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REVIEW ARTICLE

An unusual presentation of disseminated Staphylococcus aureus infection: Septic arthritis and massive pleural empyema

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ABSTRACT

We report the case of a 56-year-old male who presented to the emergency department with a 10-day history of fever, chills, generalized weakness, and reduced appetite, followed by severe left knee pain and swelling and progressively worsening shortness of breath. The knee pain became severe enough to prevent weight bearing, while his respiratory symptoms progressed to breathlessness at rest. On presentation, he was febrile, tachycardic, tachypneic, and mildly hypoxemic. Examination revealed a markedly swollen, erythematous, warm, and tender left knee with severe pain on movement, together with markedly reduced air entry over the left lower and middle lung fields. Initial investigations demonstrated significant leukocytosis and markedly elevated inflammatory markers. Chest radiography showed a massive left sided pleural effusion with compressive change in the adjacent lung. Blood cultures subsequently grew methicillin susceptible *Staphylococcus aureus*. Aspiration of the left knee produced purulent fluid, with synovial fluid culture growing the same organism. Computed tomography of the chest demonstrated a large loculated left sided pleural collection with pleural thickening. Pleural fluid was purulent and also grew methicillin susceptible *S. aureus*, confirming empyema. Echocardiographic assessment did not demonstrate definite infective endocarditis. The patient was initially treated with empirical intravenous antibiotics, which were subsequently narrowed to intravenous cefazolin after susceptibility results became available. The infected knee was managed with arthroscopic washout and drainage. The large pleural empyema required image guided chest tube drainage, followed by intrapleural tissue plasminogen activator and DNase for residual loculated fluid. Serial blood cultures were initially positive but became negative following source control, with subsequent improvement in fever, respiratory symptoms, inflammatory markers, and knee function. This case highlights an unusual presentation of disseminated *S. aureus* infection involving simultaneous septic arthritis and massive pleural empyema. It emphasizes the importance of searching for metastatic infection when *S. aureus* is isolated from blood, particularly in patients with persistent bacteremia or symptoms involving multiple organ systems. Early microbiological diagnosis, appropriate imaging, repeated blood cultures, effective source control, and multidisciplinary management are essential in complicated *S. aureus* infection.

KEYWORDS

Staph Aureus, Bacteremia, Septicemia, Septic Arthritis, Empyema, Infection.

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Introduction

Staphylococcus aureus infection is an important cause of serious bacterial infection and can result in a wide range of clinical presentations, from localized skin and soft tissue infection to severe bacteremia with involvement of multiple organs. Staphylococcus aureus bacteremia is associated with significant morbidity and mortality, particularly when the infection persists

or spreads from the bloodstream to distant sites. Despite improvements in microbiological diagnosis, antimicrobial treatment, imaging, and supportive care, invasive S. aureus infection remains a major clinical problem. Metastatic infection can occur in more than one third of patients with S. aureus bacteremia and may involve the heart, bones, joints, lungs, spine, kidneys, spleen, and other tissues [1,5,7]. The clinical presentation can therefore vary considerably, and patients may initially present with symptoms related to a distant site rather than with obvious features of bacteremia.

The ability of S. aureus to spread through the bloodstream is an important reason for the wide range of complications associated with invasive infection. Once bacteremia develops, organisms may adhere to damaged tissues or previously normal structures and establish secondary sites of infection. These sites can continue to produce inflammation and bacteremia even after the original source has been treated. Metastatic infection is particularly important when bacteremia persists for more than 48 hours, as prolonged bacteremia is associated with a higher risk of complications and mortality [5,7]. For this reason, S. aureus bacteremia should not be considered simply as an infection of the blood. A positive blood culture should prompt careful assessment for a primary source as well as possible secondary sites of infection.

Septic arthritis is one of the recognized metastatic complications of S. aureus bacteremia and is an important cause of acute joint pain and swelling. S. aureus is among the most common organisms responsible for septic arthritis in adults and can cause rapid destruction of articular cartilage and surrounding tissues if treatment is delayed [5,9]. The infection usually reaches the joint through hematogenous spread, although direct inoculation or spread from adjacent tissues can also occur. The clinical presentation may include acute joint pain, swelling, reduced range of movement, and fever, but the absence of fever does not exclude the diagnosis. This is particularly relevant in patients with bloodstream infection, in whom a painful or swollen joint may represent one of several sites of metastatic infection rather than an isolated joint problem [9].

The diagnosis of septic arthritis requires a high degree of clinical suspicion and appropriate microbiological investigation. Aspiration of the affected joint is an important part of the diagnostic evaluation, with synovial fluid being assessed for cell count, Gram stain, culture, and other investigations when appropriate. Blood cultures are also important, particularly when there is clinical suspicion of bacteremia or systemic infection. Although imaging can demonstrate joint effusion and surrounding inflammation, it does not replace joint aspiration for microbiological diagnosis. Early recognition is important because infection within the joint can rapidly lead to cartilage damage, reduced joint function, osteomyelitis, and systemic complications [9].

Another serious complication of invasive bacterial infection is pleural infection, which can progress to empyema. Pleural infection refers to bacterial infection within the pleural space and includes a spectrum ranging from infected pleural fluid to established empyema with frank pus. Empyema represents an advanced stage of pleural infection and can develop following pneumonia, thoracic surgery, trauma, or bacteremia with hematogenous seeding of the pleural space [10,11]. Although many cases of empyema are associated with pneumonia, the presence of a large pleural collection in a patient with S. aureus bacteremia should also raise the possibility of metastatic infection.

