EJCRIM
European Journal
of Case Reports
in Internal Medicine

BRAIN ABSCESSES CAUSED BY *TSUKAMURELLA PULMONIS*: A RARE PRESENTATION OF AN UNUSUAL MICROORGANISM

Eva Soria Alcaide, Carlos Lorente Larrañeta, Julia Rodríguez González, José Manuel Guerra Laso, María Rosario Pérez Simón, Paula Dios Díez

Internal Medicine, Complejo Asistencial Universitario de León, León, Spain

Corresponding author's e-mail: esoriaa@saludcastillayleon.es

Received: 20/07/2026
Accepted: 31/07/2026
Published: 27/11/2026

Conflicts of Interests: The Authors declare no conflict of interest.
Patient Consent: Signed informed consent for the publication of his case was obtained from the patient.
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How to cite this article: Soria Alcaide E, Lorente Larrañeta C, Rodríguez González J, Guerra Laso J. Pérez Simón MR, Dios Díez P. Brain Abscesses Caused by Tsukamurella pulmonis: A Rare Presentation of an Unusual Microorganism. EJCRIM 2026;13:doi:10.12890/2026_007319

ABSTRACT

Introduction: Tsukamurella pulmonis is a rare aerobic Gram-positive actinomycete that most commonly causes catheter-related bloodstream infections in immunocompromised patients. Central nervous system involvement is exceptionally uncommon, and its microbiological resemblance to other aerobic actinomycetes frequently delays diagnosis and appropriate treatment.

Case description: We report the case of a 75-year-old man with no relevant past medical history and a recently identified pulmonary hilar lesion who presented with fever and progressive confusion. The initial cranial computed tomography scan was unremarkable, but subsequent brain magnetic resonance imaging revealed multiple supra- and infratentorial brain abscesses. Bronchoscopic biopsy of the pulmonary lesion demonstrated necrotizing granulomatous inflammation, while microbiological analysis identified *Tsukamurella pulmonis*. Echocardiography ruled out infective endocarditis. The patient received intravenous meropenem combined with high-dose trimethoprim-sulfamethoxazole, followed by oral trimethoprim-sulfamethoxazole after 4 weeks because of marked clinical and radiological improvement. Apart from transient leukopenia, treatment was well tolerated. Despite successful control of the infection, the patient died 4 days after discharge following an episode of bronchoaspiration unrelated to progression of the infection.

Conclusion: This case highlights the importance of considering *T. pulmonis* in the differential diagnosis of invasive infections with atypical clinical and radiological findings, even in immunocompetent patients. It also emphasizes the pivotal role of advanced microbiological techniques for accurate species identification and demonstrates that prolonged targeted antimicrobial therapy may achieve favorable radiological and clinical responses despite the absence of standardized treatment recommendations.

KEYWORDS

Tsukamurella pulmonis, brain abscesses, catheterrelated bacteremia, immunocompentent host, pulmonary infection

EFIM
European Federation of Internal Medicine

Publisher
smc media srl

LEARNING POINTS

- Consider *Tsukamurella pulmonis* in the differential diagnosis of culture-positive invasive infections with atypical clinical or radiological features, even in immunocompetent patients, as delayed recognition may postpone appropriate targeted therapy.
- Accurate identification of *Tsukamurella* requires advanced microbiological techniques (matrix-assisted laser desorption/ionization time-of-flight mass spectrometry complemented by molecular sequencing) because its phenotypic similarity to other aerobic actinomycetes can lead to misidentification and inappropriate treatment.
- This case expands the limited evidence on central nervous system infection caused by *T. pulmonis*, demonstrating that prolonged combination antimicrobial therapy can achieve marked radiological improvement despite the absence of standardized treatment guidelines.

INTRODUCTION

Tsukamurella pulmonis is a Grampositive rodshaped, aerobic, weakly acidalcoholresistant bacillus. These organisms are widespread in the environment and are found mainly in water and soil. They are known to cause bacteremia in immunocompromised patients with longstanding permanent catheters, although they may also produce other types of infections, such as keratitis, conjunctivitis, otitis, pulmonary infections and brain abscesses[1].

CASE DESCRIPTION

We present the case of a 75yearold male, an active smoker of 4 cigarettes per day, with a medical history of hypertension, dyslipidemia, and class III obesity, as well as chronic coronary syndrome (unstable angina) diagnosed in 2006 with a normal angiographic study. He had undergone right knee prosthesis surgery in June 2023.

The patient was admitted to the pulmonology department for biopsy of a right hilar lung mass suspicious for malignancy. The diagnostic process began on an outpatient basis, but he developed progressive confusion, leading to a fall and head trauma at home; as such, he was brought to the emergency department. On hospital arrival, his temperature was 38.6°C, without clear infectious focus on physical examination, although a general decline was evident. Blood cultures were obtained and a cranial computed tomography (CT) scan was performed, which showed no evidence of acute intracranial pathology.

