SN Comprehensive Clinical Medicine (2026) 8:379
https://doi.org/10.1007/s42399-026-02606-2

CASE REPORT

Catheter-Related *Staphylococcus aureus* Bacteremia Complicated by Sternocleidomastoid Muscle Phlegmon and Sternoclavicular Septic Arthritis in a Hemodialysis Patient: A Case Report

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Received: 13 April 2026 / Revised: 2 August 2026 / Accepted: 10 August 2026
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Abstract

Background *Staphylococcus aureus* bacteremia is a major cause of morbidity in hemodialysis patients, often leading to metastatic complications. Sternocleidomastoid muscle phlegmon and sternoclavicular septic arthritis are uncommon but serious infectious complications of *S. aureus* bacteremia described in immunocompromised patients but rarely described in patients with end-stage renal disease or an indwelling dialysis catheter.

Case Presentation We report a case of a 50-year-old Caucasian woman with end-stage renal disease on maintenance hemodialysis. Her dialysis catheter was removed because of fever and positive blood cultures for methicillin-susceptible *S. aureus*. Despite a ten-day outpatient course of ceftriaxone and azithromycin, she developed recurrent fever, right-sided neck swelling, trismus, severe lower neck pain, and swelling and tenderness over the sternocleidomastoid muscle. She also had restricted neck movement (torticollis) and a hemorrhagic petechial rash. Odontogenic (dental) or pharyngeal infectious sources were excluded. No internal jugular vein thrombosis was detected at the initial catheter site. Imaging showed a phlegmon in the fascial compartment of the right sternocleidomastoid muscle, septic arthritis of the sternoclavicular joint with erosion of the sternal end of the clavicle, and septic pulmonary emboli with cavitation. The patient underwent surgical incision and drainage of the sternocleidomastoid muscle phlegmon. This was combined with six weeks of targeted intravenous antibiotic therapy and continued hemodialysis. Clinical and radiological improvement was achieved, with complete resolution of the infection and cutaneous manifestations.

Conclusion This case shows an unusual pattern of metastatic dissemination in catheter-related *S. aureus* bacteremia. The complications included a sternocleidomastoid muscle phlegmon and sternoclavicular septic arthritis, both arising by contiguous spread from the infected catheter tunnel, together with septic pulmonary embolism and a hemorrhagic rash. The case underscores the need for early recognition, prompt source control, and aggressive, multidisciplinary management, including early surgical intervention, for high-risk hemodialysis patients.

Keywords Sepsis · Sternocleidomastoid phlegmon · Septic arthritis · Hemorrhagic rash · *Staphylococcus aureus* bacteremia · Embolism

Introduction

Staphylococcus aureus bacteremia (SAB) is one of the most common serious bacterial infections worldwide, with a case-fatality rate of approximately 22%, according to UK Health Security Agency surveillance data from 2022 to 2023 [1]. SAB causes metastatic infection in more than one third of cases, including infective endocarditis (about 12%), septic arthritis (7%), and vertebral osteomyelitis (about 4%) [2]. SAB can be classified as "complicated" or "uncomplicated," with a complicated infection defined by metastatic infection sites, embolic phenomena, or attributable mortality. Predictors of complicated SAB include community-acquired *S. aureus*,

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Published online: 20 August 2026

positive follow-up blood cultures at 48–96 h, and persistent fever at 72 h. Skin findings such as petechiae, vasculitis, infarcts, ecchymoses, or pustules suggest an acute systemic infection [3]. Metastatic dissemination of catheter-related SAB occurs when bacteria spread from the bloodstream to other parts of the body, potentially leading to serious complications, including endocarditis and osteoarticular, soft-tissue, pleuropulmonary, and device-related infections [3]. This condition is particularly concerning because it can lead to high morbidity and mortality if not treated promptly [4]. *S. aureus* primarily colonizes the human skin and nasal mucosa. However, it causes infections in patient groups, such as those over 70 years old, Black populations, Indigenous Australians, immunocompromised individuals, people who inject drugs, and patients on hemodialysis [3].

Although skeletal muscle usually resists infection, hematogenous spread can occur in susceptible hosts, leading to pyomyositis or a deep fascial phlegmon, especially in patients with underlying conditions such as diabetes mellitus, uremia, or local tissue injury [5]. Pyomyositis is a serious, invasive soft-tissue infection and a rare complication of SAB, characterized by a localized collection of purulent exudate within the overlying muscle fascia. Sternocleidomastoid (SCM) muscle phlegmon is an acute, severe, spreading suppurative bacterial infection of skeletal muscle fibers and surrounding fascia, often preceding the formation of a diffuse exudate. Pyomyositis is increasingly reported in high-income temperate countries, where it is associated with immunocompromising conditions, including HIV infection, diabetes mellitus, malignancy, and renal failure. *S. aureus* is the most commonly isolated organism and reported mortality ranges from 1% to 23% [6]. Most cases require antibiotic treatment and surgical or image-guided intervention. Another significant concern in recent years is that *S. aureus* has become increasingly multidrug-resistant, showing resistance to antibiotics such as β-lactams, methicillin, daptomycin, linezolid, and vancomycin, as well as other classes, mainly due to the misuse and overuse of antibiotics [7].

