ProMedica Pharmacy to dose Vancomycin
Updated Policy

April 2015
Objectives:

• Review basic pharmacokinetics and pharmacodynamics properties of vancomycin

• Describe efficacy and toxicity profile of vancomycin

• Discuss the new ProMedica Pharmacy to Dose Vancomycin Policy and Guidelines

• Apply the new policy to patient cases
Vancomycin – Tricyclic Glycopeptide:

- Introduced in 1956—“Vanquish” *Staphylococcus aureus* infections

- Increased usage of vancomycin beginning in the 1980s due to increased spread of methicillin-resistant *S. aureus* (MRSA)

*J Antimicrob Chemother* 2013; 68: 743-748
Mechanism of Action

- Bactericidal Activity
- Inhibits glycopeptide polymerization in bacterial cell wall
  - Vancomycin binds to the D-Ala-D-Ala C-terminus of the pentapeptide
Pharmacokinetic Parameters

• **Absorption:**
  - Oral absorption is negligible
  - Oral vancomycin is only indicated for treatment of *C. difficile* infection

• **Distribution:**
  - Volume of distribution ~0.4-1 L/kg
  - CSF (with inflamed meninges): up to 53%
  - CSF (without inflamed meninges): 7-14%
  - Protein binding ~ 50%

• **Elimination:**
  - Primarily excreted as unchanged drug by glomerular filtration (~80-90%)
  - Elimination half-life ~ 4-6 hours in normal renal function.
  - Anephric patients half life ~ 7.5 days
  - Hemodialysis patients using high-flux membranes will remove ~1/3 - 1/2 of pre-dialysis vancomycin level
Pharmacodynamics

- Best predictor of clinical efficacy and bacteriological response: $\text{AUC}_{0-24h}/\text{MIC}$
  - Goal $\text{AUC}_{0-24h}/\text{MIC} > 400$
    - Based off animal studies and limited human studies

- Measuring $\text{AUC}_{0-24h}/\text{MIC}$ is not practical in real practice
  - Correlate trough concentrations to $\text{AUC}_{0-24h}/\text{MIC}$

<table>
<thead>
<tr>
<th>Mean Trough</th>
<th>Mean AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4 mcg/mL</td>
<td>318 ± 111</td>
</tr>
<tr>
<td>20.4 mcg/mL</td>
<td>418 ± 152</td>
</tr>
</tbody>
</table>

Jeffres MN Chest 2006;130:947-55
Rybak Am J Health-Syst Pharm. 2009;66:82-92
Efficacy

• Moise, et al:
  • Clinical and bacteriological response to vancomycin was superior in patients with higher \( \text{AUC}_{0-24h}/\text{MIC} \)

• Lodise, et al:
  • Higher vancomycin failure was seen with isolates with \( \text{MIC} \geq 1.5 \text{ mcg/mL} \) (36.4%) versus < 1 mcg/mL (15.4%) (\( p=0.04 \))

• Charles, et al:
  • Low vancomycin levels (< 10 mcg/mL) were associated with development of heterogeneous vancomycin-intermediate Staph \( \text{aureus} \) (hVISA)

Take Home Points

- Trough of 10 - 20 mcg/mL recommended to achieve an $AUC_{0-24h}/MIC \geq 400$
  - *Dependent on MIC*

- Higher clinical failures when MIC > 1 mcg/mL
  - *Harder to achieve $AUC_{0-24h}/MIC \geq 400$*

- Trough concentrations < 10 mcg/mL are associated with development of hVISA or VRSA
Toxicity

• “Mississippi Mud” – impurities in Eli Lilly’s vancomycin product caused a lot of adverse events
  • As purity increased, the amount of adverse events decreased

• Non-Concentration dependent:
  • Phlebitis
  • Red Man Syndrome
    • Associated with histamine release → tingling and flushing of the face, neck and upper torso
    • Associated with rapid infusions (> 500 mg over ≤ 30 minutes)
      • Can be avoided by increasing infusion time

Rybak Am J Health-Syst Pharm. 2009;66:82-92
Concentration Dependent Toxicity

Ototoxicity

- Associated with impurities in previous vancomycin preparations
- Possibly synergistic toxicity when combined with aminoglycoside or loop diuretics
- Likely associated with serum concentrations > 40 mcg/mL
Concentration Dependent Toxicity
Nephrotoxicity

- Definition varies in the literature:
  - 0.5 mg/dL increase from baseline in Scr or an increase of $\geq 50\%$ in Scr from baseline during vancomycin therapy

- Associated with elevated trough concentrations
  - Incidence varies in the literature - higher incidence with older formulations

- Increased incidence with concomitant nephrotoxic agent (e.g. aminoglycosides, amphotericin B, etc.)

