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Rare Presentation of *Morganella morganii* Microorganism as Epidural and Subdural Empyema

Apresentação rara de Morganella morganii Microrganismo como Empiema Epidural e Subdural

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Abstract

Background *Morganella morganii* is a gram-negative bacterium that rarely infects the central nervous system (CNS). Few reports described such an infection in the CNS. We present a case of extremely invasive *M. morganii* infection in the CNS. In addition, we performed a literature review of *M. morganii* infection in the CNS.

Case report A 53-year-old male was admitted to the hospital due to fever, general weakness, and left-sided facial muscle twitching. He had a history of diabetes mellitus, hypertension, brain tumor, and epilepsy. Multiple left frontal scalp ulcers were revealed. In addition, a computed tomography (CT) scan and magnetic resonance imaging (MRI) revealed a left side epidural abscess and subdural empyema. Moreover, the patient had left frontal bone osteomyelitis. The next day, the patient underwent craniectomy, was transferred to the intensive care unit and started an empirical antibiotic course. *Morganella morganii* was identified from the infected scalp ulcers. On the 13th day, the patient passed away due to uncontrolled status epilepticus.

Conclusion *M. morganii* can cause isolated or multiple types of CNS infections, including brain abscess, meningitis, and subdural empyema. The mortality rate may differ according to age and to the use of surgical evacuation.

Keywords
- subdural empyema
- morganella morganii
- brain infection
- scalp ulcer

Resumo

Introdução Morganella morganii é uma bactéria gram-negativa que raramente infecta o sistema nervoso central (SNC). Poucos relatos descreveram tal infecção no SNC. Apresentamos um caso de infecção extremamente invasiva por M. morganii no SNC. Além disso, realizamos uma revisão da literatura sobre a infecção por M. morganii no SNC.

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Relato de caso Um homem de 53 anos foi admitido no hospital devido a febre, fraqueza geral e espasmos da musculatura facial do lado esquerdo. Ele tinha história de diabetes mellitus, hipertensão, tumor cerebral e epilepsia. Múltiplas úlceras no couro cabeludo frontal esquerdo foram reveladas. Além disso, uma tomografia computadorizada (TC) e uma ressonância magnética (RM) revelaram um abscesso epidural do lado esquerdo e empiema subdural. Além disso, o paciente apresentava osteomielite do osso frontal esquerdo. No dia seguinte, o paciente foi submetido à craniectomia, foi transferido para a unidade de terapia intensiva e iniciou curso empírico de antibiótico. Morganella morganii foi identificada a partir das úlceras do couro cabeludo infectadas. No 13° dia, o paciente faleceu devido a estado de mal epiléptico não controlado.

Conclusão M. morganii pode causar tipos isolados ou múltiplos de infecções do SNC, incluindo abscesso cerebral, meningite e empiema subdural. A taxa de mortalidade pode diferir de acordo com a idade e com o uso da evacuação cirúrgica.

Palavras-chave
- Empiema Subdural
- Morganella morganii
- Infecção cerebral
- Úlcera do couro cabeludo

Introduction

Morganella morganii is a gram-negative aerobic bacilli that belongs to the Enterobacteriaceae family and is part of the normal gut microbiota.[1–3] *Morganella morganii* infection can cause urinary tract infection, blood sepsis, soft tissue, wound, and hepatobiliary tract infection.[1,2] Central nervous system (CNS) infection with *M. morganii* is rarely encountered and reported in the literature, including brain abscess, meningitis, and subdural empyema.[3] In the present case report, we present a case of aggressive *M. morganii* CNS infection using case report (CARE) guidelines.[4] Moreover, we performed a literature review by searching for articles related to CNS infection by *M. morganii* in the PubMed and Scopus databases.

