull SB. What is the best size descriptor to use for pharmacokinetic studies in the obese? Br J Clin Pharmacol. 2004; 58:119-133.
17. Han PY, Duffull SB, Kirkpatrick CMJ, Green B. Dosing in obesity: a simple solution to a big problem. Clin Pharm Ther 2007; 82(5):505-8.
18. Hollenstein UM, Brunner M, Schmid, et al. Soft tissue concentrations of ciprofloxacin in obese and lean subjects following weight-adjusted dosing. International Journal of Obesity 2001; 25:354-8.
19. Janson B, Thursky K. Dosing of antibiotics in obesity. Curr Opin Infect Dis 2012; 25(6):634-49.
20. Kampmann JP, Klein H, Lumholtz B et al. Ampicillin and propylthiouracil pharmacokinetics in intestinal bypass patients followed up to a year after operation. Clin Pharmacokinet 1984; 9(2):168-76.
21. Kees MG, Weber S, Kees F, et al. Pharmacokinetics of moxifloxacin in plasma and tissue of mobidly obese patients. J Antimicrob Chemother 2011; 66(10):2330-5.
22. Leader WG, Tsubaki T, Chandler MH. Creatinine-clearance estimates for predicting gentamicin pharmacokinetic values in obese patients. Am J Hosp Pharm 1994; 51(17):2125-30.
23. Lodise TP, Lomaestro BM, Drusano GL. Application of antimicrobial pharmacodynamic concepts into clinical practice: focus on B-lactam antibiotics. Pharmacother 2006; 26(9):1320-32.
24. Medico CJ, Walsh P. Pharmacotherapy in critically ill obese patient. Crit Care Clin 2010; 26:679-88.
25. Muzevich KM, Lee KB. Subtherapeutic linezolid concentrations in a patient with morbid obesity and

methicillin-resistant Staphlococcus aureus pneumonia: case report and review of the literature. Ann Pharmacother 2013; 47:e25.
26. Newman D, Scheetz MH, Adeyemi OA et al. Serum piperacillin/tazobactam pharmacokinetics in a morbidly obese individual. Ann Pharmacother 2007; 41:1734-9.
27. Overweight and obesity: home. Department of Health and Human Services: Centers for Disease Control and Prevention. Accessed at: http://www.cdc.gov/nccdphp/dnpa/obesity/index.htm. Updated 2009 Aug 27. Accessed September 13, 2009.
28. Owens RC. Antimicrobial stewardship: application in the intensive care unit. Infect Dis Clin North Am 2009; 23(3):683-702.
29. Owens R, Ambrose PG, Nightingale CH. Antibiotic Optimization. Taylor & Francis Group 2005. Boca Raton, FL. pg 261-326.
30. Pai MP, Bearden DT. Antimicrobial dosing considerations in obese adult patients. Pharmacotherapy 2007; 27:1081.
31. Salazar DE, Corcoran GB. Predicting creatinine clearance and renal drug clearance in obese patients from estimated fat-free body mass. Am J Med 1988; 84(6):1053-60.
32. Snider RD, Kruse JA, Bander JJ, Dunn GH. Accuracy of estimated creatinine clearance in obese patients with stable renal function in the intensive care unit. Pharmacotherapy 1995; 15:747–53.
33. Spinler SA, Nawarskas JJ, Boyce EG, et al. Predictive performance of ten equations for estimating creatinine clearance in cardiac patients. Iohexol Cooperative Study Group. Ann Pharmacother 1998; 32(12):1275-83.
34. Spinler SA, Nawarskas JJ, Boyce EG, Connors JE, Charland SL, Goldfarb S, for The Iohexol Cooperative Study Group. Predictive performance of ten equations for estimating creatinine clearance in cardiac patients. Ann Pharmacother 1998; 32:1275–83.
35. Strum AW, Allen N, Rafferty KD, et al. Pharmacokinetic Analysis of Piperacillin Administered with Tazobactam in Critically Ill, Morbidly Obese Surgical Patients. Pharmacotherapy 2013; Ahead of Print July 17.
36. Traynor AM, Nafziger AN, Bertino JS, Jr. Aminoglycoside dosing weight correction factors for patients of various body sizes. Antimicrob Agents Chemother 1995; 39(2):545-8.
37. Vachharajani V, Vital S. Obesity and Sepsis. J Intens Care Med 2006; 21(5):288-95.
38. Wurtz R, Itokazu G, Rodvold K. Antimicrobial dosing in obese patients. Clin Infect Dis 1997; 25(1):112-8.
39. Yuk J, Nightingale CH, Sweeney K et al. Pharmacokinetics of nafcillin in obesity. J Infect Dis 1988; 157(5):1088-9.

IV TO PO EMPIRIC ANTIMICROBIAL STEPDOWN

General guiding principles for IV to PO step-down:

1. Consider spectrum of coverage required as per indication and choose the appropriate PO regimen to ensure similar coverage of specific organisms.
2. Stay within the same antimicrobial class if possible to prevent drug/bug mismatch as a result of switching.
3. PO step-down may not be appropriate in some infectious indications (i.e. Endocarditis, meningitis, certain prosthetic joint infections etc.) or patient populations (i.e. Intractable vomiting, short gut syndrome, intractable diarrhea.)
4. As always, culture and sensitivity results should be used to guide stepdown when available
5. Patient factors should be considered.

IV ANTIMICROBIAL REGIMEN	SUGGESTED PO EQUIVALENT REGIMENS*
Ampicillin 1g IV q4-6h	*Uncomplicated Urinary source:* Amoxicillin 500mg PO TID *Respiratory:* Amoxicillin 500mg TID *Other sources including complicated urinary source and Gram Negative Bacteremia :* Amoxicillin 1000mg PO TID
Piperacillin/tazobactam 3.375g IV q6h	*No pseudomonal coverage required:* Amoxicillin/clavulanic acid 875/125mg PO BID *Pseudomonal coverage required:* Consider ID/antimicrobial stewardship consult *Febrile neutropenia:* Amoxicillin/clavulanic acid 875/125mg PO BID + ciprofloxacin 500mg PO BID
Cefazolin 1g IV q8h	Cephalexin 500mg PO QID or Cefadroxil 500 mg PO BID Gram Negative Bacteremia: Cephalexin 1000mg PO QID or Cefadroxil 1000mg BID
Cefazolin 1g IV q8h + metronidazole 500mg IV q12h	Amoxicillin/clavulanic acid 875/125mg PO BID **or** Cephalexin 500mg PO QID *or* Cefadroxil 500 mg PO BID *and* metronidazole 500mg PO BID
Ceftriaxone 1g IV q24h	*Urinary source:* Cephalexin 500mg PO QID **or** Amoxicillin/clavulanic acid 875/125mg PO BID **or** Cefixime 400mg PO daily

	Respiratory source: Amoxicillin/clavulanic acid 875/125mg PO BID **or** Cefuroxime 500mg PO BID *Intra-abdominal source:* Amoxicillin/clavulanic acid 875/125mg PO BID
Ceftriaxone 1g IV q24h + azithromycin 500mg IV q24h	Amoxicillin/clavulanic acid 875/125mg PO BID *and* azithromycin 500mg PO daily **or** Cefuroxime 500mg PO BID *and* azithromycin 500mg PO daily
Ceftriaxone 1g IV q24h + metronidazole 500mg IV q12h	Amoxicillin/clavulanic acid 875/125mg PO BID **or** Cephalexin 500mg PO QID or Cefadroxil 500 mg PO BID *and* metronidazole 500mg PO BID
Ertapenem Meropenem	No PO stepdown recommended, **Consider ID service/antimicrobial stewardship consult**
Ciprofloxacin 400mg IV q12h	Ciprofloxacin 500mg PO BID
Ciprofloxacin 400mg IV q12h + metronidazole 500mg IV q12h	Ciprofloxacin 500mg PO BID *and* metronidazole 500mg PO BID
Moxifloxacin 400mg IV q24h	Moxifloxacin 400mg PO daily
Clindamycin 600mg IV q8h	Clindamycin 300mg PO QID

*The chart below contains suggested options for IV to PO step down of empiric antimicrobials or when microbiology is not available in patients with normal renal function.

ICU PIPERACILLIN/TAZOBACTAM (TAZOCIN) EXTENDED INFUSION (EI) PROTOCOL

Increasing antimicrobial resistance resulting in increased mortality has led clinicians to re-evaluate the optimal method of antimicrobial administration. For β-lactam antimicrobials like piperacillin/tazobactam, the bacterial killing activity is dependent on the amount of time the free drug concentration is above the minimum inhibitory concentration (MIC) during the dosing interval. Maximal bactericidal activity occurs when free drug levels exceed the MIC for 40-60% of the dosing interval. Extending the infusion time of Piperacillin/tazobactam from 30 minutes to 4 hours takes advantage of this concept, resulting in a prolonged time above the MIC. Clinical trials have demonstrated that extended infusions optimize treatment outcomes (i.e. clinical cure, reduced hospital length of stay, mortality), and reduce costs.

At TEGH this protocol will be limited to critically ill patients with severe sepsis in the ICU patients ONLY. *All patients (regardless of CrCl) will receive a loading dose of 4.5 g IV x 1 to be given over 30min followed immediately by the first extended infusion dose.*

Piperacillin/tazobactam EI dosing recommendations:

CrCl *	≥ 20 mL/min	< 20 mL/min (including peritoneal and hemodialysis)	CVVHDF
Dose < 100 kg	3.375 g IV q8h infused over 4 hours	3.375 g IV q12h infused over 4 hours	3.375 g IV q8h infused over 4 hours
Dose ≥ 100 kg	4.5 g IV q8h infused over 4 hours	4.5 g IV q12h infused over 4 hours	4.5 g IV q8h infused over 4 hours

*Total volume (drug + diluent) = 120mL; infuse at a rate of 30mL/h over 4 hours
**May substitute eGFR for CrCl; pharmacy to review and adjust as appropriate

Converting between EI and Intermittent Piperacillin/tazobactam (*responsibility of the admitting/transferring physician)*

Discontinuing EI and starting intermittent dosing

- Discontinue previous order for piperacillin/tazobactam
- Add new order for intermittent piperacillin/tazobactam; dosing/frequency as per TEGH Antimicrobial Handbook
- Schedule start time for first dose of new order 6 hours after last dose of EI piperacillin/tazobactam initiated
- If an EI piperacillin/tazobactam dose is infusing on transfer to a medical/surgical floor, complete the administration of that dose over the 4 hour duration as per protocol

Discontinuing intermittent and starting EI dosing

- Discontinue previous order for piperacillin/tazobactam
- Add new order for EI piperacillin/tazobactam as directed above
- If patient has received a dose of piperacillin/tazobactam on the intermittent regimen (or a 1x dose in the ED) within the last 6 hours, no bolus dose is required and the first 4 hour infusion is to be started immediately
- If no piperacillin/tazobactam doses have been given previously, initiate the EI protocol as per above, including the bolus dose
- If an intermittent piperacillin/tazobactam dose is infusing on transfer to the ICU, complete the administration of that dose over the 30 minute duration as per usual practice

Y-site Compatibility*

Compatible

Amikacin	Fentanyl	Magnesium sulfate	Ondansetron
Amphotericin B liposomal	Fluconazole	Methylprednisolone	Phenylephrine
Argatroban	Furosemide	Metoclopramide	Potassium chloride
Calcium gluconate	Gentamicin	Metoprolol	Ranitidine
Clindamycin	Heparin	Metronidazole	Sodium bicarbonate
Dexamethasone	Hydrocortisone	Milrinone	Tigecycline
Diphenhydramine	Hydromorphone	Nitroglycerin	Trimethoprim/Sulfamethoxazole
Dopamine	Linezolid	Norepinephrine	Vancomycin *(1g/250mL concentration **ONLY**; all other concentrations are INCOMPATIBLE)*
Epinephrine	Lorazepam	Octreotide	Vasopressin

Incompatible

Acyclovir	Ciprofloxacin	Insulin	Rocuronium
Amiodarone	Cisatracurium	Midazolam	Tobramycin
Amphotericin B	Diltiazem	Pantoprazole	Vancomycin *(all concentrations other than that listed above)*
Azithromycin	Dobutamine	Phenytoin	

*Consult pharmacy during regular operating hours for additional information regarding IV compatibility as needed.
* Additional compatibility information available on iCare ⇦ Virtual Library ⇦ MicroMedex® ⇦ click MicroMedex®2.0 button ⇦ Tools tab: Trissel's™ 2 IV Compatibility ⇦ enter medications to check compatibility within "enter search term box" ⇦ click "submit" at bottom of page. *Consult Pharmacist-on-call after hours regarding IV compatibility if above references do not resolve compatibility concerns.

AMINOGLYCOSIDE DOSING GUIDELINES

Ordering aminoglycoside (AMG) Therapy (Age ≥18yo)

1. Tobramycin is the AMG of choice at Michael Garron. Use of gentamicin and amikacin is restricted to current antimicrobial policies.

