American Journal of Medical Case Reports, 2024, Vol. 12, No. 3, 42-45
Available online at http://pubs.sciepub.com/ajmcr/12/3/4
Published by Science and Education Publishing
DOI:10.12691/ajmcr-12-3-4

Eikenella Corrodens, Fusobacterium Nucleatum and Parvimonas Micra: A Case of Polymicrobial Brain Abscess

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Received February 09, 2024; Revised March 10, 2024; Accepted March 17, 2024

Abstract Brain abscess represents one of the most serious complication of head and neck infections. While anaerobic bacteria are frequent isolates from brain abscesses, usually in a mixed culture, *Eikenella corrodens* is rarely isolated from this site. *E. corrodens* is a fastidious gram-negative bacterium that normally colonizes the oral cavity and upper respiratory tract. We report a case of a 42-year-old immunocompetent lady with a background of Ebstein cardiac anomaly who presented with parietooccipital brain abscess. She underwent awake surgery under navigation guidance, burr hole drainage of the abscess. Abscess culture revealed growth of *E. corrodens* in addition to anaerobic bacterial growth of *Fusobacterium nucleatum* and *Parvimonas micra*. The patient was successfully treated with a six weeks course of intravenous ceftriaxone and metronidazole which resulted in complete resolution of the abscess.

Keywords: *brain abscess, eikenella corrodens, fusobacterium nucleatum, parvimonas micra, polymicrobial infection, oral flora*

Cite This Article: Waad Al Saleemi, Amal Al Balushi, Ahmed AlAzri, Mustafa Al Shaaibi, Amina Al-Jardani, Azza Al Rashdi, Khalsa Al Ramadhani, Hala Al Hinai, and Nawal Al Kindi, "Eikenella Corrodens, Fusobacterium Nucleatum and Parvimonas Micra: A Case of Polymicrobial Brain Abscess." *American Journal of Medical Case Reports*, vol. 12, no. 3 (2024): 42-45. doi: 10.12691/ajmcr-12-3-4.

1. Introduction

Brain abscess is a localized suppurative infection of the brain parenchyma that is caused by bacteria, fungi and rarely parasites [1]. It represents a complication arising from nearby infections such as otitis media, sinusitis, periodontal diseases, and dental abscesses [2]. Microorganisms from these infections spread contiguously. Alternatively, systemic infections predominantly endocarditis result from microorganisms spreading via the bloodstream [3]. Trauma to the craniofacial region, including neurosurgical interventions, can also serve as an entry point for these microorganisms [4]. Additional predisposing conditions include cardiac right-to-left shunts, such as congenital heart disease, and compromised immune systems, like those seen in solid organ transplant recipients [2,5]. The exact incidence rate of brain abscess remains uncertain; however, it has been approximated to fall within the range of 0.2 to 1.9 cases per 100,000 person-years [5].

2. Case Report

This case report describes a 42-year-old lady with a medical history significant for Ebstein anomaly, atrial flutter, and hypothyroidism. The patient presented with a two-week history of severe headache, visual disturbance, on-and-off fever, and upper respiratory tract infection symptoms. Neurological examination revealed a left visual field hemianopia, but no other focal neurological deficits. Imaging studies, including CT and MRI scans (Figure 1), identified a right occipital iso-dense mass lesion with perilesional edema, indicative of a brain abscess.

Blood culture was negative, and the inflammatory markers showed a white blood cell count of 8.6 (range 2.4-9.5x10^3 /uL) and a C-reactive protein level of 1.56 (range 0-5 mg/L), indicated the absence of significant systemic inflammation. Due to her comorbidities and the risks associated with general anesthesia, she underwent

awake surgery under navigation guidance, burr hole drainage of the abscess. The pus sample's direct microscopy revealed the presence of gram-positive cocci and gram-negative bacilli with a 4+ pus cell count. Pus culture aerobically grew gram-negative bacilli(Figure 2), characterized by rough, convex, round, or irregular-edged, gray, translucent colonies with a pit in the agar and a non-hemolytic nature (Figure 2), identified as *Eikenella corrodens*.The anaerobic cultures exhibited a combination of gram-negative long and thin bacilli with tapered ends and gram-positive cocci, specifically identified as *Fusobacterium nucleatum and Parvimonas micra* (Figure 3). Identification of these microorganisms were performed by automated identification system; Vitek and confirmed using Matrix Assisted Laser Desorption/Ionization Time Of Flight Mass Spectrometry (MALDI-TOF MS). Following the surgery, the patient was started empirically on intravenous ceftriaxone 2 grams twice daily and intravenous metronidazole 500 mg three times daily.

