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CASE REPORT

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Multifaceted manifestations: A case report of MRSA pneumonia with sepsis, pyelonephritis, and ileus muscle abscess

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Key Clinical Message

Methicillin-resistant staph aureus (MRSA) infections are challenging to treat, and with the emergence of community-associated MRSA (CA-MRSA) strains, early consideration of this pathogen in populations without typical risk factors is critical. Here we present a case of CA-MRSA pneumonia that resulted in Community-acquired pneumonia (CAP) with septic shock, pyelonephritis, and muscle abscess.

KEYWORDS

MRSA pneumonia, muscle abscess, pyelonephritis, septicemia

1 | INTRODUCTION

Among the different pathogens that lead to bacteremia, *Staphylococcus aureus* has the highest incidence rate in the North American population. It is estimated that out of every 100,000 persons who develop bacteremia, 4.2% to 38.2% of cases are due to *S. aureus*.[1] *S. aureus* has been reported to infect various organs and sites, including the lungs, cardiovascular system, and surgical sites, among others.[2] Treating *S. aureus* has been challenging due to the frequent presence of antibiotic resistance among *S. aureus* isolates, with MRSA being of paramount clinical concern.[3] MRSA not only requires prolonged treatment, which comes with high associated costs but also carries a very high mortality rate, which could reach as high as 60%.[4] One of the many complications of MRSA is bacteremia, which can lead to both sepsis and septic shock.[5] After adjusting for different variables, the rate of invasive MRSA infections in the United States was 31.8 per 100,000 individuals in 2005. Of these invasive MRSA infections, 75% involved *S. aureus* bacteremia.[6] Concerning pneumonia, *S. aureus* was traditionally considered a nosocomial pathogen. However, in recent times, both MRSA and meticillin-sensitive staphylococcus aureus (MSSA) have emerged as significant contributors to healthcare-associated pneumonia (HCAP). Upon reviewing over 4500 hospitalized pneumonia cases, *S. aureus* was found to be responsible for over a third of all HCAP instances.[7]

2 | CASE PRESENTATION

2.1 | History and examination

A 53-year-old gentleman with a relevant medical history of hypertension, tobacco use disorder, dyslipidemia, and Class III obesity was presented to the emergency department (ED) due to low back and left-side lower extremity

pain, which prevented him from ambulating. He described his pain as lateral, radiating from his left hip to his knee, ankle, and sometimes to his toes. This pain began 4 days prior to his hospital visit, and he has been unable to walk since then. He reported taking Methocarbomol at home without significant relief. He denied any provoking factors, including trauma or falls, swelling in the legs, or recent surgeries. He also denied recent weight gain, wearing tight-fitting clothes, or changes in exercise habits, besides being bed-bound for a few days.

The patient also mentioned a cough for the past 4 weeks, with recent worsening in the past 4 days, which was associated with shortness of breath. He endorsed smoking one pack a day for the past 17 years. He noticed increased sputum production with white phlegm, difficulty sleeping, chills, feeling feverish, and sweating episodes, especially during nighttime. The patient reported not coming to the hospital earlier because he expected to get better.

On examination, the patient's vitals were as follows: a temperature of 37.6°C, blood pressure of 116/69 mmHg, pulse of 89 beats/min, respiratory rate of 18 breaths/min, and oxygen saturation of 90% on room air. Patient's parameters showed weight 140 kg, height 180 cm, and BMI 43. The patient appeared diaphoretic with an obese habitus. Lungs auscultation significant for decrease air entry on the right upper lobe, and symmetrical chest wall expansion was noted. Decreased spontaneous range of motion on the left lower extremity, tenderness over the left lateral hip, and low back paraspinal tenderness were noted. Motor exam showed power +1 on left lower extremity in comparison to +5 on right lower extremity. Sensation were intact. The skin over the lower lumbar spine was warm to the touch. Otherwise, the physical exam was unremarkable.

