

**TITLE: ANTI-INFECTIVE DOSING RECOMMENDATIONS FOR RENAL DYSFUNCTION:
ADULT**

GUIDELINES:

Based on recommendations from the Subcommittee on Anti-Infective Use and the Formulary and Therapeutics Committee, these guidelines shall be used by prescribers and pharmacy personnel to aid in the appropriate dosing of antimicrobials in patients with renal dysfunction.

PURPOSE:

To recommend appropriate dosage adjustments in patients with renal insufficiency in order to reduce the likelihood of adverse drug reactions and improve efficacy.

APPLICABILITY:

Prescribers, pharmacists, nurses

PROCEDURE:

1. Determine patient's dosing weight (DW)
 - A. Non-Obese patients: Use ideal body weight (IBW) unless total body weight (TBW) is less. Non-obese is defined as TBW < 30% over ideal body weight
 - 1) IBW (males) = 50 kg + (2.3 x height in inches > 60 inches)
 - 2) IBW (females) = 45 kg + (2.3 x height in inches > 60 inches)
 - B. Obese patients: Use adjusted body weight (ABW) in obese patients (TBW > 30% over IBW)
 - 1) ABW (kg) = IBW + 0.4 (TBW – IBW)
2. Estimate patient's creatinine clearance (CrCL)
 - A. CrCL (male) mL/min = $\frac{(140 - \text{age}) \times \text{DW}^* (\text{kg})}{72 \times \text{SCr}}$ (x 0.85 for females)
 - B. For patients on dialysis, determine the type of dialysis method
 - 1) Hemodialysis (HD)
 - 2) Peritoneal Dialysis (PD)
 - 3) Continuous Renal Replacement Therapy (CRRT)
3. Determine which antimicrobial will be initiated in the patient
4. Once an antimicrobial is selected, follow the row across to the appropriate column based on CrCL or type of dialysis.

EXTENDED INTERVAL ("ONCE DAILY") AMINOGLYCOSIDE DOSING AND MONITORING IN ADULTS

This is an alternative dosing method which may be less nephrotoxic than conventional dosing with similar efficacy. The higher peak concentrations achieved with this high-dose method may result in a more rapid killing of organisms due to the concentration-dependent killing observed with aminoglycosides. The lower trough concentrations may result in a potentially lower incidence of toxicity.

Single-daily high dose aminoglycoside therapy should not be confused with patients receiving conventional dosing methods (1 to 2 mg/kg/day) for whom the dosing interval has been adjusted to every 24 hours because of renal dysfunction.

The following are conservative guidelines for the selection, dosing, and monitoring of extended interval ("once daily") dosing of aminoglycosides adapted from published pharmacokinetic and pharmacodynamic literature.

Exclusion criteria:

| | |
|---|---|
| Elderly (age > 70 years) | Endocarditis |
| Pregnancy or post-partum | Synergy for gram positive infections |
| Renal insufficiency (CrCl < 30 ml/min) | Cystic fibrosis (increase dose to 7-10 mg/kg) |
| Dialysis | Surgical prophylaxis |
| Severe liver disease or ascites | Severe fluid overload states |
| History or signs of hearing loss or vestibular toxicity | Extensive burns (> 50% total body surface area) |

IMPORTANT * DO NOT USE TOTAL BODY WEIGHT UNLESS PATIENT'S ACTUAL WEIGHT IS LESS THAN THEIR IDEAL WEIGHT *****

1. Determine patient's dosing weight (DW)

- a. **Non-Obese patients:**
Use ideal body weight (IBW) unless total body weight (TBW) is less. Non-obese is defined as TBW < 30% over ideal body weight
- IBW (males) = 50 kg + (2.3 x height in inches > 60 inches)
IBW (females) = 45 kg + (2.3 x height in inches > 60 inches)
- b. **Obese patients:**
Use adjusted body weight (ABW) in obese patients (TBW > 30% over IBW)
- ABW (kg) = IBW + 0.4 (TBW - IBW)

2. Determine patient's dose (round to nearest 20 mg for gentamicin/tobramycin and to nearest 100 mg for amikacin)

Gentamicin / Tobramycin 5 - 7 mg/kg x DW (CF: 7-10 mg/kg x DW)
Amikacin 15 - 20 mg/kg x DW

3. Estimate patient's creatinine clearance (CrCL)

CrCL (male) ml/min = $(140 - \text{age}) \times \text{DW (kg)} / 72 \times \text{SCR}$ (x 0.85 for females)

(Use minimum SCR of 1 mg/dL. Certain disease states or other factors may alter the relationship between SCR and CrCL resulting in over- or under-estimation of CrCL)

4. Determine patient's dosing interval based on CrCL

| CrCL (ml/min) | Interval (hrs) |
|---------------|--|
| > 50 | q24h |
| 30-50 | q36h <i>OR</i> use conventional dosing |
| < 30 | Not eligible, use conventional dosing |

5. Serum concentration monitoring

- Using Trough Levels:**
- Trough concentrations should be checked 30 to 60 minutes prior to the next (second) dose. Desired levels:
 - Gentamicin / tobramycin < 0.5 mg/L
 - Amikacin < 2.5 mg/L
 - If level is greater than desired trough, extend dosing interval by 12 hours and repeat level (or use conventional dosing and monitoring methods). If the next level continues to be high, then change to conventional dosing method.