We report the case of a 50-year-old woman with a complex presentation of catheter-related SAB. She was undergoing hemodialysis. Her illness was complicated by SCM muscle phlegmon, septic arthritis, septic pulmonary embolism, and a hemorrhagic rash. This unusual presentation poses a diagnostic challenge because the initial symptoms are nonspecific and may mimic other deep neck infections. This case highlights possible pathophysiological mechanisms, diagnostic pitfalls, and the importance of timely surgery and multidisciplinary management.

Case Presentation

Patient Information

A 50-year-old Caucasian woman with end-stage renal disease on maintenance hemodialysis (three times weekly for 6 months; short dialysis vintage) and poorly controlled type 1 diabetes mellitus (12 years) was promptly transferred from a rural hospital to the oral and maxillofacial department at a tertiary hospital. Two weeks before admission, she presented to the rural hospital with fever up to 38 °C, along with nausea, vomiting, and diarrhea. There was purulent discharge from a right internal jugular vein (IJV) tunneled hemodialysis catheter, and blood cultures were positive for methicillin-susceptible *S. aureus (MSSA)*. The chest radiograph was unremarkable. Comorbidities included diabetic nephropathy, severe anemia, polyneuropathy, arterial hypertension, and heart failure. Leukocytosis (WBC 13.7×10^9/L, 89% neutrophils) was observed. Hospitalization and catheter removal were offered on the day the blood culture became positive; however, the patient categorically refused and believed that antibiotic treatment alone would be sufficient. She consented only after inflammation developed around the catheter exit site. The tunneled IJV catheter was removed three days after the initial positive blood culture was obtained. The initial diagnosis was a catheter-related bloodstream infection (CRBSI). She received outpatient treatment with ceftriaxone 1.0 g intravenously twice daily for 10 days and azithromycin 500 mg orally once daily for 6 days. During antibiotic therapy, her clinical condition improved, with resolution of fever and weakness and a decrease in leukocytosis. However, her condition worsened again after completing the antibiotic therapy, and she was transferred to the regional tertiary hospital's oral and maxillofacial department.

She presented with fever (38 °C), diffuse, painful, erythematous swelling of the right side of the neck (Fig. 1a), and a hemorrhagic rash on the limbs with lower-extremity edema (Fig. 1b, c). Physical examination revealed a frail patient with pale, dry skin and mucosae, a pulse of 92/min, and a blood pressure of 140/80 mmHg. The face was symmetric, the mouth opening was free, and her voice was unchanged. Soft-tissue swelling over the right SCM muscle was minimally tender, doughy in consistency, and had preserved sensation. Although the cervical and head lymph nodes were not enlarged, the liver was palpable at the costal margin.

Hemodialysis was subsequently continued through the arteriovenous (AV) fistula. An AV fistula had been created approximately four months earlier, but because it had not