S. aureus is an important cause of severe pleural infection and may produce a rapidly progressive illness, particularly in patients with bacteremia or other invasive infection. Pleural infection can become increasingly organized over time, with fibrin deposition, septation, loculation, and formation of a thick pleural peel. These changes can prevent adequate drainage and interfere with lung expansion. Patients may present with fever, chest pain, shortness of breath, cough, or persistent signs of systemic infection. In some patients, respiratory symptoms may be less prominent than expected despite a large pleural collection, particularly when the infection develops as part of a wider disseminated process [10,11].

The diagnosis of empyema is based on a combination of clinical findings, imaging, and pleural fluid analysis. Chest radiography may demonstrate a pleural effusion, while ultrasound is useful for identifying septations and guiding pleural procedures. Computed tomography can provide additional information regarding the size and extent of the collection, pleural thickening, loculation, and associated lung abnormalities. Pleural fluid should be sent for microbiological and biochemical analysis when pleural infection is suspected. Frankly purulent fluid is diagnostic of empyema, while other findings such as low pleural fluid pH, low glucose, and high lactate dehydrogenase can support the diagnosis of complicated pleural infection [10,11].

Management of pleural empyema requires more than antimicrobial therapy alone in many patients. Appropriate antibiotics should be started promptly and adjusted according to culture results and antimicrobial susceptibility testing. However, infected pleural fluid generally requires effective drainage. Chest tube drainage is an important part of initial management, while intrapleural treatment with tissue plasminogen activator and DNase may be considered when residual loculated fluid remains after drainage [10,12]. Surgical treatment, including video assisted thoracoscopic surgery, may be required when infection does not respond adequately to medical treatment or when there is extensive organization and failure of lung re expansion [10,11]. The choice of treatment depends on the clinical condition of the patient, the stage of pleural infection, imaging findings, and response to initial treatment.

The simultaneous presence of septic arthritis and massive pleural empyema in a patient with S. aureus infection is unusual and raises the possibility of widespread hematogenous dissemination. These findings may initially appear to represent two separate infectious processes. However, when they occur together, particularly in the presence of positive blood cultures, they should prompt consideration of a common bloodstream source. S. aureus has the ability to seed multiple distant sites, and the identification of one metastatic focus should therefore increase clinical suspicion for additional sites of infection [5,7]. Failure to recognize this pattern may result in incomplete source control and persistent bacteremia.

The investigation of disseminated S. aureus infection should therefore extend beyond the site that initially attracts clinical attention. Repeated blood cultures are important to establish clearance of bacteremia, while imaging should be directed by symptoms and clinical findings. Echocardiography may be required to assess for infective endocarditis, particularly in patients with persistent bacteremia or other features suggesting an intravascular source. Additional imaging may be needed to identify osteomyelitis, deep abscesses, septic pulmonary lesions, or other metastatic sites [1,5,7]. This approach is important because some secondary infections may remain clinically silent until they become advanced.

Treatment of S. aureus bacteremia requires appropriate antimicrobial therapy together with identification and control of the source of infection. The choice of antibiotic depends on whether the organism is methicillin susceptible or methicillin resistant, as well as on the patient's clinical condition and susceptibility results. Duration of treatment is determined by the presence or absence of metastatic infection and other complications. Patients with complicated bacteremia generally require prolonged treatment, particularly when deep sites such as joints, bone, pleural space, or the heart are involved [5,8]. Source control is equally important, as antibiotics alone may be insufficient when there is an infected joint or a large purulent pleural collection.

Septic arthritis requires prompt drainage in addition to antimicrobial therapy. Arthroscopic lavage is commonly used for larger joints, while open surgical drainage may be required in selected cases depending on the extent of infection and local findings. Treatment should also include repeated clinical assessment for persistent infection and restoration of joint movement once the infection is controlled [9]. Similarly, management of empyema requires effective drainage and close monitoring of the clinical response. The coexistence of these two conditions therefore requires coordinated management involving infectious disease physicians, orthopedic surgeons, respiratory physicians, thoracic surgeons, radiologists, and microbiology specialists.

The pathophysiology of disseminated S. aureus infection is related to the organism's ability to adhere to host tissues, evade immune defenses, invade damaged structures, and survive within infected sites. Once organisms enter the bloodstream, they can circulate and establish infection in tissues with favorable conditions for bacterial attachment and growth. The resulting inflammatory response can produce local tissue destruction as well as systemic manifestations such as fever, leukocytosis, hypotension, and organ dysfunction. The development of infection in more than one distant site reflects the systemic nature of the disease and is associated with a more complicated clinical course [1,5].

This case is important because it demonstrates an unusual presentation of disseminated S. aureus infection involving both a joint and the pleural space. Septic arthritis and pleural empyema are each well recognized complications of serious bacterial infection, but their coexistence as manifestations of disseminated S. aureus infection can make the underlying disease difficult to recognize. The presence of a large pleural empyema together with septic arthritis should prompt careful assessment for persistent bacteremia and other metastatic sites of infection. Early recognition of this pattern is important because successful treatment depends not only on appropriate antibiotics but also on timely drainage and source control.

In summary, S. aureus bacteremia is a potentially severe systemic infection with the ability to produce metastatic infection in multiple organs and tissues. Septic arthritis and pleural empyema are important manifestations that require rapid diagnosis and treatment. Their coexistence represents a complex clinical situation in which a single bloodstream infection can produce disease in anatomically distant sites. Careful microbiological investigation, appropriate imaging, repeated blood cultures, early antimicrobial treatment, and effective source control are essential components of management. This case highlights the importance of considering disseminated S. aureus infection when septic arthritis occurs together with a large pleural collection, even when the initial presentation appears to involve only one organ system.