2. Physician should enter “tobramycin, Pharmacist to dose” powerplan.

tobramycin, Pharmacist to dose (Planned Pending)	
Consults	
Pharmacist to assess	Order & monitor specific meds - MD ONLY, tobramycin
Vital Signs/Monitoring	
Weight	as_directed to determine appropriate tobramycin dose
Laboratory	
Creatinine - includes eGFR	once, Stat
Creatinine - includes eGFR	T+3;0600, qMonThurs, Routine, X 1 week
Medications	
eGFR greater than 30 mL/min	
Effective body weight less than or equal to 60 kg = 300 mg	
tobramycin	300 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 61 kg - 64 kg = 320 mg	
tobramycin	320 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 65 kg - 68 kg = 340 mg	
tobramycin	340 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 69 kg - 72 kg = 360 mg	
tobramycin	360 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 73 kg - 76 kg = 380 mg	
tobramycin	380 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 77 kg - 80 kg = 400 mg	
tobramycin	400 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 81 kg - 84 kg = 420 mg	
tobramycin	420 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight between 85 kg - 88 kg = 440 mg	
tobramycin	440 mg, IVPB, q24h, Infuse Over: 1 h
Effective body weight greater than or equal to 89 kg = 460 mg	
tobramycin	460 mg, IVPB, q24h, Infuse Over: 1 h
eGFR less than or equal to 30 mL/min	
Effective body weight less than or equal to 80 kg = 160 mg	
tobramycin	160 mg, IVPB, once, (Pharmacy to order subsequent doses), Infuse Over: 1 h, for 1 dose
Effective body weight greater than or equal to 81 kg = 200 mg	
tobramycin	200 mg, IVPB, once, (Pharmacy to order subsequent doses), Infuse Over: 1 h, for 1 dose

Note: The following population/indications are exempt from tobramycin use. Gentamicin may be used where appropriate.

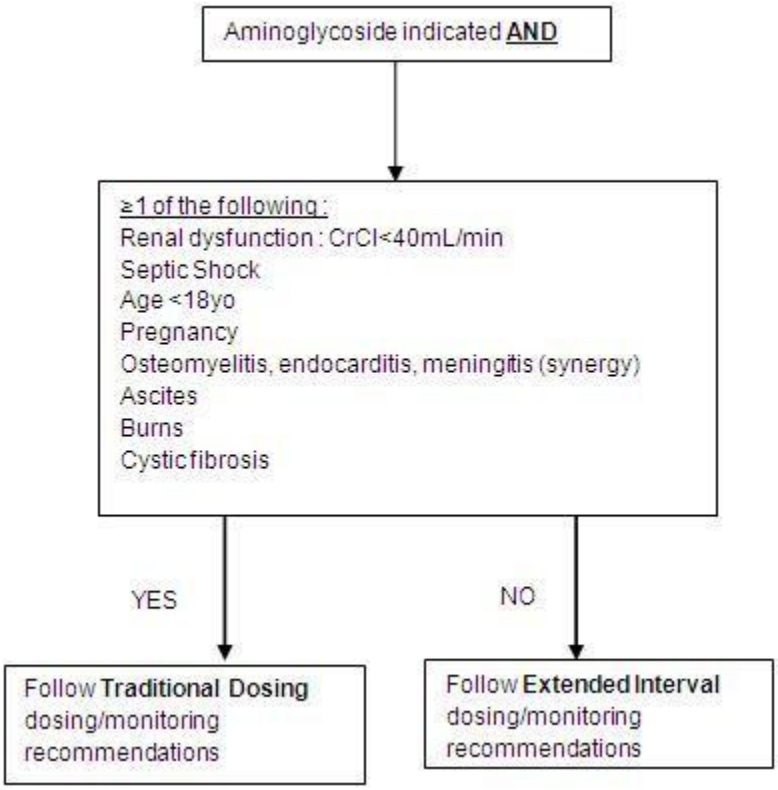
- Neonatal and pediatric patients: Physicians are encouraged to order aminoglycosides based on Hospital for Sick Children’s guidelines. Pharmacy will assume responsibility for subsequent dosing and monitoring based on aminoglycoside levels.
- Intrapartum fever/infection
- Synergistic use in endocarditis. Physicians please use “gentamicin, pharmacy to dose” powerplan

Estimating IBW and Creatinine Clearance using Cockcroft-Gault Equation

$CrCl_{male} = \frac{(140 - Age) \times IBW[kg] \times 1.2}{SCr\ [\lceil mol/L]}$ = mL/min ; $CrCl_{Female} = CrCl_{Male} \times 0.85$

SCr = Serum Creatinine (⌈mol/L)
IBW (Male) = 50 kg + 2.3 x (inches > 5 feet)
IBW (Female) = 45 kg + 2.3 x (inches > 5 feet)
*If actual body weight (ABW) is less than IBW, use ABW
*If ABW > IBW + 30%, use effective body weight (EBW).
EBW = [(ABW-IBW) x 0.4] + IBW

Algorithm for aminoglycoside dosing



Guidelines for Once Daily Extended Interval Aminoglycoside Monitoring

Initial Dosing:

- 5-7mg/kg/dose
- Maintenance dose interval
  - CrCl > 60ml/min: Q24h
  - CrCl = 40-59: q36h
  - CrCl <40 or IHD: Consider conventional multiple daily dosing
  - CRRT: q48h (ideally administered pre-dialysis)

Monitoring:

1. Serum creatinine should be drawn at baseline and every 3 days while on AG.
2. Monitor urine output q24h while on aminoglycoside
3. Baseline auditory testing should be done for patients with baseline auditory deficiencies and any patients expected to be on >3 days of therapy
4. Serum AG levels are NOT to be routinely drawn.
5. Criteria for AG levels are:
   - Expected duration of treatment > 3 days (i.e. documented infection). Obtain a trough level 30 minutes before next dose by day 3 of therapy and then qweekly for duration of therapy
   - Renal function borderline (i.e. CrCl = 40-60 mL/min or in elderly patients) or fluctuating
   - If trough level of >1.0 mg/L, re-assess need for aminoglycoside. Converting to traditional dosing may be required

Therapeutic Drug Monitoring

- CrCl > 60: Take trough level pre-third dose
- CrCl < 60: Take trough level pre-second dose
- CRRT: 24 hours after 1st dose

Table 1 - Target trough levels for once daily aminoglycoside dosing

AMINOGLYCOSIDE	DESIRED TROUGH*
Gentamicin	< 0.5 mg/L
Tobramycin	< 0.5 mg/L
Amikacin	< 1.0 mg/L

Guidelines for Conventional (Multiple Daily Dosing) Aminoglycoside Dosing and Monitoring

Initial dose:

- 1.7mg/kg/dose (unless on IHD)

Table 2 - Recommended Frequency Adjustments for Gentamicin/Tobramycin in renal dysfunction

CREATININE CLEARANCE (mL/min)	DOSING INTERVAL
> 60	q8h
40 – 59	q12h
15 - 39	q24h
< 15	Give a dose, draw a level 24h later to determine dosing interval
IHD	2mg/kg load, then 1mg/kg post IHD
CRRT	Suggest extended interval dosing

Monitoring:

1. Serum creatinine should be drawn at baseline and every 3 days while on AG.

2. Therapeutic drug Monitoring

   - CrCl > 60ml/min: Take peak post-3rd dose, trough pre-4th dose
   - CrCl 20-59ml/min: Take peak post 2nd dose, trough pre-3rd dose
   - CrCl < 20ml/min: level should generally be drawn before each dose

   Dialysis

   - IHD: trough pre-IHD before next IHD session
   - CRRT: Peak after 2nd dose, trough pre third dose

Peak level timing: 30 minutes AFTER the end of the infusion
Trough level timing: < 30 minutes BEFORE next dose

3. Levels are NOT done in-house. They are sent to Sunnybrook for testing. Expected turn-around time is within 24h

Table 3. Guidelines for desired serum concentrations for conventional dosing

INFECTION	GENTAMICIN / TOBRAMYCIN		AMIKACIN	
	Trough (mg/L)	Peak (mg/L)	Trough (mg/L)	Peak (mg/L)
Urinary tract infections	< 2	4 - 6	< 5	15
Serious infection (bacteremia, pneumonia, sepsis, cellulitis, wound)	< 2	6 - 10	< 10	20 - 25
Life-threatening infections (e.g. P. aeruginosa pneumonia)	< 2	10 - 12	< 10	25 - 30

Reference:

1. Dipiro, JT, Spruill, WJ, Wade, WE, Blouin, RA, Pruemer, JM. Concepts in Clinical Pharmacokinetics 4th edition.
2. Nicolau D, Quintilani R, Nightingale C. Once daily aminoglycosides. Conn Med 1992;56:561-63
3. Hatala R, Dinh T, Coddk DJ. Once-daily aminoglycoside dosing in immunocompetent adults: a meta-analysis. Ann Intern Med 1996;124(8):717-25.
4. UHN Initiating Intravenous (IV) Aminoglycoside Therapy Safely in Adult Inpatients [Available from: https://www.antimicrobialstewardship.com/_files/ugd/b5d454_91297fb5c84c4a8090af8e752a9cd734.pdf accessed 31 Oct 2024

VANCOMYCIN DOSING AND MONITORING GUIDELINES

Background

Vancomycin exerts its antibacterial activity by inhibiting bacterial cell wall synthesis, a process that is primarily time-dependent (time>MIC). Protein binding is moderate (~50%) and penetration of the drug into the lung and CNS is poor.

Protocol:

1. Vancomycin must be ordered by a physician.
2. Physicians who wish for pharmacists help with dosing and monitoring as per pharmacy directive should order the powerplan "vancomycin (with bolus), Pharmacist to dose"
3. After reviewing the patient's chart, the pharmacist may:
   a. Calculate or estimate creatinine clearance
   b. Establish the appropriate maintenance dose and frequency for vancomycin
   c. Order the adjusted dosages in Powerchart
   d. Document the rationale for adjustments in the pharmacy progress notes
   e. Order creatinine and serum drug levels and readjust doses as required

Empiric Dosing recommendations:

Input and initiate "vancomycin (with bolus), Pharmacist to dose" powerplan into Powerchart. Check off the appropriate bolus and maintenance dose according to patient's weight and renal function. Pharmacists will adjust future doses according to levels.

vancomycin (with bolus), Pharmacist to dose (Planned Pending)		
Consults		
☑	Pharmacist to assess	Order & monitor specific meds - MD ONLY, vancomycin
Vital Signs/Monitoring		
Baseline		
☑	Weight	once (kg)
Laboratory		
☑	Creatinine - includes eGFR	once, Urgent
☑	Creatinine - includes eGFR	qMTh, Routine, X 1 week
Medications		
Bolus Dose		
	Weight less than or equal to 60 kg	
☐	vancomycin	1.25 g, inj, IVPB, once, (BOLUS), for 1 dose
	Weight between 61 - 70 kg	
☐	vancomycin	1.5 g, inj, IVPB, once, (BOLUS), for 1 dose
	Weight between 71 - 80 kg	
☐	vancomycin	1.75 g, inj, IVPB, once, (BOLUS), for 1 dose
	Weight greater than or equal to 81 kg	
☐	vancomycin	2 g, inj, IVPB, once, (BOLUS), for 1 dose
Maintenance dose (eGFR > 30 mL/min)		
	Weight less than or equal to 70 kg	
☐ +12 hr	vancomycin	1 g, inj, IVPB, q12h
	Weight between 71 - 89 kg	
☐ +12 hr	vancomycin	1.25 g, inj, IVPB, q12h
	Weight between 90 - 119 kg	
☐ +12 hr	vancomycin	1.5 g, inj, IVPB, q12h
	Weight greater than or equal to 120 kg	
☐ +12 hr	vancomycin	2 g, inj, IVPB, q12h
Maintenance dose (eGFR < 30 mL/min)		
	Pharmacy will assess and order maintenance dose, MD to order bolus dose only	

*These are recommendations are for initial dosing only, both dose and interval should be adjusted based on trough levels.

** For hemodialysis patients, please consult pharmacy for the hemodialysis specific vancomycin protocol

Empiric Maintenance Dosing

- Consider 15m/kg/dose (maximum 2g/dose and round to the nearest 250mg)
- Dosing interval below are guidance only and assume stable renal function.

CrCl (ml/min)	Suggested <u>empiric</u> initial dosing interval
Greater than or = 60	Q12h
30-59	Q24h
Less than 30	Q48h guided by indication and follow-up monitoring

Monitoring recommendations:

<u>Serum Creatinine</u> – baseline and twice weekly while on vancomycin.

The risk of nephrotoxicity during vancomycin monotherapy is < 10% when trough concentrations are maintained ≤ 15 mg/L. The incidence of nephrotoxicity is ~10-20% for patients with trough levels maintained between 15-20 mg/L.

The risk of nephrotoxicity is further increased if any of the following apply:

- duration of therapy exceeds 14 days
- the dose per day exceeds 4 g
- trough vancomycin levels are maintained above 20 mg/L (e.g., creatinine clearance < 50 mL/min)
- potentially nephrotoxic agents are being used concomitantly – aminoglycosides, amphotericin B, cisplatin, diuretics, NSAIDs, or radiocontrast dye.

<u>Vancomycin Levels</u>

- Peak levels are no longer routinely performed due to lack of evidence correlating efficacy and toxicity.
- Trough level should normally be drawn at steady state before the 3rd or 4th dose of the regimen and should be obtained 30 minutes prior to the scheduled dose.

