Community-Associated MRSA Coming to a
Community-Associated MRSA

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In the past decade, community-associated methicillin-resistant Staphylococcus aureus infection (MRSA) has become a major epidemiologic and therapeutic challenge for primary care providers (PCPs). In light of the sharp and sustained increase in community-associated MRSA, nurse practitioners (NPs) must be skilled in its diagnosis and treatment. Community-associated MRSA infections are generally completely curable with proper treatment. Untreated or improperly treated infections, however, can lead to severe morbidity and sometimes death. NPs must not only successfully diagnose and treat this infection, but also educate patients and other healthcare providers about all aspects of the disease, including prevention.

Case Study

A 51-year-old man presented to his PCP complaining of a 3-day history of facial swelling. He reported a pimple on the left side of his upper lip that he squeezed, producing a small amount of pus. Over the next 2 days, he noticed progressive swelling of the upper lip that extended to just below his left nostril. He applied warm compresses and took ibuprofen with little relief. He felt feverish but did not take his temperature because he did not own a thermometer.

When he presented to the provider, physical examination revealed a healthy-appearing man who was in no acute distress. Temperature was 99.5°F, heart rate 100/bpm, respiratory rate 12 breaths per minute and blood pressure 130/80 mmHg. The facial examination revealed edema, erythema, tenderness, and fluctuance on his left upper lip; this extended to just below the left nostril where a small scab was noted. No purulence could be expressed with gentle palpation. No intraoral abnormalities or rashes were noted. The cranial nerve examination was normal.

The provider initially made the diagnosis of furunculosis, a common skin infection usually caused by S. aureus. The patient was given a prescription for cephalixin 500 mg P.O. q.i.d. for 10 days. He was instructed to apply warm compresses as needed, and to return to the clinic for follow-up in 1 week or sooner if there was no improvement or worsening of symptoms.

The patient returned for follow-up 3 days later complaining of worsening pain and swelling that now involved his entire upper lip. He stated he had not missed a single dose of his antibiotics. His temperature was 101°F. The wound was drained in the office with a scalpel, and purulent material was

Patient Near You?
obtained and sent for culture. He was given a prescription for sulfamethoxazole-trimethoprim, one double-strength tablet twice daily for 10 days, considering the suspicion now for community-associated MRSA infection.

The patient returned for another follow-up visit in 1 week and the infection was virtually resolved. The culture done in the office the week before did indicate MRSA. He was given a prescription for mupirocin (Bactroban) ointment, to be applied intranasally twice daily for 5 days since MRSA can persistently colonize the nares. He was also advised to shower with chlorhexidine (Hibiclens) soap daily for 10 days to attempt to decolonize any residual MRSA from his skin. He was advised to follow common sense infection control practices in his home. The patient followed all of these directions carefully, and the infection was completely resolved.

### Epidemiology of Community-Associated MRSA

MRSA infections emerged in the 1960s in response to the excessive use of methicillin and related drugs to treat severe staphylococcal infections, primarily in debilitated hospitalized patients. The incidence of MRSA infections in hospitals has risen steadily over the past 30 to 40 years, creating a difficult management problem by limiting the antimicrobials available to treat the infections.

In the early 1990s, cutaneous infections caused by MRSA were described in Australian and Canadian aboriginal patients who had little or no contact with healthcare prior to the onset of their infections. In a notable study, Herold and colleagues reported a greater than fourfold increase in MRSA infections in children without risk at an urban children’s hospital in Chicago between 1988 and 1995. The authors noted that the community-associated isolates of MRSA were uniformly susceptible to clindamycin, unlike traditional hospital-associated isolates of MRSA that are generally clindamycin-resistant. On the basis of this finding, they postulated that the origins of the community and hospital-associated strains were genetically distinct. This was supported in subsequent studies.

Community-associated MRSA is no longer a rare or even infrequent disease in the United States. Patients with purulent skin and soft tissue infections in 11 metropolitan emergency departments in U.S. cities were the subjects of a recent study. S. aureus was isolated from 76% of these patients; in 59%, the S. aureus isolate was methicillin-resistant (range 15% to 74%). Therefore, MRSA was the predominant pathogen in this population.

The authors identified risk factors for infection with community-associated MRSA compared to other bacteria. Racial and ethnic characteristics were studied, and it was noted that the risk for acquiring infection with community-associated MRSA in blacks was more than twice as high as whites (54% versus 25%). A similar racial disparity was also recently reported in patients with invasive disease caused by MRSA. In that study, incidence rates for the most serious MRSA infections were more than double in blacks compared to whites (66.5 versus 27.7 per 100,000). The authors postulated that the higher risk for MRSA infection in blacks may be related to socioeconomic status but that there may be other currently unidentified contributing factors. Other important risk factors identified by Moran and colleagues included recent antibiotic use, a reported spider bite, history of MRSA infection, and close contact with a person who has a similar infection.

