

## Guide for Drug Level Monitoring of Commonly Used Medications

**Note: This reference should be used in conjunction with the appropriate clinical judgment of the health care team**

Order	Drug	When to Draw Level?	Time to Steady State (when concentrations remain constant)*	Usual reference range**	Special Considerations
<p><b>“Trough”</b></p> <p>Also referred to as “level” should always be before a dose (trough) even if provider does not specify</p>	Aminoglycosides: Amikacin	Within 30 minutes before 3rd or 4th dose (pediatrics: 3rd dose)	2-3 doses	Trough: < 8 mg/L	<p><i>Aminoglycoside special considerations:</i></p> <ul style="list-style-type: none"> <li>Refer to UCSF Infectious Disease Management Program (IDMP) Antimicrobial Dosing Guidelines</li> <li>Peak therapeutic ranges vary depending on the severity of infection i.e higher peaks for more severe infections (e.g. cystic fibrosis)</li> <li>For HD patients target Pre HD or Post HD level will depend on severity of infection. Provider will determine if redosing needed.</li> </ul>
	Aminoglycosides: Gentamicin or tobramycin	Traditional dosing: within 30 minutes before 3rd or 4th dose (pediatrics: 3rd dose)	2-3 doses	Trough: < 2 mg/L (< 1 mg/L optimal)	
		Gram positive synergy: within 30 min before 3rd or 4th dose (pediatrics: 3rd dose)	2-3 doses	< 2 mg/L (< 1 mg/L optimal)	
		Pediatric CF extended interval dosing: within 30 minutes before 2nd dose	2-3 doses	< 1 mg/L or undetectable	
		ICN extended interval dosing: within 30 minutes before 4th dose	1 dose	< 2 mg/L (< 1.5 mg/L optimal)	
		ICN extended interval dosing (HIE or significant asphyxia): within 30 minutes before 3rd dose	1 dose	< 2 mg/L (< 1.5 mg/L optimal)	
	Carbamazepine (Tegretol®)	Within 30 minutes before dose	2-5 DAYS	4-12 mg/L	<p><i>Cyclosporine, tacrolimus, sirolimus special considerations:</i></p> <ul style="list-style-type: none"> <li>Daily trough concentrations may be monitored in inpatients due to many potential factors (including drug interactions) affecting concentrations</li> </ul> <p><i>Phenytoin special considerations:</i></p> <ul style="list-style-type: none"> <li>Check albumin level concurrently with phenytoin level</li> <li>Albumin-adjusted phenytoin level may be higher than reported i.e. levels that are at target (10-20) may actually be greater than 20 with hypoalbuminemia</li> </ul> <p>Levels may be hard to interpret for patients on HD or on valproic acid. Free phenytoin level may be warranted.</p>
	Cyclosporine (Neoral, Gengraf, Sandimmune®)	Within 30 - 60 minutes before 4th dose	2-5 DAYS	50-500 mcg/L	
	Digoxin (Lanoxin ®)	Within 30-60 minutes before dose Draw at least 6 -8 hours post dose	3-5 DAYS	0.5-2 mcg/L CHF (adult): 0.5-1.0 mcg/L	
	Ethosuximide (Zarontin®)	Before dose	4-7 DAYS	40-100 mg/L	
Lithium (Eskalith®)	Within 30 minutes before dose Draw at least 8-12 hours post dose	5 DAYS	0.5-1.5 mg/L		