<u>Target Trough Levels</u>

There is no definitive evidence that supports a relationship between trough concentrations and organism eradication or overall patient outcome. The following recommendations are based on pharmacokinetic and pharmacodynamic properties of vancomycin as well as increased prevalence of higher vancomycin MICs (i.e. 1mg/L) for S. Aureus.

INDICATION	TARGET TROUGH (mg/L)
Empiric Therapy (Skin and soft tissue infections; Urinary tract infections)	10-15
Serious gram-positive Infections: ● Bacteremia ● Meningitis ● Pneumonia	15 –20

• Endocarditis • Osteomyelitis • S. aureus infections with MIC ≥1mg/mL	

Adjusting Vancomycin Doses

- Changing the dose in increments of 250mg and/or the frequency are reasonable strategies.

References:

1. Wilhelm MP, Estes L. Symposium on Antimicrobial Agents – Part XII: Vancomycin. May Clin Proc 1999;74:928-35.
2. Matzke GR, McGory TN, Halstensen Ce et al. Pharmacokinetics of Vancomycin in Patients with Various Degrees of Renal Function. Antimicrob Agents Chemother 1984;25:433-7.
3. Rybak MJ, Lomaestro BM, Rotschafer JC, et al. Vancomycin Therapeutic Guidelines: A Summary of Consensus Recommendations from the Infectious Diseases Society of America, the American Society of Health-System Pharmacists, and the Society of Infectious Diseases Pharmacists. Clin Infect Dis 2009;49:325-7.
4. Rybak M, Lomaestro B, Rotschafer JC et al. Therapeutic monitoring of vancomycin in adult patients: A consensus review of the American Society of Health-System Pharmacists, the Infectious Diseases Society of America, and the Society of Infectious Diseases Pharmacists. Am J Health Syst Pharm. 2009 Jan 1;66(1):82-98.
5. Hidayat et al. High-Dose Vancomycin Therapy for Methicillin-Resistant Staphylococcus aureus Infections. Arch Intern Med 2006;166:2138-44.
6. Ryback MJ. The Pharmacokinetic and Pharmacodynamic Properties of Vancomycin. Clin Infect Dis 2006;2:S35-9.
7. Vancomycin HCL CPhA monograph. Oct 2011.

ADULT MALARIA TREATMENT

INDICATION FOR THERAPY	CAUSATIVE ORGANISMS	TREATMENT REGIMENS
Severe malaria **Criteria** ● History of recent possible exposure/no other recognized pathology OR ● Asexual forms of P. falciparum on blood smear **AND** One or more of the following: ● Impaired consciousness/coma ● Prostration with extreme weakness ● Severe normocytic anemia ● Acute Renal failure ● Pulmonary edema or ARDS ● Hypoglycemia ● Circulatory collapse, shock ● Spontaneous bleeding/DIC ● Repeated generalized convulsions ● Acidemia/acidosis ● Macroscopic hemoglobinuria ● Parasitemia >5% in non-immune individuals	P. Falciparum P. vivax P. knowlesi	***First line*** IV Artesunate 2.4 mg/kg per dose IV at 0, 12, 24 and 48 hours. First dose to be administered STAT. Give IV push over 1-2 min$. (Total dose = 9.6 mg/kg. No maximum dose - dose according to actual body weight for obese patients.) **PLUS one** of the following (to start 4-hours after last dose of IV artesunate): Atovaquone† 250 mg/proguanil 100 mg (Malarone) 4 tabs PO daily x 3 days **OR** Doxycycline†† 100 mg PO BID x 7 days **OR** Clindamycin* 10 mg/kg IV load, then 5 mg/kg IV q8h x 7 days ***Alternative if artesunate not available*** (First line in first trimester of pregnancy) IV Quinine Loading dose**: 5.8 mg/kg base (7 mg/kg quinine dihydrochloride) in 100 mL of NS or D5W infused by infusion pump over 30 minutes Maintenance: 8.3 mg/kg base (10 mg/kg quinine dihydrochloride) diluted in 10 mL/kg of NS or D5W infused over 4 hours q8h When patient is able to swallow, switch to oral quinine tablets to complete 3-7 days of therapy***. For patients requiring >48 h of IV therapy, reduce maintenance dose by 1/3 to 1/2. **PLUS one** of the following (either concurrently with

		quinine or immediately after): Atovaquone† 250 mg/proguanil 100 mg (Malarone) 4 tabs PO daily x 3 days **OR** Doxycycline†† 100 mg PO BID x 7 days **OR** Clindamycin* 10 mg/kg IV load, then 5 mg/kg IV q8h until blood is clear of sexual parasites
Uncomplicated falciparum malaria		Atovaquone† 250 mg/proguanil 100 mg (Malarone) 4 tabs PO daily x 3 days **OR**
		Quinine sulfate 250 mg base/300 mg salt/tab 2 tabs PO TID x 7 days **PLUS one** of the following (either concurrently with quinine or immediately after): Doxycycline†† 100 mg PO BID x 7 days **OR** Clindamycin* 300 mg PO base q6h x 7 days
Non-severe Non-falciparum malaria (For non-falciparum malaria acquired outside of New Guinea, chloroquine remains the drug of choice).	P.Ovale P.Vivax P.Malariae P.Knowlesi	Chloroquine Phosphate (Aralen) 150 mg base/tab 1.5 g base (10 tabs) over 3 days given as 2 tabs PO BID on Day 1 & 2, then 2 tabs PO on Day 3 Or Atovaquone† 250 mg/proguanil 100 mg (Malarone) 4 tabs PO daily x 3 days **PLUS** for treatment of liver forms in P. vivax/ovale only give primaquine 30 mg PO OD x 14 days****

[$]Hemolysis can occur 1-3 weeks after treatment initiation. CBC should be followed weekly for 4 weeks after treatment initiation.

†Preferred agent unless patient received Malarone prophylaxis, is pregnant, or has a CrCl less than 30 mL/min.

††Contraindicated if age <8 years old or in pregnancy or breastfeeding.

*Use clindamycin only if the patient is unable to take other alternatives (i.e. Malarone or doxycycline). Where IV therapy is recommended, may step-down to PO clindamycin 20 mg/kg/day divided QID once oral therapy is tolerated.

**Do not give IV quinine loading dose if patient received quinine, quinidine or mefloquine within preceding 24 hours.
***7 day duration of quinine therapy is recommended for *P.falciparum* infections acquired in Southeast Asia. 3 day therapy is recommended for all other regions.

****contraindicated in pregnancy/breastfeeding and may cause hemolytic anemia due to G6PD deficiency. Send test for G6PD first.

Uncomplicated malaria: symptomatic malaria without evidence of severe disease or organ dysfunction.

Severe or complicated malaria: symptomatic malaria with hyperparasitemia (> 5%) or evidence of organ damage/complications. Adjuvant therapies such as exchange transfusion should be considered after consultation with infectious diseases

IV Artesunate and IV Quinine are Special Access Drugs supplied by the Canadian Malaria Network (CMN).

- To obtain IV artesunate or quinine on weekdays 08:00 – 21:00, weekends and holidays 09:00-17:00, call the Toronto General Hospital Pharmacy Department at (416) 340-4800 x3467 or pharmacist Elena Palacios-Wong 416-340-4800 x 3499.
- After hours, call the Toronto General Hospital switchboard at (416) 340-4800 and ask for the on-call pharmacist to be paged. Please provide the following information: requesting physician, contact information, patient name and hospital address.
- Please inform the TEGH Pharmacy department if either IV artesunate or quinine has been requested though the CMN.

CMN – Toronto Physician Contact Information:
Dr. Andrea Boggild
The Toronto General Hospital
200 Elizabeth St. 13EN-1350
Toronto, ON M5G 2C4
Phone: 416-340-3675
Fax: 416-340-3260
andrea.boggild@utoronto.ca or Stefanie.klowak@uhn.ca
OR when unavailable

Infectious Disease Physician On-Call
416-340-4800 x 3155

IV Artesunate Administration Information
Artesunate is supplied as a single dose vial containing 110 mg of sterile dry-filled powder and a single-dose vial containing 12 mL of phosphate buffer diluent. Artesunate must be refrigerated. Once reconstituted with the diluent, drug must be used within 1 hour. Syringe filter and in-line filter are not mandatory**.** In rare cases where the patient cannot tolerate oral medications daily artesunate can be continued daily for a total of 7 days.

IV Quinine Administration Information
Quinine is supplied as an ampoule containing 600 mg/2 mL of sterile solution. Loading dose should be followed immediately by a maintenance dose.

Reference:

1. Canadian Recommendations for the Prevention and Treatment of Malaria Among International Travellers. CCDR 2009: Vol 35:s1. Available from: URL: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/09vol35/35s1/page7-eng.php
2. Canadian Recommendations for the Prevention and Treatment of Malaria. An Advisory Committee to Advise on Tropical Medicine and Travel. 2019. Available at URL: https://www.canada.ca/en/public-health/services/catmat/canadian-recommendations-prevention-treatment-malaria/chapter-7-treatment.html
3. University Health Network. Canadian Malaria Network - Distribution of Artesunate & Quinine: Guidelines for Pharmacy Staff. June 24, 2009.

Updated October 2024

ANTIBIOTIC PROPHYLAXIS IN SURGERY

TYPE OF SURGERY	PATIENT SELECTION	ANTIBIOTIC REGIMENS		
		Recommended regimen	**Alternative for documented allergy to cefazolin#**	**MRSA-positive Patients**
General Surgery	Laparoscopic cholecystectomy (for high risk only; e.g. >70 years, obstructive jaundice, diabetic, acute inflammation)	Cefazolin 2g IV^	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV
	Biliary/Pancreas/Liver	Cefazolin 2g IV^	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV
	Colorectal Surgery	Cefazolin 2g IV^ + Metronidazole 500 mg IV	Vancomycin 15mg/kg IV + Tobramycin 5 mg/kg IV + Metronidazole 500 mg IV	Vancomycin 15mg/kg IV + Tobramycin 5 mg/kg IV + Metronidazole 500 mg IV
	Appendectomy	Cefazolin 2g IV^ + Metronidazole 500 mg IV	Vancomycin 15mg/kg IV + Tobramycin 5 mg/kg IV + Metronidazole 500 mg IV	Vancomycin 15mg/kg IV + Tobramycin 5 mg/kg IV + Metronidazole 500 mg IV

	Gastroduodenal/Esophageal (including bariatric)	Cefazolin 2g IV^	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV
	Anorectal procedures (hemorrhoidectomy, fistulotomy, sphincterotomy for fissure)	None required	None required	None required
Gynecological and Obstetric	Emergency or elective C-Section	Cefazolin 2g IV^	Clindamycin 900 mg IV + Tobramycin 5mg/kg IV	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV
	Hysterectomy/ or surgery for pelvic organ prolapse/stress urinary incontinence surgery	Cefazolin 2g IV^	Clindamycin 900 mg IV + Tobramycin 5mg/kg IV	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV
Head and Neck Surgery, Plastic Surgery	Breast, thyroid, parathyroid	Cefazolin 2g IV^	Vancomycin 15mg/kg IV	Vancomycin 15mg/kg IV
	Head and Neck Surgery involving incision of oral, pharyngeal or nasal mucosa	Cefazolin 2g IV^	Clindamycin 900mg IV	Vancomycin 15mg/kg IV + Metronidazole 500 mg IV
	Minor Plastic Surgery or no incision of mucosa	None required	None required	None required
	Ocular Surgery	Eyedrops pre-op as per protocol	Eyedrops pre-op as per protocol	Eyedrops pre-op as per protocol

Orthopedic	Total joint replacement, Hip fracture	Cefazolin 2g IV^	Vancomycin 15mg/kg IV	Vancomycin 15mg/kg IV
Thoracic/Vascular/ Pacemaker§	All except carotid or brachial	Cefazolin 2g IV^	Vancomycin 15mg/kg IV	Vancomycin 15mg/kg IV
Urologic surgery **	**Lower Tract**			
	Cystoscopy with manipulation	Cefazolin 2g IV^	Ciprofloxacin 400 mg IV or 500 mg PO	N/A as no skin breach
	Transrectal Ultrasound (TRUS) with prostate biopsy	Ciprofloxacin 400 mg IV or 500 mg PO	Ciprofloxacin 400 mg IV or 500 mg PO	N/A as no skin breach
	Upper Tract			
	Shock wave lithotripsy	Cefazolin 2g IV^	Ciprofloxacin 400 mg IV or 500 mg PO	N/A as no skin breach
	Ureteroscopy	Cefazolin 2g IV^	Ciprofloxacin 400 mg IV or 500 mg PO	N/A as no skin breach
	Open or laparoscopic			
	Not entering GU or GI tract (e.g. Radical nephrectomy, laparoscopic nephrectomy)	Cefazolin 2g IV^	Vancomycin 15mg/kg IV pre-op	Vancomycin 15mg/kgIV pre-op
	Entering GU tract (e.g. Radical prostatectomy)	Cefazolin 2g IV^	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV pre-op	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV pre-op
	Entering GU and GI tract (eg. Radical cystectomy with ileoconduit, Ileoconduit construction)	Cefazolin 2g IV^ + Metronidazole 500mg IV	Vancomycin 15mg/kg IV + Tobramycin 5mg/kg IV + Metronidazole 500mg IV	Vancomycin 15mg/kg IV + Tobramycin 5 mg/kg IV + Metronidazole 500mg IV

Duration of prophylaxis: A single dose of preoperative antibiotics is sufficient for most surgical procedures. In general post-operative doses should not exceed 24 hours.

