**Prevotella** Brain Abscesses and Stroke Following Dental Extraction in a Young Patient: A Case Report and Review of the Literature

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**Abstract**

A brain abscess is a life-threatening infection. There are few reports describing *Prevotella* bacteremia with middle cerebral artery (MCA) occlusion and brain abscess following dental extraction in the literature. We herein describe a 32-year-old healthy man who experienced headache after tooth extraction. He was not correctly diagnosed until he experienced a stroke and a blood culture revealed *Prevotella denticola* weeks later. This case and our detailed review of related cases highlight the importance of thorough medical history-taking and clinical evaluations. Brain abscess formation should be considered in previously healthy patients with fever, stroke, and a recent history of tooth extraction.

**Key words:** brain abscess, dental extraction, *Prevotella*, stroke


**Introduction**

A brain abscess is an uncommon and life-threatening infection with an incidence of about 1 in 100,000 in the United States (1). The mortality rate was between 30 and 60% in the early 1970s but has decreased to 0 to 24% (2, 3) due to increased availability of neuroimaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI); more effective antibiotics; and improved surgical techniques. Despite the obvious reduction in mortality, brain abscess is a dangerous condition that can cause serious disability or even death.

Brain abscesses are frequently polymicrobial. The most common microorganisms reported in brain abscesses are *Streptococci* (60%), *Bacteroides* spp. (30%), enterobacteria (25%), *Staphylococcus aureus* (12%), fungi (12%), and protozoa or helminthes (<1%) (1). The most common cultivated bacteria in hematogenous brain abscesses is *Viridans Streptococci* (4). Comparatively, brain abscesses caused by *Prevotella* spp. are relatively rare. This report describes a case in which *Prevotella* spp. were isolated from a hematogenous brain abscess. In addition, we review the previously reported cases of brain abscess yielding *Prevotella* spp.

**Case Report**

We herein describe a previously healthy 32-year-old man with no history of systemic disease. He had undergone tooth extraction in January 2007. Afterwards, he experienced progressive headache for nine days and was admitted to a regional hospital. Cerebrospinal fluid (CSF) and two sets of blood cultures were collected, but the findings were negative and did not identify a definite etiology. He was discharged after being hospitalized for six days, during which time his headache improved. Five days later, he experienced headache with sudden onset of left upper limb weakness and left facial palsy and was re-admitted to the regional hospital.

At presentation, his consciousness level was E4V5M6. The patient’s temperature was 37.4°C, his pulse rate was 88 beats per minute, his respiratory rate was 18 beats per minute, and his blood pressure was 134/82 mmHg. Upon physi-
Table 1. The Antibiotic Susceptibility of \textit{P. denticola} from Blood Cultures at the Regional Hospital

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Susceptibility</th>
<th>Antibiotics</th>
<th>Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>R</td>
<td>Metronidazole</td>
<td>S</td>
</tr>
<tr>
<td>Ampicillin/Sulbactam</td>
<td>S</td>
<td>Cefmetazole</td>
<td>S</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>S</td>
<td>Cefoxitin</td>
<td>S</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R: resistant; S: susceptible

glycated hemoglobin (HbA1C) serum levels, lipid profile (cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides), C3/C4 levels, anti-nuclear antibody, anti-dsDNA, rheumatoid arthritis factor test, electrocardiography (ECG), and trans-esophageal echocardiogram (TEE) were all unremarkable. The patient’s tests for rapid plasma regain and human immunodeficiency virus antibody were non-reactive. The carotid Doppler revealed slight stenoses (left/right: 16%/15%). Two sets of blood culture collected on the day of admission yielded \textit{Prevotella denticola}, and the susceptibility is shown in Table 1. This result indicated that the patient had experienced a septic embolic ischemic stroke. The antibiotics regimen was changed to meropenem (1 g intravenously every 8 h) at the suggestion of an infectious disease specialist. After treatment, the patient’s blood cultures collected on the ninth day of hospitalization showed no growth, and his headache was improved. He was discharged after completing a 14-day meropenem treatment.

