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Methicillin-resistant Staphylococcus aureus, (MRSA)


Overview^(1,2,3)

Staphylococcus aureus (*S. aureus*), often referred to simply as “staph”, are bacteria that are commonly carried on the skin or in the nose of healthy people. Staph is one of the most common causes of skin infections in the United States. Most of these infections are minor such as pimples and boils and most can be treated with antibiotics. However, staph can also cause serious infections such as blood stream infections, surgical wound infections and pneumonia. They can produce a toxin, which can cause gastrointestinal symptoms when ingested. Approximately 10% of *S. aureus* isolates in the United States are susceptible to penicillin. However, many *S. aureus* strains, while resistant to penicillin, remain susceptible to penicillinase-stable penicillins, such as oxacillin and methicillin. Beginning in the 1960s, staph has become progressively more resistant to these antibiotics.

Strains that are oxacillin and methicillin resistant, while more accurately might be named “ORSA”, are historically termed methicillin-resistant *S. aureus* (MRSA). MRSA is defined as *S. aureus* strains that are resistant to oxacillin, nafcillin and methicillin. They can also be resistant to all β -lactam agents, including cephalosporins and carbapenems. (NOTE: MRSA isolates are often resistant to other multiple, commonly used classes of antimicrobial agents, including erythromycin, clindamycin, and tetracycline.)

MRSA infections occur most frequently among persons in hospitals and healthcare facilities such as nursing homes and dialysis centers, who have weakened immune systems. However, these infections are occurring increasingly in the community. Currently there are two genetically different strains of MRSA circulating in the United States. One is called Community-acquired MRSA (CA-MRSA) and the other is Healthcare-associated MRSA (HA-MRSA).

MRSA infections that are acquired by persons who have not been recently (within the past year) hospitalized or had a medical procedure (such as dialysis, surgery, and catheters) are known as Community-Associated (CA-MRSA) infections. CA-MRSA infections are usually manifested as skin infections, such as pimples and boils, and occur in otherwise healthy people. They are often misdiagnosed as “spider bites” and can cause serious infections if not treated early.^(2,3) CA-MRSA isolates usually are resistant only to β -lactam agents and erythromycin and can be treated with a variety of other antibiotics. Since 1996, MRSA strains with decreased susceptibility to vancomycin (minimum inhibitory concentration (MIC) \geq 4-8 $\mu\text{g/ml}$) and strains fully resistant to vancomycin (MIC \geq 16 $\mu\text{g/ml}$) have been reported.^(1,8)

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MRSA infections that are acquired by persons during the course of receiving medical care are known as HA-MRSA. HA-MRSA isolates often are multiply resistant to other commonly used antimicrobial agents, including erythromycin, clindamycin, and tetracycline. A primary antibiotic used to treat HA-MRSA is Vancomycin. A healthcare-associated⁽⁴⁾ infection is a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s) that a) occurs in a patient in a healthcare setting (e.g., a hospital or outpatient clinic), b) was not found to be present or incubating at the time of admission unless the infection was related to a previous admission to the same setting, and c) if the setting is a hospital, meets the criteria for a specific infection site as defined by CDC (e.g., surgical site infection, bloodstream infection).

Like other strains of staph, MRSA are transmissible⁽²⁾. The main mode of transmission of MRSA is via hands (especially health care workers' hands) which may become contaminated by contact with:

- a. colonized or infected patients,
- b. colonized or infected body sites of the personnel themselves, or
- c. devices, items, or environmental surfaces contaminated with body fluids containing MRSA.


In the community, some settings have factors that make it easier for staph infections (including MRSA) to be transmitted. These factors, referred to as the “5C’s” are as follows:

- **C**rowding,
- frequent skin-to-skin **C**ontact,
- **C**ompromised skin (i.e. cuts or abrasions),
- **C**ontaminated items and surfaces, and
- lack of **C**leanliness.

Locations where the 5C’s are common include schools, dormitories, military barracks, households, correctional facilities, and child care centers.

For a complete description of diseases associated with *Staphylococcus aureus*, refer to the following resources:

- *Control of Communicable Diseases Manual*. (CCDM), American Public Health Association. 19th ed. 2008.
- American Academy of Pediatrics. *Red Book: 2009 Report of the Committee on Infectious Diseases*. 28th ed. 2009.

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Case Definition

Clinical case definition:

Varies widely from asymptomatic colonization to serious illness due to abscesses, septicemia, endocarditis, and Toxic Shock Syndrome.

Laboratory Criteria:

Isolation of Methicillin-Resistant *Staphylococcus aureus*.

Case Classification:

Confirmed: A case of Methicillin-Resistant *Staphylococcus aureus* that is laboratory-confirmed.

*NOTE: HA-MRSA cases are reported quarterly, in aggregate form. All outbreaks of MRSA, either HA or CA, are reportable. Outbreak is defined as the occurrence in a community or region, illness(es) similar in nature, clearly in excess of normal expectancy and derived from a common or a propagated source.

Information Needed for Investigation


Verify the diagnosis. Confirm the diagnosis by assuring that the testing was done according to CDC guidelines.

