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Name of Journal: *World Journal of Clinical Cases*

Manuscript NO: 82644

Manuscript Type: CASE REPORT

Prevotella oris caused meningitis and spinal canal infection: A case report and literature review

Zhang *et al.* Prevotella oris caused CNS infection

Wei-Wei Zhang, Chao Ai, Chien-Tai Mao, Dong-Kang Liu, Yi Guo

Abstract

BACKGROUND

Prevotella oris-induced meningitis and *Prevotella oris*-induced meningitis concomitant with spinal canal infection are extremely rare. To the best of our knowledge, only one case has been reported as *Prevotella oris*-induced central system infection and this is the second report on meningitis combined with spinal canal infection due to *Prevotella oris*.

CASE SUMMARY

We report a case of a 9-year-old boy suffering from meningitis and spinal canal infection. The patient presented to the neurosurgery department with lumbosacral pain for 1 mo followed by headache and vomiting for 1 day. He had been treated with cephalosporin and non-steroidal antiinflammatory drugs for fever, otalgia and pharyngalgia in a local hospital 2 mo prior to this admission. During hospitalization, magnetic resonance imaging (MRI) suggested meningitis and L3-S1 Lumbosacral dural sac infection. The CSF and blood cultures were negative but the CSF specimen indicated the presence of *Prevotella oris* by metagenomic next-generation sequencing (mNGS). Previous cases of *Prevotella oris* infection were retrieved from PubMed to characterize the clinicopathological features and identify the prognostic factors and related antimicrobial treatment of infection due to *Prevotella oris*.

CONCLUSION

This report sheds light on the characteristics of *Prevotella oris* infection and highlights the role of mNGS in pathogen detection.

Key Words: *Prevotella oris*; Meningitis; Spinal canal infection; Metagenomic next-generation sequencing; Central nervous system infection; Case report

Zhang WW, Ai C, Mao CT, Liu DK, Guo Y. *Prevotella oris* caused meningitis and spinal canal infection: A case report and literature review. *World J Clin Cases* 2023; In press

Core Tip: *Prevotella oris* is an anaerobic, gram-negative, nonpigmented bacterium that rarely results in central nervous system infection. To date, only one case has been reported of *Prevotella oris* causing central nervous system infection. We report a patient who suffered from meningitis and spinal canal infection due to *Prevotella oris*. Using the metagenomic next-generation sequencing (mNGS) method, the pathogen was identified in time, although the CSF and blood cultures were negative. Early detection of pathogens is crucial for patient survival and prognosis. Although it is uncommon, clinicians should consider the possibility of *Prevotella oris*-induced meningitis and spinal canal infection, in which circumstance mNGS may be an efficient technique in detecting pathogens. Through a literature review, we analyzed the characteristics of *Prevotella oris*-induced infection and found that all patients were male, some of whom were initially diagnosed with a tuberculous infection; the most commonly used antimicrobial agent was metronidazole. This information may provide references for future studies.

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INTRODUCTION

Bacterial meningitis and spinal canal infection are not common but can be deadly and may result in permanent disabilities such as cognitive impairment and learning disabilities, which pose a threat to public health^[1,2]. The leading pathogens of bacterial

meningitis and spinal canal infection are mainly *S. pneumoniae* and *N. meningitidis*^[3]. *Prevotella oris* is rarely found in meningitis and spinal canal infections. There was only one documented case of cervical spinal epidural abscess and meningitis caused by *Prevotella oris* and *Peptostreptococcus micros*^[4]. More references are warranted to understand the characteristics of *Prevotella oris*-induced central nervous system infection. We present a case of a 9-year-old male with *Prevotella oris*-induced meningitis and spinal canal infection whose symptoms were relieved significantly after targeted antimicrobial therapy.

CASE PRESENTATION

Chief complaints

A 9-year-old Chinese boy presented to the neurosurgery clinic with a complaint of headache and vomiting for 1 day.

History of present illness

The patient had lumbosacral pain for 1 mo prior to this presentation.

History of past illness

Three months prior to admission, the patient presented with fever, otalgia and pharyngalgia and was admitted to a local hospital with a diagnosis of otitis media. He was treated with cephalosporin and non-steroidal antiinflammatory drugs (the specific agents and dosages are unknown) and the symptoms were alleviated temporarily. One month later, he had a fever again and bilateral muscle pain in the thighs. The pain spread to the whole lumbosacral region and he began to vomit and experienced a progressive headache.

Personal and family history

The patient's personal and family history was not significant.

Physical examination

Physical examination showed that his body temperature was 38 °C, pulse rate was 110 beats per min, respiratory rate was 19 breaths per min and blood pressure was 120/62 mmHg. His consciousness was clear but exhibited despondency. Neurological examinations revealed that his meningeal irritation sign was negative and other functions were normal.

Laboratory examinations

A routine blood examination revealed 12,990 Leukocytes/ μ L (79% neutrophils) and procalcitonin (PCT) was 0.099 ng/mL. The CSF was colorless and clear and the leukocyte count was 985 cells/ μ L with 89% polymorphonuclear leukocytes. The CSF glucose was 2.33 mmol/L, the CSF chloride was 114 mmol/L and the total protein was 962 mg/L. The CSF and blood cultures were negative.

Imaging examinations

Brain magnetic resonance imaging (MRI) revealed hydrocephalus and there were multiple intracranial meningeal thickening and mastoiditis on the left side (Figure 1). In addition, spinal MRI showed that the dura in the thoracolumbosacral spinal canal (mainly in the lumbar segment) was unevenly thickened and there were scattered small nodular hypointense foci in the spinal canal at the level of the L3~S1 vertebral body, with the largest being approximately 5 mm (Figure 2).

