ABSTRACT

Rarely case of brain abscesses after professional tooth cleaning

Background - Dental disorders and dental treatment are among the variety of causes of brain abscess.
Case description - The authors present the case of a patient who developed multiple brain abscesses after undergoing professional tooth cleaning. The results of a diagnostic work-up ruled out an underlying immunodeficiency. After receiving neurosurgical intervention and intensive care treatment by means of local and intravenous antibiotics for 24 days, the patient was transferred to another hospital for rehabilitation. Six months after the treatment, the patient still had moderate residual paresis of the left leg.

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Multiple brain abscesses in an immunocompetent patient after undergoing professional tooth cleaning

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A brain abscess is an encapsulated focal infection of the cerebral parenchyma (1). It is a severe, life-threatening condition that can result in permanent neurological deficits. The infection may occur as a result of the continuous spreading of bacteria from a contiguous focus directly secondary to traumatic or iatrogenic dural tearing or by means of hematogenous spreading of bacteria after the patient develops bacteremia. Dental disorders and dental treatment are some of the causes of brain abscesses (2). Often, the patient's having a medical predisposition or being immunodeficient promotes the development of brain abscesses (3). We present the case of an otherwise healthy man who had multiple brain abscesses after undergoing professional tooth cleaning.

KEY WORDS

Abscess; prophylaxis; dental care; microbiology; immunology

MRI scans

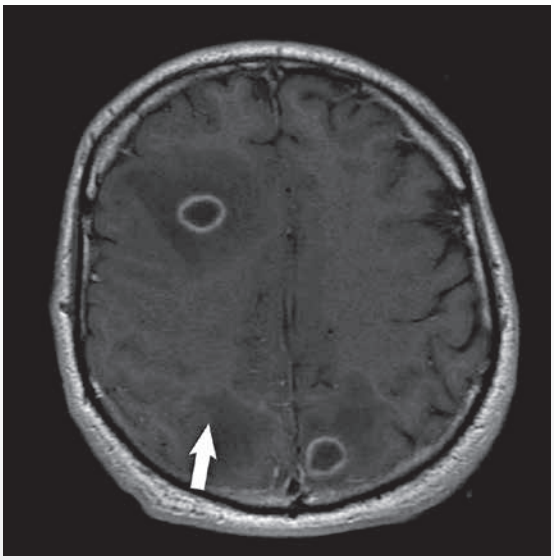

Fig. 1. T1-weighted, gadolinium-enhanced magnetic resonance imaging scan of the cerebrum showing the abscesses as two focal areas of a low T1 signal surrounded by a ringlike structure enhanced by a contrast agent. A third lesion without contrast agent enhancement in the right occipital lobe is another abscess (arrow).

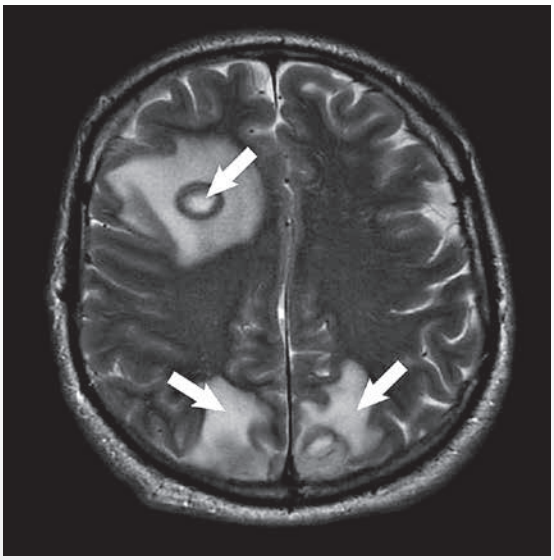

Fig. 2. T2-weighted magnetic resonance imaging scan showing three areas of increased signal intensity indicating edema surrounding the three suspected abscesses (arrows).

Case report

The patient, a 55-year-old man, sought care at a medical center because he had experienced an acute onset of weakness in his left leg. Until then, he had been in good health and had no known pre-existing conditions. The patient reported that he had received a professional tooth cleaning from his dentist 10 days before he was transferred from the medical center to our hospital (University Hospital of Dresden, Germany). He also reported that he began shivering later on the day he had his teeth cleaned and complained of a progressive headache for one week before admission to our hospital.

