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*Letter*

# *Streptococcus pneumoniae* Bacteraemia Induced L4/L5 Facet Joint Septic Arthritis

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## 1. Introduction

*Streptococcus pneumoniae* (*S. pneumoniae*) is a Gram-positive diplococcus bacterium frequently associated with invasive infections, including pneumonia, meningitis, bacteraemia, and otitis media. It is a leading cause of community-acquired pneumonia (CAP) and bacterial meningitis [1].

Septic arthritis describes inflammation of the joint space secondary to infective organisms. This is an emergency presentation as without prompt treatment it can result in permanent joint destruction and is associated with a significant mortality risk [2]. Treatment requires antibiotics and approximately 30% of patients with septic arthritis require surgical intervention [2]. Septic arthritis mediated by *S. pneumoniae* is relatively rare. A comprehensive review of 2407 septic arthritis cases revealed that 156 (6%) were caused by *S. pneumoniae*, resulting in a 19% fatality rate among adults [3]. A separate review identified 9 instances of adult pneumococcal septic arthritis, primarily affecting elderly individuals with concomitant comorbidities [4]. While *S. pneumoniae* is a known pathogen in septic arthritis, its involvement in spinal facet joint septic arthritis is exceedingly rare. The vast majority of septic arthritis cases involve joints, such as the knee, and the incidence of cases in spinal facet joints is exceptionally uncommon at approximately 1% [5]. Furthermore, spinal facet joint septic arthritis is diagnostically challenging due to the non-specific presentation of back pain with varying degrees of neurological signs. As such, the condition is often misdiagnosed or overlooked. This case report presents a previously healthy woman in her 50s who developed pneumococcal bacteremia followed by suppurative arthritis of the L4/L5 facet joints, accompanied by empyema, suggesting multifocal hematogenous dissemination. This underscores the importance of considering the possibility of facet joint involvement in patients with invasive pneumococcal infection presenting with new-onset back pain, even in the absence of traditional risk factors or neurological deficits.

## 2. Case Report

### *2.1 Initial Presentation*

A woman in her late 50s presented to the emergency department with a five-day history of fever, non-productive cough, pleuritic chest pain and malaise. Her symptoms initially began with coryza and a dry cough, which subsequently progressed. She had been self-medicating with paracetamol but presented to the hospital with worsening fatigue and generalised myalgia. At baseline, she demonstrated a high level of activity with no limitations in exercise tolerance, having successfully completed a 10-kilometre race on Christmas Day. She is a non-smoker with occasional alcohol intake. She had no notable recorded medical conditions including any history of immunosuppression, and there was no recent travel history to report. Vaccination history was Moderna coronavirus disease 2019 (COVID-19) vaccine (Spikevax) in 2022. She had not received the pneumococcal or influenza vaccine.

On admission, she was febrile at 38 °C, with bibasal crepitations and diminished air entry noted at the right lung base. She required 2 L/min of supplemental oxygen to maintain oxygen saturation above 94%. No pleural friction rub was auscultated. On the third day of admission, she reported new-onset lower back pain, characterised as radiating in a shooting manner from the lumbar region to the left leg. She had no prior history of sciatica, and there was no history of trauma or recent strenuous activity to suggest musculoskeletal injury. Neurological examination of the lower limbs was unremarkable, with preserved motor power, sensation and normal deep tendon reflexes. Bladder and bowel function were also intact. The only positive finding was pain on active flexion of the left hip.

### *2.2 Diagnostic Assessment*

On admission, her bloods demonstrated a C-reactive protein (CRP) of 520 mg/L (normal range 0–5 mg/L) and a white cell count of 14.3 × $10^9$/L (normal range 3–10 × $10^9$/L), with a neutrophilia (12.8 × $10^9$/L, normal range 2–7.5 × $10^9$/L) and a lymphopenia (0.8 × $10^9$/L, normal range 1.2–3.7 × $10^9$/L). Liver function tests (LFTs) on admission demonstrated an alanine transaminase (ALT) of 12 IU/L (normal reference range 10–35 IU/L), alkaline phosphatase

