

## Evaluation of a New Chromogenic Medium, *MRSA Select*, for Detection of Methicillin-Resistant *Staphylococcus aureus*<sup>∇</sup>

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**We compared *MRSA Select* to mannitol-salt agar with 8 µg/ml cefoxitin for the detection of methicillin-resistant *Staphylococcus aureus* (MRSA) from 6,199 clinical samples submitted for MRSA screening. The sensitivities and specificities of *MRSA Select* and mannitol-salt agar with cefoxitin were 98% and 92% versus 90% and 78%, respectively ( $P < 0.0001$ ). Most (96%) MRSA were detected after overnight incubation using *MRSA Select*.**

The clinical burden and costs associated with infection due to methicillin-resistant *Staphylococcus aureus* (MRSA) in hospitalized patients can be substantial (2, 10). It is now recognized that screening high-risk hospitalized patients to detect MRSA colonization is an effective infection control measure to reduce the risk of transmission of the organism within health care facilities (1, 14, 17). Traditional methods for the detection of MRSA from surveillance and screening specimens have included the use of a variety of selective and differential solid media (3, 12, 18, 19, 23). The use of broth culture enhancement may improve the yield of MRSA, but it is more laborious and may delay identification of the organism (7, 18, 22). The addition of the cephamycin antibiotic cefoxitin into mannitol-salt agar appears to improve the sensitivity for isolation of MRSA (20, 21; L. Louie, D. Soares, M. Vearncombe, H. Meaney, and A. Simor, Abstr. 105th Gen. Meet. Am. Soc. Microbiol., abstr. C105, p. 123, 2005).

More recently, chromogenic media incorporating chromogenic enzymatic substrates and a variety of antimicrobial agents have become available for detection of *S. aureus*, including methicillin-resistant strains (4–6, 8, 11, 13, 16, 21). Some of the evaluations of these media involved only stored collections of isolates, while others included a relatively small number of clinical specimens. We evaluated a new, commercially available chromogenic medium, *MRSA Select* (Bio-Rad Laboratories, Marnes-la-Coquette, France) and compared it to mannitol-salt agar with 8 µg/ml cefoxitin (MRSA MSA modified agar; Quelab Laboratories, Inc., Montreal, Quebec, Canada) for its ability to detect MRSA from patient specimens submitted for MRSA screening. The objectives of this evaluation were as follows: (i) to determine the sensitivities of the two culture media for detecting MRSA, (ii) to determine the abilities of the media to detect MRSA after overnight and 48-h incubation, and (iii) to determine which screening culture medium requires less workup of isolates subsequently determined not to be MRSA (specificities of the media).

A total of 6,199 specimens submitted for MRSA screening (surveillance) from 1,883 hospitalized patients were included in the study, consisting of nares swabs ( $n = 2,483$ ), perianal/rectal swabs ( $n = 2,312$ ), samples from vascular catheter exit sites ( $n = 647$ ), and skin/soft tissue ( $n = 632$ ), sputum ( $n = 58$ ), and urine ( $n = 67$ ) samples. All specimens were plated onto *MRSA Select* and mannitol-salt agar with 8 µg/ml cefoxitin (MSFOX) using the Isoplater 180 (Vista Technologies Inc., Edmonton, Alberta, Canada). The order of which plates were plated first alternated between the two media every 100 specimens. All plates were incubated at 35°C in ambient air; *MRSA Select* plates were stored and incubated in the dark. The plates were read independently at 18 to 24 h and at 48 h by experienced technologists, blinded to results obtained by each other. Suspicious colonies (small pink colonies on *MRSA Select*; yellow or pale yellow colonies on MSFOX) were identified as MRSA using conventional methods, including Gram staining, Pastorex Staph latex (Bio-Rad), tube coagulase (BD BBL coagulase plasma; Becton Dickinson Company, Sparks, MD), and latex agglutination for PBP2a (MRSA-Screen; Denka Seiken, Tokyo, Japan).

MRSA was isolated from 181 (3%) of the 6,199 specimens and from 77 (4%) of the 1,883 patients that were screened. The numbers of MRSA isolated from each medium after overnight and 48-h incubations are summarized in Table 1. *MRSA Select* detected a total of 177 (98%) MRSA compared to 163 (90%) isolates that grew on MSFOX ( $P = 0.003$ ). Although *MRSA Select* failed to recover MRSA from four specimens, this did not result in misdiagnosis of any of these patients, as other specimens from these patients collected concurrently yielded MRSA using *MRSA Select*. Of the 177 MRSA recovered on *MRSA Select*, 169 (96%) grew after overnight incubation, whereas only 125 (77%) MRSA were isolated with MSFOX after overnight incubation ( $P < 0.0001$ ). The yields of MRSA from various anatomic sites were similar for the two media, except for perianal/rectal swabs, where *MRSA Select* detected 64 MRSA and MSFOX detected only 55 ( $P = 0.003$ ). The sensitivities and specificities for all specimens and by specimen type after overnight and 48-h incubations are summarized in Table 2.

