Evaluation of a Chromogenic Biplate Medium (ChromID MRSA/ChromID S. aureus) for the Simultaneous Detection of Methicillin-Resistant and Methicillin-Susceptible Staphylococcus aureus in Preoperative Screening Samples from the Anterior Nares

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We evaluated the performance of the ChromID MRSA/ChromID S. aureus biplate for the simultaneous detection of Staphylococcus aureus and methicillin-resistant S. aureus (MRSA) in preoperative screening samples. The sensitivity and specificity were 94.2% and 93.6%, respectively, for the S. aureus compartment and 92.9% and 99.7% for the MRSA compartment after 48 h incubation.

Staphylococcus aureus is a common cause of health-care-associated infections (1–3). It is a major health concern because human carriers can spread S. aureus (3, 4). In particular, methicillin-resistant S. aureus (MRSA) is an important concern because it causes infections with higher mortality than infections caused by methicillin-susceptible S. aureus (5).

Screening on hospital admission for surgical procedures and decolonization of nasal carriers of S. aureus have been shown to reduce the number of S. aureus surgical-site infections (6). Given the potentially large number of individuals requiring screening within a presurgical population, rapid and cost-effective surveillance methods are needed (7). Culturing using selective chromogenic agar media is currently the standard procedure routinely used by many clinical laboratories (8). Ideally, selective media should achieve isolation of S. aureus and detect MRSA in one step (9, 10). Recently, the biplate ChromID MRSA/ChromID S. aureus medium (bioMérieux, Marcy-l’Étoile, France) for the simultaneous detection of MRSA and S. aureus was introduced. It is reasonable to assume that such a biplate can reduce workload and thus cost. We evaluated the performance of this biplate in preoperative screening samples.

The study was performed between March and June 2013 at University Hospitals Leuven, a 1,800-bed tertiary care hospital, after approval from the ethical committee. The background prevalences of S. aureus and MRSA in a Belgian outpatient population are estimated at 19.4% and 2.1%, respectively (11). Hospital nurses took 1,200 swabs (ESwab; Copan, Brescia, Italy) from the anterior nares of consecutive patients attending preoperative consultations for all types of surgery. In the laboratory, the swabs were used to inoculate homemade mannitol salt agar (MSA) and then the ChromID S. aureus and ChromID MRSA compartments of the biplate in a random sequence. All agar plates were examined between 16 and 24 h (referred to as 24 h) and between 42 and 48 h (referred to as 48 h) after incubation in ambient air at 37°C according to the manufacturer’s recommendations.

Suspect colonies were identified by characteristic growth morphology and color: yellow on MSA agar, green or blue-green on ChromID S. aureus, and green on ChromID MRSA. These colonies were identified with matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) on a Biotyper MS (Bruker Daltonics, Germany). MRSA isolates were confirmed with (i) an Alere PBP2a culture colony test (Alere Health, Ghent, Belgium) in accordance with the manufacturer’s instructions and (ii) testing for resistance to oxacillin by the cefoxitin disk (30 μg) (Neo-Sensitabs; Rosco, Taastrup, Denmark) method according to the Clinical and Laboratory Standards Institute recommendation (12). All these additional identification tests were performed within 2 h after plate reading. The result of the disk diffusion test was read after overnight incubation of Muller-Hinton agar (homemade) at 37°C.

From the 1,200 surveillance specimens, 311 (25.9%) S. aureus isolates were recovered; 14 (1.2%) were MRSA.

The performance of the ChromID S. aureus and ChromID MRSA compartments of the biplate was evaluated against gold standards. For S. aureus, the gold standard was defined as MALDI-TOF identification of S. aureus from the MSA and/or ChromID S. aureus compartment after 48 h incubation. For MRSA, the gold standard was defined as the MALDI-TOF identification of S. aureus on MSA and/or the ChromID MRSA compartment with a positive PBP2a culture colony test and oxacillin resistance after 48 h of incubation. The raw data and the performance characteristics of both compartments of the biplate are presented in Table 1 and Table 2, respectively.

In the ChromID S. aureus compartment, 57 isolates were falsely identified as S. aureus at 48 h. They were confirmed by MALDI-TOF as coagulase-negative staphylococci (n = 30), Micrococcus luteus (n = 20), Rothia mucilaginosa (n = 4), Streptococcus equinus (n = 1), Bacillus spp. (n = 1), and Listeria spp. (n = 1). Three false-positive results were revealed with MALDI-TOF on
the ChromID MRSA compartment at 48 h: *Bacillus* spp. (n = 2) and *Enterococcus faecalis* (n = 1).

