Bacterial meningitis secondary to otomastoiditis by Providencia Rettgeri in private of liberty

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ABSTRACT

Introduction: This case report describes a rare occurrence of meningitis caused by Providencia rettgeri in an inmate patient. Providencia rettgeri is a gram-negative bacterium that rarely causes meningitis, and is most commonly associated with urinary tract infections and septicemia in immunocompromised patients. (1)
Case Presentation: Man, 29 years old, deprived of liberty, without comorbidities. Onset of otalgia, fever and otorrhea for 21 days, with previous use of Ceftriaxone + Oxacillin, without improvement. Admitted due to prostration for 02 days, mental confusion and lowering of the level of consciousness. Physical examination showed neck stiffness, ECG 9, left otoscopy with purulent secretion and opaque tympanic membrane with central perforation of 10%. A CT scan suggestive of otomastoiditis was performed. In addition to the area of bone erosion in the posteromedial aspect of the ipsilateral mastoid, with communication with the cerebellar hemisphere determining peripheral edema. The cerebrospinal fluid was collected, antibiotic therapy for vancomycin + meropenem was scheduled, corticosteroid therapy was initiated, and the patient was referred for simple mastoidectomy on the left. It has been identified in the growth abscess culture of Providencia Rettgeri. Discussed with CCIH, we opted for maintenance of antibiotic therapy due to the patient's clinical severity and weekly cerebrospinal fluid control was suggested to determine the duration of treatment. After 28 days of treatment, the patient progressed with improvement in the CSF pattern, but developed bicytopenia. After 3 days of the end of treatment, the blood count showed improvement, the patient did not present motor or neurological sequelae, and was discharged from the hospital with outpatient follow-up.
Comments: Providencia spp. is a genus composed of five species. In the clinical setting, P. stuartii is most commonly seen in patients. Most strains of P. rettgeri exhibit pathogenic properties similar to those of P. stuartii. In a literature review, there is a lack of data on CNS infection in humans by the species P. rettgeri (2). Deprived of liberty are often exposed to unhealthy environments that can predispose to the risk of contamination by atypical pathogens. We reinforce the importance of collecting cultures to increase our knowledge about these pathogens in this population and their resistance profiles, in order to optimize the conducts in the face of atypical cases such as the one reported. (3)

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Conclusion: This case highlights the importance of considering Providencia rettgeri as a potential pathogen in cases of meningitis, especially in at-risk populations such as inmates, opening the horizon for at-risk populations for this infection. Early identification and appropriate treatment are crucial for a favorable outcome, in addition to the need for further studies on the bacteria.

Keywords: Providencia Rettgeri, Central nervous system infection, Deprived of liberty.

INTRODUCTION

Meningitis caused by *Providencia rettgeri* is an extremely rare condition, with few cases reported in the medical literature. *Providencia rettgeri* is a Gram-negative bacterium most commonly associated with urinary tract infections and septicemia in immunocompromised patients, and is an atypical occurrence in cases of meningitis .However, in prison settings, factors such as overcrowding, poor hygienic conditions, and limited access to medical care can increase the incidence of rare pathogen infections. (4)

In prison settings, the epidemiology of meningitis is influenced by conditions that favor the transmission of infectious agents. Overcrowding facilitates the spread of pathogens, while inadequate hygiene increases the vulnerability of inmates to infections. A systematic study highlighted that the incidence of infectious diseases, including meningitis, is significantly higher in prison populations compared to the general population, due to the combination of environmental and behavioral factors (3)

In addition, the prevalence of comorbidities, such as immunosuppression due to drug use or chronic diseases, contributes to greater susceptibility to severe infections among prisoners. This is especially relevant in cases of bacterial meningitis, where the host's immune response is crucial for infection control. Studies show that interventions aimed at improving the health of inmates during and after incarceration can reduce the incidence of serious infections, including meningitis. (5)

Therefore, the occurrence of Providencia rettgeri meningitis in an inmate patient not only underlines the need for strict epidemiological surveillance, but also emphasizes the importance of improving health and hygiene conditions in prison systems. This case report contributes to the understanding of the epidemiology and management of rare infections in prison environments, in addition to elucidating the diagnosis and treatment, through a case report, of an atypical germ causing meningitis. (6)