- Possible association with higher total daily doses ($\geq 4 \text{ gm/day}$)

Rybak Am J Health-Syst Pharm. 2009;66:82-92
Take Home Points

- Vancomycin can cause concentration dependent and non-concentration dependent toxicities
- Red Man Syndrome can be prevented by slowing down the infusion rate
- Ototoxicity is a rare complication associated with concentrations $\geq 40$ mcg/mL
- Nephrotoxicity rates vary in the literature
  - Associated with concomitant nephrotoxic drugs or higher total daily doses
  - Monitor trough concentrations to prevent nephrotoxicity
Updated ProMedica System Pharmacy to Dose Vancomycin for Adult Patients Guidelines
Purpose of the New Guidelines:

- Create a system-wide guideline for dosing vancomycin
- Update goal trough ranges based on indication
- Improve goal trough target attainment
- Identify what and how quality assurance of Pharmacy to Dose Vancomycin will be collected and reported
Pharmacist Responsibilities

1. Assess each new pharmacokinetic dosing request within an appropriate time period
2. Pharmacokinetic Dosing and Monitoring forms are to be initially completed and updated daily by the responsible pharmacist
3. Monitoring forms should be filled out for **ALL IV vancomycin orders**
4. Forward any active request to the designated pharmacist on the next shift.
5. **Page the provider when Scr increases greater than 0.5 mg/dL from previous day**

*Please see the ProMedica Health System Clinical Interdepartmental Policy and Procedure for the full list of RPh responsibilities*
Procedures

Obtain the necessary information prior to initiating vancomycin (below is not an all inclusive list):

1. Gender
2. Height and weight
3. Allergies
4. Serum creatinine and BUN **If over 2 days old, reorder**
5. WBC and Tmax
6. Indication for vancomycin / other pertinent diagnosis(es)
7. Culture and sensitivity data
8. Concurrent antibiotics
Determining Initial Dosing Regimen:

Calculate the patients estimated creatinine clearance using Cockcroft-Gault method

**Ideal Body Weight Calculations (IBW):**

- For Males: \[ \text{IBW (in kilograms)} = 50 + [2.3 \times (\text{height in inches minus 60})] \]
- For Females: \[ \text{IBW (in kilograms)} = 45.5 + [2.3 \times (\text{height in inches minus 60})] \]

**IBW for Amputees:**
If patient has an amputation, deduct a certain percentage off the estimated IBW based on the area amputated (decrease IBW by the following percentages):

- Total Arm: 4.9%
  - Hand: 0.7%
  - Forearm: 1.6%
  - Upper arm: 2.6%
- Total Leg: 16.1%
  - Foot: 1.5%
  - Calf: 4.3%
  - Thigh: 10.3%
Determining Initial Dosing Regimen:

Cockcroft-Gault Equation

- For Males: \( \text{Clcr} = (140 - \text{Age}) \times \frac{\text{IBW} \times \text{Scr} \times 72}{\text{Scr} \times 72} \)
- For Females: \( \text{Clcr} = (140 - \text{Age}) \times \frac{0.85 \times \text{IBW} \times \text{Scr} \times 72}{\text{Scr} \times 72} \)

Notes for Cockcroft-Gault Calculations:

- If patient’s total body weight (TBW) is less than their IBW, use TBW
- If patients less than 5 feet tall, use IBW=50 kg for males and 45.5kg for females
- In adults \( \geq 65 \) years of age and \( \text{Scr} < 0.8 \text{ mg/dL} \), round to 0.8 mg/dL
Establish Goal Trough level based on Indication

