Community-acquired methicillin-resistant *Staphylococcus aureus*: a potential diagnosis for a 16-year-old athlete with knee pain

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Abstract

Objective: This case report aims to raise awareness in chiropractic physicians of the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) in adolescents who participate in sports activities and to alert the chiropractic physician of the necessity to consider potential diagnoses that are not within their typical clinical heuristic.

Clinical Features: A 16-year-old adolescent girl entered the clinic with a complaint of left knee pain that had an insidious onset during her involvement in sports activities. Later that same day, her knee became enlarged, red, and had pustular formations with a discharge. She was taken to an urgent care facility and subsequently diagnosed with MRSA. Her history included treatment of a left knee musculoskeletal condition 6 weeks prior to which she had responded favorably.

Interventions and Outcomes: She was treated medically with an aggressive course of antibiotic therapy and excision of the furuncle. The chiropractic physician played a role in patient education and notifying local school authorities of the case.

Conclusion: Doctors of chiropractic must prepare themselves for the unexpected and remain open to diagnostic possibilities outside of the normal scope of practice. Knee pain or cellulitis of any type may require additional diagnostic and patient care protocols to make the correct

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diagnosis. With the incidence of community-acquired MRSA increasing at an alarming rate, it is certainly a diagnosis doctors of chiropractic should be aware of when treating patients, especially those involved in sports activities.

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Introduction

Accurate differential diagnosis requires a rigorous set of thought processes that need to be both thorough and efficient. Two of the most common cognitive errors in this process are “search satisfying,” in which the physician stops investigation once an initial plausible diagnosis is put forth, and “availability,”¹ in which the physician evaluates the “probability of a (diagnosis) by the ease with which relevant instances come to mind.”^{1,2} In other words, the physician subconsciously sees as more likely in a new case those diagnoses that he or she has made frequently and recently in other cases. In this case, a 16-year-old female basketball player with a previous history of left knee pain that resolved 6 weeks earlier after treatment with spinal manipulative therapy and home care presented anew with what appeared to be the same left knee pain.

Because chiropractic physicians report that they frequently treat musculoskeletal conditions and rarely treat infectious conditions,³ some may be unaware that athletes are at increased risk for community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) and may not initially consider a diagnosis of infection when maybe they should. In the athlete population, direct contact of players’ exposed extremities during practice or competition can lead to minor abrasions, thereby creating a portal of entry for bacteria.⁴ A CA-MRSA infection, which can present with symptoms of joint pain, swelling, and restricted motion, may mimic musculoskeletal conditions: extremity joint dysfunction, sprain, or strain. The purpose of this article is to share an example of a case in which an assumption was made that the patient was experiencing an exacerbation of a previously diagnosed musculoskeletal condition of the knee instead of considering the CA-MRSA infection. This case discusses lessons learned, how to recognize CA-MRSA, and how to follow up cases of CA-MRSA.

Case report

A 16-year-old female high school athlete with a complaint of left knee pain presented to a chiropractic

clinic accompanied by her parent. The complaint began 2 days prior after a basketball game. There was no trauma, and the complaint was becoming progressively more debilitating. She described the pain as severe and as restricting her mobility. Physical examination revealed altered gait due to the knee pain. Her knee was moderately edematous with no discoloration or temperature change. There were no visible skin lesions. The joint was very sensitive to the touch. She rated the pain as 8 of 10 on a visual verbal pain scale, with 10 being the most severe. Her parent reported that her daughter had recently received what they perceived to be an insect bite on her knee. Her history revealed that, 6 weeks prior, she had been treated in the same clinic for joint dysfunction of the left knee. She had responded favorably to the treatment and had returned to her normal activities including playing basketball.

Because of the perceived exacerbation of her knee condition, a magnetic resonance imaging was ordered and scheduled to be performed within 3 days. The chiropractic physician contacted the parent later that evening to follow up. She was informed that the daughter’s knee condition had worsened and that, by earlier that afternoon, her knee had become enlarged and was red with a “pimple” formation with discharge. By evening, there were several “pimples”; and the central “pimple” had black tissue surrounding the center accompanied by a cloudy discharge. Because of these developments, she had been taken to an express care facility where the discharge was cultured and an initial diagnosis of cellulitis was established. She was then treated with sulfamethoxazole, an oral antibiotic, twice a day and a topical antibiotic ointment. According to the parent, they were informed that the condition was a severe *Staphylococcus* infection or possibly MRSA. Subsequently, the culture result was positive for MRSA. Fortunately, the patient responded well to the medical treatment regimen.

