

Purulent meningitis caused by *Rhodococcus equi*

A case report

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Abstract

Rationale: Purulent meningitis refers infection of the subarachnoid space by various purulent bacteria and the corresponding inflammation of the leptomeninges. However, purulent meningitis due to *Rhodococcus equi* is extremely rare.

Patient concerns: A 40-year-old man presented with fever and intermittent headache for 6 days. Two hours prior to admission, he developed epileptic seizures.

Diagnoses: Brain computed tomography and magnetic resonance imaging showed intracerebral malacic lesions. Bacterial culture of cerebrospinal fluid revealed the presence of *R. equi*. A diagnosis of purulent meningitis caused by *R. equi* was made.

Interventions: The patient was treated with intravenous meropenem (1000 mg every 8 hours) for 19 days; then he was discharged and instructed to continue the intravenous meropenem for two weeks. After a follow-up period of 2 months, the patient had recovered completely.

Outcomes: After a follow-up period of 2 months, the patient had recovered completely.

Lessons: Central nervous system infection caused by *R. equi* is rare. Early bacterial culture of CSF is important for timely diagnosis. With sufficient antibiotic therapy, the prognosis can be favorable.

Abbreviations: CSF = cerebrospinal fluid, CT = computed tomography, MRI = magnetic resonance imaging.

Keywords: antibiotic therapy, case report, purulent meningitis, *Rhodococcus equi*

1. Introduction

Purulent meningitis refers to inflammation of leptomeninges occurring along with infection of the subarachnoid space by various purulent bacteria. Clinically, purulent meningitis usually manifests as fever, vomiting, headache, and meningeal irritation.^[1] The most common pathogens are *Pneumococcus*, *Hemophilus influenzae*, and *Staphylococcus*.^[2] However, purulent meningitis due to *Rhodococcus equi* is extremely rare.^[3] *R. equi*, also known as *Corynebacterium equi*, is an opportunistic pathogen that frequently infects horses, pigs, and cattle. Recently, there has been an increase in relevant reports of *R. equi* infection, and the majority involve septicemic children and patients with immunodeficiency.^[4] The clinical characteristics, treatment, and prognosis of intracranial infection due to *R. equi* remain unclear.

Herein, we report a case of purulent meningitis caused by *R. equi* regarding a immunocompetent patient.

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L-xC and L-nG equally contributed to this work.

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2. Case report

2.1. History

A 40-year-old man presented to us with fever and intermittent headache for 6 days. The highest temperature reached was 38.7°C, and there was no nausea or vomiting. In a local clinic, clindamycin was prescribed but only provided mild benefit. The patient also complained of rhinorrhea. Two hours before admission, he developed epileptic seizures manifesting as loss of consciousness, limb stiffness, odaxasmus, and uroclipsia for approximately 10 minutes. Twenty years before, he had experienced craniocerebral trauma and was diagnosed with cerebrospinal fluid (CSF) rhinorrhea, which was untreated.

A written informed consent form was signed by the patients before blood sampling and CSF sampling, and the study was approved by the local ethics committee of Jilin University, Changchun, China. And the patient has provided informed consent for publication of the case.

2.2. Physical examination

On admission, physical examination showed a fever (38.3°C), increased heart rate (107 beats/min), and decreased consciousness. His blood pressure was normal (130/70 mm Hg). The pupil and cranial nerve examinations showed no abnormality. The sensorimotor functions were normal in all extremities. Neck rigidity and a positive Kernig sign were noted. Other pathological reflexes were all negative.

2.3. Radiological and laboratory examinations

Head computed tomography (CT), brain magnetic resonance imaging (MRI), and thoracic CT findings were normal. Laboratory examination showed normal results on routine

blood tests and renal function indexes. The transaminase level was elevated. Antibodies for *Treponema pallidum* and human immunodeficiency virus were both negative. Bacterial culture of CSF revealed *R. equi* (Fig. 1), and the results of routine CSF tests are summarized in Table 1. A diagnosis of purulent meningitis caused by *R. equi* was made.

2.4. Treatment and outcome

Considering the hepatic dysfunction in this case, quinolones, macrolides, and rifampicin were not used. The patient was treated with intravenous meropenem (1000 mg every 8 hours) for 19 days. Repeated CSF examination showed significant improvement (Table 1). On the fifth day after admission, the patient's temperature returned to normal, and there was no return of seizure activity. On the eighth day after admission, his consciousness was significantly improved. On the 19th day, the patient was discharged and instructed to continue the intravenous meropenem for 2 weeks. Two weeks after discharge, repeated examination of CSF was normal. After a follow-up period of 2 months, the patient had recovered completely.