2.2 | Investigation and treatment

Initial laboratory workup revealed elevated C-reactive protein and leukocytosis, as demonstrated in Table 1. Rapid polymerase chain reaction tests for Flu A, Flu B, and Covid-19 were negative. Urine drug screen results were negative, and urinalysis was unremarkable (WBC <5, negative nitrite and leukocyte esterase). Sputum and blood cultures were obtained on the first day of admission. During the initial work-up in the ED, the patient was found to have right upper lobe pneumonia (Figure 1A), complicated by acute respiratory failure with a saturation of 90% on room air. Computed tomography (CT) chest without contrast revealed right upper lobe irregular consolidation with cavitation and multiple scattered bilateral pulmonary nodules, some with minimal cavitation consistent with necrotizing pneumonia (Figure 1B). Hip x-ray was negative. The patient was given ceftriaxone and doxycycline empirically and started on 2 L nasal cannula oxygen and multimodal pain management. After admission, due to physical examination findings concerning for an infectious process in the lower back and new onset hemoptysis, additional imaging was performed. CT L-spine revealed multilevel mild degenerative lumbar spine and fat stranding in the left pelvis with prominent non-enlarged lymph nodes (Figure 2). Magnetic resonance imaging (MRI) L-spine performed the next day revealed findings concerning for paraspinal pyomyositis and a 1.5 cm left ileus muscle abscess (Figure 3). On the same day, blood culture revealed gram-positive cocci in chains with a DNA probe positive for Methicillin resistance. The patient was started on culture-directed Vancomycin per pharmacy protocol and Cefazolin 2 g IV every 8 h for synergy per infectious disease (ID) recommendation. Surgery was consulted for a possible ileus muscle abscess, which did not require drainage due to its small size. Daily blood cultures were drawn until negative results on Days 5 through 7 of admission. CT abdomen was performed to confirm ileus abscess resolution, which revealed no signs of abscess; however, left kidney findings were concerning for pyelonephritis (Figure 4). Renal ultrasound was unremarkable, but repeat urine analysis was consistent with urinary infection.

TABLE 1 Blood test result.

Test name	Result	Normal value
CRP	406.5 mg/L	<5 mg/L
Sodium	134 mmol/L	135–145 mmol/L
Chloride	97 mmol/L	95–105 mmol/L
Bicarbonate	22 mmol/L	18–22 mmol/L
Anion gap	15 mmol/L	6–12 mEq/L
Glucose	102 mgL/dL	65–110 mg/dL
BUN	19 mmol/L	8–21 mg/dL
Creatinine	1.08 mmol/L	0.8–1.3 mg/dL
WBC	31.1	$4–10\times10^9$/L
Hemoglobin	12.8	13–17 g/dL (men)
Hematocrit	39.5	40%–52% (men
Platelets	577	$150–400\times10^9$/L
Absolute neutrophil count	23.6	$2–8\times10^9$/L
Bands	2.2	$<1\times10^9$/L

2.3 | Outcome and follow-up

Given negative urinalysis results on admission, negative renal ultrasound findings, and appropriateness of the current antibiotics regimen for the infection, no further action was taken for pyelonephritis per ID recommendations. Additionally, transthoracic echocardiogram (TTE) and

