Guidelines for Management of Patients with Methicillin-Resistant *Staphylococcus aureus* In Acute Care Hospitals and Long Term Care Facilities

Prepared By

The MRSA Interagency Advisory Committee
in conjunction with the
Connecticut Department of Public Health

July 1993

Guidelines for Management of Patients with Methicillin-Resistant Staphylococcus Aureus (MRSA) In Acute Care Hospitals and Long Term Care Facilities

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GLOSSARY

Case - Any patient infected with MRSA.

Cohorting - Placement of two or more patients with MRSA in the same room or separation of MRSA patients from patients who have not acquired MRSA.

Colonized patient (Carrier) - Any patient who is found to be culture-positive for MRSA, but has no signs or symptoms of infection caused by the organism.

Decolonize - To administer topical and/or systemic antimicrobial agents for the purpose of eradicating MRSA carriage by an individual.

Endemic-The usual (baseline) frequency of MRSA infection in a given facility. This frequency varies from one facility to another.

Epidemic - An increase in the incidence of MRSA infection above its expected endemic level of occurrence in a given facility.

Incidence - The number of new cases of MRSA that occurred during a given interval of time divided by the population at risk during that given interval of time. In a facility, the number of new cases should exclude cases of MRSA infection that were present or incubating at the time of admission (see examples in Appendix I).

Infected patient - A patient who has laboratory and clinical evidence of disease (e.g., wound infection, bacteremia) caused by MRSA.

Methicillin-resistant Staphylococcus Aureus (MRSA) - A strain of *Staphylococcus aureus* (*S. aureus*) resistant to methicillin. Such strains are also resistant to oxacillin and nafcillin, cephalosporins and imipenem.

Outbreak - An increase in the incidence of MRSA above its expected endemic level of occurrence in a given facility.

Universal Body Substance Precautions - A system of precautions that assumes all body substances may contain potentially infectious material. It requires good handwashing technique and consistent and appropriate use of barriers such as gloves, gowns, masks and eye protection to prevent transmission of microorganisms.

SYNOPSIS

- Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacterium that can colonize or infect people.
- MRSA strains are not more virulent than methicillin susceptible strains.
- Colonized and infected patients represent the most important reservoir of MRSA in hospitals.
- MRSA is transmitted by direct person-to-person contact, usually on the hands of health care workers.
- Limiting the spread of MRSA is desirable because the organism is resistant to oxacillin, nafcillin, cephalosporins and imipenem. Treatment of choice for MRSA infection is usually intravenous vancomycin.
- The preferred methods for antimicrobial susceptibility testing of *S. aureus* include oxacillin-salt screening plates, microdilution broth tests with 2% NaCl, and disk diffusion tests incubated for 24 hours at 35°C.
- Hospitals and LTCFs should monitor the incidence of nosocomial transmission of MRSA in their facility.
- Hospital admission because of MRSA infection is acceptable medical practice because treatment can best be accomplished in an acute care setting. However, given special circumstances, treatment of MRSA infection can be accomplished in an extended care facility or at home. This decision is based on the clinical judgement of the attending physician.
- Hospital admission solely because of MRSA **colonization** is unwarranted.
- MRSA colonization is not a contraindication to discharge from an acute care hospital to home or another facility. When a hospitalized patient who is colonized with MRSA no longer needs to receive acute nursing care (i.e. their MRSA infection and/or other acute medical problems are under control), they can be discharged. If they are discharged to another institution, that institution should be notified in advance that the patient is colonized with MRSA.

INTRODUCTION

An increasing number of institutional facilities in Connecticut are caring for MRSA patients. This increase has raised several concerns regarding inter-institutional transfer and management of these patients. These concerns prompted the formation of a MRSA Interagency Advisory Committee in January 1993. This committee consisted of health care workers from both acute and LTCFs and representatives from the Connecticut Department of Public Health and Addiction Services.

The goal of the Advisory Committee was to develop a document that would review briefly the epidemiology of MRSA and would serve as a guide for more consistent management of MRSA patients. The intent of this document is to provide reasonable guidelines that are based on the most current epidemiologic and scientific knowledge.

