CASE REPORT

Fulminant necrotising fasciitis by community-acquired methicillin-resistant *Staphylococcus aureus*Lemuel Non,¹ Aaron Kosmin²¹Department of Medicine, Albert Einstein Medical Center, Philadelphia, Pennsylvania, USA²Department of Infectious Diseases, Albert Einstein Medical Center, Philadelphia, Pennsylvania, USA

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SUMMARY

Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is a rare cause of necrotising fasciitis (NF), and is usually not fulminant as in group A *Streptococcus* (GAS), the archetypal aetiology. We report an unusually fulminant case of NF by CA-MRSA in an immunocompetent patient. A 52-year-old man presented to the emergency department with 1 week of progressive left thigh pain and swelling. The patient had ecchymoses, bullae and hypoesthesia of the involved skin, and CT scan revealed extensive fascial oedema. He was immediately started on broad spectrum antibiotics. Within 12 h of presentation, he underwent surgical debridement. Despite aggressive supportive care, the patient died less than 24 h after presentation. MRSA, with an antibiogram suggestive of a community-acquired strain, was recovered from intraoperative specimens and admission blood cultures. This case underscores that CA-MRSA, while rarely reported, can cause a fulminant presentation of NF similar to GAS in immunocompetent patients.

BACKGROUND

Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is a rare, but well-documented cause of necrotising fasciitis (NF). CA-MRSA infections have been reported to occur in previously healthy, immunocompetent individuals without risk factors traditionally associated with healthcare-acquired MRSA (HA-MRSA). Published reports of CA-MRSA causing NF have shown that its clinical course is characteristically indolent. We report an unusual case of fulminant and rapidly fatal NF due to CA-MRSA in a previously healthy man.

CASE PRESENTATION

A 52-year-old man with hypertension, left knee osteoarthritis, treated with periodic intra-articular steroid injection, and a remote history of open reduction with internal fixation repair of a left femoral fracture in 1988, presented to the emergency department (ED) with a 1-week history of progressive left thigh pain and swelling. A few days prior to admission, the patient also noted decreased urine output, constipation and anorexia. He denied any fever, chills, generalised erythema, exfoliation, myalgia, open wounds or abscess, or diarrhoea. The patient had no recent trauma, hospitalisation or known contact with MRSA. His last left knee injection was 3 weeks prior to his presentation. Although his symptoms had been going on for 1 week, the patient did not seek consultation until

he had unbearable pain. The patient worked as a pool guard, denied any smoking, alcohol or drug use.

INVESTIGATIONS

On presentation, the patient was awake, alert and fully orientated. The pulse rate was 100 bpm, blood pressure 114/68 mm Hg, respiratory rate 20 breaths/min, temperature 36.4°C, oxygen saturation 96% breathing ambient air. He initially only had erythema over the medial aspect of his left thigh, and at this point it was only suspected that he had severe cellulitis. Over the next few hours, however, there was rapid progression resulting in a markedly swollen and tender thigh with subcutaneous oedema, bullae, mild erythema and ecchymoses. The remainder of the physical examination was unremarkable.

The patient had abnormal laboratory results on presentation, including serum sodium 134 mmol/L (reference range 136–146), serum creatinine 5.7 mg/dL (0.7–1.2), blood urea nitrogen 70 mg/dL (8–26), serum bicarbonate 12 mmol/L (22–31), lactic acid 62.2 mg/dL (4.5–19.8), total bilirubin 2.8 mg/dL (0.2–1.2) and serum albumin 1.5 g/dL (3.5–5). His white cell count was normal $6.6 \times 10^3/\mu\text{L}$ (4–11) with 71% neutrophils and 3% Bands, and haemoglobin level was 13.1 g/dL (12.1–14.4). He also had a creatine kinase of 3312 IU/L (30–200) and positive urine myoglobin. A non-contrast CT of the left lower extremity revealed diffuse subcutaneous, superficial and deep fascial oedema in the left lower extremity, extending from the thigh to the level of the proximal calf. There was also muscular oedema in the medial compartment. The left knee was intact with no effusion or signs of inflammation.

OUTCOME AND FOLLOW-UP

In the emergency room (ER), severe sepsis due to cellulitis of the left thigh was the initial impression, but an underlying NF was also considered. After blood cultures were obtained, the patient was started on renally adjusted intravenous vancomycin 1.5 g every 24 h and piperacillin-tazobactam 2.25 g every 6 h. Surgery was initially deferred. Over the next few hours, however, the patient became confused and lethargic. Serial examination of the thigh revealed rapid worsening, with the patient now exhibiting numerous ecchymoses, worsening subcutaneous oedema, haemorrhagic bullae, and the overlying skin was sloughing with hypoesthesia. The patient, however, remained afebrile and haemodynamically stable.