Notification

- Immediately contact the [District Communicable Disease Coordinator](#) or the [Senior Epidemiology Specialist](#) for the District, or the Department of Health and Senior Services Situation Room (DSR) at 800-392-0272 (24/7), if an outbreak of MRSA is suspected.
- Contact the Bureau of Environmental Health Services (BEHS) (573) 751-6095 and the Section for Child Care Regulation (573) 751-2450, if a case is associated with a child care facility.
- Contact BEHS at (573) 751-6095, if a case is a foodhandler.
- Contact the Section for Long Term Care Regulation (573) 526-8524, if a case is associated with a long-term care facility.
- Contact the Bureau of Health Services Regulation (573) 751-6303, if a case is associated with a hospital or hospital-based long-term care facility.
- Please refer to the [Outbreak Investigation](#) section of this manual for more information on outbreak reporting requirements.

Control Measures

Control is of outbreaks; individual community-associated cases are not reportable. Determine time and place of exposure and population at risk. Collect specimens from suspected infection or colonization site for testing. Notify the laboratory of suspected causal agents.

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Infection Control⁽⁵⁾

1. Keep wounds that are draining covered with clean, dry, bandages.
2. Clean hands regularly with soap and water or alcohol-based hand gel (if hands are not visibly soiled). Always clean hands immediately after touching infected skin or any item that has come in direct contact with a draining wound.
3. Maintain good general hygiene with regular bathing.
4. Do not share items that may become contaminated with wound drainage, such as towels, clothing, bedding, bar soap, razors, and athletic equipment that touches the skin.
5. Launder clothing that has come in contact with wound drainage after each use and dry thoroughly.
6. If you are not able to keep your wound covered with a clean, dry bandage at all times, do not participate in activities where you have skin-to-skin contact with other persons (such as athletic activities) until your wound is healed.
7. Clean equipment and other environmental surfaces with which multiple individuals have bare skin contact with an over the counter detergent/disinfectant that specifies *Staphylococcus aureus* on the product label and is suitable for the type of surface being cleaned.⁽²⁾

Reporting Requirements


Healthcare-associated MRSA is a Category 5 disease, reportable quarterly directly to the Department of Health and Seniors Services. HA-MRSA is reportable in aggregate form, by hospitals and ambulatory surgical centers. A reporting form is available on the Department's website at: http://health.mo.gov/data/mrsavre/doc/MRSA_VREForm.doc.

Hospitals will only report on the body sites normally monitored in their facility for healthcare associated infections. If the infection was not present or incubating at the time of hospitalization and it occurs after 24-48 hours of hospitalization it will be considered a Healthcare-associated infection (HAI) (nosocomial). Reports of HAIs are sent electronically by hospitals in aggregate form.

Outbreak reporting is a Category 2 (A) disease, reportable within one (1) calendar day of first knowledge or suspicion by telephone, facsimile or other rapid communication, to the local health authority or to the Department of Health and Senior Services.

References

1. Laboratory Detection of: Oxacillin/Methicillin-resistant *Staphylococcus aureus*, <http://www.cdc.gov/mrsa/lab/lab-detection.html>. (May 2011)
2. DHSS MRSA website, <http://health.mo.gov/data/mrsavre/index.php>. (May 2011)
3. Key prevention messages for patients with Skin and Soft Tissue Infections http://www.cdc.gov/ncidod/dhqp/pdf/ar/CAMRSA_ExpMtgStrategies.pdf. (May 2011)

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4. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting, *American Journal of Infection Control, Volume 36, Issue 5, June 2008, Pages 309-332.*
5. Siegel JD et al. CDC-Healthcare Infection Control Practices Advisory Committee. Management of Multidrug-Resistant Organisms in Healthcare Settings, 2006 http://www.cdc.gov/hicpac/mdro/mdro_toc.html. (May 2011)
6. Clinical and Laboratory Standards Institute (formerly NCCLS) Standards for Antimicrobial Susceptibility Testing Performance Sixteenth Informational Supplement. M100-S16, Wayne, Pa. CLSI 2006.
7. Clinical Microbiology Reviews. Nasal Carriage of Staphylococcus aureus: Epidemiology, Underlying Mechanisms, and Associated Risks. Kluytmans J, van Belkum A, Verbrugh H. 1997; 10:505-520.

Other Sources Of Information

1. Bacterial Infections of Humans 3rd edition. Evans, Alfred S. and Brachman, Philip S. editors, Kluwer Academic/Plenum Publishers 1998, New York.
2. Guide to the Elimination of Methicillin-Resistant Staphylococcus aureus (MRSA) Transmission in Hospital Settings. An APIC Guide March 2007. Association for Professionals in Infection Control and Epidemiology, Washington, DC.
3. CDC. Laboratory capacity to detect antimicrobial resistance, 1998. MMWR 2000; 48(51): 1167-71.
4. Manual of Clinical Microbiology. Algorithm for identification of aerobic Gram-Positive cocci p 262-282. ASM Press, Washington, D.C. 1999.

Online Resources

1. Society of Healthcare Epidemiologists of America “Guidelines for Preventing Antibiotic Resistance in Hospitals”, http://www.shea-online.org/Assets/files/position_papers/AntimicroResist97.PDF (May 2011)
2. Management of Methicillin-Resistant Staphylococcus aureus (MRSA) Infections. August, 2005 (Federal Bureau of Prisons - Clinical Practice Guidelines), <http://www.bop.gov/news/PDFs/mrsa.pdf> (May 2011)
3. Official Statement from the National Athletic Trainers’ Association on Community-Acquired MRSA Infections (CA-MRSA), <http://www.nata.org/NR031605>. (May 2011)