We gratefully acknowledge the many sources from which these guidelines were developed. In particular, special acknowledgement should go to the Oklahoma State MRSA Working Group, the Oklahoma State Department of Health, the Minnesota Task Force for the Management of Persons with Methicillin-Resistant *Staphylococcus aureus*, Dr. John M. Boyce, and Marguerite Jackson, R.N.

BACKGROUND

Detection of MRSA within hospitals and LTCFs has increased dramatically in the last two decades and a great deal has been written regarding its management and control.[1-5] The first reports of MRSA isolates occurred in 1961[7] shortly after methicillin came into clinical use. Since then, MRSA have been a major cause of nosocomial infections in Europe. By the late 1970s the organism was identified in large teaching institutions in the U.S.[4] Now MRSA is common in all types of hospitals, especially in the eastern half of the U.S.[3] Once MRSA becomes endemic within a hospital, it is rarely eliminated and may eventually account for 5-50% of all nosocomial *Staphylococcus* infections.[4] Concern about MRSA is related to the potential for nosocomial transmission and the limited number of antibiotics available to treat infections caused by this organism.

MRSA, THE ORGANISM

S. aureus is a gram-positive coccus that can become part of the normal human flora. At any given time: 30-40% of the general population may be colonized with *S. aureus*. This organism is commonly found on the skin and mucous membranes. However, it is also a major human pathogen, which can cause abscesses, skin and wound infections and other more severe infections such as septicemia, endocarditis and toxic shock syndrome.[6,7]

MRSA is a strain of *S. aureus* resistant to the antibiotic methicillin; such strains are resistant to oxacillin, nafcillin, cephalosporins, imipenem and other beta lactams. A majority of strains are also resistant to erythromycin, clindamycin, tetracycline and the aminoglycosides. The resistance of MRSA to such agents is due to the presence of a low-affinity penicillin-binding protein (PBP-2a). There is no clinical or laboratory evidence that MRSA is more or less virulent than other strains of *S. aureus*.

Antimicrobial Susceptibility Tests

The most accurate methods for identifying MRSA employ molecular probes that detect the presence of the mecA gene, which encodes for production of PBP-2a, or assays that detect PBP-2a in the isolates being tested.[3] However, these methods are only available in research laboratories at the present time. The preferred methods for use in clinical microbiology laboratories are microdilution broth tests with 2% NaCl, disk diffusion tests, and oxacillin-salt plates.[3] Susceptibility tests should be incubated for 24 hours at 35° C.

Colonization and Infection with MRSA

Colonization occurs when a patient has MRSA in or on a body site but no immune response or clinical signs or symptoms of disease.[8] A person colonized with MRSA is also called a carrier.

Infection occurs when MRSA enters a body site and multiplies in tissue causing clinical manifestations of disease and an immune response.[8] This is evident by fever, a rise in the white blood cell count, or purulent drainage from a wound or body cavity. The distinction between colonization and infection should always be determined by the clinician.

Reservoirs of MRSA

Colonized and infected patients are the major reservoir of MRSA.[3,4,9] Colonization often occurs in the nares, axillae, chronic wounds, perineum or around gastrostomy and tracheostomy sites.[3] Patients at risk for MRSA colonization are generally debilitated patients who may have prolonged hospitalizations, chronic wounds, or exposure to multiple antibiotics.[3,4,9] Patients with a history of intravenous drug abuse can also be heavily colonized.[4,10]

Modes of Transmission

MRSA is usually transmitted from patient to patient on the hands of health care workers by direct contact with a person who has a purulent lesion or is an asymptomatic carrier of a pathogenic strain.[3,4,6] Colonized health care workers with dermatitis or paronychia are especially likely to transmit MRSA to patients.[4] Transmission by the airborne route is much less likely to occur except in burn units where aerosolized MRSA may contaminate environmental surfaces.[3]

GENERAL RECOMMENDATIONS FOR CONTROL OF NOSOCOMIAL TRANSMISSION OF MRSA

From a public health perspective, it is no longer reasonable to expect that any hospital or LTCF can be entirely MRSA free. Because of the endemicity of MRSA, 1-15% of the patient population in any given setting is likely to harbor MRSA. Thus, it is not reasonable to exclude known MRSA carriers from acute or long-term care settings. A major premise of these guidelines is that nosocomial spread of MRSA between patients can be effectively limited through proper use of appropriate barriers and handwashing, as it should be for any given pathogen.

