Pharmacology

Vancomycin dosing and monitoring

Every vancomycin level is a story – read it before you rewrite the dose.

- Ryan Reynolds D.O.

Learning objectives

1. Understand when vancomycin is used
2. Recognize safe dosing basics
3. Monitor for toxicity and effectiveness
4. Know when to notify the provider
5. Prevent common nursing home errors

Vancomycin

Vancomycin is an antibiotic used to treat serious gram-positive infections. It provides coverage against methicillin-resistant *Staphylococcus aureus* (MRSA) and ampicillin-resistant *Enterococcus*, and it may also be used when a patient has a severe penicillin allergy.

Clinical Pearl

Oral vancomycin is used to treat *Clostridioides difficile* colitis. It is not systemically absorbed, so it remains in the gastrointestinal tract and does not treat systemic infections. This means there is no step down therapy from IV vancomycin to PO vancomycin.

Dosing

Vancomycin is carefully dosed based on a patient's weight, kidney function, drug levels (troughs), and severity of illness. This is why it can sometimes take me a little longer to respond when vancomycin is being considered – I am reviewing all of these factors and calculating the most appropriate dose. This is not a one-size-fits-all medication, and each patient requires an individualized approach.

Doses must be given on schedule to maintain therapeutic levels. Delays can lead to subtherapeutic levels and treatment failure. For missed or delayed doses, do not double up without clarification and notify provider/pharmacy for timing adjustments.

Trough

A vancomycin trough is the blood level drawn right before the next dose. If the trough is too low for the type of infection, the drug concentration is inadequate and may not effectively treat the infection. If the trough is too high, the concentration is excessive and increases the risk of toxicity, particularly kidney injury.

Think of it like a fuel tank. The trough is the moment right before you refill the tank – the lowest point. If the tank is almost empty (low trough), you don't have enough to get where you need to go. If the tank is overfilled (high trough), you risk overflow and damage. We are trying to keep the level just right at its lowest point, not too empty and not too full.

Clinical Pearl

In general, goal troughs are 10-15 for non-severe infections and 15-20 for severe infections.

Non-severe infections may be skin and soft tissue infections, urinary tract infections, or stable patients without signs of systemic illness. Severe infections may be any patient with sepsis or hemodynamic instability, bacteremia, pneumonia, meningitis, osteomyelitis, endocarditis.

Timing is critical. A vancomycin trough must be drawn within 30 minutes before the next scheduled dose. If it is drawn too early, after the dose, or at any other incorrect time, it is not a true trough – it is a random level.

An incorrectly timed trough leads to inaccurate interpretation and inappropriate dosing decisions. A mistimed trough is worse than no trough.

Monitoring

The biggest risk with vancomycin is acute kidney injury. We need to monitor for rising BUN and creatinine, decreased urine output, and confusion.

Other risks include ototoxicity and Red Man Syndrome.

Clinical Pearl

Red Man Syndrome is an **infusion-related reaction** to IV vancomycin, not a true allergy. It occurs when the medication is infused too quickly, leading to histamine release.

Patient's may develop flushing, itching, rash, hypotension, and chest or back discomfort.

If Red Man Syndrome is suspected, stop the infusion immediately. Notify the physician. You can expect the physician to give new orders to give at a slower infusion rate with or without premedication with antihistamines.

Ongoing monitoring of kidney function and clinical status is essential while patients are receiving vancomycin.

Common Errors

Commons errors we see in the facility space include:

- Giving vancomycin without baseline labs
- Missing the trough timing
- Not recognizing acute kidney injury early
- Continuing outdated hospital orders
- Poor communication with the pharmacy and physician

> Clinical Pearl
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> The most common error I tend to see is incorrect timing of the vancomycin trough. Timing is critical. A vancomycin trough must be drawn within 30 minutes before the next scheduled dose.

Physician Notification

The nurse should notify the provider if:

- BUN and/or creatinine is rising from starting baseline
- The trough >20 or trough <10
- Decreased urine output (sometimes the only sign of kidney dysfunction)
- Patient is worsening clinically
- Missed on mistimed trough
- IV issues or missed doses

Case 1.

An 82-year-old man with a history of chronic kidney disease is receiving vancomycin following hospitalization for pneumonia with sputum cultures positive for MRSA. A “trough” level is drawn 6 hours early and results at 22. Vital signs are stable, and he is clinically doing well.

This is not a true trough. Because it was drawn too early, the level is invalid and cannot be used to guide dosing. The actual trough could be lower or higher (often higher), but we do not know. This is a timing error. Do not adjust dosing based on this value. Repeat a true trough, drawn within 30 minutes prior to the next scheduled dose, and make dosing decisions based on that result.

Case 2.

A 60-year-old female is receiving vancomycin for cellulitis with suspected MRSA. She has no history of chronic kidney disease. A repeat BMP shows her creatinine has increased from 0.9 to 1.8.

This represents a significant acute kidney injury, with an approximate 50% decline in kidney function. This is a known risk with vancomycin and requires prompt attention. Notify the physician immediately. Vancomycin may need to be held or dose-adjusted, and further evaluation of renal function is required.

Case 3.

A 79-year-old male with MRSA cellulitis weighs 80 kg and is receiving vancomycin 1 g every 24 hours. Creatinine is 1.0 (previous creatinine was 1.1). A trough drawn correctly 30 minutes prior to the dose is 8. The patient is clinically stable.

This is a valid trough and is subtherapeutic. The patient is not receiving adequate antibiotic exposure to effectively treat the infection. Notify the physician. The physician then increases the dose to 1.5 g every 24 hours, with a plan to repeat a trough prior to the 4th dose to ensure appropriate levels.