The Clinical Impact of Early Detection of ESBL-Producing Enterobacterales with PCR-Based Blood Culture Assays

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Introductions

- Bloodstream infections (BSIs) due to extended spectrum beta-lactamase (ESBL) producing Enterobacterales can cause significant morbidity and mortality.
- Starting January 4, 2021, Northwell microbiology lab implemented Genmask Dx® ePlex® Blood Culture Identification (BCID) Panels with the capability to detect blaCTX-M-Type gene.
- Our primary outcome was to assess the impact of BCID on time to appropriate therapy; secondary outcomes were to assess the clinical impact on mortality, 30-day readmission, length of stay (LOS), and total duration of antimicrobial therapy.

Methods

- An 11 hospital, pre/post retrospective analysis of adult patients hospitalized with ESBL Enterobacterales BSI was performed.
- Patients with ESBL Enterobacterales bacteremia were compared pre- and post-implementation of Genmask BCID.
- Time to appropriate therapy was calculated from Gram Stain (GS) result to escalation to a carbapenem.
- In-hospital mortality, length of stay (LOS), and total duration of antimicrobial therapy were analyzed for each cohort.
- Data were analyzed using T-test and Chi-square statistical methods.

Figure 1: Inclusion and exclusion criteria: ED: emergency department, GS: Gram Stain.

Results

Table 1: Study cohort demographics and outcomes. Comorbidities based on ICD10 diagnoses at time of discharge, and chart review.

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Pre BCID (n=130)</th>
<th>Post BCID (n=145)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (IQR)</td>
<td>71 (62-83)</td>
<td>72 (65-85)</td>
<td>0.517</td>
</tr>
<tr>
<td>Female sex No. (%)</td>
<td>62 (48%)</td>
<td>63 (44%)</td>
<td>0.544</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>Pre BCID (n=130)</th>
<th>Post BCID (n=145)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>55 (42%)</td>
<td>64 (44%)</td>
<td>0.807</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>35 (27%)</td>
<td>44 (30%)</td>
<td>0.539</td>
</tr>
<tr>
<td>Any malignancy</td>
<td>27 (21%)</td>
<td>37 (26%)</td>
<td>0.392</td>
</tr>
<tr>
<td>Immunosuppression</td>
<td>23 (18%)</td>
<td>13 (9%)</td>
<td>0.047</td>
</tr>
<tr>
<td>Dementia</td>
<td>22 (17%)</td>
<td>34 (24%)</td>
<td>0.230</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>18 (14%)</td>
<td>21 (15%)</td>
<td>1</td>
</tr>
</tbody>
</table>

- No significant difference was observed in demographics or clinical characteristics between the study groups (Table 1).
- Significant reductions were demonstrated in:
  - Median time to appropriate therapy between pre-ePlex BCID and post-ePlex BCID groups 44.5 to 7.9 hours, p=0.001 (Figure 2)
  - Total duration of antimicrobial therapy between pre-ePlex BCID and post-ePlex BCID groups 14.4 days to 12.7 days, p=<0.001 (Figure 3)
- No significant reduction in LOS, mortality or 30-day readmission was observed.

Limitations: Retrospective study design and inability to control for potential impact of the COVID-19 pandemic.

Conclusions

- In patients with ESBL-producing Enterobacterales BSIs, timely detection of blaCTX-M-Type gene by BCID provides valuable information for early initiation of appropriate and effective antimicrobials.
- Despite the decrease in time to appropriate therapy, and total antibiotic use, no significant improvement in mortality or LOS was observed.

Acknowledgement

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