Case Presentation

This case involves a 56 year old man who presented to the emergency department with fever, increasing shortness of breath, and severe pain and swelling of the left knee. He had been well until approximately 10 days before presentation, when he developed fever associated with chills, generalized weakness, and reduced appetite. The fever was initially intermittent but became more frequent over the following days. He also complained of increasing tiredness and poor sleep because of the fever. He initially did not seek medical attention because he thought the symptoms were related to a viral infection.

Approximately five days before admission, he developed pain in the left knee. The pain initially occurred with movement but gradually became severe and was present even at rest. Over the next several days, the knee became visibly swollen, red, and warm.

He found it increasingly difficult to walk and eventually required assistance to get out of bed. There was no history of recent trauma to the knee. He denied any previous episodes of joint swelling, known gout, or inflammatory arthritis. He also denied recent intra articular injection or surgery involving the affected joint.

During the same period, he developed a cough and progressively worsening shortness of breath. The breathlessness was initially noticed when walking around the house but gradually progressed to occur with minimal activity. By the day of presentation, he was short of breath even while sitting. The cough was mostly dry, with occasional small amounts of sputum. There was no hemoptysis. He did not report significant pleuritic chest pain, although he described a vague heaviness over the left side of the chest. He denied palpitations or syncope.

There was no history of recent dental treatment, skin surgery, hospitalization, or placement of an intravenous line before the onset of symptoms. He had no known history of tuberculosis exposure and no recent travel. He denied intravenous drug use. There was no recent animal bite or significant contact with farm animals. He did report having a small skin wound over the lower leg approximately two weeks earlier after accidentally scratching himself while working in his garden, although the wound had appeared minor and had healed without medical treatment.

His past medical history included hypertension and hyperlipidemia, both treated with oral medications. He was not known to have diabetes mellitus, chronic kidney disease, chronic lung disease, or previous heart disease. He had no known history of valvular disease, previous endocarditis, or joint disease. He had never undergone joint replacement. There was no history of immunosuppressive treatment.

He was a lifelong nonsmoker and reported occasional alcohol consumption. He lived with his family and was independent in his daily activities before the current illness. There was no relevant family history of rheumatological disease or recurrent joint infections.

On the morning of admission, his knee pain became severe and he was unable to bear weight on the left leg. At the same time, his breathing had become noticeably worse. His family also noted that he appeared more unwell and was intermittently confused about the time of day, although he remained able to communicate normally. This prompted his family to bring him to the emergency department.

On arrival, he appeared unwell and febrile. He was alert and able to answer questions appropriately but looked tired and uncomfortable because of the knee pain. His temperature was 38.7°C, heart rate was 116 beats per minute, blood pressure was 108/67 mm Hg, respiratory rate was 28 breaths per minute, and oxygen saturation was 89% on room air. His oxygen saturation improved with supplemental oxygen. He was not in obvious circulatory shock at the time of initial examination.

Cardiovascular examination showed tachycardia with normal first and second heart sounds. No obvious murmur was heard on the initial examination. Peripheral pulses were present and symmetrical. There was no significant peripheral edema. The jugular venous pressure was not clearly elevated.

Respiratory examination revealed markedly reduced air entry over the left lower and middle lung fields, with dullness to percussion over the same area. Breath sounds were particularly reduced at the left base. There were no widespread wheezes. The findings were suggestive of a large left sided pleural effusion.

Examination of the left knee showed marked swelling with overlying erythema and increased warmth. The patient had severe tenderness around the joint and significant pain with both active and passive movement. The range of movement was markedly restricted because of pain. He was unable to bear weight on the affected leg. There was no obvious open wound over the knee and no evidence of recent trauma. The appearance of the joint is shown in Figure 2 and was clinically concerning for septic arthritis.

Figure 1 shows the initial chest radiograph. It demonstrated a very large left sided pleural effusion occupying most of the left hemithorax, with marked blunting of the left costophrenic angle and compressive atelectatic change in the adjacent lung. The size of the effusion was disproportionate to the patient's initial respiratory symptoms and raised concern for a complicated pleural infection or empyema.

