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Case Report

Prevotella brain abscess in a healthy patient with a patent foramen ovale: Case report

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ABSTRACT

Background: Brain abscesses are relatively rare life-threatening infectious lesions often concomitant with a direct spillover of inflammation in the head or neck, hematogenous infections, and immunocompromised conditions. They rarely occur in adults without such predisposing factors. *Prevotella* is a well-known dental pathogen that very rarely causes brain abscesses.

Case Description: We report such an abscess in a 51-year-old man who was innately healthy and had no oral lesions. A comprehensive computed tomography examination of the chest, abdomen, and pelvis, was inconclusive but a transesophageal echocardiogram bubble study revealed a mild patent foramen ovale (PFO) that matched Grade 1 criteria. We deduced that the right-left shunt due to the PFO could have contributed to the brain infection and treated the patient successfully via surgical abscess aspiration and antibiotics.

Conclusion: In case of a brain abscess occurring in healthy adults, it is essential to investigate the source of infection and the existence of an arterio-venous shunt, such as PFO.

Keywords: Brain abscess, Patent foramen ovale, *Prevotella*

INTRODUCTION

Brain abscesses are relatively rare, with a prevalence of 0.4–0.9/100,000 people, but they are the most severe with a fatality rate of 10% at onset.[1,7,11] They often arise from contiguous sources, such as otolaryngological or odontogenic infections, hematogenous spreading to a distant site, or after trauma and surgery.[2] However, primary sources of brain abscesses may sometimes remain unknown.

The most common microorganisms reported in brain abscesses are from Streptococci, Bacteroides, and Enterobacteria families in addition to *Staphylococcus aureus*.[9] In contrast, brain abscesses caused by *Prevotella* species are very rare.[16] Brain abscesses can also develop after congenital heart disease repairs, such as a right-to-left shunt via the patent foramen ovale (PFO) that causes paradoxical embolization with a bacterial mass.[13]

Here, we report on a *Prevotella* brain abscess that occurred in a healthy adult with an undiagnosed PFO and also review relevant literature.

CASE DESCRIPTION

A 51-year-old previously healthy man who had no apparent oral cavity lesions presented with a headache and speech disturbance that had been present for a week. He had no history of trauma, surgery, or medical treatment for any serious illnesses, including immunological disorders. At the time of his visit, he had no fever and no signs of meningeal irritation. Blood sampling at the time of admission showed a white blood cell count of 9470/μL, a C-reactive protein level of 1.54 mg/dL, and an erythrocyte sedimentation rate of 85 mm, indicating mildly elevated parameters, but there were no decreases in complement or antibody levels. Head computed tomography (CT) on admission showed a mass lesion with brain edema in the left frontal lobe [Figure 1a]. He had no obvious symptoms or objective signs of infectious diseases, such as sinusitis, otitis media, odontogenic infections, or meningitis. Gadolinium-enhanced magnetic resonance imaging (MRI) revealed a mass in the frontal lobe with ring-enhancement while diffusion-weighted imaging (DWI) showed significant diffusion restriction, leading to the diagnosis of a brain abscess [Figure 1b-d].

On the day after admission, we drained the abscess through a drainage tube from the lesion cavity and aspirated a light red mucus. Although the patient's blood cultures were negative, *Prevotella intermedia* was detected in the surgical cultures. Since *P. intermedia* is an oral endogenous bacterium, a dentist examined the patient, but no noticeable lesions were found in the oral cavity. Contrast-enhanced chest, abdomen, and pelvis CT scans, coupled with transthoracic echocardiography to scrutinize the infection source and possible arterio-venous (AV) shunts, were unremarkable. However, a transesophageal echocardiogram (TEE) bubble study (based on bubbles detected in the left atrium) revealed several reproducible bubbles within a three-heartbeat span in the left ventricular system, suggesting the presence of a Grade 1, mild PFO [Figure 2]. We deduced that the brain abscess developed due to a paradoxical bacterial embolism through the PFO since the causative agent was an oral commensal and there was no further evidence suggesting another etiology for the brain abscess other than through the PFO.

