

Evaluation of a Direct Identification Method for *Staphylococcus aureus* from Blood Culture Broth

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We evaluated the reliability of Staphaurex (Wellcome Diagnostics, Dartford, England) for the direct identification of staphylococci from blood culture broth with evidence of positivity and a suggestive Gram-stained smear. Our evaluation indicates that this application is of limited sensitivity, thus reducing the value of a negative test. However, since the test is highly specific, a positive test is significant in predicting the isolation of *Staphylococcus aureus*.

Recently introduced commercial latex agglutination and hemagglutination assays for the rapid detection of *Staphylococcus aureus* have been reported to be as sensitive and specific as the tube coagulase test (1-3) and more accurate than the slide coagulase test (1, 2). The commercial assays detect the presence of clumping factor and protein A. Staphaurex (Wellcome Diagnostics, Dartford, England) is a commercially available assay consisting of latex particles coated with fibrinogen for the detection of clumping factor and with immunoglobulin G for the detection of protein A, which has a specific affinity for the Fc moiety of immunoglobulin G. The test is simple to perform, and the results are available in less than 30 s. Some researchers have indicated that some of these commercial assays were not as sensitive as the tube coagulase or thermonuclease test for the detection of methicillin-resistant *S. aureus* (2-4, 6, 7). Others suggested that this lack of sensitivity may be due to lack of protein A on the cell surfaces of these resistant strains (1).

Because of the clinical importance of isolating *S. aureus* from blood cultures and the necessity for prompt initiation of vigorous antimicrobial therapy, the rapid identification of *S. aureus* may be of value in determining the significance of isolates from blood cultures, since coagulase-negative staphylococci are frequently, albeit not invariably, skin contaminants. Rigby investigated the reliability of the thermonuclease test for the direct identification of staphylococci from blood cultures and concluded that it was a rapid and reliable method for the direct identification of staphylococci (5).

In light of the ease of performance of Staphaurex and the almost instantaneous results, we conducted this study to evaluate its reliability for the direct identification of staphylococci from blood culture broth of BACTEC bottles (Johnston Laboratories, Towson, Md.).

Blood samples were drawn at the bedside and inoculated immediately into BACTEC 6B and 7D bottles. Upon arrival in the laboratory, the bottles were incubated and read on the BACTEC 460 by following manufacturer recommendations. Aerobic and anaerobic bottles which were visually positive or with a high growth index reading were Gram stained and subcultured to blood and chocolate agar plates. Only bottles indicating gram-positive cocci in clumps in the blood culture broth were included in the evaluation.

A 1-ml sample of well-mixed blood culture broth was aseptically removed from positive BACTEC bottles with a

3-ml syringe. The broth was then transferred to a sterile test tube and centrifuged for 10 min at $1,000 \times g$, and the supernatant was discarded. The Staphaurex test was performed on the pelleted erythrocytes and bacteria by following the manufacturer recommendation for a suspension of isolated colonies. One drop of the pellet was used per test. To determine the effect of the presence of erythrocytes on test performance, a second 1-ml sample was removed from a limited number of BACTEC bottles. The erythrocytes were removed by an initial centrifugation at $500 \times g$ for 5 min. The resulting supernatant was then subjected to the method described above for separating the pellet. Positive reactions for the direct tests often took longer than the 20 s recommended by the manufacturer as the reading time for a suspension of isolated colonies. Reactions were graded negative to 4+ and recorded after the test card was rotated for 1 min. Staphaurex was repeated on isolated colonies from blood agar plates the following day by following the manufacturer recommendations, for the definitive identification of *S. aureus*.

A total of 199 blood cultures positive on Gram stain for gram-positive cocci in clumps were thus studied. Of the 26 cultures identified as positive for *S. aureus* from blood agar subculture, 14 were positive by direct Staphaurex with strong 4+ reactions, and 12 were negative. A total of 173 cultures were identified as coagulase-negative staphylococci on subculture. Direct Staphaurex testing on two of these cultures showed a weak 1+ reaction, while the remaining 171 tests were negative (Table 1). No attempt was made to quantitate the organisms present in the blood culture bottles at the time of the testing. It is conceivable that the low number of *S. aureus* may have contributed to the low sensitivity of the test; however, we cannot prove or disprove this possibility retrospectively.

The high specificity (98.8%) of the test is significant in that a positive result may be interpreted as a presumptive indication of the presence of *S. aureus* in blood cultures pending confirmation based on isolated colonies 1 day later. Both instances of false-positive direct Staphaurex results occurred early in the study. No further problems were noted with false-positive results during the remainder of the study. Whether the false-positive results were a consequence of over reading by the technologist performing the test is purely speculative at this point. Removal of erythrocytes from the blood culture before the organisms were pelleted did not

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TABLE 1. Comparison of direct Staphaurex on pellet from positive blood culture broth and results of final identification of staphylococci

Final identification	No. of results of direct Staphaurex on pellet ^a		Total
	Positive	Negative	
<i>S. aureus</i>	14	12	26
Coagulase-negative staphylococcus	2	171	173
Total	16	183	199

^a Sensitivity, 53.8%; specificity, 98.8%; predictive value of positive test, 87.5%; predictive value of negative test, 93.4%; efficiency, 93.0%.

improve the intensity of the reaction or the sensitivity and specificity of the test.

In conclusion, performing the Staphaurex directly on the pelleted sediment of blood culture broth positive for gram-positive cocci in clumps lacks sensitivity, but its high specificity makes it of some value for the early detection of *S. aureus* bacteremia. This application of Staphaurex lacked the sensitivity of the thermonuclease test as reported by Rigby (5). If Staphaurex is to be used, new procedures need to be investigated to improve the sensitivity of the test for this particular application.

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