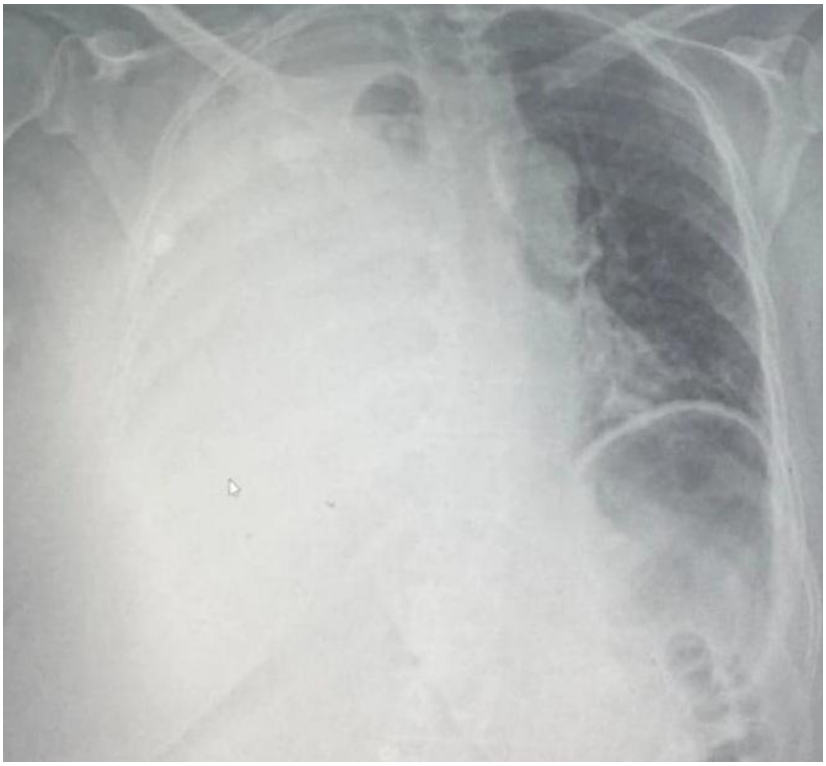

Figure 1. Chest radiograph demonstrating a massive unilateral pleural effusion involving the left hemithorax, consistent with a large pleural collection and compressive change in the adjacent lung.

The combination of fever, a markedly inflamed knee, and a large unilateral pleural effusion raised concern for a systemic bacterial infection rather than two unrelated local conditions. Septic arthritis was considered an important possibility, particularly given the acute onset, severe pain with passive movement, and inability to bear weight. The large pleural collection also raised concern for pleural infection, especially in the setting of persistent fever and systemic symptoms.

Initial laboratory investigations showed leukocytosis with a neutrophil predominance. The white blood cell count was 18.6×10^9/L, with neutrophils accounting for 91% of the total count. C reactive protein was markedly elevated at 286 mg/L, while the erythrocyte sedimentation rate was 74 mm/hour. Hemoglobin was mildly reduced at 11.4 g/dL. Platelet count was 438×10^9/L. Serum creatinine was 1.2 mg/dL, with no known previous kidney disease. Liver enzymes were mildly elevated, but bilirubin was normal. Serum lactate was 2.1 mmol/L. The overall laboratory picture was consistent with a significant systemic inflammatory response.

Because of the fever and clinical suspicion of bloodstream infection, three sets of blood cultures were obtained from separate venipuncture sites before antimicrobial treatment was started. The initial Gram stain from subsequently positive cultures demonstrated gram positive cocci in clusters. The organism was later identified as Staphylococcus aureus. Susceptibility testing showed a methicillin susceptible strain.

Electrocardiography showed sinus tachycardia without acute ischemic changes. Troponin was not significantly elevated. Given the presence of S. aureus bacteremia and the possibility of a deep source of infection, echocardiography was performed as part of the diagnostic assessment. Transthoracic echocardiography showed preserved left ventricular systolic function and no large vegetation was clearly visualized. There was no significant valvular dysfunction. Because a negative transthoracic study does not exclude endocarditis in a patient with S. aureus bacteremia, further cardiac assessment was considered appropriate in the overall diagnostic workup.

The left knee was aspirated because of the marked swelling and severe pain with passive movement. The aspirated fluid was turbid and yellow in appearance. Synovial fluid analysis showed a markedly elevated white cell count with a predominance of neutrophils. Gram stain demonstrated gram positive cocci in clusters, and subsequent culture grew the same methicillin susceptible S. aureus identified in the blood cultures. These findings confirmed septic arthritis of the left knee and provided evidence that the joint was an important focus of the disseminated infection.

Further evaluation of the chest was performed because of the large unilateral pleural effusion seen on the initial radiograph. Computed tomography of the chest demonstrated a very large left sided pleural collection with areas of loculation and adjacent compressive atelectatic change. There was associated pleural thickening, supporting the diagnosis of a complicated pleural

infection rather than a simple free flowing effusion. No obstructing endobronchial lesion was identified. There was no clear evidence of pulmonary embolism on the contrast enhanced study.

Pleural fluid was obtained for diagnostic analysis. The fluid was turbid and purulent in appearance. Laboratory analysis demonstrated a high white cell count with neutrophil predominance, low glucose, and markedly elevated lactate dehydrogenase. Pleural fluid culture also grew methicillin susceptible S. aureus, consistent with the organism isolated from the blood and knee aspirate. The microbiological findings supported the diagnosis of S. aureus empyema occurring as part of the same systemic infectious process.

Figure 2 demonstrates the appearance of the affected knee at presentation. The joint was grossly swollen with prominent erythema and increased warmth. The surrounding skin appeared tense because of the degree of swelling, and the patient had marked tenderness on examination. Movement of the knee was severely restricted because of pain.