The chiropractic physician instructed the family on proper wound care and prevention of further transmission of infection. When the parents reported that 2 other teammates had recently been treated for skin infections, we contacted the local school officials and informed them of the occurrence of MRSA infection within the team. The officials then arranged for sanitation of the

locker room and instruction of the coaches regarding infectious diseases. Investigation of the Iowa law indicated that the physician who prescribed the antibiotic regimen is the responsible party to inform the state health department.

Discussion

Signs and symptoms of CA-MRSA

Skin and soft tissue infections are by far the most common clinical manifestation in CA-MRSA⁵ and represent 75% to 77% of such cases in the United States.^{5,6} In many instances, the initial skin lesions are frequently confused with a spider bite by both patients and clinicians.⁷ Community-acquired MRSA and the brown recluse spider bite have similar clinical presentations. Brown recluse spiders are more prevalent in the South and in warmer climates. Unless the physician practices in an area where the brown recluse is endemic, it is far more likely that the initial skin lesion is a CA-MRSA presentation.^{6,8}

Community-acquired MRSA infections usually occur after the protective barrier of the skin has been compromised, for example, from trauma, ulcers, or turf abrasion, which allows bacterial access to the subepidermal tissues.^{9,10} Fig 1 lists the most common signs and symptoms of CA-MRSA skin infections that clinicians should be aware of.⁶⁻⁸ The most frequently reported presentations of CA-MRSA skin infection are furuncles (abscessed hair follicles or boils), carbuncles (coalesced masses of furuncles), and abscesses.^{6,8} Fig 2 provides a list of infection presentations and their descriptions.^{10,11} Pain and systemic symptoms that seem more severe than what the history and physical examination findings reveal may indicate CA-MRSA infection.⁸ Community-acquired MRSA skin infections commonly present as an erythematous abscess with surrounding cellulitis.^{12,13} Fig 3 shows the appearance of a skin infection associated with CA-MRSA. The hallmarks of the presentation include

- Appearance like an insect or spider bite
- Swelling
- Tenderness
- Increased warmth
- Erythema
- Infected wound
- Folliculitis, pustular lesions
- Fluctuance
- Tissue necrosis

Fig 1. Signs and symptoms of CA-MRSA.

Infection	Definition
Abscess ¹⁰	a localized collection of pus surrounded by inflamed tissue ¹¹
Furuncle also referred to as a boil ¹⁰	a localized swelling and inflammation of the skin usually resulting from a bacterial infection of a hair follicle and adjacent tissue, having a hard central core, and forming pus ¹¹
Carbuncle ¹⁰	a painful local purulent inflammation of the skin and deeper tissues with multiple openings for the discharge of pus and usually necrosis and sloughing of dead tissue ¹¹
Folliculitis ¹⁰	inflammation of one or more follicles especially of the hair ¹¹
Impetigo ¹⁰	an acute contagious staphylococcal or streptococcal skin disease characterized by vesicles, pustules, and yellowish crusts ¹¹
Cellulitis ¹⁰	diffuse and especially subcutaneous inflammation of connective tissue ¹¹

Fig 2. Common CA-MRSA skin and soft tissue infections.

erythema, warmth, swelling, and tenderness at the affected area.⁹ These infections can develop anywhere in the body, but most likely occur on extremities where they are susceptible to microtrauma.⁹ Fig 4 shows an infection location at the knee joint. The organisms most commonly found on cultures are the normal dermatologic flora¹⁴ and include *S aureus* and group A β -hemolytic *Streptococcus*.

MRSA—a worldwide problem

In the middle of the 20th century, knowledge of preventive measures in infection control along with advances in antibacterial drug development gave us

Fig 3. The appearance of a skin infection associated with CA-MRSA. Photograph courtesy of the CDC Public Health Image Library.

Fig 4. Community-acquired MRSA infection at the knee joint. Photograph courtesy of the CDC Public Health Image Library.

hope that the tide had been turned on infection control.¹⁵ Unfortunately, the misuse and overuse of these drugs and the bacterial organisms' ability to mutate and develop resistance have resulted in drug-resistant strains. In 1959, methicillin was introduced; but within 2 years, hospital-acquired MRSA was described in the United Kingdom.¹² By 1968, the first major nosocomial (an infection that develops in the hospital and was not incubating at the time of admission) outbreak in the United States was reported.¹⁶ In 1982, the first instance of MRSA

developing outside of a hospital was reported in Detroit, MI; this occurred among intravenous drug users.¹² The first report of MRSA among healthy children with no identifiable risks was published a year later.⁶ By the late 1990s, instances of MRSA were reported by people in communities with no known risk factors.^{6,17,18} In 1999, 4 pediatric deaths were reported from CA-MRSA.¹⁹ By 2004, a number of researchers had come to the conclusion that the infections resulting from CA-MRSA had reached the proportions of a worldwide epidemic.¹²