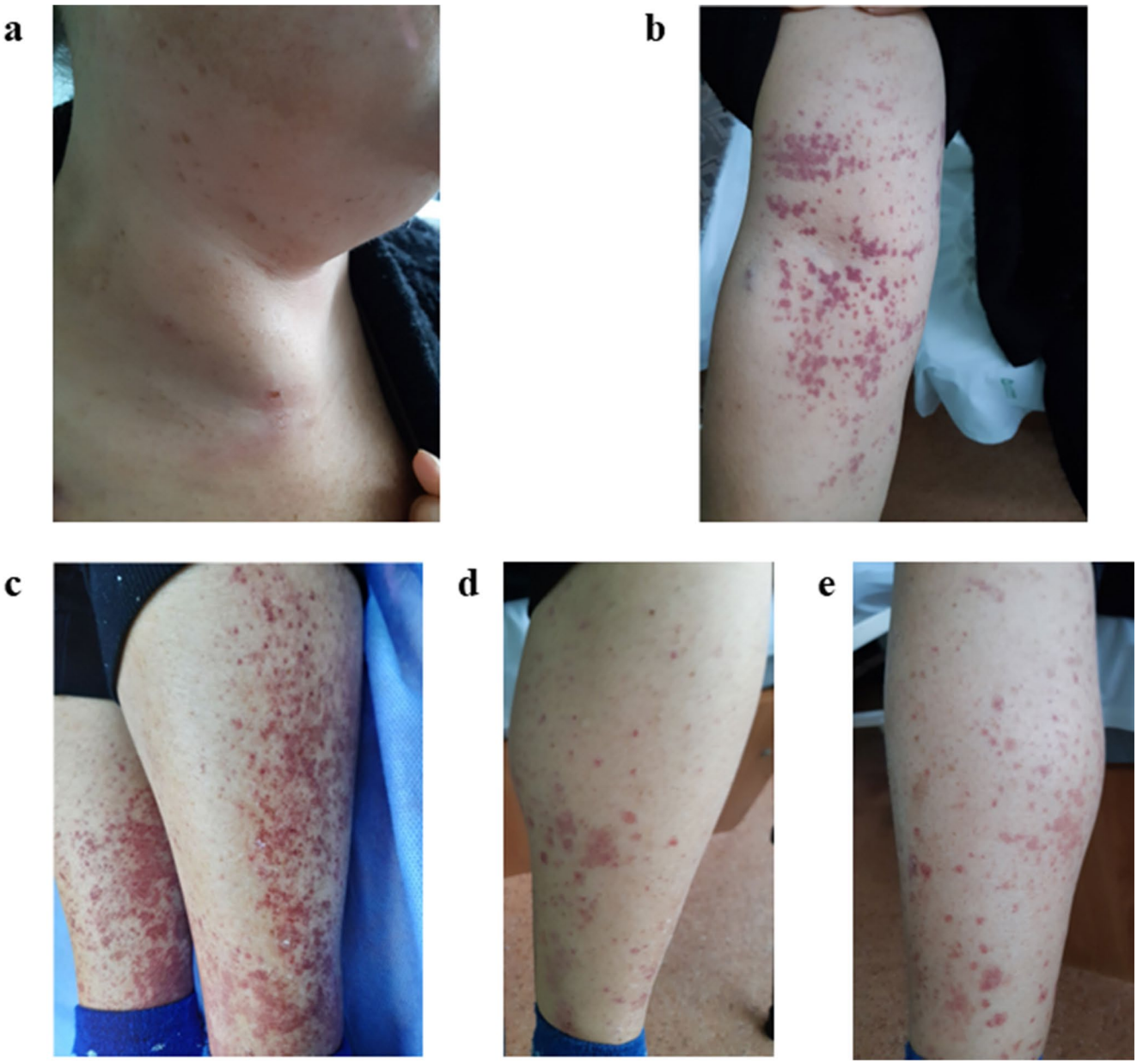


Fig. 1 Clinical presentation of the patient at admission and on the 3rd week after treatment. (**a**) Right-sided neck swelling in the region of the sternocleidomastoid muscle and (**b**, **c**) hemorrhagic rash on the right arm (**b**) and legs (**c**) on admission to the hospital. (**d**, **e**) Partial resolution of the rash on the legs on the 20th postoperative day following drainage of the right SCM muscle phlegmon surgery

matured adequately at the time of the patient's hospital presentation, hemodialysis was still performed via the tunneled IJV catheter.

Diagnostic Assessments

Two sets of blood cultures were obtained: the first, collected on admission, showed growth of MSSA, whereas the second, collected on postoperative day 3, showed no growth. The isolate was susceptible to methicillin, vancomycin, linezolid, and fusidic acid but resistant to gentamicin, tobramycin, and rifampicin, confirming its identification as MSSA. Laboratory data, obtained from tests conducted 2 days prior to admission (when the symptoms of pyomyositis occurred) and on the day of admission, showed C-reactive protein (CRP) = 89 mg/L (before hospitalization), erythrocyte sedimentation rate (ESR) = 60–77 mm/h, and procalcitonin = 2.63 ng/mL. Fever and tachycardia also met the systemic inflammatory response syndrome (SIRS) criteria (≥ 2). Procalcitonin is a weak marker of sepsis [8, 9] and is elevated by severe renal failure itself, to between 0.1 and 2 ng/mL in dialysis patients without infection [6]. Elevation

of these acute-phase reactants therefore supported, but did not establish, the diagnosis of sepsis [2].

On presentation to the hospital, she was severely anemic (hemoglobin 57–62 g/L) and had a platelet count of 362–366 × 10^9/L, a WBC count of 6.2–9.32 × 10^9/L with neutrophil counts up to 6.8 × 10^9/L, and a band count of 0.56 × 10^9/L.

Coagulation panel: fibrinogen 4.16–5.53 g/L; prothrombin time 11.7 s; international normalized ratio (INR) 0.92–0.95; Quick's % ≈ 109–111%; activated partial thromboplastin time (aPTT) 32 s.

Serology/screening: HIV, Wassermann test, HBsAg/HCV - negative.

Imaging Examination

Neck ultrasonography demonstrated a fluid-containing lesion within the right SCM. Ultrasound-guided aspiration yielded approximately 2 mL of thick, green-yellow, foul-smelling purulent material, which was sent for microbiological culture and antimicrobial susceptibility testing. Culture grew MSSA, which was susceptible to carbapenems and cephalosporins. Despite aspiration, no significant reduction in the size of the neck swelling was observed afterwards.

No evidence of thrombosis in the neck veins; IJV diameter: right 18.6 mm, left 10.3 mm. CT and MRI of the neck and chest demonstrated compartmentalized fluid accumulation with microgas inclusions, up to 14 mm thick over a length of ~10 cm; indistinct muscle contours; and perifocal edema (Fig. 2a-c). Perifocal fat was intact. Additionally, CT showed signs of arthritis, more pronounced in the right sternoclavicular joint (SCJ) and less pronounced in the left, with patchy erosions of the sternal end of the clavicle measuring up to 5 mm. In the lungs, there were signs of bilateral septic pneumonia, with a few septic foci showing cavitation measuring 5–16 mm. The mediastinum showed no pathological shift or lymph node enlargement. A pericardial effusion of up to 11–12 mm and small bilateral pleural effusions (measuring up to 11–14 mm on the left and approximately 5 mm on the right) were also noted.