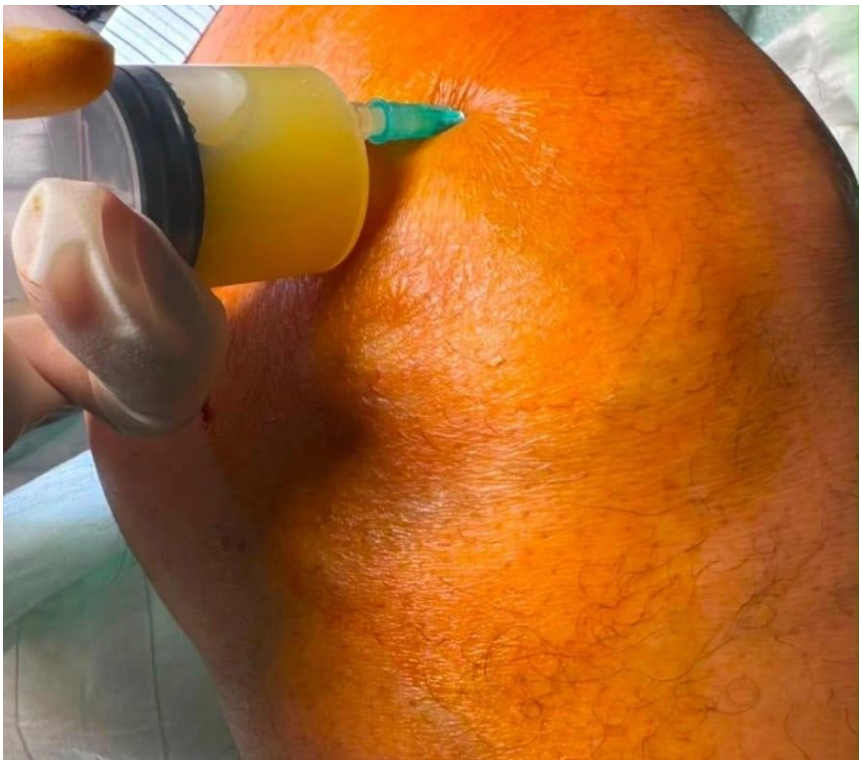

Figure 2. Gross appearance of the left knee demonstrating marked swelling, erythema, increased warmth, and tenderness, consistent with septic arthritis.

The combination of positive blood cultures, positive synovial fluid culture, and positive pleural fluid culture for the same strain of S. aureus provided evidence of disseminated infection involving anatomically distant sites. The clinical findings were also consistent with hematogenous spread, particularly in view of the simultaneous development of septic arthritis and pleural empyema. There was no alternative local explanation for the large pleural collection, and the absence of recent thoracic surgery or significant chest trauma made these causes less likely.

Further clinical assessment did not identify obvious skin or soft tissue infection apart from the previously reported minor leg wound. There were no obvious peripheral stigmata of infective endocarditis on examination. The absence of a murmur or peripheral signs did not exclude an intravascular source, particularly in the setting of S. aureus bacteremia. The diagnostic workup was therefore directed toward identifying the extent of disseminated infection and excluding additional metastatic foci.

Serial blood cultures remained positive initially, confirming persistent bacteremia. Inflammatory markers remained substantially elevated during the early hospital course. Kidney function was initially preserved, and there was no significant evidence of liver failure or severe coagulopathy. The patient's persistent fever, positive blood cultures, septic arthritis, and large purulent pleural collection supported the diagnosis of complicated disseminated S. aureus infection.

Overall, the diagnostic evaluation demonstrated methicillin susceptible S. aureus bacteremia associated with septic arthritis of the left knee and a massive left sided pleural empyema. The isolation of the same organism from blood, synovial fluid, and pleural fluid strongly supported a common disseminated infectious process rather than unrelated joint and pulmonary infections. The combination of these findings established the extent of infection and provided the basis for subsequent treatment and source control decisions.

Management course

Management focused on early treatment of the S. aureus bacteremia, control of the septic arthritis, drainage of the large pleural empyema, and identification of any additional metastatic sites of infection. Because the patient remained febrile and tachycardic with persistent bacteremia and significant respiratory symptoms, he was admitted to a monitored medical unit for close observation. Two peripheral intravenous lines were secured, and regular monitoring of blood pressure, heart rate, oxygen saturation, urine output, and temperature was started.

After the initial blood cultures and samples from the knee and pleural space had been obtained, empirical intravenous antibiotic therapy was started. The initial regimen provided coverage for both methicillin resistant and methicillin susceptible S. aureus as well as other common causes of severe bacterial infection. Once the blood cultures identified methicillin susceptible S. aureus and the same organism was recovered from the synovial and pleural fluid, the antibiotic regimen was narrowed according to the susceptibility results. Intravenous cefazolin was selected because of its activity against the isolated organism and its suitability for prolonged treatment. The antibiotic dose was adjusted according to the patient's kidney function and was reviewed regularly by the infectious diseases team [5,8].

The left knee was considered an important focus of infection because of the marked swelling, severe pain, restricted movement, and positive synovial fluid culture. Orthopedic surgery was consulted early, and operative drainage was recommended rather than relying on antibiotics alone. The patient underwent arthroscopic washout of the left knee with removal of purulent material from the joint. Multiple intraoperative samples were sent for culture and again grew methicillin susceptible S. aureus. The joint was thoroughly irrigated, and a drain was left temporarily because of the amount of infected fluid encountered. Postoperatively, the knee was examined regularly for recurrent swelling and persistent drainage. Early gentle movement was encouraged as the pain and acute inflammation improved.

The large left sided pleural collection required separate source control. In view of the size of the effusion, respiratory symptoms, loculation on computed tomography, and purulent pleural fluid, an intercostal chest drain was inserted under image guidance. A large amount of thick, infected fluid was drained during the first 24 hours. The pleural fluid culture grew the same methicillin susceptible S. aureus found in the blood and knee cultures, supporting a disseminated infection rather than an isolated pneumonia related effusion.

Despite initial drainage, follow up imaging showed residual loculated pleural fluid. Because of the incomplete drainage and the organized appearance of the collection, intrapleural tissue plasminogen activator and DNase were administered through the chest tube over a short course. This resulted in improved drainage and a reduction in the size of the residual collection [10,12]. The patient was monitored closely during treatment for bleeding and changes in respiratory status.

