Low predictive value of the Pitt Bacteraemia Score in *Staphylococcus aureus* bloodstream infection: a validation study

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**Background**

- In *Staphylococcus aureus* bloodstream infection (BSI), the Pitt Bacteraemia Score (PBS) has been described as good estimate for short-term mortality, but little is known about its overall predictive performance.

**Objective**

- The goal of our study was to externally validate the PBS on a homogenous dataset of methicillin-susceptible *S. aureus* (MSSA) BSIs at a tertiary-care center in Switzerland.

**Methods**

- At the University Hospital Basel, all consecutive patients aged ≥18 years with a first MSSA BSI between January 2008 and December 2013 were eligible for the study. We excluded patients with a missing PBS at day of BSI onset.
- We extracted relevant data from our prospective in-house BSI surveillance database. BSI onset was defined as day of first positive blood culture.
- For prediction of 30-day all-cause mortality, we measured the overall discriminative power of the PBS at BSI onset by receiver-operating characteristics analysis; the calibration of the PBS was assessed using the Hosmer-Lemeshow goodness-of-fit statistic.

**Results**

- Seven of 336 eligible patients were excluded because of a missing PBS at onset of MSSA BSI; the remaining 329 patients were included in the final analysis.
- The median age of the study population was 67 years (interquartile range [IQR], 51–78 years)
- The median PBS at BSI onset was 0 (IQR, 0–2) with patients suffering from various comorbidities (median Charlson Comorbidity Index, 3; IQR, 1–5).
- Overall, the most frequent source of BSI was skin/soft tissue (34%; 113/329) and intravascular catheters/foreign materials (27%; 90/329). At BSI onset, 98% of patients (316/323) received an adequate empirical antimicrobial therapy.
- The crude 30-day mortality was 13% (43/329). At BSI onset, 52% (170/329) and 19% of patients (63/329) had a PBS of 0 and 1 points, respectively; the concomitant specificity for 30-day all-cause mortality was 0% (PBS, 0 points) and 55% (PBS, 1 point)
- Table.
- The overall performance of the PBS in predicting the 30-day all-cause mortality was lower than published with an area under the curve of 0.711 (95% confidence interval, 0.614–0.807; P < 0.001)
- Figure.
- Hosmer-Lemeshow statistics revealed a good calibration of the PBS with an insignificant P-value (chi-square goodness-of-fit test = 2.91, P = 0.234).

**Conclusions**

- In regard to short-term mortality, the Pitt Bacteraemia Score had a low predictive value in a homogenous patient population with methicillin-susceptible *S. aureus* bloodstream infections.
- We speculate that the predictive value of the Pitt Bacteraemia Score is even lower, if used in heterogeneous populations with all types of gram-positive and -negative bloodstream infections.

### Table: Sensitivity, specificity, and predictive values of the Pitt Bacteraemia Score.

<table>
<thead>
<tr>
<th>Scoring points at BSI onset</th>
<th>Total, n (%)</th>
<th>Death within 30 days, n (%)</th>
<th>Sensitivity, % (95% CI)</th>
<th>Specificity, % (95% CI)</th>
<th>PPV, % (95% CI)</th>
<th>NPV, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>170 (52)</td>
<td>13 (8)</td>
<td>100 (75–100)</td>
<td>0 (0–1)</td>
<td>13 (10–17)</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>63 (19)</td>
<td>3 (5)</td>
<td>70 (54–83)</td>
<td>55 (49–61)</td>
<td>19 (13–26)</td>
<td>92 (87–96)</td>
</tr>
<tr>
<td>2</td>
<td>54 (16)</td>
<td>8 (15)</td>
<td>63 (47–77)</td>
<td>76 (70–81)</td>
<td>28 (19–38)</td>
<td>93 (89–96)</td>
</tr>
<tr>
<td>3</td>
<td>10 (3)</td>
<td>4 (40)</td>
<td>44 (29–60)</td>
<td>92 (88–95)</td>
<td>45 (30–61)</td>
<td>92 (88–95)</td>
</tr>
<tr>
<td>4</td>
<td>15 (5)</td>
<td>7 (47)</td>
<td>35 (21–51)</td>
<td>94 (91–96)</td>
<td>47 (29–65)</td>
<td>91 (87–94)</td>
</tr>
<tr>
<td>5</td>
<td>6 (2)</td>
<td>2 (33)</td>
<td>19 (8–33)</td>
<td>97 (94–99)</td>
<td>47 (23–72)</td>
<td>89 (85–92)</td>
</tr>
<tr>
<td>6</td>
<td>7 (2)</td>
<td>3 (43)</td>
<td>14 (5–28)</td>
<td>98 (96–99)</td>
<td>55 (23–63)</td>
<td>88 (84–92)</td>
</tr>
<tr>
<td>≥7</td>
<td>4 (1)</td>
<td>3 (75)</td>
<td>7 (1–19)</td>
<td>100 (98–100)</td>
<td>75 (19–99)</td>
<td>88 (84–91)</td>
</tr>
</tbody>
</table>

Abbreviations: BSI = bloodstream infection; CI = confidence interval; NPV = negative predictive value; PPV = positive predictive value.

* The Pitt Bacteraemia Score ranges from 0 to 14 points.
* The total of scoring points was used as cut-off (e.g. a total score of 2 resulted in a cut-off of ≥2 points).

**Figure:** Receiver-operating characteristics curve of the Pitt Bacteraemia Score.

Abbreviations: AUC = area under the curve; CI = confidence interval.

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