The professional tooth cleaning was performed as a prophylactic procedure and consisted of polishing the surfaces of the teeth. The patient had chosen to add this additional care to his routine dental care, and it was the third time he had received this treatment. The two previous tooth cleanings were performed without any periprocedural complications. At home, the patient normally brushed his teeth by using an electric toothbrush twice daily. He flossed his teeth only occasionally.

A computed tomographic (CT) scan of the patient's brain obtained at the other medical center revealed multiple cerebral lesions in both hemispheres, which is common in brain abscesses. The diagnosis of brain abscesses was supported by the results of a contrast-enhanced magnetic resonance imaging (MRI) scan the patient underwent on the same day as the CT scan; the MRI scan showed six lesions as typical ringlike structures enhanced by a contrast agent and surrounded by edema (Figs. 1 and 2). The lesions appeared as hyperintense signals in the diffusion-weighted MRI scans, indicating that the lesions were an infection rather than neoplasia (Fig. 3). The patient was transferred to our hospital for a diagnostic work-up and treatment.

We conducted a physical examination of the patient and determined that he had left-sided hemiparesis and mild meningism. The findings of an additional neurological examination and a general medical examination were normal. The patient had no cardiac murmurs. The diagnosis of multiple brain abscesses was confirmed by the results of a neurosurgical drainage procedure in which we found *Streptococcus intermedius* and *Staphylococcus warneri*. Both of these organisms were sensitive to ceftriaxone and vancomycin, and *S. intermedius* also was resistant to metronidazole. We resected two of the lesions neurosurgically, and, because the patient had additional subdural empyema, we inserted an external drain into the falx cerebri to aspirate the pus and administer antibiotics. The patient was transferred to our hospital's neurological intensive care unit after undergoing a procedure in which we initiated intravenous antibiotic therapy with ceftriaxone (2,000 milligrams twice daily), metronidazole (500 mg three times daily) and vancomycin (1,000 mg twice daily) for 24 consecutive days. In addition, we administered 5 mg of gentamicin twice a day by means of the external drain from which we aspirated fluid daily. Because the patient developed focal epileptic seizures during his stay in

Diffusion-weighted MRI sca

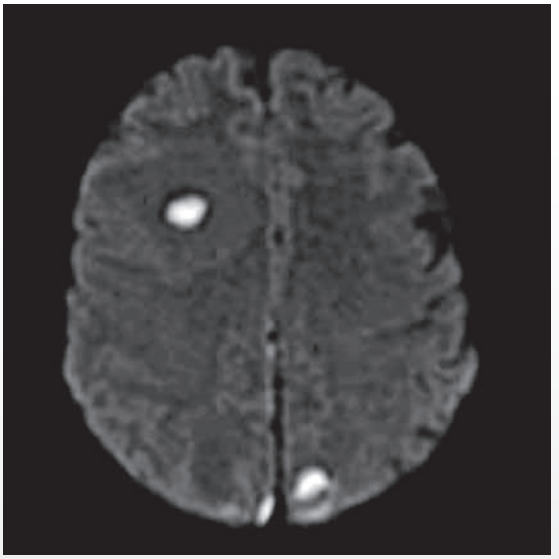

Fig. 3. Diffusion-weighted magnetic resonance imaging scan. The hyperintense signals (the light areas) represent restricted diffusion. This magnetic resonance imaging technique provides differentiation of brain abscesses from other intracranial cystic lesions and other lesions surrounded by ringlike contrast agent enhancement.

the hospital, we also administered the anticonvulsant agent levetiracetam (1,000 mg twice daily).

During the patient's 24-day stay in our hospital, we performed an extensive diagnostic work-up to exclude septic foci and underlying immunodeficiency. The results of an otolaryngological examination did not show a sinusoidal infection.

Examination by an oral and maxillofacial surgeon (H.L.) revealed that the patient had well-treated dentition in which there were no detectable caries, inflammation or abscesses. The patient showed no sign of percussion sensitivity of the maxilla and mandible, and we did not detect any swelling. The patient's periodontal status was unremarkable, and no bleeding occurred on probing. The floor of the mouth was not indurated, no purulence could be expressed from the submandibular gland and the parotid gland, and the saliva was clear. We obtained a panoramic radiograph to rule out a dental-related diagnosis, but it was of poor quality owing to the patient's inability to stand or sit upright in front of the radiograph unit. Therefore, we obtained an additional image made by means of a dental reformatting CT program (DentaScan, GE Healthcare, Milwaukee), which showed no caries, periodontal disease or periapical lesions (Fig. 4). The patient underwent transesophageal echocardiography on two occasions, and the results showed no signs of endocarditis. The results of additional radiological examinations by means of thoracic and abdominal CT scans and spinal MRI scans showed no evidence of an underlying neoplasm or additional abscesses. The results of serologic tests (for example, serum immunofixation, human immunodeficiency virus [HIV] antibody test) excluded other common causes of immunodeficiency.