CLINICAL CASE

Man, 29 years old, deprived of liberty, without comorbidities. Onset of otalgia, fever and otorrhea for 21 days, with previous use, 5 days before hospitalization, of Ceftriaxone + Oxacillin, without improvement. The penitentiary's health team reports that due to a 2-hour condition presenting a lowering of the patient's level of consciousness, he was brought to a reference service. Admitted to emergencies with a report of prostration for 02 days, mental confusion and pain in the nape of the neck. Physical examination showed neck stiffness, 9-point Glasgow Coma Scale, left otoscopy with purulent secretion, and opaque tympanic membrane with 10% central perforation. A CT scan suggestive of otomastoiditis (image 1) (image 2), (image 3), (image 4) was performed. In addition to the area of bone erosion in the posteromedial aspect of the ipsilateral mastoid, with

communication with the cerebellar hemisphere determining peripheral edema. Due to the fact that the patient presented neck stiffness, associated with a clinical lowering suggestive of a metabolic infectious cause, with clinical and imaging examination showing otitis media, complicated for acute otomastoiditis associated with central nervous system invasion, with a possible abscess, the diagnosis of acute otitis media complicated with meningoencephalitis was then hypothesized.

Due to this, it was decided to perform cerebrospinal fluid collection, staggered antibiotic therapy for Vancomycin + Meropenem by an emergency team, and corticosteroid therapy was initiated. Due to the worsening of the lower level of consciousness, he was pursued with the need for orotracheal intubation and sedation, in addition to contacting the hospital's otorhinolaryngology team to evaluate the condition of infection of the nervous system by contiguity, in addition to acute otomastoiditis. In the cerebrospinal fluid test, the patient had 576 leukocytes per mm3 (81% polymorphonucleates), glucose of 5 mg/dl, proteins of 182 mg/dl. Latex for bacteria negative, VDRL negative,

After evaluation by the otorhinolaryngology team, the patient was referred for simple mastoidectomy on the left, local abscess material was collected, and the infected site was cleaned. After the procedure, the patient was referred to the intensive care unit for intensive care and antibiotic therapy

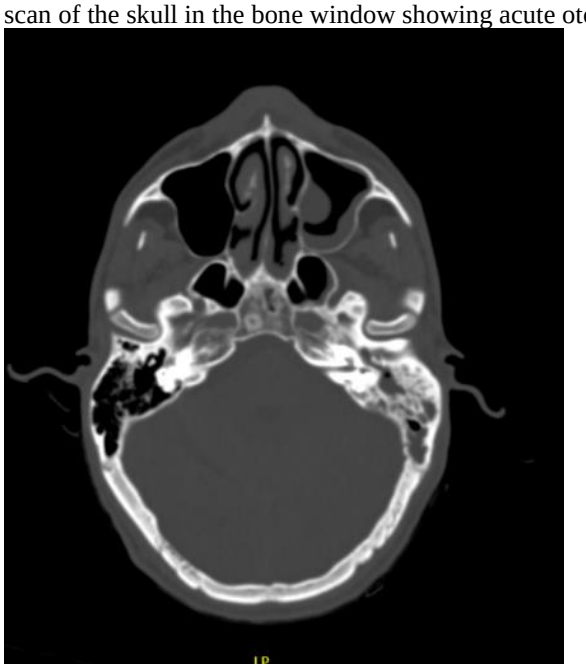
After 2 days of performing a surgical procedure, Providencia Rettgeri growth abscess was identified in culture. The patient was discussed with a local hospital infection control center that opts for antibiotic therapy due to the patient's clinical severity, and weekly cerebrospinal fluid control was suggested to determine the duration of treatment, since the antibiogram showed sensitivity to the antibiotics in use.

After 5 days in an intensive care unit bed, the patient was extubated, in addition to fully recovering the previous level of consciousness, and was then sent to the ward bed for treatment follow-up, with antibiotic therapy, and weekly cerebrospinal fluid collection. After 28 days of treatment, the patient evolved with improvement in the CSF pattern, improvement in serum and metabolic tests, in addition to complete clinical improvement, and was discharged from the prison system.