^If patient weight ≥120kg, use cefazolin 3g IV pre-op
*Dosing dependent on renal function
§ Prophylaxis should be provided for all pacemaker insertions
** Prophylaxis should be targeted to preoperative urinary cultures. For assistance with prophylaxis or resistant organism consult infectious diseases
# All penicillin allergic patients who **do not** have a severe T-cell mediated Severe Cuteaneous Adverse Reaction (SCAR) such as SJS, TEN or DRESS are safe to receive the following : Cefazolin, Ceftriaxone, Ceftazidime or Carbapenems

Timing of prophylaxis: To achieve adequate drug concentrations at the onset and throughout the operative procedure the initial dose must be given intravenously in the immediate pre-operative period (within 60 minutes for most antibiotics; 120 minutes for Vancomycin and fluoroquinolones).

If surgery is longer than 4-6 hours a second intra-operative dose is advisable for some antibiotic regimens. (Cefazolin: re-dose at 4 hrs intra-op; Clindamycin: re-dose at 6 hrs intra-op; Metronidazole: re-dose at 8 hrs intra-op).

References:

1. Bratzler DW, Houck PM. Antimicrobial prophylaxis for surgery: An advisory statement from the National Surgical Infection Prevention Project. Clin Infect Dis 2004;38:1706-15.
2. American Academy of Orthopaedic Surgeons Advisory statement – Recommendations for the use of intravenous antibiotic prophylaxis in primary total joint arthroplasty.
3. American College of Obstetricians and Gynecologists (ACOG). Antibiotic prophylaxis for gynecologic procedures. 2001.
4. Society of Obstetrics and Gynecology of Canada (SOGC). Antibiotic Prophylaxis is Obstetric Procedures. 2010.
5. American Urological Association. Best Practice Policy Statement on Urological Surgery Antimicrobial Prophylaxis, updated 2008.
6. Best Practices in General Surgery. Strategies to prevent Surgical Site Infections. June 2012
7. Bratzler DW, Dellinger EP, Olsen KM et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm 2013;70:195-283.
8. Macy E, Blumenthal KG. Are cephalosporins safe for use in penicillin allergy without prior allergy evaluation. Allergy Clin Immunol Pract 2018;6:82-9.

BACTERIAL MENINGITIS

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	EMPIRIC ANTIBIOTIC REGIMENS†
Age 18 - 50 y	*S. pneumoniae** *N. meningitides** *H. influenzae**	Ceftriaxone 2 g IV q12h ‡ + Vancomycin (dose as per hospital guidelines)
		Ceftriaxone allergy: Meropenem 2 g IV q8h + Vancomycin (dose as per hospital guidelines)
Age > 50 y or presence of risk factors- alcoholism or altered immune status or pregnancy	*S. pneumoniae** *L. monocytogenes*** *N. meningitides** *Enterobacteriaceae*** (e.g. *Klebsiella* or *E.coli*)	Ceftriaxone 2 g IV q12h ‡ + Vancomycin (dose as per hospital guidelines) + Ampicillin 2 g IV q4h
		Ampicillin and/or Ceftriaxone allergy: Meropenem 2 g IV q8h + Vancomycin (dose as per hospital guidelines)

Consider dexamethasone 0.15 mg/kg IV q6h x 4 days. Initiate dose 15-20 min before, or with first antibiotic dose but do NOT give if first dose of antibiotics has already been given. Consider discontinuing dexamethasone if meningitis is not caused by *S. pneumoniae*.

ID consultation strongly recommended for all cases of bacterial meningitis.

† Once cultures are available therapy can be tailored
* Treatment duration = 10-14 days, **Treatment duration = 21 days (Group B Strep 14-21 days)
‡ Change ceftriaxone to ceftazidime 2 g IV q8h for patient with a history of neurosurgery or head trauma in last 30 days, a neurosurgical device, or a CSF leak due to high risk of *P. aeruginosa* and *Acinetobacter* infections.

References:

1. Van de Beek, D; de Gans, J; Tunkel, AR et.al. Community-Acquired Bacterial Meningitis in Adults. NEJM 2006;352: 44-53.

2. Tunkel, AR, Hartman BJ, Kaplan SL et. al. IDSA Guidelines Practice Guidelines for the Management of Bacterial Meningitis. Clin Infect Dis 2004:39:1267-84.

CANDIDEMIA/INVASIVE CANDIDIASIS

INDICATION FOR THERAPY	CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Non-neutropenic adult	Empiric Treatment	Fluconazole 800 mg IV load, then 400 mg IV/PO q24h
		Caspofungin 70 mg IV load, then 50 mg IV q24h
		Amphotericin B liposomal 3-5 mg/kg IV q24h
Neutropenic adult with persistent, unexplained fever despite 4-7days of appropriate antibiotic therapy	Empiric Treatment*	Caspofungin 70 mg IV load, then 50 mg IV daily
		Amphotericin B liposomal 3-5 mg/kg IV q24h
Initial therapy when Candida species has been identified (Note: therapy can be further tailored once sensitivities are available)	*C. albicans* *C. tropicalis* *C. parapsilosis*	Fluconazole 400 mg IV/PO q24h
	C. glabrata	Caspofungin 70 mg IV load, then 50 mg IV q24h Note: Therapy may be changed to **Fluconazole 800mg IV/PO q24h** required for dose-dependent sensitivity.
	C. krusei C. krusei is intrinsically resistant to fluconazole	Caspofungin 70 mg IV load, then 50 mg IV q24h

	C. lusitaniae Amphotericin B resistance has been well documented for many isolates	Fluconazole 400 mg IV/PO q24h
	C. auris	Caspofungin 70 mg IV load, then 50 mg IV q24h Note: C.auris is typically susceptible to echinocandins, but patients should be monitored closely for improvement. If there is clinical deterioration or persistent fungemia >5 days, consider Amphotericin B liposomal 5 mg/kg IV q24h and consult ID

*Fluconazole not routinely used in neutropenic individuals as this drug does not cover filamentous fungi or fluconazole-resistant *Candida*.

Duration of therapy: 14 days after negative blood cultures, no metastatic complications and resolution of signs and symptoms of infection.

Clinical Aspects:

1. ID consultation
2. All patients who have candidemia, consideration should be given as to whether they should undergo an ophthalmologic examination by an ophthalmologist to look for evidence of endophthalmitis
3. Central intravenous catheters should be removed in patients with candidemia

References:

1. Blondel-Hill E, Fryters S, editors. Bugs and Drugs. Edmonton: Capital Health; 2006.
2. Dismukes WE. Introduction to Antifungal Drugs. Clin Infect Dis 2000;30:653-7.
3. Pappas PG, Rex JH, Sobe JD et al. Clinical Practice Guidelines for the Management of Candidiasis: 2009 Update by the Infectious Diseases Society of America. Clin Infect Dis 2009;48:503-535.
4. Pappas PG, Kauffman CA, Andes DR et al. Clinicial Practice Guideline for the Management of Candidiasis: 2016 Update by the Infections Diseases Society of America. Clin Infect Dis 2016:62.
5. Centers for Disease Control and Prevention. Candida auris: Treatment and Management of Infections and Colonization. 2021. Available from: https://www.cdc.gov/fungal/candida-auris/c-auris-treatment.html

CLOSTRIDIUM DIFFICILE ASSOCIATED DIARRHEA

INDICATION FOR THERAPY	CLINICAL CRITERIA	ANTIBIOTIC REGIMENS
Mild to moderate	WBC ≤ 15 SrCr < 1.5 times baseline	Vancomycin 125mg PO QID x 10 days
Severe Uncomplicated Disease	WBC > 15 SrCr > 1.5 times baseline	Vancomycin 125 mg PO QID* x 10days
Severe Complicated Disease	WBC > 15 SrCr > 1.5 times baseline Hypotension or shock Ileus Toxic megacolon or perforation	Vancomycin 500mg PO/NG QID** Note if complete ileus, consider vancomycin PR +/- Metronidazole 500 mg IV q8h x 14 days then reassess

*Note: Intravenous vancomycin is not effective for CDAD treatment
** PR dosing: Vancomycin 500mg in 50ml catheter tipped syringe, may add 50ml NS PR after provision of vancomycin, clamp rectal tube for 3hr (caution with toxic megacolon)

Management of all cases should include:

- Discontinue inciting antibiotics, when possible.
- Do not start new exacerbating antibiotics, when possible.
- Avoid motility and antimotility agents, opioids, stool softeners, laxatives, proton pump inhibitors.
- Review hydration status.

Treatment of Recurrent Disease:

- Consider Infectious Diseases consultation
- Prevent recurrent antimicrobial exposures
- Stop proton pump inhibitor if safely done
- A vancomycin pulse/taper regimen, fidaxomicin or fecal bacteriotherapy can be considered

*****Outpatient treatment with oral vancomycin or fidaxomicin is very expensive, Vancomycin is covered by Ontario drug benefit program with appropriate Limited Use (LU codes). Fidaxomicin may be covered under the Ontario Drug Benefit Exceptional Access Program for selected patients. Please consult**

pharmacist prior to discharging patient.

Reference:

1. S. B. Debast, M. P. Bauer and E. J. Kuijper on behalf of the Committee. European Society of Clinical Microbiology and Infectious Diseases: Update of the Treatment Guidance Document for Clostridium difficile Infection. Volume 20, Supplement 2, March 2014

2. McDonald et al. Clinical Practice Guidelines for *Clostridium difficile* Infection in Adults and Children: 2017 Update by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA). Clinical Infectious Diseases: February 15, 2018.

3. Johnson et al. Clinical Practice Guideline by the Infectious Diseases Society of America (IDSA) and Society for Healthcare Epidemiology of America (SHEA): 2021 Focused Update Guidelines on Management of Clostridioides difficile Infection in Adults. Clinical Infectious Diseases: June 14, 2021

COMMUNITY ACQUIRED PNEUMONIA (CAP)

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Outpatient Treatment ● Individuals with comorbidities (chronic heart, lung, liver or renal disease, diabetes, alcoholism, malignancies, asplenia) ● Individuals with immunosuppressive disease or on immunosuppressant therapy ● Use of antibiotics in last 3 months (consider selecting an antibiotic from a different class as previous exposure to antibiotics within this timeframe is a risk factor for developing drug-resistant streptococcus pneumoniae)	*S. pneumoniae* *M. pneumoniae* *C. pneumoniae* *H. influenzae* *M. catarrhalis* *Legionella sp.* *Enterobacteriaceae*	Amoxicillin 1000mg PO BID x 5-7 days
		Penicillin allergy: Cefuroxime 500 mg PO BID x 5 days *OR* Moxifloxacin 400 mg PO daily x 5 days
Inpatient admission (Non-ICU)	*S. pneumoniae* *M. pneumoniae* *C. pneumoniae* *H. influenzae*	Amoxicillin/ Clavulanic acid 875mg/125mg PO BID x 5-7 days* OR Ceftriaxone 1g IV q24h x 5-7 days*
		Ceftriaxone allergy: Amoxicillin/ Clavulanic acid 875mg/125mg PO BID x 5-7 days* *OR* Moxifloxacin 400 mg IV/PO q24h x 5-7 days
Inpatient ICU admission ● Consider atypical coverage	*S. pneumoniae* *S. aureus* *Legionella sp.* *Gram negative bacilli* *H. influenzae*	Ceftriaxone 1 g IV q24h +/- Azithromycin 500 mg IV q24h
		Ceftriaxone allergy: Moxifloxacin 400 mg IV q24h

Influenza suspected (symptoms for < 48 h)	*Influenza A or B*	**Add** Oseltamavir 75 mg PO BID
Macroaspiration suspected	*Oral Anaerobes*	Ceftriaxone 1g IV q24h
		Amoxicillin/clavulanate 875/125 mg PO BID
MRSA suspected	*MRSA*	**Add** Vancomycin (Dose as per hospital guidelines)
Pseudomonas suspected	*Pseudomonas*	Refer to Hospital Acquired Pneumonia Guidelines

*Consider adding atypical coverage when "enhanced surveillance directive" from Public Health has been issued or when patients have not responded to drug therapy after 48hrs.

**If the patient has received antibiotics within the last 3 months consideration should be given to prescribing an agent from a different class.

Duration of therapy: minimum of 3 days. Patients should be afebrile for 48h and clinically stable before discontinuation of therapy.

References:

1. Mandell LA, Wunderink RG, Anzueto A et al. Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults. Clin Infect Dis 2007;44:S27-72.

2. Jain S, Selt RG, Wunderink S, et al. Community- Acquired Pneumonia Requiring Hospitalization among U.S. Adults. N Engl J Med 2015;373:415-27.

3. Postma DF, van Werkhoven CH, van Elden LJR et al. Antibiotic treatment strategies for community acquired pneumonia in adults. N Engl J Med 2015;372:1312-23.

