ORTHOPAEDIC INFECTION: COMMUNITY-ASSOCIATED AND HEALTHCARE-ASSOCIATED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA)

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METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

Methicillin-resistant Staphylococcus aureus (MRSA) is a strain of the staph infection resistant to beta-lactam antibiotics (penicillin, oxacillin, amoxicillin, and methicillin). MRSA is a bacterium commonly carried on the skin or in the nose of healthy people who generally do not exhibit any symptoms.

The CDC reports that an estimated 25-30% of the population is colonized with Staph and only 1% with MRSA; meaning, the bacteria is present, but not causing an infection.

MRSA presents in two different environments: Community Associated MRSA (CA-MRSA) and Healthcare Associated MRSA (HA-MRSA).

RISK FACTORS TO CONSIDER

- Persons with frequent contact with hospitals and healthcare facilities (i.e.: dialysis center, nursing homes) with weakened immune systems
- Presence of invasive medical devices (e.g.: catheter, implanted medical device)
- Athletic Teams
- Military recruits/military living quarters
- Children
- Pacific Islanders, Alaskan Natives, Native Americans
- Men who have sex with men
- Persons in correctional facilities
- Urban regions
- Individuals with poor hygiene
- Individuals in crowded and close contact living conditions
- Persons who are immunocompromised due to disease, illness and/or drug use

SIGNS AND SYMPTOMS

- Surgical wound infections
- Urinary Tract infections
- Bloodstream infections
- Pneumonia
- Soft Skin Tissue Infection (boil, abscess or pimple) that is red, swollen, painful and has pus or other drainage-patients frequently refer to it as a “spider bite”
- Shortness of breath
- Fever
- Chills

Figure 1. A cutaneous abscess, caused by MRSA, located on the knee. (CDC, 2005)
WHAT IS COMMUNITY-ASSOCIATED (CA) AND HEALTHCARE-ASSOCIATED (HA) MRSA?

<table>
<thead>
<tr>
<th>CA-MRSA</th>
<th>HA-MRSA</th>
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<tbody>
<tr>
<td>• Cultured in an outpatient setting or in the first 48 hours of hospitalization</td>
<td>• Contracted by patients who:</td>
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<tr>
<td>• Contracted by persons who:</td>
<td>➢ Have undergone an invasive medical procedure</td>
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<tr>
<td>➢ Have not been recently (within the past year) hospitalized</td>
<td>➢ Are being treated in a hospital and/or healthcare facility (nursing home, dialysis center),</td>
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<tr>
<td>➢ Have not had a medical procedure (dialysis, surgery, catheters)</td>
<td>➢ Are immunocompromised</td>
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<tr>
<td>➢ Are young and otherwise healthy</td>
<td>• Most common method of contracting MRSA</td>
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TIMELINE OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

1959: Methicillin is introduced as an antibiotic.
1974: MRSA accounts for 2% of hospital staph infections in U.S.
1981: First reports of MRSA acquired in the community, while MRSA in hospitals rises steadily.
1997: MRSA accounts for 50% of hospital staph infections.
1998: University of Chicago researchers report a 25-fold increase in community-acquired MRSA from 1993 to 1995. During the same period, 35 kids in Chicago are hospitalized with community-acquired MRSA.
1999: CDC reports deaths of four otherwise healthy children from community-acquired MRSA.
2002: U. of C. team finds that new cases of community-acquired MRSA are genetically distinct from hospital strains.
2007: CDC estimates that MRSA causes 94,000 severe infections each year, killing 19,000

Sources: CDC, University of Chicago, Chicago Tribune
CASES ON THE INCREASE

Prevalence of MRSA in skin infections in Emergency rooms in 11 US cities:
Albuquerque 60%
Atlanta 72%
Charlotte 68%
Phoenix 50%
New Orleans 67%
New York 15%
Los Angeles 51%
Minneapolis 39%
Philadelphia 55%
Portland, Or 54%
Kansas City, Mo 74%
Source: New England Journal of Medicine

THE COST OF MRSA

- Longer hospital stays, which are more expensive and carry an increased chance of death
- Estimates of the excess cost of infections with MSRA compared with infections with methicillin-sensitive S. aureus range from $3,000 to $35,000 (CDC, December 2007)
- In 2006, CDC congressional testimony stated that data extracted from several published studies indicated the estimated cost of healthcare-associated infection ranges from $10,500 per case for bloodstream, urinary tract, and pneumonia infections to $111,000 per case, adjusted in 2004 dollars, for antibiotic-resistant bloodstream infection in transplant patients.
### COMPARISON OF COMMUNITY-ASSOCIATED AND HEALTHCARE-ASSOCIATED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

<table>
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<tr>
<th>CA-MRSA</th>
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<tr>
<td>• Panton Valetine gene, Staphylococcal Cassette chromosome IV (most common-USA300, USA400)</td>
<td>Genetics</td>
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<td>• Skin-to-skin contact with individual with a Staph infection</td>
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<td>• Usage of unsterilized equipment</td>
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<tr>
<td>• Contact with surfaces contaminated with Staph</td>
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<tr>
<td>• Openings in the skin</td>
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<tr>
<td>• Sharing personal items (razors, towels, etc.)</td>
<td>Modes of transmission</td>
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<td></td>
<td>• Small biopsy of skin from infected site</td>
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<td>• Drainage from infected site</td>
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<td>• Blood samples</td>
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<tr>
<td>• Antimicrobial drug susceptibility testing</td>
<td>• Polymerase Chain Reaction (PCR) rapid testing</td>
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<td>• D-zone test (specialized laboratory test)</td>
<td>• Clinical &amp; Laboratory Standards Institute (CLSI) recommends: cefoxitin disk screen test, the latex agglutination test for PBP2a, or a plate containing 6 μg/ml of oxacillin in Mueller-Hinton agar supplemented with NaCl (4% w/v; 0.68 mol/L)</td>
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<tr>
<td>• BD GeneOhm StaphSR Assay (First quick test for drug resistant infections, cleared by FDA Jan. 2008)</td>
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Note: Currently, there is no mandatory testing, but several are available. Some hospitals have implemented their own protocol for screening Emergency room patients and/or patients admitted to the hospital.
TREATMENT AND PREVENTION METHODS FOR MRSA

- Adhering to CDC and Healthcare Infection Control and Prevention Advisory Committee (HICPAC) Infection Control Guidelines
- Education of staff and patients about MRSA
- Communication, surveillance and follow-up of patients pre- and post-operatively
- Keeping infected, high risk of infection and uninfected patients separate
- Prescribing the appropriate antibiotic (only when needed—not all treatment requires antibiotics)
- Drainage, incision and soft tissue debridement of the infected area (dependent upon the depth of the infection)
- Bone excision
- Removal and revision of implant
- Hospitalization (not always required)
- Educating patients on wound care, hand and personal hygiene
- Surgeons and other healthcare workers making a conscious effort to engage in good hand hygiene through frequent hand washing and/or use of alcohol-based sanitizer

OTHER FACTS ABOUT MRSA

- A number of infection-causing bacteria, including MRSA, are becoming resistant to the most commonly prescribed antimicrobial treatments.
- 86% of the MRSA infections are healthcare associated and 14% are community associated. (CDC, 2007)
- MRSA is preventable and its transmission can be prevented through consistent and appropriate practice of CDC/HICPAC Infection Control Guidelines. (CDC, 2007)
- The percentage of MRSA infections resulting from staph infections has been steadily increasing since 1974: 1974 - 2%, 1995 - 22%, 2006 - 63%. (CDC, 2007)
- MRSA is not a required reportable disease in all states.

REFERENCES