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(ALP) of 143 IU/L (normal reference range 30–130 IU/L) and bilirubin of 6 µmol/L (normal reference range 0–20 µmol/L). After 2 days of admission, the ALP normalised to 115 IU/L and then continued to remain within normal range. Venous blood gas on admission demonstrated an alkalosis with a pH of 7.53, bicarbonate 31 mmol/L, base excess 8.4, lactate 0.8 mmol/L. The patient had normal renal function (estimated glomerular filtration rate greater than 90 mL/min throughout her admission) and liver function throughout admission. A full septic screen was undertaken. This included a respiratory viral panel and urine cultures which were both negative. Chest X-ray (Fig. 1) showed bilateral basal consolidation. She was subsequently diagnosed with CAP and commenced on empiric intravenous (IV) antibiotics in line with local guidelines. Blood cultures taken on admission grew *S. pneumoniae* (*serotype 4*) and she had a positive pneumococcal urinary antigen. No sputum samples were obtained as the patient had a non-productive cough. Following the diagnosis of *S. pneumoniae*, a transthoracic echo (TTE) was completed to assess for any vegetations significant for infective endocarditis. The TTE demonstrated an ejection fraction of 55–60%, nil significant valvular abnormalities.

A magnetic resonance imaging (MRI) Lumbar and Sacral Spine with Contrast was completed in light of the new onset of back pain to investigate for discitis. The scan demonstrated pronounced effusions in the 4th and 5th lumbar (L4/L5) facet joints, larger on the left side (Fig. 2). The spinal canal was adequate with nil compression. The appearances are most likely due to bilateral L4/L5 facet joint septic arthritis with adjacent inflammatory masses. Invasive spinal sampling was not pursued because the causative organism (*S. pneumoniae*) had already been identified via blood cultures and correlated with the MRI findings of facet joint septic arthritis. Given the absence of neurological compromise or surgical indications, the risks of procedural injury were deemed to outweigh the potential diagnostic benefits. Furthermore, the sensitivity of a biopsy would have been significantly reduced by the preceding administration of antibiotics, further supporting a conservative diagnostic approach.

The patient displayed ongoing fevers despite a strong biochemical response, marked by a reduction in CRP from 520 mg/L to 189 mg/L, indicating a clinical-biochemical discordance that required more evaluation for hidden infectious sources. Subsequently, a comprehensive whole-body assessment conducted via fluorodeoxyglucose positron emission computed tomography (FDG PET-CT) (Fig. 3) was crucial in detecting a subclinical right-sided empyema in conjunction with the primary facet joint septic arthritis.

Chest ultrasound was completed by the pleural team. It demonstrated a small area of pleural fluid not amenable to tap, and a larger right-sided effusion amenable to drainage. The interventional radiology team inserted a right-sided pleural drain under ultrasound guidance. Turbid yellow fluid was aspirated and sent for analysis. Biochemical analysis showed a total protein level of 56 g/L (exudate >35 g/L), glucose concentration of <0.1 mmol/L (normal >3.4 mmol/L) and lactate dehydrogenase (LDH) 9393 IU/L (pleural fluid LDH >2/3 upper limit of normal [280 IU/L]) which is indicative of exudate. Further pleural fluid analysis demonstrated *S. pneumoniae* 16S ribosomal deoxyribonucleic acid (rDNA) and positive *S. pneumoniae* polymerase chain reaction (PCR). Pleural fluid cytology demonstrated numerous neutrophils on a background of debris and rare reactive mesothelial cells. Pleural fluid analysis was consistent with empyema.

### *2.3 Therapeutic Intervention*

After obtaining a septic screen, including cultures, the patient was initially treated for community-acquired pneumonia with empirical antimicrobial therapy following local microbial guidelines with IV co-amoxiclav (1.2 g three times day), following a stat dose of IV cefuroxime (1.5 g) and IV clarithromycin (500 mg) in the emergency department. Blood cultures taken upon arrival revealed the presence of *S. pneumoniae*, with susceptibility to amoxicillin, benzylpenicillin, ceftriaxone and trimethoprim-sulfamethoxazole. This resulted in prompt de-escalation of antibiotics to targeted therapy with IV benzylpenicillin (1.2 g four times daily) on day 2 of admission. IV benzylpenicillin was extended for a total of 25 days due to the development of haematogenous spread and eventual spinal involvement.

