

## Methicillin Resistant *Staphylococcus Aureus* (MRSA)

*S. aureus* is a ubiquitous bacterium and is frequently found in the nose, on the skin and in the respiratory tract. It does not usually cause disease, but can cause infections under certain circumstances. *S. aureus* is therefore considered an opportunistic infection.

In the rare case that *S. aureus* causes disease, the bacterium may travel to the heart, lungs or bone, causing respectively, endocarditis, pneumonia, or osteomyelitis. Staphylococcal infections can also lead to sepsis, a rapid progressing condition which leads to tissue damage, organ failure, and death in just a few hours. Rapid diagnosis is therefore not just convenient but perhaps lifesaving.

*S. aureus* has a troubling propensity to become resistant to many of the antibiotics commonly used to treat it. The acronym MRSA stands for methicillin-resistant *Staphylococcus aureus* and refers to a strain of the species that is resistant to methicillin, the most robust of all the antibiotic drugs used to treat such infections. In fact, MRSA is resistant to most antibiotics related to penicillin, called beta-lactam antibiotics. This family of antibiotics works by inactivating bacterial penicillin binding proteins (PBPs). MRSA encodes a PBP, PBP2a, which has decreased affinity for beta-lactam antibiotics, allowing MRSA to be resistant. Furthermore, MRSA tends to colonize polymorphonuclear leukocytes (PMNs), a class of white blood cells that includes neutrophils, eosinophils, and basophils. In burn patients, who tend to be immunocompromised, PMNs have decreased bactericidal function, which allows MRSA to survive longer than normal.\* PMNs eventually undergo necrosis (a type of cell death). The infection also recruits phagocytic cells. As the infection continues, a fibrin capsule forms around the infected region, isolating the infected area. This fibrin capsule helps prevent spread of the bacteria, but also protects them from most treatments.

In addition to PML necrosis, MRSA can cause more systemic illness. Most strains of MRSA encode enterotoxins, which can cause gastroenteric and toxic shock syndromes. MRSA infections are common in hospitals, prisons, military barracks and child care facilities. Infections that are acquired from a hospital are called nosocomial infections.

### Recommended Treatments

- *Chlorhexidine*: a cation that binds and disrupts bacterial cell walls.
- *Collagenase*: an enzyme to help break down necrotic tissue.
- *Mupirocin*: a chemical that inhibits bacterial protein synthesis.

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\* Steer, A.J., G.B. Hill, and A.P.R. Wilson. 1995. The effect of burn wound surgery and teicoplanin on the bactericidal activity of polymorphonuclear leucocytes against *Staphylococcus aureus*. *Journal of Antimicrobial Chemotherapy* 36(5): 851–5. <<https://doi.org/10.1093/jac/36.5.851>>.