Drug Guideline Title:  
**Vancomycin**

**Summary:**  This guideline outlines the use of IV vancomycin. (For oral vancomycin in Clostridium difficile infection refer to therapeutic guidelines).

**Approved by:**  ICU Medical Director  
**Publication (Issue) Date:**  January 2015  
**Next Review Date:**  January 2018  
**Replaces Existing Drug Guideline:**  vancomycin  
**Previous Review Dates:**  2003, 2004

1. **Introduction contains:**  
   The risk addressed by this policy:
   
   **Patient Safety**

   **The Aims / Expected Outcome of this policy:**  
   
   Vancomycin will be administered safely and without adverse side effects

**Related Standards or Legislation**

- NSQHS Standard 1 Governance  
- National Standard 4 Medication Safety

**Related Policies**

- LH_PD2013_C03.01 [Drug Administration](#)  
- LH_PD2010_C03.00 [Drug Prescribing](#)  
- LH_PD2008_C03.12 [Administration of IV Medication](#)

2. **Policy Statement:**  
   - All care provided within Liverpool Hospital will be in accordance with infection control, manual handling and minimisation and management of aggression guidelines.  
   - Medications are to be prescribed and signed by a medical officer/authorised nurse practitioner (NP) unless required during an emergency.  
   - All drugs administered during an emergency (under the direction of a medical officer/authorised nurse practitioner) are to be documented during the event, then prescribed and signed following the event.  
   - Medications are to be given at the time prescribed (as close to the time as is possible when multiple drugs require ‘same time’ administration and, when the nurse is caring for more than one patient, recognition is given to a possible short delay to administration – antibiotics and other lifesaving drugs are to be prioritised) and are to be signed by the administering nurse.
Liverpool Hospital ICU Guideline: Pharmacology Intensive Care Unit

Vancomycin

- Parenteral medication prescriptions and the drug are to be checked with a second registered or endorsed enrolled nurse prior to administration. The “rights of drug administration” must be followed: right: patient, drug, dose, route, administration, time, reason for the drug, documentation, education and evaluation/outcome.
- Adverse drug reactions are to be documented and reported to a medical officer.
- Medication errors are to be reported using the hospital electronic reporting system: IIMS.
- Guidelines are for adult patients unless otherwise stated.

3. Principles / Guidelines

Actions
- Vancomycin is an antibacterial glycopeptide.
- It interferes with cell membrane synthesis in multiplying organisms.

Indications
- For the treatment of infections caused by sensitive gram-positive organisms.
- It is indicated for treatment of potentially life threatening infection, such as:
  - MRSA bacteremia
  - Endocarditis due to streptococcus viridans, streptococcus bovis and enterococci
  - Early onset prosthetic valve endocarditis due to staphylococcus epidermidis
  - Staphylococcal osteomyelitis, pneumonia, septicaemia
- It should be reserved for infections that are resistant to other first line anti-infective agents.

Contraindications
- Do not give intramuscularly.
- Hypersensitivity.
- Avoid in patients with severe hearing loss.

Precautions
- It should be administered in a dilute solution at a rate not exceeding 1g/hour to avoid rapid infusion related reactions, e.g. hypotension, flushing, erythema, urticaria and pruritus (‘red man syndrome’)
- Dilute reconstituted solution further before use to avoid pain and thrombophlebitis.
- Avoid extravasation.
- Avoid bolus or rapid administration as systolic hypotension may occur.
- Avoid bolus or rapid administration as ototoxicity may occur.
- Because of its ototoxicity and nephrotoxicity, vancomycin should be used with care in patients with renal insufficiency and those on renal replacement therapy. If it is necessary to use vancomycin parenterally in patients with renal impairment, the dose and/or dose intervals should be adjusted carefully and blood levels monitored. Monitor serum levels and renal function during therapy.

Significant Interactions
- Incompatible with albumin, aminophylline, ceftazidime, chloramphenicol, dexamethasone, heparin, hydrocortisone, rocuronium, sodium bicarbonate, sodium valproate, streptokinase, urokinase and moxifloxacin.
- There is increased risk of toxicity when given with other ototoxic/nephrotoxic drugs (aminoglycosides, amphotericin, cisplatin).
- In order to minimise the risk of nephrotoxicity when treating patients with underlying renal dysfunction or those patients receiving concomitant therapy with an aminoglycoside, serial monitoring of renal function should be performed and particular care should be taken in following appropriate dosing schedules.