FURTHER DIAGNOSTIC WORK-UP

To investigate the pathogenic microorganisms, a CSF specimen was tested using mNGS and the results showed the presence of *Prevotella oris* with a sequence number of 630 copies and a relative abundance of 1.81%.

FINAL DIAGNOSIS

The patient was diagnosed with meningitis and L3-S1 Lumbosacral dural sac infection.

TREATMENT

Initially, the patient was empirically treated with intravenous vancomycin (40 mg/kg/d in two divided doses) and meropenem (40 mg/kg every 8 h). He also underwent a puncture and external drainage of the right ventricle and was given intracranial pressure-decreasing agents and systemic nutritional support. His symptoms were not improved. After the mNGS results indicated the presence of *Prevotella oris*, antibiotic therapy was changed to intravenous metronidazole (15 mg/kg every 6 h) and meropenem (40 mg/kg every 8 h) for 2 wk, followed by meropenem (40 mg/kg every 8 h) for another 2 mo due to intolerance of metronidazole-induced gastrointestinal reaction.

OUTCOME AND FOLLOW-UP

The patient's temperature returned to normal and his symptoms improved significantly with targeted antimicrobial therapy. After one month of treatment, the routine blood examination showed that the leukocyte count and the percentage of neutrophil granulocytes returned to normal. The leukocyte count of CSF was 66 cells/ μ L with 33% polymorphonuclear leukocytes. The CSF glucose was 3.11 mmol/L, the CSF chloride was 117 mmol/L and the total protein was 560 mg/L. Brain and spinal MRI showed that the thickening of the intracranial and lumbosacral dura mater was greatly resolved. The ventricular drainage catheter was pulled out. The patient was continuously treated for another month and followed up for 2 mo without recurrence.

DISCUSSION

Central nervous system (CNS) infections are potentially devastating and disabling infectious diseases worldwide, including meningitis, encephalitis, spinal and cranial abscesses, discitis and other complications. It is estimated that the global incidence of CNS infections was 389/100,000 between 1990 and 2016^[5]. Although CNS infections are not common in developed countries, they remain a public health problem in developing

countries^[5, 6]. Bacterial infections are one type of CNS infections and can be frequently caused by *H. influenzae*, *S. pneumoniae*, *N. meningitidis*, GBS and *Listeria monocytogenes* in children^[7]. *Prevotella oris*, a nonpigmented, anaerobic, gram-negative, rod-shaped bacterium, is a periodontopathogen and frequently detected in periodontal diseases^[8]. We retrieved and reviewed previous cases of *Prevotella oris* causing extraoral infection from the PubMed database (Table 1). *Prevotella oris* was reported as a pathogen in pleural infection, bacteremia, hepatic abscess, pericarditis, mediastinitis, sepsis and empyema. Only one case was reported as cervical spinal epidural abscess and meningitis due to *Prevotella oris* and *Peptostreptococcus micros* after retropharyngeal surgery in 2004^[4]. Upon review, we found that all reported cases were male and two of the seven cases were initially diagnosed as a tuberculosis infection, which indicated that the symptoms of *Prevotella oris*-induced infection may not be specific and may be similar to tuberculosis infection. For this case, the boy did not show significant meningitis or spinal infection symptoms. His meningeal irritation sign was negative and the glucose level of CSF was in the normal range. Both his blood and CSF cultures were negative. All these factors make pathogen identification more difficult.

To investigate the pathogen, we used mNGS, a promising and clinically validated test for CNS infections^[9]. Traditional blood and CSF bacterial cultures are essential laboratory tests in meningitis and spinal canal infection. It rarely detects pathogens effectively and in a timely manner under certain circumstances, such as infections caused by oral flora^[10]. Compared to traditional methods, mNGS can improve the detection of pathogens to aid clinicians with a timely diagnosis. Some researchers have validated the effects of mNGS in CNS infections^[11, 12]. It can also provide guidance for clinicians in choosing appropriate antimicrobial regimens. To date, antimicrobial treatment recommendations have been lacking for *Prevotella oris*-induced nervous system infection. By reviewing previous case reports, we found that the most commonly used antibiotic for treating *Prevotella oris*-induced infection was metronidazole, while other antibiotics included piperacillin-tazobactam, ampicillin/sulbactam, levaquin, ertapenem, ciprofloxacin and ceftriaxone. For the

documented *Prevotella oris*- and *Peptostreptococcus micros*-induced cervical spinal epidural abscess and meningitis cases, fosfomycin, ceftriaxone and metronidazole were used for targeted therapy (Table 1). According to the European Committee of Antimicrobial Susceptibility Testing (EUCAST) guidelines, *Prevotella oris* was susceptible to metronidazole, imipenem, chloramphenicol and ceftiofur discs^[13]. For this patient, we used metronidazole and meropenem to treat his infection after we found that the effect of empirical antimicrobial therapy was unsatisfactory. His infection was controlled in a timely and effective manner.

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CONCLUSION

¹To the best of our knowledge, this is the second report on meningitis combined with spinal canal infection due to *Prevotella oris*. Despite rareness, *Prevotella oris* may cause meningitis and spinal canal infection. The symptoms of this kind of infection may not be typical and conventional culture tests have difficulty detecting pathogens. mNGS is a promising technique to identify pathogens under such circumstances. ¹Clinicians should be aware of this possibility and treat it with rapid imaging, neurosurgical intervention and targeted antibiotics.

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