Eleven days later, the patient experienced fever, vomiting, headache, and neck stiffness after waking up in the morning. He was readmitted to the regional hospital, and diclofenac was prescribed. Thereafter, he was transferred to our emergency room (ER). Upon admission to the ER, his consciousness level was E4V5M6, his temperature was 35.9°C, his pulse rate was 64 beats per minute, his respiratory rate was 16 beats per minute, and his blood pressure was 142/78 mmHg. A physical examination revealed neck rigidity and muscle weakness in the left upper limb. A brain CT...
scan showed four ring-enhancement mass lesions in the right fronto-temporal regions and basal ganglia with midline deviation and right uncal herniation (Fig. 3). About four hours after admission, his consciousness levels changed to E3V5 M6 and an ECG revealed sinus bradycardia (42 beats per minute). The patient’s multiple brain abscesses were assumed to be increasing his intracranial pressure. Emergent surgical drainage with external ventricular drain (EVD) was performed, and he was admitted to the intensive care unit (ICU) after surgery.

In the ICU, he was prescribed empirical antibiotics with cefepime (2 g intravenously every eight hours) plus metronidazole (500 mg intravenously every 8 h). On the second day of admission, his TEE showed no cardiac valvular vegetations. He did not show signs of fever or neurological symptoms progression after ICU admission. An odontogenic source of the brain abscesses was suspected after we completely reviewed his clinical course and imaging findings. On the fourth day of admission we switched antibiotics to penicillin plus metronidazole, which was recommended for odontogenic brain abscess; we did not have the susceptibility data from the regional hospital at that time. A follow-up brain CT scan was performed on the eighth day of admission and revealed residual abscesses in the right frontal region and right basal ganglia, and surgical drainage with EVD was performed again. His left limb weakness and left facial palsy recovered slightly after the second procedure. On the 15th day of admission, a new brain CT scan showed the brain abscesses to have significantly improved. We switched the patients from penicillin and metronidazole to the oral form of chloramphenicol (500 mg every 6 h). He was discharged after 18 days of hospitalization. The patient’s clinical course is detailed in Fig. 4.

After discharge, the patient was treated with chloramphenicol for eight weeks. There were no reports of headache, dizziness, or neurological defects noted during his outpatient department follow-up. A brain CT was performed again in June and showed no evidence of an abnormal mass lesion in the brain (Fig. 5).

Discussion

Almost all types of dental procedures can cause bacteremia (5). The most common bacteria isolated from blood samples collected after dental extraction are Viridans group streptococci (46%), followed by Actinomyces spp. (25%), Veillonella parvula (8%), and Bacteroides spp. and Lactobacillus spp. (5%) (5). The development of bacteremia after dental procedures may result in extra-oral complications, such as infectious endocarditis and prosthetic joint infections. There are a handful of reported cases of brain abscess following dental extraction in the literature. The unique feature of our case is the patient’s clinical course; septic embolic ischemic stroke occurred first and was followed by evident brain abscess formation. Prevotella brain abscesses are infrequent. We searched PubMed for English articles using the terms “brain abscess and Prevotella” and “brain abscess and Bacteroides” because the genus Prevotella belonged to the genus Bacteroides before 1990. A total of 21 articles were identified, among which 4 articles containing 15 cases lacked detailed case-specific information (6-9). The remaining 17 articles, including 29 cases, are described in Table 2.

The most common infectious source reported in the literature was odontogenic (12/29, 41%), followed by otogenic (8/29, 28%), and sinusitic (6/29, 21%). Most cases involved brain abscess formation due to contiguous spreading. In addition to Prevotella spp., other genuses of bacteria are isolated in up to 92% (24/26) of cases. The patient described herein is the third case where a brain abscess culture grew a
single *Prevotella* spp.

The etiology of stroke caused by septic emboli from an odontogenic source was quite obvious. First, the patient’s neurological symptoms developed nine days after he underwent a dental extraction. Secondly, the initial brain CT at the regional hospital showed multiple hypodense areas in the right MCA territory (Fig. 1), and the brain MRA revealed occlusion of right MCA (Fig. 2). Thirdly, the blood and brain abscess cultures yielded *Prevotella* spp. Finally, he was a healthy young adult without systemic diseases, such as hypertension, diabetes mellitus, hyperlipidemia, coagulation diseases, autoimmune diseases, or malignancy. There are several pathways by which bacteria of oral origin may enter the cranium. The following pathways have been postulated: 1) by direct extension, 2) by hematogenous spread, or 3) by local lymphatics. Through direct extension, infection may spread along the facial planes to the orbit and the base of the skull. Ultimately, the microorganisms invade the cranium by resorption of bone or through foramina, resulting in brain abscess (1). There were no infectious symptoms in the patient’s face or skull base or any associated infectious findings on his imaging studies. Multiple brain abscesses were found in the territory of the MCA, which is a frequent pattern of hematogenous spread. Furthermore, his blood and
### Table 2-1. Brain Abscesses Caused by *Prevotella* spp. in the Related Literature

