

Accuracy of vancomycin trough levels: An experience at a large university based hospital

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Abstract

To analyze the results from the clinical monitoring of serum vancomycin levels among our patients receiving this drug, we have done a retrospective study of data from routine monitoring of serum vancomycin concentrations. The study population includes adult patients who received vancomycin for more than 3 days and had a trough vancomycin serum concentration documented. We obtained 30 vancomycin concentrations from our patients. With a mean trough concentrations was 12.3 micrograms/mL. Only 32% of the patients were on the normal ranges, 27% were above the range and 40% under the lower limit. Also we found that only in 25% of the time the initial dosage of the vancomycin was calculated correctly based on the patient's actual body weight and only in < 50% of the time the maintenance dose of vancomycin was calculated based on the creatinine clearance. This might be explained by the type of the population sampled, reflecting a selection bias by detecting levels only among patients with an increased risk for toxicity. Finally, we stress the importance of accurately documenting dose, timing, and renal function in the records of all patients subjected to serum vancomycin determinations.

INTRODUCTION

To analyze the results from the clinical monitoring of serum vancomycin levels among our patients receiving this drug, we have done a retrospective study of data from routine monitoring of serum vancomycin concentrations. The study population includes adult patients who received vancomycin for more than 3 days and had a trough vancomycin serum concentration documented. We obtained 30 vancomycin concentrations from our patients. With a mean trough concentrations was 12.3 micrograms/mL. Only 32% of the patients were on the normal ranges, 27% were above the range and 40% under the lower limit. Also we found that only in 25% of the time the initial dosage of the vancomycin was calculated correctly based on the patient's actual body weight and only in < 50% of the time the maintenance dose of vancomycin was calculated based on the creatinine clearance. This might be explained by the type of the population sampled, reflecting a selection bias by detecting levels only among patients with an increased risk for toxicity. Finally, we stress the importance of accurately documenting dose, timing, and renal function in the records of all patients subjected to serum vancomycin determinations.

RESULT AND DISCUSSION

The initial dosing interval is determined by the target vancomycin trough and the creatinine clearance (CL_{cr}) which may be estimated by using the Cockcroft equation.

- The dosing interval is adjusted to achieve and maintain a target trough level between 8 and 20 mg/L depending on the severity and location of the infection (the higher targets may be necessary for the treatment of CNS and bone infections). If necessary, the dosing interval may be as short as q6h. Continuous vancomycin infusion has been used successfully in special cases (see references below).
- If the trough is < 8 mg/L, the dosing interval is shorten by one step (e.g., from 12 hr to 8 hr or from 24 hr to 12 hr, etc)
- If the trough is >20 extend the dosing interval by one step.
- "Peak" levels are usually kept at < 45 mg/L. However, monitoring vancomycin peaks has little or no clinical value and most centers have abandoned this practice.
- Hemodialyzed pts may be dosed at 15-20 mg/kg. A

level is then taken 2-3 hrs after the next hemodialysis. Dosage will have to be individualized according to the level obtained and the severity of infection.

- The reported vancomycin level in HD patients may be falsely elevated (by 10 to 40%). A trough level of 15 - 25 mg/L may be more appropriate in these patients.
- Most patients will require dosing every other dialysis.
- Peritoneal Dialysis
 - Give 15-20 mg/kg
 - Repeat dose once every ~ 7 days.
- Oliguric / Anuric ARF Patients Who Are Not on Dialysis Yet:
- Give 15-20 mg/kg.
- Draw a random levels every 2-3 days, and re-dose if level < 10 mg/L.
 - Oliguric / Anuric ARF Patients on continuous venovenous hemofiltration (CVVC):
- Give a loading dose of 15 mg/kg followed by 10 mg/kg q24h
- Monitor trough level; should be maintained > 8 mg/L.

initial vancomycin dose, in 18/37 which is 48% the vancomycin dose never been adjusted, although the trough level is sub-therapeutic, and in 6/38 which is 15% of the cases the vanco dose was adjusted.

To provide a good patient's care, lower the average number of hospital stay and to lower the number of cases where we get a Vanco-resistance infection, we would like to be more organized and thorough regarding the vanco serum level and we would like to put some ideas as following:

VANCOMYCIN SERUM DRUG LEVELS

1. To consider initial routine serum levels for unstable patients with abnormal renal function.
2. If therapy is continued beyond 72 hours, an initial Vancomycin trough should be obtained at that time for the following patient populations:
4. Critically ill patients (e.g. concurrent organ dysfunction; suspected altered Volume of Distribution). For patients with impaired renal function, a trough may be drawn sooner than 72 hrs.
5. Patients with renal dysfunction/failure based on elevations in serum creatinine above the age-related reference range
6. Patients who have recently received or are currently receiving nephrotoxic drugs (e.g. amphotericin B, aminoglycosides, cyclosporine, ifosfamide, cyclophosphamide, Cisplatin, IV acyclovir)

In our study we have been following on 37 adult patients admitted with different infectious disease, been treated with vancomycin and the result is as following:

1. In 28/37 which is 75% of cases, the initial dose of vancomycin was 1g/12 hours, regardless the patient's weight and there creatinine clearance.
 2. The blood draw time never been documented by the nursing staff, even by checking the patient's chart and the nurse note. What we have on invision is the time when the labs received the blood sample.
 3. In 8/37 which is 21% of the patients the vancomycin trough was therapeutic based on the
2. Patients who are not clinically responding after 72 hours
 3. Patients who have persistent positive cultures.
 1. A level may be drawn sooner than 72 hours for:
 3. Patients with thermal injuries.
 4. Patients with renal dysfunction.
 5. Patients receiving 4 grams or greater of Vancomycin per day.
 1. Vancomycin troughs should be drawn within 1 hour prior to dose.
 2. Vancomycin peak concentrations are rarely drawn due to

poor correlation between peak levels and toxicity or efficacy, but if a peak level is necessary, it should be obtained 1 hour after the end of the infusion. For most infections, a peak level of 30-40 mcg/mL is adequate. For some severe infections (e.g. meningitis, osteomyelitis), peak levels up to 50-60 mcg/mL may be required per Infectious Disease recommendations.

3. Vancomycin troughs should be checked or rechecked as necessary based on the following:
5. Patients with renal dysfunction or a significant increase in Serum Creatinine
6. Patients who are not clinically responding to treatment
7. Patients with persistent positive cultures
8. Patients recently initiated on therapy with a concurrent nephrotoxic agent
9. After 10 - 14 days of therapy

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