Case Presentation

A 53-year-old male patient with multiple comorbidities, including diabetes mellitus and hypertension, was admitted to our hospital as an emergency case of a 1-week history of intermittent fever, general weakness, and left-sided facial muscle twitching. He had a history of left side temporoparietal brain tumor excision (astrocytoma) 20 years ago. He was found to be neglected by the family as all his relatives live far away from him. Besides, he had been diagnosed with right side acute subdural hematoma (SDH) and was treated surgically 8 months before, and he had been diagnosed with epilepsy 8 years before, which was managed with phenytoin as a single antiepileptic medication. Physical examination revealed high-grade fever (38.3 C°) and other vital signs were within normal ranges. Multiple left frontal scalp ulcers and necrosis were detected (►**Figure 1**). The patient's Glasgow coma scale was 11 as he could open his eyes spontaneously (4), as well as producing sounds when in pain (2) and flexion to pain (5). Pupils were normal sized and reactive to light. Power examinations showed right-side weakness. Blood laboratory exams showed elevation in white blood cell (WBC) count (13.4 $^{*} \times 10^{9}$/L), mainly neutrophils (81%), C-reactive protein (140 mg/L), erythrocyte sedimentation rate (ESR) (62 mm/hr). Other lab results were within normal ranges. Both CT scan and MRI images revealed left side epidural abscess, subdural empyema, cerebral atrophy, and cerebritis in the frontal area (►**Figure 2**). The patient was prepared for surgery and, on the next day, he underwent left decompressive craniectomy surgery and evacuation of the epidural abscess, the subdural empyema, and the infected part of the skull. The artificial dura of the previous tumor excision was also removed. Pus biopsy was taken and sent to the microbiology lab.

MacConkey agar or blood agar were used for bacteria while sabouraud dextrose agar was used to detect any fungal growth. Although no growth was detected from the pus culture, the scalp ulcer culture was positive for *M. morganii*. The antibiotic susceptibility test showed resistance against fluoroquinolones, cefixime, and ampicillin with sulbactam. On the other hand, it was sensitive to aminoglycosides and other cephalosporins. The patient was kept on phenytoin for seizure control and treated with vancomycin, ceftriaxone, and metronidazole at the initial period, then the antibiotics regimen changed to gentamicin and ceftriaxone IV according to the susceptibility to antibiotics.

The patient was observed in the intensive care unit for 13 days, then he passed away due to uncontrolled status epilepticus.

Fig. 1 Patient scalp before surgery (left) and after surgery (right). We see evidence of multiple necrotic infected areas on the scalp with redness around them, which indicated signs of active infection.