<table>
<thead>
<tr>
<th>Indication</th>
<th>Desired Trough</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTI</td>
<td>10 - 15 mcg/mL</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>10 - 15 mcg/mL</td>
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<tr>
<td>Abscess</td>
<td>15 - 20 mcg/mL</td>
</tr>
<tr>
<td>Bacteremia/Sepsis</td>
<td>15 - 20 mcg/mL</td>
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<tr>
<td>Pneumonia</td>
<td>15 - 20 mcg/mL</td>
</tr>
<tr>
<td>Osteomyelitis</td>
<td>15 - 20 mcg/mL</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>15 - 20 mcg/mL</td>
</tr>
<tr>
<td>Meningitis</td>
<td>15 - 20 mcg/mL</td>
</tr>
<tr>
<td>Pre-HD level</td>
<td>15 - 20 mcg/mL</td>
</tr>
<tr>
<td>Vancomycin MIC &gt;1</td>
<td>15 - 20 mcg/mL</td>
</tr>
</tbody>
</table>

Pre-HD levels will be drawn with AM labs on days patients will receive hemodialysis.
Initial Dosing

**Loading Dose: 20 - 25 mg/kg use TBW**

- Applicable to patients with goal trough of 15 - 20 mcg/mL or patients severely ill
  - Loading dose should be given regardless of renal function

- **Maximum dose = 2.5 gm (round to nearest 250 mg)**

- Review patient profile to ensure patient has not already received vancomycin before ordering a loading dose.
  - If patient meets criteria for a loading dose and has recently received a dose of vancomycin (e.g. 1000 mg x 1 in ER), a subsequent “booster” dose can be given to reach a total combined dose of 20 - 25mg/kg.
Initial Dosing

Maintenance Dose:
• For stable renal function:
  • **Goal trough 10 - 15 mcg/mL**: 15 mg/kg (Initial range: 15 – 17 mg/kg)
  • **Goal trough 15 - 20 mcg/mL**: 18 mg/kg (Initial range: 18 – 20 mg/kg)

• **Maximum initial dose = 2 gm (round to nearest 250 mg)**
  • After level is obtained, maximum dose can be increased to 2.5 gm
  • Typical initial total daily dose should not exceed 4 gm

• Hemodialysis:
  • **Weight base dosing:**
    • Less than 70 kg → 500 mg post dialysis
    • 70-100 kg → 750 mg post dialysis
    • Greater than 100 kg → 1000 mg post dialysis
## Initial Frequency

### Guidelines for Vancomycin Dosing Interval and Level Monitoring

<table>
<thead>
<tr>
<th>CrCl (mL/min)</th>
<th>Interval</th>
<th>Level Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 75 mL/min and &lt; 35 years old</td>
<td>Q8H</td>
<td>Trough Before 4th dose</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>Q12H</td>
<td>Trough Before 4th dose</td>
</tr>
<tr>
<td>60 – 70</td>
<td>Q12H or Q18H</td>
<td>Trough Before 4th dose</td>
</tr>
<tr>
<td>35 – 59</td>
<td>Q24H</td>
<td>Trough Before 3rd</td>
</tr>
<tr>
<td>25 – 34</td>
<td>Q48H</td>
<td>Trough Before 2nd</td>
</tr>
<tr>
<td>&lt; 25</td>
<td>Dose by level</td>
<td>Random level within 48 hours from last dose; re-dose when level in therapeutic range</td>
</tr>
<tr>
<td>Intermittent HD</td>
<td>Post HD dosing</td>
<td>Pre-HD level on the day that the 3rd vancomycin dose will be due</td>
</tr>
</tbody>
</table>

**Draw Trough 30 mins prior to dose**
<table>
<thead>
<tr>
<th>CrCl (mL/min)</th>
<th>Interval</th>
<th>Level Monitoring</th>
</tr>
</thead>
<tbody>
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<td>Q8H</td>
<td>Trough Before 4th dose</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>Q12H</td>
<td>Trough Before 4th dose</td>
</tr>
<tr>
<td>60 – 70</td>
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<tr>
<td>25 – 34</td>
<td>Q48H</td>
<td>Trough Before 2nd</td>
</tr>
<tr>
<td>&lt; 25</td>
<td>Dose by level</td>
<td>Random level within 48 hours from last dose; re-dose when level in therapeutic range</td>
</tr>
<tr>
<td>Intermittent HD</td>
<td>Post HD dosing</td>
<td>Pre-HD level* on the day that the 3rd vancomycin dose will be due</td>
</tr>
</tbody>
</table>