Cardiovascular assessment showed sinus rhythm at 90 bpm on ECG, with left axis deviation and electrocardiographic features of left ventricular hypertrophy. Transthoracic echocardiography, performed on admission and repeated two weeks into treatment, demonstrated significant left ventricular and interventricular septal hypertrophy without chamber enlargement, associated with Grade I (impaired relaxation) diastolic dysfunction. Mild mitral and tricuspid regurgitation and aortic sclerosis were present. Left ventricular systolic function remained preserved, with an ejection fraction of 53%. No valvular vegetation was seen on either echocardiography. Contrast-enhanced chest computed tomography showed no intracardiac mass, although the study was not ECG-gated and was not intended as a dedicated assessment for endocarditis. Transesophageal echocardiography was not performed.

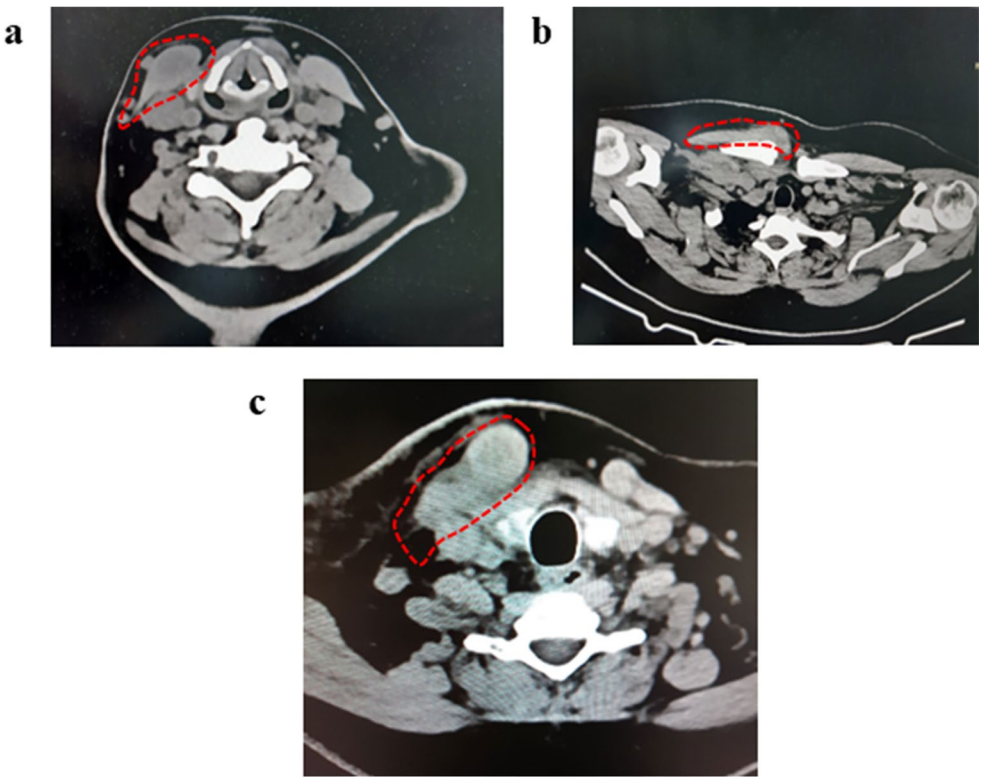


Fig. 2 CT images of the neck and thoracic cavities. (**a**–**c**) Transverse CT images of the neck and chest showing an enlarged fascial compartment of the right sternocleidomastoid muscle, highlighted in red

Diagnosis

The final diagnosis was complicated MSSA bacteremia arising from an infected tunneled hemodialysis catheter, with contiguous extension producing a right SCM muscle phlegmon and SCJ septic arthritis with erosion of the sternal end of the clavicle, along with metastatic septic pulmonary emboli and a widespread petechial rash.

Surgery and Treatment

Empirical antimicrobial therapy with meropenem (1 g IV every 12 h) and doxycycline (100 mg orally every 12 h) was initiated at admission, as the microbiology of the neck collection was unknown and repeat blood cultures and susceptibility testing of the purulent exudate were pending. Meropenem was selected to provide broad-spectrum coverage against Gram-positive, Gram-negative, and anaerobic organisms commonly found in deep neck space collections, while doxycycline was added to extend coverage against community-acquired methicillin-resistant *S. aureus*.

On the day of admission, the patient underwent incision, debridement, and drainage of the right SCM muscle fascial sheath along the anterior and posterior surfaces, with entry into the muscle belly and exploration to the level of the SCM articulation. Pus was obtained on puncture (Fig. 3a-b). Postoperatively, local infection was controlled, and there were no signs of mediastinitis. Treatment of comorbidities included scheduled hemodialysis. Blood cultures obtained on the third postoperative day showed no bacterial growth.

Once blood and pus cultures confirmed an MSSA isolate, therapy was de-escalated on the third postoperative day to cefazolin 2 g intravenously after each hemodialysis session and continued for six weeks. Cefazolin was not included in the susceptibility panel reported by the laboratory and was selected based on documented methicillin susceptibility.