It is estimated that invasive MRSA infections occur in approximately 94 000 persons each year and lead to approximately 19 000 deaths. Roughly 86% of these infections are health care-associated cases, and 14% are community-associated cases.²⁰⁻²² There are several populations, listed in Fig 5, that are at risk for CA-MRSA.^{6,7,12,16,23-27}

Community-acquired MRSA seems to be on the rise particularly in children and young adults.²⁸⁻³⁰ In particular, athletes participating in contact sports are at increased risk of developing CA-MRSA.^{4-6,31} The infection spreads via sharing of equipment and personal items, and through direct physical contact, especially when abrasions or lacerations of the skin are present.⁵ Community-acquired MRSA infections have been documented in baseball, basketball, volleyball, weightlifting, rugby, canoeing, cross-country running³¹, football,^{4,31-35} fencing,³² wrestling,^{32,36} and soccer.²⁷

The chiropractic physician's role

For chiropractic physicians, a viable treatment protocol is to recognize key signs and symptoms and to make an immediate referral to the patient's medical physician, and then to manage patients with CA-MRSA through patient education. Patients should be advised to keep wounds covered with clean dry bandages, clean hands with soap and water or waterless hand sanitizer after changing dressings, bathe regularly, and avoid sharing of potentially contaminated items such as towels, washcloths, bedding, bar soap, razors, clothing, or athletic equipment. They should not participate in sports or childcare unless their wounds are covered or healed. Patients should be instructed to seek medical care promptly if systemic symptoms develop or local symptoms worsen or do not improve within 48 hours.

The Centers for Disease Control and Prevention (CDC) has also issued formal recommendations regarding measures to prevent the spread of staphylococcal skin infections among sports participants. These recommendations can be used as a guideline for patient education and are summarized in Fig 6.⁴

- Children and young adults especially racial minorities^{6,7,12,23,24}
- Aboriginal/native people including American, Alaskan, Australian, Pacific and Canadian^{6,7,12,16,24,25}
- Tattoo recipients^{6,12}
- Other family members of someone who has been diagnosed with MRSA^{6,24,25}
- Daycare workers^{6,7,24,25}
- Competitive sports participants^{6,7,26,27}
- Military personnel^{6,7,12,27}
- Men who have sex with other men^{6,7,12,25}
- Recent arrests or inmates in correctional facilities^{6,7,24-27}
- Low socioeconomic status^{6,7,12,25,26}
- Individuals who are in close quarter or closed population environments²⁶
- Individuals from long-term care facilities²⁶
- Women pregnant and post partum^{6,12}
- Intravenous drug users^{12,25}
- HIV positive individuals²⁶
- Individuals who had recent healthcare contact²⁶

Fig 5. Populations at risk for CA-MRSA.

Recommendations:

1. Cover all wounds. If the wound cannot be covered consider excluding the player from practice or competition until the wound is healed or can be covered
2. Encourage good hygiene, including showering and washing with soap after all practices and competition
3. Ensure availability of adequate soap and hot water
4. Discourage sharing of towels and personal items (eg, no sharing equipment or clothing)
5. Establish routine cleaning schedules for shared equipment
6. Train athletes and coaches in first aid for wounds and recognition of wounds that are potentially infected
7. Encourage athletes to report skin lesions to coaches and encourage coaches to assess athletes regularly for skin lesions.

Fig 6. The CDC recommendations for the prevention of staphylococcal skin infections in athletes.

Conclusion

In retrospect, the incidental statement that the patient had had an insect bite on her knee and the fact that her pain seemed out of proportion to the history and examination results were significant findings. Knowing that participation in team sports is a risk factor for CA-MRSA and that "... musculoskeletal infections are the most common of the invasive infections caused by CA-MRSA isolates in children ages 2 to 18" coupled with an awareness that, in many cases of CA-MRSA, the initial skin lesion is easily confused with a spider or insect bite might have increased the probability in the doctor's mind of infection as a differential diagnosis.^{8,23} The application of this knowledge would have raised a "red flag" to consider CA-MRSA as a differential diagnosis. We hope the reporting of this case report will assist others in similar clinical situations.

Being aware of other possibilities and the willingness to be open to new situations and unexpected diagnoses can help us be successful in our diagnosis when these unique situations arise. With the incidence of CA-MRSA increasing at an alarming rate, it certainly is a differential diagnosis the chiropractic physician has to consider when treating patients.

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