Three chromogenic media, chromID MRSA SMART (SMART), chromID MRSA first generation (chromID), and Brilliance MRSA (OX2), were evaluated for methicillin-resistant Staphylococcus aureus (MRSA) screening using 1,220 samples. The sensitivity at 24 h was significantly better with the SMART agar (66.4%) than that with chromID agar (50.5%). Enrichment and incubation until 48 h are still needed for an optimal yield.

Methicillin-resistant Staphylococcus aureus (MRSA) is a major cause of nosocomial infections (1, 2). Asymptomatic carriers in the nose, throat, or on the skin represent the major reservoirs for MRSA transmission in hospitals (3, 4). Rapid identification of MRSA colonization is of utmost importance to identify carriers in order to implement infection control procedures and reduce patient-to-patient transmission (5–7). Several chromogenic agars have been specifically developed for MRSA screening. These media show superior sensitivity and specificity compared to genic agars have been specifically developed for MRSA screening. The selectivity was assessed by the growth of noncharacteristic colonies (annex flora), which was evaluated by recording its abundance using a semiquantitative method (streaking method). High selectivity was defined as the absence of growth in media. The selectivity was estimated by the McNemar test (Stata 12 software).

This prospective study was conducted between January and May 2014 at Hôpital Erasme, Brussels, Belgium, and Amphia Hospital, Breda, The Netherlands. Screening samples were collected from patients admitted to both hospitals using ESwab transport medium (Copan Diagnostics). The swabs were inoculated into EB supplemented with 6.5% NaCl (bioMérieux) and directly on the SMART, chromID, and OX2 agars, and a Colombia agar plate with 5% sheep blood (SBA) (growth control) at 35 to 37°C. EB was subcultured after 24 h until 48 h are still needed for an optimal yield.

Each new MRSA isolate per patient and discrepant results between the three media were tested for the presence of the mecA gene by in-house PCR (Erasme) (12) or GeneXpert (Xpert SA nasal G3 kit version 4; Cepheid) (Amphia). Discrepant results (typical MRSA colonies and mecA negative) were further analyzed for the presence of the mecC gene, and the MICs to cefoxitin and oxacillin were determined (11, 13). The presence of MRSA recovered from at least one of the media (primary chromogenic agar or after enrichment) was considered the gold standard. True-positive results were defined as MRSA isolates showing characteristic colonies (color and morphology) confirmed by PCR, false-positive results as isolates with typical colonies not confirmed by PCR (mecillin-susceptible S. aureus [MSSA] or a member of another taxon), and false-negative results as MRSA isolates confirmed by PCR not showing typical colonies or not growing on one of the media. The sensitivity was assessed by the growth of noncharacteristic colonies (annex flora), which was evaluated by recording its abundance using a semiquantitative method (streaking method). High selectivity was defined as the absence of growth in media. The selectivity was estimated by the McNemar test (Stata 12 software).

Five hundred eighty-nine patients (385 from Erasme and 204 from Amphia) were screened for MRSA carriage by sampling swabs from the nares (n = 605), throat (n = 206), perineum (n = 199), and skin (n = 27), as well as pooled samples (n = 154) and other samples (n = 29). Thirty-four samples (2.7%) were excluded because the growth was negative. Some patients were sampled more than once (1 to 15 samples/patient). MRSA strains were isolated from 107 specimens (~9% in both hospitals) either from the SMART (n = 101), OX2 (n = 99), or chromID (n = 98) agars. Ninety-three strains were recovered from all three media, 5 from two media, and 9 from only one of the media tested. After 24 h of incubation, 79 of 107 MRSA strains (73.8%) were detected, 15 additional MRSA strains (14.0%) were isolated at 48 h, and 13 strains (12.2%) were isolated only after the enrichment step.
New Chromogenic Agars for MRSA Screening

The performance of each medium after 24 and 48 h of incubation and enrichment is shown in Table 1. The highest overnight sensitivity was 66.4% with the SMART agar, followed by that with the OX2 (60.7%) and chromID (50.5%) agars. The sensitivity increased to 78.5% (SMART), 72.9% (OX2), and 71% (chromID) after 48 h and was ≥85% after the enrichment step for all three agars. The difference in sensitivity was statistically significant between the SMART and chromID agars at 24 and 48 h (P < 0.001 and 0.03, respectively) and between the OX2 and chromID agars after overnight incubation (P = 0.02). The specificity of the different selective agars at 24 h was excellent (≥99%) but decreased significantly (P < 0.05) after 48 h of incubation and enrichment. The organisms responsible for false-positive results were mainly *Enterococcus* spp., *Enterobacter* spp., coagulase-negative *Staphylococcus*, and MSSA. Even if the specificity of the SMART agar was not statistically different between the two centers (P = 0.12, Pearson’s chi-square test), the MSSA isolates were more significantly able to grow and produce false-positive results on the SMART agar after 48 h of incubation or after enrichment at the Belgian site (P < 0.001). All three media showed high selectivity, especially after 24 h of incubation.

Rapid and accurate detection of MRSA carriers is the key to implementing infection control procedures. Any delay in the reports will impact patient management. Laboratory screening for MRSA requires a balance between specificity, sensitivity, cost, and rapidity of detection. Culture with selective chromogenic agar is currently the standard procedure routinely used by most laboratories for MRSA screening (14). Ideally, selective media should detect MRSA in one step to decrease the turnaround time. Prolonging the incubation time to 48 h and using enrichment broth enhance the sensitivity of MRSA detection at the expense of decreasing specificity.

The SMART agar is intended to allow optimal reading at 18 to 24 h of incubation and to reduce additional work through improved specificity. The sensitivity of the SMART agar was statistically significantly higher at 24 h than that with chromID, but no difference in sensitivity between the SMART and OX2 agars was observed. However, 30 (29.7%) of MRSA isolates detected in the present study would have been missed by the SMART agar if screening samples had been inspected only at 18 to 24 h. As previously reported, an EB step increases the yield for MRSA detection, which is also the case for the new SMART agar (8, 10, 15). A difference in the specificity of the SMART agar plates was noted between the two study sites at 48 h of incubation. This observation was subsequently determined to be due to more frequent breakthrough of MSSA on the medium at one site. All MSSA strains growing on the SMART agar were susceptible to cefoxitin and oxacillin and negative for the mecA and mecC genes. Upon further review, the manufacturer discovered a solubility issue with the selective antibiotic used to suppress the growth of MSSA, resulting in subinhibitory concentrations in some batches. As a result, the production process and quality control steps were modified to ensure appropriate concentrations of the selective agent in the medium. After correction, the MSSA isolates resulting in false-positive interpretations were retested and showed no growth on the medium through to the end of the product shelf-life.

In conclusion, the SMART agar has substantially improved sensitivity, particularly at 24 h of incubation, compared to that of the previous version, but enrichment before inoculation and prolonged incubation for 48 h are needed for an optimal yield. This
study shows that the new bioMérieux SMART agar provides a viable alternative to the OX2 and chromID agars for MRSA culture screening.

ACKNOWLEDGMENTS

We thank Judith Racapé for the statistical analysis, Slavka Penickova for her technical assistance, and bioMérieux and Oxoid, which kindly provided the agars used in this study.

This study was supported by funding from bioMérieux.

Jan Kluytmans is a consultant for bioMérieux.

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