Outcome

The patient recovered over the subsequent three weeks, with eradication of the infection, satisfactory postoperative wound healing, and partial resolution of petechiae in the upper and lower extremities by the 20th postoperative day (Fig. 1d-e); complete resolution was observed 5 weeks after hospitalization. Recovery was assessed clinically and radiologically. Repeat neck ultrasonography showed no residual fluid collection in the SCM muscle, and repeat chest radiography showed clearing of bilateral pulmonary infiltrates with no new cavitary lesions. Repeat computed tomography of the chest and SCJ was not performed. After wound healing, with the wound bed clean and adequately granulated, and after normalization of both hematological and renal parameters, the patient was discharged from the inpatient ward. Because she required ongoing renal replacement therapy, she continued to attend the hemodialysis department of the same tertiary hospital three times weekly, where cefazolin 2 g was administered intravenously after each session until the six-week course was completed. This approach allowed a prolonged parenteral regimen to be delivered without inpatient admission. She was subsequently referred back to her hometown for ongoing follow-up under the supervision of her treating physician.

Discussion

Patients with chronic kidney disease receiving dialysis are particularly vulnerable to SAB due to repeated healthcare exposure, frequent use of intravascular catheters, fluid overload, and the immunosuppressive effects of the uremic state. The rate of dialysis-related CRBSI in patients with a tunneled hemodialysis catheter ranges from 1.1 to 5.5 cases per 1,000 catheter-days [4]. Patients with chronic kidney

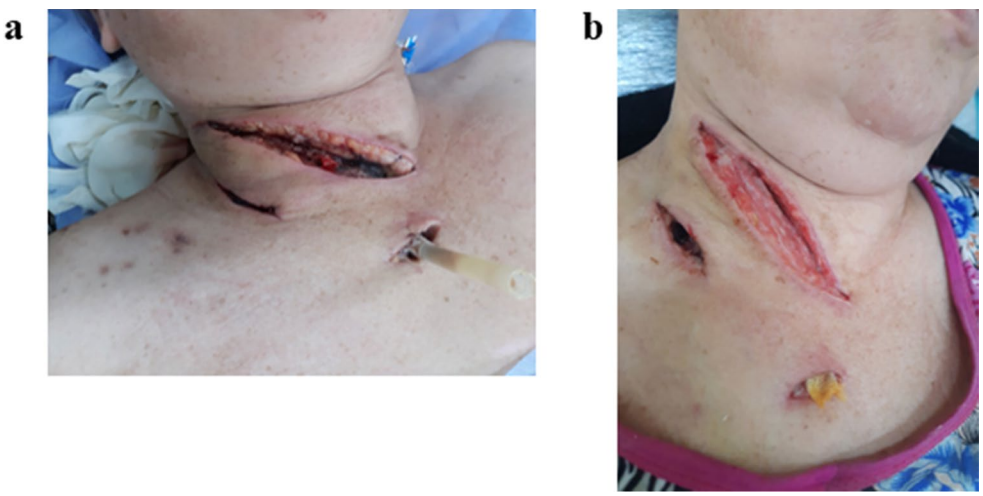


Fig. 3 Surgical management of the phlegmon. (**a**) Wound appearance on the 4th postoperative day after incision and drainage. (**b**) Removal of the drainage tube and wound healing on the 12th postoperative day, showing a clean wound with granulation tissue formation

disease who are not on dialysis experience significantly higher mortality after SAB, with reported mortality rates of 39.5%, compared with 27.6% in dialysis-dependent patients and 7.9% in patients without chronic kidney disease [10].

In the case presented, the patient with end-stage kidney disease initially received a 10-day outpatient course of ceftriaxone and azithromycin, which led to clinical improvement. Neither the regimen nor the three-day delay in removing the infected catheter met current standards: MSSA should be treated with cefazolin or an antistaphylococcal penicillin once susceptibility is known [2]. In addition, isolation of *S. aureus* from a tunneled dialysis catheter indicates prompt removal [4].

After 10 days of antibiotic therapy, the fever began to rise, and the patient's physical examination revealed slight swelling and asymmetry in the neck. Various causes of fever and asymmetrical neck swelling should be considered. Common causes of deep head and neck space infection (DNSI), such as odontogenic infection from poor oral hygiene or acute or chronic tonsillitis, were ruled out as sources of infection after consultations with the dentistry and otolaryngology departments. The prevalence of DNSI among patients with end-stage renal disease over the 15-year period from 2005 to 2019 was only 2.2% [11]. One of the more common DNSIs is Ludwig angina, which presents with systemic and local clinical symptoms, as seen in our patient. Furthermore, patients with pulmonary involvement may present with pneumonia or empyema. Other less common manifestations of metastatic disease include soft tissue abscesses, pyomyositis, splenic and hepatic abscesses, osteomyelitis, endocarditis, pericarditis, renal abscesses, and brain abscesses [12]. Lemierre syndrome was ruled out as a cause because anaerobic blood cultures were negative for *Fusobacterium necrophorum* and there was no typical septic thrombophlebitis of the IJV. Instead, *S. aureus* was detected in blood cultures and in purulent exudate from the SCM phlegmon. The laboratory profile of our patient offers crucial insights into the pathophysiology of *S. aureus* sepsis. The initial neutrophilia, documented two weeks before hospitalization, reflected the acute inflammatory response to catheter infection. Levels > 2.0 ng/mL for procalcitonin and elevated CRP are associated with a high risk for progression to severe sepsis or septic shock [13]. In culture-proven bacteremia, these markers supported rather than established the diagnosis; persistently positive follow-up blood cultures, rather than biomarker levels, predict secondary metastatic infection [13].Together with clinical signs of fever and tachycardia, SIRS criteria (≥ 2) are fulfilled [8, 9].