Adverse Effects
- Chills, fever, nausea.
- Thrombophlebitis.
• Hypotension, asystole.
• Flushing/erythematous rash and hypotension – ‘Red Man’ syndrome may occur if infused rapidly or high doses used. Usually resolves over one hour.
• Histamine release – erythema, pruritus, localized oedema.
• Nephrotoxicity.
• Ototoxicity

**Presentation**

500mg vancomycin vial.

**Administration Guidelines**

- Reconstitute 500 mg vancomycin with sterile water 10mL per vial.
- Administer doses up to 1gram in 100mL sterile 0.9% sodium chloride over 1 hour.
- Doses > 1gram are delivered in 200mL sterile 0.9% sodium chloride over 2 hours.
- Dose: depends on renal and hepatic function and the site of sepsis.

**Loading Dose:**

A loading dose of **25 to 30 mg/kg** vancomycin may be considered to help achieve a therapeutic concentration more quickly, particularly in patients with serious infections who are critically ill.

**Maintenance Dose (Intermittent Dosing)**

For intermittent vancomycin dosing in adults, an appropriate starting maintenance dose is **15 to 20 mg/kg** (actual body weight). The frequency of administration depends on the patient's renal function; in patients with a creatinine clearance (CrCl) more than 60 mL/min, 12-hourly dosing is recommended for all indications. For convenience, the suggested starting dosage for an average-weight (70 kg) patient is given in the table below. Subsequent dosage is determined by the results of trough plasma concentration monitoring.

**Table 1: Starting vancomycin maintenance dosage and timing of trough concentration measurements for average 70kg adult.**

<table>
<thead>
<tr>
<th>Creatinine clearance (mL/min) NB1</th>
<th>Starting maintenance dosage for 70kg patient</th>
<th>Timing of trough plasma concentration measurement NB2</th>
</tr>
</thead>
<tbody>
<tr>
<td>more than 90</td>
<td>1.5 g 12-hourly</td>
<td>before the fourth dose</td>
</tr>
<tr>
<td>60 to 90</td>
<td>1 g 12-hourly</td>
<td>before the fourth dose</td>
</tr>
<tr>
<td>20 to less than 60</td>
<td>1 g 24-hourly</td>
<td>before the third dose</td>
</tr>
<tr>
<td>less than 20</td>
<td>1 g 48-hourly NB3</td>
<td>48 hours after the first dose NB3</td>
</tr>
</tbody>
</table>

**NB1:** Powerchart shows Creatine clearance - the Cockcroft-Gault formula is used to approximate creatinine clearance.

**Adult males:**

\[
CrCl (\text{mL/min}) = \frac{(140 - \text{age}) \times \text{weight (kg)}}{0.814 \times \text{serum creatinine (micromol/L)}}
\]

**Adult females:** Multiply the above formula by 0.85

**NB2:** If a loading dose is given, it is considered the first dose.

**NB3:** The clinical context determines whether the next dose is given before the trough concentration result is available, or withheld until the result is known.
Monitoring and Dose adjustment for intermittent dosing
The recommended target trough concentration for intermittent vancomycin dosing when treating complicated infections is 15 to 20 mg/L.

Table 2: Adjustment of vancomycin dosage for adults NB1

<table>
<thead>
<tr>
<th>Trough plasma concentration</th>
<th>Suggested dosage adjustment NB2</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 10mg/L</td>
<td>Increase dosage by adjusting either the dose or the dose interval. Consider switching to continuous infusion for patients requiring high or frequent daily doses.</td>
</tr>
<tr>
<td>10 to 14 mg/L</td>
<td>For patients with uncomplicated infection who are clinically improving, maintain current dosage. For patients with complicated infection, increase dosage by adjusting either the dose or the dose interval to achieve a trough concentration of 15 to 20 mg/L.</td>
</tr>
<tr>
<td>15 to 20 mg/L</td>
<td>Maintain current dosage.</td>
</tr>
<tr>
<td>21 to 25 mg/L</td>
<td>Adjustments may not be necessary, depending on the clinical context; maintain current dosage, or reduce dosage by adjusting either the dose or the dose interval, or withhold dose.</td>
</tr>
<tr>
<td>more than 25 mg/L</td>
<td>Withhold dose until trough concentration is less than 20 mg/L.</td>
</tr>
</tbody>
</table>

NB1: Suggested dosage adjustments aim to achieve a target trough concentration of 15 to 20 mg/L. When treating central nervous system infection, a trough concentration up to 25 mg/L may be used to improve penetration of vancomycin into the cerebrospinal fluid.