Our study showed very good sensitivity and specificity of the biplate in detecting *S. aureus* and MRSA at 48 h. At 24 h, the performance of the biplate was rather low (sensitivities of 66.2% for *S. aureus* and 57.1% for MRSA) and lower than the performance reported in several other studies. For example, Cherkaoui et al. showed a sensitivity of 76% for detecting MRSA using chromogenic agar from the same manufacturer (13). For detecting *S. aureus*, Perry et al. showed a sensitivity of 97% after 22 h of incubation (14). There are three possible explanations for the differences in results between our findings and theirs. First, the specimens in our study originated from the anterior nares, where the bacterial load is presumably lower than in wound swabs, which were used in the study by Perry et al. (14). Second, reading the plates earlier than 22 h after incubation might be too early to reveal growth. Morris et al. showed that the sensitivity of MRSA chromogenic agar after incubation for 16 to 23 h (48.6%) was substantially lower than the sensitivity after incubation for 22 to 24 h (71.3%) (15). Third, we performed our study as in routine practice, without putting the swab back in the ESwab tube after streaking the first agar and without using enrichment broth. The sensitivity of chromogenic agar in detecting MRSA is lower when no enrichment broth is used (16).

Since there was a considerable number of false positives at 48 h (6%) in the ChromID *S. aureus* compartment, we advise the use of MALDI-TOF for confirmation of green colonies grown at 48 h.

The specificity of the MRSA compartment of the biplate (99.7 to 100%) is high and in line with earlier data (14–18).

Workload and cost of the ChromID *S. aureus*/MRSA biplate should be discussed in case a laboratory considers the implementation of this medium. The time needed to inoculate two separate agar plates is longer than that required to inoculate one biplate (either manually or automatically). Compared to agars such as MSA, where all colonies should be identified, workload is reduced even more. In addition, introduction of MALDI-TOF makes confirmation of suspect colonies on chromogenic agars easy and fast. However, this biplate will not reduce the time to achieve the definitive results, since the maximum sensitivity of the biplate is reached after 48 h. Fast PCR techniques give a result within 1 to 2 h but have the disadvantage of being expensive.

**REFERENCES**


**TABLE 1 Results of the Chrom ID biplate (n = 1,200 ESwabs)**

<table>
<thead>
<tr>
<th>ChromID</th>
<th>Incubation</th>
<th>No. (%) with MALDI-TOF confirmation resulta</th>
<th>Screening for MRSA and <em>S. aureus</em> with a Biplate</th>
<th>MRSA</th>
<th>Positive Total</th>
<th>Sensitivity Specificity PPV NPV (1,200)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S. aureus</strong></td>
<td>16–24</td>
<td>Positive 206 (66.2) 9 (1.0) 215</td>
<td>0 Total</td>
<td>16–24</td>
<td>66.2 99.0 95.8 89.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative 105 (33.8) 880 (99) 985</td>
<td>8 Total</td>
<td>16–24</td>
<td>94.2 93.6 83.7 97.9</td>
<td></td>
</tr>
<tr>
<td>42–48</td>
<td>Positive 293 (94.2) 57 (6.4) 350</td>
<td>18 (5.8) 832 (93.6) 850 Total 311 889 1,200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MRSA</strong></td>
<td>16–24</td>
<td>Positive 8 (57.1) 0 (0) 8</td>
<td>6 (43.9) 1,186 (100) 1,192 Total 14 1,186 1,200</td>
<td>16–24</td>
<td>66.2 99.0 95.8 89.3</td>
<td></td>
</tr>
<tr>
<td>42–48</td>
<td>Positive 13 (92.9) 3 (0.3) 16</td>
<td>1 (7.1) 1,183 (99.7) 1,184 Total 14 1,186 1,200</td>
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</tbody>
</table>

a Result for *S. aureus* from MSA and/or the ChromID *S. aureus* compartment after 48 h of incubation for the *S. aureus* compartment and confirmed *S. aureus* on MSA and/or ChromID MRSA and positive PBP2a test and resistance to oxacillin after 48 h of incubation for the MRSA compartment.

**TABLE 2 Performance characteristics of ChromID S. aureus and MRSA for clinical surveillance swabs (n = 1,200)***

<table>
<thead>
<tr>
<th>ChromID</th>
<th>Incubation</th>
<th>Sensitivity Specificity PPV NPV (1,200)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S. aureus</strong></td>
<td>16–24</td>
<td>66.2 99.0 95.8 89.3</td>
</tr>
<tr>
<td>42–48</td>
<td>94.2 93.6 83.7 97.9</td>
<td></td>
</tr>
<tr>
<td><strong>MRSA</strong></td>
<td>16–24</td>
<td>57.1 100 100 99.5</td>
</tr>
<tr>
<td>42–48</td>
<td>92.9 99.7 81.3 99.9</td>
<td></td>
</tr>
</tbody>
</table>

*PPV, positive predictive value; NPV, negative predictive value.*


