[ Primary Care ]

# Community-Associated Methicillin-Resistant *Staphylococcus aureus* Infections in the Athlete

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**Context:** Community-associated methicillin-resistant *Staphlococcus aureus* (CA-MRSA) has become of increasing concern in the athletic setting. Appropriate recognition, treatment, and prevention measures are all paramount to protect individual athletes and teamwide outbreaks.

**Evidence Acquisition:** Relevant electronic databases (Medline or PubMed) through 2008 were searched. Articles and studies relevant to this topic were reviewed for pertinent clinical information.

**Study Type:** Clinical review.

**Results:** CA-MRSA is an increasing problem both in the community at large and in the athletic population.

**Conclusion:** Early infections based on methicillin-resistant *Staphlococcus aureus* are often misidentified, leading to delay in appropriate treatment. A high level of suspicion, prompt recognition, and appropriate treatment can minimize morbidity associated with CA-MRSA. Careful selection of antibiotics in suspected cases is important, with more severe infections requiring hospitalization and intravenous antibiotics. Eradication of bacteria in colonized patients has not yet proven to be effective. Prevention of infections is multifaceted, and it includes education, proper personal hygiene, routine cleaning of equipment, and proper wound care.

**Keywords:** methicillin-resistant *Staphlococcus aureus*; treatment; prevention

Methicillin-resistant *Staphylococcus aureus* (MRSA) was first described in the 1960s as a nosocomial pathogen. In the early 1980s, infections based on community-associated MRSA (CA-MRSA) began emerging. These infections were related to the spread of MRSA from hospitals into the larger community.[5] However, since the mid-1990s, a highly pathogenic community-acquired organism without health care association has emerged.[23,30] Today the prevalence of CA-MRSA infections are on the rise and becoming a major public health threat.[15] These infections are increasing worldwide. In many emergency rooms throughout the United States, this organism is identified as the primary pathogen in skin-related infections.[28]

The emergence of CA-MRSA poses a unique challenge for the clinician. The increasing prevalence of CA-MRSA in many communities, coupled with the organism's unique pattern of virulence, antibiotic resistance, and clinical presentation, has important treatment implications.

## CASE

A professional athlete presents to the trainer with multiple pruritic "spider" bites on the posterior aspect of his upper thigh, acquired while sleeping. The trainer initially treated him symptomatically, and within 24 hours, the affected areas had developed induration and erythema. The team physician evaluated him and administered oral antibiotics. The athlete's symptoms progressed within 48 hours to include increased pain, surrounding erythema, and multiple abscesses. He was admitted to the hospital, where an incision and drainage procedure was performed. A copious amount of pus was expressed from

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Table 1. Criteria to distinguish between HA-MRSA and CA-MRSA.[a]

| Criteria | HA-MRSA | CA-MRSA |
|---|---|---|
| Hospitalization within last year | × | |
| Recent surgery | × | |
| Residency in nursing home or skilled-facility | × | |
| Positive culture of MRSA within 48 hours after hospital admission | | × |
| No permanent indwelling catheters or medical device | | × |
| No medical history of MRSA infection or colonization | | × |

[a]MRSA, methicillin-resistant *Staphylococcus aureus*; HA, health care associated; CA, community associated.

multiple sites. Intravenous antibiotics were started. Wound culture results revealed a heavy growth of MRSA susceptible to trimethoprim/sulfamethoxazole. He was released from the hospital and followed in the training room. He completed a course of trimethoprim/sulfamethoxazole and returned to full play without residual disability.

Unfortunately, this is not a unique case. The experience of the St Louis Rams (professional football team), as published in the *New England Journal of Medicine* in 2005, brought to the forefront the emergence of the "superbug" in the athletic arena.[24] Other publications (scientific journals and general media) have supported the increasing prevalence of MRSA in the athletic population.[1,10,24,26,32]

## CHARACTERISTICS OF CA-MRSA

CA-MRSA has characteristics that are distinct from those encountered in cases of health care–associated MRSA (HA-MRSA), which suggests that most CA-MRSA isolates did not originate from nosocomial strains. Observed differences have demonstrated that the majority of CA-MRSA isolates carry the *mecA* gene on the highly mobile type IV staphylococcal chromosomal cassette, whereas the HA-MRSA typically carries the gene on the type II staphylococcal chromosomal cassette.[16,29] The *mecA* gene encodes for the methicillin-resistance penicillin-binding protein. The smaller staphylococcal chromosomal cassette associated with the majority of CA-MRSA has less ability to carry antimicrobial-resistance genes, likely resulting in a greater number of antibiotic susceptibility observed with CA-MRSA.[12,16] This is in contrast to the larger type II staphylococcal cassette that is typically carried by the HA-MRSA organisms, allowing for a greater resistance to multiple antimicrobial classes. CA-MRSA strains are typically resistant to beta lactams and 1 or 2 other drug classes. Of increasing concern are multidrug-resistant USA 300 isolates.[2,17] The identification of multidrug-resistant CA-MRSA further emphasizes the importance of mandating prevention techniques in training facilities and locker rooms, surveillance, and rapid identification and treatment of skin and soft tissue infections in athletes.

