Prevalence of ST171 in Enterobacter Isolates from 2001 to 2013 in 15 hospitals in NYC

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Abstract

Background: Multilocus sequence type ST171 was identified as the most prevalent ST in a point prevalence study of carbapenem-resistant Enteroberacter (26/106) isolates from New York City. There is no study of prevalence of this ST over time. To evaluate a large sample of Enterobacter from the period 2001-2013, we developed a PCR assay to identify ST171 isolates rapidly.

Methods: Isolates were collected in NYC as part of a cross-sectional Gram negative antibiotic resistance assessment in the years, 2001, 2003-04, 2006, 2009 and 2013. Agar dilution MIC were obtained for all isolates as part of these studies. We assayed 284 clinical Enteroberacter isolates for ST171 using a novel PCR assay, forward primer AGAAGGAGCATTGCGGCCGCT and reverse ACTACGGTGTTAAAGAATGATCGCCA. Following amplification, ST171 positive isolates were identified by gel electrophoresis. Enterobacter isolates were also assessed for the presence of blaKPC using a previously described RT-PCR assay.

Results: ST171 was identified in 17/284 (6%) Enterobacter isolates. This sample collection was heavily antibiotic resistant with 83/284 Enteroberacter isolates harboring blaKPC. Of the 284 isolates, 142 (50%) were resistant to any carbapenem and 113 (40%) were resistant to ceftazidime. Twelve of the 17 isolates occurred in clusters of isolates of the same species occurring in a single hospital at the same time. There were 2 clusters of 3 cases and 3 clusters of 2 patients each.

The oldest ST171 strain identified was an Enterobacter cloacae isolate collected in 2001. Prevalence of ST171 was calculated for each year of data: 0/20 in 2001, 0/20 in 2003-04, 7/73 (9.6%) in 2006, 6/38 (15.8%) in 2009 and 3/25 (12%) in 2013.

Conclusion: This far clinically significant infections from Carbapenem-resistant Enterobacteriaceae (CRE) have largely been restricted to K. pneumoniae especially blaKPC harboring ST258.

Enterobacter isolates were collected in NYC as part of a cross-sectional Gram negative antibiotic resistance assessment in 2001, 2003-04, 2006, 2009 and 2013. MIC (minimum inhibitory concentration) was obtained by agar dilution to imipenem, meropenem and ertapenem. Only 6 years were sampled between 2001-2013 as a result fluctuations in prevalence may have been missed.

Methods

Enterobacter isolates were collected in NYC as part of a cross-sectional Gram negative antibiotic resistance assessment in 2001, 2003-04, 2006, 2009 and 2013. MIC (minimum inhibitory concentration) was obtained by agar dilution to imipenem, meropenem and ertapenem as well as to a full range of penicillins and cephalosporins for each isolate as part of these studies.

Results

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Table 1: Distribution and Resistance pattern of ST171 isolates per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Total isolates</th>
<th>blaKPC positive</th>
<th>blaKPC negative</th>
<th>ST171 positive</th>
<th>ST171 negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>60</td>
<td>20</td>
<td>40</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2003</td>
<td>17</td>
<td>6</td>
<td>11</td>
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<tr>
<td>2004</td>
<td>7</td>
<td>2</td>
<td>5</td>
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<tr>
<td>2006</td>
<td>73</td>
<td>13</td>
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<tr>
<td>2009</td>
<td>38</td>
<td>15</td>
<td>23</td>
<td>4</td>
<td>4</td>
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<tr>
<td>2013</td>
<td>133</td>
<td>5</td>
<td>128</td>
<td>19</td>
<td>0</td>
</tr>
</tbody>
</table>

Conclusion: This study identified the oldest ST 171 in an Enteroberacter spp. in 2001.

• This isolate was susceptible to both meropenem and ertapenem but intermediate to imipenem and resistant to ceftazidime suggesting this strain type may have acquired a plasmid containing blaKPC gene.

• To date the first reported ST 171 was detected in 2011 at a Western Pennsylvania hospital

• In addition the emergence of the first plasmid encoded strain of blaKPC-2 in Enteroberacter sp. occurred also in 2001

• Interestingly all ST 171 isolates were species specific to E. cloacae and E. aerogenes more likely to harbor the blacPC gene.

• Prevalence of ST 171 tracks with the prevalence of carbapenem resistance.

• Thirty-six percent of the carbapenem-resistant Enteroberacter isolates were ST 171 strains and 2.8% of the isolates exhibiting phenotypic susceptibility to a carbapenem were ST 171 strains.

• This highlights that the absence of the strain increases the probability that the Enteroberacter spp. will be susceptible to a carbapenem

• The relative prevalence of ST 171 in CR Enterobacter samples differs with findings from Gomez-Simmonds et al whose prevalence at 43% was nearly half of their 53 CREC isolates.

• In the study there was a noted decline after 2006 in the detection of ST 171 and blacPC, harboring Enteroberacter spp. This may be due to better infection control policies and more judicious use of broad spectrum antibiotics.

Limitations

Collection of a larger sample size from 2003/2004 may have shown prevalence of ST 171 among the 15 hospitals only 6 years were sampled between 2001-2013 as a result fluctuations in prevalence may have been missed.

The study sample was collected from a pre-existing cohort of 1071 Enteroberacter isolates collected over the course of 13 years. There may be sampling bias among the 15 hospitals since samples were collected based on voluntary participation from the respective microbiology labs.

In addition having this strain type is not the only characteristics that contributes to carbapenem resistance. This study did not investigate the presence of AmpC or porin mutations which can contribute to varying resistance of the Enteroberacter spp.

References


Figure 1: Number of ST171 isolates per year in comparison to blacPC