Molecular Epidemiology of carbapenem non-susceptible *Acinetobacter baumannii* isolates from the Gulf Cooperation Council States

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BACKGROUND

*Acinetobacter baumannii* is a well-known pathogen for causing hospital-acquired infections. For example, in the United States *A. baumannii* found to be responsible for 5 - 10% of cases of ICU-acquired pneumonia (1); where in Riyadh 26.5% of ventilator-associated pneumonia between 2005 and 2009 were caused by *Acinetobacter* spp (2). This success is partially due to the high prevalence of multidrug resistant phenotype among *A. baumannii*. In the Middle East, and in particular countries of the Gulf Cooperation Council (GCC) carbapenem resistance of *A. baumannii* increased dramatically over the last decades (3). For example, a study from Bahrain found 58% of *A. baumannii* isolates non-susceptible to carbapenem (4), while the prevalence of imipenem nonsusceptible *A. baumannii* in Riyadh hospitals peaked to reach more than 90% (5, 6). Such high prevalence of carbapenem resistance among *A. baumannii* is limiting treatment options, which can lead to increased morbidity and mortality due to infections caused by carbapenem resistant *A. baumannii* (CRAB). The primary aim of the present study was to investigate the molecular epidemiology of carbapenem resistance mechanisms in *A. baumannii* isolates collected from hospitals across in the vast GCC region.

METHODS

**Participating countries**

Saudi Arabia  
United Arab of Emirates  
Kuwait  
Bahrain  
Qatar  
Oman

Non-duplicate clinically isolated *Acinetobacter* collected over 20 months (July 2011 – January 2013)  
Resistant to extended spectrum cephalosporins or/and carbapenems  
Disk diffusion susceptibility testing using EUCAST criteria  
Identification of *A. baumannii* was done by PCR screening for *bla*<sub>OXA-23</sub>  
PCR screening for *bla*<sub>OXA-23</sub>, *bla*<sub>OXA-24</sub>, *bla*<sub>OXA-58</sub>, *bla*<sub>NDM</sub>, and *bla*<sub>IMP</sub>

RESULTS

\[ n=128 \text{ *Acinetobacter* were collected} \]

\[ (n=118) \text{ were carbapenem non-susceptible *Acinetobacter} \]

\[ (n=118) \text{ had positive OXA-51 => 118 *A. baumannii} \]

\[ (n=82) \text{ were OXA-23 positive, } (n=82) \text{ were OXA-40 positive, and none were OXA-58, IMP, NDM, nor KPC positive} \]

Figure 1. The distribution of carbapenem resistance mechanisms among the *A. baumannii*

**Table. The distribution of OXA-23 and OXA-40 among the GCC isolates**

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Acinetobacter</th>
<th>Non-susceptible Acinetobacter</th>
<th>OXA-23</th>
<th>OXA-40</th>
<th>OXA-58</th>
<th>IMP</th>
<th>NDM</th>
<th>KPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuwait</td>
<td>8</td>
<td>8 (100%)</td>
<td>8 (100%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Saudi Arabia - Riyadh</td>
<td>50</td>
<td>49 (98%)</td>
<td>49 (98%)</td>
<td>22 (45%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Saudi Arabia - Khobar</td>
<td>36</td>
<td>32 (88%)</td>
<td>32 (88%)</td>
<td>27 (84%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bahrain</td>
<td>8</td>
<td>8 (100%)</td>
<td>8 (100%)</td>
<td>4 (50%)</td>
<td>5 (62%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Oman</td>
<td>9</td>
<td>5 (56%)</td>
<td>5 (56%)</td>
<td>1 (100%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Qatar</td>
<td>9</td>
<td>8 (89%)</td>
<td>8 (89%)</td>
<td>1 (100%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>8</td>
<td>8 (100%)</td>
<td>8 (100%)</td>
<td>8 (100%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>118 (92%)</td>
<td>118 (92%)</td>
<td>n=82 (69%)</td>
<td>5 (4%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

CONCLUSION

This is the first regional study to systematically analyse *A. baumannii* isolated from the GCC States. Class D ß-lactamase, particularly OXA-23, is the main resistance mechanism among carbapenem non-susceptible *A. baumannii* isolated from the GCC States. The intrinsic OXA-51 may also play a significant role in the carbapenem resistance. Other resistance mechanisms could play a role in carbapenem resistance.

REFERENCES


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