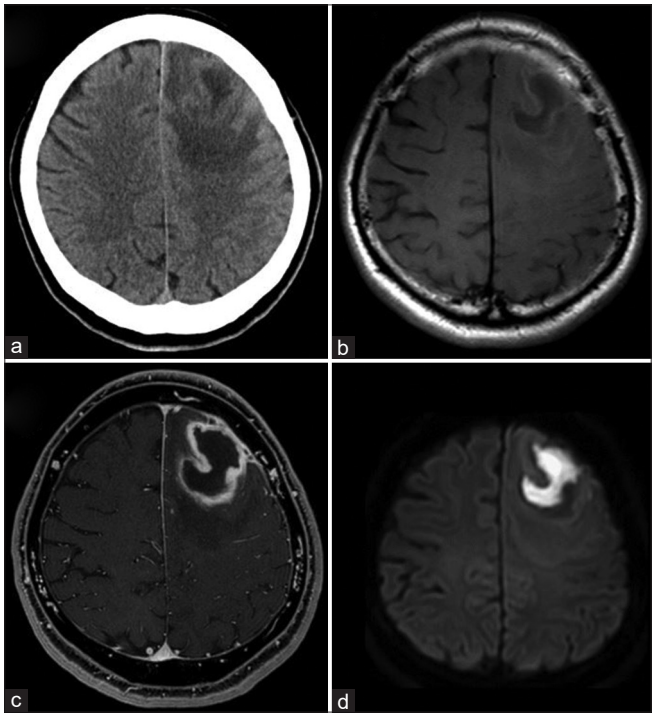

Figure 1: (a) A non-contrast head computed tomography on admission showing a mass lesion with edema in the left frontal lobe. (b) A non-contrast T1-weighted magnetic resonance (MR) image showing a mass lesion in the left frontal lobe. (c) A gadolinium-enhanced MR image showing a ring-enhancement. (d) A diffusion-weighted image (without gadolinium) showing a significant restriction of diffusion in the lesion.

Antimicrobial therapy was initially guided by the literature, with third-generation cephem, vancomycin, and intravenous dexamethasone for cerebral edema. Since anaerobic bacteria were suspected as the causative organism of the abscess, the antibiotic was changed to cefmetazole. After detecting *P. intermedia,* along with the results of sensitivity testing to antibiotics, piperacillin-tazobactam and metronidazole were used [Figure 3]. To confirm the effect of these drugs, an MRI was performed 2 weeks after surgery and the size of the brain abscess was greatly reduced on DWI. These antimicrobial drugs were continued and the abscess clearly shrank 2 months after admission. Three months after admission, the patient was discharged home without any sequelae. After discharge from the hospital, the antibiotics were changed to oral metronidazole and amoxicillin. One month after discharge from the hospital, the oral metronidazole was discontinued due to the appearance of peripheral neuropathy,

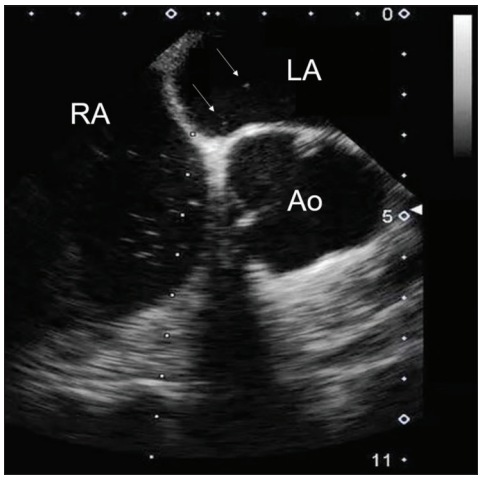

Figure 2: Transesophageal echocardiogram bubble study showing air bubbles (arrow). RA: the right atrium, LA: the left atrium, Ao: the aorta.

which was thought to be a side effect of the drug. One and a half months after discharge, the antibiotic was terminated (since the erythrocyte sedimentation rate was normalized) and a head MRI showed a further reduction in abscess size [Figure 3].

DISCUSSION

In this case, abscess drainage was performed before antimicrobial therapy as recommended by guidelines when the causative pathogen cannot be identified.[2] The microorganisms causing brain abscesses vary depending on the infection pattern, but Streptococcus is the most common in healthy individuals.[10] *P. intermedia* is an anaerobic gram-negative rod-shaped bacteria most commonly detected in periodontal diseases;[5] however, brain abscesses caused by this Gram-negative, obligate anaerobe are very rare.[16] Its hematogenous infections are less frequent than the contiguous spread and, to our knowledge, there have been only seven cases with such hematogenous infections reported [Table 1]. The average patient age, according to these reports, was 34.5-years-old and five were men. Two types of hematogenous infections exist: one is associated with severe systemic infections while the other is PFO-associated without systemic involvement. Brain abscesses caused by hematogenous *Prevotella* infection tended to form multiple rather than solitary lesions, were most commonly located in the frontal lobe, and 5 out of 7 cases (including this case) were