Checking Random Levels: Check level 12 hours after dose

| Level result at 12 hours (mg/L) | Dosing Recommendation |
|---------------------------------|----------------------------------|
| Gentamicin / Tobramycin < 2.5 | Continue with same dose |
| < 7.5 | |
| 2.5 - 4.5 | Extend dosing interval by 12 hrs |
| 7.5 - 13.5 | |
| > 4.5 | Use conventional dosing |

Repeat level weekly AND with any significant changes in renal function. Serum creatinine should be monitored every 1-3 days.

CONVENTIONAL AMINOGLYCOSIDE DOSING AND MONITORING IN ADULTS

1. Determine patient's dosing weight (DW)

- a. **Non-Obese patients:**
Use ideal body weight (IBW) unless total body weight (TBW) is less. Non-obese is defined as TBW < 30% over ideal body weight
- IBW (males) = 50 kg + (2.3 x height in inches > 60 inches)
IBW (females) = 45 kg + (2.3 x height in inches > 60 inches)
- b. **Obese patients:**
Use adjusted body weight (ABW) in obese patients (TBW > 30% over IBW)
- ABW (kg) = IBW + 0.4 (TBW - IBW)

2. Estimate patient's creatinine clearance (CrCL)

CrCL (male) ml/min = $(140 - \text{age}) \times \text{DW (kg)} / 72 \times \text{SCR}$ (x 0.85 for females)

(Use minimum SCR of 1 mg/dL. Certain disease states or other factors may alter the relationship between SCR and CrCL resulting in over- or under-estimation of CrCL)

3. Select appropriate loading and maintenance doses based on the drug and estimated CrCL

(round dose to nearest 10 mg for gentamicin/tobramycin and to nearest 50 mg for amikacin)

| Drug | Loading dose (mg/kg)* | Maintenance dose | Dosing interval based on estimated CrCL | | | |
|-----------------------|-----------------------|--------------------|---|-------|-------|---------|
| | | | 50-80 | 30-50 | 10-30 | <10 |
| Gentamicin synergy UT | 2 to 3 | 1.5 to 2 mg/kg q8h | q12h | q24h | q48h | q48-72h |
| | None | 1 mg/kg q8h | | | | |
| | None | 1 mg/kg q8h | | | | |
| Tobramycin UT | 2 to 3 | 1.5 to 2 mg/kg q8h | q12h | q24h | q48h | q48-72h |
| | None | 1 mg/kg q8h | | | | |
| | None | 1 mg/kg q8h | | | | |
| Amikacin | 7.5 to 9 | 7.5 mg/kg q12h | q12h | q24h | q48h | q48-72h |

*Loading dose needed only in life-threatening infections or in dialysis patients to achieve steady state levels more rapidly.

| Drug | Dose and frequency in dialysis patients | | |
|-----------------------|---|---------------------------------|---------------------|
| | Hemodialysis (dose POST dialysis) | Peritoneal dialysis (every 48h) | CRRT (every 24-48h) |
| Gentamicin UT synergy | 1.5 to 2 mg/kg | 1.5 to 2 mg/kg | 1.5 to 2 mg/kg |
| | 1 mg/kg | 1 mg/kg | 1 mg/kg |
| | 1 mg/kg | 1 mg/kg | 1 mg/kg |
| Tobramycin UT | 1.5 to 2 mg/kg | 1.5 to 2 mg/kg | 1.5 to 2 mg/kg |
| | 1 mg/kg | 1 mg/kg | 1 mg/kg |
| | 1 mg/kg | 1 mg/kg | 1 mg/kg |
| Amikacin | 7.5 mg/kg | 7.5 mg/kg | 7.5 mg/kg |

The rate and amount of drug removed are influenced by a variety of host and dialysis-related factors. Monitoring of aminoglycoside peaks and troughs is highly recommended.

4. Serum concentration monitoring

- Serum peaks (for efficacy) AND troughs (for toxicity) must be monitored.**
- Obtain levels with the 4th dose after initiation of therapy or after dose adjustment. It is important to obtain serum concentrations earlier (with the 3rd dose) in patients with low CrCL (< 50 ml/min).
- Recheck only trough levels every 5 to 7 days to ensure levels remain low.
- A trough level should be obtained within 30 minutes of a dose and a peak level at least 30 minutes after the end of the infusion.
- DOCUMENTATION OF AMINOGLYCOSIDE ADMINISTRATION TIME AND THE TIMES SAMPLES WERE OBTAINED ARE ESSENTIAL IN INTERPRETING THE RESULTS. If samples are not obtained at the correct time, the results may be FALSELY elevated or underestimated.
- In patients with severe renal dysfunction, random levels, taken around the time the subsequent dose is due, should be obtained to determine appropriate dosing interval. In hemodialysis patients, check a level prior to the next scheduled dialysis. In both patient groups, redose when level ("troughs") falls to < 2 mg/L for gentamicin/tobramycin and < 10 mg/L for amikacin.

| Indication/ Site of infection | Desired concentrations (mg/L) | | | |
|--|-------------------------------|--------|----------|--------|
| | Gentamicin / Tobramycin | | Amikacin | |
| | Peak | Trough | Peak | Trough |
| Uncomplicated lower UTI, synergy in gram (+) infections* | 3-5* | < 1 | 20-25 | 5-10 |
| Gram (+) sepsis, other serious gram (+) infections | 5-7 | < 2 | 20-30 | 5-10 |
| Gram (+) pneumonia | 7-9 | < 2 | 25-30 | 5-10 |

* Serum concentration monitoring is usually not necessary when used for synergy or UTIs, but periodic trough levels are suggested to ensure low levels in the elderly and those with renal dysfunction.