When Dosing By Level- enter in “Vancomycin 1mg IV PRN” to notify all other health care providers that the patient is on vancomycin
### Guidelines for Vancomycin Dosing Interval and Level Monitoring

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<thead>
<tr>
<th>CrCl (mL/min)</th>
<th>Interval</th>
<th>Level Monitoring</th>
</tr>
</thead>
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<td>Q8H</td>
<td>Trough Before 4&lt;sup&gt;th&lt;/sup&gt; dose</td>
</tr>
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<td>&gt; 70</td>
<td>Q12H</td>
<td>Trough Before 4&lt;sup&gt;th&lt;/sup&gt; dose</td>
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<tr>
<td>35 – 59</td>
<td>Q24H</td>
<td>Trough Before 3&lt;sup&gt;rd&lt;/sup&gt;</td>
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<td>25 – 34</td>
<td>Q48H</td>
<td>Trough Before 2&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
<tr>
<td>&lt; 25</td>
<td>Dose by level</td>
<td>Random level within 48 hours from last dose; re-dose when level in therapeutic range</td>
</tr>
</tbody>
</table>

**Intermittent HD**

**Post HD dosing**

Pre-HD level* on the day that the 3<sup>rd</sup> vancomycin dose will be due

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*Pre-HD levels are to be drawn with AM labs on days patients will be receiving dialysis.*
## Evaluating Trough Levels

### How To Adjust Vancomycin Based on Levels

<table>
<thead>
<tr>
<th>Action Needed / Trough Goal and Levels</th>
<th>10 – 15 mcg/mL</th>
<th>15 – 20 mcg/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q48H → Q24H, keep same dose</td>
<td></td>
<td>&lt; 8 mcg/mL</td>
</tr>
<tr>
<td>Q24H → Q12H, keep same dose</td>
<td></td>
<td>&lt; 10 mcg/mL</td>
</tr>
<tr>
<td>Q18H → Q12H, keep same dose</td>
<td>&lt; 8 mcg/mL</td>
<td></td>
</tr>
<tr>
<td>Q12H → Q8H, keep same dose</td>
<td>8 – 9.9 mcg/mL</td>
<td>10 – 13.4 mcg/mL</td>
</tr>
<tr>
<td>Q8H → increase dose by 250 mg, keep same interval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase dose by 250 mg, keep same interval</td>
<td>8 – 9.9 mcg/mL</td>
<td>10 – 13.4 mcg/mL</td>
</tr>
<tr>
<td>No Changes</td>
<td>10 - 16.5 mcg/mL</td>
<td>13.5 – 20.9 mcg/mL</td>
</tr>
<tr>
<td>Decrease dose by 250 mg, keep same interval</td>
<td>16.6 - 20 mcg/mL</td>
<td>21 - 25 mcg/mL</td>
</tr>
<tr>
<td>Q8H → Q12H, keep same dose</td>
<td></td>
<td>20.1 - 25 mcg/mL</td>
</tr>
<tr>
<td>Q12H → Q24H, keep same dose</td>
<td>20.1 - 25 mcg/mL</td>
<td>25.1 - 30 mcg/mL</td>
</tr>
<tr>
<td>Q18H → Q24H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q24H → Q48H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold Dose and recheck random level after 2 doses of old regimen have passed</td>
<td>&gt; 25 mcg/mL</td>
<td>&gt; 30 mcg/mL</td>
</tr>
</tbody>
</table>
Evaluating Trough Levels