Image 1 – CT scan of the skull in a bone window showing acute otomastoiditis, with erosion of the floor that separates the mastoid from the brain, observing continuity

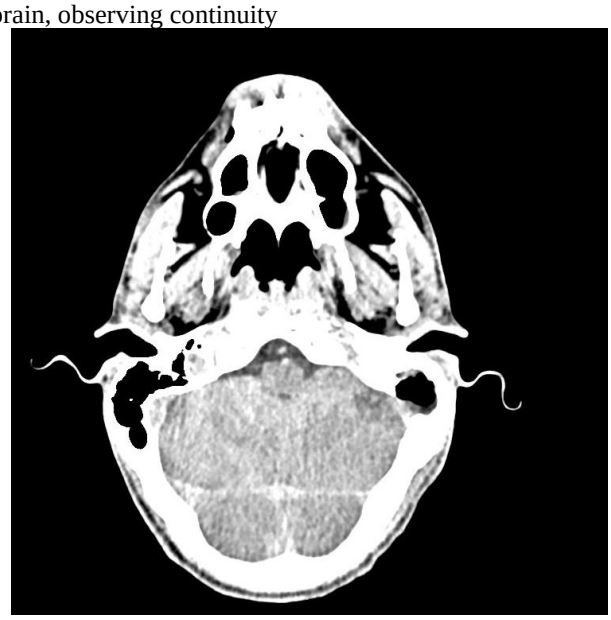
Source: personal collection

Image 2 – CT scan of the skull in the bone window showing acute otomastoiditis



Source: personal collection

Image 3 – CT scan of the skull in the cerebral window showing acute otomastoiditis, with erosion of the floor that separates the mastoid from the brain, observing continuity



Source: personal collection

Image 4 – CT scan of the skull in the bone window showing acute otomastoiditis, with erosion of the floor that separates the mastoid from the brain, observing continuity

Source: personal collection

REVIEW OF DIFFERENTIAL DIAGNOSES OF MENINGITIS

Meningitis can be caused by a variety of pathogens, including viruses, bacteria, fungi, and mycobacteria. In the case in question, the differential diagnosis initially considered viral meningitis, bacterial meningitis caused by other common pathogens, fungal and tuberculous meningitis. Each of these etiologies was investigated and excluded based on specific clinical and laboratory findings. (4)

MENINGITE VIRAL

Viral meningitis is commonly caused by enteroviruses, mumps viruses, herpesviruses, and arboviruses. These cases usually have a milder clinical course and cerebrospinal fluid (CSF) scans with lymphocytic pleocytosis, mildly elevated proteins, and normal glucose). In the case described, neutrophilic pleocytosis and reduced CSF glucose were inconsistent with a viral aetiology. (4)

BACTERIAL MENINGITIS BY OTHER PATHOGENS

The most common bacterial causes of meningitis include *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*. These pathogens are usually identified by CSF culture or antigen tests. In the case presented, CSF revealed the presence of *Providencia rettgeri* through culture, excluding other common bacteria. (4)

FUNGAL MENINGITE

Fungal meningitis, often caused by *Cryptococcus neoformans* or *Candida* species, is more common in immunocompromised patients. CSF in these cases usually shows lymphocytic pleocytosis, elevated proteins, and low glucose, with identification of the fungus by India ink or culture.In the present case, the specific bacterial identification ruled out a fungal origin. (4)

MENINGITE TUBERCULOSA

Tuberculous meningitis, caused by *Mycobacterium tuberculosis*, usually presents with an insidious onset with neurological symptoms and CSF changes similar to fungal meningitis. Specific tests such as PCR for TB or long-term cultures are required for confirmation. The absence of clinical and laboratory characteristics specific to TB helped to exclude this etiology. (4)

DIFFERENTIAL DIAGNOSIS NOT CASE REPORT:

As described in the case, the patient had clinical symptoms suggestive of meningitis, and then a cerebrospinal fluid test was performed. The patient had 576 leukocytes per mm3 (81% polymorphonucleates), glucose of 5 mg/dl, proteins of 182 mg/dl. Latex for bacteria negative, VDRL negative. This pattern is suggestive of bacterial infection, seen as leukocytosis, at the expense of polymorphonucleates, in addition to excessive glucose consumption. This fact is confirmed with the growth of *Providencia rettgeri* in culture medium.