Although a number of USA strains of CA-MRSA have been identified, the Centers for Disease Control and Prevention reported at least 3 US strains are more prevalent. Pulsed field gel electrophoresis has identified USA 300 clone as the predominant CA-MRSA strain, whereas USA 100 is more common in HA-MRSA infections.[25,28] CA-MRSA strains frequently express genes that encode for a virulence factor known as Panton-Valentine leukocidin. This cytotoxin creates destructive holes in leukocytes and has been associated with soft tissue infections and necrotizing pneumonia.[33,35]

## RISK FACTORS FOR DEVELOPING CA-MRSA

The Centers for Disease Control and Prevention has developed criteria that can assist in distinguishing HA-MRSA from CA-MRSA.[7] Table 1 highlights the most common distinguishing criteria.

CA-MRSA infections have been identified in healthy individuals of all ages who have not had recent exposure to health care facilities.[6,30] At-risk populations have been identified and shown to have an increased prevalence of CA-MRSA infections; these populations include day care attendees, military personnel, correctional facility inmates, males having sex with other males, those living in crowded settings, and athletes (Table 2).[4,9,18,27]

Table 2. At-risk population for community-associated methicillin-resistant *Staphylococcus aureus*.

| |
|---|
| Athletes |
| Day care attendees |
| Military personnel |
| Inmates at correctional facilities |
| Males having sex with other males |
| Persons living in crowded settings |

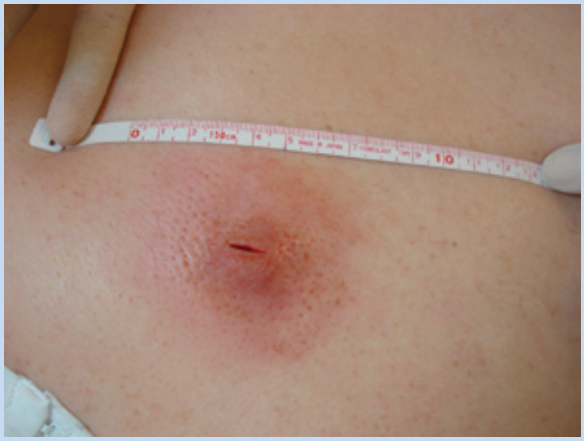

Figure 1. Weight lifter requiring incision and drainage of a furuncle that cultured positive for methicillin-resistant *Staphylococcus aureus*.

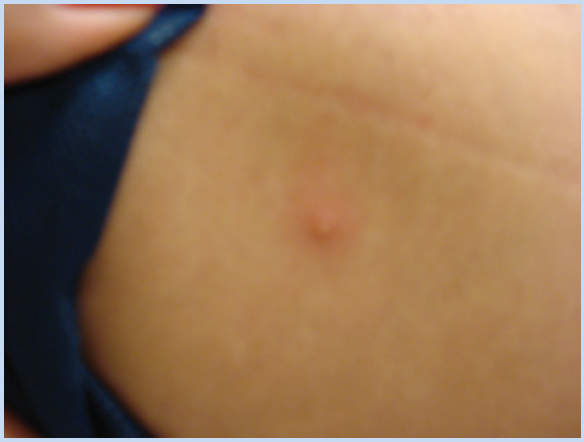

Figure 2. Division I athlete with recurrent infections colonized with methicillin-resistant *Staphylococcus aureus*.

Risk of exposure to the organism has been described through transmission routes both direct and indirect. Direct exposure can occur if the athlete comes into contact with a draining lesion or touches an object contaminated by the infected skin. Other, less obvious exposure can occur when the athlete shares an unwashed towel, shaves with a contaminated item, or shares other personal hygiene items. Risk can also increase with athletes who share nonsanitized training equipment, whirlpools, and rehab equipment. MRSA has been shown to survive for days to months on inanimate objects, and cultures obtained from ultrasound gel, countertops, and exercise equipment have been positive for MRSA.[8,24] All these common components in the athletic environment place athletes and staff at increase risk of exposure and potential infection.

People who have chronic or recent skin conditions may be at increased risk for MRSA because the natural skin barrier is compromised. Athletic activity often results in skin injury that creates a point of entry for the organism (eg, cuts and abrasions). Athletes who participate in contact sports that have prolonged physical contact (eg, football) are more likely to acquire MRSA infections.