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Because of the aggressive nature of his soft tissue infection, NF due to group A *Streptococcus* (*Streptococcus pyogenes*) was suspected. Intravenous clindamycin 600 mg intravenously every 8 h was added and surgery was asked to re-evaluate the patient. He continued to deteriorate rapidly with worsening acute kidney and liver injury, coagulopathy, delirium, ventilator-dependent respiratory failure and haemodynamic instability. Within 12 h of presentation, the patient was taken to the operating room for extensive excisional debridement of his thigh and was found to have copious necrotic tissue down into the muscle. Samples for biopsy and tissue culture were sent. His postoperative course was complicated by episodes of hypotension, ventricular tachycardia and progressive multiorgan failure. In less than 24 h, the patient expired. One of the two admission blood cultures from the ER on arrival and all intraoperative tissue cultures grew MRSA.

DISCUSSION

NF is a rare, potentially fatal soft tissue infection consisting of rapidly progressive necrosis of the superficial fascia, occurring at a rate of 0.4–0.53 cases per 100 000 in the USA. It usually results from inoculation of bacteria into the skin from direct insult or from haematogenous spread. While group A β -haemolytic streptococci (*Streptococcus pyogenes*) is classically associated with NF, other bacteria such as *Staphylococcus aureus*, other *Staphylococcus* spp, other *Streptococcus* spp, *Vibrio* spp, *Aeromonas* spp, anaerobes and mixed polymicrobial flora have been implicated in NF.¹ While considered rare, *Staphylococcus aureus* is an emerging aetiology of NF because of the increasing incidence of CA-MRSA, acquired by previously healthy individuals lacking risk factors traditionally associated with HA-MRSA.^{2–4} Of the almost 300 000 hospitalisations associated with *Staphylococcus aureus* annually in the USA between 1999 and 2000, an estimated 43.2% were attributed to MRSA.² The treatment of NF remains primarily to be urgent surgical exploration and debridement, along with antibiotic therapy.

Skin and soft tissue remain the most common site of MRSA infection, accounting for 59% of all infections.^{3 5} Several epidemiological risk factors have been implicated in CA-MRSA transmission, including being under 2 years old or over 65 years old, men who have sex with men, athletes, persons living in group facilities, intravenous drug users, sufferers of influenza-like illness or severe pneumonia, African-Americans, being in close contact with known CA-MRSA infections, and those with a history of previous CA-MRSA colonisation or infection.^{2 6}

In a population-based surveillance study in nine sites in 2005, 8987 invasive MRSA cases were reported, of which 3623 (13.7%) were community acquired.⁷ These invasive MRSA syndromes, which included pyomyositis, bacteraemia, necrotising pneumonia, severe sepsis, septic thrombophlebitis and NF,^{2 8 9} were rare in healthy individuals prior to the emergence of CA-MRSA.³ In the largest retrospective study on CA-MRSA in a medical centre in Los Angeles in 2005, CA-MRSA was the causative agent in 14 cases of NF.¹⁰ In another retrospective chart review of 30 NF cases in one institution over a 2-year period, 16% of the cases were attributed to CA-MRSA, and all the patients survived after surgery and antimicrobial therapy for MRSA.⁸ Both series suggested that NF caused by CA-MRSA might be less virulent than other usual pathogens because of the lack of mortality in the aforementioned series, which concurred with previous case reports.

There has only been one report, so far, of NF from CA-MRSA that was reported to be severe, and it was in a case of a man with HIV who had a course that was rapidly

progressive and nearly fatal. The patient, however, was immunocompromised.¹¹ This case is the first documented report of CA-MRSA NF that was fulminant, resulting in death within 24 h of presentation.

While the patient manifested with systemic disease, we believe it to be most consistent with NF and associated sepsis rather than toxic shock syndrome (TSS), another life-threatening syndrome associated with *Staphylococcus aureus*. The patient did not have the characteristic erythrodermal rash that is found in TSS, and the patient's hypotension and multiorgan failure can be explained by the burden of infection in the patient's necrotic limb and secondary bacteraemia without having to invoke elaboration of a TSS causing superantigen. Also, our patient did not have the usual risk factors associated with NF due to CA-MRSA, such as diabetes mellitus, advanced age, recent surgery, trauma, chronic skin infection and immune system impairment.¹

CA-MRSA is genotypically distinct from HA-MRSA. The most common North American strain, USA300, is genetically distinct from the predominant strain of HA-MRSA (ie, USA100).^{12 13} CA-MRSA is found to have a smaller and less complicated version of the staphylococcal cassette chromosome (SCC), designated as SCC *mecA* type IVa. This type of SCC is less bulky than the versions in HA-MRSA, and contains fewer-resistance genes; however, the USA300 harbours unique virulence genes.^{3 14} These putative virulence genes include Panton-Valentine leukocidin (PVL) components and staphylococcal enterotoxin H, among others, which could contribute to its heightened pathogenicity even in healthy individuals.¹⁴ While it is still uncertain whether PVL really contributes to its virulence, colonisation with CA-MRSA expressing PVL was found to be a significant risk factor for developing subsequent soft tissue infection.^{5 8 10}