Hemodialysis patients

- Pre-HD level > 25 mcg/mL: Hold dose and recheck random level morning of next hemodialysis
- Pre-HD level 21 - 25 mcg/mL: Decrease maintenance dose by 250 mg
- Pre-HD level 15 - 20 mcg/mL: No change
- Pre-HD level 10 - 15 mcg/mL: Increase maintenance dose by 250 mg
- Pre-HD level < 10 mcg/mL: Increase maintenance dose by 500 mg
Monitoring Form
<table>
<thead>
<tr>
<th>Date</th>
<th>2/7</th>
<th>2/8</th>
<th>2/9</th>
<th>2/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of Therapy</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUN (mg/dL)</td>
<td>32</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCr (mg/dL)</td>
<td>0.6</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tmax (C)</td>
<td>37.8</td>
<td>36.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WBC (X 10^9/L)</td>
<td>10.2</td>
<td>9.5</td>
<td></td>
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</tr>
<tr>
<td>% Segs</td>
<td>76</td>
<td>82</td>
<td></td>
<td></td>
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<tr>
<td>% Bands</td>
<td>21</td>
<td>15</td>
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<tr>
<td>ANC</td>
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<tr>
<td>Platelets (X 10^9/L)</td>
<td>11</td>
<td>123</td>
<td></td>
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<tr>
<td>Est. ClCr (mL/min)</td>
<td>72</td>
<td>65</td>
<td></td>
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<tr>
<td>Urine Output (peds ml/kg/hr)</td>
<td>-</td>
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<tr>
<td>I/O net</td>
<td>-</td>
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<tr>
<td>Hemodialysis</td>
<td></td>
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</tr>
<tr>
<td>Weight (kg)</td>
<td>75</td>
<td></td>
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<tr>
<td>Peak/Tr Time Ordered</td>
<td>Tr 9:30 AM</td>
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</tbody>
</table>

Check on days pt receives HD
Record time tr level ordered

Daily Lab Values and Tmax

ProMedica Hospital Monitoring Form
Pharmacokinetic Dosing & Monitoring Form

History, including current diagnosis(es) and other pre-existing conditions:

Allergies:
<table>
<thead>
<tr>
<th>Date</th>
<th>Specimen (Site)</th>
<th>Gram Stain</th>
<th>Organism(s)</th>
<th>Susceptibility(ies)</th>
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<tbody>
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**Concomitant Antimicrobial Medications**

<table>
<thead>
<tr>
<th>Start Date</th>
<th>Stop Date</th>
<th>Medication Regimen (Drug Name/Dose/Route/Interval)</th>
<th>Start Date</th>
<th>Stop Date</th>
<th>Medication Regimen (Drug Name/Dose/Route/Interval)</th>
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<tbody>
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**Outcome Data**

- **Initial Dose (mg/kg)** __________
- **Frequency** __________
- **If Pharmacy to Dose - Dose based on policy?** □ Yes □ No
  **If No, Reason? (e.g. clinical judgment)** __________

- **Duration of Therapy** __________

- **Initial Peak/Trough:** _____ mcg/mL
- **Number of Pk/t r > goal** __________
- **Number of Pk/ tr < goal** __________
- **Total # levels** __________

- **Did patient experience Nephrotoxicity (Scr increase >0.5 from baseline)?** □ Yes □ No
  **Non-antibiotic reasons for nephrotoxicity?** □ Yes □ No
Initial Patient Data

<table>
<thead>
<tr>
<th>NAME</th>
<th>AGE</th>
<th>GENDER</th>
<th>MRN</th>
<th>□ cm (ALL TCH pts)</th>
<th>□ inches</th>
<th>Ideal Body Weight:</th>
<th>□ cm (ALL TCH pts)</th>
<th>□ inches</th>
<th>Ideal Body Weight:</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**Adults**

IBW (male) = 50 + (2.3 X Height in inches over 5 feet)

IBW (female) = 45.5 + (2.3 X Height in inches over 5 feet)

**Children** (1 to 18 years of age)

IBW = Height² X 1.65 / 1000

IBW is in kg; Height is in cm

Actual Body Weight _________ kg

Dosing Body Weight _________ kg

DBW = 0.4 X [Actual body wt – Ideal body wt] + Ideal body wt.  [All wts are in kg]

---

**DOSING INFORMATION** *(Use separate sheet for each agent)*

<table>
<thead>
<tr>
<th>DRUG NAME</th>
<th>Loading Dose?</th>
<th>IF Yes: Dosage &amp; Route</th>
<th>Desired Peak (mcg/mL)</th>
<th>Desired Trough (mcg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>□ No □ Yes</td>
<td>IF Yes, Date and Time of Loading Dose</td>
<td>Dose per body weight: mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

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Initial vancomycin dosing information
### Date and time of regimen