Treatment of MRSA Patients

Hospital admission for serious MRSA infection is acceptable medical practice because the patient will usually require intravenous antibiotic therapy with vancomycin.[11] An acute care setting is needed because vancomycin can have adverse reactions, such a ototoxicity, and in some instances produce nephrotoxicity.[7] It often requires the patient's serum levels to be monitored to assure therapeutic dosing.

The patient can be returned to a LTCF or home once treatment is complete and the clinical manifestations of infection are resolved. This is most evident when fever and white blood cell counts are normalized and erythema, swelling, and purulent drainage no longer exists. After treatment the patient may still be colonized with MRSA. However, transfer should not be contingent on negative cultures because colonization may persist for long periods of time.[12]

Less serious infections (e.g., minor skin/wound infection, UTI's) may be treated in a LTCF or at home. This decision should always be based on the clinical judgement of the attending physician.

Decolonization of MRSA Patients

Hospital admission for MRSA colonization is unwarranted, and treatment for MRSA colonization is of limited efficacy and controversial.[3] Treatment for MRSA colonization may prove useful for some immunocompromised patients or during some MRSA epidemics; however, systemic treatment has not been shown to be more effective or safer than topical regimens.[3] A decision to attempt to decolonize should be made only after consultation with the hospital epidemiologist or infection control experts.

If treatment for colonized patients is indicated, the following regimens can be used.

- Mupirocin (Bactroban) ointment tid for 7 days can be applied to colonized areas such as nares, wounds, decubiti, or dermatitis. It should not be used on chronic wounds for long periods of time, as this practice may promote emergence of mupirocin resistant strains of *S. aureus*.
- Trimethoprim-sulfamethoxazole DS bid for 7 days or minocycline 100 mg PO bid for 7 days may be necessary when an invasive device such as an endotracheal tube or gastrostomy tube site is colonized, or for pulmonary colonization. Note that minocycline can have vestibular side effects in the elderly. Rifampin 300 mg bid can be used in combination with the Trimethoprim-sulfamethoxazole or minocycline regimens listed above if colonization has not cleared in 7 days. Rifampin should not be used as a sole agent since the organism often becomes resistant under such circumstances. Oral regimens have not been documented to be more effective than topical ones.
- Bathing colonized patients with antimicrobial soaps such as Hibiclens every day has been employed, but its efficacy is not documented.

Universal Body Substance Precautions

According to the Centers for Disease Control and Prevention (CDC), universal precautions apply only to blood and other body fluids containing visible blood[18] and were developed primarily to reduce the risk of transmitting HIV and HBV to health care workers. Technically, universal precautions do not apply to saliva, feces, nasal secretions, sputum, sweat, tears, urine and vomitus unless they contain visible blood.[18] Since MRSA colonization often occurs in the nares, axillae, throat and perineum, universal precautions alone may not be sufficient to completely prevent the spread of MRSA.

Universal body substance precautions are based on the rationale that some infectious agents are frequently present at all moist body sites. Patients may be colonized with MRSA and not be identified as carriers. While universal precautions and body substance precautions utilize the same barrier techniques,[16] body substance precautions are intended to reduce the risk of nosocomial infection in both patients and personnel. Universal body substance precautions use good handwashing technique and barriers such as gloves, masks, gowns and eye protection to prevent transmission of microorganisms from patient-to-patient, patient-to-staff, or staff-to-patient.

Consistent practice of universal body substance precautions (Appendix II) should be considered in the care of all patients.

Epidemiologic Studies and Outbreak Measures

Infection control personnel should review laboratory reports upon receipt to identify patients with MRSA.[13] Although this method will not detect all patients who are infected, it will assist in establishing an estimated endemic (baseline) rate of MRSA infection.