4. Management of community acquired pneumonia. http://www.antimicrobialstewardship.com/sites/default/files/article_files/asp_simple_messaging_-_cap_algorithm_-_final_2016.pdf

5. Uranga A, Espana P, Bilbao A, et al. Duration of antibiotic treatment in community-acquired pneumonia: a multicenter randomized clinical trial. JAMA Intern Med 2016; 176(9): 1257-1265.

6. El Moussaoui R, De Borgie CAMJ, Van Den Broek P, et al. Effectiveness of discontinuing antibiotic treatment after three days versus eight days in mild to moderate-severe community acquired pneumonia: randomized, double blind study. BMJ 2006 332(7554): 1355.

7. Metlay 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. Am. J. Respir. Crit. Care Med. 2019. Available from: https://doi.org/10.1164/rccm.201908-1581ST

8. Dinh et al. Discontinuing β-lactam treatment after 3 days for patients with community-acquired pneumonia in non-critical care wards (PTC): a double-blind, randomised, placebo-controlled, non-inferiority trial. Lancet. 2021. 397;10280:1195-1203.

Febrile Neutropenia

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Febrile Neutropenia	Gram positive cocci (*Staphylococci, Streptococci*) Gram negative bacilli (*E. coli, Klebsiella sp, Pseudomonas aeruginosa*) Often polymicrobial	Piperacillin-Tazobactam 3.375 g IV q6h
		Penicillin allergy: Meropenem 500 mg IV q6h ***OR*** Vancomycin (Dose as per hospital guidelines) + Ciprofloxacin 400 mg IV q12h + Tobramycin (Dose as per hospital guidelines) + Metronidazole 500 mg IV/PO q12h
	MRSA or central line infection suspected	**Add** Vancomycin (Dose as per hospital guidelines)
	Hospitalization for <72 h and radiologic evidence of chest infiltrates/pneumonia suspected	**Add** Azithromycin 500 mg IV q24h
Low Risk Neutropenia* Low risk Neutropenia: 1. Solid Malignancy (no hematologic malignancy) 2. Able to take oral medications 3. Expected duration of	Gram positive cocci (*Staphylococci, Streptococci*) Gram negative bacilli (*E. coli, Klebsiella sp, Pseudomonas aeruginosa*) Often polymicrobial	Ciprofloxacin 750 mg po BID + Amoxicillin-Clavulanate 875/125 mg po BID
		Penicillin allergy: Cephalexin 500mg po QID

neutropenia <7 days 4. Clinically stable 5. No serious comorbid conditions 6. Adequate renal/hepatic function 7. MASCC score ≥21		+ Ciprofloxacin 750mg po BID* **OR** Levofloxacin 750 mg PO daily
Persistent fever following 4-7 days of antimicrobial therapy	*Candida sp.*	**Add** antifungal agent (See guidelines for Candidemia)
Orophargyngeal and/or esophageal candidiasis		**Add** Fluconazole 200 mg IV/po x 1, then 100mg IV/po q24h
Mucositis		**Add** Chemo Mouthwash (nystatin + lidocaine), 15-30 mL swish and swallow or spit QID

BMT = Bone marrow transplant, SCT = Stem cell transplant

*Low Risk Neutropenia: must meet all of the following criteria: 1) Solid tumor, 2) Able to take oral medications, 3) Expected duration of neutropenia < 7 days, 4) Clinically stable, 5) No serious comorbid conditions and 6) Adequate renal & hepatic function, 7) MASCC score ≥21

MASCC risk-index score

CHARACTERISTIC	POINTS
Burden of febrile neutropenia ● No or mild symptoms ● Moderate symptoms ● Severe symptoms	 5 3 0
No hypotension (systolic BP >90mmHg)	5
No COPD	4
Solid tumor or hematological malignancy with no previous fung l infection	4
No dehydration requiring parenteral fluid resuscitation	3
Outpatient status at time of onset of fever	3

Age <60	2

Duration of Therapy:
Known etiology:
Continue antibiotics directed against any known etiology for a minimum of 7 days.

Unknown etiology:

Absolute Neutrophil Count (ANC) > 0.5 for 2 consecutive days: discontinue antibiotics when afebrile for at least 48 hours.

ANC 0.1-0.5:

- if initially low risk and clinically stable, may discontinue antibiotics when afebrile for 5-7 days.
- if initially high risk or clinically unstable, continue antibiotics and reassess when ANC > 0.5 and clinically stable.

ANC < 0.1: continue antibiotics and reassess when ANC > 0.5 and clinically stable.

References:

1. Hughes WT et al. 2002 Guidelines for the Use of Antimicrobial Agents in Neutropenic Patients with Cancer. Clin Infect Dis 2002; 34: 730-51.

2. Paul M et al. Empirical antibiotic monotherapy for febrile neutropenia: systematic review and meta-analysis of randomized controlled trials. J Antimicrob Chemother 2006; 57: 176-89.

3. Vidal L et al. Oral versus intravenous antibiotic treatment for febrile neutropenia in cancer patients: a systematic review and meta-analysis of randomized trials. J Antimicrob Chemother 2004; 54: 29-37.

4. Rolston KVI. Challenges in the treatment of infections caused by gram-positive and gram-negative bacteria in patients with cancer and neutropenia. Clin Infect Dis 2004; 40: S246-52.

5. Kern WV, Marchetti O, Drgona L et al. Oral antibiotics for fever in low-risk neutropenic patients with cancer: a double-blind, randomized, multicenter trial comparing single daily moxifloxacin with twice daily ciprofloxacin plus amoxicillin/clavulanic acid combination therapy-EORTC infectious disease group trial XV. J Clin Oncol. 2013;31(9): 1149.

6. Outpatient Management of Fever and Neutropenia in Adults Treated for Malignancy: American Society of Clinical Oncology and Infectious Diseases Society of America Clinical Practice Guideline Update Randy A. Taplitz et. al. J Clin Oncol 36 (2018)

HEPATITIS B: POST-EXPOSURE MANAGEMENT OF PERCUTANEOUS AND MUCOSAL EXPOSURE TO BLOOD AND BODY FLUIDS

Health-care personnel status or patient	Postexposure testing		Postexposure prophylaxis		Postvaccination serologic testing€
	Source patient (HBsAg)	HCP/Patient testing (anti-HBs)	HBIG*	Vaccination	
Documented responderΔ after complete series (≥3 doses)	No action needed				
Documented nonresponder◊ after 6 doses	Positive/ unknown	No testing required	HBIG x2 separated by 1 month	No need to vaccinate	No
	Negative	No action needed			
Response unknown after 3 doses	Positive/ unknown	<10 mIU/mL§	HBIG x1	Initiate revaccination – Give 1 dose of hepatitis B vaccine. Retest anti-HBs in 4 wks; if < 10 IU/L complete second hepatitis B vaccine series	Yes
	Negative	<10 mIU/mL	None		
	Any result	≥10 mIU/mL	No action needed		
Unvaccinated/incompletely vaccinated or vaccine refusers	Positive/ unknown	No testing required	HBIG x1	Complete vaccination	Yes
	Negative	No testing required	None	Complete vaccination	Yes

* HBIG should be administered intramuscularly as soon as possible after exposure when indicated. HBIG dosage is 0.06 mL/kg.

€ Should be performed 1 to 2 months after the last dose of the HepB vaccine series (and 4 to 6 months after administration of HBIG to avoid detection of passively administered anti-HBs) using a quantitative method that allows detection of the protective concentration of anti-HBs (≥10 mIU/mL).

Δ A responder is defined as a person with anti-HBs ≥10 mIU/mL after ≥3 doses of HepB vaccine.

◊ A nonresponder is defined as a person with anti-HBs <10 mIU/mL after ≥6 doses of HepB vaccine.

Note: All HCP/patients who have anti-HBs <10 mIU/mL, or who are unvaccinated or incompletely vaccinated, and sustain an exposure to a source patient who is HBsAg-positive or has unknown HBsAg status, should undergo baseline testing for HBV infection as soon as possible after exposure, and follow-up testing approximately 6 months later. Initial baseline tests consist of total anti-HBc; testing at approximately 6 months consists of HBsAg and total anti-HBc.

References:

Schillie, S., Murphy TV, Sawyer M, My K, Hughes E, Jiles R, de Perio MA, Reilly M, Byrd K, Ward JW. Centers for Disease Control and Prevention (CDC). MMWR Recomm Rep. 2013 (RR-10):1

HIV - POST-EXPOSURE PROPHYLAXIS

INDICATION FOR THERAPY	ANTIBIOTIC REGIMENS
HIV Prophylaxis **Post- blood/body fluid exposure**	Truvada® (tenofovir 300 mg & emtricitabine 200 mg) 1 tablet PO daily x 28 days **AND** Dolutegravir 50mg PO daily x 28 days

- Post exposure prophylaxis information and medication (4 day kit) is available in the Emergency Department for staff and patients.
- First dose of medication should be given as soon as possible post exposure (ideally within 2-4 hours).
- All drug costs for occupational exposure will be covered by TEGH.

Refer to TEGH policy http://sqlapp1tegh/dotNet/documents/?docid=4829&mode=view

References:

1. Infection Control and Hospital Epidemiology 2013; 34 (9)
2. Ontario Hospital Association and Ontario Medical Association. Blood-Borne Diseases Surveillance Protocol for Ontario Hospitals. November 2012
3. Policy Tech 7.6.1.31; Blood Borne Disease (HIV, Hepatitis B and C) Post Exposure Prophylaxis for Employees
4. Darrell H. S. Tan, Mark W. Hull, Deborah Yoong, Cécile Tremblay et al. Canadian guideline on HIV pre-exposure prophylaxis and nonoccupational postexposure prophylaxis. CMAJ Nov 2017, 189 (47) E1448-E1458; **DOI:** 10.1503/cmaj.170494

HOSPITAL ACQUIRED PNEUMONIA (HAP) & VENTILATOR ASSOCIATED PNEUMONIA (VAP)

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Early onset HAP (occurring within 4 days of hospitalization) and: ● No immunosuppressive disease; ● No bronchiectasis; ● Not intubated	*Streptococcus pneumoniae* *Haemophilus influenzae* Methicillin-sensitive *S.aureus* Enteric gram negative bacilli (*E.Coli, K. pneumoniae, Enterobacter* sp, *Proteus* sp, *Serratia marcescens)*	Amoxicillin-Clavulanate 875/125mg PO BID Ceftriaxone 1g IV q24h ***Ceftriaxone allergy*:*** Moxifloxacin 400 mg IV/PO q24h
Late onset HAP (>4 days of hospitalization) and: ● No immunosuppressive disease; ● Hemodynamically stable; ● No previous antibiotics in last 3 months; ● No bronchiectasis; ● Not intubated	Enteric gram-negative bacilli (*Klebsiella, Enterobacter, Serratia, E. coli, Proteus, Haemophilus influenzae, Pseudomonas*) and *Staphylococcus aureus* Note: Pseudomonas is an infrequent cause of pneumonia in non-critical care areas at TEGH.	Ceftriaxone 1g IV q24h ***Ceftriaxone allergy*:*** Moxifloxacin 400 mg IV/PO q24h
HAP or VAP with: ● immunosuppressive disease; ● Hemodynamically unstable; ● Previous antibiotics in last 3 months; ● Bronchiectasis; ● Intubated	Pathogens listed above *plus* the following pathogens that have the potential for multi-drug resistance: *Pseudomonas aeruginosa* *Klebsiella pneumoniae* *Acinetobacter sp.*	Piperacillin-tazobactam 3.375 g IV q6h (if in ICU, refer to extended infusion protocol) ***Penicillin allergy:*** Meropenem 500mg IV q6h
HAP, HCAP or VAP with MRSA suspected	*Methicillin Resistant Staphylococcus aureus (MRSA)* (risk factors include MRSA colonization, head trauma, diabetes, hospitalization in ICU)	**Add** Vancomycin (Dose as per hospital guidelines)

* All penicillin allergic patients who **do not** have a severe T-cell mediated Severe Cutaneous Adverse Reaction (SCAR) such as SJS, TEN or DRESS are safe to receive the following : Cefazolin, Ceftriaxone, Ceftazidime or Carbapenems

Hospital Acquired Pneumonia (HAP) - pneumonia that occurs ≥48 after hospital admission, which was not incubating at the time of admission.

Ventilator Associated Pneumonia (VAP) - pneumonia that arises > 48-72 h after endotracheal intubation.

Duration of Treatment: Patients initially treated with appropriate antibiotics may only require 5- 8 days of total therapy.

Combination regimens of beta-lactam-aminoglycoside combinations to treat *P. aeruginosa* infections are not routinely recommended due to the lack of documented clear benefit. Combination therapy should be considered in specific patient circumstances such as previous infection with multi-drug resistant *P.aeruginosa*, febrile neutropenia etc.