The interventional radiology team performed percutaneous insertion of a chest drain under ultrasound guidance to treat the right-sided empyema seen on cross-sectional imaging. Drain output ceased after approximately one week. A follow-up computed tomography (CT) thorax showed significant improvement of the right-sided empyema and resolution of the smaller left-sided pleural effusion. The chest drain was subsequently removed without complication.

During admission, the patient developed neuropathic lower back pain with radicular symptoms, secondary to septic arthritis of the left L4/L5 facet joint. This was managed conservatively. She was initiated on amitriptyline 25 mg at night, which resulted in minimal symptomatic improvement.

After 25 days of her IV antibiotic course, the patient exhibited marked clinical improvement, with a significant reduction in inflammatory markers; her CRP had decreased to 8.1 mg/L, on the last recorded measurement prior to IV antibiotic cessation (Fig. 4). The patient was subsequently discharged with ongoing input from both the respiratory and infectious diseases teams. She was prescribed a further two-week course of oral co-trimoxazole (960 mg twice daily) to complete her antibiotic regimen, as advised by the infectious diseases team. Co-trimoxazole was chosen due to sensitivities noted from initial blood cultures. Outpatient

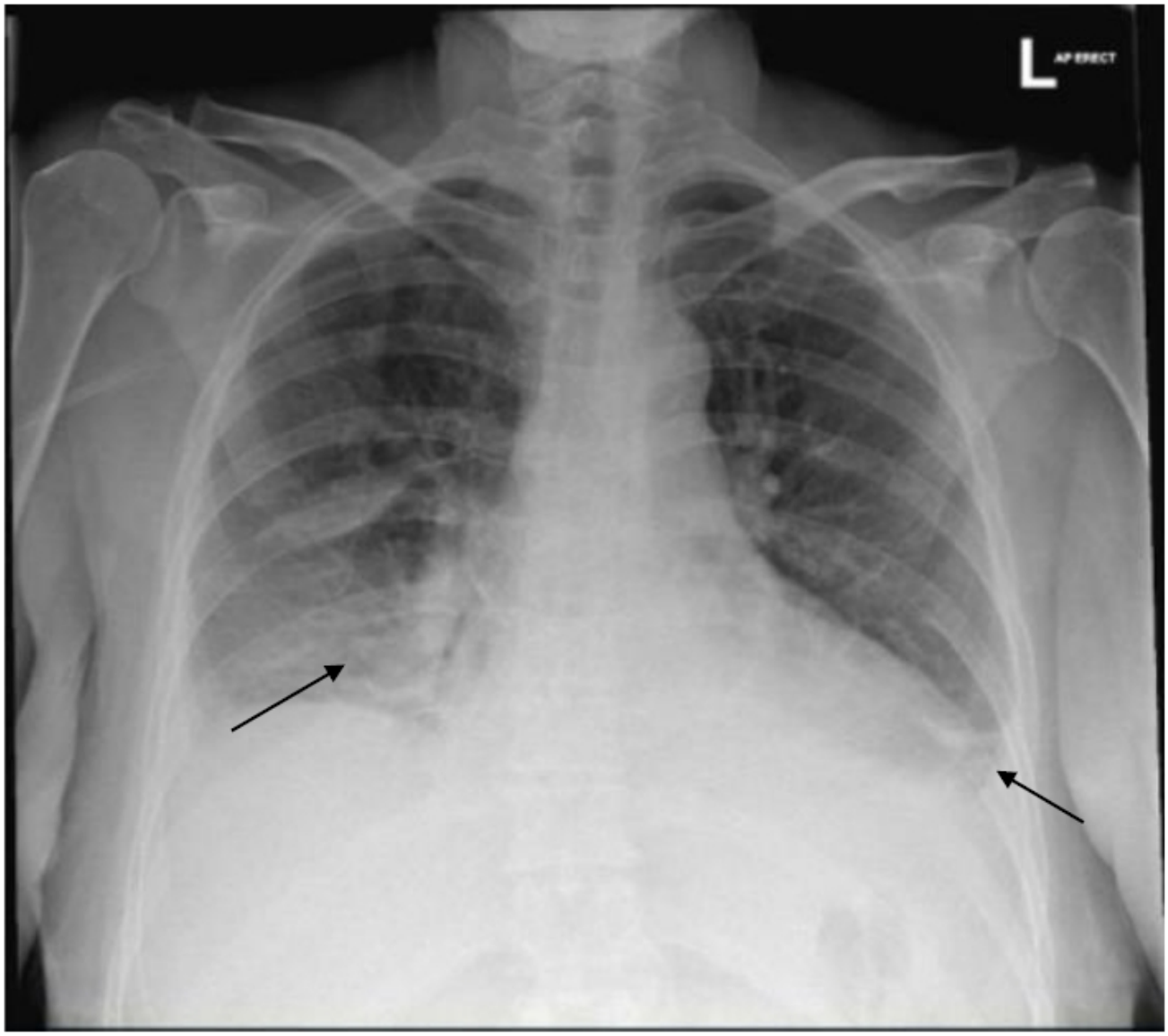



**Fig. 1. Chest X-ray on admission demonstrating bilateral lower zone opacification, as demonstrated by the arrows**.

follow-up was arranged with both the pleural and infectious diseases services.

*2.4 Follow-Up and Outcomes*

Two-weeks post-discharge, the patient was reviewed in the pleural outpatient clinic. By this time, she had completed her antibiotic course and remained clinically well. Subsequent blood tests indicated additional improvement in inflammatory markers (CRP 1.9 mg/L; white cell count $5.3 \times 10^9$/L). A repeat ultrasound confirmed complete resolution of pleural fluid collections bilaterally.

Approximately five weeks post-discharge, the patient underwent MRI of the lumbar and sacral spine. The scan demonstrated significant improvement in the previously identified left L4/L5 facet joint septic arthritis and significant improvement of the left paraspinal intramuscular inflammatory mass. Slight effusion and degenerative changes were also noted at the right L4/L5 facet joint. She was formally discharged from the respiratory clinic and continues to receive multidisciplinary follow-up under the care of the infectious diseases team to monitor her recovery from the spinal infection.

## 3. Discussion

Spinal facet joint septic arthritis is a rare and often overlooked disease, representing a minor fraction of vertebral infections. The infrequency and frequently understated initial characteristics complicate prompt diagnosis. While predominantly seen in older or immunocompromised persons, numerous case reports have shown its manifestation in younger, previously healthy patients [6]. Our case details a previously healthy woman in her late 50s, without significant comorbidities or immunosuppressive risk factors, who developed facet joint septic arthritis due to *S. pneumoniae*

