

## Invasive streptococcus pneumoniae infection in the hip joint and thigh muscle group of an adult diagnosed by Q-mNGS: a case report

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### Abstract

Joint infections and myositis due to *S. pneumoniae* are rare. We report the case of a young adult male presenting with right hip joint infection complicated by thigh muscle abscess, successfully treated by surgical debridement, drainage tube placement, and aggressive antimicrobial therapy. A 38-year-old male presented with right buttock and thigh swelling, pain, night sweats, and limited mobility for 45 days. Imaging examination indicated soft tissue infection around the right hip joint with abscess formation. Quantitative meta-genomic next-generation sequencing (Q-mNGS) of joint fluid confirmed *S. pneumoniae* as the pathogen. Surgical intervention was performed due to lack of significant improvement after six days of anti-inflammatory therapy. The patient recovered well post-operatively and was discharged with medication after a total hospital stay of 31 days. This case highlights the importance of considering *S. pneumoniae* as a potential pathogen in joint and soft tissue infections in adults.

**Keywords:** Streptococcus pneumoniae, Hip joint infection, Muscle abscess, Q-mNGS.

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### Introduction

According to the site of infection, pneumococcal disease (PD) can be categorised into non-invasive pneumococcal disease (NIPD) and invasive pneumococcal disease (IPD). The IPD refers to infections caused by *Streptococcus pneumoniae* (*S. pneumoniae*) invading normally sterile sites and tissues not in direct communication with the outside environment.<sup>1</sup> The IPD alone results in nearly a million deaths annually among elderly and paediatric populations worldwide, with the majority occurring in developing countries. The PD remains a significant global public health concern. While *S. pneumoniae* commonly causes diseases such as lobar pneumonia, meningitis, and bacteraemia when host immunity is compromised, joint

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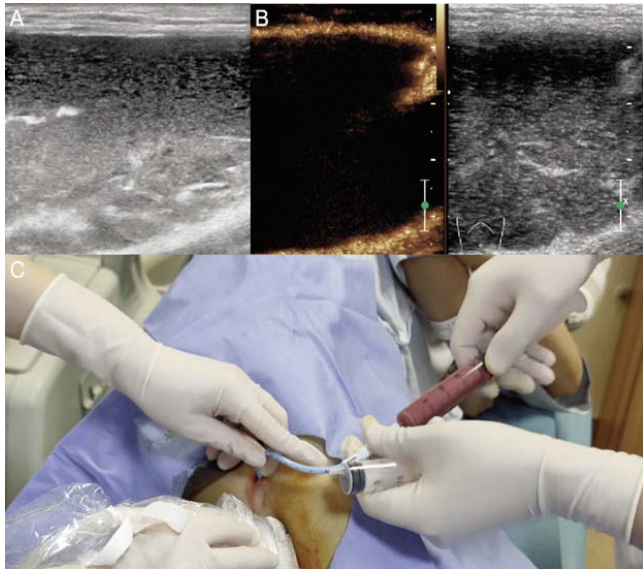
and muscle infections in young adults are rare. This case report aims to raise awareness among clinicians regarding the potential of *S. pneumoniae* as an uncommon pathogen causing joint and soft tissue infections.

### Case Report

The patient was a 38-year-old male who developed lower back pain and right buttock discomfort 45 days ago. The pain was persistent, accompanied by night sweats, and he had a fever with a temperature of 38.7°C. Subsequently, the pain in the buttock decreased and moved to the inner aspect of the upper segment of the right thigh, where a soft, poorly defined swelling developed with slightly increased skin temperature. The patient avoided knee extension due to pain. The patient was admitted to Hangzhou Red Cross Hospital with a tentative diagnosis of "right hip purulent arthritis" in March 2022. On examination, vital signs were: temperature: 37°C, heart rate: 81 beats/min, respiration rate: 20 breaths/min, and blood pressure: 124/87 mmHg. The patient felt tenderness in the right hip joint and a poorly defined, soft, tender mass on the inner aspect of the right thigh. The patient denied a history of hypertension, diabetes, familial genetic disorders, or infectious diseases. Based on history, physical examination, imaging studies, and laboratory findings, the diagnosis of purulent arthritis of the right hip joint and thigh muscle abscess was established. Differential diagnoses considered included: 1) Tuberculous arthritis, which is often accompanied with pulmonary tuberculosis, low fever, night sweats, predominant bone destruction and cool skin temperature (cold abscess), and 2) Joint tumours, usually associated with primary tumour lesions and elevated tumour markers in laboratory tests.

Upon admission, laboratory investigations revealed blood glucose at 260 mg/dL, neutrophil count at 6,500 cells/mm<sup>3</sup>, CRP at: 1.881 mg/dL, and erythrocyte sedimentation rate of 70 mm/h. White blood cells were within normal ranges. Acid-fast bacilli were not present in sputum smear, bacterial growth was absent in sputum culture, and blood culture did not reveal bacteria or anaerobic organisms.

