a positive culture, sufficient colonies are usually available for performing identification and susceptibility procedures. However, the attached agar slant and liquid medium must be inspected carefully and individually to detect growth, and each bottle must be inverted individually for subculturing. The Oxoid Signal system has an advantage in that growth is easily seen when observing whole series of bottles on a rack in the incubator. In only 15 (0.7 %) instances a signal of less than 1 mm appeared when broth turbidity was noted and a microorganism could be cultured. The false positive signals can be reduced if less than 10 ml of blood is inoculated per bottle or the Signal device is attached after the bottle has been preincubated. Both systems have the advantages of being free of special equipment costs and easily usable in a routine laboratory.

References


Comparative Evaluation of a Latex Test for the Identification of Staphylococcus aureus

M. Stevens*, C. Geary

A rapid latex agglutination test, Staphaurex, was tested for its ability to identify Staphylococcus aureus using 72 reference strains and 785 clinical isolates of the family Micrococcaceae. All reference strains of Staphylococcus aureus were Staphaurex-positive. Non-Staphylococcus aureus reference strains were negative. Using clinical strains, the results of the Staphaurex test were compared with the results of other tests commonly used to identify Staphylococcus aureus. A total of 393 clinical isolates were classified as Staphylococcus aureus. The Staphaurex, slide coagulate, tube coagulate/human plasma and tube coagulate/rabbit plasma tests correctly identified 98 %, 93.6 %, 93.6 % and 97.5 % of the Staphylococcus aureus strains, respectively. The performance of the Staphaurex test, in terms of sensitivity and specificity, was significantly better than the slide coagulate test. It was as sensitive and almost as specific as the tube coagulate rabbit test and more sensitive than the tube coagulate human test.

The tube and slide coagulate tests have been widely employed to differentiate Staphylococcus aureus from other species of Staphylococcus and from Micrococcus spp. False tube coagulate results due to non-specific reactions, variability in plasma types and type of anticoagulant used have been reported (1). Other methods have been employed to identify Staphylococcus aureus, including tests to determine the production of deoxyribonuclease (DNase) (2) and thermostable nuclease (TNase) (3). Clumping factor and coagulate-negative strains of Staphylococcus aureus are documented (4).

Essers and Radebold (5) described a whole plasma-coated latex agglutination test that simultaneously detected clumping factor and protein A and that has been advocated as a valuable additional test for the identification of Staphylococcus aureus (6). A commercially produced latex agglutination test (Staphaurex, Wellcome Diagnostics, UK) is evaluated here. The reagent consists of polystyrene latex particles coated with fibrinogen and IgG. When
mixed with a suspension of *Staphylococcus aureus*, agglutination of the latex particles occurs either by the interaction of clumping factor with the fibrinogen or by the action of protein A on the Fc segment of the IgG or by both. The purpose of this study was to determine in a routine clinical laboratory the performance of the Staphaurex test in its ability to detect *Staphylococcus aureus* and to compare it with that of other commonly used methods.

**Materials and Methods.** A total of 72 strains obtained from culture collections and representing the family *Micrococcaceae* were tested. Many were used in the taxonomic study of Feltham (7). The reference strains studied and the number tested were as follows: *Staphylococcus aureus* (11), *Staphylococcus sciuri* (11), *Staphylococcus epidermidis* (8), *Staphylococcus saprophyticus* (5), *Staphylococcus intermedius* (5), *Staphylococcus haemolyticus* (3), *Staphylococcus warneri* (3), *Staphylococcus cohnii* (2), *Staphylococcus simulans* (6), *Staphylococcus capitis* (2), *Staphylococcus xylosus* (2), *Planococcus citreus* (1), *Micrococcus nishinomiyaensis* (2), *Micrococcus kristinae* (1), *Micrococcus sedentarius* (1), *Micrococcus lylae* (1) and *Staphylococcus* spp. (3). A total of 785 catalase-positive, gram-positive cocci exhibiting colonial characteristics of staphylococci were obtained from clinical specimens. They were confirmed as *Staphylococcus* spp. on the basis of catalase activity, acid production from glycerol in the presence of erythromycin, and susceptibility to Lysostaphin (8).

The tube coagulase/rabbit and tube coagulase/human tests were performed using a brain heart infusion (BHI) (Oxoid, UK) broth culture with fresh rabbit plasma and pooled sequestrated human plasma, respectively (9). The tube coagulase/rabbit and tube coagulase/human tests were read hourly for 4 h and after overnight incubation at room temperature, based on the observation that occasional isolates of *Staphylococcus aureus* will not produce coagulase at 37 °C (10). The slide coagulase test was performed using Wellcome rabbit plasma (Wellcome Diagnostics, UK) (11). The Staphaurex latex agglutination test was performed as directed by the manufacturer. The DNase test was performed using DNase agar (Oxoid, UK), according to the manufacturer's instructions. Thermostable nuclease activity (TNase) was determined by the method of Lachica et al. (3). Certain apparently aberrant strains were tested with APISTAPH (API Laboratory Products, UK) for identification of species. Novobiocin sensitivity was tested by incorporating the antibiotic into Mueller-Hinton agar (Oxoid, UK) at a concentration of 1.6 mg/l.

Strains exhibiting both TNase and DNase activity and possessing free and/or bound coagulase were classified as *Staphylococcus aureus*. The sensitivity of the tests was defined as the percentage of test positives considered to be *Staphylococcus aureus*. The specificity was defined as the percentage of test negatives considered to be species other than *Staphylococcus aureus*. Statistical significance was determined using the chi-square test applying Yate's correction.

**Results and Discussion.** All the reference strains were Staphaurex-negative except for *Staphylococcus aureus*. A total of 393 clinical isolates that were TNase- and DNase-positive and that demonstrated free or bound coagulase were designated *Staphylococcus aureus*. Eight *Staphylococcus aureus* strains were Staphaurex-negative. Of these, seven were slide coagulase-negative, but positive for the other tests. One strain was autoagglutinable in the slide coagulase test and negative in the tube coagulase test using human plasma. A further 392 strains did not conform to the above criteria for *Staphylococcus aureus* and were designated non-*Staphylococcus aureus*. Table 1 shows the performance of the tests.

In this study 349 strains (Strain group A, Table 2) produced free coagulase (detected by human and rabbit plasma), clumping factor, heat stable nucleases and DNase. All of these strains, which included ten

<table>
<thead>
<tr>
<th>Test</th>
<th><em>S. aureus n = 393</em></th>
<th></th>
<th><em>non-S. aureus n = 392</em></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td>Auto-agglutination</td>
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<tr>
<td>Staphaurex</td>
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<td>Tube coagulase (rabbit plasma)</td>
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<td>Tube coagulase (human plasma)</td>
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<td>0</td>
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<tr>
<td>Slide coagulase</td>
<td>368</td>
<td>21</td>
<td>4</td>
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</tbody>
</table>

Table 1: Comparison of Staphaurex, tube coagulase and slide coagulase tests for identification of *Staphylococcus* spp.