Community-associated MRSA has now been reported extensively in a variety of populations including children in day care, amateur and professional athletes, military personnel, men who have sex with men, and American Indian communities. Tattoo recipients, particularly those receiving services at unlicensed tattoo parlors, were recently identified as at risk for this infection as well.

The prevalence of community-associated MRSA in athletic populations deserves special mention. Outbreaks have been reported at every level of competition, including junior high school, high school, college, and professional athletics. Participation in contact sports such as football and wrestling increases the risk of infection compared to noncontact sports. In one investigation, an outbreak of community-associated MRSA was reported on a college football team. Risk factors for infection in the study group included players at certain positions (cornerbacks and wide receivers), those sustaining turf abrasions, and those who engaged in cosmetic body shaving. Players with abraded skin and those who spent more time in contact with the playing surface appeared to be at higher risk for acquiring infection.
The topic of community-associated MRSA infection in athletes was recently reviewed, and it was determined that many sports medicine practitioners are not proficient at recognizing and treating this disease. Media interest, such as a report of an outbreak of community-associated MRSA on a professional football team, have brought needed attention to this subject in the sports medicine community.

Many outbreaks of community-associated MRSA have occurred in children, including some of the first reports of this epidemic. A study from 1990 to 2003 of MRSA infections at a Texas children’s hospital showed that 93% of MRSA isolates were community-associated. An explosive increase in the number of cases was found during the latter years of the study; no more than nine community-associated MRSA infections were identified per year prior to 1999, but an astounding 459 cases were identified in 2003. Even healthy newborns have not been immune to community-associated MRSA infection; a recent report documented separate outbreaks in newborn nurseries in Chicago and Los Angeles.

Hospital and community-associated forms of MRSA differ sharply in their epidemiology, clinical presentation, and management. Naimi et al described demographic and clinical differences between hospital and community-associated MRSA infections (see Table: “Comparison of Hospital- and Community-Associated MRSA Infections”). Of note, most of the community-associated MRSA infections were initially treated with drugs to which the organism was nonsusceptible. This latter observation likely reflected clinicians’ unfamiliarity with the ongoing epidemic of community-associated MRSA.

### Clinical Manifestations

The most common clinical manifestation of community-associated MRSA infection are signs and symptoms of skin and soft tissue infection. The typical lesions are furuncles; pustular, indurated lesions ranging in size from less than 1 centimeter to more than 10 centimeters. Lesions may be single or multiple, and may be found on any body surface, including limbs, trunk, buttocks, groin, and face. Fever is commonly associated with these lesions, and although most patients are not severely systemically ill, there are reports of patients presenting with necrotizing fasciitis, severe sepsis, and septic shock.

Pulmonary infection has also been linked to community-associated MRSA. In contrast to skin and soft tissue infection, pulmonary infection is often associated with severe disease including necrotizing pneumonia and respiratory failure. For example, Francis and colleagues described four patients with severe necrotizing pneumonia who presented to a Baltimore hospital during a 2-month period. One of the four patients died, and the other three suffered prolonged hospitalizations requiring extensive rehabilitation after hospital discharge. Since that time, additional reports of severe community-acquired pneumonia caused by MRSA have been published. Although MRSA is an uncommon cause of community-acquired pneumonia compared to other pathogens, the fulminant disease with which it has been associated has led some authors to consider inclusion of antibiotic therapy directed against MRSA in empiric regimens for community-acquired pneumonia.

Virtually all of the organisms that cause community-associated MRSA soft tissue infections and pneumonia carry the gene for Panton-Valentine leukocidin (PVL). PVL is an exotoxin, a substance secreted by bacteria that has long been associated with necrotizing infections of soft tissues and lungs, but has only recently been associated with the current community-associated MRSA epidemic. Many experts have postulated that PVL is the toxin that actually causes the tissue destruction in community-associated MRSA infections; however, at least one publication has disputed it as the cause of the severe infection.

In one study, the USA300 strain caused 99% of the MRSA infections that originated in the community. In contrast, collections of hospital-associated MRSA isolates are typically represented by multiple different clones of the organism. The clonal tendency of community-associated MRSA isolates suggests that a single, well-preserved strain of the organism continues to cause the bulk of the disease in the United States and elsewhere.