3. Discussion

3.1. Etiology

R. equi is a facultative, nonmotile, nonspore-forming, gram-positive coccobacillus, which was originally named *C. equi* by

Magnusson in 1923.^[5] However, subsequent research discovered that *R. equi* and *Corynebacterium* have different structures on the cell wall, and this bacterium is currently grouped with the aerobic actinomycetes. It is named *Rhodococcus* because of its ability to form a red pigment. *R. equi* exhibits slow growth characterized by a polymorphous growth pattern.

R. equi is commonly found in natural soil, and primarily causes zoonotic infections in grazing animals, such as foals, pigs, and goats.^[4] This organism rarely infects immunocompetent humans; however, with the increasing incidence of HIV, *R. equi* has become an important pathogen in immunocompromised individuals.^[5]

3.2. Clinical manifestations

The most common pathological changes of *R. equi* infection are chronic suppurative bronchopneumonia and extensive pulmonary abscess. Patients usually present with fever, cough, dyspnea, and chest pain. The *R. equi* infection is usually occult in onset and may manifest as septicemia, pneumonia, tonsillitis, meningitis, and endocarditis. The fever is characterized by a moderate-to-high temperature (38°C–39°C) with an irregular pattern and may be accompanied by chills, fatigue, headache, and muscular pain.

Central nervous system involvement of *R. equi* infection is exceedingly rare. The clinical presentations are nonspecific, including fever, headache, vomiting, and meningeal irritation signs. Severe cases may develop unconsciousness, seizures, and

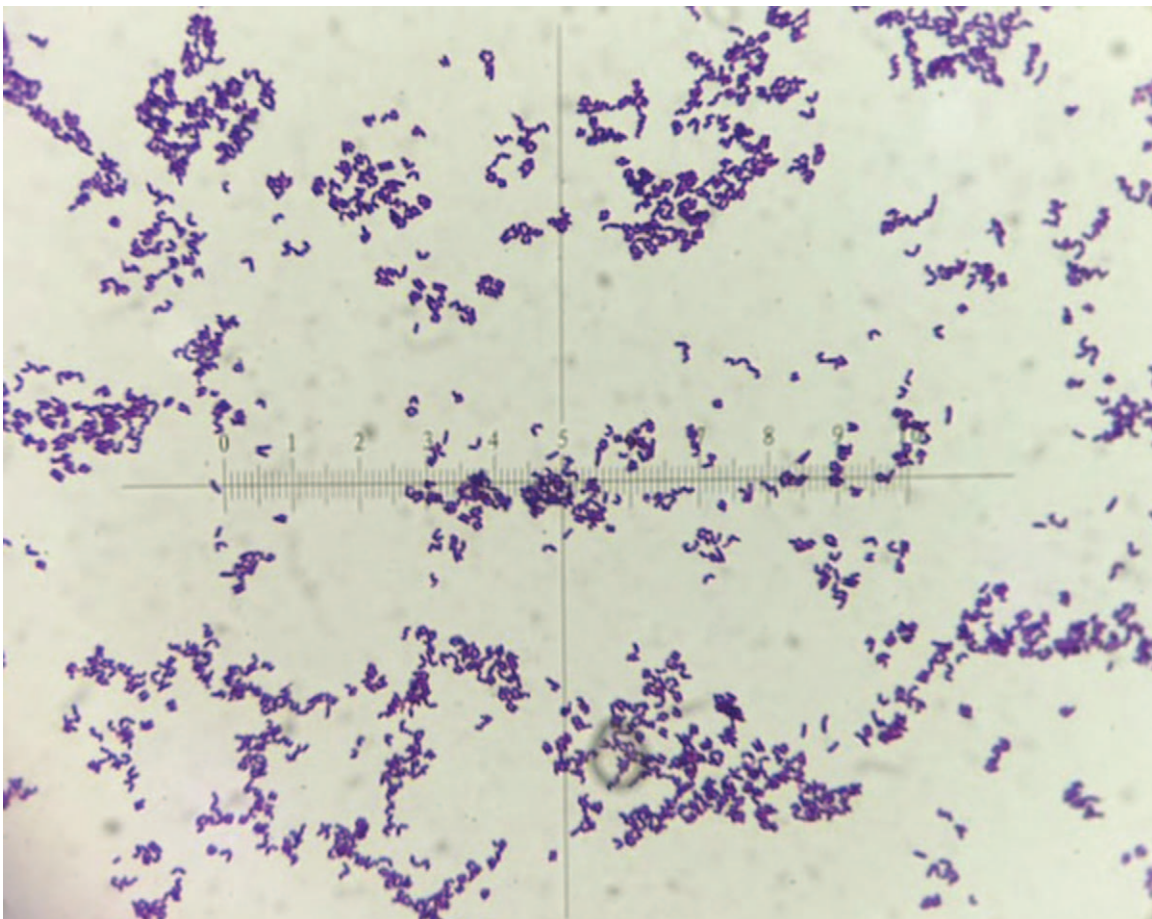


Figure 1. Bacterial culture of cerebrospinal fluid. Microscopically, bacterial culture of cerebrospinal fluid showed *Rhodococcus equi* (100×).

