

M084-2 Skin wound: M084-2 Nares (bilateral sample): methicillin-resistant *Staphylococcus aureus* (MRSA) Notification of Infection Control /Isolation Precaution Notification

HISTORY This simulated nares swab was collected from a 46-year old male motor vehicle accident patient transferred from a USA Hospital. It was sent to category A and B laboratories to process and report according to their laboratory protocol. It was anticipated that all laboratories would screen for MRSA.

CMPT QA Internal validation indicated that the sample contained 4+ pure culture of MRSA, viable for 17 days.

GRADING (maximum grade=8) A grade of 4 was assigned for reporting the challenge organism as MRSA and for reporting Notification of Infection Control (to be termed Isolation Precaution Notification). As 14 out of 15 (93%) reference laboratories correctly identified this organism as an MRSA this challenge was considered suitable to grade. One reference laboratory reported *Staphylococcus aureus*, refer.

All laboratories that processed the sample reported *S. aureus*. Six laboratories (1A, 5B) reported *S. aureus*, refer (n=5), but did not specify MRSA. Two category B laboratories did not submit a result. All results received and grades assigned are shown in Table 1. Methods for those laboratories reporting MRSA are listed in Table 2. Five laboratories (3A, 2B) indicated they do not process nose swabs. Given the history of this patient as a trauma patient who was transferred from a USA hospital there should be an assessment of the possibility of MRSA.

GRADING (maximum grade = 8)

IDENTIFICATION: 100% (71/71) of category A laboratories and 90% (28/31) of category B laboratories that submitted a reported received a grade of 4/4.

ISOLATION PRECAUTION NOTIFICATION: 94% (67/71) of category A laboratories and 83% (24/29) of category B laboratories that submitted a reported received a grade of 4/4.

NOTE In facilities that do not have specific infection control staff, the laboratory should notify the ward staff about the MRSA isolate and the report should include a comment code indicating isolation precautions are needed. Recognizing that not all facilities have a designated Infection Control practitioner, CMPT will now use the term Isolation Precaution Notification.

Isolation Precaution Notification All reference laboratories reported Notification of Infection Control, including the reference laboratory that reported *S. aureus*, refer. This component of the challenge was therefore considered suitable for grading. Results received and grades assigned are shown in Table 3. A total of 65 category A and 19 category B laboratories indicated that they would notify infection control of the positive MRSA finding. The 3 category B laboratories that reported MRSA, refer, indicated only that they would refer the sample so it is difficult to determine if they would notify infection control when the final result was determined. This practice would result in delays in reporting.

Table 1. M084-2 Results received from category A and B laboratories and the grades assigned.

Results received	A	B	Methods	Total	Grade
MRSA (methicillin-resistant <i>Staphylococcus aureus</i>)	70	24	See Table 2	94	4
<i>S. aureus</i> , refer confirm methicillin resistance	0	1	Catalase, slide, tube coagulase	1	4
<i>S. aureus</i> , refer (all reported AST results as oxacillin resistant)	1	3	1A [catalase, slide coagulase, Vitek2 for AST]; 3B [catalase, tube coagulase]	4	3
<i>S. aureus</i> (reported AST results as oxacillin resistant)	0	1	Vitek2, SLA, MRSA media*	1	1
No report submitted	0	2	/	2	0
Nose samples not routinely processed	3	2	/	5	ungraded
	74	33		107	/

Laboratories are encouraged to report "MRSA" or "presumptive MRSA" to infection control when they have sufficient information to suggest that the isolate is a *S. aureus* that is resistant to oxacillin. This would include, sufficient growth within 24 hours on an MRSA screening agar, and confirmation that the isolate is *S. aureus* (e.g. is coagulase positive by Latex Agglutination or tube coagulase or shows appropriate col-

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Table 2. M084-2 Methods reported by category A (n=70) and B (n=24) laboratories that reported MRSA.
NOTE: Most laboratories reported a combination of methods.

