Orthopaedic Infection: Community-associated and Healthcare-associated Methicillin-Resistant Staphylococcus aureus (MRSA)

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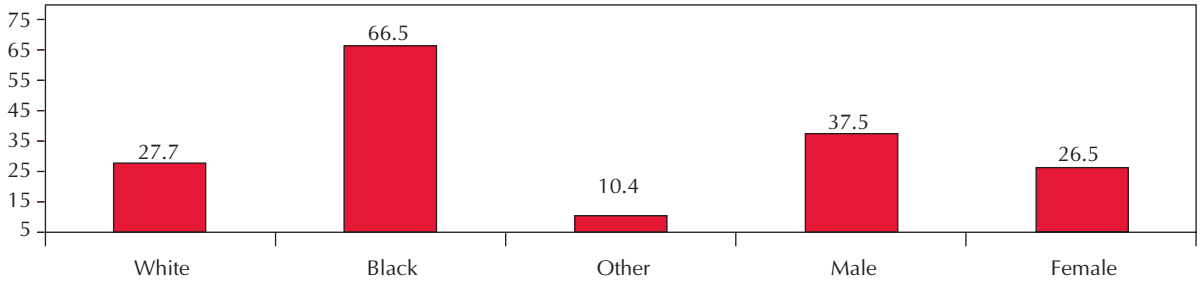
METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

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).

Estimated Incidence Rates (per 100,000) of Invasive Methicillin-Resistant Staphylococcus aureus Infections by Race and Sex, Active Bacterial Core Surviellence, United States 2005



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

Figure 1. A cutaneous abscess, caused by MRSA, located on the knee. (CDC, 2005)

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

WHAT IS COMMUNITY-ASSOCIATED (CA) AND HEALTHCARE-ASSOCIATED (HA) MRSA?

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

TIMELINE OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS

1959: Methicillin is introduced as an antibiotic.

1961: Bacteriologist Patricia Jevons discovers first Methicillin-resistant Staphylococcus aureus (MRSA) in England hospitals.

1968: First report of MRSA in American hospitals in Boston.

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

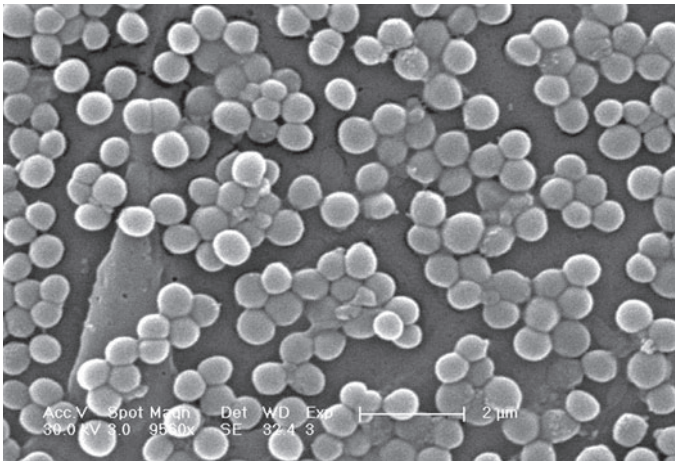


Figure 2. Scanning electron micrograph of MRSA. (Janice Carr, CDC)

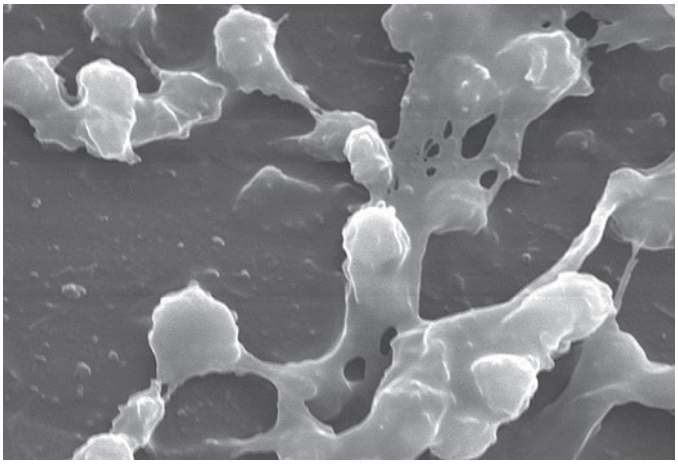


Figure 3. MRSA found on the luminal surface of an indwelling catheter. "Bioflim", the sticky looking substance, protects the bacteria from antimicrobial agents. (Janice Carr, CDC)