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<p><b>“Trough”</b></p> <p>Also referred to as “level” should always be before a dose (trough) even if provider does not specify</p>	Phenobarbital (Luminal®)	Before dose	2-4 WEEKS	10-40 mg/L (adults) 15-40 mg/L (pediatrics)	<p>Vancomycin special considerations:</p> <ul style="list-style-type: none"> <li>• Troughs are not recommended if anticipated duration of therapy is short (<math>\leq 3</math> days)</li> <li>• Vancomycin peak levels should not be obtained</li> <li>• Obtain trough in patients with unstable renal function, renal replacement therapy, when serum Cr may not accurately reflect GFR i.e. patients <math>&gt; 70</math>, reduced muscle mass, severely altered volumes of distribution, or for CNS infections, endocarditis, ventilator-associated pneumonia, bacteremia or osteomyelitis caused by MRSA</li> <li>• Once weekly monitoring in adults is reasonable in patients with stable renal function. (Data supporting safety of prolonged troughs of 15-20 mcg/ml is limited.)</li> <li>• For pediatric patients, monitoring every 4 days is reasonable, but patients may be monitored every two days with doses <math>\geq 25</math> mg/kg/dose IV q6h.</li> <li>• Random vancomycin concentrations may be appropriate for patients with CrCl <math>&lt; 10</math> ml/min not on renal replacement therapy to assess appropriateness of redosing</li> </ul>
	Phenytoin (Dilantin®) or Fosphenytoin (Cerebyx®)	Within 30 minutes before AM dose Draw at least 4 hours post IV dose and 6-9 hours post PO dose	3-4 DAYS	Total phenytoin: 10-20 mg/L Free phenytoin: 1-2 mg/L	
	Procainamide (Procan®)	IV 6-12 hours after start of infusion PO draw prior to next dose	12-24 HOURS	4-8 mg/L NAPA $< 30$ mg/L (hepatic impairment)	
	Primidone (Mysoline®)	Within 1 hour before next dose	2-3 DAYS	5-15 mg/L	
	Sirolimus (Rapamune®)	Within 30 to 60 minutes prior to 4 <sup>th</sup> dose If patient is concurrently on cyclosporine, sirolimus must be dosed 4 hours after cyclosporine	6-10 DAYS	5-15 mcg/L	
	Tacrolimus (Prograf®, Hecoria)	Within 30 - 60 minutes before AM dose	3 doses	5-15 mcg/L	
	Valproic Acid (Depakote®, Depakene®)	Within 30 minutes before dose	2-3 DAYS	50-125 mg/L	
	Vancomycin	Within 30 minutes before 4th dose	3 doses	10-20 mg/L 15-20 mg/L for serious infections	
<p><b>Pre or Post Hemodialysis (HD)</b></p>	Aminoglycosides: Gentamicin or Tobramycin	Pre HD or 1 hour Post HD level before a dose to determine if redosing needed	--	1-3 mg/L Post HD: $< 2$ mg/L	
	Vancomycin	Before HD	--	10-20 mg/L	

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<b>Peak</b>	Aminoglycosides: Amikacin	30 minutes after completion of 30-minute infusion 60 minutes after IM dose	2-3 doses	20-30 mg/L**	<p><i>Enoxaparin special considerations:</i></p> <ul style="list-style-type: none"> <li>• Levels are not routinely drawn in adults but may be indicated in certain circumstances such as severe renal impairment, pregnancy, or morbidly obese</li> <li>• Levels are routinely obtained in pediatric patients and are drawn after the first dose</li> <li>• Heparin level (Low Molecular Weight Heparin) refers to the antifactor-Xa level</li> </ul>
	Aminoglycosides: Gentamicin or tobramycin	Traditional dosing: 30 minutes after completion of 30-minute infusion	2-3 doses	5-10 mg/L** Higher peaks may be warranted based on indication	
		ICN extended interval dosing: 30 minutes after completion of 4th dose	1 dose	6-15 mg/L** Draw in < 35 weeks gestational age only	
	Enoxaparin (Lovenox®)  Heparin level (Low Molecular Weight Heparin)	4 hours after dose After first dose (pediatrics) After third dose (adults)	3 doses (adults) 1 dose (pediatrics)	Daily dosing (adults): 1-2 unit/mL  Q12H dosing (adults and pediatrics): 0.5-1 unit/mL	
	Theophylline (Theo-Dur®)	Immediate release products: 1-2 hours after third dose Sustained release products: 4-8 hours after 3rd dose	2-3 DAYS (adults) 3 doses  Variable, may check earlier if toxicity or reduced clearance suspected	5-20 mg/L	
<b>Random Level</b>	Aminoglycosides: Gentamicin or tobramycin	Adult extended interval dosing: within 6-14 hrs after dose (provider to specify time of draw)	--	2-30 mg/L per Hartford nomogram If trough ordered, <1 mg/L or undetectable	

\* Time to steady state reflects maintenance dosing (no load)

\*\* Reference range may differ for specific indications

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### How do I interpret a level?

- Concentrations drawn after a dose typically represent a peak level
- Trough concentrations are usually drawn within 30 minutes prior to a dose
- If a level was not drawn at the correct time, then please inform the team

### What to do if a level is high

- If level is high and drawn at the appropriate time, holding a dose may be warranted, especially if patient is exhibiting side effects
- Always inform the team if a level is high to be sure that they are aware

### References:

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