<table>
<thead>
<tr>
<th>References</th>
<th>No. of cases</th>
<th>Age</th>
<th>Sex</th>
<th>Infectious source</th>
<th>Route</th>
<th>Bacteria isolates form brain abscess</th>
<th>Management</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>2</td>
<td>22 M</td>
<td>Otogenic</td>
<td>Contiguous spread</td>
<td><em>Bacteroides melaninogenicus</em>, <em>Bacteroides fragilis</em>, anaerobic Streptococcus, Veillonella.</td>
<td>Drainage and penicillin (17 days).</td>
<td>Dead</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>21 M</td>
<td>Sinusitic</td>
<td>Contiguous spread</td>
<td><em>Bacteroides melaninogenicus</em></td>
<td>Drainage and penicillin (6 weeks).</td>
<td>Recovery</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>M</td>
<td>M</td>
<td>Sinusitic</td>
<td>Contiguous spread</td>
<td><em>Bacteroides melaninogenicus</em>, <em>Streptococcus milleri</em> Lancefield group F, <em>Bacteroides melaninogenicus</em>, <em>Citrobacter diversus</em></td>
<td>Surgical aspiration and chloramphenicol (6 weeks).</td>
<td>Recovery</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>&lt;1, M</td>
<td>?</td>
<td>?</td>
<td><em>Prevotella buccae</em>, <em>Prevotella oris</em>, <em>Bilophila wadsworthia</em>, <em>Bacteroides fragilis</em></td>
<td>Surgical aspiration and penicillin (3 weeks).</td>
<td>Recovery</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>55 F</td>
<td>Otogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella buccae</em>, <em>Prevotella oris</em>, <em>Bilophila wadsworthia</em>, <em>Bacteroides fragilis</em> Peptostreptococcus Anaerobius</td>
<td>Surgical aspiration and metronidazole (1 week).</td>
<td>Recovery</td>
<td></td>
</tr>
</tbody>
</table>
brain abscess cultures both yielded the same *Prevotella* spp. These findings are supportive of hematogenous spreading in the present case. No case of brain abscess caused by *P. denticola* has been reported in the literature to date, and there are also no reported cases of septic embolic ischemic stroke originating from tooth extraction and progressing to brain abscess.

The *Prevotella* genus, characterized as gram-negative, obligately anaerobic, non-spore-forming, non-motile rods that are moderately saccharolytic and inhibited by 20% bile broth, were included in the *Bacteroides* genus before 1990. Based on the results of study in 1990, *Prevotella* was proposed as a new genus due to a phenotypically and phylogenetically coherent group of species that was significantly different from the genus *Bacteroides* (10). *Prevotella denticola*, one of the pigmented *Prevotella* species, is a frequent inhabitant of the mouth, even in childhood (11). It is also the predominant species in dental abscesses, with rates of 31.37% (12). In addition to dental and periodontal infection (11, 13, 14), *P. denticola* has been reported to cause superficial face and neck abscesses and endocarditis (15, 16). In the present case, *P. denticola* resulted in a brain abscess.

Once an abscess has formed, surgical excision or drainage combined with prolonged antibiotics is recommended. For *Prevotella* brain abscesses, which usually originate from otoprogenic and dental infection, metronidazole plus a third- or fourth-generation cephalosporin, as well as penicillin plus metronidazole, are two most recommended regimens (17). Surgical drainage with an external ventricular drain (EVD) and antibiotics with penicillin plus metronidazole with prolonged antibiotics is recommended. For *Prevotella* brain abscesses, which usually originate from otoprogenic and dental infection, metronidazole plus a third- or fourth-generation cephalosporin, as well as penicillin plus metronidazole, are two most recommended regimens (17). Surgical drainage with an external ventricular drain (EVD) and antibiotics with penicillin plus metronidazole with prolonged antibiotics is recommended.