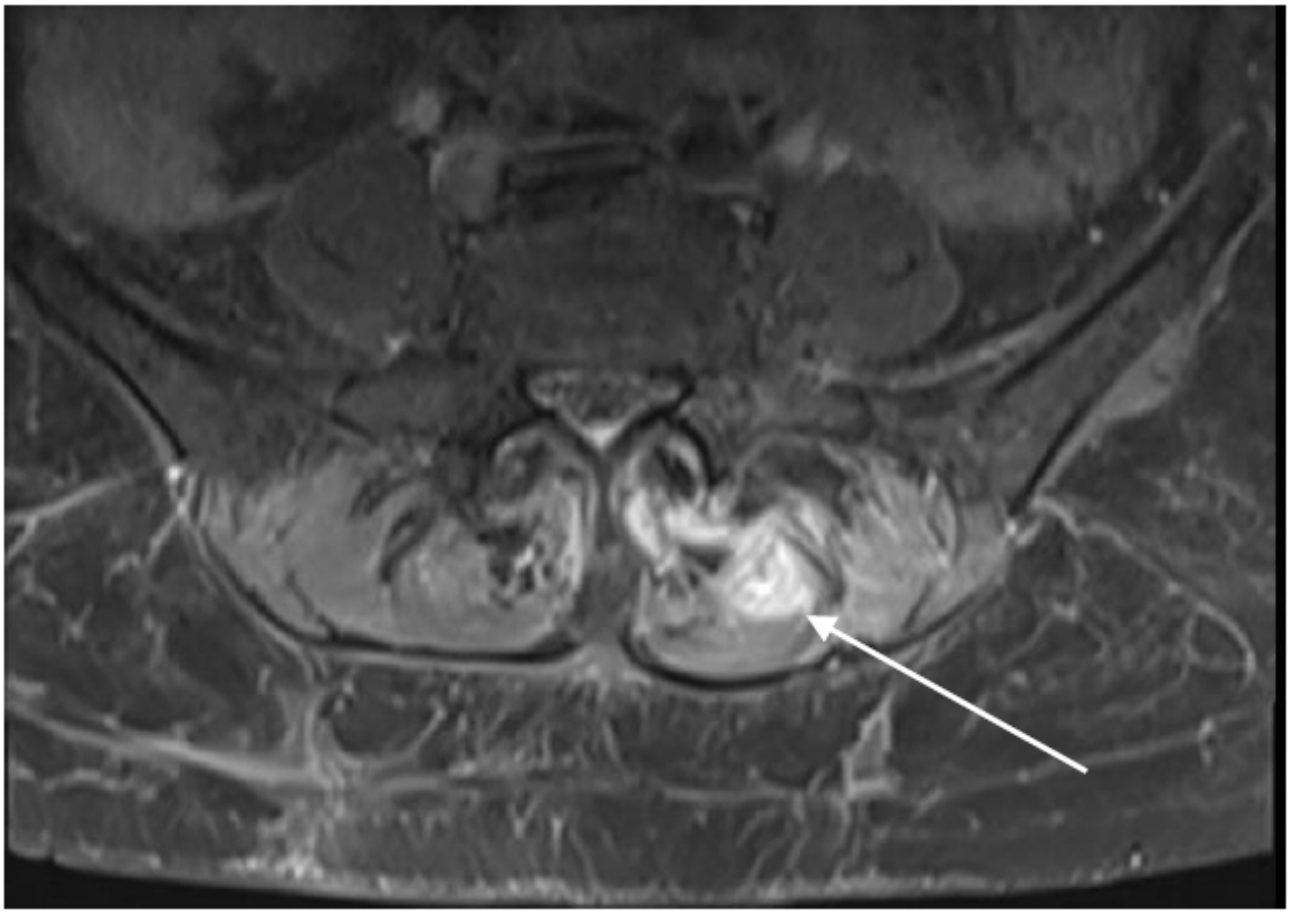


**Fig. 2. MRI (Magnetic Resonance Imaging) lumbar and sacral spine with contrast**. This image shows a pronounced left-hand side L4/L5 facet joint effusion, marked by the arrow.

