Intravenous Vancomycin use in Adults (Continuous Infusion)

Background

This policy covers the use of intravenous vancomycin prescribed as a **continuous Infusion**. The evidence for this guidance is detailed below.

Continuous infusion of vancomycin is for treatment only and is preferred, when practical, for patients with severe or deep-seated infections (e.g. pneumonia, endocarditis, bone and joint infections).

Vancomycin can also be administered as an intermittent (pulsed) infusion – refer to **separate guidance**.

This policy does not apply to the use of vancomycin in patients treated in Renal Units or receiving haemodialysis or haemofiltration.

An Antimicrobial app and/or an online calculator is available in all boards and should be used to calculate the initial dose requirements.

Contra-indications and cautions

- Contra-indications to vancomycin therapy – hypersensitivity.
- Cautions for vancomycin therapy:
  - To avoid the risk of "red-neck/red-man syndrome", pain or muscle spasm, ensure that the administration rate is not faster than 500 mg per hour.
  - Concurrent administration of neurotoxic and / or nephrotoxic agents increases the risk of vancomycin toxicity. Review therapy and consider amending or withholding nephrotoxic drugs during treatment with vancomycin. Where possible, avoid co-administration with the following:
    - amphotericin
    - potent diuretics
    - aminoglycosides
    - NSAIDs, and
    - ACE inhibitors.
  - The above list is not exhaustive – consult the Summary of Product Characteristics eSPC for a full list https://www.medicines.org.uk/emc/search?q=%22Vancomycin%22
  - Patients with previous hearing loss due to potential ototoxicity.

Reference:

A H Thomson et al, Development and evaluation of vancomycin dosage guidelines designed to achieve new target concentrations, J Antimicrob Chemother (2009) 63 (5): 1050-1057.

Prescribing and documentation

STEP 1: Prescribe the loading dose and maintenance continuous infusion

- To reduce the risk of mortality, commence vancomycin administration within 1 hour of recognition of sepsis.
- *If creatinine is known* – use the online calculator or app (preferred method). The guidelines (below) in Table 1 (loading dose) and Table 2 (maintenance continuous infusion dose) can be used if the online calculator is not available. The dose amount and dosage interval are based on estimated creatinine clearance (Box 1) and **actual** body weight.
- *If creatinine is not known* – calculate and prescribe a loading dose based on actual body weight (Table 1). Calculate the maintenance continuous infusion dose once the creatinine is available.

Box 1: Estimation of creatinine clearance (CrCl)

The following 'Cockcroft Gault' equation can be used to estimate creatinine clearance (CrCl)

$$\text{CrCl (mL/min)} = \frac{[140 - \text{age (years)}] \times \text{weight (kg)} \times 1.23 \text{ (male) OR } \times 1.04 \text{ (female)}}{\text{serum creatinine (micromol/L)}}$$

Cautions

- Use actual body weight or maximum body weight whichever is lower.
  For maximum body weight table see https://www.sapg.scot/media/4471/maximum-body-weight-table.pdf
- In patients with low creatinine (< 60 micromol/L), use 60 micromol/L.
- Note: Use of estimated glomerular filtration rate (eGFR) is not recommended

Loading dose

Table 1: Initial vancomycin LOADING dose

Actual body weight	Dose	Volume of sodium chloride (0.9%) *	Duration of infusion
< 40 kg	750 mg	250 mL	90 minutes
40 – 59 kg	1000 mg	250 mL	2 hours
60 – 90 kg	1500 mg	500 mL	3 hours
> 90 kg	2000 mg	500 mL	4 hours

* Glucose 5% may be used in patients with sodium restriction.

Volumes used are for peripheral administration. More concentrated solutions (10mg/ml) must be given via a central line.

Maintenance Continuous Infusion

- Start the continuous infusion **immediately** after the loading infusion is complete.

Table 2: Vancomycin MAINTENANCE continuous infusion dose

Vancomycin continuous infusion – initial MAINTENANCE dosage guidelines		
CrCl (mL/minute)	**Daily dose**	**Dose for continuous infusion over 12 hours**
< 20	Use pulsed infusion or follow Renal Unit guidelines	
20 – 29	500 mg	250 mg
30 – 39	750 mg	375 mg
40 – 54	1000 mg	500 mg
55 - 74	1500 mg	750 mg
75 - 89	2000 mg	1000 mg
90 - 110	2500 mg	1250 mg
>110	3000 mg	1500 mg

- For peripheral infusion dilute doses up to 1250 mg in 250 ml sodium chloride (0.9%) and doses above 1250 mg and up to 2000 mg in 500 mL sodium chloride (0.9%). More concentrated solutions (10mg/ml) must be given via a central line.
- Glucose 5% may be used in patients with sodium restriction.

Note that patients who have unusual clinical characteristics, such as weight < 40 kg, weight >120 kg, age >90 years may require dose adjustments and require close monitoring. Contact pharmacy for advice.

STEP 2: Monitor the vancomycin concentration and reassess the continuous infusion dose

Concentrations are meaningless unless the dose & sample times are recorded

- Due to wide variability in the handling of vancomycin, early analysis of a vancomycin concentration is required to ensure that the dosage regimen is appropriate.
- Take a sample after 12 – 24 hours of starting the continuous infusion then every 1 - 2 days, or daily if the patient has unstable renal function.
- Monitor creatinine daily.
- Record the time of the blood sample on the request form and the sample tube.

Target vancomycin concentrations

- **Target steady state concentration range: 15 – 25 mg/L**.
- If the patient is **seriously ill (severe or deep-seated infections), the target range is 20 – 25 mg/L.**
- If the measured concentration is < 20 mg/L, consider increasing the dose amount.
- If the patient is failing to respond, seek advice from microbiology or an infection specialist.

Adjustment of vancomycin doses - continuous infusion

- Always check that the dosage history and sampling time are appropriate before interpreting the result.
- Seek advice from pharmacy or microbiology if you need help to interpret the result.

If the measured concentration is unexpectedly HIGH or LOW, consider the following:

- Were the dose and sample times recorded accurately?
- Was the correct dose administered?
- Was the sample taken from the line used to administer the drug?
- Has renal function declined or improved?
- Does the patient have oedema or ascites?

Table 3: Adjustment of Vancomycin Doses – continuous infusion

Vancomycin concentration	Suggested dose change
<15 mg/L	Increase the 12 hourly dose by 250 mg
15 - 25 mg/L	If the patient is responding, maintain the present dosage regimen. If the patient is seriously ill, consider increasing the dose amount to achieve a steady state concentration of 20 – 25 mg/L.
26 - 30 mg/L	Decrease the 12 hourly dose by 250 mg
>30 mg/L	Stop until < 25 mg/L then restart at a lower dose

If in doubt, take another sample before modifying the dosage regimen and / or contact pharmacy for advice

General points

- Document any action taken in the medical notes.
- Undertake pre-prescribing checks (Box 2) to assess the risk of toxicity.
- Review the need for vancomycin daily.
- If a patient requires to be switched from continuous to pulsed infusions contact pharmacy for advice.

Box 2: Toxicity

- Monitor creatinine daily. Seek advice if renal function is unstable (change in creatinine level)
- Signs of renal toxicity include increase in creatinine or decrease in urine output / oliguria
- Consider an alternative agent if creatinine is rising or the patient becomes oliguric.
- Vancomycin may increase the risk of aminoglycoside induced ototoxicity