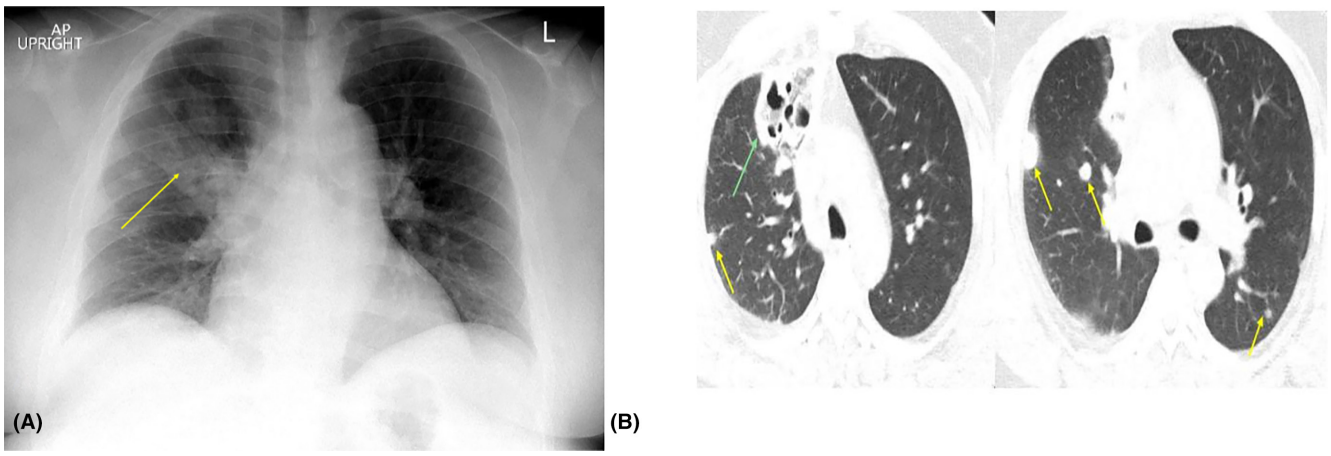

FIGURE 1 (A) Initial CXR on admission demonstrated right upper lobe pneumonia (arrow). (B) CT chest without contrast. Multiple bilateral pulmonary nodules (yellow arrow), right upper lobe consolidation with cavitations (green arrow).

FIGURE 2 CT L-spine admission Day 1. There is fat stranding (yellow arrow) and a prominent pelvic lymph node (green arrow) along the left iliopsoas.

transesophageal echocardiogram (TEE) were performed, yielding negative results for infective endocarditis. The patient experienced gradual clinical and laboratory improvement in the following days. Cefazolin was discontinued on Day 10, and the patient was discharged with a recommendation to continue intravenous vancomycin for a total of 8 weeks as per ID specialist recommendation.

3 | DISCUSSION

MRSA pneumonia is one of the leading causes of HCAP in recent times. However, strains of MRSA have emerged recently, causing CA-MRSA pneumonia in patients with neither exposure to the healthcare system nor other traditional risk factors, as observed in our patient. These strains have also tested positive for Panton-Valentine leukocidin (PVL), a virulence factor most closely linked to severe disease.[8] The increase in CA-MRSA infections can be explained by past studies done by Bogaret et al., that showed increased use of the conjugated pneumococcal vaccine may have led to increased colonization with *S. aureus*, thus possibly resulting in an increase in MRSA colonization. This was further supported by Gorwitz et al., who demonstrated increased MRSA colonization among the community, partially explained by the rise in certain strains associated with community transmission.[9,10] While clear risk factors for MRSA CAP have not yet been identified, factors such as recurrent hemodialysis, recurrent skin infections, and previous MRSA infection and colonization have been strongly linked to infection. Additionally, diabetes mellitus, tobacco use, alcohol use disorder, and immunosuppressive states have been associated with MRSA infection. Human-to-human transmission via close contact and sharing towels, needles, and other contaminated instruments may also play a role in infection.[8] This serves as an important reminder that in the ever evolving world of bacteriology, traditional as well as non-traditional presentations and histories must be kept in mind while approaching patients.

Establishing clinical suspicion and identifying patients with risk factors is crucial for diagnosing and treating MRSA-related infections. Our patient, as discussed above, has an extensive smoking history; however, urine drug screening was negative for illicit drugs, and he denied ever using injecting or sharing instruments. Gillet et al. has shown us that certain *S. aureus* strains, especially PVL-positive strains, have been linked with severe necrotizing pneumonia.[11] As seen in our patient, this can often present with hemoptysis, fevers greater than 40°C, and tachycardia. Chest imaging can be used to demonstrate classical radiological findings,