The respiratory condition gradually improved following pleural drainage. His oxygen requirement decreased over the following days, and his respiratory rate returned toward normal. Repeat chest radiography demonstrated progressive reduction in the size of the pleural collection and improved aeration of the left lung. Because drainage remained satisfactory and there was no clinical deterioration, immediate surgical intervention was not required. Thoracic surgery was nevertheless involved early in case the collection failed to resolve or became increasingly organized.

The persistent S. aureus bacteremia prompted further assessment for an intravascular source and additional metastatic infection. Transthoracic echocardiography did not show a definite vegetation. Because S. aureus bacteremia carries a significant risk of infective endocarditis and the patient had evidence of infection at more than one distant site, transesophageal echocardiography was subsequently performed. This did not demonstrate a definite valvular vegetation or an intracardiac abscess. These findings made infective endocarditis less likely, although the patient continued to be managed as having complicated S. aureus bacteremia because of the documented metastatic infections.

Repeat blood cultures were obtained every 24 to 48 hours until clearance was demonstrated. The initial repeat cultures remained positive, which was concerning for persistent bacteremia and prompted continued investigation for an undrained focus. Following surgical washout of the knee and effective drainage of the pleural empyema, subsequent blood cultures became negative. This clinical response supported adequate source control of the major infected sites.

Fluid management was guided by the patient's clinical condition. He received intravenous fluids during the initial period of sepsis, with care taken to avoid excessive fluid administration because of the large pleural collection and respiratory compromise. He did not require vasopressor support. Oxygen was continued initially through a nasal cannula and was gradually reduced as his respiratory status improved. Venous thromboembolism prophylaxis was provided during the period of reduced mobility, provided there was no contraindication.

Analgesia was given for the severe knee pain, particularly during the first few days following surgery. As the infection improved, the patient was encouraged to mobilize with assistance. Physiotherapy was involved because of the marked reduction in knee

movement before treatment. There was gradual improvement in the range of movement, although some stiffness remained during the early recovery period.

Inflammatory markers were followed during the admission together with the full blood count and kidney and liver function. The white blood cell count gradually decreased from 18.6 × 10^9/L, and C reactive protein showed a progressive fall after drainage of the infected joint and pleural space. Fever also became less frequent and subsequently resolved. Kidney function remained stable during antibiotic treatment, and there was no evidence of significant antibiotic related liver injury.

Because of the disseminated nature of the infection, the patient was assessed for other possible metastatic foci. He did not develop new focal neurological symptoms, back pain, or abdominal pain during the admission. There was no clinical evidence of another deep abscess. The absence of additional symptoms, together with the improvement after source control, made further extensive imaging unnecessary at that stage.

The infectious diseases team recommended a prolonged course of intravenous antibiotic therapy because the patient had complicated S. aureus bacteremia with confirmed septic arthritis and pleural empyema. The final duration was planned according to the clearance of blood cultures, clinical response, adequacy of source control, and follow up imaging rather than treating the bacteremia as an uncomplicated episode [5]. The importance of completing the full course was discussed with the patient and his family.

Over the following week, the patient's general condition improved significantly. His appetite returned, fever resolved, and his breathing became considerably easier. The chest drain output progressively decreased, while repeat chest imaging showed substantial improvement in the left pleural collection. The surgical wound over the knee remained clean, and there was a gradual reduction in swelling and tenderness. He was able to stand and walk short distances with assistance and physiotherapy.

The chest drain was removed once drainage had become minimal and follow up imaging showed adequate resolution of the collection. The patient remained clinically stable after removal, with no recurrence of respiratory distress or fever. The knee continued to improve with physiotherapy and gradual mobilization. There was no recurrence of joint swelling during the later part of the admission.

The patient was subsequently transferred from the monitored setting to the general medical ward once his vital signs and respiratory status had stabilized. Intravenous antibiotic therapy was continued, with regular review of blood cultures and inflammatory markers. A follow up plan was arranged with infectious diseases, orthopedic surgery, and respiratory or thoracic surgery teams. The patient was also advised to return promptly if he developed recurrent fever, worsening joint pain or swelling, shortness of breath, or other new symptoms.

The overall clinical course was consistent with disseminated methicillin susceptible S. aureus infection complicated by septic arthritis of the left knee and a massive left sided pleural empyema. Successful treatment required both prolonged antimicrobial therapy and timely source control of the infected joint and pleural space. The clearance of the bacteremia following drainage and washout, together with improvement in fever, inflammatory markers, respiratory symptoms, and joint findings, supported an appropriate response to treatment.

This case highlights the importance of searching for metastatic infection when S. aureus is isolated from blood, particularly when the patient has persistent fever or symptoms involving more than one organ system. In this patient, treatment of the bloodstream infection alone would not have been sufficient. Drainage of the empyema and surgical washout of the septic joint were essential parts of treatment and were followed by clearance of the bacteremia and progressive clinical recovery [5,9,10,12].

Discussion

This case represents a severe and unusual manifestation of disseminated methicillin susceptible *Staphylococcus aureus* infection, with simultaneous septic arthritis of the knee and a massive unilateral pleural empyema. It highlights an important clinical point that *S. aureus* bacteremia should not be viewed simply as a bloodstream infection. Once *S. aureus* is isolated from blood, the clinician needs to actively look for deep and metastatic sites of infection, particularly when fever persists or the patient has focal symptoms. A recent review in *JAMA* reported that metastatic infection occurs in more than one third of patients with *S. aureus* bacteremia, with septic arthritis, endocarditis, vertebral infection, abscesses, and septic pulmonary complications among the recognized manifestations [5]. In the present case, the knee and pleural space represented two anatomically distant sites infected by the same organism.

