# Acute Encephalopathy in a Patient with Raoultella Ornithinolytica Infection: A Challenging Presentation

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## ABSTRACT

Raoultella ornithinolytica is a rare, gram-negative environmental enterobacterium. Although infections in humans caused by R. ornithinolytica are uncommon, there are increasing reports implicating it in urinary tract infections, hepatobiliary infections, and bacteremia, designating it as an emerging pathogen. Its habitat is primarily in aquatic environments and soil, with seafood frequently identified as a potential source of infection. While these infections have predominantly been described in immunocompromised patients previously, our case suggests that advanced age may be a significant risk factor. We describe a case of a 73-year-old man presenting with encephalopathy who then was found to have R. ornithinolytica bacteremia from a genitourinary source. Following antibiotic treatment, the infection resolved and the neurologic symptoms improved. To the best of our knowledge, this is the first documented case in the medical literature of R. ornithinolytica featuring a primary neurologic presentation.


**KEYWORDS:** Raoultella ornithinolytica, encephalopathy, altered mental status, bacteremia, UTI

## INTRODUCTION

Raoultella ornithinolytica is a gram-negative, encapsulated, facultative anaerobic bacterium. It belongs to the family Enterobacteriaceae, sharing this classification with E. coli and Klebsiella pneumoniae. R. ornithinolytica was previously categorized in the genus Klebsiella until the year 2001. It is unique in its ability to convert histidine to histamine,[1] a characteristic linked to its association with histamine fish poisoning.[2] Its pathogenicity is attributed to several factors, including its ability to form biofilms, polysaccharide capsules, siderophores, and fimbriae.[3] Typically, it is found in plants, water, and soil, but can also be found in insects such as bees, termites, and ticks, as well as in chickens and fish. In humans, it is known to colonize the pharynx and gastrointestinal tract.[2] In the few reported clinical cases it has been identified as a causative agent in opportunistic infections, particularly affecting immunocompromised patients. These infections affected multiple systems, including the hepatobiliary, respiratory, gastrointestinal, and genitourinary systems, but have not been associated with neurological symptoms or encephalopathy to date.[4] Infectious disease-associated encephalopathy is defined as diffuse brain dysfunction caused by an infection. The clinical picture comprises neurological or psychiatric abnormalities, ranging from subclinical alterations to coma.[5] In this context, we describe a case of a 73-year-old man with encephalopathy due to R. ornithinolytica bacteremia from a genitourinary source who presented with stroke-like symptoms.

## CASE REPORT

A 73-year-old male, with a past medical history including myasthenia gravis, retinitis pigmentosa, and hyperlipidemia, presented to the emergency department with acute onset of peripheral vision loss, confusion, and speech disturbance in the setting of dizziness, nausea, and diarrhea. His regular medication regimen included pyridostigmine and simvastatin. According to the patient's family, the patient had no pre-existing cognitive deficits, and the onset of confusion and gait instability occurred suddenly one-and-a-half days prior to the emergency department visit. Residing in a coastal town, the patient had consumed seafood the day before the onset of symptoms. He was initially seen at a community hospital, where computed tomography angiography (CTA) of the brain and neck revealed stenosis of the distal left vertebral artery. Given this finding and his presentation of dizziness and ataxia, he was transferred to a comprehensive stroke center with concern for a posterior circulation ischemic stroke.

On initial examination at the stroke center, the patient exhibited difficulty naming objects, and was oriented only to person. Additionally, he reported feeling nauseous. Bilateral upper extremity ataxia was evident, but no dysarthria was observed. He showed no nystagmus, motor weakness or sensation loss. His vital signs were remarkable for a fever to 38.1°C. Despite the previously identified stenosis in CTA, subsequent brain magnetic resonance imaging (MRI) revealed no evidence of ischemia or perfusion delays, and it was concluded that the stenosis was unrelated to the patient's current presentation. He therefore underwent further infectious workup including CT-abdomen, which showed no evidence of acute infection. A lumbar puncture was performed, and

cerebrospinal fluid (CSF) analysis showed normal glucose levels, no elevated leukocytes, and no bacterial growth. A transthoracic echocardiogram was negative for endocarditis. Laboratory evaluation was notable for a leukocytosis with leukocytes of 14.1 x$10^9$/L, elevated C-reactive Protein of 183 mg/L, and thrombocytopenia with platelets of 149 x$10^9$/L. Urinalysis revealed leukocytes at 14 cells/microL and hematuria, with a negative result for nitrite. Blood cultures were obtained and eventually grew out R. ornithinolytica. A urine culture was also positive for the same pathogen. Electroencephalography (EEG) performed later in the clinical course displayed diffuse continuous theta slowing with generalized cerebral dysfunction. A follow-up MRI scan two weeks later still showed no signs of infarction. Empiric antibiotic therapy with cefepime, vancomycin, and doxycycline was started after obtaining blood and urine cultures. The choice of antibiotics was limited by the patient's penicillin allergy and myasthenia gravis, in which macrolides and fluoroquinolones are contraindicated. After two days, antimicrobial therapy was narrowed to ceftriaxone, and after eight days the patient was transitioned to oral cefpodoxime for a total course of 14 days. Fever and leukocytosis resolved on hospital day two. A blood culture after three days showed no growth. The patient's symptoms progressively improved, eventually returning to his neurologic baseline.