ADULT ANTI-INFECTIVE DOSING GUIDELINES 2011 - 2012

RECOMMENDATIONS FOR VANCOMYCIN AND AMINOGLYCOSIDE DOSING

RECOMMENDATIONS FOR DOSE ADJUSTMENT IN PATIENTS WITH RENAL DYSFUNCTION

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2011 Anti-Infective Costs

| | Approx. Cost / Dose | Common Adult Dose | Approx. Cost / Day | Approx. Cost / Dose | Common Adult Dose | Approx. Cost / Day | | | | | |
|--|---------------------|-------------------|--------------------|---------------------|-------------------|--------------------|-------------------|-------------|-------------|-----------------|-------------------|
| PENICILLINS | | | | | | | | | | | |
| Ampicillin 2 g IV | \$ 7 | 2 g q4h | \$ 42 | | | | | | | | |
| Oxacillin 2 g IV | \$ 18 | 2 g q4h | \$ 108 | | | | | | | | |
| Amox/clav (Augmentin) 875/125 mg PO | \$ 0.95 | 1 tab q12h | \$ 1.90 | | | | | | | | |
| Amp/sulb (Unasyn) 3 g IV | \$ 4 | 3 g q6h | \$ 16 | | | | | | | | |
| Piptazo (Zosyn) 4.5 g IV | \$ 22 | 4.5 g q6h | \$ 88 | | | | | | | | |
| CEPHALOSPORINS | | | | | | | | | | | |
| Cephalexin 500 mg PO | \$ 0.09 | 500 mg q6h | \$ 0.36 | | | | | | | | |
| Cefazolin 1 g IV | \$ 0.83 | 1 g q8h | \$ 2.50 | | | | | | | | |
| Cefuroxime 500 mg PO | \$ 9.30 | 2 g q6h | \$ 37.20 | | | | | | | | |
| Ceftriaxone 1 g IV | \$ 0.35 | 500 mg q12h | \$ 0.70 | | | | | | | | |
| Cefepime 2 g IV | \$ 4.40 | 200 mg q12h | \$ 8.80 | | | | | | | | |
| Cefixime 300 mg PO | \$ 1.40 | 1 g q24h | \$ 1.40 | | | | | | | | |
| Cefixime 2 g IV | \$ 10 | 2 g q8h | \$ 30 | | | | | | | | |
| Cefepime 2 g IV | \$ 9.50 | 2 g q 8h to 12h | \$ 19.29 | | | | | | | | |
| CARBAPENEMS / MONOBACTAMS | | | | | | | | | | | |
| Aztreonam 1 g IV | \$ 40 | 1 g q8h | \$ 120 | | | | | | | | |
| Imipenem/cilastatin 500 mg IV | \$ 38 | 500 mg q6h | \$ 152 | | | | | | | | |
| Meropenem 500 mg IV | \$ 18 | 500 mg q6h | \$ 72 | | | | | | | | |
| Meropenem 2 g | \$ 71 | 2 g q8h | \$ 213 | | | | | | | | |
| AMINOGLYCOSIDES | | | | | | | | | | | |
| Gentamicin 100 mg IV | \$ 2 | 100 mg q8h | \$ 6 | | | | | | | | |
| Gentamicin 350 mg IV | \$ 3.25 | 350 mg q24h | \$ 3.25 | | | | | | | | |
| Tobramycin 100 mg IV | \$ 2 | 100 mg q8h | \$ 6 | | | | | | | | |
| Tobramycin 350 mg IV | \$ 6.25 | 350 mg q24h | \$ 6.25 | | | | | | | | |
| Tobramycin 300 mg INH | \$ 85 | 300 mg q12h | \$ 170 | | | | | | | | |
| Amikacin 500 mg IV | \$ 4.20 | 500 mg q12h | \$ 8.40 | | | | | | | | |
| QUINOLONES | | | | | | | | | | | |
| Levofloxacin 500 mg PO | \$ 2.80 | 500 mg q24h | \$ 2.80 | | | | | | | | |
| Levofloxacin 500 mg IV | \$ 15 | 500 mg q24h | \$ 15 | | | | | | | | |
| Levofloxacin 750 mg IV | \$ 15 | 750 mg q24h | \$ 15 | | | | | | | | |
| MACROLIDES | | | | | | | | | | | |
| Erythromycin 500 mg IV | \$ 11 | 500 mg q6h | \$ 44 | | | | | | | | |
| Azithromycin 250 mg PO | \$ 1.85 | 250 mg q24h | \$ 1.85 | | | | | | | | |
| Azithromycin 500 mg IV | \$ 5.50 | 500 mg q24h | \$ 5.50 | | | | | | | | |