NB2: Dosage adjustments should be made in a simple linear manner (eg if the trough concentration is half the target concentration, double the dose).

Continuous Infusion over 24 hours.
- Continuous infusion of vancomycin is especially useful for patients requiring higher or more frequent doses.
- The starting dose for a 24-hour infusion should be the same as the total 24-hour dose recommended in Table 1 above. This dose should be preceded by a loading dose, unless switching from intermittent to continuous infusion.

<table>
<thead>
<tr>
<th>Creatinine clearance (mL/min)</th>
<th>Continuous infusion over 24hr dosage for 70kg patient</th>
<th>Dilution and infusion rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>more than 90</td>
<td>3 g over 24 hrs</td>
<td>Dilute in 48ml (total volume) – rate of 2ml/hr</td>
</tr>
<tr>
<td>60 to 90</td>
<td>2 g over 24 hours</td>
<td>Dilute in 48ml (total volume) – rate of 2ml/hr</td>
</tr>
<tr>
<td>20 to less than 60</td>
<td>1 g over 24-hours</td>
<td>Dilute in 48ml (total volume) – rate of 2ml/hr</td>
</tr>
<tr>
<td>less than 20</td>
<td>500 g over 24 hours</td>
<td>Dilute in 48ml (total volume) – rate of 2ml/hr</td>
</tr>
</tbody>
</table>

Note: Do NOT adjust the rate of infusion. To adjust the daily dose delivered by continuous infusion, the infused dose (i.e. the concentration of the subsequent infusion) needs to be adjusted.
**Clinical Considerations** 1,3

- Need for larger vancomycin doses (more than 4 grams per day) are associated with increased nephrotoxicity and an alternative agent should be considered in consultation with Infectious diseases specialist.

- **In most ICU patients, daily trough levels of vancomycin should be attended.** Trough levels are taken an hour before the scheduled timing of the dose. The clinical context determines whether the next dose is given before the trough concentration result is available, or withheld until the result is known.

- In patients receiving prolonged treatment with vancomycin, the trough plasma concentration should be measured at least weekly. More frequent measurement may be required in patients with impaired or changing renal function, and patients receiving concomitant nephrotoxins such as aminoglycosides, angiotensin converting enzyme inhibitors (ACEI) or angiotensin II receptor blockers (ARB).

- Patients with normal renal function only need levels done if:
  - Renal / hepatic function deteriorates.
  - They are receiving other nephrotoxic drugs eg. aminoglycosides, amphotericin, cisplatin.
  - Treatment is for > 5 days.
  - Meningitis (need higher than normal dose).
  - Augmented renal clearance and significantly altered volume of distribution (burns, severe sepsis, trauma) is common in hyperdynamic critically ill patients and may increase the risk for subtherapeutic vancomycin exposure.

**NOTE:** Patients on Renal Replacement Therapy: see below.

**Patients on Renal Replacement Therapy** 5,9

**Intermittent Haemodialysis (IHD) or Intermittent HaemoDiaFiltration (IHDF)**

- The dose is given according to patient weight as per dosing schedule above in Table 1.
- High flux membranes with convective clearance that are used for IHD and IHDF can clear significant amounts of vancomycin.
- Patients should have dose given after each IHD /IHDF treatment session. Levels should be taken prior to the next dialysis session.

**Continuous veno-venous haemodiafiltration (CVVHDF).**

- Standard doses should be given according to weight and renal function and further dosing guided by levels at 24 hours. ICU patients have significant variability in clearance and distribution.
- Trough levels only should be measured. Trough levels are taken an hour before the scheduled timing of the dose.
  - Level desired is 15 - 20 mg/L.
4. **Performance Measures**

All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.

5. **References and links**