

# An atypical presentation of polymicrobial gas-forming brain abscess in the setting of congenital heart disease and infective endocarditis

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## Abstract

Brain abscess is a rare, yet life-threatening infection. It may arise from local spread of an adjacent infection, or through hematogenous spread from a distant site. Diagnosis of brain abscess can be challenging given the wide spectrum of presenting features. Classically, the infection is facilitated by a number of predisposing factors including immunosuppression and structural heart diseases. Here, we describe the case of a 43-year-old woman with an uncorrected congenital heart disease, and who presented with a stroke-like picture. She turned out to have a gas-containing brain abscess caused by rare organisms in the setting of infective endocarditis.

## Keywords

prevotella oris; stroke; brain abscess; septic emboli

## Back Ground

Brain abscess is an uncommon and life-threatening infection [1], which mostly results from predisposing factors, such as an underlying disease, treatment with immunosuppressants, disruption of the blood-brain barrier, or a systemic source of infection – mainly endocarditis or bacteremia [2].

Infective Endocarditis (IE) causes neurological complications in 55% of cases [3], of which 12% were attributed to brain abscesses. Those, however, are rarely gas-forming, and the majority results from either contiguous infections such as sinusitis, hematogenous spread secondary to a systemic infection, or abnormal fistulous communication secondary to skull fracture or sinus surgery [4]. In gas-forming brain abscesses, *Klebsiella pneumoniae* has been reported as the most common causative pathogen, followed by *Streptococcus viridans*, *Pseudomonas aeruginosa*, and *Peptostreptococcus species* [4].

To the best of our knowledge, we are reporting the first case of a gas-containing brain abscess cau-

sed by *Prevotella oris* and *Streptococcus anginosus* in a patient with congenital heart disease (CHD) and IE.

## Case Report

A 43-year-old woman presented with severe bi-frontal headache, associated with nausea, and partially relieved by analgesics. Her family reported slowness in her mental function, and a past medical history of uncorrected cyanotic CHD, situs inversus, and a right frontal sterile brain abscess that was evacuated 4 years prior to presentation. Neurologic examination was remarkable for slowness in response, paraphasic errors, and partial left central facial palsy.

A Computed Tomography (CT) scan of the brain showed a left fronto-parietal subarachnoid hemorrhage with no evidence of dural vein thrombosis or intracranial aneurysms on contrast examination. Magnetic Resonance Imaging (MRI) of the brain showed evidence of an acute cortical-subcortical infarct in the left parietal lobe with hemorrhagic transformation, and an old area of gliosis in the right frontal lobe, representing a remnant of the previous abscess.

During her hospitalization, the patient experienced right-sided weakness, along with persistent fever and decreased level of consciousness, for which she required intubation afterwards. A transthoracic echocardiography was then performed, showing evidence of aortic valve vegetations consistent with endocarditis, dextrocardia, tricuspid atresia, pulmonary valve stenosis, and septal defects. Blood cultures were obtained and the patient was empirically started on vancomycin, gentamicin and amoxicillin. Afterwards, repeat brain imaging showed evidence of pus and abscess formation. Meropenem was then added to the antibiotic regimen.

Subsequently, the patient underwent craniotomy with abscess drainage. Bacterial identification by 16s ribosomal RNA sequencing identified *Prevotella oris* and *Streptococcus anginosus*. Blood cultures returned positive for coagulase-negative staphylococci. Four days post-operation, the patient had acute desaturation with asystole that failed resuscitation trials, after which she passed away.

## Discussion

Cerebral emboli, which occur in 10-35% of patients with left-sided IE, result from dislodgment of cardiac vegetations followed by vessel occlusion and various degrees of infarction [5, 6]. The main risk of neurologic complications is the delay in diagnosis and the subsequent absence of appropriate, timely antibiotic therapy [6]. Although the majority of cerebral emboli in IE patients are clinically silent, ischemic events account for 40- 50% of clinically apparent neurological complications, surpassing meningitis and brain abscess, which occur in around 12% [5].

Although less than 5% of patients with brain abscess have IE, this complication should be suspected when multiple abscesses of obscure sources are present. Most brain abscesses observed in the setting of IE are caused by *Staphylococcus aureus* [6].

Gas-containing brain abscesses usually result from glucose fermentation by gas-forming organisms, or from escape of air into the cranium through an abnormal communication [4]. A study of the clinical features of patients with gas-containing brain abscesses by Su et al included 11 patients during a 27-year period. The predisposing factors included hematogenous spread in five patients, contiguous infection in one patient, and abnormal fistulous communication due to head injury in four other patients. *Klebsiella pneumoniae* was found to be the most common causative pathogen [4]. While most brain abscesses are formed in a polymicrobial setting [7,8], coinfections with *Prevotella oris* and *Streptococcus anginosus* have not been reported before.

*Prevotella* is a gram-negative, obligately anaerobic, non-motile rod [1]. *P. oris* is known to be associated with oral and systemic infections [9]. A review in 2014 of 29 cases of *Prevotella* brain abscesses found that the most common infectious source was odontogenic (41%), followed by otogenic (28%), and sinusitic (21%) [1].

*Streptococcus anginosus* is a member of the viridans group streptococci. It is a commensal microbe of the mucosae in the oral cavity and urogenital tract. It is unique among the viridans group in forming abscesses and causing endocarditis [10]. In one review, the brain was involved in over 90% of cases of *S. anginosus* disseminated infections [10].

The clinical scenario in the present case is distinctive in the presumption that septic emboli secondary to IE caused an ischemic stroke at first, which was then followed by evident brain abscess formation. Presence of gas within abscesses aids in the diagnosis and is known to be caused by anaerobic infections, likely by *P. oris* in our case.

Although most cases of *Prevotella* brain abscesses are the result of an oro-facial infection spread, no evidence of such an infection was identified in our patient. Moreover, the fact that the patient had an uncorrected CHD, along with echocardiographic evidences of right-to-left shunting, facilitated brain abscess formation. In patients with a right-to-left shunt, accumulation of a bacterial mass without being trapped in the pulmonary microcirculation may lead to the embolization of the cerebral microcirculation, causing brain abscess formation [11].

## Conclusion

To the best of our knowledge, our patient is the first in the literature to have a gas-containing brain abscess caused by *Prevotella oris* without a clear odontogenic source, and the first to have *P. oris* coinfection with *S. anginosus*. The route of these organisms to the brain is presumed to be facilitated by the patient's congenital cardiac shunting, and the formation of the abscess by these organisms was enabled by an ischemic environment provided by septic emboli due to IE.

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