

Problems with Rapid Agglutination Methods for Identification of *Staphylococcus aureus* When *Staphylococcus saprophyticus* Is Being Tested

DAN B. GREGSON, DONALD E. LOW, MARTIN SKULNICK, AND ANDREW E. SIMOR*

Department of Microbiology, Mount Sinai Hospital, University of Toronto, Toronto, Ontario M5G 1X5, Canada

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Six rapid agglutination tests for identification of *Staphylococcus aureus* were evaluated by using 62 strains of *S. aureus*, 63 strains of *S. saprophyticus*, and 67 strains of other coagulase-negative staphylococci. *S. saprophyticus* was responsible for 19 of 26 false-positive results and 20 uninterpretable reactions. Thus, urinary staphylococcal isolates that are positive by rapid agglutination tests may require other confirmatory tests for the identification of possible *S. saprophyticus*.

Rapid agglutination tests have been developed to identify *Staphylococcus aureus* directly upon primary isolation. These test kits are based on the agglutination of either sensitized erythrocytes or latex particles by *S. aureus* clumping factor or protein A. Although previous studies have shown most of these kits to be highly sensitive and specific for the identification of *S. aureus* (1-4, 7, 11), we noted occasional false-positive results when strains of *S. saprophyticus* were tested with one such kit. A similar observation was also made by Berke and Tilton (3), who described false-positive reactions with three of six strains of *S. saprophyticus* tested with several commercial agglutination assays. However, no study has specifically evaluated these kits with large numbers of *S. saprophyticus* isolates. We therefore evaluated the ability of six rapid agglutination tests to differentiate *S. aureus* from *S. saprophyticus*.

Sixty-two isolates of *S. aureus*, 67 isolates of coagulase-negative staphylococci other than *S. saprophyticus* (63 *S. epidermidis* and 4 *S. haemolyticus*), and 63 urinary isolates of *S. saprophyticus* were obtained from three Canadian cities (Toronto, Hamilton, and Winnipeg). The methods of Kloos and Schleifer (6) and thermostable DNase were used to identify all isolates. All strains of *S. aureus* used in this study were susceptible to methicillin as determined by the standards of the National Committee for Clinical Laboratory Standards (9).

Six rapid agglutination test kits were evaluated: Staphyloslide (BBL Microbiology Systems, Cockeysville, Md.), Staphylase (Oxoid, Basingstoke, England), Staphylatex (American MicroScan, Mahwah, N.J.), Staphaurex (Wellcome Diagnostics, Dartford, England), Bacto Staph Latex (Difco Laboratories, Detroit, Mich.), and IDS Staphylochrome Test (Innovative Diagnostics Systems, Atlanta, Ga.). Staphyloslide and Staphylase kits are hemagglutination methods, and the remainder are latex agglutination assays.

All staphylococcal isolates were stored at -70°C. Slide agglutination tests were conducted according to the instructions provided with the kits. All tests were done blinded to the identification of the isolate and independently of other kits to prevent pretest bias. Test results were recorded as positive, negative, or uninterpretable. Uninterpretable tests occurred when there was agglutination of negative controls.

The sensitivities and specificities of the various kits tested

are shown in Table 1. All of the tests were found to be very sensitive for the identification of *S. aureus*. If uninterpretable reactions are excluded, all kits, with the exception of the IDS Staphylochrome Test, were also highly specific for *S. aureus*. The Staphylase kit had the lowest sensitivity (95%), and the IDS Staphylochrome Test had the lowest specificity (86%). Incorrect identification results for all test kits are summarized in Table 2. Whereas testing other coagulase-negative staphylococci gave only 7 false-positive results, *S. saprophyticus* was responsible for 19 of 26 false-positive results and all of the 20 uninterpretable reactions. False-positive results with *S. saprophyticus* occurred with 12 strains (18%) when the IDS Staphylochrome Test was used and with six isolates (9%) when Staphaurex was used. All kits were easy to use, but the latex agglutination tests could be done more rapidly than erythrocyte agglutination tests when large numbers of isolates were tested at once.

The results of this study confirm previous reports (1-4, 7, 11) that these rapid agglutination tests are sensitive and relatively specific for the identification of *S. aureus*. However, problems were apparent when strains of *S. saprophyticus* were tested. All uninterpretable results occurred when strains of *S. saprophyticus* were tested by Staphyloslide and Staphylase, the tests using the hemagglutination method. Direct interaction with unsensitized erythrocyte surface components is the presumed mechanism of these uninterpretable reactions. These results confirm the necessity of using negative controls when staphylococci are tested by rapid agglutination tests. False-positive reactions occurred with strains of *S. saprophyticus* that were tested by the IDS

TABLE 1. Performance characteristics of six rapid agglutination tests for the identification of *S. aureus* among 192 staphylococcal isolates^a

Test	Sensitivity (%)	Specificity (%)
Staphyloslide	98	100 ^b
Staphylase	95	99 ^b
Staphylatex	97	99
Staphaurex	100	95
Bacto Staph Latex	100	100
IDS Staphylochrome Test	98	86

^a 62 *S. aureus*, 63 *S. saprophyticus*, 63 *S. epidermidis*, and 4 *S. haemolyticus*.

^b Nine uninterpretable results from Staphyloslide and 11 uninterpretable results from Staphylase were excluded when the specificity was calculated.

* Corresponding author.

TABLE 2. Results of testing *S. aureus*, *S. saprophyticus*, and other staphylococci with six rapid agglutination kits

Test	Agglutination reaction particle	No. of test results ^a with:								
		<i>S. aureus</i> (n = 62)			Coagulase-negative staphylococci (n = 67)			<i>S. saprophyticus</i> (n = 63)		
		+	-	Un	+	-	Un	+	-	Un
Staphyloslide	Erythrocyte	61	1	0	0	67	0	0	54	9
Staphylase	Erythrocyte	59	3	0	1	66	0	0	52	11
Staphylatex	Latex	60	2	0	0	67	0	1	62	0
Staphaurex	Latex	62	0	0	0	67	0	6	57	0
Bacto Staph Latex	Latex	62	0	0	0	67	0	0	63	0
IDS Staphylochrome Test	Latex	61	1	0	6	61	0	12	51	0

^a Symbols: +, positive result; -, negative result; Un, uninterpretable reaction.

Staphylochrome Test, Staphaurex, and Staphylatex, i.e., kits using latex particles coated with fibrinogen and immunoglobulin G. As all isolates with uninterpretable results would require alternative methods of species identification and as false-positive reactions would incorrectly identify isolates as *S. aureus*, the utility of these agglutination kits may be limited when specimens with a high frequency of *S. saprophyticus* are tested.

In summary, we conclude that *S. saprophyticus* can commonly cause false-positive and uninterpretable results when tested with rapid agglutination kits for the identification of *S. aureus*. Since *S. saprophyticus* is an important cause of urinary tract infections (5, 8), we recommend that urinary staphylococcal isolates undergo other confirmatory tests, such as tube coagulase and novobiocin disk screen (8, 10) tests, for the presumptive identification of *S. saprophyticus*.

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