Due to the patient's progressive worsening and confusion during hospitalization, brain magnetic resonance imaging (MRI) was performed and revealed multiple supratentorial and infratentorial lesions compatible with brain abscesses. Given these findings, an echocardiogram was requested, which ruled out lesions suggestive of infectious endocarditis. Bronchoscopy revealed no macroscopic abnormalities. Samples were sent for pathological examination, which demonstrated necrotizing granulomatous inflammation with deposition of anthracotic pigment, without signs of malignancy. The samples were sent to microbiology and tested positive for Tsukamurella pulmonis.

Following the findings of the lung biopsy, the patient was subsequently transferred to the Internal Medicine Department for evaluation and patient follow-up, where antibiotic therapy consisting of trimethoprimsulfamethoxazole 2400/480 mg daily, folic acid 5 mg per day, and meropenem 2 g every 8 hours was initiated. Treatment was continued for 28 days. Dexamethasone was added to reduce perilesional edema associated with the brain abscesses.

A followup brain MRI performed during the fourth week of antibiotic therapy showed clear radiological improvement of the intracranial lesions (*Fig. 1-4)*. Given the radiological and clinical improvement, the patient was discharged with oral trimethoprimsulfamethoxazole 1600/320 mg every 8 hours, pending followup in the outpatient clinic. No significant adverse effects were observed during hospitalization, aside from transient leukopenia following the switch to oral therapy.

Four days after discharge, the patient returned to the emergency department after an episode of bronchoaspiration and died later that same day.

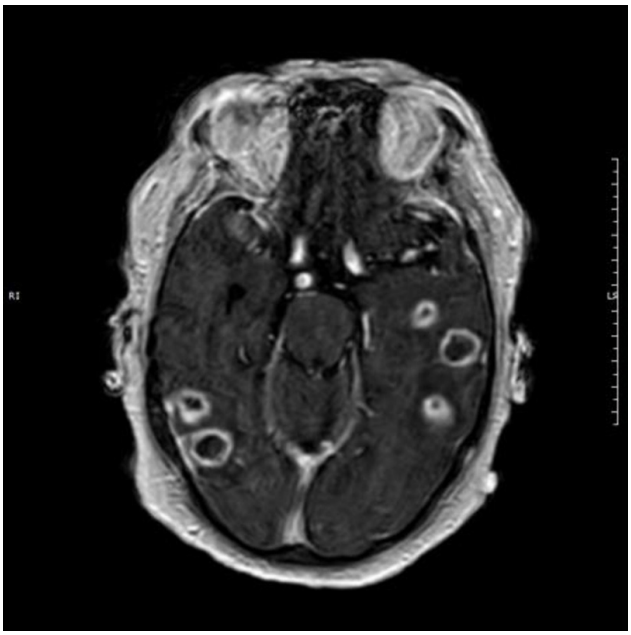


Figure 1. *Transversal slices from the initial magnetic resonance imaging scan.*

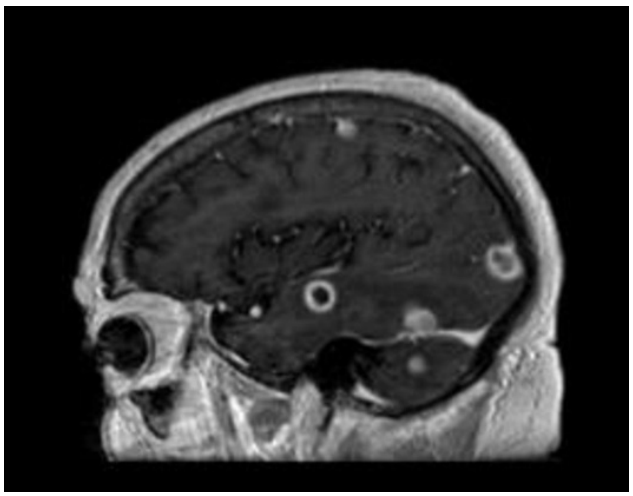


Figure 2. Sagittal slices from the initial magnetic resonance imaging scan.

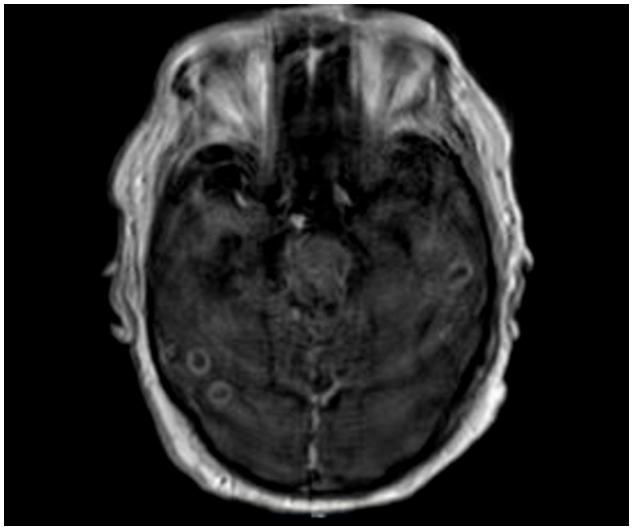


Figure 3. Transversal slices from the follow up magnetic resonance imaging scan.