When several cases of MRSA are identified in a facility, it is important to establish whether the isolates are epidemiologically linked. One way to achieve this is to do a comparison of the antimicrobial susceptibility pattern of each isolate. However, analysis of antimicrobial susceptibility patterns may be misleading, particularly if strains gain or lose plasmids containing antimicrobial resistance determinants.[3] Thus, it is desirable to use one or more additional typing systems, such as phage typing or analysis of restriction endonuclease digests of plasmid, or chromosomal DNA if they are readily available.[19]

If the isolates are the same strain and cases are occurring at a higher rate than expected for that facility, the institution is probably experiencing an outbreak. Upon recognition of an outbreak, immediate reinforcement of infection control procedures should be implemented. Additional control measures may include:

- Culturing patient care personnel who are epidemiologically linked to the outbreak.
- Performing a survey, which consists of culturing all patients on a particular unit or ward for MRSA colonization. Although labor intensive, this type of survey may help to identify the source of the outbreak.

Culturing

All persons with suspected bacterial infections should be routinely cultured. Culturing of persons without symptoms to determine whether colonization with MRSA has occurred is not routinely recommended and should be determined on a case-by-case basis in consultation with the hospital epidemiologist or infection control experts. When it has been determined that culturing is necessary, several sites may be considered for culturing.[11]

- Nares. A sterile, premoistened swab should be taken from both anterior nares. The swab should be placed gently and allowed to remain in each nares for 2 to 3 seconds. The same swab can be used for both nares. The swab must be placed in a sterile transport system and labeled before it is sent to a qualified laboratory for identification. The laboratory should be instructed to look for MRSA. This may entail looking only for MRSA by using selective media if the purpose is to monitor MRSA presence or absence.

- **Other sites.** When other sites (such a groin or axilla) are cultured swabs should be used in a manner similar to that for nares. Wounds and sites of invasive devices, such as intravenous catheters or gastrostomy tubes, should be gently swabbed with a rolling motion. If drainage is present, the skin area should first be gently cleaned with sterile gauze moistened with saline. If the site is suppurative or shows tissue destruction, culture the area most heavily involved. The anatomic location of the site must be indicated on the requisition form. For questions about culturing methods, refer to the facility's individual culturing policy or contact the microbiology laboratory evaluating the cultures.

  It is important to be aware that negative cultures from one or multiple sites does not mean a person is free of MRSA.

RECOMMENDATIONS FOR ACUTE CARE HOSPITALS

Patient Placement

MRSA colonization of patients may persist for months or years. Therefore, patients who have had MRSA should be considered to be colonized whenever they are readmitted to the hospital. This information should be readily available in the patient record.

When a culture is positive for MRSA, or the patient has a history of having had MRSA, the patient should be evaluated for placement.

- Ideally, all patients colonized or infected with MRSA should be placed in a private room (negative air flow ventilation is NOT warranted).
- Patients with extensive burns should always be placed in a private room.
- Two MRSA colonized or infected patients may be placed in the same room (cohorting).
- If isolation or cohorting is not possible, patients who are colonized with MRSA and without a chronic skin condition (e.g. eczema) or patients who have drainage or secretions that can be easily contained can be placed in a semi-private room with a non-MRSA affected patient who is at low risk for developing infection. To be considered low risk the roommate:
    - should have intact skin (no open wounds or chronic skin conditions)
    - should be mentally competent
    - should be able to maintain personal hygiene
    - should be able to comply with handwashing
    - should not be immune compromised
    - should not have invasive devices such as tracheostomy tubes, gastrostomy tubes, or intravenous devices or be anticipated to have them for the remainder of their hospitalization

Precautions

- Maintain Universal Body Substance Precautions, a system that recognizes that any patient can harbor infectious organisms and that all body substances should be treated consistently because they might contain potentially infectious material.[14,15]

Housekeeping

- Practice standard housekeeping methods for cleaning rooms of patients with MRSA.

- Disinfect equipment after each patient use as per hospital policy.

Communication

- Identify history of MRSA infection/colonization in the patient's medical record.
- Notify other hospital departments of MRSA colonization/infection prior to transfer/travel to those departments.
- Notify other institutions, as soon as possible, of patient's history of MRSA when planning inter-agency transfer. This will help to ensure that optimal infection control measures are instituted.

Treatment

- When a culture is positive for MRSA, the physician will decide if this culture represents colonization or infection and what treatment, if any, is necessary. The infectious disease consultant can help with this decision. Treatment of MRSA infection usually requires IV vancomycin.