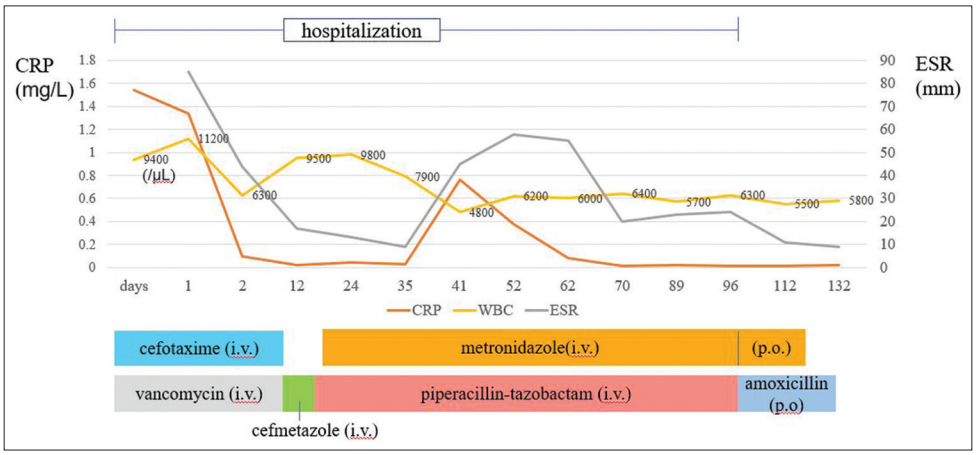

Figure 3: The inflammatory response level and duration of antibiotic use during treatment. CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, WBC: White blood cell.

Table 1: Summary of *Prevotella* brain abscess cases that occurred due to hematogenous infection.

Author, Year	Case No.	Age/Sex	Source	PFO	*Bacteria*	Location	Number of lesions	Outcome
Fredericka *et al*., 1982	1	21/F	Infective endocarditis	N.D.	*Prevotella oralis*	Frontal lobe	Single	GR
Huits *et al*., 2006	2	17/F	Septicemia	N.D.	*Prevotella bivia*	Frontal and occipital lobes	Multiple	GR
Sakamoto *et al*., 2009	3	46/M	Pyothorax	N.D.	*P. species Streptococcus species, P. micros, Peptostreptococcus anaerobius*	Frontal lobe	Multiple	GR
Horiuchi *et al*., 2012	4	55/M	Odontogenic	Yes	*P. intermedia, Bacteroides fragilis, P. micros*	Frontal lobe	Multiple	GR
Wu *et al*., 2014	5	32/M	Odontogenic	N.D.	*P. species*	Frontal and temporal lobes	Multiple	GR
Han *et al*., 2016	6	20/M	Odontogenic	Yes	*P. species*	Frontal lobe and cerebellum	Multiple	GR
Present Case, 2021	7	51/M	Odontogenic	Yes	*P. intermedia*	Frontal lobe	Single	GR

M: Male, F: Female, GR: Good recovery (defined as a report that the patient has been discharged from the hospital due to improvement or disappearance of symptoms), N.D.: Not described, PFO: Patent foramen ovale, *P. species: Prevotella species, P. micros: Peptostreptococcus micros, P. intermedia: Prevotella intermedia*

mono-microbial. With the use of appropriate antibiotics, the prognosis, as seen in the present case, is favorable.

Brain abscesses in healthy individuals are rare[6] and, in 20–30% of cases, the source of infection is unknown.[17] Even if the abscess itself is treated, there is always a risk of recurrence if the infection source is left untreated, highlighting the need to thoroughly search for the source of infection. Echocardiography and transcranial doppler ultrasound are used to detect right and left shunts[3] but mild PFO is often undetectable by transthoracic echocardiography alone; thus, a detailed examination by TEE is necessary. In the present case, TEE combined with the microbubble test improved detection accuracy since the presence of microbubbles in the left ventricular system during a three-to-five-heartbeat span is suspicious and indicative of PFO. Negative results from this test may lead to differential diganosis of an extracardiac shunt, such as a pulmonary AV fistula.[4,12] In the present case, bacteria from the oral cavity were thought to be transmitted hematogenously via the PFO and, as such, anatomic closure of the PFO with good oral hygiene seems to be the best course of action for preventing recurrences. However, there are few reports of PFO closure for brain abscess recurrence prevention and its usefulness remains unclear.[8,15]

In the present case, we decided to closely monitor the patient rather than perform PFO closure because the shunt volume was small and there were no PFO-related symptoms. In the case of cryptogenic ischemic stroke, PFO closure is associated with a lower rate of recurrent ischemic strokes than medical therapy alone.[14] However, there are no reports demonstrating its usefulness for brain abscess prevention. Therefore, any indication for PFO treatment from the viewpoint of preventing brain abscess recurrence should be carefully determined.

CONCLUSION

We treated a brain abscess caused by *P. intermedia* in a healthy adult with undiagnosed PFO. Since, even in healthy adults, the small size of a PFO can cause brain abscesses, it is essential to conduct a thorough search for the source of infection in such patients. When a brain abscess occurs in a healthy person, a comprehensive examination is required to identify the source of infection and the presence of an AV shunt, including TEE with microbubble testing.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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