AMH – Neonatal Unit	Vancomycin Continuous Infusion – Neonatal Parenteral Drug Monograph			
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Actions and uses:
Glycopeptide antibiotic which is active against many gram positive bacteria, notably staphylococci.[1]

Indication(s):
Treatment of late onset infections in the neonatal unit.[1,2]
Treatment of infections where sensitivities indicate.

Formulation:
Vials containing 500mg for reconstitution.[1]

Licensed Status:
Licensed.

Loading dose: 15mg/kg over 1 hour via intravenous infusion[3,4,5]
(Round dose DOWN to nearest whole number)

- Take serum creatinine level (micromol/L) before commencing vancomycin, or a level should be available within the last 12 hours. The loading dose should be given while awaiting the serum creatinine level result. **Do not delay administering loading dose if serum creatinine cannot be taken for any reason but take the sample ASAP**.
- Loading dose is **not** required if the patient is receiving intermittent vancomycin. This may be applicable to patients transferred from other centres who do not use continuous vancomycin.
- See page 3 on restarting vancomycin in patients who have been on a vancomycin continuous infusion within the last 36 hours.

Maintenance Continuous Intravenous Infusion[3,4,5]

- Maintenance continuous infusion can only start once there is recorded serum creatinine level, this level must have been taken before commencing loading dose or a result available within the last 12 hours.

Serum creatinine (micromol/L)	**Corrected gestational age (CGA)**	**Dose**
<40	**≥40 weeks**	**50mg/kg/day**
<40	**<40 weeks**	**40mg/kg/day**
40 – 60	**All**	**30mg/kg/day**
>60	**All**	**20mg/kg/day**

Extremely low birth weight (ELBW) infants with increasing creatinine OR SEVERE RENAL IMPAIRMENT IN ANY PATIENT requiring a dose reduction below 20mg/kg/day - consider alternative antibiotic therapy (following discussion with microbiology) or changing to one off 10mg/kg dosing with ongoing monitoring at 12 hourly intervals and subsequent doses only given when vancomycin trough falls below 20mg/L. This should be discussed with the clinical pharmacist and a senior clinician**.**[3]

See the British National Formulary for Children (BNFC) [7] and consult Royal Aberdeen Children's Hospital (RACH) Vancomycin – Paediatric Drug Monograph[8] for **dosing for a baby who is Term+4 weeks corrected gestational age**. This is available via the intranet by following:
Hospital Portal > Antimicrobial Guidelines > Hospital / Acute Care > Paediatrics > Gentamicin and vancomycin.

Prescription Requirements:
Continuous infusions must be prescribed on the Prescription and Administration Record (PAR) and the Paediatric Fluid Prescription and Recording Sheet.
Any changes in rate of administration **must be documented on Badgernet by the prescriber**. A written/electronic record of prescriber instructions for rate changes must be maintained at all times.

Reconstitution:[9]
- Using water for injection, make up the vial as per Medusa 'brand specific' displacement chart to give a 50mg in 1ml solution.
- **Further dilute** to a 5mg/ml solution with sodium chloride 0.9% or glucose 5% before administration and give by IV infusion over at least 60 minutes via syringe pump. **For IV infusion only.**
- Make up new a vial and syringe for the maintenance infusion, following the same reconstitution and dilution process as above.
- In fluid restricted patients a maximum concentration of 10mg/ml may be given over at least 60 minutes via **CENTRAL LINE ONLY.** The risk of infusion-related undesirable effects can be increased with higher concentrations.[4,7,9]

Administration:[3,4,5]
Loading dose: IV infusion over 60 minutes.
Maintenance infusion: Continuous IV infusion. **Change solution every 24 hours.**

Special circumstances:
- For babies weighing less than 500g a final concentration of 2.5mg/ml should be used (to prevent infusion rates of less than 0.1ml/hr). This concentration **only** applies to maintenance infusions.

Suitable diluents:[1,3,4,7,9]
Glucose 5%, Sodium Chloride 0.9%.

Side Effects/Cautions/Contraindications:[1,4,5,7,8,9]
(See Summary of Product Characteristics (SPC) for full list of cautions, contra-indications, side-effects and drug interactions)
- Ototoxicity and nephrotoxicity particularly in combination with other nephrotoxic or ototoxic agents. Monitor renal and auditory function.
- Hypersensitivity reactions i.e. chills, fever, hypotension and a characteristic rash known as 'Red Man Syndrome' or 'Vancomycin Infusion Reaction' are usually caused by too rapid an infusion. If this occurs during the loading dose, increase infusion time. If this occurs during the continuous infusion, the infusion should be stopped. A new syringe should be prepared if the decision is made to restart the infusion.
- Vancomycin has a low pH and may cause venous irritation and tissue damage in cases of extravasation. Dilute infusion correctly as very irritant. Monitor cannula site carefully if administering peripherally.

Therapeutic Drug Monitoring:

Target range 15-25mg/L[3,5,6]
- Take a level between 20-24 hours of starting maintenance infusion, or after a dose change.
- Take sample from a different access point to where vancomycin is being infused.
- A serum creatinine level should be taken alongside vancomycin level.
- Creatinine levels should be checked daily.
- CRP levels are not required daily and should be taken as clinically needed.

Vancomycin concentration	Suggested dose alteration	
< 10 mg/L	Increase daily dose by 50%	Round new dose down to the nearest whole number
10 to <15 mg/L	Increase daily dose by 25%	
15 to 25 mg/L	No change	
>25 to 30 mg/L	Decrease the daily dose by 25%	
>30 mg/L	Stop the infusion for 4-6 hours and then re-check level. Restart the infusion at the next lower dose once level is <25mg/L	

Repeat steady state level more frequently if any of the following apply:[4]

- 10% change in body weight.
- 25% change in serum creatinine.
- Age-related dose adjustment e.g. baby now over 40 weeks CGA.
- Interruption in IV infusion e.g. lost IV access.
- Infant receives treatment with a nephrotoxic drug e.g. Ibuprofen for Patent Ductus Arteriosus (PDA) treatment.

