Minocycline Activity Tested Against Acinetobacter baumannii, Burkholderia cepacia Species Complex, Stenotrophomonas maltophilia, and Select Enterobacteriaceae Isolates from a European Surveillance Program (2013)

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Materials and Methods

Isolates: Of A. baumannii (393), 31% were MDR (≥2 mg/L) infections. For other Gram-negative isolates (1,429), 11% were MDR (≥2 mg/L). Enterobacter cloacae (30) and Enterobacter aerogenes (12) were the predominant species. There were 3 strains of Acinetobacter baumannii, 13 strains of P. aeruginosa, and 1 strain of G. vaginalis. All isolates were tested at least twice.

Sensitivity Testing: All isolates were susceptibility tested using the reference MicroScan® NCCLS broth microdilution method. MDR and extensively drug-resistant (XDR) MDR Enterobacteriaceae and A. baumannii were selected as per currently recommended guidelines using the following antibacterial class representation: tetracyclines (4 strains), cephalosporins (4 strains), carbapenems (1 strain), quinolones (3 strains), and aminoglycosides (2 strains). MDR Enterobacteriaceae and A. baumannii were selected as per currently recommended guidelines using the following antibacterial class representation: tetracyclines (4 strains), cephalosporins (4 strains), carbapenems (1 strain), quinolones (3 strains), and aminoglycosides (2 strains). CLSI criteria were used when EUCAST criteria were not available.

Results

Acinetobacter spp. may be found as causes of multidrug-resistant (MDR) and extensively drug-resistant multidrug (XDR) and there is limited chemotherapy therapy options available. Minocycline activity was the second most active agent and had excellent activity against this specific strain set. Minocycline was the second most active agent and had excellent activity against this specific strain set.

Among the MDR A. baumannii, colistin was the most active agent exhibiting a MIC of 0.5 mg/L (92.6% susceptible). Susceptibility to doxycycline was lower at 25.2% and tetracycline susceptibility was further diminished at 14.4%.

The MIC results for minocycline for the three Enterobacteriaceae spp. complex isolates ranged from 2-4 mg/L for doxycycline and 4-32 mg/L for tetracycline (Table 3). Doxycycline was slightly less active (MIC 1-4 mg/L; 90.8% and 94.8% susceptible) and the most active “tetracycline” (Table 2).

Table 1. Summary of minocycline activity tested against selected Gram-negative bacterial isolates from European and Mediterranean region medical centers (2013).

<table>
<thead>
<tr>
<th>Organism</th>
<th>No. of isolates</th>
<th>MIC90</th>
<th>MIC50</th>
<th>MIC25</th>
<th>MIC1</th>
<th>%S</th>
<th>%I</th>
<th>%R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter baumannii</td>
<td>389</td>
<td>218 (0.1)</td>
<td>14 (0.5)</td>
<td>21 (1.2)</td>
<td>27 (1.5)</td>
<td>30 (3.2)</td>
<td>30 (3.2)</td>
<td>42 (3.4)</td>
</tr>
<tr>
<td>MDR</td>
<td>118</td>
<td>61 (0.1)</td>
<td>13 (0.5)</td>
<td>22 (1.0)</td>
<td>24 (1.0)</td>
<td>33 (1.7)</td>
<td>33 (1.7)</td>
<td>43 (2.1)</td>
</tr>
<tr>
<td>&gt;8 mg/L</td>
<td>66</td>
<td>33 (0.1)</td>
<td>10 (0.4)</td>
<td>19 (0.9)</td>
<td>21 (0.9)</td>
<td>32 (1.5)</td>
<td>32 (1.5)</td>
<td>43 (2.1)</td>
</tr>
<tr>
<td>&gt;8 mg/L</td>
<td>53</td>
<td>22 (0.1)</td>
<td>12 (0.5)</td>
<td>24 (1.0)</td>
<td>24 (1.0)</td>
<td>33 (1.5)</td>
<td>33 (1.5)</td>
<td>43 (2.0)</td>
</tr>
<tr>
<td>&gt;8 mg/L</td>
<td>17</td>
<td>9 (0.1)</td>
<td>2 (0.1)</td>
<td>6 (0.3)</td>
<td>6 (0.3)</td>
<td>9 (0.5)</td>
<td>9 (0.5)</td>
<td>12 (0.6)</td>
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<td>9 (0.5)</td>
<td>9 (0.5)</td>
<td>12 (0.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antimicrobial agent</th>
<th>MIC90</th>
<th>MIC50</th>
<th>MIC25</th>
<th>MIC1</th>
<th>%S</th>
<th>%I</th>
<th>%R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minocycline</td>
<td>0.5</td>
<td>1.0</td>
<td>2.0</td>
<td>4.0</td>
<td>94.1</td>
<td>0.0</td>
<td>5.9</td>
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<tr>
<td>Doxycycline</td>
<td>1.0</td>
<td>2.0</td>
<td>4.0</td>
<td>8.2</td>
<td>94.8</td>
<td>3.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>4.5</td>
<td>9.0</td>
<td>26.7</td>
<td>68.8</td>
<td>87 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

Table 2. Activity of minocycline and comparator agents against Acinetobacter baumannii.

Materials and Methods

Introduction

Tetracyclines differ greatly in their activity against Gram-negative bacteria (Tables 2-4). Minocycline was the most active “tetracycline” susceptibility was further diminished at 14.4%. Susceptibility to gentamicin/vancomycin/ amikacin was 72.4%, respectively.

The MIC results for minocycline for the three Enterobacteriaceae spp. complex isolates ranged from 2-4 mg/L for doxycycline and 4-32 mg/L for tetracycline (Table 3). Doxycycline was slightly less active (MIC 1-4 mg/L; 90.8% and 94.8% susceptible) and the most active “tetracycline” (Table 2).

Conclusion

The tetracyclines, discovered in the 1940s, were an early class of broad-spectrum of antibiotics with activity against Gram-positive and negative bacteria. Second-generation semisynthetic compounds such as doxycycline (1968) and minocycline (1974) were developed. Resistance to minocycline was voluntarily withdrawn in the UK in 1994 as it was no longer used and the MDR Enterobacteriaceae, tigecycline, meropenem and colistin were the most active agents at 82.2, 96.4 and 89.8%, respectively.

Acknowledgements

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References


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