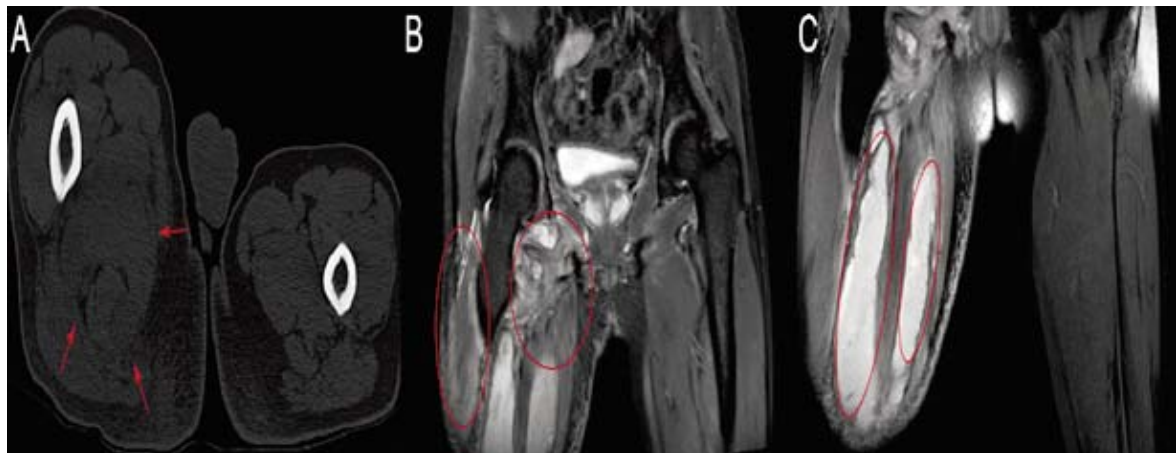
Two-dimensional ultrasound and contrast-enhanced



**Figure-1: Ultrasound Results.**  
 (A) Large, anechoic area was observed between the posterior thigh muscle groups, filled with fine punctate light spots.  
 (B) CEUS revealed significant enhancement of the surrounding tissues around the lesion area, with a large unenhanced area in the centre.  
 (C) With ultrasound guidance, 50ml of purulent bloody fluid was extracted and sent for examination and a drainage tube was placed.

ultrasound indicated a large hypoechoic area in the posterior thigh muscle group on the right side with poor internal echogenicity, suggestive of abscess formation (Figure 1). Computed tomography (CT) scan revealed significant swelling of soft tissues around the right hip joint and internal posterior thigh muscles, indicating soft tissue infection with abscess formation. Magnetic resonance imaging (MRI) demonstrated multiple elongated T1 and T2 signal intensities with unclear margins in the muscles and soft tissues around the right hip joint, irregular cystic signals in the muscle gap, consistent with soft tissue infection, and abscess formation around the right hip joint (Figure 2).

Due to the formation of a thigh muscle abscess on the right side, the patient underwent ultrasound-guided percutaneous drainage. Tests for mycobacterium tuberculosis DNA and mycobacterium tuberculosis complex were negative in the aspirated pus. Bacterial and fungal cultures of the pus were negative, as were the cultures of drainage fluid. Due to persistent infection symptoms and the need to identify the causative pathogen, pus was sent for Quantitative meta-genomic next-generation sequencing (Q-mNGS) testing.



**Figure-2: Figure 2: CT and MRI Results**  
 (A) CT showed soft tissue swelling behind the right femur (red arrows).  
 (B) The T2-weighted MRI image revealed multiple strip-like and patchy signals within the muscles and soft tissues surrounding the right hip joint (red boxes).  
 (C) The T2-weighted MRI image revealed an irregular cystic within the inter-muscular space of the thigh (red boxes).

**Table-1: Q-mNGS Results**

Type	Name	Genus		Species		
		Sequence number	Relative abundance (%)	Name	Sequence number	Relative abundance (%)
G+	Streptococcus	106477	94.54	Streptococcus pneumoniae	74927	66.53
G+	Staphylococcus	7	<0.01	Staphylococcus hominis	4	<0.01
DNA	unclassified Anelloviridae	16	0.02	Torque teno virus	6	<0.01

The Q-mNGS results indicated that the causative pathogen is *S. pneumoniae*.