| Clarithromycin 500 mg PO | \$ 3.70 | 500 mg q12h | \$ 7.40 | | | | | | | | |
| MISCELLANEOUS | | | | | | | | | | | |
| Clindamycin 300 mg PO | \$ 0.85 | 300 mg q6h | \$ 3.40 | | | | | | | | |
| Clindamycin 600 mg IV | \$ 14 | 600 mg q8h | \$ 42 | | | | | | | | |
| 900 mg IV | \$ 17 | 900 mg q8h | \$ 51 | | | | | | | | |
| Daptomycin 420 mg IV | \$ 215 | 420 mg q24h | \$ 215 | | | | | | | | |
| Linezolid 600 mg PO | \$ 84 | 600 mg q12h | \$ 168 | | | | | | | | |
| Linezolid 600 mg IV | \$ 110 | 600 mg q12h | \$ 220 | | | | | | | | |
| Metronidazole 500 mg PO | \$ 0.10 | 500 mg q8h | \$ 0.30 | | | | | | | | |
| Metronidazole 500 mg IV | \$ 1.65 | 500 mg q8h | \$ 4.95 | | | | | | | | |
| Polymyxin B 200 mg IV | \$ 32 | 200 mg q24h | \$ 32 | | | | | | | | |
| Tigecycline 50 mg IV | \$ 69 | 50 mg q12h | \$ 138 | | | | | | | | |
| TMP/SMX PO | \$ 0.18 | 1 DS tab q12h | \$ 0.36 | | | | | | | | |
| DS = 160 mg TMP/800 mg SMX | | | | | | | | | | | |
| TMP/SMX IV 20 ml = | \$ 16 | 320 mg TMP | \$ 64 | | | | | | | | |
| 320 mg TMP/1600 mg SMX | | q6h | | | | | | | | | |
| Vancomycin 1 g IV | \$ 7 | 1 g q12h | \$ 14 | | | | | | | | |
| ANTIFUNGALS | | | | | | | | | | | |
| Fluconazole 400 mg PO | \$ 0.50 | 400 mg q24h | \$ 0.50 | | | | | | | | |
| Fluconazole 400 mg IV | \$ 7.70 | 400 mg q24h | \$ 7.70 | | | | | | | | |
| Amphotericin B 70 mg IV | \$ 17 | 70 mg q24h | \$ 17 | | | | | | | | |
| Ampho B Lipid (Abelcet) 350 mg IV | \$ 305 | 350 mg q24h | \$ 305 | | | | | | | | |
| Ampho B Liposomal (Ambisome) 350 mg IV | \$ 425 | 350 mg q24h | \$ 425 | | | | | | | | |
| Micafungin 100 mg IV | \$ 98 | 100 mg q24h | \$ 98 | | | | | | | | |
| Voriconazole 200 mg PO | \$ 45 | 200 mg q12h | \$ 90 | | | | | | | | |
| Voriconazole 280 mg IV | \$ 184 | 280 mg q12h | \$ 368 | | | | | | | | |
| ANTIVIRALS | | | | | | | | | | | |
| Acyclovir 400 mg PO | \$ 0.18 | 400 mg 5x/d | \$ 0.90 | | | | | | | | |
| Acyclovir 350 mg IV | \$ 3.25 | 350 mg q8h | \$ 9.75 | | | | | | | | |
| Famciclovir 500 mg PO | \$ 8 | 500 mg q12h | \$ 16 | | | | | | | | |
| Valacyclovir 1000 mg PO | \$ 12 | 1000 mg q12h | \$ 24 | | | | | | | | |
| Foscarnet 6 g IV | \$ 71 | 6 g q12h | \$ 142 | | | | | | | | |
| Ganciclovir 350 mg IV | \$ 34 | 350 mg q12h | \$ 68 | | | | | | | | |
| Valganciclovir 900 mg PO | \$ 65 | 900 mg q12h | \$ 130 | | | | | | | | |
| Ideal Body Weight (IBW) Reference Chart | | | | | | | | | | | |
| Height (cm) | Height (in) | IBW (male) (kg) | IBW (female) (kg) | Height (cm) | Height (in) | IBW (male) (kg) | IBW (female) (kg) | Height (cm) | Height (in) | IBW (male) (kg) | IBW (female) (kg) |
| 152.4 | 60 | 50 | 45 | 165.1 | 65 | 61.5 | 56.5 | 177.8 | 70 | 73 | 68 |
| 154.9 | 61 | 52.3 | 47.3 | 167.6 | 66 | 63.8 | 58.8 | 180.3 | 71 | 75.3 | 70.3 |
| 157.5 | 62 | 54.6 | 49.6 | 170.2 | 67 | 66.1 | 61.1 | 182.9 | 72 | 77.6 | 72.6 |
| 160 | 63 | 56.9 | 51.9 | 172.7 | 68 | 68.4 | 63.4 | 185.4 | 73 | 79.9 | 74.9 |
| 162.6 | 64 | 59.2 | 54.2 | 175.3 | 69 | 70.7 | 65.7 | 188 | 74 | 82.2 | 77.2 |