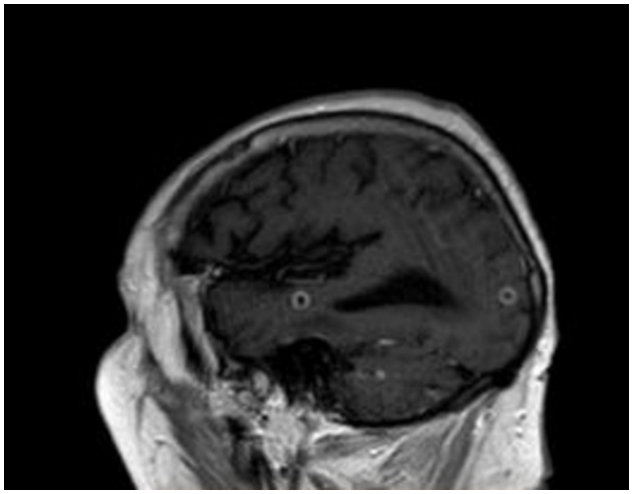


Figure 4. Sagittal slices from the follow up magnetic resonance imaging scan.

DISCUSSION

Tsukamurella is a genus of actinobacteria that is phenotypically very similar to *Nocardia*, *Rhodococcus*, *Gordonia*, and nontuberculous mycobacteria, making it difficult to identify. In clinical practice, this ambiguity may contribute to underestimation of its incidence and delays in appropriate therapy. In recent years, identification has improved through combined microbiological approaches, including matrix-assisted laser desorption/ ionization time-of-flight (MALDITOF) mass spectrometry with 16S ribosomal ribonucleic acid sequencing and the use of alternative marker genes, such as secA1 for specieslevel discrimination. This approach was illustrated in a case of catheterrelated bloodstream infection in an immunocompromised pediatric patient, in which MALDITOF was insufficient for species identification and additional molecular techniques were required[1].

The clinical spectrum of *Tsukamurella* infection is broad, and presentations in the form of brain abscesses are exceedingly rare[1-3].

Among the clinical manifestations, bacteremia is the most widely described in the literature[1,2], clearly associated with immunosuppression and intravascular devices. Although infrequent, hematogenous dissemination can progress to infectious endocarditis. Malik et al. reported the first case of *Tsukamurella* endocarditis in an immunocompromised host, underscoring the need to consider echocardiography in cases of sustained bacteremia or when distant embolic events are present[4].

Pulmonary infections caused by *Tsukamurella* may present with patterns ranging from bilateral patchy infiltrates to cavitary lesions. The first case of communityacquired pneumonia described by Maalouf et al. demonstrated that both clinical and radiologic findings may overlap with pneumonias caused by other microorganisms[5]. Along similar lines, the case reported by Pérez et al. described the coexistence of *Tsukamurella* infection with lung adenocarcinoma in a cavitary lesion, despite clinical improvement with antibiotics, thereby illustrating that this genus may mask or coexist with malignant processes. Thus, when cavitation or atypical evolution is observed, biopsy should be considered[7].

Another relevant group of infections caused by this pathogen involves the eye, with manifestations including conjunctivitis, keratitis, and canaliculitis, particularly in association with ophthalmic devices, suggesting a potential tropism for foreign materials[3,6].

Regarding treatment, standardized therapeutic guidelines are lacking. Many classic empirical regimens may be suboptimal until precise identification and *in vitro* susceptibility testing are available. In endocarditis, a combination of imipenem and trimethoprimsulfamethoxazole administered for 6 weeks achieved microbiologic cure, suggesting this regimen may be effective in highinoculum infections[4]. For pulmonary infections, Maalouf and Pérez's groups [5,7] used targeted regimens combining a rifamycin with a quinolone.

In the series of 25 bacteremia cases reported by Leroy et al.[1], multiple antimicrobial regimens were documented, with variability not only in composition but also in duration.

Among the antimicrobials with the greatest *invitro* activity are carbapenems, amikacin, quinolones, and trimethoprimsulfamethoxazole. Some authors propose combining a βlactam with an aminoglycoside, or a macrolide with a quinolone, as appropriate therapeutic options for extrapulmonary infections. In any case, as with other infections associated with prosthetic devices, removal of the prosthetic material is essential for adequate source control.

Brain abscesses caused by *Tsukamurella* spp. are an exceptional entity whose diagnosis represents a clinical challenge due to this genus's phenotypic similarity to other aerobic actinomycetes of the order Corynebacteriales. Our case underscores the need to consider *Tsukamurella pulmonis* in the differential diagnosis of invasive infections, even in patients without severe immunosuppression, particularly in the presence of atypical radiologic findings or clinical evolution not explained by common pathogens.

The lack of consensus about therapeutic guidelines and the variability in *in vitro* susceptibility profiles complicate the selection of appropriate empirical therapy. Conventional regimens may be insufficient until definitive microbiological identification is available, highlighting the importance of combining techniques such as mass spectrometry and gene sequencing to guide early targeted therapy. In this context, the most frequently used antimicrobial options (carbapenems, quinolones, trimethoprimsulfamethoxazole, and aminoglycosides) are based on limited case series, underscoring the need for additional clinical evidence.

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