REVIEW OF EXISTING LITERATURE

Providencia rettgeri is a rare gram-negative bacterium belonging to the Enterobacteriaceae family, generally recognized for its association with urinary tract infections and occasionally with

more severe infections such as meningitis. The literature on *Providencia rettgeri* as an etiologic agent of meningitis is limited, reflecting its rarity in this context. Documented cases often highlight the importance of early diagnosis and appropriate antimicrobial therapy due to the antimicrobial resistance it can present.

RARITY OF INFECTION AND PARTICULARITIES

Providencia rettgeri *infection* is uncommon, which can lead to diagnostic challenges. It has intrinsic and acquired resistance mechanisms that can complicate treatment, making it potentially resistant to multiple antibiotics. The ability to form biofilms also contributes to their persistence in hospital settings and the spread of infections.

DIAGNOSTIC AND THERAPEUTIC CHALLENGES

Diagnosing Providencia rettgeri meningitis can be challenging due to its similarity to other enterobacteria and the need for specific laboratory tests for accurate identification. The choice of antimicrobial treatment should consider the local resistance profile and the results of susceptibility testing. The combination of antimicrobial agents may be necessary due to frequent resistance to first-line antibiotics, as we saw in the case report (Association of meropenem with vancomycin)

In summary, while *Providencia rettgeri* is an uncommon cause of meningitis, its growing antimicrobial resistance and associated diagnostic challenges highlight the importance of epidemiological surveillance and careful clinical management to improve patient outcomes

DISCUSSION

Meningitis caused by *Providencia rettgeri* is a clinically challenging and uncommon condition. This bacterium, a member of the Enterobacteriaceae family, is most frequently associated with urinary tract infections and is rarely identified as the etiologic agent of central nervous system infections. A review of the existing literature reveals that documented cases of meningitis caused by *Providencia rettgeri* are limited, reflecting its low incidence and highlighting the importance of case studies for a better understanding of this condition (7)

The rarity of this infection contributes to significant challenges in diagnosis and clinical management. Healthcare professionals' lack of familiarity with this bacterium can result in delays in diagnosis and inappropriate treatment initially, which can adversely affect patients' clinical outcomes. Therefore, awareness of *Providencia rettgeri* as a potentially pathogenic pathogen in systemic infections, including meningitis, is crucial to ensure appropriate therapeutic intervention from the early stages of the disease. (8)

A distinctive aspect of *Providencia rettgeri* is its ability to develop antimicrobial resistance, which can further complicate treatment. Epidemiological studies indicate that this bacterium may exhibit resistance to multiple antibiotics, including those commonly used to treat central nervous system infections, such as ceftriaxone and ampicillin (Jean et al., 2014). Therefore, the initial choice of antimicrobial therapy should be guided by susceptibility test results, with consideration for the use of combinations of agents to optimize treatment efficacy. However, we must emphasize that in case of diagnostic suspicion of meningitis, we must start empirical treatment, following the current guidelines in addition to recommendations from the hospital infection control center of your workplace, so as not to delay the therapeutic approach.

Diagnostic challenges associated with *Providencia rettgeri* meningitis include the need for specific laboratory methods for accurate identification. This is crucial due to the phenotypic similarity of this bacterium to other members of the Enterobacteriaceae family, which may result in initial diagnostic confusion. Methods such as MALDI-TOF mass spectrometry and molecular testing are essential to differentiate *Providencia rettgeri* from other common bacterial species involved in meningitis (7)

In addition to the diagnostic challenges, the therapeutic management of meningitis by *Providencia rettgeri* requires a multidisciplinary and individualized approach. Antimicrobial therapy should be adjusted according to the results of susceptibility testing and closely monitored to assess the patient's clinical response and eradication of infection. In severe or complicated cases, consideration of neurosurgical interventions may be necessary to relieve intracranial pressure or treat complications such as brain abscesses. As in the case addressed, the patient had a continuous infection with the inner ear and due to this he needed a surgical approach. (8)

