



Case Report

Abscesses of the spine and iliac fossa caused by infection with the opportunistic bacterium *Fusobacterium nucleatum*YunTao Gu^{a, *}, Yuan Zhou^c, TianQiong Hu^a, Hai Zhao^a, YongPing Wang^b, YongXiong He^{a, *}^a Department of Spinal Surgery, The Second Affiliated Hospital of Hainan Medical University, Haikou, Hainan 570100, China^b Department of Joint surgery, The Second Affiliated Hospital of Hainan Medical University, Haikou, Hainan 570100, China^c Department of Thoracic Surgery, The Second Affiliated Hospital of Hainan Medical University, Haikou, Hainan 570100, China

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ABSTRACT

We present a case of spinal and iliac fossa infection caused by *Fusobacterium nucleatum* in a 52-year-old male patient with unexplained back pain. Notably, the patient had no history of periodontal infections. Magnetic resonance imaging (MRI) revealed abscesses at the L3-4 vertebrae and hip, with dura mater and cauda equina compression. Next-generation sequencing (NGS) of the aspirate confirmed the presence of *Fusobacterium nucleatum*. The patient was treated with antibiotics (carbapenems, and metronidazole) and underwent surgical procedures for abscess drainage and internal fixation, resulting in the removal of 1000 ml of pus. Following a 46-day recovery period, the patient made a full recovery. This rare infection poses a significant diagnostic challenge due to its insidious onset and low blood culture sensitivity. The role of next-generation sequencing (NGS) in this context is paramount, as it has been instrumental in arriving at an accurate diagnosis and formulating an effective treatment plan. In view of the challenges posed by this infection, NGS emerges as a crucial tool for the diagnosis and management of unexplained infections.

Introduction

Fusobacterium nucleatum, a gram-negative anaerobic coccus, is typically found within the oral and gastrointestinal flora. It is known for its high virulence potential, which leads to periodontal infections [1]. *Fusobacterium nucleatum* has long been considered an opportunistic pathogen because it is frequently isolated and identified in anaerobic samples from patients with different infections [2]. The contribution of *Fusobacterium nucleatum* to extraoral diseases remains rather mechanistically speculative. While the bacterium has been identified in a variety of clinical specimens from patients with diverse diseases, including appendicitis [3], brain abscesses [4], osteomyelitis [5], and pericarditis [6], the role of *Fusobacterium nucleatum* in these pathologies remains unclear. Given the disease's significant impact on patients' daily lives, a comprehensive understanding of its clinical features and effective treatment strategies is imperative to enhance patient quality of life.

Case report

A 52-year-old male patient presented with back and waist pain that developed without any obvious precipitating factors one month prior.

He exhibited no fever symptoms and initially received treatment with traditional Chinese medicine at a local hospital; however, his condition did not improve. One week ago, the lower back pain progressively worsened, accompanied by numbness and pain in both lower limbs and the left hip, as well as restricted mobility of the hip joint. Upon admission, the patient exhibited no fever symptoms, periodontal infections, night sweats, or weight loss. Laboratory studies revealed an elevated erythrocyte sedimentation rate of 78 mm/h and a C-reactive protein level of 153.60 mg/L, with a white blood cell count of $12.02 \times 10^9/L$. The blood and pus cultures were negative. The MRI of the lumbar spine revealed abnormal signals at the L3-4 vertebrae, along with swelling and abscess formation in the surrounding soft tissues and bilateral piriformis muscles. Notably, there was compression of the dura mater and cauda equina at the L3/4 level (Fig. 1 A). Conversely, an MRI of the hip joint revealed swelling of the left piriformis muscle and abscess formation around both L4/5 vertebrae and the left hip joint (Fig. 1 B). A CT scan of the hip joint revealed swelling with uneven density in both piriformis muscles and the left iliopsoas muscle, raising suspicion for infection (see Fig. 1 C).

The patient was administered intravenous ceftazidime-sulbactam for antibiotic therapy; however, his symptoms showed no improvement.

* Corresponding author.