VANCOMYCIN DOSING AND MONITORING IN ADULTS

1. Estimate patient's creatinine clearance (CrCL)

CrCL (male) mL/min = $(140 - \text{age}) \times \text{IBW (kg)} / (72 \times \text{SCr})$ (x 0.85 for females)

IBW (males) = 50 kg + (2.3 x height in inches > 60 inches)
IBW (females) = 45 kg + (2.3 x height in inches > 60 inches)

Instead of IBW, use adjusted body weight (ABW) in obese patients (TBW > 30% over IBW).
ABW (kg) = IBW + 0.4 (TBW - IBW)
(Use minimum serum Cr and CrCL resulting in over- or under-estimation of CrCL)

2. Determine maintenance dose using the following

Each maintenance dose (approx. 15 mg/kg of actual body weight) should be administered at the dosing interval recommended for a patient's CrCL. Utilize recommended infusion rates to minimize development of "Red Man's Syndrome."

| VANCOMYCIN DOSES | | INFUSION RATE BASED ON DOSE |
|--------------------|-----------|-----------------------------|
| Total body wt (kg) | Dose (mg) | (approx. ≤ 15 mg/min) |
| ≥ 111 | 1750 | 120 minutes |
| 90 - 110 | 1500 | 90 minutes |
| 75 - 89 | 1250 | 75 minutes |
| 60 - 74 | 1000 | 60 minutes |
| 50 - 59 | 750 | 60 minutes |
| 30 - 49 | 500 | 60 minutes |

| VANCOMYCIN DOSING INTERVAL BASED ON ESTIMATED CrCL | | Dosing interval |
|--|--|--|
| CrCL (mL/min) | | |
| ≥ 100 | | Q8 - 12h (Consider Q8h dosing if < 50 years old with severe infection and normal renal function) |
| 50 - 99 | | Q12h |
| 30 - 49 | | Q24h |
| < 30 * | | Initial loading dose of 15 - 20 mg/kg. Redose with 15 mg/kg when serum level ≤ 15 mg/L or when ≤ 20 mg/L in severe infections where penetration may be compromised (e.g., meningitis, pneumonia) |
| Peritoneal dialysis | | Q24 - 48h |
| Continuous renal replacement therapy (CRRT) | | Maintain trough 10-15 mg/L or 15-20 mg/L in severe infections where penetration may be compromised (e.g., meningitis, pneumonia) |

* For patients with acute renal failure or unstable/rapidly increasing SCr, dose as if CrCL < 30 mL/min. Consider Q48h dosing in patients with CrCL 20-30 mL/min and stable SCr.
A one-time loading dose of 25-30 mg/kg of actual body weight may be considered for seriously ill patients (e.g., sepsis, febrile neutropenia, suspected/proven MRSA bacteremia with CrCL > 30 mL/min) to rapidly attain therapeutic concentrations.

3. Serum concentration monitoring

In most cases, **ONLY vancomycin troughs necessary** for routine monitoring
- Obtain trough levels prior to the 4th dose of a new regimen (prior to the 3rd dose for patients with dosing intervals > 24 hours).
- Trough levels should be obtained within 30 minutes before the next scheduled dose.
- Repeat trough levels weekly with stable dosing OR with any significant changes in renal function.
- **Target trough concentrations of 10-15 mg/L recommended.** Trough concentrations of 15 - 20 mg/L may be desired in selected, severe or complicated infections where drug penetration may be compromised (e.g., meningitis, pneumonia, endocarditis/complicated bacteremia, osteomyelitis).
- Peak levels **NOT** routinely obtained.
Random concentrations **ONLY** if severe renal dysfunction or receiving renal replacement therapy.
- Obtain a level within 24 - 48 hours in patients on CRRT or after 3 - 4 days in patients on HD/PD. More frequent sampling is usually not necessary. Redose when serum level ≤ 15 mg/L and when ≤ 20 mg/L in severe infections. Redosing patients when pre-dialysis level is ≤ 25-30 mg/L is also appropriate.

INTRAPERITONEAL ANTIBIOTIC DOSING RECOMMENDATIONS FOR PERITONEAL DIALYSIS PATIENTS *

The following are guidelines for the intraperitoneal dosing of antimicrobials in patients with 100 mL/day urine output. These doses should be empirically increased by 25% in patients with residual renal function (defined as > 100 mL/day urine output):

| | Single Daily Dose (One Bag per Day) | Each Bag (Continuous dosing, mg/L) | |
|---------------------------|--|------------------------------------|-----------------------|
| | | Loading dose (LD) | Maintenance dose (MD) |
| Amikacin | 2 mg/kg | LD 25 | MD 12 |
| Ampicillin | ND | LD 1000 | MD 125 |
| Ampicillin/sulbactam | 2 g every 12 hours | LD 1000 | MD 100 |
| Aztreonam | ND | LD 1000 | MD 250 |
| Cefazolin | 15 mg/kg | LD 500 | MD 125 |
| Cefepime | 1 g | LD 500 | MD 125 |
| Cefazidime | 1 - 1.5 g | LD 500 | MD 125 |
| Clindamycin | ND | LD 300 | MD 150 |
| Gentamicin/tobramycin | 0.6 mg/kg | LD 8 | MD 4 |
| Imipenem/cilastatin | 1 g two times per day | LD 500 | MD 200 |
| Oxacillin | ND | LD 1000 | MD 125 |
| Quinupristin/dalfopristin | 25 mg/L in alternate bags ¹ | LD 300 | MD 150 |
| Penicillin G | ND | LD 50,000 Units | MD 25,000 Units |
| Vancomycin | 15 - 30 mg/kg every 5 - 7 days (follow levels) | LD 1000 | MD 25 |

LD = loading dose, in mg; MD = maintenance dose, in mg. ND = No data; NA = not applicable
Given in conjunction with 500 mg intravenously twice daily. *Adapted from *Perit Dial Int* 2005; 25 (2): 107.

