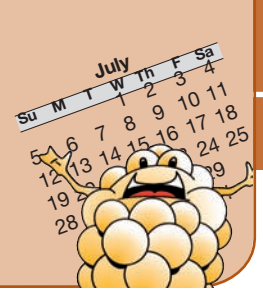




# *CA-MRSA: A New Threat!*

**Edward Tam, MD; and John M. Embil, MD, FRCPC**

Methicillin resistant *Staphylococcus aureus* (MRSA) has long been associated with healthcare facilities. However, recently a new variant of MRSA has arisen in the community. This strain, known as community-acquired MRSA (CA-MRSA), is not merely a healthcare-associated MRSA (HA-MRSA) that has escaped into the community. Rather, it is a unique and distinct microorganism which can lead to severe skin and soft tissue infections, such as furunculosis and necrotizing fasciitis and necrotizing pneumonias. Given the emergence of this new pathogen in the community, CA-MRSA is our **Bug of the Month**.

## *What is* S. aureus*?*

*Staphylococcus aureus (S.aureus)* is a gram-positive bacteria routinely found on the skin and on the mucous membranes of approximately one-third of humans, without causing any problems. However, *S. aureus*, is a highly virulent microorganism, which can cause:

- skin and soft tissue infections (*i.e.,* abscesses, cellulitis)
- bloodstream and endovascular infections (*i.e.,*endocarditis)
- food poisoning and
- osteomyelitis.

In the 1980s, *S. aureus* was responsible for tampon-associated toxic shock syndrome.

*S. aureus* causes invasive infections by overcoming host defenses. The most frequent routes by which this organism causes invasive infection is by:

- an abrasion, a cut, or a minor trauma, which allows the microorganism to invade the skin and soft tissues, or
- by an infected vascular access device.

These provide ready access of *S.aureus* into circulation.

## *What is CA-MRSA?*

Methicillin is a ß-lactam antibiotic that is very similar to cloxacillin. Cloxacillin is the usual drug of choice for treating *S. aureus* infections. Some strains of *S. aureus* undergo changes within their penicillin-binding proteins, which confer resistance to methicillin (or cloxacillin); therefore, these antibiotics are no longer active against *S. aureus* and are designated as MRSA.

During the past 20 years, hospital-based surveillance programs have revealed that the number of patients, either colonized or infected with MRSA, has increased. Although traditionally associated with healthcare environments, there have been numerous reports of infections in the community with MRSA. Table 1 summarizes the difference between the CA-MRSA and HA-MRSA strains. One of the major differences is in the at risk groups or conditions. Whereas typically we think about MRSA as affecting those individuals in hospitals or other institutional-care settings, CA-MRSA refers to a specific group of MRSA strains which cause community-onset infection and which have their own unique characteristics that distinguish them from typical HA-MRSA.

## *Who is at risk of CA-MRSA?*

In contrast to HA-MRSA, infections due to CA-MRSA often occur in populations of healthy individuals who have had no prior prolonged contact with a healthcare institution (*i.e.,* hospitalization, surgical procedures *etc.*). Outbreaks have been reported in the following individuals:

- Prisoners
- Athletes
- Children (particularly those in daycare centres)
- Injection drug users
- Homeless persons
- Men who have sex with men

The common risk-factors in these cases may be close contact in large groups and situations of poor hygiene.

## *What clinical syndromes are associated with CA-MRSA?*

By far, the most common presentation of CA-MRSA infection is that of furunculosis (appearing as so-called dermonecrotic spider-bite lesions) and other skin and soft tissue infections, such as cellulitis. However, reports of necrotizing pneumonia, especially in the setting of preceding influenza illness, have detailed a situation in which pneumonia caused by

**Dr. Embil** is a Consultant, Infectious Diseases and an Associate Professor, University of Manitoba. He is also the Medical Director, Infection Prevention and Control Program, Health Sciences Centre and Winnipeg Regional Health Authority, Winnipeg, Manitoba.