Epidemiology

- Infection control practitioners or hospital epidemiologists should review microbiology records to detect MRSA isolates and establish line lists of patients with MRSA.
- Each institution should establish baseline incidence rates for MRSA cases to enable them to detect increased incidence of nosocomial transmission.
- Routine "surveillance" cultures of axilla, groin, nares, etc. are not routinely recommended and should be discouraged since colonization may persist for long periods of time. Once a patient has MRSA, the patient should be considered colonized even if treatment has been instituted. Recolonization occurs frequently.

Outbreak Measures

In the event of an outbreak, hospital policies for outbreak control should be instituted.

- Perform typing of MRSA isolates such as phage typing or analysis of restriction endonuclease digests of plasmid, or chromosomal DNA if readily available to establish if a common-source outbreak is occurring.
- Perform culture surveys of high risk patients to determine current levels of colonization.
- Culture personnel who are involved in the care of those who are MRSA positive and treat those believed to be persistent MRSA nasal carriers.

- Report outbreak or suspected outbreak to the Connecticut Department of Public Health, Epidemiology Section (860) 509-7995, and the Local Department of Health. This is in accordance with Section 19a-36-A2 of the Public Health Code.

Recommendations for Transfer to LTCFs

- If the clinical condition had resolved, the patient should be assumed to be colonized with MRSA and transfer **should not** be contingent on obtaining negative cultures.

RECOMMENDATIONS FOR LONG TERM CARE FACILITIES

Introduction

In a LTCF, MRSA transmission from roommate to roommate occurs at a relatively slow rate.[5] This is different from acute care facilities where transmission of MRSA among roommates or other patients with close contact has been well documented. Given that cross-transmission in nursing facilities has been rarely documented and that private rooms in nursing facilities are in short supply, placement of patients in private rooms is not appropriate.

Any approach aimed at controlling MRSA transmission needs to consider that most LTCFs encourage ambulation and group participation in social events.[17] Isolating patients colonized with MRSA not only stigmatizes these patients but also deprives them of essential interactions with others and decreases their rehabilitation potential.[17] Therefore, when determining room selection, the MRSA patient and the risk that this patient presents to other residents and staff in the facility must be evaluated. Criteria to consider include:[11]

- From what body sites has MRSA been cultured? Is the drainage or body substance containable?
- What invasive devices, if any, are present?
- What is the mental competence and personal hygiene of the individual and how do these factors relate to the patient's potential to transmit MRSA?
- What kind of direct patient care is being provided to this patient? MRSA and other infectious agents are most frequently spread from patient to patient on the hands of health care workers by direct contact transmission. Are appropriate handwashing and infection control procedures being recommended and are health care providers complying with them?

Patient Placement

- **Multiple bed room**

  A patient who is colonized with MRSA should not be denied admission to a nursing home. Most of these individuals may room with a MRSA-positive resident (cohorting) if one has been identified, or may have a low-risk roommate (i.e., one who does not have tubes, catheters, intravascular lines, wounds or decubiti).

  Most MRSA patients should be allowed to ambulate and socialize in other sections of the facility and participate in group activities.

- **Private rooms should be considered for the following MRSA patients.** In addition, these patients should not be allowed to ambulate or socialize without one-to-one supervision. This supervision should attempt to minimize direct physical contact with other residents, staff and visitors.

  Patients with respiratory colonization and a productive cough.

  Patients with colonization of a draining wound that cannot be contained.

  Colonized patients who do not understand basic hygiene and have an active skin condition which may facilitate transmission of MRSA (e.g., eczema), colonized patients who may soil the room with body substances to such an extent that a roommate would be likely to have inadvertent contact[16] or as warranted by the Infection Control Committee.

Precautions

The most important measure to control the spread of MRSA is handwashing and adherence to universal body substance precautions. Universal body substance precautions are based on the rationale that infectious agents are frequently present at all moist body sites. Patients may be colonized with MRSA and not be identified as carriers. Consistent practice of universal body substance precautions should be considered in the care of all patients.

Housekeeping

Practice standard housekeeping methods for cleaning rooms of patients with MRSA.

Epidemiology

- Maintain a line list of patients with MRSA.
- Establish baseline incidence rates for MRSA cases to detect increased incidence of nosocomial transmission.
- Routine surveillance cultures are not recommended.