**Enter the dose and frequency**

**Time of dose prior to level**

**Level**

**Time level was drawn**

**Any Changes?**

<table>
<thead>
<tr>
<th>Start Date &amp; Time of 1st Dose</th>
<th>Dosage Regimen (Dose/Route/Interval)</th>
<th>Sched Admin Times</th>
<th>Date &amp; Time of Last Dose</th>
<th>Measured level (mcg/mL)</th>
<th>Time Drawn</th>
<th>Kelim (hr⁻¹)</th>
<th>T1/2elim (hrs)</th>
<th>Vd (L/kg)</th>
<th>Calculated Cp (mcg/mL)</th>
<th>Recommendation (New dose/route/interval; NC=No change, etc.)</th>
<th>Outcome (Accepted/Rejected)</th>
<th>RPh</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/12 @ 11:30</td>
<td>1000 mg q12 hr</td>
<td>0:00, and 12:00</td>
<td>2/14 00:32</td>
<td>TR</td>
<td>2/14 12:01</td>
<td>TR</td>
<td>TR</td>
<td>PK</td>
<td>PK</td>
<td>NC</td>
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### HOSPITAL COURSE / DISCUSSIONS WITH PRESCRIBERS

<table>
<thead>
<tr>
<th>DATE</th>
<th>COMMENTS</th>
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<th>COMMENTS</th>
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**Comments**
These are **GUIDELINES** that the pharmacist will use in conjunction with clinical judgment when selecting appropriate dosing for patients.
Patient Vignette:

Pt is a 32 yo male with chief complaint of fever and “feeling fatigued”. Past medical history is significant for IVDA and previous fracture of left tibia s/p internal fixation

- Vitals: Hr 120 bpm, Tmax 38.4 C, BP: 90/80, RR 18
- Ht = 170 cm Wt = 74 kg
- Initial Pertinent Labs: WBC 18, BUN 32, Scr 0.4
- Blood cultures 2/2: GPC in clusters on gram stain
Patient Vignette:

- Physician orders vancomycin Pharmacy to Dose. Which one is the most appropriate dose?

A. Load the patient with vancomycin 1500 mg IV x 1, then start 1250 mg IV q8h
B. The patient does not need a loading dose, start the patient on 1250 mg IV q8h
C. The patient does not need a loading dose, start the patient on 1250 mg IV q12h
D. Load the patient with vancomycin 1500 mg IV x1, then start 1250 mg IV q12H
Patient Vignette:

- Physician orders vancomycin Pharmacy to Dose. Which one is the most appropriate dose?

A. Load the patient with vancomycin 1500 mg IV x 1, then start 1250 mg IV q8h
B. The patient does not need a loading dose, start the patient on 1250 mg IV q8h
C. The patient does not need a loading dose, start the patient on 1250 mg IV q12h
D. Load the patient with vancomycin 1500 mg IV x 1, then start 1250 mg IV q8H
Explanation

• Loading dose is applicable to patients with goal trough of 15 - 20 mcg/mL
  • Patient has blood cultures (2 of 2) positive for GPC, clusters + the patient is “septic” → therefore his goal trough is 15 - 20 mcg/mL

• Maintenance dose: 18 mg/kg = 1,332 mg → round to 1250 mg

• Pt is < 35 yo and est CrCl ≥ 75 mL/min →
  • q8h dosing is appropriate
Patient Vignette:

Vancomycin level was drawn appropriately before the patient's 4th dose = 11.1 mcg/mL. What is the most appropriate response?

A. Increase vancomycin to 1500 mg IV q8h
B. Keep the same dose and recheck a trough in ~ 1 week
C. Increase to 2gm IV q8h
Patient Vignette:

Vancomycin level was drawn appropriately before the patient’s 4th dose = 11.1 mcg/mL. What is the most appropriate response?