References:

1. American Thoracic Society/ Infectious Diseases Society of America. Guidelines for the Management of Adults with Hospital-Acquired, Ventilator-Associated and Healthcare-Associated Pneumonia. Am J Respir Crit Care Med 2005;171:388-416.
2. Chastre J, Wolff M, Fagon JY et al. Comparison of 8 vs. 15 Days of Antibiotic Therapy for Ventilator-Associated Pneumonia in Adults. JAMA 2003;90:2588-98. 3. Hilf M, Yu VL, Sharp J et al. Antibiotic therapy for Pseudomonas aeruginosa bacteremia: outcome correlations in a prospective study of 200 patients. Am J Med 1989;87:540-6. 4. Rotstein C, Evans G, Born A, et al. Clinical practice guidelines for hospital-acquired pneumonia and ventilator-associated pneumonia in adults. Can J Infect Dis Med Microbiol 2008;19(1):19-53.
3. American Thoracic Society/Infectious Diseases Society of America. Management of Adults with Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. Clin Infect Dis: 2016:63.
4. American Thoracic Society//Infectious Diseases Society of America. 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. Am. J. Respir. Crit. Care Med. 2019. Available from: https://doi.org/10.1164/rccm.201908-1581ST

INFECTIVE ENDOCARDITIS (IE)

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Streptococcal Endocarditis (Penicillin susceptible strains)	Viridans group streptococci (*S sanguis, S mitis, S salivarius, S mutans*) *Streptococcus bovis*	Native Valve
		Penicillin G sodium 12-18 MU IV divided q4-6h x 4-6 weeks
		Ceftriaxone 2 g IV/IM q24h x 4-6 weeks
		Combination Therapy for shorter treatment duration (only with ID consultation) Penicillin G sodium 12-18 MU IV divided q4-6h Or Ceftriaxone 2g IV/IM q24h x 2 weeks + Gentamicin* 1 mg/kg IV q8h x 2 weeks
		Ceftriaxone allergy: Vancomycin** x 4 weeks
		Prosthetic Valve
		Penicillin G sodium 24 MU IV divided q4-6h x 6 weeks *May consider adding:* Gentamicin* 1 mg/kg IV q8h x 2 weeks
		Ceftriaxone 2 g IV/IM q24h x 6 weeks *May consider adding:* Gentamicin* 1 mg/kg IV q8h x 2 weeks
		B-lactam anaphylaxis: Vancomycin** x 6 weeks
Staphylococcal Endocarditis	*S aureus (MSSA)*	Native Valve
		Cloxacillin 2 g IV q4h x 6 weeks
		Cefazolin 2 g IV q8h x 6 weeks
		Cefazolin and Penicillin allergy: Vancomycin** x 6 weeks
		Prosthetic Valve
		Cloxacillin 2 g IV q4h x 6 weeks Or Cefazolin 2g IV q8h x 6 weeks + Gentamicin* 1 mg/kg IV q8h x 2 weeks + Rifampin 300 mg po q8h x 6 weeks

		Cefazolin and penicillin allergy: Vancomycin** x 6 weeks + Rifampin 300 mg po q8h x 6 weeks + Gentamicin* 1 mg/kg IV q8h x 2 weeks
Enterococcal Endocarditis (penicillin, gentamicin and vancomycin susceptible strains)	*E faecalis* *E faecium*	Native Valve
		Ampicillin 2g IV q4h x 6 weeks*** + Ceftriaxone 2g IV q12h x 6 weeks***
		Ampicillin 2 g IV q4h x 4-6 weeks*** + Gentamicin* 1 mg/kg IV q8h x 4-6 weeks***
		Penicillin/Ampicillin allergy or resistance: Vancomycin** x 6 weeks + Gentamicin* 1 mg/kg IV q8h x 6 weeks
		Prosthetic Valve
		Ampicillin 2g IV q4h x 6 weeks + Ceftriaxone 2g IV q12h x 6 weeks
		Ampicillin 2 g IV q4h x 6 weeks + Gentamicin* 1 mg/kg IV q8h x 6 weeks
		Penicillin/Ampicillin allergy or resistance: Vancomycin** x 6 weeks + Gentamicin* 1 mg/kg IV q8h x 6 weeks
Endocarditis – other pathogens	Coagulase-negative staphylococcus *MRSA* *Enterococcus* Culture-Negative Fungi	Consult with Infectious Diseases service

Empiric treatment of IE is not recommended. A microbiologic diagnosis should be aggressively sought before therapy is started. Please consult Infectious Diseases service if empiric therapy is being considered.

*There is insufficient data for the use of high dose (once-daily) aminoglycosides in the treatment of IE. Target peak 3-4 mg/L, trough < 1 mg/L. Addition of gentamicin in IE caused by staphylococci in absence of prosthetic material is optional as clinical benefit of this practice has not been established.
**Vancomycin - dose as per hospital guidelines. Target trough 15-20 mg/L.
***Treat for 6 weeks if patient has had symptoms of illness for greater than 3 months.

References:

1. AHA Scientific Statement. Infective Endocarditis: Diagnosis, Antimicrobial Therapy and Management of Complications. Circulation 2005:11:e394-e433.
2. Ribera E, Gomez-Jimenez J, Cortes E et al. Effectiveness of cloxacillin with and without gentamicin in short-term therapy for right-sided Staphylococcus aureus endocarditis: a randomized, controlled trial. Ann Intern Med 1996:125:969-74.
3. Fernandez-Hidalgo N, Almirante B, Gavalda J et al. Ampicillin plus ceftriaxone is as effective as ampicillin plus gentamicin for treating enterococcus faecalis infective endocarditis. Clin Infect Dis 2013

INTRA-ABDOMINAL INFECTIONS

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Community Acquired **Uncomplicated** (Non-perforated appendicitis, perforations without established infection)	Enterobacteriaceae Anaerobes +/- Gram-positive cocci (stomach/duodenum)	Cefazolin 2 g IV q8h + Metronidazole 500 mg IV/PO q12h
		Cefazolin allergy: Ceftriaxone 1g IV q24h + Metronidazole 500 mg IV/PO q12h ***Cefazolin AND Ceftriaxone allergy:*** Tobramycin (dose as per hospital guidelines) Metronidazole 500 mg IV/PO q12h
Community Acquired Complicated **Mild to moderate infections** (perforated appendicitis, diverticulitis)	Enterobacteriaceae Anaerobes (including *B. fragilis*)	Cefazolin 2 g IV q8h + Metronidazole 500 mg IV/PO q12h
		Cefazolin allergy: Ceftriaxone 1g IV q24h + Metronidazole 500 mg IV/PO q12h ***Cefazolin AND Ceftriaxone allergy:*** Tobramcyin (dose as per hospital guidelines) + Metronidazole 500 mg IV/PO q12h
Community Acquired Complicated **Severe infections** (Shock, new organ failure, ICU patient)	Same as above	Ceftriaxone 1g IV q24h + Metronidazole 500 mg IV/PO q12h
		Piperacillin-tazobactam 3.375 g IV q6h (If admitted to ICU, refer to extended infusion protocol)
		Ceftriaxone allergy:

		Tobramycin (dose as per hospital guidelines) + Metronidazole 500 mg IV/PO q12h
Health Care Associated **Mild to moderate infections** (Hospitalized ≥ 5 days, anastomotic leak, post-operative abscess, recent antibiotics, recent hospitalization)	Enterobacteriaceae Anaerobes Enterococcus Possibly drug resistant gram negative bacilli	Ceftriaxone 1g IV q24h + Metronidazole 500 mg IV/PO q12h
		Piperacillin-tazobactam 3.375 g IV q6h
		Ceftriaxone and penicillin allergy: Meropenem 500mg IV q6h
Health Care Associated **Severe infections** (Hospitalized ≥ 5 days, anastomotic leak, shock, ICU, recent antibiotics, recent hospitalization)	Enterobacteriaceae Anaerobes Enterococcus Possibly drug resistant gram negative bacilli	Piperacillin-tazobactam 3.375 g IV q6h (If admitted to ICU, refer to extended infusion protocol)
		Penicillin allergy: Meropenem 500mg IV q6h
Biliary Tract **Mild to moderate infections** (e.g. acute cholangitis)	Enterococcus, Streptococci, Enterobacteriaceae, Anaerobes	Cefazolin 2 g IV q8h
		Ceftriaxone 1 g IV q24h
		Cefazolin AND Ceftriaxone allergy: Tobramycin (as per hospital guidelines)
Biliary Tract **Severe** (Severe physiological disturbance, advanced age, immunocompromised state, or bilio-enteric anastomosis).	Enterococcus, Streptococci, Enterobacteriaceae, Anaerobes	Ceftriaxone 1 g IV q24h + Metronidazole 500 mg IV q12h +/- Ampicillin 2 g IV q6h*
		Piperacillin-tazobactam 3.375 g IV q6h (If admitted to ICU, refer to extended infusion protocol)
		Penicillin AND ceftriaxone allergy: Meropenem 500mg IV q6h

Prophylaxis for Spontaneous Bacterial Peritonitis	Enterobacteriaceae S. pneumoniae Streptococcus sp.	Short term (e.g. GI Bleed) – TMP/SMS 1 DS PO bid x 7 days Or Ceftriaxone 1g IV q24h x 7 days Long term (e.g.previous episode of SBP or ascitic fluid protein < 10 g/L) – TMP/SMS 1 DS tab PO daily or Norfloxacin 400 mg PO daily or Ciprofloxacin 750 mg PO weekly

Patients undergoing cholecystectomy for acute cholecystitis should have antimicrobial therapy discontinued within 24 h unless there is evidence of infection outside the wall of the gallbladder.

* Community-acquired biliary infection, activity against enterococci is not required, because the pathogenicity of enterococci has not been demonstrated. For selected health care associated infections or immunosuppressed patients, particularly those with hepatic transplantation, enterococcal infection may be significant and require treatment

References:

1. Solomkin J, et al. Diagnosis and management of complicated intra-abdominal infections in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. Clin Infect Dis 2010;50:133-64.
2. Antibiotics for complicated intra-abdominal infections. Pharmacist's Letter/Prescriber's Letter 2010;26(3):260321.
3. Toronto Antimicrobial Stewardship Corridor (TASC). Best Practice in General Surgery: Management of Intra-Abdominal Infections, Dec 2011.

OPHTHALMIC INFECTIONS

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Bacterial Conjunctivitis ¥	*Staphylococcus aureus,* *Streptococcus pneumoniae,* *Haemophilus* spp.,*Moraxella catarrhalis*	Polysporin® 2 drops to affected eye(s) QID
		Tobramycin 0.3% 1-2 drops to affected eye(s) QID
		Moxifloxacin 0.5% 1 drop to affected eye(s) TID
		Fusidic acid 1% 1 drop to affected eye(s) BID

¥ Red Flag symptoms requiring Ophthalmology consultation:

- Recent Reduction of visual acuity
- Severe pain
- Photophobia (Severe light sensitivity)
- Ciliary flush (i.e., a pattern of injection in which the redness is most pronounced in a ring at the limbus. Note: the limbus is the transition zone between the cornea and the sclera) in association with pain &/or photophobia
- Significant foreign body sensation that prevents the patient from keeping the eye open which fails to resolve with topical lubricants (artificial tears)
- Corneal opacity in association with a red eye
- Pupil abnormalities (eg., RAPD, fixed dilated pupil)
- Diplopia (new onset)
- Severe headache with nausea
- Severe lid swelling
- History of recent eye surgery, IF patient is symptomatic
- Ocular Trauma

References:

1. Guidelines for the treatment and management of acute bacterial conjunctivitis in children and adults. University of Texas, School of Nursing, Family Nurse Practitioner Program. Austin (TX): University of Texas, School of Nursing; 2005. Available from URL: http://www.guideline.gov/summary/summary.aspx?ss=15&doc_id=7353&nbr=4351

2. Sheikh A, Hurwitz A. Antibiotics versus placebo for acute bacterial conjunctivitis. Cochrane Database of Systematic Reviews. 2006. Available from URL:http://www.cochrane.org/reviews/en/ab001211.html.

3. Anti-infective Guidelines for Community –acquired Infections. Anti-infective Review Panel. 2013 Edition

PELVIC INFLAMMATORY DISEASE

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Ambulatory-outpatient	Chlamydia *N. gonorrhoeae* Anaerobes Enterobacteriaceae	Ceftriaxone 500 mg IM x 1 dose**+ Doxycycline 100 mg PO BID x 14 days +/- Metronidazole† 500 mg PO BID x 14 days
		Amoxicillin/Clavulanic acid 875/125 mg PO BID + doxycycline 100 mg PO BID x 14 days Or Doxycycline 100 mg PO BID +/- metronidazole 500 mg PO BID x 14 days
Severe -Requiring Hospitalization	Chlamydia *N. gonorrhoeae* Anaerobes *Enterobacteriaceae*	Ceftriaxone* 1 g IV q24h + Metronidazole* 500 mg IV/PO q12h +/- Doxycycline 100 mg PO BID
		Ceftriaxone allergy: Clindamycin* 900 mg IV q8h + Tobramycin (as per hospital guidelines)*

† Metronidazole should be added if a tuboovarian abscess is suspected

*When patient clinically improved, step down to oral antibiotics therapy with Doxycycline 100 mg PO BID *or* Amoxicillin Clavulanic acid 875/125 mg PO BID +/- Doxycycline 100 mg PO BID (Amoxicillin Clavulanic acid preferred if tuboovarian abscess suspected) x 14 days total

**for persons weighing >150kg, with documented gonococcal infection, 1g of ceftriaxone should be administered

NOTE: Doxycycline should not be used in pregnant woman >15 weeks gestational age.