The emerging antimicrobial resistance among strains of *Providencia rettgeri* highlights the continued importance of epidemiological surveillance and hospital-acquired infection control. Prevention strategies, such as the rational use of antibiotics and infection control measures, are key to mitigating the spread of this resistant bacterium and improving patient outcomes. Collaboration between clinical, laboratory, and public health teams is essential to address these growing challenges and ensure appropriate and effective management practices. (7)

Associating *Providencia rettgeri* with the prison system may be relevant due to conditions that often favor the spread of bacterial infections, including antimicrobial resistance. Prisons are environments where factors such as overcrowding, poor hygiene, and limited access to adequate health care can increase the risk of infections. (3)

POSSIBLE APPROACHES TO REDUCE PRISON INFECTIONS

Improvement of hygiene conditions

Implementing educational programs and strict hygiene practices within prisons can reduce the spread of pathogenic bacteria like *Providencia rettgeri*. This includes regular access to clean water, adequate sanitation facilities, and the promotion of personal hygiene practices among inmates. (2)

Tracking and epidemiological surveillance

Establishing pathogen tracking programs among inmates and prison staff can aid in the early identification of infections. Regular epidemiological surveillance can monitor the prevalence of bacterial infections and identify potential outbreaks, allowing for a rapid and effective response. (2)

Improved access to health

Ensuring that all inmates have timely access to adequate healthcare, including regular medical checkups and treatment for infections, is critical. This can help in the early detection of infections and the implementation of appropriate preventive and therapeutic measures. (2)

Antibiotic Control and Antimicrobial Resistance

Implementing strict antibiotic prescribing policies and infection control practices can help minimize the development and spread of antimicrobial resistance among prison populations. This includes education on the proper use of antibiotics and monitoring for bacterial resistance. (2)

Impact on public health

Reducing infections within the prison system not only improves the health of inmates, but also has significant impacts on public health in general (2)

Prevention of community outbreaks

Prisons are entry and exit points to the community. Reducing the prevalence of bacterial infections like *Providencia rettgeri* inside prisons can decrease the chance of outbreaks spreading to the general population. (2)

Reduction of healthcare costs

Treating resistant bacterial infections can be extremely costly. By preventing infections within prisons, health systems can save significant resources that would otherwise be used in the treatment of complicated infections. (2)

Improvement in the quality of life of inmates

Reducing infections not only prevents health complications but also contributes to a safer and more humane prison environment, improving the quality of life for inmates. (2)

In summary, addressing infections like *Providencia rettgeri* within the prison system not only protects the health of inmates but also has a positive impact on public health and health resource management. Implementing preventive measures and improving access to healthcare are essential steps to mitigate the risks associated with bacterial infections in correctional settings.

CONCLUSION

The case of meningitis caused by *Providencia rettgeri* illustrates the complexity and challenges associated with the diagnosis and treatment of rare bacterial infections. This bacterium, although uncommon, has antimicrobial resistance characteristics that can significantly complicate clinical management. The literature review and case studies highlight the importance of prompt identification of the pathogen and the appropriate choice of antimicrobial therapy to improve patients' clinical outcomes. (10)

IMPLICATIONS IN CLINICAL PRACTICE

Meningitis by *Providencia rettgeri* underscores the need for constant surveillance and infection control in high-risk settings, such as prisons. Improving hygiene, implementing educational programs on rational antibiotic use, and ensuring adequate access to health care are essential to prevent and manage bacterial infections within these vulnerable populations. Additionally, strict epidemiological surveillance can aid in the early detection of outbreaks and the implementation of effective preventive measures. (11) (12).

SUGGESTIONS FOR FUTURE RESEARCH

Future research on meningitis in at-risk populations, including inmates, is needed to better understand the epidemiology and risk factors associated with severe bacterial infections. Studies investigating the antimicrobial resistance profile of *Providencia rettgeri* and other bacteria in prison settings are key to guiding infection control policies and optimizing treatment strategies. In addition, investigations exploring new diagnostic and therapeutic approaches can help improve the clinical management of these complex infections.

In summary, the case of meningitis by *Providencia rettgeri* underlines the importance of epidemiological surveillance, infection control, and ongoing research to address clinical and public health challenges in prison settings and beyond. Multidisciplinary collaboration between health

professionals, researchers, and health policy makers is essential to mitigate the impacts of these serious infections and improve patient outcomes.

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