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

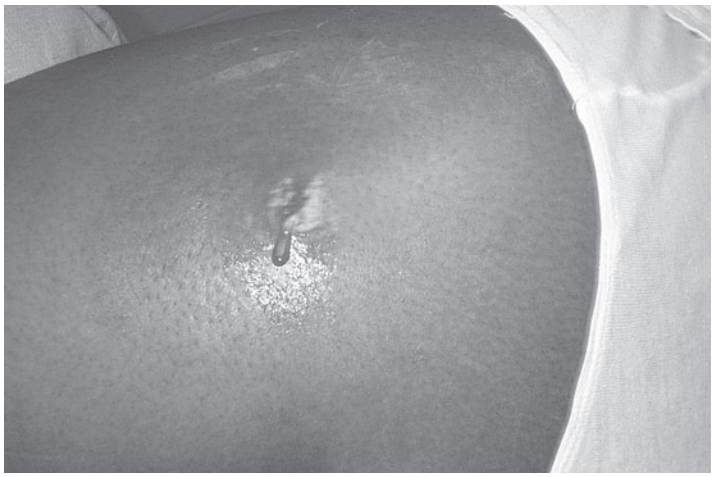


Figure 4. A cutaneous abscess, caused by MRSA, located on the hip, which had begun to spontaneously drain. (CDC, 2005)

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-sensistive 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

CA-MRSA		HA-MRSA
• Panton Valetine gene, Staphylococcal Cassette chromosome IV (most common-USA300, USA400)	**Genetics**	• Various Staphylococcal cassette chromosome (most common-USA100, USA200)
• Skin-to-skin contact with individual with a Staph infection • Usage of unsterilized equipment • Contact with surfaces contaminated with Staph • Openings in the skin • Sharing personal items (razors, towels, etc.)	**Modes of transmission**	• Patients who have a MRSA infection or carry the bacteria on their bodies and exhibit no symptoms • Equipment, devices environmental surfaces or items contaminated with bodily fluids containing MRSA • Colonized or infected body sites of the personnel themselves • Poor hand hygiene (not washing hands or using alcohol-based hand sanitizer between patients)
• Small biopsy of skin from infected site • Drainage from infected site • Blood samples	**Methods of Diagnosis**	Listed by type of infection • Pneumonia- obtain sputum culture • Bloodstream infection- obtain blood cultures • Urinary tract infection-obtain urine cultures • Skin or nasal swab
• Antimicrobial drug susceptibility testing • D-zone test (specialized laboratory test) • BD GeneOhm StaphSR Assay (First quick test for drug resistant infections, cleared by FDA Jan. 2008)	**Types of Tests**	• Polymerase Chain Reaction (PCR) rapid testing • Clinical & 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) • BD GeneOhm StaphSR Assay

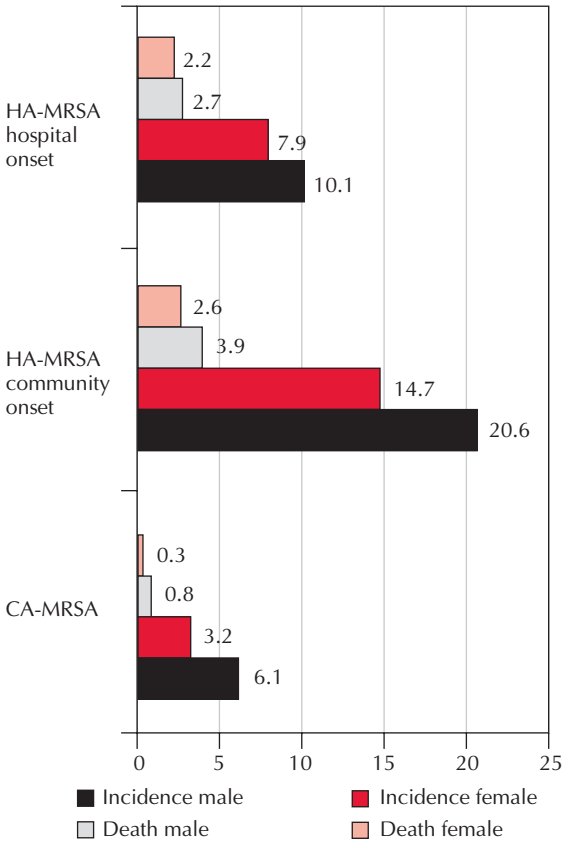
Note: Currently, there is no mandatory testing, but several are available. Some hospitals have implemented their own protocol for screening Emergency room patients and/or patients admitted to the hospital.

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.



Source: Journal of the American Medical Association

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