Given the patient's elevated blood glucose levels, a diagnosis of diabetes was made. The patient received subcutaneous insulin injections of 8.5 units for QD pump, with blood glucose control being monitored. Empirical treatment included intravenous administration of 0.45g of Levofloxacin and 0.4g of Cefoperazone and Sulbactam, along with oral administration of 60mg of Loxoprofen sodium for antimicrobial therapy. The Q-mNGS testing of the pus sample performed one day later reported *S. pneumoniae* as the pathogen, with resistance detected against Tetracyclines, Macrolides, and Lincomycin (Table 1). Unfortunately, due to financial constraints, antibiotic sensitivity testing was not conducted on this specimen. Based on the antimicrobial susceptibility profile of *S. pneumoniae*, treatment was adjusted to intravenous administration of 4.5g of Piperacillin and Tazobactam, and 0.4g of Levofloxacin for anti-inflammatory therapy. Three days later, while the patient's lumbar and right buttock acidosis and pain had not significantly improved, surgical treatment was considered.

## Discussion

*S. pneumoniae*, a Gram-positive bacterium characterised by lanceolate morphology arranged in pairs or short chains, was first isolated from the sputum in 1881 by Pasteur in France and Sternberg in the United States.<sup>2,3</sup> *S. pneumoniae* primarily spreads via respiratory droplets or autoinfection from colonised sites. Children and the elderly are particularly susceptible populations.

Recent literature reports indicate that *S. pneumoniae* can invade tissues and organs throughout the body, presenting with diverse clinical infection types that may occur concurrently or sequentially.<sup>4</sup> Pili on *S. pneumoniae* serve as crucial adhesion and virulence factors during pathogenesis. Studies have identified *S. pneumoniae* pili as promising candidates for protein vaccines, highlighting their potential in combined immunisation strategies.<sup>5</sup>

In cases of joint and soft tissue infections caused by *S. pneumoniae*, several risk factors include intravenous drug use, concurrent infections from different sites, diabetes mellitus, trauma, central venous catheter-related infections, asymptomatic odontogenic sinusitis, poor oral hygiene, and heavy smoking. The present patient had diabetes mellitus with poorly controlled blood glucose levels due to lack of regular monitoring, posing a high risk for infection. However, despite notable symptoms of lumbar and right buttock pain, other potential sites of infection were overlooked. Joint and soft tissue infections may result from systemic bacteraemia, either by direct spread to the hip joint and soft tissues or secondary to

systemic bacteraemia.<sup>6</sup>

The patient was admitted due to discomfort from lumbar and right buttock pain, with investigations indicating soft tissue infection with abscess formation around the right hip joint. Conventional anti-inflammatory treatment showed poor efficacy, prompting ultrasound-guided drainage tube placement to alleviate symptoms. However, blood and drainage fluid cultures did not identify the causative pathogen, complicating targeted clinical management. Early adoption of Q-mNGS as a molecular diagnostic tool is crucial in clinical scenarios with high suspicion of infection but uncertain pathogen identification. Microbiological diagnosis remains crucial in infectious disease diagnostics, transitioning from traditional culture-based methods to molecular biology techniques requires a shift in the mind-set among clinical practitioners and clinical microbiologists. This shift aims to guide pathogen identification, precise antibiotic selection, and improve patient outcomes.<sup>7</sup>

Following Q-mNGS testing, which identified *S. pneumoniae*, the patient received three days of adjusted therapy with Piperacillin, Tazobactam, and Levofloxacin, but showed no significant improvement in symptoms, probably due to the extensive infection area and formation of large abscesses. Therefore, surgical intervention was necessary. Intraoperatively, the presence of joint infection with localised abscesses and sinuses extending along muscle gaps toward the posterior thigh was noted. Despite negative findings on ultrasound, CT and MRI scans for sinus tracts, surgical excision of infected lesions and synovial tissues, along with placement of four drainage tubes at the incision site, was performed. Post-operatively, the drainage tubes showed minimal fluid output after eight days, with ultrasound revealing no evident pus or exudate in the surgical area. The patient's pain at the right hip and thigh incision site significantly improved, with clean and dry wound dressings observed, leading to discharge with continued medication after 13 days.

## Conclusion

As an uncommon pathogen, *S. pneumoniae* requires specific pathogenic conditions causing joint and soft tissue infections. Blood and puncture fluid cultures have low positivity rates. In case of high clinical suspicion of infection but where the causative pathogen remains unclear, early adoption of Q-mNGS or other molecular technologies is advisable. These technologies facilitate pathogen identification, determination of antibiotic sensitivity and resistance and enhance treatment efficacy and prognosis.

**Abbreviations:** PD = pneumococcal disease, S. pneumoniae = Streptococcus pneumoniae, CT = computed tomography, MRI = magnetic resonance imaging, Q-mNGS = quantitative meta-genomic next-generation sequencing.

**Consent for publication:** The patient gave written informed consent for publishing his case report.

**Data availability:** Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

**Disclaimer:** None to declare..

**Conflict of Interest:** The authors declare that there was no potential conflict of interest..

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## AUTHOR'S CONTRIBUTION:

**DS:** Concept, writing-original draft preparation, review, editing, supervision, project administration and final approval.

**TN:** Investigation, writing-original draft preparation and final approval.

**XLY:** Investigation, writing-original draft preparation, project administration and final approval.