Table 1**Results of cerebrospinal fluid examinations.**

Parameter	Intracranial pressure (mmH ₂ O)	Leukocyte count ($\times 10^6/L$)	Neutrophil percentage (%)	Lymphocyte percentage (%)	Monocyte percentage (%)	Protein (mg/L)	Glucose (mmol/L)	Chloride (mmol/L)
On admission	220	4640	80	16	4	5454	2.59	119.9
One week after admission	160	90	2	91	7	1296.8	2.51	117.1
Two weeks after admission	160	20	0	94	6	1092.1	2.0	119

mg/L = milligram per liter, mmH₂O = millimeter of water, mmol/L = millimoles per liter.

Cerebrospinal fluid examinations normal values: intracranial pressure (mmH₂O): 80 to 180; leukocyte count ($\times 10^6/L$): 0; neutrophil percentage (%): 0; lymphocyte percentage (%): 0; monocyte percentage (%): 0; protein (mg/L): 200 to 400; glucose (mmol/L): 2.5 to 4.5; chloride (mmol/L): 119 to 129.

Table 2**CSF characteristics during *Rhodococcus equi*-induced purulent meningitis compared with previously reported values^[6].**

Parameter	Intracranial pressure (mmH ₂ O)	Leukocyte count ($\times 10^6/L$)	Neutrophil percentage (%)	Monocyte percentage (%)	Protein (mg/L)	Glucose (mmol/L)	Chloride (mmol/L)
Present case	220	4640	90	10	5454	2.0	119.9
Previous case	Not reported	1170	98	2	1860	2.11	Not reported

CSF = cerebrospinal fluid, mg/L = milligram per liter, mmH₂O = millimeter of water, mmol/L = millimoles per liter.

neurological deficits due to cerebral parenchyma involvement. Lee et al reported a case of central nervous system infection with *R. equi*, which presented with encephalopathy involving the hemispheres, cerebellum, mesencephalon, and brainstem.^[6] In the current case, the patient had a previous history of craniocerebral trauma and had been diagnosed with CSF rhinorrhea. One week before admission, he experienced rhinorrhea again with fever and pharyngalgia. We considered the purulent meningitis to be caused by retrograde infection of *R. equi* via the CSF rhinorrhea. Routine CSF test results for *R. equi*-induced purulent meningitis are nonspecific as well: elevated leukocyte count, increased protein level, and reduced glucose level.

The characteristics of *R. equi*-induced purulent meningitis are summarized in Table 2. The changes in CSF during *R. equi*-induced purulent meningitis were nonspecific as previously reported,^[6] manifesting as elevated leukocyte counts ($>500 \times 10^6$ – $1000 \times 10^6/L$) with a significantly increased neutrophil percentage, elevated protein level (>1000 mg/L), and reduced glucose level (<2.5 mmol/L).

3.3. Diagnosis and treatment

Bacterial culture of CSF is the gold standard for diagnosis of *R. equi*-induced purulent meningitis. Notably, some scholars proposed that a bacterial culture of 18 to 24 hours may provide a false-negative as *R. equi* grows slowly.^[5] Thus, we recommend repeated examinations with a much longer culture time. In the present study, we cultured the bacteria for 68 hours, and *R. equi* was clearly identified microscopically.

Antibiotic therapy is the first choice of treatment for *R. equi*-induced purulent meningitis. However, due to the rarity of this infection, the most effective regimen has yet to be determined. Antibiotics to which *R. equi* is sensitive include ciprofloxacin, levofloxacin, erythromycin, meropenem, linezolid, vancomycin, and rifampicin; combined use of multiple antibiotics may lead to synergistic effects. Lee et al reported a case of recurrent meningitis and encephalopathy that was successfully treated with a 90-day

regimen of intrathecal vancomycin and amikacin in conjunction with intravenous and oral antibiotics.^[6]

4. Conclusions

Central nervous system infection by *R. equi* is extremely rare. Bacterial culture of CSF should be highlighted for early diagnosis. With effective antibiotic therapy, the prognosis can be favorable.

Author contributions

Conceptualization: Jingyao Liu.

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Methodology: Lexiang Cui.

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Resources: Lexiang Cui, Lina Gu.

Supervision: Lexiang Cui.

Writing – original draft: Lexiang Cui.

Writing – review and editing: Jingyao Liu.

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