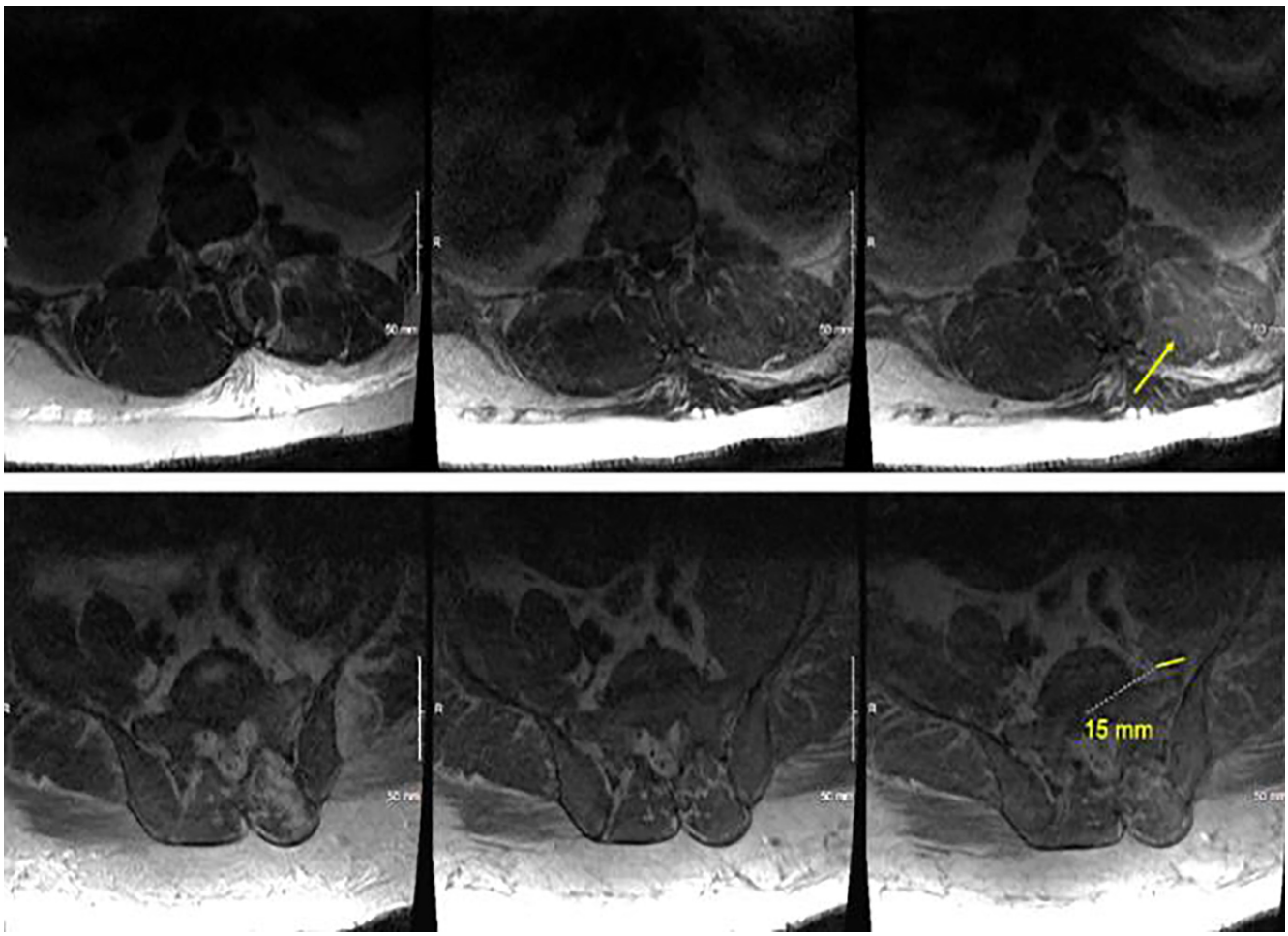

FIGURE 3 MRI lumbar spine admission Day 2: t1, t2 w/o and w/contrast. There are extensive inflammatory changes with edema (yellow arrow) and enhancement involving the left paraspinal muscles throughout the lumbar spine and upper sacrum. There is inflammation in the medial aspect of the left ileus muscle at L4 and L5 with 1.5 cm fluid collection along the medial margin of the left iliacus muscle at L5-S1 (yellow line).

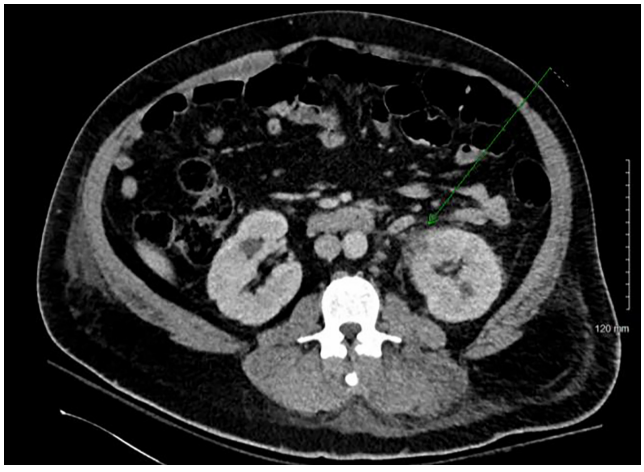

FIGURE 4 CT Abdomen and pelvis with IV contrast admission Day 5. There is focal perinephric fat stranding around the medial aspect of the lower pole of left kidney consistent with pyelonephritis (green arrow).

as discussed in the prior section. These factors, in addition to erythroderma and leukopenia, have been associated with increased mortality.[12]

Despite the strong clinical suspicion in our patient, the diagnosis needed to be confirmed. Blood, urine, and especially sputum cultures should be sent immediately, with the initiation of empiric antibiotics without delay.[13] However, since sputum culture is not specific or sensitive to MRSA, most patients can undergo bronchoalveolar lavage or deep tracheal aspirate to isolate the organism.