| | Max Adult Daily Dose | GENERAL COMMENTS / MIC CONSIDERATIONS | ID Approval for Listed Doses ¹ | Usual Adult Dose ¹ (CrCL > 50 mL/min) | CrCL 30 to 50 mL/min | CrCL 10 to 30 mL/min | CrCL < 10 mL/min | HEMODIALYSIS ² | PERITONEAL DIALYSIS | CONTINUOUS RENAL REPLACEMENT THERAPY (CRRT) ³ |
|--|----------------------|--|---|---|--|---|--|--------------------------------------|---|--|
| PENICILLINS | | | | | | | | | | |
| Amoxicillin (PO) | 3 g | | No | 250 to 500 mg q8h | 250 to 500 mg q8h | 250 to 500 mg q12h | 250 to 500 mg q24h | 500 mg q24h | | 500 mg q12h |
| Amoxicillin/clavulanate (PO) (Augmentin) | 1.75 g (amoxicillin) | | No | 875 mg q12h | 875 mg q12h | 500 mg q12h | 500 mg q24h | | 250 mg q12h | 500 mg q12h |
| Ampicillin/sulbactam (IV) (Unasyn) | 12 g (amp/sub) | Mild infections e.g., cystitis Moderate to severe infections e.g., pneumonia, bacteremia | No | 1.5 g q6h 3 g q8h | 1.5 g q6h 3 g q8h | 1.5 g q12h 3 g q12h | 1.5 g q24h 3 g q24h | | ND | 1.5 g q8 - 12h 3 g q8 - 12h |
| Ampicillin (IV) | 12 g | | No | 1 to 2 g q4 - 6h | 1 to 2 g q6-8h | 1 to 2 g q8-12h | | | 500 mg to 1 g q12h | 1 to 2 g q8 - 12h |
| Oxacillin (IV) ⁴ | 12 g | Monitor LFTs, WBC | No | | | | 2 g q4 - 6h | | | |
| Penicillin G (IV) | 30 M Units | | No | 2 to 4 M Units q4h | 2 M Units q4h | | | 1 M Units q4h | | 1 to 2 M Units q4h |
| Piperacillin/tazobactam (IV) (Zosyn) | 27 g (pip/tazo) | Use 4.5 g q6h or extended infusion for Pseudomonas; Dose adjust CrCL < 40 mL/min; next adjustment CrCL < 20 mL/min. | Yes (q8h) | 4.5 g q6-8h | 4.5 g q8h | | 4.5 g q12h | | | 4.5 g q8h |
| | | Extended infusion for MICs up to and including 16 mg/L | Yes | 4.5 g infuse over 4 hours q8h | | | 4.5 g infuse over 4 hours q12h | | | 4.5 g infuse over 4 hours q8h |
| CEPHALOSPORINS | | | | | | | | | | |
| Cefazolin (IV) | 8 g | ID approval required for doses > 1 g q8h | No | 1 g q8h | 1 g q8h | 1 g q12h | 1 g q24h | | 500 mg q12h | 1 to 2 g q12h |
| Cephalexin (PO) | 4 g | Dose 500 mg q12h for UTIs | No | 500 mg q6h | 500 mg q6h | 500 mg q8 - 12h | 500 mg q12 - 24h | 500 mg q24h | 500 mg q12 - 24h | 500 mg q12 - 24h |
| Cefadroxil (PO) | 2 g | | No | 1 g q12h | 1 g q24h | | | 1 g q12h | | ND |
| Cefoxitin (IV) | 12 g | | No | 2 g q6h | 1 to 2 g q8 - 12h | 1 to 2 g q12 - 24h | 1 to 2 g q24 - 48h | 1 g q24 - 48h | 1 g q24h | 1 g q8 - 12h |
| Cefuroxime (IV) | 6 g | | No | 750 mg q8h | 750 mg q8h | 750 mg q12h | | 750 mg q24h | | 750 mg q12h |
| Cefuroxime (PO) | 1 g | | No | 250 to 500 mg q12h | 250 to 500 mg q12h | | | 250 to 500 mg q24h | | 250 to 500 mg q12h |
| Ceftriaxone (IV) ³ | 4 g | Dose 2 g q12h for meningitis - ID approval required doses > 1 g q24h | No | | | | 1 g q24h | | | |
| Cefepoxime (PO) | 800 mg | | No | 200 mg q12h | 200 mg q12h | 200 mg q24h | | 200 mg 3x/week after HD | 200 mg q24h | ND |
| Ceftazidime (IV) | 6 g | Dose 2 g q8h for meningitis | Yes | 1 to 2 g q8h | 1 to 2 g q12h | 1 to 2 g q24h | 1 to 2 g q48h | 1 to 2 g 3x/week after HD | 500 mg q24h | 1 to 2 g q8h |
| Cefepime (IV) | 6 g | Empiric dose, known MIC ≤ 8 mg/L Febrile neutropenia, meningitis, known MIC = 16 mg/L | Yes | 1 g q8h for CrCl 51 - 75 2 g q8h for CrCl > 75 | 1 g q12h | 1 g q24h | | 1 g q24h | 1 g q24h | 1 to 2 g q8h |
| | | | Yes | 2 g q8h | 2 g q12h | 2 g q24h | | 1 g q24h | 2 g q48h | 2 g q8h |
| MONOBACTAMS | | | | | | | | | | |
| Aztreonam (IV) | 8 g | Dose 2 g q8h for febrile neutropenia and meningitis | Yes (2 c) | 1 to 2 g q8h | 1 to 2 g q8h | 1 to 2 g q12h | | 1 to 2 g q24h | | 1 to 2 g q12h |
| CARBAPENEMS | | | | | | | | | | |
| Imipenem (IV) | 4 g | Monitor renal function (SCR); Use when known MIC ≤ 2 mg/L | Yes | 500 mg q8h | 500 mg q8h | 500 mg q12h | 250 mg q12h | 500 mg q12h | 250 mg q12h | 500 mg q8 - 8h |
