Intravenous Vancomycin Use in Adults Intermittent (Pulsed) Infusion

Background

This policy, which was written by the Scottish Antimicrobial Prescribing Group (SAPG) based upon NHS Greater Glasgow and Clyde guidance and adapted for use within Ayrshire and Arran, covers the use of intravenous vancomycin prescribed as an **intermittent (pulsed) infusion**. This can be used for treatment or prophylaxis.

Vancomycin can also be prescribed as a continuous infusion. Continuous infusion of vancomycin is preferred, when practical, for patients with severe or deep-seated infections (e.g. pneumonia, endocarditis, bone and joint infections) – 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.

Contra-indications and cautions

- Contra-indications to vancomycin therapy – hypersensitivity
- Cautions for vancomycin therapy:
    - To avoid the risk of vancomycin infusion reactions, 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
        - ACE inhibitors
    - The above list is not exhaustive – consult the Summary of Product Characteristics eSPC for a full list (www.medicines.org.uk)
    - Patients with previous hearing loss due to potential ototoxicity.

Prescribing and documentation

- The NHS Ayrshire and Arran intermittent (pulsed) vancomycin prescribing, administration and monitoring chart must be used when vancomycin is prescribed as per this guideline.
- The chart should be used for prescribing doses of vancomycin in conjunction with the existing inpatient prescribing chart (e.g. Kardex or electronic prescribing) and medical/nursing documentation. These charts contain a stepwise approach to safe and effective prescribing and key points of advice on monitoring, interpreting and re-prescribing.
- An antimicrobial app and/or an online calculator is available and should be used to calculate the initial dose requirements.

STEP 1: Prescribe the loading dose and maintenance dosage regimen

- To reduce the risk of mortality, commence vancomycin administration within 1 hour of recognising sepsis.
- *If creatinine is known* – use the online calculator available on the Antimicrobial site on AthenA/ Antimicrobial Companion app (preferred method). The guidelines (below) in Table 1 (loading dose) and Table 2 (maintenance dose) can be used if the online calculator or Antimicrobial Companion app 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 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 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	1.5 hours
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.

N.B. the loading dose is based on weight only so does not take account of renal function. When using the online calculator/or app, on rare occasions a patient's clearance of vancomycin may be so high that the maintenance dose is higher than the loading dose. In these circumstances, the loading dose should be the higher of the loading and maintenance doses i.e. if loading dose is calculated as lower than maintenance dose then give the maintenance as a loading dose instead.

MAINTENANCE DOSAGE REGIMEN

- Give the first maintenance infusion 12, 24 or 48 hours after the loading infusion according to dose interval provided by the online calculator/or app or Table 2 (below).

Table 2: Vancomycin MAINTENANCE dosage regimen

VANCOMYCIN PULSED INFUSION - INITIAL MAINTENANCE DOSAGE GUIDELINES			
CrCl (mL/min)	**Dose amount**	**Volume of sodium chloride (0.9%)***	**Dose Interval**
< 20	500 mg over 1 hour	250 mL	48 hours
20 - 29	500 mg over 1 hour	250 mL	24 hours
30 - 39	750 mg over 1.5 hours	250 mL	24 hours
40 - 54	500 mg over 1 hour	250 mL	12 hours
55 - 74	750 mg over 1.5 hours	250 mL	12 hours
75 - 89	1000 mg over 2 hours	250 mL	12 hours
90 - 110	1250 mg over 2.5 hours	250 mL	12 hours
>110	1500 mg over 3 hours	500 mL	12 hours

* Glucose 5% may be used in patients with sodium restriction. Doses up to 2000 mg can be diluted in 500 mL fluid. More concentrated solutions (10mg/ml) must be given via a central line.

The daily dose can be split into 3 equal doses and given 8 hourly. This approach is especially useful for patients who require high doses as it produces higher trough concentrations.
- For example, 1500 mg 12 hourly (3000 mg per day) could be prescribed as 1000 mg 8 hourly and 750 mg 12 hourly (1500 mg per day) as 500 mg 8 hourly.

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

STEP 2: Monitor the vancomycin concentration and reassess the dosage regimen

Concentrations are meaningless unless the dose & sample times are recorded accurately

- 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 trough sample (pre-dose) within 24 - 48 hours of starting maintenance therapy then every 2 - 3 days, or daily if the patient has unstable renal function.
- Monitor creatinine daily.
- Record the exact time of all vancomycin samples on the sample request form.
- If renal function is stable, give the next dose before the trough result is available. If renal function is deteriorating, withhold until the result is available then follow the advice in Table 3.

Target vancomycin concentrations

- **Target trough concentration range: 10 – 20 mg/L**
- If the patient is **seriously ill (severe or deep-seated infections), the target range is 15 – 20 mg/L.** If the measured concentration is < 15 mg/L, consider increasing the dose amount or reducing the dosage interval (see 8 hourly dosing above).
- If the patient is failing to respond, seek advice from microbiology or an infection specialist.

Adjustment of the vancomycin dosage regimen

- 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.

Table 3: Adjustment of Vancomycin Dosage Regimen

Vancomycin concentration	Suggested dose change
<10 mg/L	Increase the dose by 50% and consider reducing the dosage interval or seek advice
10 – 15 mg/L	If the patient is responding, maintain the present dosage regimen. If the patient is seriously ill, consider increasing the dose amount or reducing the dosage interval to achieve a trough level of 15 – 20 mg/L.
15 – 20 mg/L	Maintain the present dosage regimen
>20 mg/L	Stop until <20 mg/L then seek advice

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

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?
- Was the sample taken during drug administration?
- Has renal function declined or improved?
- Does the patient have oedema or ascites?

General points

- Record the exact time of all vancomycin samples on the prescribing chart and sample request form.
- Undertake pre-prescribing checks (Box 2) to assess the risk of toxicity.
- Reassess the dose and continue or prescribe a dosage change.
- Document the action taken in the medical notes.
- Review the need for vancomycin daily.

Box 2: Toxicity

- Monitor creatinine daily. Seek advice if renal function is unstable (e.g. a change in creatinine).
- 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 – use caution if co-prescribing.

Management of delays in vancomycin dose administration

This guidance has been developed by pharmacists in NHS Greater Glasgow and Clyde and applies to situations where a patient has stable renal function and a dose of vancomycin has been delayed unintentionally (for example due to loss of intravenous access).

This guidance below does not apply where the dose has been deliberately withheld (for example due to a high vancomycin trough level or deteriorating renal function). Contact pharmacy for advice in these cases. If you are unsure how to determine if the patient has deteriorating renal function, contact medical or pharmacy staff.

Refer to the Table 4 below if dose unintentionally delayed by ≤ 50% of the dosing interval.

Table 4: Vancomycin dose – unintended delay of ≤ 50% of dosing interval

Dose interval	Dose delay	Action
12 hourly	≤ 6 hours	▪ Give the delayed dose immediately ▪ Record the date and exact time of administration ▪ Give the next dose at the originally prescribed time
24 hourly	≤ 12 hours	
48 hourly	≤ 24 hours	

e.g. If vancomycin doses are prescribed at 10am and 10pm regularly and 10am dose has been delayed due to loss of IV access by 4 hours, i.e. dose delay ≤ 6 hours, give dose immediately once access has been restored (in this example - 2pm) and continue with next dose at originally prescribed time (in this example - 10pm).

For doses unintentionally delayed >50% of the dosing interval contact pharmacy for advice.

Bibliography

Scottish Antimicrobial Prescribing Group Intravenous Vancomycin use in Adults Intermittent (Pulsed) infusion, June 2019. Accessed July 2021