METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* (MRSA)

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Staphylococcus aureus is a common bacterium which is carried on the skin and/or in the nose of approximately 20 to 40% of otherwise healthy individuals. As long as this organism remains on the surface, it generally causes no harm. However, under the right circumstances, it can cause a broad range of infections ranging from mild skin conditions such as boils or furuncles to potentially life-threatening infections involving the blood, lungs, or other organs and tissues in the body.

Prior to the start of the modern era of antibiotics in the early 1940s, *Staphylococcus aureus* was fully susceptible to penicillin. However, soon after the introduction and widespread use of penicillin into clinical practice, this organism quickly adapted to become penicillin-resistant. Although initially it was found only in the hospital setting, it eventually moved into the community to become extremely common. The mechanism of this resistance is mediated through the production of an enzyme known as beta-lactamase which is capable of destroying the active sight of penicillin and thus rendering it ineffective. The rapid emergence and spread of beta-lactamase producing *Staphylococcus aureus* lead to the development of semi-synthetic penicillins, such as methicillin, cloxacillin, oxacillin, and nafcillin which are not destroyed by this beta-lactamase enzyme. These drugs have become known as "beta-lactamase stable penicillins". Within a year of their introduction in 1960, *Staphylococcus aureus* once again quickly adapted and developed a new mechanism of resistance to these agents. By producing a new or altered target site that no longer allowed these agents to bind to them, the emergence of Methicillin Resistant *Staphylococcus aureus* (MRSA) was borne. The rate and extent of this resistance has varied considerably depending on the patient population and geographic location of the patient. For the most part, this type of resistance has been limited to patients in a healthcare setting or to those in close contact (e.g. household) with such patients and thus the term Hospital-acquired (also termed hospital-associated and healthcare-associated) Methicillin Resistant *Staphylococcus aureus* (HA-MRSA) has been used. The concern with HA-MRSA is that not only is the organism resistant to penicillin-type antibiotics, but it is also resistant to many other unrelated classes of antibiotics. For years, vancomycin has remained one of the few available antibiotics with activity against MRSA. Fortunately, advancements in antibiotic development have lead to the availability of newer agents (e.g. linezolid, quinupristin/dalfopristin, tigecycline) with activity against MRSA.

Until recently, most *Staphylococcus aureus* strains in the community have remained susceptible to the beta-lactamase stable penicillins as well as to many other classes of antibiotics. However, in the past few years, strains of MRSA have been recognized as causing infections in the community in patients who have never been in a healthcare setting. Most of the reported infections have been associated

with cutaneous abscesses and occasionally life-threatening respiratory tract infections. These strains are referred to as Community-acquired (also termed community-associated) MRSA (CA-MRSA) and, in general, are genetically distinct from HA-MRSA. Most strains carry a relatively unique set of virulence genes known as Panton-Valentine leukocidin (PVL) which produce toxins capable of causing severe destruction and death of tissues. Patients who have been particularly at risk for infection with CA-MRSA have included prisoners, athletes, men who have sex with men, drug users and Native Americans. Although the mechanism of resistance of CA-MRSA is the same as for HA-MRSA, isolates of CA-MRSA tend to be more susceptible to a broader range of non-penicillin type antibiotics, including drugs such as clindamycin, trimethoprim-sulfamethoxazole and even fluoroquinolones. Unlike the treatment of HA-MRSA infections, the treatment of CA-MRSA infections has varied from no antibiotic therapy for minor skin infections such as furuncles to a wide variety of both oral and intravenous antibiotics depending on the severity of the infection. Although the rate of MRSA amongst community isolates of *Staphylococcus aureus* in Canada is felt to be low, some regions have reported significant numbers.

Although much is known about MRSA, much remains to be learned. Continued vigilance with good infection control practices and personal hygiene will be essential for preventing the spread of these organisms. The collection of good surveillance data will help in our understanding of the spread of these organisms both in the community and in the healthcare setting. Further studies on the genetic make up of these organisms are required to help understand their virulence and antibiotic susceptibility. The development of newer antimicrobial agents that are effective in treating patients infected with these organisms is required.

Selected References:

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