

## TEST INFORMATION

### Therapeutic Drug Monitoring Guidelines

#### GUIDELINES FOR THERAPEUTIC DRUG MONITORING

1. Document the date & time collected.
2. Document the date & time the dose was administered at time of request.
3. Do not collect level until patient has reached steady state (5 half-lives) unless following a loading dose or performing a kinetic study.
4. The recommended minimum collection time after a last dose may be too short for patients with renal or hepatic dysfunction.

DRUG Therapeutic Range	HALF-LIFE <small>for patients with normal organ function (5 half lives = Steady State)</small>	OPTIMAL COLLECTION TIME	ABSOLUTE LIMITS OF ACCEPTABLE COLLECTION TIME		
5-FLUOROCYTOSINE (5FC) 25-80 ug/mL	3-6 h	PEAK: 2h after oral TROUGH: immediately before dose			
AMIKACIN, <u>Traditional Dose</u> Peak: 15-35 mg/L Trough: <5 mg/L	2-3 h (adult <30 y) 3-6 h (adult >30 y) 4-8 h (neonate)	PEAK: 60 m after 60 m IV infusion; 1-2 h with decreased renal function TROUGH: immediately before dose	PEAK: 30 min to 2 h after IV infusion TROUGH: no sooner than 1 h before next dose		
AMIKACIN, <u>Single Daily Dose (SDD)</u> Peak: 35-50 mg/L Trough: approaching zero	2-3 h (adult <30 y) 3-6 h (adult >30 y) 4-8 h (neonate)	PEAK: <b>2 h after 60 m IV infusion</b>	PEAK: <b>2 h after IV infusion</b>		
AMIODARONE 500-2500 ng/mL	8-107 d	TROUGH: level is <u>preferred</u> , collect immediately before dose	Collect no sooner than 12 h after last dose.		
AMITRIPTYLINE 75-250 ng/mL (sum of amitriptyline & nortriptyline)	17-40 h	TROUGH: level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.		
CARBAMAZEPINE 4-12 mg/L (parent) 0.8-3.2 mg/L (metab) 13-33 % (free)	10-30 h (adult) 8-19 h (child)	TROUGH: level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.		
CHLORAMPHENICOL 10-20 ug/mL	2-4 h	PEAK: 2-3 h after oral dose or 1-2 h after 60 min IV infusion	Peak levels collected before full absorption or distribution will result in falsely low levels.		
CYCLOSPORINE Therapeutic levels vary with type of transplant *See below.*	10-27 h (adult) <18 h (child)	TROUGH: immediately before next dose	Collect no sooner than 2 h before next dose.  Do not collect from catheter lumen in which cyclosporine has been administered.		
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>CYCLOSPORINE Reference Ranges</p> <p><b>Kidney Transplant</b></p> <p>Pediatric <span style="float: right;">ug/L</span></p> <p>0-3 months post transplant 175-200</p> <p>3-6 months post transplant 150-175</p> <p>6-9 months post transplant 125-150</p> <p>9-12 months post transplant 100-125</p> <p>&gt; 1 yr post transplant 75-100</p> <p>Adult HLA identical living donor</p> <p>0-3 months post transplant 125-150</p> <p>&gt;3 months post transplant 100-125</p> <p>Adult all other donors</p> <p>0-3 months post transplant 150-200</p> <p>3-6 months post transplant 125-150</p> <p>&gt; 6 months post transplant 100-125</p> </td> <td style="width: 50%; vertical-align: top;"> <p><b>Heart Transplant</b></p> <p>0-3 months post transplant 150-250</p> <p>3-6 months post transplant 125-225</p> <p>6-12 months post transplant 100-200</p> <p>&gt;12 months post transplant 50-150</p> <p><b>Heart and Lung Transplant</b> 200-250</p> <p><b>Liver Transplant</b></p> <p>0-6 months post transplant 150-200</p> <p>&gt;6 months post transplant 100-150</p> <p><b>Pancreas Transplant</b></p> <p>0-6 mo post transplant 200-250</p> <p>6-12 mo post transplant 150-200</p> <p>&gt;12 months post transplant 100-150</p> <p><b>Bone Marrow Transplant</b> 200-400</p> </td> </tr> </table>				<p>CYCLOSPORINE Reference Ranges</p> <p><b>Kidney Transplant</b></p> <p>Pediatric <span style="float: right;">ug/L</span></p> <p>0-3 months post transplant 175-200</p> <p>3-6 months post transplant 150-175</p> <p>6-9 months post transplant 125-150</p> <p>9-12 months post transplant 100-125</p> <p>&gt; 1 yr post transplant 75-100</p> <p>Adult HLA identical living donor</p> <p>0-3 months post transplant 125-150</p> <p>&gt;3 months post transplant 100-125</p> <p>Adult all other donors</p> <p>0-3 months post transplant 150-200</p> <p>3-6 months post transplant 125-150</p> <p>&gt; 6 months post transplant 100-125</p>	<p><b>Heart Transplant</b></p> <p>0-3 months post transplant 150-250</p> <p>3-6 months post transplant 125-225</p> <p>6-12 months post transplant 100-200</p> <p>&gt;12 months post transplant 50-150</p> <p><b>Heart and Lung Transplant</b> 200-250</p> <p><b>Liver Transplant</b></p> <p>0-6 months post transplant 150-200</p> <p>&gt;6 months post transplant 100-150</p> <p><b>Pancreas Transplant</b></p> <p>0-6 mo post transplant 200-250</p> <p>6-12 mo post transplant 150-200</p> <p>&gt;12 months post transplant 100-150</p> <p><b>Bone Marrow Transplant</b> 200-400</p>
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DESIPRAMINE 50-150 ng/mL	12-76 hr	TROUGH: level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.		