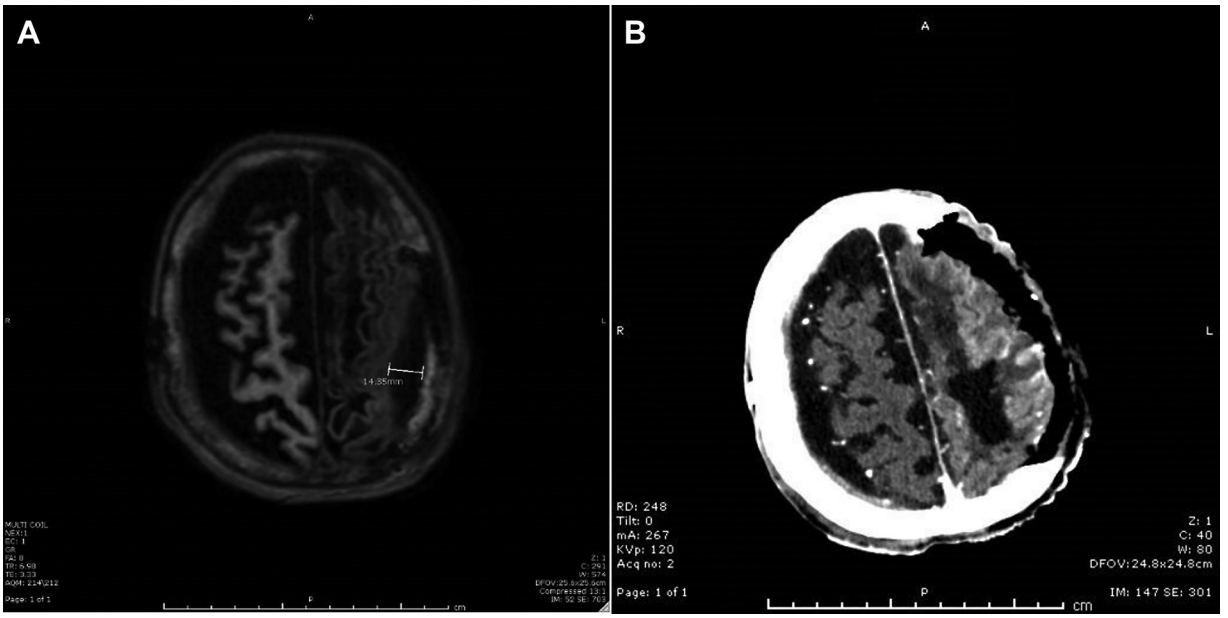

Fig. 2A Brain axial view T1 magnetic resonance imaging with IV contrast showing left frontal epidural and subdural empyema measuring about 1.4 cm in it maximum thickness, associated with a hypodense area involving the underlying left frontal lobe suggesting for encephalitis, the left frontal lobe appears edematous with effacement of the sulci and leptomeningeal enhancement. **Fig. 2B** Brain computed tomography scan with IV contrast showing interval resolution of the previously noted left frontal convexity empyema with a large area of pneumocephalus at its site. The left frontal lobe appears edematous with effacement of the sulci and leptomeningeal enhancement, suggesting for encephalitis.

Discussion

Morganella morganii is a rare causative agent of intracranial infections. Previous studies have reported brain abscesses, meningitis, and subdural empyema with this infection.[5,6] In the present case report, we reported the first case of extremely invasive *M. morganii* CNS infection involving the scalp, the skull, and the epidural and subdural spaces.

Risk factors and the source of the infection in the brain are unclear due to the scarcity of cases reported in the literature. However, iatrogenic, otogenic, wound infections, and urinary tract infection (UTI) as possible sources of infection have been reported previously.[1,2,5] In our case, tumor excision surgery was performed on the same side of the infection but was performed 20 years ago which was an unusual risk factor.

In the previously reported studies, the age of the patients ranged from 1 day to 78 years old (►**Tables 1** and **2**). There were more male cases than female cases (nine male cases, seven female cases, and one unreported case). The mortality rate of the reported studies in the literature, including our case, was 27.8%. The most common presentation was meningitis, with 10 cases; 5 cases were isolated meningitis,[7–11] 2 were combined with brain abscesses,[3,12] 1 was combined with subdural empyema,[13] 1 was combined with encephalitis,[14] and 1 was combined with sepsis.[15] The second most common presentation was brain abscess, with seven cases; five cases were isolated brain abscesses,[5,16–18] two cases were combined with meningitis,[3,12] and one case was combined with subdural empyema.[19] Eight cases were < 2 years old (►**Table 1**). A total of 47% of the cases were infants with a history of trauma,[6,13] preterm infants,[15] born from mothers with chorioamnionitis,[11] and delivered by vacuum-assisted vaginal delivery.[20] No significant prior history or possible risk factors were identified in the remaining infant cases.[9,17,18] Surprisingly, none of the infants had died.

In the cohort of patients > 2 years old (►**Table 2**), the mortality rate was high, reaching 50%. Three patients had a history of chronic suppurative otitis media. Brain abscess and meningitis have been previously reported as possible intracranial complications of chronic suppurative otitis media.[21]

Only three cases described osteomyelitis caused by *M. morganii*.[20,22,23] Staudt et al. reported a case of skull osteomyelitis and infected cephalohematoma with *M. morganii* in a 1-day old infant.[20] Our case is the second case of skull osteomyelitis and the fourth case of osteomyelitis in general. Subdural empyema can be caused by a superimposed infection of a previous SDH.[6] The identification of *M. morganii* is based on culturing the biopsy on MacConkey agar or blood agar.[3] In our case, both were negative for the aspirated pus but positive for the superficial scalp lesions. The rate of negative pus culture from subdural empyema is reported to range from 7 to 53%.[24] In our case, possible sources of such a rare pathogen might be iatrogenic from the previous burr-hole drainage to clear the SDH, but the infection was in the contralateral side from the intracranial potential space created from his previous tumor excision,[25] which was performed 20 years before.

Morganella morganii also contains an inducible ampC β -lactamase gene, making it resistant to penicillin and to first- and second-generation cephalosporins.[26] In addition, overproduction of ampC β -lactamase by the loss of *ampD* gene expression can cause treatment failure with third-