E-mail address: 13866339633@126.com (Y. He).<https://doi.org/10.1016/j.idcr.2025.e02205>

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Given the uncertainties regarding the nature of the spinal infection, whether it was spinal tuberculosis or another condition, the antibiotic treatment was continued for one week before proceeding with lumbar abscess aspiration and drainage. The aspirate was then subjected to Next-Generation Sequencing (NGS) testing, which identified *Fusobacterium nucleatum* (Table 1). The patient was treated with carbapenems and metronidazole antibiotics for the purpose of combating the infection. The patient had a large number of abscesses in the left iliac fossa. Pre-operative preparation was enhanced, and incision and drainage of the lumbar and iliac fossa abscesses were performed under general anesthesia. Internal fixation of pedicle screws was also implemented. Approximately 1000 ml of pus was extracted during the surgical procedure (see Fig. 2). Postoperative treatment included continuous wound irrigation and drainage, as well as symptomatic treatment. Our patient was started on intravenous carbapenems, 1 g every 24 hours for 6 weeks, and 500 mg of Flagyl (metronidazole). Following 46 days of treatment, the patient was deemed to be cured. The patient was discharged from the hospital and prescribed oral antibiotics for a duration of 6 weeks (Amoxicillin/clavulanate potassium 875 mg twice daily). There were no reports of pain or discomfort in the lumbar region or left hip. Subsequent follow-up examinations, including the most recent one on December 12th of this year, did not reveal any abnormalities.

Discussion

Fusobacterium nucleatum is a multifaceted bacterium that engages in diverse interactions with other microorganisms and humans, ranging from beneficial to detrimental in nature [7]. As our understanding of diseases linked to members of the microbiota grows, there is an increasing inclination to swiftly transition to clinical applications. However, before exploring the potential of *Fusobacterium nucleatum*-targeted treatments, it is crucial to deepen our understanding of the fundamental biology of *Fusobacterium nucleatum* in its natural environment and other, potentially disease-associated, locations. This includes investigating its influence on host cells and other microorganisms with which it interacts closely. Addressing the challenge of defining causation by *Fusobacterium nucleatum* in vertebral osteomyelitis and discitis, two diseases associated with this bacterium, is also paramount.

The clinical manifestations of spinal infection are insidious and include severe back pain, signs of spinal cord compression, tenderness, discomfort, muscle spasms, and neurological deficits [8,9]. Fever is

Table 1
Next generation sequencing (NGS) results.

Overview of pathogenic microorganism detection results		
Targeted sequencing results:	Mycobacteria:	No suspected pathogen was detected
	Bacterial:	No suspected pathogen was detected
	Fungus:	No suspected pathogen was detected
	DNA virus:	No suspected pathogen was detected
Metagenomic sequencing results:	Atypical pathogen:	No suspected pathogen was detected
	Mycobacteria:	No suspected pathogen was detected
	Bacterial:	<i>Fusobacterium nucleatum</i> (14640)
	Fungus:	No suspected pathogen was detected
	DNA virus:	No suspected pathogen was detected
	Atypical pathogen:	No suspected pathogen was detected
	Parasite:	No suspected pathogen was detected

present in 40 % of cases, and imaging manifestations include disc space narrowing, endplate erosion, and vertebral irregularities [10]. Magnetic resonance imaging manifestations included signal enhancement of the disc space and vertebral endplate involvement, and CT showed bone destruction. Notably, the patient exhibited no fever symptoms during the clinical course. *Fusobacterium nucleatum* is a specialized anaerobe, the common pus cultures are usually performed under aerobic or partially anaerobic conditions. However, these conditions may not be conducive to *Fusobacterium nucleatum* growth and multiplication. Consequently, this may be the primary reason why the patient's blood and pus cultures are negative. Spinal osteomyelitis caused by *Fusobacterium nucleatum* is a rare condition, its insidious onset and poor sensitivity to blood cultures, coupled with its vague clinical manifestations, complicate diagnosis significantly. The standard treatment protocol for this condition involves the administration of antibiotics for a duration of 6–12 weeks. The aspirate was subjected to Next-Generation Sequencing (NGS) testing, which led to the identification of *Fusobacterium nucleatum*. Consequently, the patient was treated with carbapenems and metronidazole, which are commonly prescribed antibiotics effective against



Fig. 1. Lumbar MRI showed abnormal signals in L3-L4 vertebrae, swelling, and abscess formation in the surrounding soft tissues and bilateral psoas major muscles, with compression of the dural sac and cauda equina at the L3/4 level(A). Hip joint MRI showed swelling of the left psoas major muscle, abscess formation around L4, L5 vertebrae, and the left hip joint; further clinical examination was recommended(B).CT scan of the hip joint demonstrated swelling with uneven density in both piriformis muscles as well as in the left iliopsoas muscle, raising suspicion for infection(C).