An important clinical clue in the diagnosis of community-associated MRSA is the presence of specific symptoms such as fever, rash, and swelling. These symptoms may herald the onset of severe infection, which can be manifested as necrotizing fasciitis, sepsis, or septic shock. Additionally, the presence of a purplish rash, known as the Erysipelas sign, may indicate a more severe form of infection. Diagnosis can be confirmed through laboratory testing, which may include cultures of affected tissues or body fluids, as well as DNA analysis to identify specific MRSA strains.

### Comparison of Hospital- and Community-Associated MRSA Infections

<table>
<thead>
<tr>
<th></th>
<th>Hospital-associated</th>
<th>Community-associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient type</td>
<td>Older, multiple comorbidities</td>
<td>Younger, otherwise healthy, athletes, inmates</td>
</tr>
<tr>
<td>Infection type</td>
<td>Pneumonia, bloodstream, endocarditis, urinary tract</td>
<td>Skin/soft tissue (furuncles, spider bites), necrotizing pneumonia</td>
</tr>
<tr>
<td>Treatment</td>
<td>Infectious antibiotics</td>
<td>Oral antibiotics, incision and drainage</td>
</tr>
<tr>
<td>Prevention</td>
<td>Hand hygiene</td>
<td>Decontamination, hand hygiene</td>
</tr>
</tbody>
</table>

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Community-Associated MRSA

Antibiotic Options for Adults with Community-Associated MRSA

<table>
<thead>
<tr>
<th>Drug</th>
<th>Adult dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfamethoxazole-trimethoprim</td>
<td>One double-dose strength tablet orally b.i.d.</td>
<td>Potential interaction with warfarin; dose adjustment for renal insufficiency</td>
</tr>
<tr>
<td>Minocycline</td>
<td>100 mg orally b.i.d.</td>
<td>May cause dizziness</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>100 mg orally b.i.d.</td>
<td>An alternative for minocycline, although less active against MRSA</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>300-450 mg orally t.i.d. or q.i.d.</td>
<td>Associated with Clostridium difficile diarrhea</td>
</tr>
<tr>
<td>Linezolid</td>
<td>600 mg orally b.i.d.</td>
<td>Not for routine use (see text)</td>
</tr>
</tbody>
</table>

The treatment of community-associated MRSA skin and soft tissue infection is the patient’s report of a spider bite. In nearly all cases of self-reported spider bites, however, patients did not actually see a spider bite them. Patients may attribute their infection to a spider bite since the typical erythematous, indurated, and centrally pustular lesions of community-associated MRSA infection can easily be mistaken for a spider bite.

Because of the common mistake, the Centers for Disease Control and Prevention (CDC) has created an educational campaign designed to direct patients to their healthcare providers if they believe they were bitten by a spider. Patients and the public need to understand that spiders do not carry or transmit MRSA.

Treatment of Community-Associated MRSA

The treatment of community-associated MRSA infection is comprehensive. Elements of treatment include appropriate antimicrobial selection, incision and drainage when appropriate, and consideration of decolonization of reservoirs of infection including the nares and skin.

Clinicians must be familiar with antibiotics that are active against most strains of MRSA because therapy is often chosen before culture and susceptibility results are known (see Table: “Antibiotic Options for Adults with Community-Associated MRSA”). Most isolates of community-associated MRSA remain susceptible to multiple antibiotic classes; however, drugs used to treat traditional skin and soft tissue infections such as cephalexin and dicloxacillin are ineffective against these organisms. In contrast, drugs such as sulfamethoxazole-trimethoprim and tetracyclines (minocycline, doxycycline) are active against most isolates of community-associated MRSA. Although the majority of community-associated MRSA isolates are susceptible in vitro to clindamycin, some of these isolates demonstrate so-called inducible clindamycin resistance, in which the antibiotic may be rendered ineffective in vivo despite the in vitro susceptibility. Of note, the laboratory test to detect inducible clindamycin resistance may take up to 48 hours to perform, and the results are generally not available at the time the provider needs to make a decision on antibiotic prescription. This phenomenon may result in decreased reliability on clindamycin as an empiric antibiotic choice in community-associated MRSA infections. Linezolid (Zyvox) is a newer oral antibiotic with excellent activity against MRSA; however, its prohibitive cost and extensive adverse effect profile limit its routine use in the management of community-associated MRSA.

Incision and drainage is typically utilized in conjunction with antibiotic therapy, but in at least one study, the authors determined that incision and drainage alone of small abscesses (less than 5 centimeters) was adequate and that no additional benefit was achieved with the addition of antibiotics. Nonetheless, most clinicians still prescribe antibiotic therapy even when incision and drainage has been performed.