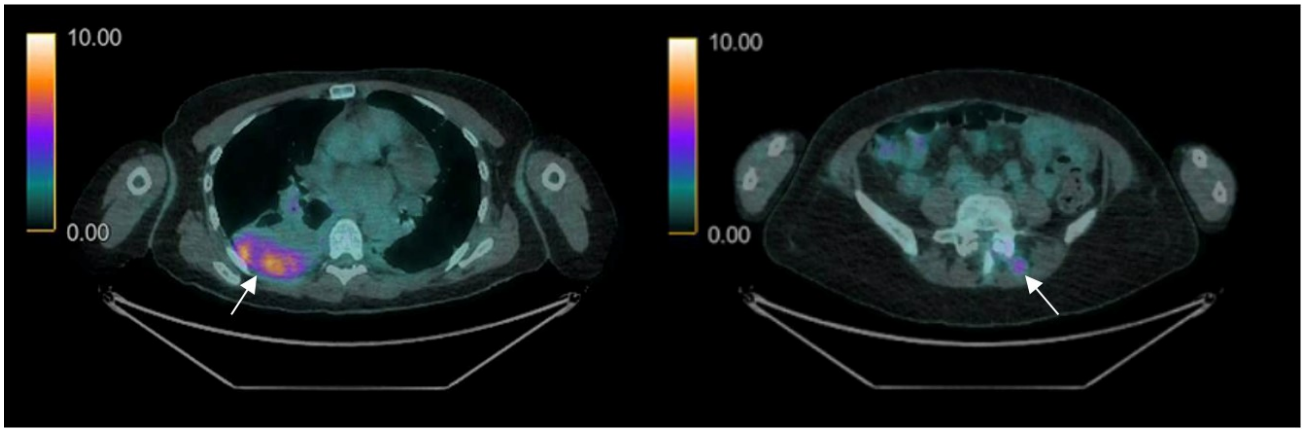



**Fig. 3. Both images from FDG PET-CT scan**. Left-hand side image: arrow marking area of patchy increased pleural avidity concerning for right-sided empyema. Right-hand side image: arrow locating area of increased avidity on the left L4/L5 facet joint. FDG PET-CT, fluorodeoxyglucose positron emission computed tomography.

following pneumococcal bacteraemia, underscoring the necessity of considering this diagnosis even in low-risk individuals.

Spinal facet joints are synovial joints with an arterial blood supply from the posterior spinal branches of segmental spinal arteries. The haematogenous spread of bacteria to these joints results in synovial invasion causing an inflammatory response. The lumbar spine is the most typically affected area in facet joint septic arthritis, with the L4/L5 joint being the predominant location of involvement [5]. This anatomical propensity is probably attributable to mechanical stress and increased blood flow in the lumbar area.