Outbreak Measures

While an outbreak is defined as an increase in the incidence of MRSA about its expected endemic level, in a LTCF an outbreak is suggested if there are three or more nosocomially-acquired cases that are linked by person (e.g., same health care provider), place (e.g. same wing) or time (onsets within 10 days of one another).

Upon recognition or suspicion of an outbreak, immediate reinforcement of infection control procedures should be implemented. In addition, according to Sections 19a-36-A2 and 19-13-D8t(g) of the Public Health Code, suspected institutional outbreaks must be reported to the Connecticut Department of Public Health, Epidemiology Section (860) 509-5995, the Health Systems Regulations (860) 509-7400 and the Local Department of Health. These agencies can assist in the investigation of the outbreak and assess the need for further control measures.

Communication

Notify other institutions, as soon as possible, of patient's history of MRSA when planning inter-agency transfer. This will help to ensure that optimal infection control measures are instituted.

SUMMARY

Detection of MRSA within hospitals and LTCFs his increased dramatically within the last two decades. While infection rates may vary from facility to facility, it is no longer reasonable to expect that any hospital or LTCF can be entirely MRSA free.

The most common means of transmission of MRSA from patient to patient is by transient carriage on the hands of health care personnel. Since patients who are carriers of MRSA may not be identified as such, thorough handwashing combined with consistent use of universal body substance precautions is a common sense approach to the prevention of nosocomial transmission of MRSA and other infectious agents. Ongoing education programs can be used to reinforce this message among all health care workers.

MRSA colonization need not deter admission or transfer to ACHs or LTCFs. However, to ensure that optimal infection control measures are instituted, prompt notification between hospitals and LTCFs is critical when planning interfacility transfer of MRSA patients.

MRSA is here to stay. However, through appropriate handwashing, proper use of protective barriers and ongoing education, transmission of this organism among patients and health care providers can be minimized.

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APPENDIX I

When calculating rates, ACFs and LTCFs use different denominators when determining population at risk. Therefore, specific examples have been given for each type of facility.

ACUTE CARE FACILITY:

Incidence rate = $\frac{\text{new cases occurring during a given time period}}{\text{no. of discharges during given time period}} \times 10^{n}$*

EXAMPLE: In March 1993, 12 patients in Hospital A developed a MRSA infection. The hospital had 1500 total discharges for the month. What is the monthly incidence of MRSA per 10,000 discharges?

$\frac{12}{1500} \times 10{,}000 = 80$ cases per 10,000 discharges

LONG TERM CARE FACILITIES

Incidence rate = $\frac{\text{new cases occurring during a given time period}}{\text{(average daily census) x (time)}} \times 10^{n}$*

EXAMPLE: Facility A, which has an average daily census of 100, identified 4 new MRSA infections in June 1993. What is the monthly incidence of MRSA infections per 1,000 persons?

$\frac{4}{100 \times 30} \times 1{,}000 = 1.3$ cases per 1,000 person days.

* 10^{n} is a constant that transforms the result of the division into a uniform quantity. 10^{n} is generally represented by 1,000, 10,000 or 100,000.

APPENDIX II
Universal Body Substance Precautions

- Handwashing is felt to be the most important procedure to prevent the transmission of MRSA. Wash hands before contact with each patient or patient-related items, and again before leaving the room.

- Wear gloves when it is likely that hands will be in contact with moist body substances (blood, urine, feces, wound drainage, oral secretions, sputum or vomitus) or non-intact skin. Change gloves between care of different anatomical sites (i.e. after oral care, before moving onto dressing changes). The same pair of gloves should not be worn for prolonged periods or used on multiple patients. Hands should always be washed after removal of gloves.

- Wear masks and/or protective eyewear when it is likely that eyes and/or mucous membranes will be splashed with body substances (e.g., when suctioning a patient with copious secretions).

- For patients with burns, wear gowns, gloves and masks when entering patient's room. Wear gowns or plastic aprons if clothing is likely to become soiled.

- Soiled linens should be bagged near the location where used. They should not be sorted or rinsed in the patient care area. Linen that is heavily soiled with moist body substances that may soak through a linen bag must be placed in an impervious bag to prevent leakage. Linen handlers must wear barrier protection which includes gloves. Soiled linen need not be washed separately.

- Environmental surfaces should be routinely cleaned with an effective EPA registered disinfectant to reduce the bacterial load.