A. Increase vancomycin to 1500 mg IV q8h
B. Keep the same dose and recheck a trough in ~ 1 week
C. Increase to 2gm IV q8h
## Interpreting Trough Levels

<table>
<thead>
<tr>
<th>Action Needed / Trough Goal and Levels</th>
<th>10 – 15 mcg/mL</th>
<th>15 – 20 mcg/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q48H → Q24H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q24H → Q12H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q18H → Q12H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q12H → Q8H, keep same dose</td>
<td>&lt; 8 mcg/mL</td>
<td>&lt;10 mcg/mL</td>
</tr>
<tr>
<td>Q8H → increase dose by 250 mg, keep same interval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase dose by 250 mg, keep same interval</td>
<td>8 – 9.9 mcg/mL</td>
<td>10 – 13.4 mcg/mL</td>
</tr>
<tr>
<td>No Changes</td>
<td>10 – 16.5 mcg/mL</td>
<td>13.5 – 20.9 mcg/mL</td>
</tr>
<tr>
<td>Decrease dose by 250 mg, keep same interval</td>
<td>16.6-20 mcg/mL</td>
<td>21-25 mcg/mL</td>
</tr>
<tr>
<td>Q8H → Q12H, keep same dose</td>
<td>20.1-25 mcg/mL</td>
<td>25.1-30 mcg/mL</td>
</tr>
<tr>
<td>Q12H → Q24H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q18H → Q24H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q24H → Q48H, keep same dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hold Dose and recheck random level after 2 doses of old regimen have passed</td>
<td>&gt;25</td>
<td>&gt;30</td>
</tr>
</tbody>
</table>
Patient Vignette 2

- Pt is a 87 yo female being admitted for shortness of breath. Past medical history is significant for ESRD on dialysis MWF, diabetes mellitus, CAD, and atrial fibrillation.

Vitals: Hr 90 bpm, Tmax 38.7 C, BP: 121/82, RR 18

Ht = 162 cm Wt = 76 kg

Initial Pertinent Labs: WBC 13.2, BUN 64, Scr 4.5

Blood cultures: Pending
Sputum cultures: Pending
Chest Xray: Pending
Patient Vignette 2

- Provider orders pharmacy to dose vancomycin. Which is the most appropriate initial dosing?

A. 750 mg x 1 NOW, then 750 mg post dialysis
B. 1000 mg x 1 NOW, then 1000 mg post dialysis
C. 1500 mg x 1 NOW, then 750 mg post dialysis
D. None of the above are correct
E. 750 mg x 1 NOW, then 750 mg post dialysis
Patient Vignette 2

- Provider orders pharmacy to dose vancomycin. Which is the most appropriate initial dosing?

A. 750 mg x 1 NOW, then 750 mg post dialysis
B. 1000 mg x 1 NOW, then 1000 mg post dialysis
C. 1500 mg x 1 NOW, then 750 mg post dialysis
D. None of the above are correct
E. 750 mg x 1 NOW, then 750 mg post dialysis
Explanation

- Patient coming in with SOB - vancomycin most likely being used for possible pneumonia

- Loading dose → 20 - 25 mg/kg on TBW is appropriate REGARDLESS of renal function

- Based on the guidelines - 76 kg = 750 mg post dose
Patient Vignette 2

• When would you check a level in our patient from Vignette 2 and what is her goal level?

A. Patient is on hemodialysis - no level is necessary
B. 1 hour after hemodialysis – goal level 10 - 15mcg/mL
C. Right before hemodialysis- goal level 15 - 20 mcg/mL
D. With AM labs on the day of hemodialysis- goal level 15 - 20 mcg/mL
Patient Vignette 2

• When would you check a level in our patient from Vignette 2 and what is her goal level?

A. Patient is on hemodialysis - no level is necessary
B. 1 hour after hemodialysis - goal level 10 - 15mcg/mL
C. Right before hemodialysis - goal level 15 - 20 mcg/mL
D. With AM labs on the day of hemodialysis - goal level 15 - 20 mcg/mL
Patient Vignette 2

• A level was ordered with AM labs the day the patient was due for her 3rd dose. The level was 22.1 mcg/mL. What is the most appropriate action?
  A. Do nothing - level is OKAY
  B. Check another level tomorrow morning – no dose tonight
  C. Decrease dose to 500 mg post dialysis- okay to give after dialysis today
  D. Decrease dose to 500 mg post dialysis - start at next dialysis session
Patient Vignette 2

- A level was ordered with AM labs the day the patient was due for her 3rd dose. The level was 22.1 mcg/mL. What is the most appropriate action?