| Meropenem (IV) | 6 g | Monitor renal function (SCR); Meningitis or MIC = 4 mg/L | Yes | 500 mg q6h | 500 mg q8h | 500 mg q12h | | 500 mg q24h | | 500 mg q8 - 12h |
| | | Monitor renal function (SCR); Extended infusion for MIC 4-16 mg/L for non-lactose fermenting gram-negatives | Yes | 2 g q8h | 2 g q12h | 2 g q24h | | 500 mg q12h | | 2 g infuse over 3hrs q8h |
| QUINOLONES | | | | | | | | | | |
| Levofloxacin (PO, IV) | 750 mg | Monitor mental status changes; Mg ²⁺ , Ca ²⁺ , Al ³⁺ containing antacids, iron, zinc, and sucralfate ↓ PO quinolone absorption > 90% (separate administration times by ≥ 2 hrs) | Yes | 250 mg q24h | 250 mg q24h | | 250 mg q48h | | 250 mg q24h | 250 mg q24h |
| | | | Yes | 500 mg q24h | 250 mg q24h | | 250 mg q48h | | 250 mg q24h | 250 mg q24h |
| | | | Yes | 750 mg q24h | 750 mg q48h | | 500 mg q24h | | 500 mg q24h | 500 mg q24h |
| MACROLIDES | | | | | | | | | | |
| Azithromycin (PO, IV) | 500 mg | IV formulation requires ID approval except ICU, ED, OB/GYN | No | | | | 500 mg q24h | | | |
| Clarithromycin (PO) | 1 g | | No | 500 mg q12h | | 500 mg q12h | | 500 mg q12h | | 500 mg q24h |
| ANTIFUNGALS | | | | | | | | | | |
| Amphotericin B (IV) | 1.5 mg/kg | Monitor SCR, K ⁺ , Mg ²⁺ , PO ₄ ; Administer in D ₅ W over 4 to 6 hrs | No | | | 0.5 to 1 mg/kg q24h (consider 500 mL - 1 L NS pre- or divided pre- and post-infusion to ↓ risk of nephrotoxicity) | | | | |
| Micafungin (IV) | 100 mg | | Yes | | | 100 mg q24h | | | | |
| Lipid amphotericin B (IV) (Abelcet) | 5 mg/kg | Monitor SCR, K ⁺ , Mg ²⁺ , PO ₄ ; Administer in D ₅ W over 2 hrs | Yes | | | 5 mg/kg q24h (consider 500 mL - 1 L NS pre- or divided pre- and post-infusion to ↓ risk of nephrotoxicity) | | | | |
| Fluconazole (PO, IV) | 1.6 g | Monitor LFTs; consider PO therapy (> 90% bioavailability); Please refer to NYP Candida Guidelines | Yes | | | 200 mg q24h | | | | |
| | | Cystitis, oral candidiasis | | | | 6 to 12 mg/kg q24h (round to multiples of 200 mg) | 3 to 6 mg/kg q24h (round to multiples of 200 mg) | | | 6 to 12 mg/kg q24h (round to multiples of 200 mg) |
| Flucytosine (PO) | 150 mg/kg | Monitor SCR, CBC | Yes | 12.5 to 25 mg/kg q6h | 12.5 to 25 mg/kg q12 - 24h | | 12.5 to 25 mg/kg q24 - 48h | | 500 mg to 1 g q24h | 12.5 to 25 mg/kg q12 - 24h |
| Voriconazole (PO, IV) ³ | 12 mg/kg | IV: caution CrCL < 50 mL/min (cyclosporin may accumulate) | Yes | | 6 mg/kg q12h x 2, then 4 mg/kg q12h; Hepatic impairment (Child-Pugh Class A or B): 6 mg/kg q12h x 2, then 2 mg/kg q12h | | | | | |
| ANTIVIRALS | | | | | | | | | | |
| Acyclovir (IV) | 30 mg/kg | Monitor SCR, WBC, mental status changes. Dose based on ideal or adjusted body weight. | No | 5 to 10 mg/kg q8h | 5 to 10 mg/kg q12h | 5 to 10 mg/kg q24h | | 2.5 to 5 mg/kg q24h | | 5 to 10 mg/kg q24h |
| Famciclovir (PO) | 1.5 g | | No | 500 mg q8 - 12h | 500 mg q12 - 24h | 500 mg q24h | 250 mg q24h | 250 mg 3x/week after HD | ND | ND |
| Valacyclovir (PO) | 3 g | Monitor SCR, CBC, mental status changes | No | 1 g q8 - 12h | 1 g q12h | 1 g q24h | 500 mg q24h | 1 g 3x/week after HD | 500 mg q48h | 500 mg q24h |
| Ganciclovir (IV) | 10 mg/kg | Monitor SCR, WBC; Induction Dosing - - - - - Monitor SCR, WBC; Maintenance Dosing - - - - - | Yes | 5 mg/kg q24h | 2.5 mg/kg q24h | 1.25 mg/kg q24h | 1.25 mg/kg 3x/week | 1.25 mg/kg 3x/week after HD | 1.25 mg/kg 3x/week | 2.5 mg/kg q24h |
| | | | | 900 mg q12h (induction) | 450 mg q24h (CrCL 25 - 39) | 450 mg q48h | 0.625 mg/kg 3x/week | 0.625 mg/kg 3x/week after HD | 0.625 mg/kg 3x/week | 1.25 mg/kg q24h |
| Valganciclovir (PO) | 1.8 g | Monitor SCR, WBC; Use IV or PO ganciclovir for patients with CrCL < 10 mL/min and/or receiving dialysis | Yes | 900 mg q24h (maintenance) | 450 mg q24h (CrCL 40 - 59) 450 mg q24h (CrCL 40 - 59) 450 mg q48h (CrCL 25 - 39) | 450 mg twice weekly | | | Not Recommended | Not Recommended |