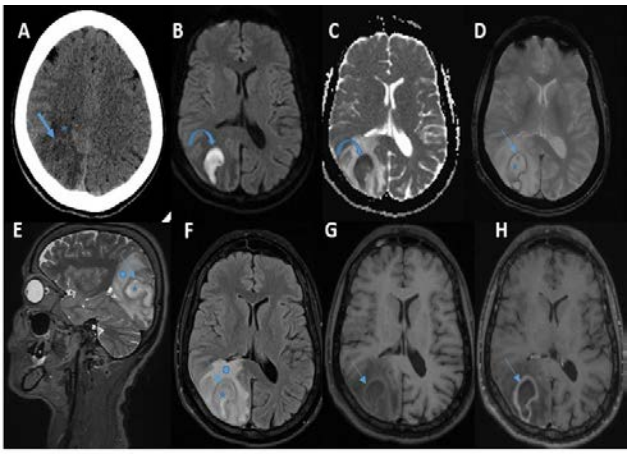

Figure 1. In the right parieto-occipital region, an irregular space occupying lesion was seen A. Axial CT head shows a hypodense center with hyperdense rim (arrow) surrounded by vasogenic edema (star). B & C the lesion shows diffusion restriction centrally (curved arrow). D: The wall of the lesion shows blooming on SWI sequence (arrow). E & F : The lesion shows high signal centrally on sagittal T2 & axial FLAIR sequences (star) and rim of dark signal (arrow) with surrounding vasogenic edema (circle). G: The rim of the lesion is hyperintense on T1 with central hypointense signal. H: Post contrast administration, the lesion shows smooth peripheral enhancement

Immediate postoperative CT revealed surgical changes with pneumocephalus and associated brain edema, but no significant midline shift. The patient remained afebrile and was referred to a local hospital for continued prolonged antibiotic course therapy. She completed a 6-week course of ceftriaxone and metronidazole, followed by a repeat MRI to assess progress which showed full resolution of brain abscess with no residual infection. Due to her original cardiac disease, she was seen by a cardiologist and evaluated for possible continuous risky source of infection with an echocardiogram which showed no vegetation or evidence of infective endocarditis. The case was also referred to Ear, Nose and Throat and dentistry specialists for further evaluation and follow up. The plan is for her to have regular follow up under neurosurgery for months to make sure no complication or recurrence occurs.

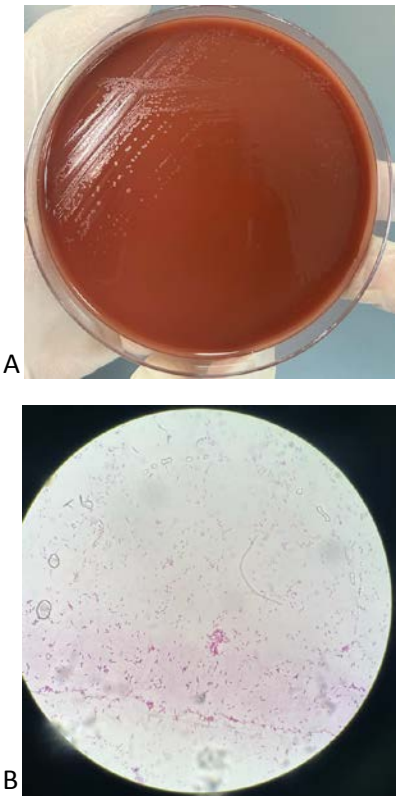

Figure 2. A The growth of Eikenella corrodens can be seen by the small, greyish colonies that typically create agar depressions (or "pits"). B Gram stain of Eikenella corrodens shows pleomorphic bacilli that sometimes appears coccobacillary

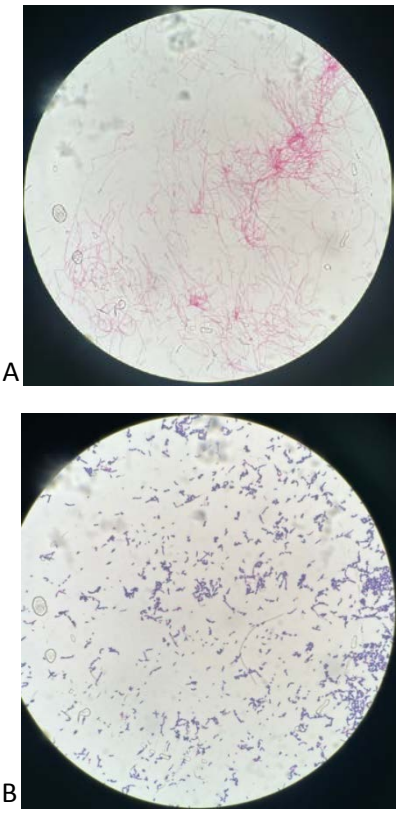

Figure 3. A Gram stain of Fusobacterium nucleatum observed as moderately long and thin bacilli with tapered ends and typical fusiform morphology B Gram stain of Parvimonas micra shows gram positive small cocci or cocco-bacilli

