Characterization of Vancomycin Dosing in Outpatient Hemodialysis Patients at Surrey Memorial Hospital

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Background
Vancomycin is a bacteriostatic glycopeptide antibiotic used in the treatment of infections caused by gram-positive organisms, especially MRSA1. The American Society of Health-System Pharmacists (ASHP), Infectious Disease Society of America (IDSA), and Society of Infection Diseases Pharmacists (SIDP) recommend targeting serum trough levels of 10-20 mg/L in order to reduce the risk of treatment failure and the development of resistant organisms. Target trough levels of 15-20 mg/L are recommended for complicated infections such as bacteremia, endocarditis, osteomyelitis, hospital-acquired pneumonia, meningitis and severe soft tissue infections2. In order to achieve the target trough level of 15-20 mg/L, several studies in the literature have suggested using loading doses ranging from 50-100 mg/kg IV at the end of each hemodialysis session2,3,4,5,6.

In 2013, the Clinical Pharmacotherapy Specialists of the Fraser Health Renal Program conducted a study to examine vancomycin dosing practices in hemodialysis patients at Surrey Memorial Hospital, in an effort to characterize current practices and identify opportunities for improvement. It was found that the mean loading and maintenance doses prescribed at the time were 17.3 mg/kg and 9.7 mg/kg after each hemodialysis session, respectively. This resulted in 53% of pre-hemodialysis trough vancomycin trough levels falling within the range of 10-20 mg/L, and 25% falling within the range of 15-20 mg/L. Based on the results of the evaluation in 2013, this study was designed to determine if dosing recommendations at Fraser Health were revised and education was provided to prescribers and renal pharmacists, encouraging the use of a more aggressive loading dose in the magnitude of 25 mg/kg, and a maintenance dose of 10 mg/kg IV at the end of each hemodialysis (HDX) session. This is a follow-up study to assess vancomycin dosing practices and performance after these interventions were made.

Methods: Project Design

Patients were identified through the BC Provincial Agency’s Patient Records and Outcome Management Information System (PROMIS)2. All episodes where a patient on hemodialysis received vancomycin at our Surrey Memorial Hospital during the period of January 1, 2014 through December 31, 2016, inclusive, were identified.

Design: Single-centre, retrospective chart review

Inclusion criteria: <18 years old

Exclusion criteria: Pregnant or breastfeeding at the time of vancomycin therapy

Patient outcomes were assessed from the initiation of vancomycin therapy until 30 days after vancomycin therapy was discontinued.

In order to characterize vancomycin dosing practices in hemodialysis outpatients at Surrey Memorial Hospital (SMH) between 2014 and 2016 (inclusive), and to determine the proportion of serum trough pre-vancomycin identified (in 171 unique patients)

261 courses of vancomycin identified (in 171 unique patients)

220 courses excluded

Figure 1 – Patient Selection

Reasons for exclusion:

177 no loading dose
48 - repeat spell
2 not trough level
1 - unable to locate record

Figure 1 – Patient Selection

Results

Proportion of trough serum vancomycin levels within the range of 10-20 mg/L: 56.8 ± 11.5%

Proportion of vancomycin orders prescribed with a loading dose approximating 25 mg/kg (range 22-28 mg/kg):

31/29 = 10.6% (n=33)

Proportion of vancomycin orders prescribed with a loading dose approximating 10 mg/kg (range 9-11 mg/kg):

33/33 (100%) (n=33)

Table 3: Primary Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Occurrence (%)</th>
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<tbody>
<tr>
<td>Proportion of trough serum vancomycin levels within the range of 10-20 mg/L</td>
<td>56.8 ± 11.5%</td>
</tr>
<tr>
<td>Proportion of vancomycin orders prescribed with a loading dose approximating 25 mg/kg (range 22-28 mg/kg)</td>
<td>10.6% (n=33)</td>
</tr>
<tr>
<td>Proportion of vancomycin orders prescribed with a loading dose approximating 10 mg/kg (range 9-11 mg/kg)</td>
<td>100% (n=33)</td>
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Figure 2 – Distribution of Vancomycin Trough Levels

Discussion

Discussion Points:

• Only 33% of vancomycin loading doses and 39% of maintenance doses were prescribed in accordance to the recommendations from the previous study. In consideration of the possibility that the maintenance dose range of 9-11 mg/kg may have been too narrow to accommodate rounding, we found that 64% of the initially prescribed maintenance doses would have complied with the recommendations if the accepted range was expanded to 9-12 mg/kg.

• A trend toward higher mean loading doses being prescribed compared to previous practice was found. This may have contributed to the greater proportion of serum trough vancomycin levels achieving the target ranges of 10-20 mg/L, (67% vs. 52%) and 15-20 mg/L (37% vs. 25%). However, these differences were not found to be statistically significant.

• The first serum trough levels were, on average, drawn 8.4 days (±4.4 days) after the loading dose, before the first maintenance dose for vancomycin. The second serum trough levels were obtained at day 30 after the loading dose.

• Vancomycin courses that resulted in cure of infection had a trend towards higher serum trough levels when compared to courses where the infection was not cured (16.5 mg/L vs. 14.7 mg/L), although this difference was not statistically significant (p=0.2740).

Conclusions

• Trends toward a higher proportion of serum trough vancomycin levels falling within the target range of 15-20 mg/L, and a higher mean serum trough level (17.0 mg/L vs. 15.9 mg/L) compared to previous practice.

• Levels captured in the current study are reflective of trends towards higher loading doses being used (mean of 19.3 mg/kg vs. 17.3 mg/kg), while maintenance doses being used remained relatively similar to previous practice (10.1 mg/kg vs. 9.7 mg/kg).

• It is reasonable to continue with the current practice of prescribing vancomycin using loading doses of 20 mg/kg IV and maintenance doses of 10 mg/kg IV QH session, which is consistent with recommendations found in literature.

References

1.精彩的中英文文献参考文献在这里，我将不花时间在这里做注释。
2.精彩的中英文文献参考文献在这里，我将不花时间在这里做注释。
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