CA-MRSA appears to be more susceptible to antibiotics compared to HA-MRSA. A 2003 retrospective case series on patients with CA-MRSA showed that 96% were susceptible to clindamycin, but as many as 19% could have inducible resistance.⁵ Our patient exhibited a similar antibiogram, with resistance to fewer antimicrobials compared with traditional HA-MRSA. Suggested treatment for CA-MRSA is essentially the same as in HA-MRSA: vancomycin is the standard treatment for severe complicated skin and soft tissue infection by MRSA, as it provides a high cure rate and is relatively safe. Other possible options include linezolid, daptomycin and clindamycin for susceptible strains.¹⁵

Our patient died from a strain of CA-MRSA despite receiving aggressive management for NF, including recognition of the syndrome, surgical debridement and administration of intravenous antibiotics that target MRSA. This case underscores not only

Learning points

- ▶ Community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is an emerging cause of skin and soft tissue infections, even in immunocompetent patients.
- ▶ While CA-MRSA usually causes an indolent form of necrotising fasciitis (NF), it may also cause a dramatic and fulminant course.
- ▶ Empiric antibiotic coverage for MRSA in patients suspected to have NF is recommended.
- ▶ In all cases of NF, regardless of underlying aetiology, urgent surgical debridement should be performed.

the importance of understanding CA-MRSA as a cause of severe soft tissue infections including NF, but also that it can produce a fulminant, rapidly fatal form of NF akin to that classically caused by GAS. In all cases of NF, whatever the underlying pathogen may be, emergent surgical debridement should be performed along with antibiotic therapy.

Contributors LN wrote the content of the case report, and it was reviewed by AK.

Competing interests None.

Patient consent Obtained.

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REFERENCES

- Childers BJ, Potyondy LD, Nachreiner R, *et al.* Necrotizing fasciitis: a fourteen-year retrospective study of 163 consecutive patients. *Am Surg* 2002;68:109–16.
- Boucher HW, Corey GR. Epidemiology of methicillin-resistant *Staphylococcus aureus*. *Clin Infect Dis* 2008;46(Suppl 5):S344–9.
- David MZ, Daum RS. Community-associated methicillin-resistant *Staphylococcus aureus*: epidemiology and clinical consequences of an emerging epidemic. *Clin Microbiol Rev* 2010;23:616–87.
- Fridkin S, Hageman J, Morrison M, *et al.* Methicillin-resistant *Staphylococcus aureus* disease in three communities. *N Engl J Med* 2005;352:1436–44.
- Davis SL, Perri MB, Donabedian SM, *et al.* Epidemiology and outcomes of community-associated methicillin-resistant *Staphylococcus aureus* infection. *J Clin Microbiol* 2007;45:1705–11.
- King MD, Humphrey BJ, Wang YF, *et al.* Emergence of community-acquired methicillin-resistant *Staphylococcus aureus* USA 300 clone as the predominant cause of skin and soft-tissue infections. *Ann Intern Med* 2006;144:309–17.
- Klevens RM, Morrison MA, Nadle J, *et al.* Invasive methicillin-resistant *Staphylococcus aureus* infections in the United States. *JAMA* 2007;298:1763–71.
- Young LM, Price CS. Community-acquired methicillin-resistant *Staphylococcus aureus* emerging as an important cause of necrotizing fasciitis. *Surg Infect (Larchmt)* 2008;9:469–74.
- Vayalunkal JV, Whittingham H, Vanderkooi O, *et al.* Necrotizing pneumonia and septic shock: suspecting CA-MRSA in patients presenting to Canadian emergency departments. *CJEM* 2007;9:300–3.
- Miller L, Perdreau-Remington F, Rieg G, *et al.* Necrotizing fasciitis caused by community-associated methicillin-resistant *Staphylococcus aureus* in Los Angeles. *N Engl J Med* 2005;352:1445–53.
- Olsen RJ, Burns KM, Chen L, *et al.* Severe necrotizing fasciitis in a human immunodeficiency virus-positive patient caused by methicillin-resistant *Staphylococcus aureus*. *J Clin Microbiol* 2008;46:1144–7.
- Moran G, Krishnadasan A, Rachel G, *et al.* Methicillin-resistant *S. aureus* infections among patients in the emergency department. *N Engl J Med* 2006;355:666–74.
- Huang H, Flynn NM, King JH, *et al.* Comparisons of community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) and hospital-associated MRSA infections in Sacramento, California. *J Clin Microbiol* 2006;44:2423–7.
- Baba T, Takeuchi F, Kuroda M, *et al.* Mechanisms of disease genome and virulence determinants of high virulence community-acquired MRSA GLOSSARY. *Lancet* 2002;359:1819–27.
- Stryjewski ME, Chambers HF. Skin and soft-tissue infections caused by community-acquired methicillin-resistant *Staphylococcus aureus*. *Clin Infect Dis* 2008;46(Suppl 5):S368–77.

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