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Evaluation of Brilliance MRSA 2 Agar for Detection of Methicillin-Resistant Staphylococcus aureus in Clinical Samples

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We compared 2 chromogenic media (Oxoid Brilliance MRSA 2 agar [Thermo Fisher Scientific] and MRSA-ID [bioMérieux]) for the detection of methicillin-resistant Staphylococcus aureus (MRSA) in 1,368 hospital samples. For both media, broth enrichment was essential to obtain satisfactory diagnostic performance. Although with direct cultures only, the diagnostic performance (particularly sensitivity) of Brilliance MRSA 2 agar appears better than that of MRSA-ID, no difference in sensitivity or specificity between the media was detected after inclusion of an enrichment step.

Rapid and accurate screening of patients for methicillin-resistant Staphylococcus aureus (MRSA) is essential to control MRSA in hospitals. Several chromogenic selective media have been developed to facilitate such screening. We previously compared the diagnostic performances of two of these media, Brilliance MRSA agar (Thermo Fisher Scientific) and MRSA-ID (bioMérieux, France), for the detection of MRSA in nose and throat samples taken from veterinarians and their household members (1). Although sensitivities were high and similar for both media, the specificity of the Brilliance MRSA agar (88.7%) was substantially less than that of MRSA-ID (98.5%). Since then, the manufacturer of the Brilliance MRSA agar has redeveloped the medium to improve its accuracy, particularly the specificity, which would reduce the number of confirmatory tests required. In the current study, we compared the performances of the new Brilliance MRSA 2 agar and MRSA-ID for the detection of MRSA.

The study was conducted in the Laboratory for Microbiology and Infection Control in Amphia Hospital, Breda, The Netherlands. In this laboratory, the MRSA-ID medium was used for the routine screening for MRSA, and the Brilliance MRSA 2 agar was included as a comparator for this study. The composition of each chromogenic medium is proprietary. The selective mixture inhibits the growth of methicillin-sensitive staphylococci and most other bacteria and yeasts. Contrary to MRSA-ID medium, the performance of Brilliance MRSA 2 agar is not affected by light exposure, which is a practical advantage in its use. On Brilliance MRSA 2 agar, MRSA forms distinctive blue colonies, while such colonies on the MRSA-ID medium are green.

Rectal, throat, and nose swabs were collected between December 2011 and July 2012 using the ESwab transport medium (Copan Diagnostics). ESwab containers were vortexed, and swabs were used to inoculate both MRSA-ID agar and Brilliance MRSA 2 agar plates and a Columbia agar plate with 5% sheep blood (SBA growth control). The order in which samples were inoculated on the 2 chromogenic media was alternated weekly. The fluid remaining from the ESwab container (500 to 1,000 µl) was inoculated in Mueller-Hinton broth (6.5% NaCl) that was subcultured after 18 to 24 h of incubation at 36 to 37°C in normal atmosphere on both chromogenic media and on a Columbia agar plate with 5% sheep blood (SBA). The latter was included as a backup to detect the presence of MRSA strains that would remain undetected by both chromogenic media.

All agar plates were read after 18 to 24 h of incubation at 36 to 37°C, according to instructions of the manufacturers. Because all procedures were performed in the context of routine laboratory procedures, cultures obtained with each of the three media from single samples were examined by single laboratory technicians. Classification (suspect or non-suspect) of colony growth was done before the results of the confirmatory tests were known, and technicians were specifically instructed not to amend their initial classification. As a gold standard for the presence of MRSA in a sample, MRSA had to be recovered from at least one of the media, including the SBA plate. Colony growth was classified as follows: (i) no growth, (ii) colonies not suspected as MRSA, and (iii) colonies indicative of MRSA. Isolates from suspect colonies were then identified using a latex agglutination test (Staph Plus kit; Diagnostic Mondial Laboratories, Vienna, Austria) and a test for DNase production (Oxoid DNase agar; Thermo Fisher Scientific, Basingstoke, United Kingdom). When isolates were identified as Staphylococcus aureus, methicillin resistance was detected by automated susceptibility testing (Vitek 2; bioMérieux) and by cefoxitin disk diffusion tests using the criteria defined by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) for methicillin resistance (2). For each new MRSA isolate per patient, and if results of the 2 media were discordant in subsequent cultures from that patient, we tested for the presence of the mecA gene by PCR (GeneXpert; Cepheid). In samples without suspect growth on the chromogenic media, any colony of S. aureus growing on SBA was tested for methicillin resistance.

Of 1,368 samples that were screened, 102 samples (42 patients) tested positive. None of the MRSA strains were detected on SBA only. After direct inoculation (without the enrichment step), only 67 and 53 MRSA-positive samples were detected by Brilliance MRSA 2 agar and MRSA-ID, respectively. Thus, sensitivities for both chromogenic media after direct inoculation were very low, although the Brilliance MRSA 2 agar performed better than MRSA-ID (sensitivities were 65.7% and 52.0% for Brilliance MRSA agar [88.7%] and MRSA-ID [98.5%]).
MRSA 2 agar and MRSA-ID, respectively; $P < 0.001$; McNemar’s test for paired samples). Specificity was slightly higher using the Brilliance MRSA 2 agar medium (1,256/1,266 and 1,263/1,266 for MRSA-ID and Brilliance MRSA 2 agar, respectively; $P = 0.09$) (Table 1), but the statistical evidence was not strong. Overall, diagnostic accuracy was higher for the Brilliance MRSA 2 agar than for MRSA-ID (97.2% versus 95.7%, respectively; $P < 0.001$).

With inclusion of a broth enrichment step, sensitivity dramatically increased for both media: the Brilliance MRSA 2 agar detected all MRSA-positive samples, while the MRSA-ID medium detected 100/102 (98.0%) positive samples ($P = 0.50$). Specificities remained high and similar for both media (99.1% and 98.8% for Brilliance MRSA 2 agar and MRSA-ID, respectively; $P = 0.70$), with 12 and 15 false positives for the Brilliance MRSA 2 agar and MRSA-ID, respectively. Predictive values and diagnostic accuracy are shown in Table 1. Lastly, growth of bacterial isolates not suspected for MRSA was found more frequently on the MRSA-ID medium than on the Brilliance MRSA 2 agar (919/1,368 [67.2%] versus 764/1,368 [55.8%], respectively; $P < 0.001$).

In conclusion, the current Brilliance MRSA 2 agar has substantially improved specificity compared to that of the previous version, while sensitivity remained high. When no enrichment is used, its diagnostic performance (in particular, sensitivity) was superior to that of MRSA-ID, but no evidence of a difference between the media was found after broth enrichment. It should be noted that the study size limits the detection of small differences in sensitivity. The most striking finding of this study is that almost half of all MRSA isolates remained undetected when using direct culture only, an observation which confirms previous reports that broth enrichment is essential for detection of MRSA (1, 3–5).

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