The coagulation panel in this patient shows preserved fibrinogen synthetic function. During sepsis, elevated fibrinogen levels are a critical component of the pathophysiological cascade. *S. aureus* secretes coagulase and von Willebrand factor-binding protein, which non-enzymatically activate prothrombin, converting fibrinogen to fibrin independently of the normal coagulation cascade [14]. The normal INR and aPTT indicate that the clotting factor consumption typical of disseminated intravascular coagulation (DIC) was not present at the time of diagnosis. It is conceivable that, in our patient, the abundant fibrinogen substrate could facilitate staphylococcal agglutination within fibrin networks, promoting bacterial persistence and dissemination.

Contrast-enhanced neck CT is the gold standard for diagnosing the source and extent of DNSI. Here, two unusual instances of *S. aureus* sepsis were found: a phlegmon confined to the fascial layer of the SCM muscle and septic arthritis. Involvement of both the SCM muscle and the SCJ in our patient indicates a shared pathogenic process originating from the infected hemodialysis catheter, with direct contiguous spread into the immediately adjacent fascial planes rather than hematogenous seeding of two rare sites. Both structures lie along the catheter tunnel [15].

Pyomyositis is a bacterial infection of striated muscle, most common in tropical regions and often caused by *S. aureus* [16]. The pathogenesis of primary pyomyositis involves hematogenous seeding of muscle during bacteremia, which is commonly asymptomatic and transient [17]. In rare cases, pyomyositis can progress to phlegmon when exudate spreads beyond its localized capsule, resulting in a severe, potentially life-threatening infection. Only a few such cases have been reported in the literature [18]. Community-acquired methicillin-resistant *S. aureus* strains that express Panton-Valentine leukocidin are associated with increased frequency and severity of pyomyositis [19]. Diabetes mellitus, present in our patient, is a predisposing factor even in the absence of other risk factors or trauma [20]. In the present case, the development of SCM phlegmon and SCJ septic arthritis was most likely secondary to an extensive tunneled-catheter infection, with direct contiguous spread of infection into the adjacent fascial planes and surrounding structures due to their close anatomical proximity to the infected catheter tract.

The anatomical proximity of the SCJ to central venous catheter insertion sites in the internal jugular or subclavian veins creates a direct pathway for bacterial seeding. Our patient demonstrated CT findings consistent with arthritis, primarily involving the right SCJ. Sternoclavicular joint infection is rare, accounting for less than 1% of all joint infections [15, 21]. Colonization of the catheter tract may result in seeding into the SCJ capsule due to trauma from catheter insertion [22]. Septic arthritis is a serious joint infection that requires immediate treatment to prevent permanent damage. It typically presents with a rapid onset of severe joint pain, swelling, and sometimes fever. *S. aureus* SCJ septic arthritis in a hemodialysis patient is rare, and the

available evidence is limited to isolated case reports. A comparative summary of similar cases is presented in Table 1. *S. aureus* is the most common pathogen, identified in approximately 49% of culture-proven cases of SCJ septic arthritis [23]. SCJ infections usually occur in patients with predisposing risk factors, including intravenous drug use, hemodialysis, infected central venous line, diabetes mellitus, and immunosuppression [24].

Our patient's neck ultrasound showed no evidence of neck vein thrombosis. The dilated right IJV detected on ultrasound most likely reflects venous stasis from prior catheterization rather than thrombophlebitis. The absence of IJV thrombosis, despite adjacent deep tissue infection and septic pulmonary emboli, suggests that, in our patient, septic emboli may originate directly from the infected catheter site or from microscopic thrombi not detectable on imaging. Septic pulmonary embolism is an uncommon disorder in which a microorganism-containing thrombus causes an inflammatory reaction and mechanical obstruction in the pulmonary vasculature [29]. Our patient demonstrated a few septic foci with cavitation measuring 5–16 mm and bilateral septic pneumonia on CT imaging. The pathogenesis of septic pulmonary embolism involves inflammation from the translocation of microorganisms from the primary focus of infection into the venous system, endothelial damage, and the production of thrombogenic toxins, which together lead to thrombosis. A thrombus leads to infarcts and multiple abscesses by occluding the veins [30]. Typical chest CT findings include bilateral, peripheral, poorly marginated lung nodules that tend to cavitate, with moderately thick, irregular walls; pleura-abutting, wedge-shaped peripheral lesions; and pleural effusion [32]. Cavitation occurs when the center of the infected nodule undergoes necrosis and liquefaction, eventually communicating with the bronchial tree and expelling purulent content [31, 32]. The size of the cavitary lesions (5–16 mm) in our patient indicates early-to-moderate-stage septic emboli. Identifying the stage of septic pulmonary emboli is clinically essential because it confirms ongoing embolic spread from an active intravascular focus, prompts urgent source control, guides antimicrobial duration and intensity, enables close monitoring to prevent progression, and is associated with a more favorable prognosis than advanced cavitary disease. This profile is typical of contemporary septic pulmonary embolism series, in which chronic