### Table 2-2. Brain Abscesses Caused by *Prevotella* spp. in the Related Literature

<table>
<thead>
<tr>
<th>References</th>
<th>No. of cases</th>
<th>Age</th>
<th>Sex</th>
<th>Infectious source</th>
<th>Route</th>
<th>Bacteria isolates form brain abscess</th>
<th>Management</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>1</td>
<td>21</td>
<td>M</td>
<td>Odontogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella</em> sp., <em>Peptostreptococcus micros</em>, <em>Peptostreptococcus prevoti</em>, <em>Streptococcus</em> sp.</td>
<td>Craniotomy+drainage and meropenem.</td>
<td>Recovery</td>
</tr>
<tr>
<td>27</td>
<td>2</td>
<td>33</td>
<td>M</td>
<td>Sinusitic</td>
<td>Contiguous spread</td>
<td><em>Prevotella</em> intermedius, <em>Fusobacterium nucleatum</em>.</td>
<td>No detail</td>
<td>?</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>61</td>
<td>M</td>
<td>Odontogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella</em> intermedius, <em>Fusobacterium nucleatum</em>.</td>
<td>No detail</td>
<td>?</td>
</tr>
<tr>
<td>41</td>
<td>1</td>
<td>41</td>
<td>M</td>
<td>Odontogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella</em> intermedius, <em>Fusobacterium nucleatum</em>.</td>
<td>No detail</td>
<td>?</td>
</tr>
<tr>
<td>55</td>
<td>1</td>
<td>17</td>
<td>F</td>
<td>Post-infectious</td>
<td>Hematogenous spread</td>
<td><em>Prevotella</em> sp.</td>
<td>Benzyll-penicillin + metronidazole.</td>
<td>Recovery</td>
</tr>
<tr>
<td>62</td>
<td>1</td>
<td>46</td>
<td>M</td>
<td>Odontogenic</td>
<td>Hematogenous spread</td>
<td><em>Prevotella</em> sp.</td>
<td>Benzyll-penicillin + metronidazole.</td>
<td>Recovery</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>41</td>
<td>M</td>
<td>Odontogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella</em> sp., <em>Entamoeba</em> sp., <em>H. influenzae</em></td>
<td>Drainage + craniotomy and penicillin+metronidazole (6 weeks)</td>
<td>Recovery</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>61</td>
<td>M</td>
<td>Odontogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella</em> sp., <em>Streptococcus</em> sp., <em>Peptostreptococcus</em> sp., <em>Fusobacterium</em> sp.</td>
<td>Drainage and panipenem/betamipron (2 weeks)</td>
<td>Recovery</td>
</tr>
<tr>
<td>32</td>
<td>1</td>
<td>46</td>
<td>M</td>
<td>Odontogenic</td>
<td>Hematogenous spread</td>
<td><em>Prevotella</em> sp.</td>
<td>Craniotomy+excision and metronidazole(6 weeks)</td>
<td>Recovery</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>35</td>
<td>F</td>
<td>Odontogenic</td>
<td>Contiguous spread</td>
<td><em>Prevotella buccae</em>, <em>Bacteroides</em> sp., <em>Wolinella</em> sp.</td>
<td>Hemicranietomy+drainage+partial lobectomy and panipenem+cefotaxime+metronidazole (6 weeks)</td>
<td>Recovery</td>
</tr>
<tr>
<td>34</td>
<td>1</td>
<td>9</td>
<td>F</td>
<td>Left peritonsillar abscess</td>
<td>Contiguous spread</td>
<td><em>Campylobacter gracilis</em>, No specimen</td>
<td>Antibiotics (6 weeks)</td>
<td>Recovery</td>
</tr>
<tr>
<td>Our case</td>
<td>1</td>
<td>32</td>
<td>M</td>
<td>Odontogenic</td>
<td>Hematogenous spread</td>
<td><em>Prevotella</em> sp.</td>
<td>Drainage and penicillin + metronidazole (2 weeks), followed by chloramphenicol (8 weeks)</td>
<td>Recovery</td>
</tr>
</tbody>
</table>

*Bacteroides melaninogenica* was later changed to *Prevotella melaninogenica*.

*Bacteroides oralis* was later changed to *Prevotella oralis*.

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with no history of systemic disease presents with sudden loss of focal brain function and fever or headache after tooth extraction, septic embolic stroke with brain abscess should be considered. Furthermore, cultures from such patients should be assessed for the presence of *Prevotella denticola*.

The authors state that they have no Conflict of Interest (COI).

**References**