**Dr. Tam** is a Resident, Internal Medicine, University of Manitoba, Winnipeg, Manitoba.

**Table 1**

## Characteristics of CA-MRSA vs. HA-MRSA

| | CA-MRSA | HA-MRSA |
|---|---|---|
| **Resistant to ß-lactam antibiotics?** | Yes | Yes |
| **Other antimicrobial resistance** | ß-lactam alone (common) | Multi-drug resistance (common) |
| **At-risk groups or conditions** | • Children<br>• Athletes<br>• Prisoners<br>• Soldiers<br>• Injection-drug users | • Residents in long-term care<br>• Prolonged hospitalization<br>• Intensive care unit<br>• Admission<br>• Diabetics<br>• Hemodialysis |
| **PVL toxin** | Frequent | Rare |
| **Associated syndromes** | • Skin and soft tissue infections<br>• Necrotizing pneumonia | • Nosocomial pneumonia<br>• Urinary tract infections<br>• Bacteremias<br>• Surgical site infections |

CA-MRSA: Community-acquired Methicillin resistant *Staphylococcus aureus*
HA-MRSA: Healthcare-associated Methicillin resistant *Staphylococcus aureus*
PVL: Panton-Valentine Leukocidin toxin

CA-MRSA may become more common. Other cases that have been reported include:

- life-threatening sepsis,
- osteomyelitis,
- endocarditis and
- sinusitis.

Although mortality from CA-MRSA infection has been reported sporadically, it is generally uncommon.

## *Why is CA-MRSA so virulent?*

One factor which seems to predispose CA-MRSA strains to cause necrotizing infections is the presence of a gene which encodes for an exotoxin called Panton-Valentine Leukocidin (PVL) toxin. This exotoxin is lethal to neutrophils and is associated with skin and soft tissue infections. The vast majority of CA-MRSA isolates have been shown to express the PVL toxin. A recent study has shown that CA-MRSA possesses enhanced infectivity and virulence compared to methicillin susceptible *S. aureus* (MSSA).

## *When should CA-MRSA infection be suspected?*

Aside from those in risk groups and those who suffer from previously noted clinical syndromes, CA-MRSA infection should also be expected in the setting of any soft tissue infection that does not resolve despite the use of an appropriate ß-lactam antibiotic, such as cloxacillin or cephalexin. Always consider CA-MRSA in individuals who present without significant risk factors for infection and/or who present with furunculosis or recurring furunculosis.

## *How should CA-MRSA infections be treated?*

The first aspect of initiating treatment for infections caused by CA-MRSA is a high index of suspicion for CA-MRSA. Clearly, individuals from high-risk groups, or those failing therapy with a ß-lactam agent should raise suspicion about infection with CA-MRSA. ß-lactam agents (*i.e.,* cloxacillin and cephalexin/cefazolin) are the usual mainstays of treatment for skin and soft tissue infections and will not be effective in the treatment of infections caused by CA-MRSA. If furuncles are present, incision and drainage should be performed with a sample of pus submitted for bacterial culture. While awaiting culture and sensitivity results, empiric therapy directed against CA-MRSA should be initiated.

In the absence of any severe systemic symptoms or signs of invasive disease, outpatient therapy, with either trimethoprim sulfamethoxazole or doxycycline would be appropriate, because CA-MRSA isolates are nearly uniformly susceptible to these agents. Use of erythromycin should be avoided because resistance is becoming common. In situations where *ß-hemolytic streptococci* are also being considered as possible etiologic agents (*i.e.,* cellulitis, erysipelas), monotherapy with trimethoprim sulfamethoxazole is not recommended and instead, combination therapy with the addition of a ß-lactam agent should offer adequate coverage.

Variable susceptibility of CA-MRSA to clindamycin has been displayed and a decision on its use when CA-MRSA is suspected may depend on knowledge of local epidemiology. As a general rule, in the management of recurrent abscesses and non-resolving infections, it is important to submit specimens of pus not only for routine gram staining and bacterial culture, but also for fungal and mycobacterial stains and culture.

In cases of severe systemic illness from suspected CA-MRSA, including necrotizing pneumonia, skin and soft tissue infection, or presumed septicemia, empiric parenteral treatment with vancomycin is indicated, as these microorganisms are uniformly susceptible to vancomycin.