Table 1 Summary of reported cases of catheter-related *S. aureus* bacteremia complicated by SCJ septic arthritis in a hemodialysis patient and similar cases

№	Patient description	Bacteremia source	Clinical presentation	Treatment, outcome	Reference
1	74-year-old man with comorbidities included arterial hypertension, poorly controlled insulin-dependent type 2 diabetes mellitus, chronic renal failure, heart failure and peripheral artery disease	Long-term suprapubic catheter in place for 10 months; urosepsis with MRSA	Fever and painful mass of the left SCJ with inflammatory signs, occurring one week after catheter-related bacteremia treated with antibiotics	Vancomycin and gentamicin treatment resolved symptoms	[25]
2	61-year-old man with poorly controlled diabetes mellitus	Iatrogenic infection during injections	Swelling and severe tenderness over the left SCJ, fever, respiratory distress, oxygen saturation 80%; imaging revealed SCJ abscess with extension into the mediastinum and SCM, left paraspinal muscle swelling at L2, and L3–L4 spondylodiscitis with a contiguous extradural abscess	Surgical incision and drainage of the SCJ, followed by antibiotic therapy with cefotiam improved clinical condition	[26]
3	44-year-old woman with end-stage renal disease on peritoneal dialysis and tertiary hyperparathyroidism	Tenckhoff catheter	Bilateral septic arthritis of the SCJ with osteomyelitis; recurrence of pain and fever after discontinuation of antibiotics, with left SCJ swelling and purulent discharge	Six weeks of intravenous cefazolin without improvement, followed by multiple surgical debridements and excision of bilateral clavicular heads; subsequent antibiotic therapy with vancomycin led to clinical improvement	[27]
4	60-year-old woman, non-smoker, with no history of immunosuppression or known risk factors for lung disease	*S. aureus* bacteremia secondary to bacteremic pneumonia	Pleuritic chest pain, severe pain in the left shoulder and mid-clavicular region, fever (38 °C), and cough without expectoration; concurrent pneumonia and SCJ septic arthritis	Initial therapy with ceftriaxone and levofloxacin resulted in minimal clinical response. Subsequently, intravenous ciprofloxacin and amoxicillin–clavulanic acid were administered according to susceptibility testing, leading to improvement of clinical symptoms. Without surgical drainage complete resolution was achieved.	[28]

kidney disease (68.4%) and diabetes mellitus (36.8%) are the most common comorbidities and venous catheters the most common source (57.9%) [33].

The associated findings in our patient, including pericardial and bilateral pleural effusions, are attributable to reactive serosal inflammation secondary to an adjacent pulmonary infection, which is typical of pulmonary embolism [34]. The hemorrhagic rash observed on the skin or in the mucous membranes of our patient can arise during bacteremia through five main mechanisms: DIC and coagulopathy, direct vascular invasion and occlusion by organisms, infective vasculitis, emboli, and toxin-induced vascular changes [35]. Another potential cause of the hemorrhagic rash, infective endocarditis, was considered unlikely based on chest CT and echocardiography, which showed no evidence of valvular vegetations or other features suggestive of endocardial infection [3]. Complete resolution of the petechiae after source control and targeted therapy supports this interpretation rather than a primary hematologic disorder or purpura fulminans, both of which would cause permanent tissue necrosis [36].

Infective endocarditis was an important differential because recurrent fever, septic pulmonary emboli, and a petechial rash are recognized features of endocardial infection. Transthoracic echocardiography is indicated in all patients with SAB, and transesophageal echocardiography is indicated in those at high risk [2]. Two transthoracic echocardiographic studies and contrast-enhanced chest CT showed no vegetation, but neither test excludes the diagnosis of infective endocarditis: transthoracic echocardiography has a sensitivity of 61% (95% CI 45–75%) compared with transesophageal echocardiography [2]. Transesophageal echocardiography was not performed.

The Shwartzman phenomenon may offer an additional explanation for the petechial rash. In this experimental reaction, a priming dose of endotoxin, followed 2–48 h later by a provocative dose, produces widespread microvascular thrombosis and petechial hemorrhage [37]. The two-week interval between the initial catheter infection and the recurrence of sepsis with rash in our patient is consistent with this mechanism, and the elevated fibrinogen, with normal INR and platelet count, is more consistent with microvascular endothelial damage than with DIC [38]. This remains speculative.