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DIGOXIN 0.5-2.0 ng/mL (adults) 3-4 ng/mL (<3 mo)  0.5-2.0 ug/L (adults) 3-4 ug/L (<3 mo)	36-44 h (adult) 12-24 h (child) 18-33 h (infant) 35-88 h (neonate)	> 6 h after last dose	Collect no sooner than 6 h after last dose until immediately before next dose.
DOXEPIN 90-250 ng/mL (sum of doxepin & metabolite)	8-36 h (doxepin) 38-81 h (metabolite)	TROUGH: level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.
GENTAMICIN <u>Traditional Dosing</u> Peak: 5-12 mg/L Trough: <1 mg/L	1.5-3 h (adult <30 y) 3-6 h adult >30 y) 4-8 h (neonate)	PEAK: 60 m after 60 m IV infusion; 1-2 h with decreased renal function TROUGH: immediately before dose	PEAK: 30 min to 2 h after IV infusion TROUGH: no sooner than 1 h before next dose
GENTAMICIN <u>Single Day Dosing (SDD)</u> Peak: 17-24 mg/L Trough: approaching zero	1.5-3 h (adult <30 y) 3-6 h adult >30 y) 4-8 h (neonate)	PEAK: 2 h after 60 m IV infusion	PEAK: 2 h after IV infusion
HEPARIN	<p>For monitoring guidelines refer also to the Coagulation Testing Guidelines and Monitoring Anticoagulation procedure S:PC-2114. If collected 4-6 hours after administration:</p> <ul style="list-style-type: none"> <li>Low molecular weight heparin: If administered twice daily: 0.60-1.0 IU/mL. If administered once daily: 1.0-2.0 IU/mL.</li> <li>Unfractionated heparin: "Low intensity" for CV, vascular, and thrombolytic therapy: 0.15-0.35 IU/mL (PTT 60-75 seconds); "high intensity" for DVT and PE: 0.3-0.7 IU/mL (PTT 70-105 seconds).</li> </ul> <p>Heparin does not have a half-life. With high concentrations, heparin is excreted by kidneys and metabolized by the liver. Below the renal threshold, 0.5-1.0 U/mL, heparin is metabolized only by the liver at a constant rate. At &lt;0.1 U/mL, the metabolic capacity of the liver is no longer saturated, and the rate of clearance slows. With liver disease, the response is slower and prolonged.</p>		
IMIPRAMINE 100-300 ng/mL (sum of imipramine & desipramine)	9-24 h	TROUGH level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule
LEVETIRACETAM (Keppra®) Trough: 5-45 mcg/mL	6-8 h	TROUGH immediately before next dose	TROUGH: no sooner than 1 h before next dose
LIDOCAINE 1.2-6.0 ug/mL	1-2 h	Collect steady state levels 30-90 m after a loading dose or 6-12 h after a maintenance dose. After loading dose, peak levels occur at end of IV infusion.	
LITHIUM 0.5-1.5 mmol/L	27 h	TROUGH immediately before next dose	Collect no sooner than 8-10 hours after last dose.
Mycophenolic Acid (CellCept®) MPA: 1.00-3.50 mg/L	8-16 h 13-17h (Glucuronide)	TROUGH: level is <u>preferred</u> , collect immediately before dose	
NORTRIPTYLINE 50-150 ng/mL	18-93 h	TROUGH level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.
PHENOBARBITAL 15-40 mg/L	50-120 h (adult) 40-70 h (child)	TROUGH level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.
PHENYTOIN 10-20 mg/L (total) 1-2 mg/L (free) 6-13% free	8-60 h	TROUGH level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.
PRIMIDONE 5-12 mg/L	3-19 h	TROUGH level is <u>preferred</u> , collect immediately before dose	Advisable to monitor at same time in dosing schedule.
PROCAINAMIDE 4-10 mg/L (procaïnamide) 15-25 mg/L (sum of procaïnamide & NAPA) 5-30 mg/L (NAPA)	2-4 h 8 h (NAPA)	TROUGH level is preferred, collect immediately before dose	Collect no sooner than 1 h before next dose.
SIROLIMUS (Rapamune®), Rapamycin 5-15 ug/L	46-79 h	TROUGH level immediately before next dose	