A. Do nothing - level is OKAY
B. Check another level tomorrow morning – no dose tonight
C. **Decrease dose to 500 mg post dialysis - okay to give after dialysis today**
D. Decrease dose to 500 mg post dialysis - start at next dialysis session
Explanation

Per the dosing guidelines:

- Pre-HD level > 25 mcg/mL: Hold dose and recheck random level morning of next hemodialysis
- Pre-HD level 21 - 25 mcg/mL: Decrease maintenance dose by 250 mg
- Pre-HD level 15 - 20 mcg/mL: No change
- Pre-HD level 10 - 15 mcg/mL: Increase maintenance dose by 250 mg
- Pre-HD level < 10 mcg/mL: Increase maintenance dose by 500 mg
Pt is a 71 yo male that was found down by his family. Past medical history is significant for diabetes mellitus. Upon admission, it was noted that the patient was in rhabdomyolysis with an initial CPK level of 1,210 mg/dL.

Vitals: Hr 86 bpm, Tmax 37.4 C, BP: 110/81, RR 14

Ht = 177 cm Wt = 116 kg

Initial Pertinent Labs on admission:
WBC 14.2, BUN 89, Scr 4.61, CPK 1,210

Labs on day 2 of hospitalization:
WBC 9.2, BUN 89, Scr 3.35, CPK 866

Sputum cultures: Many GPC, in clusters
Chest Xray: Left lower lobe infiltrates
On day 2 of hospitalization, the physician enters in “Vancomycin Pharmacy to Dose”- which is the most appropriate answer?

A. Vancomycin 1000 mg IV x 1 NOW, check random with AM labs tomorrow (enter in vancomycin 1mg IV PRN PRN)
B. Vancomycin 1500 mg IV q48H, check trough before 2\textsuperscript{nd} dose
C. Vancomycin 2000 mg IV x 1 NOW, check random with AM labs tomorrow (enter in vancomycin 1mg IV PRN)
D. Vancomycin 2000 mg IV x 1 NOW, then start 1500 mg IV q48H, check trough before 3\textsuperscript{rd} dose
Patient Vignette 3

On day 2 of hospitalization, the physician enters in “Vancomycin Pharmacy to Dose”- which is the most appropriate answer?

A. Vancomycin 1000 mg IV x 1 NOW, check random with AM labs tomorrow (enter in vancomycin 1mg IV PRN PRN)

B. Vancomycin 1500 mg IV q48H, check trough before 2\textsuperscript{nd} dose

C. Vancomycin 2000 mg IV x 1 NOW, check random with AM labs tomorrow (enter in vancomycin 1 mg IV PRN)

D. Vancomycin 2000 mg IV x 1 NOW, then start 1500 mg IV q48H, check trough before 3\textsuperscript{rd} dose
Pt is a 45 yo male coming in with cellulitis of his left lower leg that failed PO antibiotics as an outpatient. Past medical history is significant for uncontrolled diabetes mellitus, peripheral vascular disease, morbid obesity, CAD s/p CABG and HTN.

Vitals: Hr 92 bpm, Tmax 37.1 C, BP: 155/94, RR 14

Ht =171 cm Wt = 202 kg

Initial Pertinent Labs on admission:
- WBC 10.9, BUN 23, Scr 0.98

Culture left lower leg: *staphylococcus aureus* (MRSA vancomycin MIC \(\leq 0.5 \text{ mcg/mL}\))
Patient Vignette 4

The provider orders pharmacy to dose vancomycin. Which is the most appropriate answer?

A. 2,000 mg IV q12h
B. 2,500 mg IV q12h
C. 1500 mg IV q12h
D. 3000 mg IV q12h
E. 1500 mg IV q8h
The provider orders pharmacy to dose vancomycin. Which is the most appropriate answer?

A. 2,000 mg IV q12h
B. 2,500 mg IV q12h
C. 1500 mg IV q12h
D. 3000 mg IV q12h
E. 1500 mg IV q8h
Explanation

- Patient is coming in with cellulitis - goal trough is 10 - 15 mcg/mL

- Initial dosing would be 15mg/kg →
  - $15 \times 202\text{kg} = \sim 3000\text{ mg}$

- According to the guideline-
  - MAX initial recommended = 2000 mg