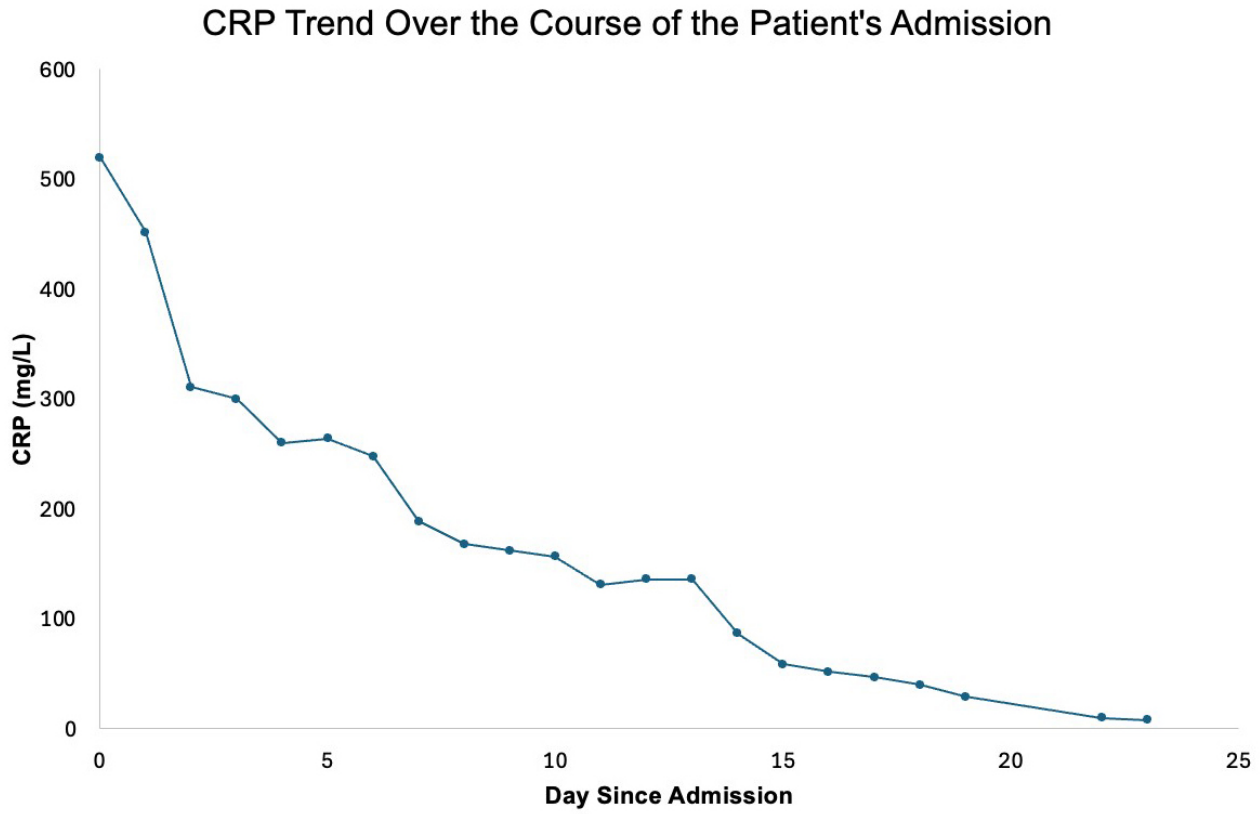



**Fig. 4. Graph showing the trend of C-reactive protein (CRP) with antibiotic treatment during the patient's inpatient admission**. Day 0 (day of admission) treatment with cefuroxime + clarithromycin + co-amoxiclav. Day 1 treatment with regular IV co-amoxiclav. Day 2 onwards IV benzylpenicillin.

The patient in our case exhibited facet joint involvement at L4/L5, consistent with the patterns seen in the literature.

The pathogen most commonly associated with facet joint septic arthritis is *Staphylococcus aureus*, accounting for about 64% of cases [5,7]. Less commonly, Gram-negative bacilli and streptococcal species are detected. *S. pneumoniae*, while a predominant etiological agent of CAP and invasive infections including meningitis and bacteraemia [1], is an exceptionally uncommon cause of septic arthritis, particularly in spinal facet joints. A separate study documented 9 cases of pneumococcal septic arthritis in adults, primarily affecting individuals of advanced age with concomitant conditions [4]. The discovery of the causal culprit in our patient's facet joint infection highlights the possibility of haematogenous dissemination from a pulmonary source.

Initial symptoms are frequently non-specific and encompass fever, malaise, and lumbar discomfort. The patient exhibited pleuritic chest pain, tiredness, and thereafter experienced acute lower back pain radiating to the leg. Acute back pain and fever are the most frequently reported symptoms in facet joint septic arthritis, and they were also present in a large multicentre study of 65 patients [8]. Neurological involvement is prevalent in facet joint septic arthritis, occurring in up to 60.7% of cases, and may manifest as radicular discomfort, limb paralysis, or sphincter dysfunction [8]. Our patient exhibited radicular discomfort extending from the lower back to the left leg, indicative of sciatic nerve root irritation. Nonetheless, the evaluation revealed no obvious neurological impairments, including motor weakness, altered sensation, or disturbances in bowel or bladder function. This may indicate early identification and timely antimicrobial intervention, which likely averted more neural compression or the emergence of epidural complications.