Methods reported	Coagulase	SLA	PBP2a	Media screen*	Commercial Method	PCR (mec A gene)
MRSA (n=94)	66 (56A, 10B)	38 (28A, 10B)	23 (20A, 3B)	52 (42A, 10B)	MicroScan (15A); Vitek2, (12A, 4B); Vitek (1A, 3B); BD Phoenix (1A)	2A

*KEY: SLA slide latex agglutination; MRSA-Screen Latex Agglutination Test for detection of PBP2a; Media screen includes one or more of: Chromogenic agar for MRSA screening (e.g. Denim Blue agar, MRSA Select agar, etc), oxacillin, vancomycin, or ceftoxitin screen.

our on a Chromogenic MRSA screening media as per the manufacturer's instructions on reporting MRSA). Testing for PBP2a¹⁰ or PCR for the *mecA* gene can be a secondary procedure that can be performed once the organism has been subcultured to non-selective media. The MRSA-Screen Latex Agglutination Test (LAT; Oxoid, Basingstoke, United Kingdom) for detection of PBP2a is a rapid, easy to perform, and accurate method for the detection of MRSA. This test provides an alternative to the detection of the *mecA* gene by PCR in clinical laboratories when this technique is unavailable.

Isolation of an MRSA positive patient as early as possible is important to prevent spread to other patients in the hospital setting. Rapid detection of oxacillin resistance can facilitate early targeted treatment and offers an opportunity for improving patient outcomes. Also, many centers are interested in rapidly identifying patients infected or colonized with MRSA for isolation or selected presurgical decontamination. **In facilities that do not have specific infection control staff, the laboratory should notify the ward staff about the MRSA isolate and the report should include a comment code indicating isolation precautions are needed.** Recognizing that not all facilities have a designated Infection Control practitioner, CMPT will now use the term Isolation Precaution Notification.

Identification of *Staphylococcus aureus* Performance on this sample was excellent. As noted in Tables 1 and 2, a variety of commercial and classic methods were used to successfully identify MRSA. Classical testing for *S. aureus* was mostly by tube coagulase. Some laboratories use commercial slide agglutination procedures for differentiation of *S. aureus* from coagulase-negative staphylococci. A number of these commercial tests were reported earlier to have reduced sensitivity for MRSA strains^{1,2}. Newer tests have incorporated anticapsular antibodies to *S. aureus* to increase the sensitivity of the tests³. However, "small colony variants" and the Ontario strain^{4,5} have emerged that have smaller colony morphology and unreliable latex/coagulase activity. The tube coagulase test is the only coagulase test that will reliably identify these variants as *S. aureus*. **Identification, susceptibility testing and screening of MRSA** Methicillin resistance among *S. aureus* strains is mediated by the production of a unique penicillin-binding protein (PBP) called either PBP2' or 2a. This is a 78kD protein with a low affinity for binding with β -lactam antimicrobials. The *mecA* gene encodes this novel PBP and is present on the chromosome of all isolates of MRSA. Automated systems, e.g., MicroScan, Vitek,

and Vitek 2, and oxacillin or ceftioxin screens are commonly used to identify *S. aureus* strains as MRSA.

A number of methods have been used with good sensitivity and specificity for screening MRSA. The oxacillin screen plate contains 6 mg/L of oxacillin and added 4% NaCl. Screening for MRSA may require prolonged incubation because of the heteroresistant nature of the population of cells. *S. aureus* strains must be incubated for a full 24 hours on this medium before discard. In strains that have not been subcultured in the laboratory, the automated systems may occasionally either under- or over-call oxacillin resistance^{7,8}. Newer updates to the automated systems have been designed to take this issue into account. The manufacturer of E-test recommends that Mueller Hinton agar supplemented with 2% NaCl should be used to test for oxacillin resistance by that method. For Kirby Bauer testing, either a 1 μ g oxacillin disk or 30 μ g ceftioxin disk is used on Mueller Hinton agar without added NaCl. The zone diameter breakpoint for resistance using oxacillin is ≤ 10 mm; for ceftioxin the breakpoint is ≤ 19 mm. Some strains of MRSA may show larger zones of inhibition around the oxacillin disk with tiny colonies within the zone of inhibition. Careful examination using transmitted light may be necessary to identify them. Disk diffusion testing with ceftioxin has been shown to be more reliable with fewer discrepant strains^{9,10}. **No single definitive test will capture all strains of MRSA.** When discrepancies between methods occur, those strains should be submitted to a reference laboratory for *mecA* analysis. A number of screening agar media have also become available commercially that have good sensitivity and specificity. These media incorporate either oxacillin or ceftioxin as the selective agent and have either mannitol salt or chromogens to facilitate selective identification of MRSA. These media are relatively similar in sensitivity and specificity^{11,12}.