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<b>TACROLIMUS (FK-506)</b> Solid organ transplant: 5-15 ug/L Blood and marrow transplant: 5-10 ug/L	10-25 h (adult) <18 h (child)	TROUGH level immediately before next dose	
<b>THEOPHYLLINE</b> 10-20 mg/L  For apnea of prematurity (gestational age <38 w): 6-14 mg/L	3-8 h (adult) 1-8 h (child) 12-60 h (neonate)	TROUGH level is preferred, collect immediately before dose	PEAK: 1-2 h after last dose for fast release and 4-6 h for slow release
<b>TOBRAMYCIN</b> Traditional Dose Peak: 5-12 mg/L Trough: <1 mg/L	1.5-3 h (adult <30y) 3-6 h (adult >30y) 4-8 h (neonate)	PEAK: 60 m after 60 m IV infusion; 1-2 h with decreased renal function  TROUGH: immediately before dose	PEAK: 30 m to 2 h after IV infusion. TROUGH: no sooner than 1 h before next dose
<b>TOBRAMYCIN</b> Single Daily Dose (SDD) Peak: 17-24 mg/L CF High Dose Peak: 40-50 mg/L Trough: approaching zero	1.5-3 h (adult <30y) 3-6 h (adult >30y) 4-8 h (neonate)	PEAK: 2 h after 60 m IV infusion	PEAK: 2 h after IV infusion
<b>VALPROIC ACID</b> 50-100 mg/L (total) 5-10 mg/L (free) 8-12% free	8-17 h	TROUGH level is preferred, collect immediately before dose	PEAK: 30 m to 1 h after single dose of syrup. 2-8 h after tablets or capsules
<b>VANCOMYCIN</b> Peak: 20-50 mg/L Trough: 8-20 mg/L	4-10 h (adult) 6-10 h (neonate) 2-3 h (child)	PEAK: 2 h after 60 m IV infusion; 3-4 h with decreased renal function  TROUGH: immediately before dose	PEAK: 2 h after IV infusion. TROUGH: no sooner than 1 h before next dose
<b>WARFARIN</b> (COUMADIN®) INR = 1.5-3.5 depending on condition	2.5 days	<u>Induction:</u> <ul style="list-style-type: none"> <li>• Induction of warfarin anticoagulation should be done while the patient is therapeutically anticoagulated with heparin.</li> <li>• Give daily doses of slightly more than expected maintenance dose until INR is in therapeutic range, then decrease to expected maintenance dose.</li> <li>• Keep heparin in therapeutic range for 24-48 h after INR is in therapeutic range.</li> </ul>	

Conversions: o ng/mL = ug/L o ug/mL = mg/L
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