3. Disscussion

Eikenella corrodens, initially identified by Eiken in 1958, is characterized as a facultative anaerobic Gram-negative bacillus. It is commonly found in the oral and upper respiratory tracts and has been associated with conditions such as meningitis and the formation of abscesses, accompanied by necrosis of the affected tissue [6]. It displays a distinctive antimicrobial susceptibility pattern and tends to be susceptible to penicillin but resistant to penicillinase-resistant penicillins like dicloxacillin. Additionally, it shows resistance to macrolides, metronidazole, and aminoglycosides [7].

Parvimonas micra, formerly known as *Peptostreptococcus micros* and *Micromonas micros*, is a gram-positive anaerobic coccus typically present in various areas of the body, including the oral cavity, respiratory system, gastrointestinal tract, and genitourinary tract [8]. Currently, there is limited research exploring brain abscesses caused by *P. micra*. Only around 16 case reports have been published regarding this specific occurrence [8,9] [11,12,13,14,15]. Identifying *P. micra* can pose challenges through conventional culture or 16S ribosomal RNA gene sequencing [13]. However, accurate identification is achievable through Matrix-Assisted Laser Desorption/Ionization Time-Of-Flight Mass Spectrometry (MALDI-TOF MS) [17]. There is considerable uncertainty about the most suitable antibiotic regimen for treating *P. micra* infections. Penicillin, amoxicillin (with or without clavulanic acid), piperacillin (with or without tazobactam), cefoxitin, ceftriaxone, imipenem, meropenem, ciprofloxacin, clindamycin, and metronidazole have all shown effectiveness against *P. micra*. Although certain strains of *P. micra* may exhibit resistance to metronidazole, the antibiotic therapy commonly used for most *P. micra* brain abscess cases typically involve the concurrent administration of ceftriaxone and metronidazole [11].

Fusobacterium nucleatum is a gram-negative anaerobic bacterium that is abundant in both the human oral cavity and the gastrointestinal tract [17]. *Fusobacterium* species can lead to cerebral abscesses through the hematogenous spread of bacteria originating from various sources such as dental infections, bronchiectasis, lung abscesses, and empyema. It is notable that in some cases of Fusobacterium-caused brain abscesses, the primary infection source may not be identified [18]. At the therapeutic level, azithromycin, metronidazole, clindamycin, and colistin are deemed effective against *Fusobacterium* species. However, there have been instances of reduced susceptibility to neomycin, erythromycin, amoxicillin, and ampicillin observed in some cases. The production of β-lactamase or penicillinase by *F. nucleatum* has been documented, contributing to resistance against certain antibiotics [19].

The medical history of the patient in the current study indicates a predisposing factor of systemic infection due to hematogenous diffusion, specifically congenital heart disease. Additionally, the patient exhibited very poor oral health, which might have contributed to a local spread of pathogens through contiguous means. Certainly, odontogenic foci account for approximately 13.6% of brain abscess cases [20]. Among these, the estimated overall mortality rate for odontogenic brain abscesses is about 8.3% [21].

Swift and accurate diagnosis coupled with appropriate treatment significantly decreases the mortality rate associated with brain abscesses, especially in patients without predisposing factors like congenital heart diseases, pulmonary hypertension, or multiple brain abscesses. Typically, treating cerebral abscesses involves a combination of surgical intervention and antibiotic therapy [6].

In this case report, the initial treatment for the patient involved a combination of ceftriaxone, metronidazole. Streptococci, Gram-negative aerobes, and strict anaerobes are frequently implicated in brain abscesses. Third-generation cephalosporins are favored due to their excellent penetration of the central nervous system, making them the preferred drug. However, the diversity of antibiotics commonly used for this condition, coupled with the limited number of cases observed, hinders the establishment of a standardized therapeutic regimen. Additionally, susceptibility testing is challenging due to the fastidious growth of these microorganisms and the potential production of beta-lactamases.

4. Conclusion

This case report highlights the complexity of managing a brain abscess in a patient with congenital heart anomalies. Multidisciplinary collaboration involving neurosurgery, medical microbiology, infectious diseases, and cardiology is crucial for optimal patient care. The importance of prolonged antibiotic therapy and vigilant follow-up for potential cardiac complications in this unique patient population is emphasized.

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