C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

DOSING AND MONITORING OF VANCOMYCIN IN PEDIATRIC PATIENTS

Patient Population/Unit/Service	Dosing Recommendations
Dosing recommendations for children with normal renal function (CrCl ≥ 60 mL/min) except in the following situations: • Cystic fibrosis patients • CHC patients • ECMO patients • NICU patients • Low muscle mass	Infants > 5000 g to children < 18 years: 20 mg/kg/dose IV q8h (max initial dose: 1250 mg) *For infants ≤ 5000 g, refer to NICU dosing
Children with renal insufficiency	CrCl 40 to < 60 mL/min: < 12 years: 15 mg/kg IV q8h ≥ 12 years: 10 mg/kg IV q8h CrCl 30 to < 40 mL/min: < 12 years: 15 mg/kg IV q12h ≥ 12 years: 10 mg/kg IV q12h CrCl < 30 mL/min: < 12 years: 15 mg/kg IV q24h* ≥ 12 years: 10 mg/kg IV q24h* *Check random level between 12-24 hours after first dose. Redose for level < 15 mcg/mL
Dosing recommendations for children on CRRT, peritoneal dialysis, or hemodialysis	CRRT: Dose per the following equation: $Effluent\ rate\ \left(\frac{mL}{m^2*hr}\right) = \frac{Dialysate\ rate\ \left(\frac{mL}{hr}\right) + Replacement\ rate\ \left(\frac{mL}{hr}\right)}{BSA\ (m^2)}$ • < 2000 mL/m^2/hr: 10 mg/kg/dose IV q12h (max: 1000 mg/dose) • ≥ 2000 to <4000 mL/m^2/hr: 15 mg/kg/dose IV q8h (max: 1000 mg/dose) • ≥ 4000 mL/m^2/hr: 20 mg/kg/dose IV q8h (max: 1000 mg/dose) -Please consider native UOP and potential for additional clearance -Obtain levels prior to 2nd or 3rd dose depending on clinical scenario Peritoneal dialysis: 10 mg/kg/dose IV q24h Hemodialysis: 10 mg/kg/dose IV x1 post dialysis
Cystic fibrosis	Children < 12 years: 20 mg/kg/dose IV q6h (max initial dose: 900 mg) Children ≥ 12 years: 20 mg/kg/dose IV q8h (max initial dose: 1250 mg)
CHC patients If CrCl < 60 mL/min, please refer to dosing recommendations for children with renal insufficiency	Open chest prophylaxis or patients within 72 hours of cardiac surgery: 10 mg/kg/dose IV q12h Patients with depressed cardiac function/heart failure* AND ≥ 72 hours since last cardiac surgery: 10 mg/kg/dose IV q8h Patients with normal cardiac function AND ≥ 72 hours since last cardiac surgery: 15 mg/kg/dose IV q8h *Depressed cardiac function/heart failure indicated by patient being on inotropes (e.g., milrinone) OR at least two of the following: ACE-inhibitor, beta-blocker, digoxin, spironolactone

Patient Population/Unit/Service	Dosing Recommendations
ECMO (PICU)	Children with normal renal function (CrCl ≥ 60 mL/min): 15 mg/kg/dose IV q8h (max initial dose: 1250 mg) Children with renal insufficiency (CrCl < 60 mL/min): Refer to *Children with renal insufficiency* section above
Low muscle mass (e.g., muscular dystrophy,cerebral palsy, spinal muscular atrophy)	15 mg/kg/dose q8h
NICU	Less than 1200 g AND 14 days or younger: 15 mg/kg/dose IV q18h Less than 1200 g AND older than 14 days: 15 mg/kg/dose IV q12h 1200-2000 g AND 14 days or younger: 15 mg/kg/dose IV q12h 1200-2000 g AND older than 14 days: 15 mg/kg/dose IV q8h 2000-5000 g AND 7 days or younger: 15 mg/kg/dose IV q12h 2000-5000 g AND older than 7 days: 15 mg/kg/dose IV q8h More than 5000 g: 20 mg/kg/dose IV q8h ECMO: 15 mg/kg/dose IV q18h Therapeutic hypothermia (cooling): 15 mg/kg/dose IV q18h Peritoneal dialysis: 10 mg/kg/dose IV q24h

C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

Goals of Therapy for Vancomycin:

	Therapeutic Goals

Vancomycin	• AUC is the preferred method of vancomycin monitoring
	• Goal AUC is 400-600 regardless of MIC and should not be adjusted for MICs less than or equal to 1
	• Open chest prophylaxis:
	  ○ Trough of 5-10 mcg/mL
	• Redose if pre-dialysis:
	  ○ < 20 mcg/mL
	• Dosing by levels:
	  ○ Trough 10-15 mcg/mL

Initiating Vancomycin Therapy:

1. If patient recently received vancomycin, review the previous regimen and patient information, and initiate the most recent therapeutic dose.
2. Doses should be based on DOSING weight
3. Avoid initial doses > 3600 mg per DAY.