## DISCUSSION

We report a case of a 73-year-old man who presented with encephalopathy exhibiting stroke-like symptoms and was found to have a urinary tract infection and bacteremia caused by R. ornithinolytica. The incidence of infections with R. ornithinolytica is low with only few reported cases and therefore it is considered a rare pathogen.[6] For example, in a hospital in South Korea, it was found in 0.15 % of all bacteremia cases.[7] Since the first description there have been reported a total of 68 case reports of R. ornithinolytica infections on PubMed. While the low number of reports of R. ornithinolytica infections is on the rise, it remains unclear whether this is due to environmental factors leading to increased prevalence, or whether it is simply being diagnosed more now that the tools are available to differentiate it from other Raoultella and Klebsiella genera.[8] Initially, case reports only identified infections in immunocompromised patients. More recent reports also describe healthy patients being affected.[3] In this case, the patient's only risk factor was his advanced age. With a mortality rate ranging from 34-44%, rapid identification and treatment of R. ornithinolytica bacteremia are imperative.[6]

The patient resided along the coast and frequently prepared raw seafood. The patient and his family do not recall a specific exposure; however, accidental ingestion or environmental exposure are possible sources of infection.[9] The susceptibility pattern in our case, as shown in **Table 1**, demonstrated resistance only to ampicillin, which is consistent with previous reports. The bacterium carries the Bla-ORN-1 gene to produce a group A beta-lactamase, rendering it intrinsically resistant to penicillins.[10]

**Table 1.** Antibiogram showing the antibiotic susceptibility of the R. ornithinolytica strain isolated.

| Antibiotic drug | Susceptibility |
|---|---|
| Amoxicillin/CA (≤ 2 mcg/ml) | S |
| Aztreonam (≤ 1 mcg/ml) | S |
| Cefepime (≤ 1 mcg/ml) | S |
| Ceftriaxone (≤ 1 mcg/ml) | S |
| Ciprofloxacin (≤ 0.25 mcg/ml) | S |
| Ertapenem (≤ 0.5 mcg/ml) | S |
| Gentamicin (≤ 1 mcg/ml) | S |
| Levofloxacin (≤ 0.12 mcg/ml) | S |
| Meropenem (≤ 0.25 mcg/ml) | S |
| Piperacillin/tazobactam (≤ 4 mcg/ml) | S |
| Tetracyclines (≤ 1 mcg/ml) | S |
| Trimethropim/Sulfa (≤ 20 mcg/ml) | S |
| Ampicillin (≤ 4 mcg/ml) | R |

S: Susceptible; R: Resistant.

To our knowledge, we describe the first case of R. ornithinolytica bacteremia with a primary neurologic manifestation. While infections may trigger acute ischemic stroke through inflammatory pathways,[11,12] other conditions can mimic stroke and account for 30–43% of all patients evaluated for stroke in the emergency department.[13] Symptoms that mimic posterior circulation cerebrovascular events pose a higher risk of misdiagnosis due to their vague presentations, with symptoms including visual disruptions, dizziness, vertigo, and ataxia.[14] The most common underlying conditions of stroke mimics are seizures, conversion disorder, migraine, and hypoglycemia, with infection being less common.[15] MRI is recommended and often necessary to distinguish between stroke and its mimics.[16]

Given his concurrent gastrointestinal and neurologic symptoms, unremarkable CSF examination and imaging, and deceleration on EEG, our patient's presentation is most consistent with encephalopathy secondary to infection. This condition stems from microcirculatory abnormalities and altered brain metabolism.[17] While encephalopathy in the setting of infection is common, there is no previous report of R. ornithinolytica-induced encephalopathy. Given its close relation to the Klebsiella genus, it is possible that some previously reported cases were misdiagnosed as Klebsiella, when in fact the diagnostic tools did not yet exist to distinguish Klebsiella from R. ornithinolytica.

## CONCLUSION

We report a patient with R. ornithinolytica infection who presented with initial symptoms consistent with encephalopathy. In an acute presentation like in this case, brain MRI is useful for differentiating it from ischemic stroke, and the neurologic symptoms can effectively be treated with antibiotic therapy. Further studies are needed to elucidate the epidemiology and clinical picture of this bacterial infection.

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### Acknowledgments


The authors thank the family of the patient for consenting to this publication.


### Disclosures


No author has any financial or proprietary conflict of interest.

No financial support was received for this publication.


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