TREATMENT Physicians would not consider using penicillin or ampicillin for nasopharyngeal colonization of MRSA and reporting of vancomycin on an MRSA from this source might encourage the inappropriate use of vancomycin. Mupirocin has been shown to be effective in some patients for nasal decontamination of MRSA^{13,14} but standardized susceptibility testing methods for this agent are not available and resistance with widespread use in selected settings has been reported¹⁵. Antimicrobial susceptibility testing need not be

routinely performed or reported from this sample. There were several treatment or decolonization comments added by some laboratories in this challenge. These may be confusing to clinicians, and may not reflect the susceptibility of the individual strain of MRSA. Local knowledge of susceptibility to agents such as rifampin, fusidic acid or mupirocin would be required to provide accurate information for clinical use. In most cases that is not necessary or helpful.

Report submitted	A	B	Total	Grade
MRSA, reported to IC (SOP report to Public Health [1A, 3B])	66	22	88	4
Reported <i>S. aureus</i> to IC	1	2	3	3
MRSA, not reported to IC	4	0	4	0
MRSA, refer	0	3	3	0
Reported <i>S. aureus</i> , no report to IC; <i>S. aureus</i> , refer	0	2	2	0
N/a because sample not routinely processed (3A, 2B); no culture report submitted (2B)	3	4	7	Not graded
Total	74	33	107	/

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CLINICAL SIGNIFICANCE MRSA is an important nosocomial pathogen in Canada. The most common reservoirs of MRSA are infected or colonized patients, and most harbor the organism for many months. Nares are the most common site of MRSA colonization but skin, throat, and rectal colonization also occur. Hospital personnel can also serve as reservoirs to transmit to other patients. Nasal carriage¹⁶ or a break in the skin¹⁷ have been identified as sources of prolonged carriage and infections. If patients become infected with MRSA, the mortality rates are higher compared with equivalent infections due to MSSA. In most instances, contact precautions as described in the “*Guidelines for Isolation Precaution in Hospitals*”¹⁸ or in local hospital infection prevention and control documents should be used to control the spread of MRSA within healthcare facilities. The need to have admission surveillance to screen for asymptomatic carriage of MRSA in high risk patients is recommended in Canada²⁵ and in some USA states it is mandated by law²⁶. The patient in this challenge was transferred from a USA hospital making this patient “high risk” and therefore appropriate for admission screening for MRSA. The sites that did not perform screening for MRSA for this nares swab and did not send the sample to a reference laboratory should review their protocols to ensure they reflect current admission screening recommendations²⁵.

Community-acquired MRSA (CA-MRSA) infections have also become more prevalent in the last few years. As reported recently in the Canadian Medical Association Journal, community associated MRSA in certain populations can have increased morbidity and mortality¹⁹. Community-acquired MRSA usually are less resistant to other antibiotics compared to hospital-acquired MRSA²⁰. This could be due to less exposure to other antibiotics in the community population, unlike patients who have been hospitalized for some time. Clindamycin is often recommended for treatment of CA-MRSA infections²³⁻²⁵ but if erythromycin is resistant then a D-test is needed to ensure that clindamycin sensitivity is reliable²³.

There are increasing concerns regarding MRSA strains that have reduced susceptibility to vancomycin²¹. These are referred to as hVISA strains that appear susceptible to vancomycin by *in vitro* testing but have elevated MICs close to the cutoff that may not respond well to vancomycin therapy. Some of the automated methods do not facilitate detection of these elevated but sensitive MICs as the range of dilutions tested is limited. Finally, recent data indicates that MRSA are showing greater resistance to fluoroquinolones²². (Note: CLSI⁶ indicates that fluoroquinolones should only be selectively tested and reported.) The production of newer antibiotics may be required to meet the challenge of treating patients with drug resistant MRSA infections.

Colonization and infection with MRSA in Canada have become more widespread in recent years and laboratories need to have on hand reliable screening methods for early identification and rapid notification. Vigilance and rapid communication by the laboratory to Infection Control as well as the ward is necessary to ensure that appropriate isolation precautions are rapidly implemented to prevent the spread of MRSA within healthcare facilities.

REFERENCES

See critique M061-2 for References 1-22

http://www.cmpt.ca/critiques_2006/m061_2_nose_mrsa_may_06.pdf

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