The initial presentation also demonstrates why disseminated *S. aureus* infection can be difficult to recognize. The patient had fever, generalized weakness, shortness of breath, and a painful swollen knee. These findings could initially be interpreted as pneumonia with an unrelated musculoskeletal problem, particularly when the respiratory symptoms are more prominent at presentation. However, the combination of a hot swollen joint and systemic illness should immediately raise concern for septic arthritis. The 2023 SANJO guideline emphasizes that no single clinical feature can reliably exclude septic arthritis and that

a painful, swollen, warm joint should maintain a high level of suspicion, even when fever is absent [9]. In this patient, the severe pain with passive movement, marked swelling, and inability to bear weight were particularly important clinical clues.

One of the more useful lessons from this case is the relationship between *S. aureus* bacteremia and focal metastatic infection. The organism has a particular ability to adhere to damaged tissue and establish infection at distant sites. A patient with bacteremia may therefore present with pain in a joint, back, chest, abdomen, or another distant location rather than with symptoms that clearly point toward the bloodstream. The 2025 *JAMA* review specifically notes that patients with *S. aureus* bacteremia commonly present with symptoms arising from metastatic infection, and that computed tomography or magnetic resonance imaging should be directed by localizing symptoms and clinical findings [5]. In practical terms, a patient with *S. aureus* bacteremia and a painful joint should have the joint investigated rather than assuming that the bacteremia explains the pain nonspecifically.

The septic arthritis in this case was confirmed by aspiration of purulent synovial fluid, with growth of the same methicillin susceptible *S. aureus* recovered from the blood. This is clinically important because blood culture positivity alone does not prove that a particular joint is infected. Synovial fluid provides direct microbiological evidence of joint infection and can also help distinguish septic arthritis from crystal arthritis or other inflammatory conditions. The SANJO guideline recommends joint aspiration as the key diagnostic procedure and emphasizes that microbiological identification is more important than relying on synovial leukocyte count alone [9]. A useful clinical point is that antibiotics should generally be delayed until joint fluid and blood cultures have been obtained when the patient is not in sepsis, because starting antibiotics first can reduce culture yield [9]. In a patient who is clearly septic, however, diagnostic sampling should not cause a dangerous delay in antimicrobial treatment.

The pleural findings added a second major challenge. A massive unilateral pleural effusion in a febrile patient should not automatically be attributed to uncomplicated pneumonia. The size of the collection, systemic toxicity, loculation, pleural thickening, and purulent fluid in this case were consistent with pleural infection and established empyema. The 2023 British Thoracic Society guideline emphasizes the importance of pleural fluid assessment and imaging in suspected pleural infection and recognizes that infected pleural collections can progress through increasingly organized stages [10]. Ultrasound is particularly useful because it can identify septations and guide drainage, while computed tomography helps define the extent of the collection and the condition of the surrounding lung and pleura [10,11].

The microbiological link between the blood, joint, and pleural fluid was particularly significant. Isolation of the same organism from all three sites strongly supported hematogenous dissemination rather than two unrelated infections occurring simultaneously. Although pleural infection commonly develops from pneumonia, the clinical context in this case suggested that the pleural space was another metastatic site of invasive *S. aureus* infection. This distinction is important because it changes the way the patient is investigated. When empyema occurs together with *S. aureus* bacteremia and septic arthritis, the clinician should actively consider the possibility of a systemic source and search for other metastatic the pleural infection. Antibiotics alone are often insufficient once a pleural collection has become frankly infected. Drainage was therefore an essential component of treatment in this case. The 2023 BTS guideline recommends initial chest tube drainage for pleural infection and supports foci rather than treating the pleural infection as an isolated pulmonary problem.

The management of the septic arthritis also illustrates an important principle of *S. aureus* infection: antibiotics are not a substitute for source control. The SANJO guideline recommends arthroscopic lavage for septic arthritis involving larger joints, while open revision may be necessary in selected patients depending on the extent of infection and tissue damage [9]. In this patient, arthroscopic washout was performed because of the purulent joint infection and marked clinical inflammation. The subsequent improvement in pain and swelling, together with clearance of bacteremia, supported adequate control of the joint infection. Early mobilization after the acute infection is controlled is also important because prolonged immobilization can result in joint stiffness and loss of function [9].

The same principle applies to the pleural infection. Antibiotics alone are often insufficient once a pleural collection has become frankly infected. Drainage was therefore an essential component of treatment in this case. The 2023 BTS guideline recommends initial chest tube drainage for pleural infection and supports the use of intrapleural tissue plasminogen activator with DNase when drainage has ceased but a residual collection remains [10]. This recommendation is supported by the MIST2 trial, which demonstrated improved clearance of pleural opacity and a lower rate of surgical referral with combined tissue plasminogen activator and DNase compared with placebo or either drug alone [12]. This is an important practical distinction because the benefit comes from the combination rather than from using either agent separately.

The ERS and ESTS statement on pleural infection also emphasizes that management should be individualized according to the stage of infection, drainage, intrapleural therapy, and the patient's clinical response [11]. Surgery remains important when adequate drainage cannot be achieved or when organized infection persists. However, the presence of a large empyema does not automatically mean that the patient should proceed directly to surgery. In this case, chest tube drainage followed

by intrapleural therapy produced adequate clinical and radiological improvement, making immediate thoracic surgery unnecessary. This stepwise approach is particularly relevant in patients who have simultaneous infections at other anatomical sites.