The number of specimens with suspicious colonies requiring further investigation that turned out not to be MRSA differed

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TABLE 1. Summary of screening culture results of MRSA *Select* and mannitol-salt agar with ceftioxin for 6,199 specimens

Medium	No. (%) of MRSA ( <i>n</i> = 181) after incubation for:		No. (%) of specimens with the following culture result after incubation for the indicated time:			
	18–24 h	48 h	No growth or no suspicious colonies		Growth of suspicious colonies (not MRSA), requiring further workup	
			18–24 h	48 h	18–24 h	48 h
MRSA <i>Select</i>	169 (93)	177 (98)	6,002 (99.5)	5,552 (92)	28 (0.5)	470 (8)
Mannitol-salt agar with ceftioxin	125 (69)	163 (90)	5,627 (93)	4,676 (77)	447 (7)	1,360 (23)

substantially between the two media, with 1,360 of 6,199 (23%) for MSFOX compared to only 470 of 6,199 (8%) for MRSA *Select* ( $P < 0.0001$ ) (Table 1). The vast majority of pink colonies that were not MRSA on MRSA *Select* appeared at 48 h of incubation and were infrequently found after overnight incubation.

Traditional methods for detection of MRSA from screening and surveillance specimens have used a variety of broth-based or selective and differential solid media. Mannitol-salt agar with oxacillin has been available for many years and is commonly used (7, 12). However, some strains of *S. aureus* may be inhibited by the salt component of the medium, and this may reduce its sensitivity (9). Mannitol-salt agar with ceftioxin appears to be superior for MRSA screening, probably because cephamycins are better inducers of PBP2a (15, 20, 21). Several other medium formulations have also been evaluated, with variable results and often delayed identification of MRSA (3, 7, 19, 22, 23).

The present study adds to available information describing the performance and utility of screening media incorporating chromogenic enzyme substrates for the isolation and detection of MRSA (4–6, 8, 11, 13, 21). We found that MRSA *Select* has improved sensitivity and specificity for the recovery of MRSA from screening specimens regardless of the body site sampled,

with reduced time to detection. The majority (96%) of the MRSA isolates could be detected on MRSA *Select* after 18 to 24 h of incubation, suggesting that more prolonged incubation of these plates would provide only a small increase in yield. In a recent evaluation of MRSA *Select* for MRSA screening, Stoakes et al. found that only 3% of pink colonies at 24 h gave false-positive results (were not MRSA) (21). In the current study, 28 (14%) of the 197 specimens that yielded suspicious pink colonies after 18 to 24 h were not MRSA, although this represented only 0.5% of all the specimens cultured. Most of these organisms were subsequently found to be enterococci or diphtheroids, although there were a few members of the family *Enterobacteriaceae* and coagulase-negative staphylococci. On the basis of these results, we suggest that pink colonies growing on MRSA *Select* should be examined by Gram staining and latex agglutination, if appropriate.

Even though the cost of MRSA *Select* plates is greater than that of MSFOX or other nonchromogenic media, the total costs of materials, reagent, and processing of screening specimens for MRSA using MRSA *Select* in our laboratory during this evaluation were nearly equivalent (\$9,758 Canadian) to the cost of using MSFOX (\$9,106 Canadian). This is because there was a much greater number of suspicious colonies growing on MSFOX, which required subculture and additional test-

TABLE 2. Sensitivities and specificities of MRSA *Select* and mannitol-salt agar with ceftioxin for all specimens by specimen type after 18 to 24 h and 48 h of incubation

Specimen type (no. of specimens) [no. of MRSA]	Medium	Sensitivity (%) after incubation for:		Specificity (%) after incubation for:	
		18–24 h	48 h	18–24 h	48 h
Overall (6,199) [181]	MRSA <i>Select</i>	93 <sup>a</sup>	98 <sup>b</sup>	99.5	92 <sup>a</sup>
	Mannitol-salt agar with ceftioxin	69 <sup>a</sup>	90 <sup>b</sup>	92	78 <sup>a</sup>
Catheter exit site samples (647) [14]	MRSA <i>Select</i>	100	100	99.8	97
	Mannitol-salt agar with ceftioxin	50	86	98	90
Nares swabs (2,483) [57]	MRSA <i>Select</i>	90	97	99.6	93
	Mannitol-salt agar with ceftioxin	70	95	97	89
Perianal/rectal swabs (2,312) [64]	MRSA <i>Select</i>	97	100 <sup>b</sup>	99.3	90
	Mannitol-salt agar with ceftioxin	66	86 <sup>b</sup>	85	58
Sputum samples (58) [4]	MRSA <i>Select</i>	100	100	100	94
	Mannitol-salt agar with ceftioxin	50	75	100	93
Skin/soft tissue samples (632) [42]	MRSA <i>Select</i>	91	95	99.5	95
	Mannitol-salt agar with ceftioxin	81	93	96	85

<sup>a</sup> The values are significantly different for the two media ( $P < 0.0001$ ).

<sup>b</sup> The values are significantly different for the two media ( $P = 0.003$ ).

ing (tube coagulase and latex agglutination tests) to exclude the presence of MRSA. In addition, work flow efficiency in the laboratory was improved, as less technologist time was required to examine and process the MRSA *Select* plates.

In conclusion, MRSA *Select* is a chromogenic culture medium with improved sensitivity and specificity for isolation of MRSA from surveillance and screening specimens compared to other currently available culture media. Almost all isolates can be detected after overnight incubation, with decreased laboratory technologist workload and associated cost savings. The reduced time to detection of MRSA could facilitate more rapid implementation of recommended infection control barrier precautions (1, 14).

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