Blood cultures are crucial for diagnosis and yield positive results in approximately fifty percent of facet joint septic arthritis cases [9]. Blood cultures identified *S. pneumoniae*, allowing for targeted antimicrobial treatment. Prompt microbiological confirmation is crucial; delays in diagnosis might increase the risk of sequelae such as epidural abscess, osteomyelitis, and neurological impairment [8].

MRI is the preferred imaging technique for diagnosing facet joint septic arthritis and is very sensitive in detecting early inflammatory alterations, joint space involvement, and paraspinal soft tissue extension [10]. Our patient's MRI revealed bilateral L4/L5 facet joint involvement with adjacent inflammatory masses, indicating septic arthritis and nearby myositis/inflammatory mass. Follow-up imaging indicated resolution of these abnormalities with prolonged

antibiotic therapy, demonstrating the utility of MRI in both diagnosis and disease progression monitoring.

According to the Royal College of Radiologists (RCR) 2022 criteria, FDG PET-CT can be employed as an effective method for systemic monitoring when traditional imaging is unclear [11]. Although MRI is the gold standard for delineating localised spinal architecture, its limited field of view could fail to recognise concurrent systemic seeding. Therefore, due to ongoing patient fevers, we conducted a FDG PET-CT to review for any other subsequent reservoirs of infection and detected a right-sided empyema which was subsequently drained. This diagnostic shift corresponds with studies indicating that PET-CT changes management in roughly one-third of complex infection cases by identifying secondary foci [12]. Importantly, metabolic mapping enabled early thoracocentesis for source control and ensured that the antibiotic course was correctly matched to the overall systemic disease burden.