SEEK ADVICE FROM CONSULTANT AND/OR PHARMACY WHEN NECESSARY

Dose Adjustment:

- Discuss with neonatal consultant and/or Pharmacist if daily vancomycin dose is to exceed 100mg/kg/day.[4]
- Severe renal impairment: as in dosing section.

Restarting vancomycin in patients who have been on a vancomycin continuous infusion within the last 36 hours[3]

Serum creatinine	Time since stopping infusion	Recommendation
<40 micromol/L	< 6 hours	Restart the infusion at the previous maintenance dose
	6 to 18 hours	Give half the loading dose then restart the infusion at previous maintenance dose
	>18 hours	Give the full loading dose then restart the infusion at previous maintenance dose
40 – 59 micromol/L	< 12 hours	Restart the infusion at the previous maintenance dose
	12 to 24 hours	Give half the loading dose then restart the infusion at previous maintenance dose
	>24 hours	Give the full loading dose then restart the infusion at previous maintenance dose
>60 micromol/L	< 24 hours	Restart the infusion at previous maintenance dose. If creatinine has recently increased, check a vancomycin level before restarting the vancomycin infusion.
	24 to 36 hours	Give half the loading dose then restart the infusion at previous maintenance dose
	>36 hours	Give the full loading dose then restart the infusion at previous maintenance dose

Compatibility with other medicines:[3,9]

Fluids: Glucose 5%, Glucose 10%, Lipid, Sodium Chloride 0.9%, Sodium Chloride 0.9% with Glucose 5%, Total Parenteral Nutrition (TPN).

Medicines: Aciclovir, amiodarone, atracurium, caffeine citrate, calcium gluconate, caspofungin, doxapram, fentanyl, fluconazole, Insulin (soluble), magnesium sulfate (in glucose 5%), meropenem, midazolam, milrinone, morphine sulfate (in glucose 5%), paracetamol.

Incompatibility with other medicines:[3,9]

Medicines: albumin, amphotericin, cephalosporin antibiotics (e.g. cefotaxime), chloramphenicol, dexamethasone sodium phosphate, furosemide, heparin, omeprazole, pantoprazole, penicillin antibiotics; phenobarbital, phenytoin, piperacillin/tazobactam, rocuronium, sodium bicarbonate.

- Vancomycin is usually incompatible with alkaline solutions.
- Always flush intravenous lines well between administration of vancomycin and beta-lactam antibiotics.
- Vancomycin has a low pH and may cause chemical or physical instability when mixed with other compounds.

NOTE: These compatibility/incompatibility lists are not exhaustive. Please contact your ward pharmacist for further information on compatibility with any medicines not included, or consult other reference sources as appropriate.

Storage Instructions:

Vials: Store below 25°C, keep vial in original carton to protect from light.[1]

Once reconstituted: Stable for up to 24 hours at 25°C when reconstituted as directed.[1]

Further Information:

There is no need to stop the infusion for theatre.[3]

References:

1. Summary of Product Characteristics (SPC) for Vancomycin 500mg powder for concentrate for solution for infusion vials – Bowmed Ibisqus Limited. Last revised 01/08/2022, accessed 22/07/24.
2. NHS Grampian staff empirical therapy guidance for common infections in children in the acute sector – NHS Grampian. Last revised 30/03/21, accessed 22/07/24.
3. West of Scotland NEONATAL Parenteral Drug Monographs 'Vancomycin Continuous Infusion' – West of Scotland Neonatal group. Version 8 - Last revised 30/04/24, accessed 22/07/24.
4. Australasian Neonatal Medicines Formulary 'Vancomycin – continuous infusion regimen' - Australasian Neonatal Medicines Formulary Consensus Group. Version 1.3 - Last revised 16/11/24, accessed 22/07/24.
5. The Royal Children's Hospital Melbourne 'Vancomycin' monograph - The Royal Children's Hospital Melbourne. Last revised 30,11,2019, accessed 22/07/24.
6. Ainsworth, Sean, 2020. *Neonatal Formulary: Drug Use in Pregnancy and the First Year of Life*, 8th edn. Oxford: pp 813-817.
7. British National Formulary for Children online 'Vancomycin'- Pharmaceutical Press. Last revised 19/04/22, accessed 22/07/24.
8. Royal Aberdeen Children's Hospital 'Vancomycin – Paediatric Drug Monograph' – NHS Grampian. Last revised 31/10/2020, accessed 22/7/24.
9. Medusa NHS Injectable Medicines Guide 'Vancomycin Intravenous – CHILD monograph'- Injectable medicines guide multidisciplinary advisory group. Version 10- last revised 02/11/23, accessed 22/7/24.

Administer reconstituted solutions immediately.

All vials, ampoules and infusion bags are for single use only unless otherwise stated.

Dose may vary depending on indication, age, renal function, hepatic function and concomitant medications.
The compatibility information is not exhaustive – please contact medical staff/pharmacy for further information on compatibility with any medicines not included.
If extravasation occurs, contact senior medical staff immediately and follow the local extravasation in neonates guideline.
Consult the Medusa Injectable Medicines Guide for specific management for individual drugs.
This monograph is intended as a quick reference guide to aid the safe prescription and administration of medicines to neonates within the Neonatal Unit at AMH. It can be used for neonates within other settings across NHS Grampian as appropriate. Please use this monograph in conjunction with the package insert and the BNF for Children.