Limitations

Some data were unavailable. The referring hospital did not document when the blood cultures first became negative or how many blood cultures in the initial set were positive, so the duration of bacteremia before admission is unknown. Repeat CT of the chest and SCJ was not obtained at the end of treatment, so residual osteoarticular infection cannot be ruled out. Finally, two departures from recommended management occurred before referral: a ten-day course of ceftriaxone and azithromycin for culture-proven *S. aureus* bacteremia, and a three-day delay in removing the infected catheter after the patient declined admission.

Conclusion

This case highlights a rare, severe presentation of catheter-related SAB complicated by deep neck phlegmon involving the SCM muscle, SCJ involvement, septic pulmonary emboli, and hemorrhagic rash in a patient with end-stage renal disease on hemodialysis. The combination of contiguous SCM phlegmon and sternoclavicular septic arthritis, with metastatic septic pulmonary emboli in the absence of jugular vein thrombosis, represents an atypical pattern of dissemination. Uremia, diabetes mellitus, and a central venous catheter likely contributed to bacterial persistence, contiguous extension along the catheter tract, and secondary septic pulmonary embolization.

The report underscores the need for a high index of suspicion for deep musculoskeletal and joint involvement in patients with *S. aureus* bacteremia who present with neck swelling, elevated inflammatory markers, or embolic phenomena. In immunocompromised hemodialysis patients, signs of bacterial seeding into muscle or joint tissues should prompt early, aggressive evaluation. Importantly, this case demonstrates that antibiotic therapy alone is insufficient because deep musculoskeletal sites are poorly penetrated, even when the pathogen is susceptible in vitro. Early surgical incision and drainage are therefore essential to achieve adequate source control and optimize antimicrobial efficacy and must be paired with targeted therapy of adequate duration - four to six weeks for complicated disease and six weeks when osteoarticular involvement or septic emboli are documented, as in this patient [2, 4]. Finally, to reduce the risk of such life-threatening complications, preventive strategies, including the development and use of catheters with antibacterial or anti-biofilm coatings, should be further considered for high-risk hemodialysis populations. Antimicrobial-coated catheters and antimicrobial lock therapy are the principal approaches currently under evaluation [39]. By describing this case, we aim to raise awareness of this rare complication in a high-risk patient population and to underscore the importance of early recognition and treatment.

Abbreviations

AV	Arteriovenous
aPTT	activated Partial Thromboplastin Time
CRBSI	Catheter-Related Bloodstream Infection
CRP	C-Reactive Protein

DIC	Disseminated Intravascular Coagulation
DNSI	Deep Neck Space Infection
ESR	Erythrocyte Sedimentation Rate
IJV	Internal Jugular Vein
INR	International Normalized Ratio
MSSA	Methicillin-Susceptible Staphylococcus Aureus
SAB	Staphylococcus Aureus Bacteremia
SIRS	Systemic Inflammatory Response Syndrome
SCJ	Sternoclavicular Joint
SCM	Sternocleidomastoid
WBC	White Blood Cells

Acknowledgements Open access publishing facilitated by Macquarie University, as part of the Springer Nature—Macquarie University agreement via the Council of Australian University Librarians.

Author Contributions Conceptualization, M.S, M.Ski, R.S, and B.H.; methodology, M.S., M.Ski, V.M, L.V; validation, S.T., T.O. and K.H.; investigation, M.S, M.Ski, R.S, I.S, L.V; resources, C.X, T.Y, M.Ski, M.S, I.S, B.H; writing—original draft preparation, M.S, M.Ski, B.H; writing—review and editing, M.S, M.Ski, R.S, V.M, I.S, L.V, T.Y, C.X, S.T, T.O, S.B, K.H, B.H.; visualization, M.S, M.Ski; supervision, B.H, S.T, T.O, K.H; project administration, M.S, M.Ski, B.H; funding acquisition, M.S, M.Ski, C.X, B.H, K.H, S.T, T.O., S.B. All authors have read and agreed to the published version of the manuscript.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions. This work was supported partly by JSPS KAKENHI Grant Numbers JP24K10435 (BH), JP24K11549 (KH), JP25K11620 (ST), JP25K11940 (TO), a grant from The Japanese Society of Hematology Research Grant (KH), a grant from The Salt Science Research Foundation (BH), Taiju Life Social Welfare Foundation (KH), Grants from the Society of Iodine Science (KH, BH), Radiation effects association (KH) and International Joint Usage/Research Center, the Institute of Medical Science, the University of Tokyo (KH, BH), and a grant from Institute for Environmental & Gender-specific Medicine, Juntendo University (BH), Macquarie University Postgraduate Research Fund (MS), International Macquarie Research Excellence Scholarship "iMQRES" (MS).

Data Availability No datasets were generated or analysed during the current study.

Code Availability Not applicable.

Declarations

Ethics Approval The study was approved by the Institutional Ethics Committee of Poltava State Medical University (protocol number 236 approved on: 20 March 2025), for studies involving humans and the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to Participate The patient provided informed consent to participate in the study.

Written Consent for Publication Additional informed consent was obtained from the patient, for which identifying information is included in this article.

Competing Interests The authors declare no competing interests.

Conflict of Interest The authors declare no conflicts of interest. The funders had no role in the study design, data collection, analysis, or interpretation, manuscript writing, or the decision to publish the results.

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Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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