The incision and drainage procedure, which can often be done in the PCP’s office, is recommended; the procedure reduces the bacterial inoculum and allows a culture and sensitivity to guide decision-making. Because MRSA infections can have varying antimicrobial susceptibility patterns, a culture and sensitivity is essential in that it establishes MRSA infection and allows public health officials to track the infection.

Patients with MRSA infection are frequently colonized with the bacteria on parts of the body that may be remote from the site of infection, including the nares, pharynx, axilla, perineum, and rectum. This colonization may predispose a patient to relapse of infection. A recent report demonstrated that patients with hospital-associated MRSA infections can be decolonized (at least transiently) with the use of nasal mupirocin ointment, chlorhexidine skin washes, and oral antibiotics, and that this strategy may be effective in halting the spread of outbreaks. Definitive evidence of successful decolonization from community-associated MRSA, however, does not yet exist. Some guidelines recommend using intranasal and topical decolonization only in selected situations, including patients who have had multiple recurrences of MRSA infection and when continuous MRSA transmission is present in a confined population such as a nursing home.
Prevention Strategies

1. Keep draining wounds covered with clean, dry bandages.
2. Perform hand hygiene regularly with soap and water or alcohol-based hand gel (if hands are not visibly soiled). Always perform hand hygiene immediately after touching infected skin or any item that has come in direct contact with a draining wound.
3. Maintain good general hygiene with regular bathing.
4. Do not share items that may become contaminated with wound drainage, such as towels, clothing, bedding, bar soap, razors, and athletic equipment that touches the skin.
5. Launder clothing that has come in contact with wound drainage after each use, and dry thoroughly.
6. If you are not able to keep your wound covered with a clean, dry, bandage at all times, do not participate in activities where you have skin-to-skin contact with other persons (such as athletic activities) until your wound is healed.
7. Clean equipment and other environmental surfaces with which multiple individuals have bare skin contact with an over-the-counter detergent/disinfectant that specifies *Staphylococcus aureus* on the product label and is suitable for the type of surface being cleaned.


as a household or sports team.26

Providers should counsel patients and families about the pathogenesis, treatment options, and expected outcomes from infection with community-associated MRSA. Guidelines are available, such as one published by the Illinois Department of Public Health.21 Consultation with an infectious disease specialist should be considered for patients who do not respond to standard therapy, sustain multiple relapses, or in any case where the patient or healthcare provider desires expert advice.

Prevention of Community-Associated MRSA

Preventing the spread of community-associated MRSA infection is a critical component of its management but is often overlooked. The CDC recently issued26 expert recommendations for the treatment and prevention of community-associated MRSA infection (see Table: “Prevention Strategies”).

Household contacts of patients diagnosed with community-associated MRSA infections also should be screened for disease.28 Screening can be accomplished by culturing any active sites of infection, the nares, or pharynx. The infection is frequently passed between household members by direct contact, and failure to treat and/or decontaminate family members may result in a continuous cycle of infection and reinfection in the household.27 Dogs have even been established as carriers of community-associated MRSA strains, but the risk that presents to other members of the household is unclear.28

The Importance of Follow-Up

Follow-up to resolution of community-associated MRSA is essential as well. Unlike traditional furunculosis, which almost always resolves with initial treatment, furunculosis associated with community-associated MRSA has a more variable outcome.13 Incorrect antimicrobial choices and failure to drain infected lesions may lead to treatment failure. Therefore, patients should be instructed about the importance of following up with their healthcare provider, preferably before discontinuing antibiotics, so that appropriate modifications to therapy can be made if the infection is not responding as expected.

Some patients have heard about MRSA on the evening news and associate it with debilitated hospitalized patients. This may lead some to worry about an underlying immune compromise. It is essential to tell patients the difference between community-associated MRSA and hospital-associated MRSA to alleviate fears.

Many experienced healthcare providers have been treating furunculosis in a standard manner for a long period of time. However, in the last few years community-associated MRSA has emerged as nonresponsive to traditional therapy. NPs remain on the front lines of the battle against community-associated MRSA. The increasing presence of NPs in primary care offices, emergency departments, and in retail medicine clinics translates into greater opportunities to effectively diagnose, treat, prevent, and educate patients, peers, and the public about this evolving healthcare problem.

REFERENCES

8. Rihn JA, Michaels MG, Harner CD. Community-acquired methicillin resis-
Community-Associated MRSA

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