MALDI-TOF utility in a region with low antibacterial resistance rates

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The manuscript has not been published, but the results were presented in poster format at the 2015 ICAAC conference.

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Dear Editor,

We read with great interest the study and commentary regarding rapid molecular diagnostic (RMD) techniques with antimicrobial stewardship (AMS) support [1,2]. Both manuscripts caution that single center studies are limited by local resistance rates. Previous single center studies of RMD, specifically matrix assisted laser deionization time of flight mass spectrometry (MALDI-TOF) demonstrated improved clinical and fiscal outcomes [3-5]. These results, which have become the norm in published MALDI-TOF studies, were conducted in locations with higher antibiotic resistance rates. Our retrospective study assessing MALDI-TOF implementation with AMS intervention in a healthcare system with relatively low antibiotic resistance rates are discordant with those presented [6].

Our primary analysis was time to susceptible antibiotic administration from phlebotomy, before and after MALDI-TOF implementation. All results were reported to the AMS pharmacist in an 18 hour window. Secondary outcomes included time to final identification, time to de-escalation, length of hospital stay, and 30-day all-cause mortality. During a two month period adult patients with bacteremia were included if they were admitted to the intensive care, hematology, or transplant units. A subset analysis in ICU patients was completed with corollary comparators. Patients with clinically identified bacterial contaminants were excluded. Antibiotic de-escalation was defined as appropriate narrowing of antibiotic spectrum following microbiologic laboratory updates. Continuous variables were evaluated with a two-tailed unpaired t-test, and categorical variables with Fisher’s Exact.

There was no difference before (n=47) and after (n=49) MALDI-TOF implementation for time to susceptible antibiotic administration (13.1 vs 18.6 hours, p=0.32), length of hospital stay following bacteremia (11.4 vs 10.0 days, p=0.46), and 30-day mortality (10.6% vs 8.9%, p=1.0). Antibiotic de-escalation occurred in 69 of 96 patient encounters and was not effected by MALDI-TOF (48.4 versus 65.6 hours, p=0.097). The time to pathogen identification was appropriately reduced after implementation.
(75.0 vs 51.4 hours, p=0.003). The ICU subset analysis identified similar results (Table 1) with no decrease in ICU length of stay following bacteremia (185.5 vs 137.3 hours, p=0.42).

Our academic, tertiary care referral hospital with a robust AMS program implemented MALDI-TOF and failed to improve outcomes in high risk patients. Our institutional rate of methicillin-resistance in *Staphylococcus aureus* is 34 % and gram-negative resistance rates maximum to anti- *Pseudomonas* β-lactams of 20%. Prescription analysis of 49 patients found susceptible antibiotics were administered to 37 patients prior to Gram stain results, 9 patients after Gram stain but prior to MALDI-TOF, and only 2 additional patients after MALDI-TOF results. One patient was not treated after having a central line removed and clinical improvement.

Our study unfortunately did not demonstrate improved clinical outcomes found previously [3,4]. This was likely due to low institutional resistance rates and an active AMS program. However, MALDI-TOF implementation has resulted in positive secondary effects. Providers are pleased with rapid turnaround times of bacterial identification results. Laboratory expendable costs associated with traditional identification methods are lower since MALDI implementation. Although investment in RMD technology usually relies on improving clinical outcomes, our results identify that local resistance patterns and AMS interventions may have more influence over the clinical outcomes of RMD tools.

Acknowledgments

*Potential conflicts of interest.* L.S. is a member of the Speaker’s Bureau for Cubist and an investigator for Merck. B.F is a grant investigator for Merck. B.B and K.R have no conflicts to disclose.
References:


Table 1.

<table>
<thead>
<tr>
<th>Primary and Secondary Outcomes</th>
<th>Before MALDI-ToF Implementation</th>
<th>After MALDI-ToF Implementation</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Time to susceptible antibiotic (hours)</td>
<td>46 encounters&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.1</td>
<td>4.2</td>
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<tr>
<td>Time to antibiotic de-escalation (hours)</td>
<td>33 encounters</td>
<td>48.4</td>
<td>49.5</td>
</tr>
<tr>
<td>Time to final organism identification (hours)</td>
<td>47 encounters</td>
<td>75.0</td>
<td>61.2</td>
</tr>
<tr>
<td>Duration of hospital stay following BSI (days)</td>
<td>47 encounters</td>
<td>11.4</td>
<td>8.6</td>
</tr>
<tr>
<td>30 day all cause mortality (percent)</td>
<td>47 patients</td>
<td>10.6%</td>
<td></td>
</tr>
</tbody>
</table>

**ICU Subset analysis**

| Time to susceptible antibiotic (hours)                             | 24 encounters                                    | 17.9  | 8.7    | 0.33-116.3 | 25 encounters                                           | 12.6  | 3.0    | 0.23-124.6 | 0.469   |
| Time to final organism identification (hours)                      | 25 encounters                                    | 77.3  | 65.1   | 48.3-192.0 | 25 encounters                                           | 49.7  | 47.3   | 14.3-110.5 | 0.003   |
| Duration of ICU stay following BSI (days)                          | 25 encounters                                    | 185.5 | 80.7   | 10.7-955.6 | 25 encounters                                           | 137.3 | 88.5   | 2.1-821.9  | 0.415   |
| Duration of hospital stay following BSI (days)                     | 25 encounters                                    | 15.1  | 10.6   | 2.4-39.8   | 25 encounters                                           | 12.1  | 7.4    | 1.9-35.1   | 0.370   |
| 30 day all cause mortality (percent)                               | 25 patients                                      | 16.0% |        |           | 22 patients                                             | 18.1% |        |           | 1.000   |

<sup>a</sup> 1 patient withdrew care before susceptibility results

<sup>b</sup> 1 patient with VRE E. faecium from PICC infection treated with Zosyn after pulling PICC