Monitoring within 48 hours of starting vancomycin:

1. Vancomycin levels should be unnecessary if therapy is not anticipated to exceed 48 hours.
2. Do not check vancomycin concentrations within the first 48 hours except in the following situations:

Clinical Situation	**Monitoring Recommendation**
Approximately 90% of patients will have vancomycin discontinued within 48-72 hours and most patients do not require levels	
Documented Gram-positive infection	• Obtain 2 vancomycin levels at steady state and calculate AUC to achievegoal AUC of 400-600 • Obtain a peak level ~2 hours after the END of infusion and a trough prior to the next dose for most patients to calculate AUC
Septic shock	
Weight > 100 kg	
Children with low muscle mass (e.g., muscular dystrophy, cerebral palsy, spinal muscular atrophy)	
Significant acute changes in renal function, CrCl < 30 mL/min, therapeutic hypothermia, ECMO, AKI, or neonates < 72 hours old whose mothers received peri-partum vancomycin	• Obtain a vancomycin level and dose per level • Monitor random levels in patients and re-dose when level <15 mcg/mL

CHC	• Reasons to check trough prior to second dose (aka "safety level")
	  ○ New start ECMO
	  ○ Peritoneal dialysis
	  ○ Cooling protocol
	  ○ Concern for renal dysfunction as indicated by either of the following:
	  ▪ Low UOP (< 1 mL/kg/hr)
	  ▪ SCr > 130% of baseline

Monitoring after 48 hours of starting vancomycin:

1. Use the following table to guide monitoring of vancomycin based on the patient's clinical status:

Clinical Situation	Monitoring Recommendation
NICU	• Trough only monitoring may be preferred for patients < 1000 g OR in first week of life due to low blood volume and/or potentially rapidly fluctuating renal function • However, in patients with stable renal function, AUC based monitoring is recommended for invasive MRSA infections to optimize treatment efficacy
Patients with stable renal function (including patients with CKD and receiving CRRT)	• Obtain 2 vancomycin levels at steady state and calculate AUC to achieve goal AUC of 400-600 • Obtain a peak level ~2 hours after the END of infusion and a trough prior to the next dose for most patients to calculate AUC • Document individualized trough range that corresponds to AUC of 400-600 for that patient
Patients on conventional hemodialysis	• Check pre-HD level • Redose if pre-HD level < 20 mcg/mL
CHC patients within 72 hours of surgery	• Check trough concentration • Redose for trough < 10 mcg/mL
Patients who have fluctuating fluid and/orrenal status	• Use clinical judgement to determine monitoring strategy • It is reasonable to perform AUC or trough-based monitoring. The instability of renal clearance or volume of distribution should be considered when evaluating levels and subsequent dosing

2. Dose should not exceed 100 mg/kg/day at any point in therapy.
3. Consider ID consult in patients with confirmed MRSA infection who do not improve on vancomycin. ID consult should be ordered for all patients with MRSA bacteremia.
4. Refer to the following table for recommendations on frequency of ordering vancomycin levels and serum creatinine:

Clinical Situation	Monitoring Recommendation
Subsequent levels should be drawn every 1-7 days, and serum creatinine should be monitored at least every 48 hours during entire course of vancomycin therapy. Avoid evening and overnight levels if clinically stable.	
Patients with changing fluid status or renal function	• Obtain levels every 1-3 days • Monitor 2 vancomycin levels to facilitate AUC calculation, when possible • In patients receiving one-time doses (i.e., dosing by level), monitor random levels and re-dose when level < 15 mcg/mL
Patients with stable fluid status and renalfunction requiring long-term therapy	• Obtain levels every 5-7 days, after initial level(s) are therapeutic • Once a patient is on a stable dose with an AUC between 400 and 600, monitoring of vancomycin troughs may be acceptable in patients with stable fluid status and renal function

5. Vancomycin infusion reaction, characterized by flushing, redness of the trunk, and itching, may occur during or shortly after the infusion. Management should include prolonging the infusion time to 2 hours. Could also consider diphenhydramine.

Michigan Medicine AUC Calculator:

https://www.med.umich.edu/asp/misc/UMich_PK_Calculator.xlsx

Antimicrobial Subcommittee Approval:	01/21; 04/21; 05/21; 08/22	Originated:	01/21
P&T Approval:	02/21; 04/21; 05/21; 11/22	Last Revised:	09/22

Revision History: CW Decentralized Pharmacist Committee Approval: 09/22
04/21: Adjusted NICU dosing, added low muscle mass dosing
05/21: Adjusted NICU, CF, and general population dosing.
09/22: Adjusted CHC dosing, added AUC vs. trough monitoring guidance for NICU, adjusted pre-HD level for redosing, added CRRT dosing, clarified timing of peak levels, changed language regarding vancomycin infusion reaction.