Table 1 Reported cases of patients younger than 2 years old

Name	Age (gender)	Description of the infection	Treatment	Outcome	Notes
Bond et al., 2020[6]	13 months old (female)	Subdural empyema	Meropenem and surgical evacuation	Recovery	First case of sterile empyema
Milligan et al., 2013[9]	3 weeks old (female)	Meningitis	Cefotaxime and gentamicin	Recovery	
Park et al., 2004[13]	7 months old (male)	Meningitis and subdural empyema	Ceftriaxone, metronidazole and surgical evacuation	Recovery	History of meningitis
Paul et al., 2020[15]	32 + 5 gestational weeks (male)	Meningitis and sepsis	Meropenem and gentamicin	Recovery	Preterm infant due to fetal distress
Sinha et al., 2006[11]	6 days old (female)	Meningitis	Cefotaxime, gentamicin, and meropenem	Recovery	Mother had chorioamnionitis before the delivery
Staudt et al., 2016[20]	1 day old (male)	Cephalohematoma and osteomyelitis	Vancomycin, meropenem and surgical evacuation	Recovery	Delivered via vacuum extraction
Thomas et al., 2007[17]	2 months old (male)	Brain abscess	Unspecified antibiotics and surgical evacuation	Discharged	Patient discharged on oral chloramphenicol with no follow-up
Verboon-Maciolek et al., 1995[18]	8 days old (male)	Brain abscess	Cefotaxime, gentamicin, and surgical evacuation	Recovery	Cultures of pus aspirated from the abscess were sterile

Table 2 Reported cases of patients older than 2 years old

Name	Age (gender)	Description of the infection	Treatment	Outcome	Notes
Abdalla et al., 2006[5]	38 years old (female)	Brain abscess	Cefepime and surgical evacuation	Death	History of craniotomy due to a motor vehicle accident
Águeda et al., 2013[19]	9 years old (male)	Brain abscess and subdural empyema	Ceftriaxone, vancomycin, ceftriaxone, and surgical evacuation	Recovery	History of chronic suppurative otitis media
Isaacs et al., 1987[7]	78 years old (female)	Meningitis	Pefloxacin mesylate	Death	The reason of death was coronary heart disease
Lu et al.,1999[12]	55 years old (female)	Brain abscess and meningitis	Imipenem/ cilastatin and surgical evacuation	Recovery	The patient underwent caniotomy, then developed the infection
Mastroianni et al., 1994[8]	45 years old (male)	Meningitis	Netilmicin and ceftriaxone	Death	History of AIDS
Ndiaye et al., 2010[14]	12 years old (male)	Meningoencephalitis	Cefotaxime and gentamicin	Recovery	History of chronic otitis media
Patil et al., 2010[3]	12 years old (male)	Brain abscess and meningitis	Amikacin, ceftriaxone, and metronidazole	Recovery	History of chronic suppurative otitis media
Rau et al., 2002[16]	Not reported (not reported)	Brain abscess	Third-generation cephalosporins and surgical evacuation	Recovery	
Samonis et al., 2001[10]	25 years old (female)	Meningitis	Cefotaxime and amikacin	Death	
Present study	53 Years old (male)	Skin, skull, encephalitis, epidural abscess, and subdural empyema	Gentamicin, ceftriaxone, and surgical evacuation	Death	History of hypertension, diabetes, epilepsy, and brain tumor treated with craniotomy

generation cephalosporins.[26] In our case, the antibiotic susceptibility test showed resistance to cefixime, a third-generation cephalosporin. This was also noted by Sinha et al., who described a case of cefotaxime-resistant *M. morganii* during treatment due to overexpression of ampC β -lactamase.[11] Thus, the use of third-generation cephalosporins should be monitored continuously even if the bacterium showed an initial susceptibility and response. Third-generation cephalosporins, meropenem, and gentamicin were the most used antibiotics in the literature (►**Tables 1** and **2**). In most cases, surgical evacuation by burr-hole drainage or craniotomy was performed. In our case, the patient underwent craniectomy due to the presence of osteomyelitis. The mortality rate when the surgical evacuation was performed was 20%, compared with 37.5% when the surgical evacuation was not performed. Therefore, surgical management with the administration of the appropriate antibiotics is needed to increase the chances of survival.

Conclusion

In the present case report, we reported a very rare case of *M. morganii* infection in an adult patient that involved the scalp, the skull, and the epidural and subdural spaces with unusual presentation and unknown risk factors. Clinical presentation and mortality rate may differ according to age. The use of surgical evacuation resulted in a decreased mortality rate.

Ethics Approval and Consent to Participate

Written informed consent was obtained from the patient for publication of the case report and any related images.

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Conflict of Interests

The authors have no conflict of interests to declare.

Contribution of the Authors

Daoud S. S.: Supervision and critical review of the manuscript.

Jarrar S.: Supervision and literature review.

Ababneh O. E.: Writing of the manuscript, data collection, and review.

Jbarah O. F.: Writing and editing of the manuscript, data collection, and review.

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