Reference:

1. *Canadian Guidelines on Sexually Transmitted Infections, January 2010 Edition*. Ottawa, ON: Public Health Agency of Canada, 2010. Available from: URL: http://www.phac-aspc.gc.ca/std-mts/sti-its/pdf/sti-its-eng.pdf
2. Public Health Agency of Canada update on the Treatment of Gonococcal Infections http://www.phac-aspc.gc.ca/std-mts/sti-its/alert/2011/alert-gono-eng.php
3. Supplementary statement for recommendations related to the diagnosis, management, and follow-up of pelvic inflammatory disease. 2014. http://www.phac-aspc.gc.ca/std-mts/sti-its/cgsti-ldcits/assets/pdf/pid-aip-eng.pdf
4. Kimberly A, Workowski MD, Laura H, et al. Sexually Transmitted Infections Treatment Guidelines. 2021. MMWR Recomm Rep 2021;70. Available at: https://www.cdc.gov/std/treatment-guidelines/pid.htm

PREVENTION OF BACTERIAL ENDOCARDITIS

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Patients with high risk cardiac conditions* undergoing the following interventions: ● Dental procedures involving manipulation of gingival tissue/periapical region of teeth or perforation of the oral mucosa ● Respiratory tract procedures involving excision of the mucosa (ie. Tonsillectomy, andenoidectomy and bronchoscopy with biopsy) ● Procedures involving piercing infected skin, skin structure or musculoskeletal tissue	Viridans group Streptococcus Staphylococcus	***Standard General Prophylaxis***
		Amoxicillin 2 g PO once 1 hr prior to procedure**
		Penicillin allergy: Cephalexin 2 g PO once 1 hr prior to procedure
		Penicillin and Cephalexin allergy: Doxycycline 100mg PO once 1 hr prior to procedure or Clarithromycin 500 mg PO once 1 hr prior to procedure
		Unable to take Oral Medications
		Ampicillin 2 g IV/IM once within 30 min before procedure
		Penicillin allergy: Cefazolin 1 g IV once 1 hr prior to procedure
		Penicillin and Cefazolin allergy: Clindamycin 600 mg IV once within 30 min before procedure
Gastrointestinal and Genitourinary procedures	Enterococcus	Routine prophylaxis no longer recommended***

*Cardiac conditions associated with highest risk of adverse outcome from endocarditis:

- prosthetic cardiac valve including trans-catheter implanted prostheses and homografts
- prosthetic material used for cardiac valve repair, such as annuloplasty rings, chords or clips
- previous infective endocarditis
- unrepaired cyanotic congential heart disease or repaired congenital heart disease, with residual shunts or valvular regurgitation at the site of or adjacent to the site of prosthetic patch or prosthetic device
- cardiac transplant with valve regurgitation attributable to a structurally abnormal valve

**In the event that an antibiotic is inadvertently not given prior to the procedure the dosage may be given up to 2 hours afterwards.

***Patients with an established GI/GU infection or enterococcal colonization should receive prophylaxis with Amoxicillin/Ampicillin or Vancomycin if patient has a penicillin allergy.

****Clindamycin is no longer recommended for antibiotic prophylaxis for a dental procedure

Reference:

1. Prevention of Infective Endocarditis – Guidelines from the American Heart Association Rheumatic Fever, Endocarditis and Kawasaki Disease Committee. Circulation 2007; 116:1736-1754.
2. Wilson et al. Prevention of Viridans Group Streptococcal Infective Endocarditis: A Scientific Statement From the American Heart Association. 2021. Circulation. Available from: https://doi.org/10.1161/CIR.0000000000000969

PROPHYLAXIS FOR OPPORTUNISTIC INFECTIONS IN PATIENTS INFECTED WITH HIV

INDICATION FOR PROPHYLAXIS	CRITERIA FOR INITIATION OF PROPHYLAXIS	USUAL REGIMEN(S)
Pneumocystis jiroveci (P. *carinii)*	CD4+ count < 200 mcg/mL or oropharyngeal candidiasis*	Co-trimoxazole DS 1 tablet po daily or Co-trimoxazole SS 1 tablet po daily***
Toxoplasma gondii	IgG antibody to toxoplasma and CD4+ count < 100 mcg/mL*	Co-trimoxazole DS 1 tablet po daily
Mycobacterium avium complex (MAC)	CD4+ count < 50 mcg/mL**	Azithromycin 1200 mg po weekly †
Varicella zoster (chickenpox - primary prophylaxis)	CD4+count >200 mcg/mL and No evidence of immunity to varicella††	Varicella vaccine 2 doses, 3-6 months apart
Herpes zoster (prevention of recurrence)	For people with HIV ≥18 years. Consider delaying vaccination until the patient is virologically suppressed on ART or until the CD4 count is $\geq$200 cells/mm^3 to ensure a robust vaccine response	Recombinant zoster vaccine (Shingrix) (2 doses, 2 to 6 months apart)
Varicella zoster (VZV) (secondary prophylaxis/exposure)	Significant exposure to chickenpox or shingles in patients who: ● have no history of either condition, or ● are negative for antibodies to VZV	Varicella zoster immune globulin (VZIG) administered IM $\leq$ 96 h post exposure
Streptococcus pneumoniae	All patients	20-valent pneumococcal conjugate vaccine (PCV20) [$]
Hepatitis B	All susceptible patients who are anti-HBs-negative	Hepatitis B 40mcg vaccine x 4 doses (at 0, 1, 2 and 6 months)

Hepatitis A	All susceptible patients who are anti-HAV-negative	Hepatitis A vaccine x 2 doses
Influenza	All patients	Inactivated influenza virus vaccine IM x 1 yearly prior to flu season
COVID-19	All patients	As per current guidelines
Human Papilloma Virus (HPV)	All patients age 9-45 and those with ongoing risk of new exposures if not completed previously	3-dose schedule (Gardasil-9) (0, 1–2, and 6 months)****
Meningococcus serogroup A, C, W, Y (MenACWY) ◊	All Patients	Meningitis C-ACYW x 2 doses (8 weeks apart) ; Booster dose of MenACWY vaccine every 5 years
Measles, Mumps and Rubella Vaccine	Patients with a CD4 count ≥200 cells/mm^3 and who have no evidence of immunity to measles, mumps, and rubella (evidence of immunity is defined as: patient was born before 1957, and/or had documentation of receipt of MMR, and/or has laboratory evidence of immunity or disease Δ	Two doses of measles, mumps, and rubella vaccine (MMR) at least 1 month apart
Mpox	Should be offered to all people with HIV who have potential for mpox exposure	Imvamune (live nonreplicating vaccinia vaccine) x 2 doses, given at least 28 days apart
Tetanus, Diphtheria and Pertussis	All patients	Administer the combination tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) once if the person with HIV had not been vaccinated at age 11 or older, and then tetanus and diphtheria toxoids vaccine (Td) or Tdap every 10 years thereafter

* May discontinue if CD4+ count > 200 mcg/mL for greater than or equal to 3 months
**May discontinue if CD4+ count > 100 mcg/mL for greater than or equal to 3 months
*** Co-trimoxazole SS may be better tolerated therefore may consider if toxoplasma negative.

† Generally no longer recommended if patient is going to be starting treatment because CD4 count expected to rise quickly to above 50.

†† Evidence of immunity to varicella:

- Documented receipt of two doses of VAR or MMRV; *or*
- Diagnosis of varicella or zoster by a health care provider; *or*
- Laboratory evidence of immunity or disease

$ People with HIV who previously received 13-valent pneumococcal conjugate (PCV13) vaccine and 23-valent polysaccharide (PPSV23) vaccine can be administered one dose of PCV20 at least 5 years after last dose of pneumococcal vaccine to complete their pneumococcal vaccinations

****Currently, Gardasil-9 is only covered publicly for students in Grade 7, and for "men who have sex with men who are 26 years of age and younger who identify as gay, bisexual, as well as some individuals who identify as trans, and how have not started their HPV vaccine series before September 5, 2017"

◊ MenB is not routinely indicated for individuals with HIV, except for those at increased risk for serogroup B meningococcal disease (asplenia, complement deficiency, eculizumab use, occupational exposure).

Δ The MMR vaccine **is contraindicated** during pregnancy. People of childbearing potential who get the MMR vaccine should wait 4 weeks before getting pregnant.

Consult Infections Diseases Service where alternatives to usual regimens are required.

References

1. Advisory Committee on Immunization Practices (ACIP) Recommended Immunization Schedule for Adults Aged 19 Years and Older — United States, 201: **February 7, 2014 / 63(05);110-112. Available from: URL:http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6305a7.htm?s_cid=mm6305a7_w**.
2. MMWR Recommendations and Reports. Guidelines for Preventing Opportunistic Infections Among HIV-Infected Persons 2009;58;RR-4. Available from: URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5804a1.htm Panel on Opportunistic Infections in HIV-Infected Adults and Adolescents. Guidelines for the prevention and treatment of opportunistic infections in HIV-infected adults and adolescents: recommendations from the Centers for Disease Control and Prevention, the National Institutes of Health, and the HIV Medicine Association of the Infectious Diseases Society of America. Available from: http://aidsinfo.nih.gov/contentfiles/lvguidelines/adult_oi.pdf. Accessed Feb 4, 2014
3. Kim DK, Riley LE, Hunter P. Advisory Committee on Immunization Practices Recommended Immunization Schedule for Adults Aged 19 Years or Older — United States, 2018. MMWR Morb Mortal Wkly Rep 2018;67:158–160. DOI: http://dx.doi.org/10.15585/mmwr.mm6705e3
4. Ontario Ministry of Health and Long-Term Care. Nine-valent Human Papillomavirus (HPV9) Vaccine for Ontario's High-Risk HPV Immunization Program: Information for Patients. 2017. Available from: https://www.health.gov.on.ca/en/pro/programs/immunization/docs/hpv9_patient_fact_sheet.pdf
5. Thompson et al. Primary Care Guidance for Persons With Human Immunodeficiency Virus: 2020 Update by the HIV Medicine Association of the Infectious Diseases Society of America. 2020. Available from: https://doi.org/10.1093/cid/ciaa1391
6. Government of Canada National Advisory Committee on Immunization. Immunization of immunocompromised persons: Canadian Immunization Guide. 2021.Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-3-vaccination-specific-populations/page-8-immunization-immunocompromised-persons.html#a29

7. https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-13-meningococcal-vaccine.html#p4c12t1
8. https://clinicalinfo.hiv.gov/en/guidelines/hiv-clinical-guidelines-adult-and-adolescent-opportunistic-infections/immunizations

Updated October 2024

SKIN & SOFT TISSUE INFECTIONS

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Purulent SSTI (ie. Skin abscesses, carbuncles and furuncles)	*S. aureus*	Antimicrobials not routinely recommended for management of uncomplicated purulent SSTIs Incision and drainage most effective management **Recurrent infection:** TMP/SMS 1 DS PO BID Or Doxycycline 100mg PO BID X 5-7 days
Non-purulent SSTI Uncomplicated Cellulitis, Impetigo, Erysipelas *Or* Superficial Ulcers with Cellulitis in Non-Diabetic patients	Group A, C, G Streptococcus, *S. aureus*	Cephalexin 500 mg PO QID x 5-7 days or Cefadroxil 500 mg PO BID
		Cefazolin 1 g IV q8h¥ x 5-7 days
		Cefazolin or cephalexin allergy: Moxifloxacin 400 mg PO daily
	MRSA suspected	TMP/SMX 1 DS PO BID Or Doxycycline 100 mg PO BID
		Vancomycin (dosing as per hospital guidelines)
Necrotizing Fasciitis* **If MRSA suspected add Vancomycin**	Empiric Treatment before culture results	Piperacillin/Tazobactam 3.375 g IV q6h+ Clindamycin 900 mg IV q8h +/- IVIG 1-2g/kg x 1, then 0.5-2g/kg at day 2-5 if needed(if signs of Streptococcal Toxic Shock Syndrome). *Please consider ID consult*
	Invasive Group A Streptococcus	Penicillin G 4 MU IV q4h + Clindamycin 900 mg IV q8h +/- IVIG 1-2g/kg x 1, then 0.5-2g/kg at day 2-5 if needed(if signs of Streptococcal Toxic Shock Syndrome). *Please consider ID consult*

		Penicillin allergy: Ceftriaxone 1g IV q24h + Clindamycin 900 mg IV q8h +/- IVIG 1-2g/kg x 1, then 0.5-2g/kg at day 2-5 if needed(if signs of Streptococcal Toxic Shock Syndrome). *Please consult ID*
	Mixed aerobic Gram-negative bacilli and anaerobes	Piperacillin/Tazobactam 3.375 g IV q6h Or Ceftriaxone 1 g IV q24h + Metronidazole 500 mg IV/PO q12h *Please consider ID consult*
Diabetic foot infection OR Decubitus ulcer (infected) **If MRSA suspected add Vancomycin**	Most mild superficial infections are: *S. aureus* Streptococcus species More complicated infections may include: *S. aureus* Streptococcus species *Enterobacteriaceae* Anaerobes	**MILD Infection:** Superficial, Localized with no Systemic Involvement Cephalexin 500 mg PO QID or Cefadroxil 500 mg PO BID Or Amoxicillin/Clavulanic Acid 875 mg/125 mg PO BID Or TMP/SMX 1 DS tab PO BID + Metronidazole 500 mg PO BID Or Cefazolin 1 g IV q8h
		MODERATE Infection: full thickness ulcer with deep tissue involvement, NO systemic illness Ceftriaxone 1 g IV q24h + Metronidazole 500 mg PO BID Or Amoxicillin/Clavulanic Acid 875 mg/125 mg PO BID
		Ceftriaxone allergy: Moxifloxacin 400 mg PO q24h
		SEVERE Infection: Systemic or Bone Involvement** Piperacillin/Tazobactam 3.375 g IV q6h (if admitted to ICU, refer to extended infusion protocol) Or Ceftriaxone 1 g IV q24h + Metronidazole 500 mg PO/IV q12h
		Ceftriaxone allergy: Moxifloxacin 400 mg PO/IV q24h +/-