Colonization also may play a role in infectivity. Studies have reported that 25% to 30% of the general population is colonized at any given time with methicillin-sensitive *S aureus*. Of those colonized, less than 1% are colonized with MRSA.[22,30] In addition to the nares, MRSA has been found on skin, pharynx, gastrointestinal tract, axilla, perineum, and rectum (Figure 1).[19,31]

## CLINICAL FINDINGS

CA-MRSA soft tissue infections may clinically present as cellulitis, folliculitis, furuncles, carbuncles, and abscesses.[14] The infection often begins as a mild superficial infection of the skin, which may look harmless at onset but rapidly develop into large abscesses within 24 to 48 hours (Figures 2 and 3). The lesions are often mistaken for spider bites.[20] Although skin and soft tissue infections are more common with CA-MRSA, osteomyelitis, otitis media, respiratory tract, and blood sepsis can occur.[21]

## TREATMENT

The clinician must maintain a high index of suspicion when confronted with skin and soft tissue infections. It is important to culture all purulent skin lesions. The information obtained from the culture guides antibiotic selection and provides information about community prevalence of MRSA. The primary treatment of an abscess or purulent skin lesion is that of incision and drainage. Although incising and draining the lesion (Figure 4) is usually adequate to resolve the infection, it is

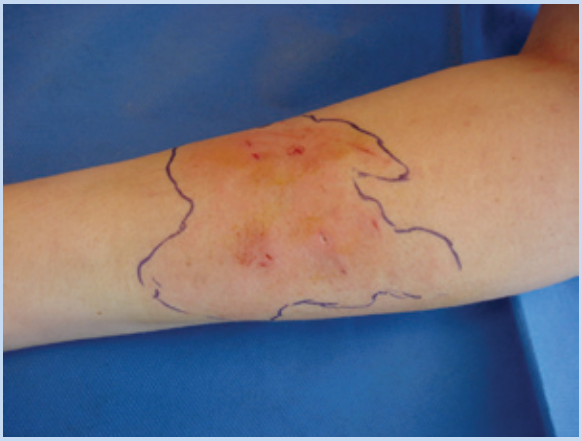

Figure 3. A typical presentation of a patient who developed a rapid, spreading cellulitis with multiple small pustules and abscesses within 24 hours.

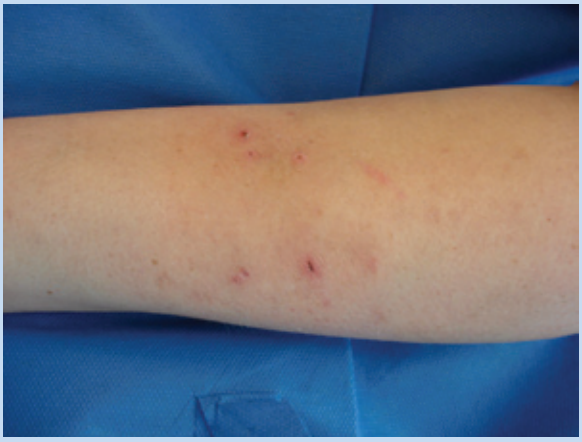

Figure 4. Resolving cellulitis after incision and drainage and antibiotic treatment.

sometimes insufficient, and empiric antibiotic treatment may be necessary. Empiric antibiotic therapy may include clindamycin, trimethoprim-sulfamethoxazole or tetracycline.[11] When selecting an antibiotic before the availability of culture results, the physician must take into account susceptibility data from the community. Using antibiotics following the incision and drainage of the lesion is left to the discretion of the treating physician. Factors that determine the need for antibiotics include the size of the lesion, cellulitis, age of the patient (very young or elderly), fever, signs of systemic infection, and comorbid conditions. MRSA should be included in the differential in all skin and soft tissue infection but especially in rapidly progressing

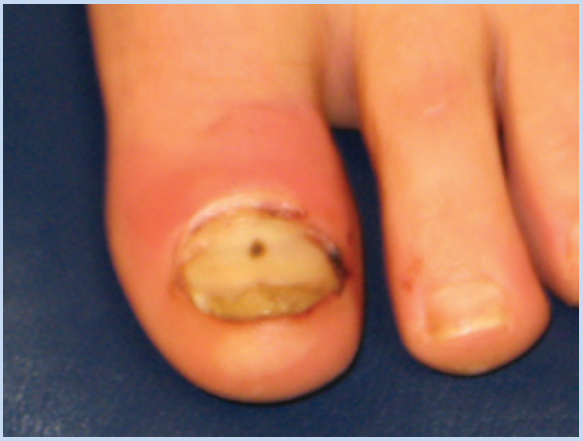

Figure 5. Division I athlete requiring hospitalization and intravenous vancomycin for toe infection related to methicillin-resistant *Staphylococcus aureus*.