Management often entails extended IV antibiotic medication customised to the diagnosed infection, frequently alongside supportive or procedural measures. The patient was administered 25 days of IV benzylpenicillin, succeeded by two weeks of oral co-trimoxazole, as per microbiological recommendations. There is no definitive guidance on treatment duration in patients with spinal facet joint septic arthritis. However, Ross and Ard [5] reviewed 117 cases of facet joint septic arthritis and antibiotic duration, for patients treated after 2000, was a mean of 8 weeks and a median duration of 6 weeks. Our treatment duration was 39 days (5.6 weeks) and was guided by clinical response, microbiological evidence, and imaging results.

In contrast to cases necessitating spinal surgical intervention for epidural abscesses or vertebral instability, our patient did not require neurosurgical involvement, and her spinal infection was handled conservatively. She was initiated on amitriptyline for the treatment of neuropathic back pain, which yielded minimal clinical alleviation. This underscores the significance of a multidisciplinary strategy, incorporating infectious diseases, pulmonary medicine, imaging, and pain management in the treatment of complex disseminated infections.

The occurrence of pleural infection in addition to spinal seeding demonstrates the degree of haematogenous spread in invasive pneumococcal illness and the need for continuing monitoring for distant consequences.

There are several limitations to this report. This is a single case and cannot establish incidence or generalisable treatment recommendations. The diagnosis of facet joint involvement was made based on the MRI findings and correlation with the blood culture results and not direct histological or microbiological sampling of the joint itself as it was not felt that invasive sampling was clinically indicated. In this case the duration of antibiotics was guided by clinical response, support from the microbiology team and imaging rather than an evidence-based protocol which is reflective of the paucity of evidence-based recommendations for treatment duration of this condition. Finally, only one follow-up imaging confirming resolution was obtained at roughly 5 weeks post-discharge and thus longer-term outcome data are not available.

## 4. Conclusion

This case demonstrates that pneumococcal bacteraemia can result in facet joint septic arthritis and multifocal metastatic infection. It highlights the need for a low threshold for spinal imaging in patients with bacteraemia who develop new localised spinal pain, even when neurological examination is normal, and for investigating persistent fever despite appropriate antimicrobial therapy as a marker of occult infection. In this case, severe back pain with pain on active flexion of the left hip prompted targeted spinal MRI, but presentation can vary considerably, and imaging should be tailored to the specific signs and symptoms with which a patient presents. Combining early targeted imaging with whole-body imaging, such as FDG PET-CT, can help identify clinically silent septic foci and guide source control. Greater awareness of this presentation may reduce diagnostic delay, enable timely source control, and help prevent neurological morbidity.

## Key Points

• Clinicians should have a heightened level of suspicion for spinal infections in patients with new-onset back pain associated with recent bacteraemia or systemic infection, despite the lack of traditional risk markers.

• Whilst there are no concordant guidelines on the management of spinal facet joint septic arthritis, treatment duration should be guided by a combination of clinical presentation and biochemical response.

• *S. pneumoniae* can be a causative organism of septic arthritis, therefore, new-onset of localised joint pain in a patient with *S. pneumoniae* bacteraemia needs to be further investigated.

## Availability of Data and Materials

Not applicable.

## Author Contributions

RB and MA (Substantial Contributions To: Conceptualisation, Data Acquisition and Analysis, Writing—Original Draft, Writing—Review and Editing), MG (Supervision and Substantial Contributions To: Conceptualisation, Writing—Review and Editing). All authors gave final approval of the version to be published. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

## Ethics Approval and Consent to Participate

This report describes a single patient's case and their standard clinical care; it does not constitute research and therefore did not require approval from a Research Ethics Committee, in line with the UK Health Research Authority's definition of research and UCLH's local research governance policy. This case report was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent for publication, including accompanying clinical images, was obtained directly from the patient.


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## Conflicts of Interest

The authors declare no conflicts of interest.

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