

Vancomycin Continuous Infusion for patients on Intensive Care Unit (ICU)

No conflict of interest.

Authors

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Background

- Vancomycin is a glycopeptide antibiotic used as first line treatment option for Gram-positive infections such as those caused by staphylococcal and streptococcal species, including Methicillin-Resistant Staphylococcus Aureus (MRSA).¹
- Currently intermittent infusions are used on Critical Care Unit where Vancomycin is administered as an initial Loading Dose of 25mg/kg. Intermittent dosing is 15mg/kg twice daily with dose adjustments for reduced renal function.²
- Monitoring requires a trough level to be taken when Vancomycin is at steady state, estimated around 4th or 5th dose in patients with normal renal function, and the target level is 15-20mg/L.²
- Vancomycin is a non-concentration dependent antibiotic, meaning it does not require high peak concentrations for efficacy, it is the AUC₂₄ to MIC ratio that best correlates to clinical outcomes. Studies have shown AUCs to be similar for continuous and intermittent Vancomycin infusions but that target levels would be reached earlier and more often with continuous infusions of Vancomycin.¹
- Vancomycin continuous infusions have additional benefits including reduced risk of nephrotoxicity, ease of monitoring as the level can be checked at any time once the infusion is at steady state.³

Aim

- To develop a proposal for the introduction of Vancomycin Continuous Infusion for use on the ICU with a view to full implementation throughout the unit in consultation with Anaesthetic and Microbiology Departments.

Methods

- To develop a Vancomycin continuous infusion dosing schedule for patients admitted to ICU; through a review of the literature available and with reference to Vancomycin continuous infusion protocols already established on ICU's in other hospitals.
- A standardised prescription for administration of Vancomycin continuous infusion needs to be incorporated on the electronic clinical information system currently in use on ICU. An IV Drug Monograph will be included in the 'Critical Care Intravenous Medication Infusion Guidelines'.
- Vancomycin serum level is taken at 6am with regular bloods, and sent to the laboratory each day or more regularly if required.
- To recommend Vancomycin continuous infusion in patients with a dedicated IV line in agreement with Anaesthetic and Microbiology Consultants at the daily antimicrobial ward review.

Results

- Vancomycin continuous infusion represents a significant advantage over the current method of intermittent infusion as per studies reviewed, the benefits include;
 - quicker time to achieve therapeutic levels
 - reduced risk of nephrotoxicity, although the clinical outcome for the patient is not any better for Vancomycin continuous infusions than intermittent infusion.
- A Proposal for Vancomycin continuous infusion has been developed to guide dosing and therapeutic drug monitoring in patients with normal renal function, in patients with renal impairment and in patients on continuous renal replacement therapy.
- Therapeutic drug monitoring of Vancomycin levels is simplified with a blood sample sent at 6am each morning when regular bloods are usually taken by nursing staff.
- A standard concentration of Vancomycin for continuous infusion has been set up on the electronic clinical information system to facilitate prescribing.
- The aim would be to proceed to the implementation of Vancomycin continuous infusions for all patients admitted to ICU including and to include regular audit.

Conclusion

- Vancomycin continuous infusion would be of benefit to patients and staff on ICU. It would mean less risk of toxicity for patients and reduced monitoring of Vancomycin levels.
- It may also be cost-saving if lower doses are given and there is reduced processing of Vancomycin levels.

References

- Wainio et al. The pharmacokinetics/pharmacodynamic rationale for administering vancomycin via continuous infusion. Journal of Clinical Pharmacy and Therapeutics, 2015,40,259-265.
- Microguide App. Adult Antimicrobial Guide, University Hospital Limerick Group.
- Cristallini et al. New Regimen for Continuous Infusion of Vancomycin in Critically Ill Patient. Antimicrobial agents and Chemotherapy, August 2016; Vol60; No8; 4750-4756.

Prescription view on the Clinical Information System

Proposal for Vancomycin Continuous Infusion Administration (Excerpt)

LOADING DOSE			
Vancomycin 20-25mg/kg use actual body weight			
<ul style="list-style-type: none"> Never give > 2g per dose A loading dose can be administered to patients with impaired renal function Consider 20mg/kg in patients with renal impairment or CRRT 			
MAINTENANCE INFUSION			
<ul style="list-style-type: none"> Start the continuous Vancomycin infusion immediately after the loading dose The dose depends on the patient's renal function GFR (Glomerular Filtration Rate ml/min) calculated using the Cockcroft & Gault equation. 			
Infusions of Vancomycin 1g in 100ml for central or 1g in 250ml for peripheral administration in Sodium Chloride 0.9% or Glucose 5% are prepared and the rate is according to the TDD (Total Daily Dose) in 24hours.			
NORMAL RENAL FUNCTION			
Renal Function as per GFR	Weight kg	Daily Dose in 24hours	Infusion Rate ml/hr
>60ml/min	60-70	Within range of 25-30mg/kg/24hours	Central 10mg/ml Peripheral 4mg/ml
		1500mg (25mg/kg)	6ml/hr 16ml/hr
		2000mg (28mg/kg)	8ml/hr 21ml/hr
		2000mg (25mg/kg)	8ml/hr 21ml/hr
		2500mg (27mg/kg)	10ml/hr 26ml/hr
100	2500mg (25mg/kg)	10ml/hr 26ml/hr	
DOSE ADJUSTMENT			
<ul style="list-style-type: none"> Send a Vancomycin Level at 6am each day (with the morning routine bloods) or as advised. For dose adjustment use the following guideline after 24hours of treatment. 			
Vancomycin Serum Level mg/L	Suggested Dose Change		
<15mg/L	Reload 500mg and increase continuous infusion by 500mg		
15-20mg/L	Increase continuous infusion by 500mg/24hours		
20-25mg/L	No Change - Target Level achieved		
25-30mg/L	Decrease continuous infusion by 500mg/24hours		
>30mg/L	Stop infusion and check levels every 6hours once level is found to be <30 resume infusion at a lower rate.		
CONTINUOUS RENAL REPLACEMENT THERAPY (CRRT)			
<ul style="list-style-type: none"> Start the continuous Vancomycin infusion immediately after the loading dose. 			
CVVH (ml/kg/hr)	Daily Dose mg	Infusion Rate Central	ml/hr Peripheral
10-15	1000	4ml/hr	10ml/hr
15-20	1250	5ml/hr	13ml/hr
20-25	1500	6ml/hr	16ml/hr
25-30	1750	7ml/hr	18ml/hr
>30	2000	8ml/hr	21ml/hr