Once cultured, immediate empiric treatment is recommended. The first choice of antibiotics recommended by the Infectious Disease Society of America is IV Vancomycin or Linezolid 600 mg twice daily, orally or intravenously.[14] Our patient was started on Vancomycin and Cefazolin based on the culture sensitivities. A review conducted by Rose et al. in 2021[15] showed benefits of initiating dual antimicrobial therapy. Combination treatment with vancomycin and

beta-lactams (Cefazolin as in our patient's case) showed a decrease in clinical failure and a reduction in the duration of bacteremia. However, care must be taken for the possibility of nephrotoxicity, with the option to use daptomycin in bacteremia only instead. Given the inactivation of Daptomycin by surfactant in the lungs,[16] As with the case discussed in the previous section, near-immediate clinical improvement was noticed in our patient, with eventual clearing of the bacteremia from Day 5 to Day 7 of antimicrobial therapy. Recommendations by Rose et al.[15] call for initial intensive therapy followed by de-escalating treatment based on patient response and according to local antibiotic stewardship, as seen by the decision to stop cefazolin and continue with vancomycin in our patient. Prompt and appropriate antibiotic initiation not only allowed for better clinical outcomes, but also resulted in creating treatment plans requiring medication only for as long as required.

It is well-known that MRSA bacteremia can be complicated by increased mortality and morbidity and the development of skin and soft tissue infections (SSTI), endocarditis, pneumonia, bone, and joint infections, seeding of other organs such as kidneys, and CNS infections.[17,18] In our patient, CT and MRI of the lumbar spine showed an ileus muscle abscess. In addition to culture-directed antibiotics, current guidelines include surgical incision and drainage for deep tissue abscesses.[17] As in our patient, surgical consultation resulted in the decision not to surgically drain and to continue with antibiotic therapy based on the size of the abscess. An extensive review by Yacoub et al.[19] supports this decision. They recommend percutaneous catheter drainage of psoas abscesses greater than 3 cm in size with antibiotics for smaller abscesses and surgical drainage for recurrent lesions. Repeat follow-up CT eventually showed resolution of the abscess after a course of antibiotic use.

Other complications must be ruled out with appropriate examinations and investigations. A TTE followed by a TEE for infective endocarditis[10] and imaging for suspicious lung, bone, joint, and soft tissue lesions. Our patient underwent cardiological imaging and TEE, which showed no lesions and required no further treatment.

Our case showcases not only the importance of appropriate antibiotic treatment for clinical improvement but also the role it has to play in decreasing and limiting the extent of complications. Continued research and updates for disease pathogens and their new treatment recommendations and resistance patterns are the need of the hour in our ever-evolving world.

4 | CONCLUSION

In summary, our findings detail a severe case of community-acquired MRSA pneumonia in a patient with no significant medical history, further complicated by septicemia, pyelonephritis, and muscle abscess. Timely diagnosis and treatment are crucial for improving outcomes in cases of necrotizing pneumonia attributed to community-acquired MRSA. We advocate for the consideration of community-acquired MRSA as a potential pathogen in cases of community-acquired pneumonia, particularly if initial treatments are ineffective. Additionally, clinicians should maintain a high index of suspicion for this disease in young, otherwise healthy individuals with a toxic clinical presentation and involvement of multiple organs. Despite optimal interventions, it is important to recognize that catastrophic complications may still occur.

AUTHOR CONTRIBUTIONS

Ahmad Damlakhy: Conceptualization; methodology; writing – original draft; writing – review and editing. **Zohaib A. Khan:** Conceptualization; writing – original draft. **Anas Abdelqader:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Dmitrii Chernyshev:** Conceptualization; methodology; writing – original draft; writing – review and editing. **Emily Ross:** Conceptualization; data curation; investigation; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The data used to support this study are included within the article. Further inquires can be directed to the corresponding author.

ETHICS STATEMENT

Not applicable.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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