The antimicrobial management of this case also deserves attention. Empirical therapy for serious *S. aureus* bacteremia should initially cover methicillin resistant strains until susceptibility results are available. Once methicillin susceptible *S. aureus* is identified, treatment should be narrowed to an appropriate beta lactam such as cefazolin or an antistaphylococcal penicillin [5]. Continuing broad spectrum therapy after susceptibility results are available exposes the patient to unnecessary antimicrobial toxicity and may not provide an advantage. In this patient, narrowing treatment to cefazolin was therefore appropriate once MSSA was confirmed.

Another important feature was the persistence of bacteremia during the early part of admission. Persistent positive blood cultures should never be dismissed as simply a marker of severe illness. They are also a warning that an infected focus may remain inadequately controlled. The recent *JAMA* review identifies bacteremia persisting for 48 hours or longer as an important marker of complicated infection and recommends further evaluation for endocarditis and metastatic sites [5]. In this patient, continued positive cultures prompted further assessment and reinforced the need for definitive drainage of the knee and pleural space. Blood cultures subsequently became negative following source control, providing additional evidence that these sites were clinically important.

The cardiac evaluation was also relevant even though echocardiography did not demonstrate definite endocarditis. All patients with *S. aureus* bacteremia should undergo echocardiographic assessment, while transesophageal echocardiography is particularly important in patients with persistent bacteremia, metastatic infection, persistent fever, or other features suggesting a high risk of endocarditis [5]. A negative transthoracic echocardiogram should therefore not be interpreted as completely excluding endocarditis in a patient with complicated *S. aureus* bacteremia. In this case, the absence of a definite vegetation made endocarditis less likely, but did not change the classification of the infection as complicated because there were already proven deep metastatic sites.

A further clinical lesson is that the extent of disease should influence the duration of treatment. This was not an uncomplicated *S. aureus* bacteremia that could be treated with a short course after rapid clearance of blood cultures. The patient had confirmed septic arthritis, empyema, and initially persistent bacteremia. These features place the infection in the complicated category and justify prolonged antimicrobial therapy together with close clinical and microbiological follow up [5]. The exact duration should be individualized according to source control, bacteremia clearance, response to treatment, and the presence or absence of additional deep infection.

The case also demonstrates why multidisciplinary care is particularly important in disseminated *S. aureus* infection. Infectious diseases input is needed to select and adjust antibiotics and determine duration. Orthopedic involvement is required for definitive treatment of septic arthritis, while respiratory and thoracic teams are important when pleural drainage or surgery is required. Radiology and microbiology also play central roles in identifying and characterizing metastatic infection. Treating each site separately without recognizing the common bloodstream infection could result in incomplete source control and continued bacteremia.

The most important learning point from this case is that the combination of a hot swollen joint and a large pleural collection in a febrile patient should prompt consideration of a disseminated bacterial infection. When *S. aureus* is subsequently isolated from blood, the threshold for investigating both findings should be very low. Conversely, when *S. aureus* is isolated from a septic joint or empyema, blood cultures should be considered carefully because bacteremia may identify a much broader infectious process. The apparently unrelated symptoms in different organ systems may in fact represent different manifestations of the same bloodstream infection.

In conclusion, this case illustrates the ability of *S. aureus* to produce simultaneous metastatic infection in anatomically distant sites. The combination of septic arthritis and massive pleural empyema is unusual and creates significant diagnostic and therapeutic challenges. Early recognition of the infected joint, prompt pleural imaging and drainage, repeated blood cultures, echocardiographic assessment, appropriate narrowing of antimicrobial therapy, and aggressive source control were central to the patient's recovery. Current guidance supports a practical approach in which *S. aureus* bacteremia is treated as a systemic disease requiring an active search for metastatic infection rather than as an isolated positive blood culture [5,9,10,11]. In this patient, the most important intervention was not simply choosing the correct antibiotic, but finding and controlling the places where the organism had established infection.

Conclusion

This case highlights an important clinical lesson: *Staphylococcus aureus* bacteremia should never be regarded as an isolated laboratory finding. When a patient presents with fever together with a hot, swollen joint and respiratory symptoms, clinicians should consider the possibility that apparently unrelated findings may represent different manifestations of the same disseminated infection. In this patient, septic arthritis and massive pleural empyema were caused by the same organism, demonstrating the ability of *S. aureus* to spread through the bloodstream and establish infection at distant sites.

One of the most useful lessons is that the physical examination can still provide the earliest clues to complicated infection. A severely painful joint with restricted passive movement should prompt urgent assessment for septic arthritis, while a large unilateral pleural effusion in a febrile patient should not automatically be attributed to uncomplicated pneumonia. The combination of these findings should raise the suspicion of a systemic bacterial process and lead to early blood cultures, joint aspiration, and pleural imaging.

Another important lesson is that successful treatment depends on source control as much as antibiotic selection. Persistent bacteremia should prompt clinicians to look for an undrained focus rather than simply continuing antibiotics. In this case, clearance of the bloodstream infection followed drainage of the empyema and surgical washout of the infected joint.

Ultimately, the case demonstrates a simple but important principle: **when *S. aureus* is found in the blood, look beyond the blood.** Search for the painful joint, the hidden abscess, the infected pleural space, the spine, the heart, and other potential metastatic sites according to the clinical picture. Early recognition, repeated blood cultures, appropriate imaging, targeted antimicrobial therapy, and timely source control can transform a potentially fatal disseminated infection into a treatable condition. The most valuable diagnostic clue may not be the positive blood culture itself, but recognizing where the organism has gone next.

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