| ANTITUBERCULOSIS | | | | | | | | | | |
| Ethambutol (PO) | 2.5 g | Monitor uric acid, LFTs, vision test | No | 15 to 25 mg/kg q24h | | 15 to 25 mg/kg q24 - 36h | | 15 to 25 mg/kg q48h | | 15 to 25 mg/kg q24 - 36h |
| Isoniazid (PO) | 300 mg | Monitor LFTs | No | | | | 5 mg/kg (300 mg) q24h | | | |
| Pyrazinamide (PO) | 2 g | Monitor LFTs | No | 15 to 30 mg/kg q24h | | 12 to 20 mg/kg q24h | | | 15 to 30 mg/kg q24h | |
| Rifampin (PO) ⁴ | 600 mg | Monitor LFTs; significant drug interaction potential | No | | | | 600 mg q24h | | | |
| MISCELLANEOUS | | | | | | | | | | |
| Clindamycin (IV) ⁵ | 4.8 g | | No | | | | 600 to 900 mg q8h | | | |
| Daptomycin (IV) | 12 mg/kg | Monitor CPKs, 2 nd or 3 rd line option for MRSA/VRE. Consider higher doses when MIC ≤ 3 - 4 mg/L | Yes | 6 to 8 mg/kg q24h | 6 to 8 mg/kg q24h | | 6 to 8 mg/kg q48h | | | 6 to 8 mg/kg q24h |
| Doxycycline (PO, IV) | 300 mg | | No | | | | 100 mg q12h | | | |
| Linezolid (PO, IV) | 1.2 g | Monitor CBC; consider PO therapy (~100% bioavailability) | Yes | | | 600 mg q12h (preferred for VRE infections and for MRSA infections if intolerance/allergy to vancomycin) | | | | |
| Metronidazole (PO, IV) ⁶ | 4 g | Monitor mental status changes | No | 500 mg q8 - 12h | 500 mg q8 - 12h | | 500 mg q12h | | 500 mg q8 - 12h | |
| Polymyxin B (IV) | 3 mg/kg | Reduce dose when CrCL < 80 mL/min; 1 mg = 10,000 units; Monitor SCR, electrolytes, and neurotoxicity | Yes | 3 mg/kg q24h (can divide dose q12h) | 2.5 to 3 mg/kg load x 1, then 1 to 1.5 mg/kg q24h | 2.5 to 3 mg/kg load x 1, then 1 to 1.5 mg/kg q24h | | | 2.5 to 3 mg/kg load x 1, then 1 mg/kg q3 - 5 days | |
| Quinupristin/dalfopristin (IV) ⁷ | 22.5 mg/kg | Monitor LFTs, arthralgias/myalgias | Yes | | | | 7.5 mg/kg q8h | | | |
| Ticagrelor (IV) ⁸ | 100 mg | Adjust maintenance dose in severe hepatic impairment | Yes | | | 100 mg x 1, then 50 mg q12h; Severe hepatic impairment (Child-Pugh Class C): 100 mg x 1, then 25 mg q12h | | | | |
| Trimethoprim (TMP) / sulfamethoxazole (PO, IV) | 2 (TMP) | Monitor SCR, WBC, K ⁺ , platelets; SS-80 mg TMP; DS-160 mg TMP | No | 8 to 10 mg/kg/day divided q6 - 12h | 4 to 5 mg/kg/day divided q6 - 12h | 4 to 5 mg/kg/day divided q6 - 12h | 2 to 2.5 mg/kg/day divided q12 - 24h | 2 to 2.5 mg/kg/day divided q12 - 24h | 8 to 10 mg/kg/day divided q6 - 12h | 8 to 10 mg/kg/day divided q6 - 12h |
| | | | | 15 to 20 mg/kg/day divided q6 - 8h | 7.5 to 10 mg/kg/day divided q6 - 12h | 7.5 to 10 mg/kg/day divided q6 - 12h | 5 mg/kg/day divided q12 - 24h | 5 mg/kg/day divided q12 - 24h | 15 mg/kg/day divided q8 - 12h | 15 mg/kg/day divided q8 - 12h |

¹ The dosing recommendations presented here are for ~70 kg adults with moderate to severe infections based on published literature and clinical experience. These recommendations should only be used as guidelines and dosing based on pharmacokinetic and clinical evaluation is suggested where possible. ² For antimicrobials dosed every 24 hours in patients on hemodialysis, doses should be administered after dialysis on dialysis days. Alternatively, all doses may be administered once daily in the evening to ensure administration after dialysis on dialysis days. ³ Dosing adjustment may be necessary in patients with severe liver dysfunction. ⁴ For patients receiving continuous veno-venous haemofiltration (CVVH) or continuous veno-venous hemodialysis (CVVHD) at ≥ 1L/h; ⁵ For up-to-date antibiotic approval requirements please refer to the Antibiotic Control Program; there are some exceptions by services and hospital location; ND = no data available.

RESPONSIBILITY:

Joint Subcommittee on Anti-Infective Use

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