		Metronidazole 500 mg PO/IV q12h
Cellulitis/Phlebitis secondary to IV line *Majority of cases can be treated with catheter removal and warm compress TID alone*	S. *aureus* Coagulase-negative staphylococci (including S. *epidermidis*)	**If antibiotics required**: Cefazolin 1 g IV q8h¥
		Cefazolin allergy or MRSA Suspected: Vancomycin (dose as per hospital guidelines)
Human Bites** *Give tetanus booster (Td) if none in the past 5 years.*	*S. aureus* *Streptococcus species* Oral anaerobes *Haemophilus species* *Eikenella corrodens*	**Non-Severe Infections:** Amoxicillin-Clavulanic Acid 875/125 mg PO BID
		Severe infections: Ceftriaxone 1 g IV q24h + Metronidazole 500 mg PO/IV q12h Or Piperacillin/Tazobactam 3.375 g IV q6h
		B-lactam anaphylaxis: Doxycycline 100 mg PO BID Or TMP/SMX 1 DS PO BID + Metronidazole 500 mg PO BID Or Moxifloxacin 400 mg PO/ q24h
Animal Bites (Dogs and Cats) *Give tetanus booster (Td) if none in the past 5 years.*	*S. aureus* *Streptococcus species* Oral anaerobes *Pasteurella multocida* *Captnocytophaga canimorsus*	**Prophylaxis***:** Amoxicillin-Clavulanic Acid 875/125 mg PO BID x 3-5 days
		Treatment Non-Severe: Amoxicillin-Clavulanic Acid 875/125 mg PO BID
		Treatment Severe: Ceftriaxone 1 g IV q24h + Metronidazole 500 mg PO/IV q12h Or Piperacillin/Tazobactam 3.375 g IV q6h
		B-lactam anaphylaxis: Doxycycline 100 mg PO BID Or TMP/SMX 1 DS PO BID + Metronidazole 500 mg PO BID Or Moxifloxacin 400 mg PO q24h

Note: Most cases of uncomplicated cellulitis can be managed using oral therapy alone. If intravenous therapy is needed initially (inability to take oral medications or early concern regarding aggressive infection), step-down

to oral antibiotics should be considered within 48-72 hours. A total **duration** of therapy of 5-7 days is sufficient for most uncomplicated skin and soft tissue infections.

† Based on microbiology data from Toronto hospitals the incidence of Group A streptococcal resistance to clindamycin is 14%.

¥ Consider cefazolin 2g IV q8h for patients >100kg

*Severe soft tissue infections may require a combined medical and surgical approach and consultation with Infectious Diseases and Surgical Services is recommended.

** Human bites do not generally require prophylaxis, but can be considered if the wound is through the dermis, especially on the hand.

******* Consider prophylaxis for animal bites if:

1. moderate to severe injury <8 hours old, especially if edema or crush injury;
2. deep puncture wounds (especially due to cat bites);
3. hand wounds or in close proximity to a bone or joint (particularly prosthetic joints);
4. immunocompromised patients (including those with splenectomy, liver disease, or steroid therapy);
5. wounds requiring closure; and
6. wound is in the genital area.

References:

(1) Stevens DL et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America Clinical Infectious Diseases. Clinical Infectious Diseases ; 2014 : 1 -43

(2) Stevens DL, Bisno AL, Chambers HF et al. Guidelines for Skin and Soft-Tissue Infections. Clin Infect Dis 2005;41:1373-80.

(3) Mermel LA, Farr BM, Sherertz RJ et al. Guidelines for the Management of Intravascular Catheter-Related Infections. Clin Infect Dis 2001;32:1249-72.

(4) Lipsky BA, Berendt AR, Cornia PB, Pile JC et al. Diagnosis and Treatment of Diabetic Foot Infections. Clin Infect Dis 2012;54:132-173.

SEVERE SEPSIS & SEPTIC SHOCK

INDICATION FOR THERAPY	PATIENT SELECTION	ANTIBIOTIC REGIMENS
Undifferentiated Infectious Source	Ward patients: ● Community acquired ● Hemodynamically stable ● Non-immunosuppressed ● No previous history of resistant organisms	Ceftriaxone 1g IV q24h ***Ceftriaxone allergy*:*** Piperacillin-tazobactam 3.375 g IV q6h
	One or more of the following: ● Critical care admission ● Nosocomially acquired ● Hemodynamically unstable ● Immunosuppressed ● History of colonization/infection with resistant organisms	Piperacillin-tazobactam 3.375 g IV q6h (if admitted to ICU, refer to extended infusion protocol) ***Penicillin allergy*:*** Meropenem 500mg IV q6h
	MRSA infection suspected	**ADD** Vancomycin (dose as per hospital guideline)

* All penicillin allergic patients who **do not** have a severe T-cell mediated Severe Cuteaneous Adverse Reaction (SCAR) such as SJS, TEN or DRESS are safe to receive the following : Cefazolin, Ceftriaxone, Ceftazidime or Carbapenems

Patients with septic shock can be identified with a clinical construct of sepsis with persisting hypotension requiring vasopressors to maintain MAP ≥65 mm Hg and having a serum lactate level >2 mmol/L (18 mg/dL) despite adequate volume resuscitation. With these criteria, hospital mortality is in excess of 40%.

References:

1. Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA.* 2016;315(8):801–810. doi:10.1001/jama.2016.0287
2. Rhodes, Andrew BS, Evans, Laura, Alhazzani, Waleed et al, Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2016. Critical Care Medicine: March 2017 - Volume 45 - Issue 3 - p 486–552

URINARY TRACT INFECTIONS (UTI)

INDICATION FOR THERAPY	USUAL CAUSATIVE ORGANISMS	ANTIBIOTIC REGIMENS
Asymptomatic Bacteruria	Enterobacteriaceae, enterococci, pseudomonas,	No treatment recommended (Exceptions for patients scheduled to undergo TURP or other urologic procedures where mucosal bleeding is expected.)
Uncomplicated Lower tract (acute cystitis/urethritis) *Uncomplicated UTIs are defined as symptomatic bacteriuria in adult non-pregnant women with apparently normal urinary tracts.*	Enterobacteriaceae (incl. *E. coli, Klebsiella, Proteus*), *S. saprophyticus*, Enterococci	Nitrofurantoin (MacroBID) 100 mg PO BID x 5 days
		Co-Trimoxazole DS 1 tab PO BID x 3 days
		Cephalexin 500mg PO QID x 5 days
		First Line in Pregnancy: Cephalexin 500 mg PO QID x 5 days
Complicated or Catheter-associated Treat catheter-associated bacteriuria only if clinical symptoms of urinary tract infection present	Enterobacteriaceae (incl. *E. coli, Klebsiella, Proteus*), *S. saprophyticus*, Enterococci	TMP/SMX DS 1 tab PO BID x 7 days
		Amoxicillin/clavulanic acid 875mg PO BID x 7 days
	Pseudomonas	Ciprofloxacin 500 mg PO BID x 7days**
Upper Tract (mild to moderate pyelonephritis not requiring hospitalization in women)	Enterobacteriaceae (incl. *Serratia, Enterobacter, Citrobacter*), *S. saprophyticus*, Enterococci	TMP/SMS DS 1 tab PO BID x 7 days
		Ciprofloxacin 500mg PO BID x 7 days

Upper Tract (moderate to severe acute pyelonephritis) Therapy can be tailored once causative organism identified and sensitivities available. Once clinically stable, oral therapy is recommended.	Enterobacteriaceae (incl. *Serratia, Enterobacter, Citrobacter*), *S. saprophyticus*, Enterococci	Ceftriaxone 1g IV daily x 7 days
		Ceftriaxone allergy: Ciprofloxacin 400 mg IV q12h x 7 days or Ciprofloxacin 500mg PO BID x 7 days
		In Pregnancy: Ceftriaxone 1 g IV q24h x 7days

* There is a theoretical risk of hemolytic anemia in the fetus or newborn, especially in those with G6PD deficiency but cases reports have been rare. Numerous studies have shown the use of nitrofurantoin in pregnancy to be safe.

** Therapy can be stopped at 3 days in individuals < 60 yrs if catheter removed.

These guidelines are for empiric treatment. Therapy should be tapered according to urine culture and sensitivity results once available.

References:

1. Nicolle LE, Bradley S, Colgan R, et al. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clin Infect Dis 2005;40:643-54.
2. Gupta K, Hooton TM, Roberts PL, Stamm WE. Short-Course Nitrofurantoin for the Treatment of Acute Uncomplicated Cystitis in Women. Arch Intern Med. 2007;167(20):2207-2212.
3. Lee M, Bozzo P, Einarson A, et al. Motherisk Update Urinary tract infections in pregnancy. Can Fam Physician 2008;54:853-4.
4. Wagenlehmner FME, Weidner W, Naber KG. An update on uncomplicated urinary tract infections in women. Curr Opin Urol 2009;19:368-74.Gupta K, Hooton TM, Naber KG, 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. *Clin Infect Dis* 2011;52:e103-20.

SPLENECTOMY VACCINATION GUIDELINES

SCHEDULE	VACCINE TYPE (AVAILABLE BRANDS)	COMMENTS
Elective splenectomy		
2 weeks prior to surgery	20-valent pneumococcal conjugate vaccine (PCV20) 0.5 mL SC/IM x 1 dose (***Prevnar-20)***	
	Meningococcal Quadravalent Conjugate vaccine (Groups A, C, Y and W-135) 0.5 mL IM (deltoid preferred) x 1 dose ***(Nimenrix)***	Second dose of **(Men-C-ACYW)** should be given eight weeks after the 1st and arrange for booster doses to be given every 5 years thereafter.
	Serogroup B meningococcal (MenB-4C) vaccine 0.5 mL IM x 1 dose ***(Bexsero)***	Second dose of Serogroup B meningococcal vaccine with Bexsero should be given at least 4 weeks after the 1st dose.
	Haemophilus b Conjugate vaccine 0.5 mL IM x 1 dose **(Hib)** ***(Act-HIB)***	
Emergent splenectomy		
2 weeks post-surgery (ideally) or prior to discharge if risk to be lost to follow-up	20-valent pneumococcal conjugate vaccine (PCV20) 0.5 mL SC/IM x 1 dose (***Prevnar-20)***	
	Meningococcal Quadravalent Conjugate vaccine (Groups A, C, Y and W-135) 0.5 mL IM (deltoid preferred) x 1 dose ***(Nimenrix)***	Second dose of **(Men-C-ACYW)** should be given eight weeks after the 1st and arrange for booster doses to be given every 5 years thereafter.
	Serogroup B meningococcal (MenB-4C) vaccine 0.5 mL IM x 1 dose ***(Bexsero)***	Second dose of Serogroup B meningococcal vaccine with Bexsero should be given at least 4 weeks after the 1st dose.

	Haemophilus b Conjugate vaccine 0.5 mL IM x 1 dose **(Hib)** ***(Act-HIB)***	

Brands available on MGH formulary are in *bolded italics.

**Yearly influenza vaccine is recommended for all patients admitted during flu season (Oct –March) who have not yet received it that year.

***COVID-19 vaccination should be recommended based on up to date guidance

*** Administer the combination tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) once if the person has not been vaccinated at age 11 or older, and then tetanus and diphtheria toxoids vaccine (Td) or Tdap every 10 years thereafter

References:

1. https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-3-vaccination-specific-populations/page-7-immunization-persons-with-chronic-diseases.html
2. Canadian National Advisory Council on Immunization (NACI), Statement on conjugate meningococcal vaccine for serogroups A, C, Y and W135, May 2007.
3. Canadian National Advisory Council on Immunization (NACI), Update on meningococcal disease and meningococcal vaccine conjugate recommendations, April 2009.
4. Advisory Committee on Immunization Practices (ACIP) Recommended ImmunizationSchedule for Adults Aged 19 Years and Older — United States, 2013: February 1, 2013 / 62(01);9-19. Available from: URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/su6201a3.htm
5. Prevention and control of meningococcal disease: recommendations of the Advisory Committee on Immunization Practices (ACIP). Cohn AC, MacNeil JR, Clark TA, Ortega-Sanchez IR, Briere EZ, Meissner HC, Baker CJ, Messonnier NE, Centers for Disease Control and Prevention (CDC). MMWR Recomm Rep. 2013;62(RR-2):1.
6. https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-16-pneumococcal-vaccine.html