infections that are not responding to the empiric antimicrobial treatment. Admission to the hospital for intravenous antibiotics may be needed in these situations (Figure 5).[13]

Proper identification and management of skin and soft tissue infections is imperative in reducing morbidity and mortality. The majority of these infections resolve without consequence, but deaths have been reported.[6]

## PREVENTION

A multidisciplinary approach is necessary to fully implement prevention strategies (see Table 3). This approach should include all athletic personnel and family members. Education is the key to prevention. Staff and athletes must be educated about MRSA and the importance of good hygiene practices. The athlete should inform the medical staff about skin lesions no matter how innocuous they appear.

MRSA has been shown to survive on surfaces for hours and even months,[8] which further emphasizes that proper cleansing of all equipment is imperative in reducing the potential spread of the infection. Universal precautions should be enforced at all times, with a strong focus on proper hand washing. Stringent daily disinfecting practices should be employed in the training room, locker room, showers, and common areas. It may be helpful to have an infectious disease specialist review disinfecting policies, inspect a facility's training room and locker room, and make additional prevention recommendations.

## RECURRENT MRSA INFECTIONS: PRESURGICAL SCREENING AND DECOLONIZATION TECHNIQUES

There is currently no consensus concerning the ideal patient population to screen or the optimal decolonization protocol. Over the course of many years, researchers have investigated

Table 3. Athletic facility prevention.

| |
|---|
| Educate staff and athletes. |
| Enforce hand washing. |
| Use soap dispensers rather than bar soap. |
| Shower immediately after workouts. |
| Avoid sharing personal items: towels, water bottles, shavers, combs/brushes, etc. |
| Disinfect whirlpools, hot tubs, showers, and exercise equipment according to manufacturing specifications. |
| Establish routine cleaning schedules for the equipment. |
| Wash and dry clothing according to manufacturer's specifications. |
| Report all skin lesions to medical staff. |
| Perform proper wound care and coverage. |
| Use antibiotics appropriately. |

numerous decolonization regimens. Decolonization agents have included skin washes and topical and systemic antimicrobial treatments. To date, decolonization efforts have failed to eliminate recolonization. Decolonization with agents such as mupirocin nasal ointment and antiseptic body washes has been studied and may be appropriate in colonized individuals who have recurrent MRSA infections or who are at high risk for postoperative infections.[3,34] Clinicians who are considering screening presurgical patients for decolonization are advised to consult with hospital infectious disease specialists. Studies are ongoing to further define the ideal decolonization agent (or agents).

## RETURN-TO-SPORTS CRITERIA

Athletes with MRSA skin or soft tissue infections require prompt treatment and close monitoring of their infections. Exclusion from participation depends on the severity of the infection, the ability to appropriately cover the wound, and the specific sport. Athletes with evidence of spreading cellulitis or systemic symptoms (ie, fever and chills) should be restricted from sports participation. Athletes with contained infections but no systemic symptoms may be able to participate, although they are typically handled on a case-by-case basis. Following the identification of a MRSA infection, the sports medicine team should review and comply with the return-to-sports guidelines developed by the governing sports organization. Full compliance with the guidelines protects the athlete and the other participants.

## SUMMARY

Medical providers face an increasing challenge of CA-MRSA prevalence in the treatment and care of athletes. Therefore, a high degree of clinical suspicion is required to adequately identify and diagnose the infection. Best practices include involving all members of the athletic staff (athletes, athletic trainers, and team physicians) in the monitoring and treatment of these infections. In addition, it is imperative that early detection and aggressive treatment of CA-MRSA infections be implemented to limit morbidity and mortality. Incision and drainage of abscesses and culture-directed antibiotic treatment are the mainstays of treatment. Hospitalization may be necessary for individuals with systemic symptoms or worsening infections (for intravenous antibiotics).

## Clinical Recommendations

**SORT: Strength of Recommendation Taxonomy**
**A:** consistent, good-quality patient-oriented evidence
**B:** inconsistent or limited-quality patient-oriented evidence
**C:** consensus, disease-oriented evidence, usual practice, expert opinion, or case series

| Clinical Recommendations | SORT Evidence Rating |
|---|---|
| Athletes are at increased risk for community-associated methicillin-resistant *Staphylococcus aureus*.[27] | C |
| Prevention should include education, proper hygiene, and routine cleaning of equipment.[11] | C |
| Decolonization has not yet proven to be effective in the community setting.[11] | C |
| Return to sports should be judged on a case-by-case basis.[27] | C |

For more information about the SORT evidence rating system, see www.aafp.org/afpsort.xml and Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. *Am Fam Physician.* 2004;69:549-557.

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