Fig. 2. The pus was sucked out during the operation(A and B).

Fusobacterium nucleatum. The choice was based on the NGS results. The patient's NGS results indicated a single infection with *Clostridium nucleatum*, excluding any additional bacterial pathogens. The rationale behind the utilisation of carbapenem antibiotics can be summarised as follows: 1, Carbapenem antibiotics are effective in the treatment of complicated infections, including severe infections, particularly in immunocompromised patients with a significant role. The patient exhibited a protracted infection, reduced immunity, and a severe condition, which can be categorised as a serious infection. In conjunction with the assessment of our hospital pharmacist and infectious disease specialist, carbapenem antibiotics were recommended in conjunction with anti-infective treatment. 2, In comparison to ampicillin/sulbactam, carbapenem antibiotics exhibit reduced susceptibility to bacterial resistance. This is due to their potent inhibition of bacterial cell wall synthesis, which hinders bacteria's ability to combat them. 3, The patient is economically disadvantaged, and the carbapenem antibiotics currently utilised in our hospital are part of a centrally procured class of medications that are considerably more economical than ampicillin/sulbactam antibiotics.

It is noteworthy that the patient exhibited a substantial number of abscesses in the left iliac fossa, which necessitated surgical intervention.

However, it is important to note that NGS is not without its limitations in clinical applications. Firstly, sample limitation: sample contamination or background noise has the potential to affect the accuracy of the test; RNA samples are unstable and prone to degradation. Secondly, technical challenge: reliance on high quality reference databases may prevent the detection of emerging pathogens. Thirdly, cost and time: the cost of the test is relatively high, especially for single-sample sequencing. Finally, there is a lack of standardisation and quality control, which can result in large inter-laboratory variations in results.

Conclusion

Spinal osteomyelitis, an infection of the bone marrow, caused by *Fusobacterium nucleatum*, is a rare condition with few reported cases. This is due to its insidious onset, coupled with its low sensitivity to blood cultures, and its vague clinical manifestations, which complicate diagnosis significantly. The application of next-generation sequencing (NGS) to detect *Fusobacterium nucleatum* in this case provided critical insights, facilitating subsequent management strategies. It is recommended that patients presenting with unexplained infections undergo NGS

diagnostics to enhance diagnostic accuracy.

Ethical approval

This study was approved by the Ethics Committee of the Second Affiliated Hospital of Hainan Medical University

Consent

The patient's son provided written consent for the publication of this clinical picture.

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Author Statement

All authors have contributed significantly to the study, manuscript preparation, and revision. Below is a summary of the contributions of each author:

YunTao Gu and YuanZhou drafted the original manuscript. Tian-Qiong Hu and Hai Zhao are in charge of landscaping pictures. YongPing Wang and YongXiong He undertake manuscript revisions and language modifications. All authors contributed to the clinical management of the patient, reviewed the manuscript, and approved the final version of the manuscript. The patient's son provided written consent for the publication of this clinical picture.

All authors have read and approved the final manuscript and agree to its submission to IDCases. The authors declare no conflict of interest related to the content of this manuscript.

Author contribution

YunTao Gu and YuanZhou drafted the original manuscript. Tian-Qiong Hu and Hai Zhao are in charge of landscaping pictures. YongPing Wang and YongXiong He undertake manuscript revisions and language modifications. All authors contributed to the clinical management of the patient, reviewed the manuscript, and approved the final version of the manuscript.

CRediT authorship contribution statement

YunTao Gu: Writing – original draft. **YongXiong He:** Writing – review & editing. **Yuan Zhou:** Writing – original draft. **TianQiong Hu:** Visualization. **Hai Zhao:** Visualization. **YongPing Wang:** Writing – review & editing.

Declaration of Competing Interest

We declare no competing interests.

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