After receiving treatment in our hospital, the patient was transferred to another hospital for rehabilitation. Six months later, he still had moderate paresis of the left leg but was able to walk without assistance.

Discussion

A brain abscess is rare but life threatening. It consists of a focal cerebral infection surrounded by a well-vascularized capsule. Its clinical presentation is highly variable and depends on the size and location of the abscess, the virulence of the infectious organism and the presence of pre-existing conditions (4). Typical symptoms are headache, nausea, vomiting and an impaired level of consciousness (5,6). In addition to either a direct infection occurring after experiencing a penetrating head injury or undergoing neurosurgery or an indirect infection due to the continuous spread of otogenic infections, hematogenic spread of endocarditis or other septic foci has been reported (7). The latter often results in multiple, bihemispheric abscesses (8), as we observed in our patient. Depending on the size and location of the abscess, focal neurological deficits such as paresis, aphasia, hypoesthesia and symptomatic seizures may occur.

Brain abscesses are rare in developed countries. Although information regarding the incidence of brain abscesses is scarce, the incidence varies from 0.3 to 1.3 cases per 100,000 people in the United States, with 1,500 cases reported annually (9). About 1 to 2 percent of intracranial masses are brain abscess in developed countries (10).

The authors of several case reports have described the odontogenic foci of brain abscesses, mostly in patients with poor oral health or after dental treatment (2,11,12). In these cases, the authors described both modes of infection dissemination, either by means of direct extension via fascial planes or by means of hematogenic or lymphatic spread. Immunodeficiency secondary to HIV infection, alcohol abuse, diabetes, chemotherapy or cancer may promote the development of brain abscesses (1,3). Bacteremia's occurring even as a result of routine daily dental interventions such as toothbrushing has been well documented, although its significance remains unclear (13,14). During oral and maxillofacial surgical procedures, the incision may lead to bacteremia regardless of the extent of the surgical procedure (15).

Rapid initiation of high-dose intravenous antibiotics is essential in the treatment of brain abscesses. A combination of several antibiotics with an extended spectrum of activity should be administered because the responsible organism or organisms usually are not known at the beginning of the treatment, and polymicrobial infection may be possible. Third-generation cephalosporins and metronidazole are recommended empirically, and vancomycin may be added in cases in which patients

with postsurgical or posttraumatic abscesses are infected with bacteria that are resistant to multiple drugs (16). Regarding polymicrobial infection, the oral cavity in particular has a broad variety of different bacteria, which may give rise to polymicrobial infection (11). *S. intermedius* is part of the normal oral microflora and has been found to cause brain abscesses (3,17,18). The authors of one case report described a brain abscess caused by *S. intermedius* after the patient underwent tongue piercing (19). S. *warneri* is a coagulase-negative staphylococcus that commonly resides in the nasal cavity and on the skin, but it also has been cultured in saliva and therefore should be considered normal oral flora (20). Compared with other staphylococci, it is found less frequently to be a human pathogen, but it should be considered in cases of bacterial endocarditis and in patients with nosocomial infections (21).

Even if a bacterial infection was not caused by trauma, it still may cause cerebral infections and brain abscesses. The results of diligently performed diagnostic work-ups may not always reveal the source of the abscess (6).

PRACTICAL IMPLICATIONS

Although it happens rarely, professional tooth cleaning may be considered a cause of brain abscesses even in otherwise healthy patients.

As we did not identify underlying immunosuppression or any additional abscesses or septic foci by means of the diagnostic work-up, we concluded that the most likely cause of the multiple brain abscesses observed in our patient was transient bacteremia that spread hematogenically after the patient underwent a professional tooth cleaning.

To the best of our knowledge, the development of a brain abscess in a healthy patient after receiving a professional tooth cleaning has not been reported. The authors of one case report

Dental reformatting CT

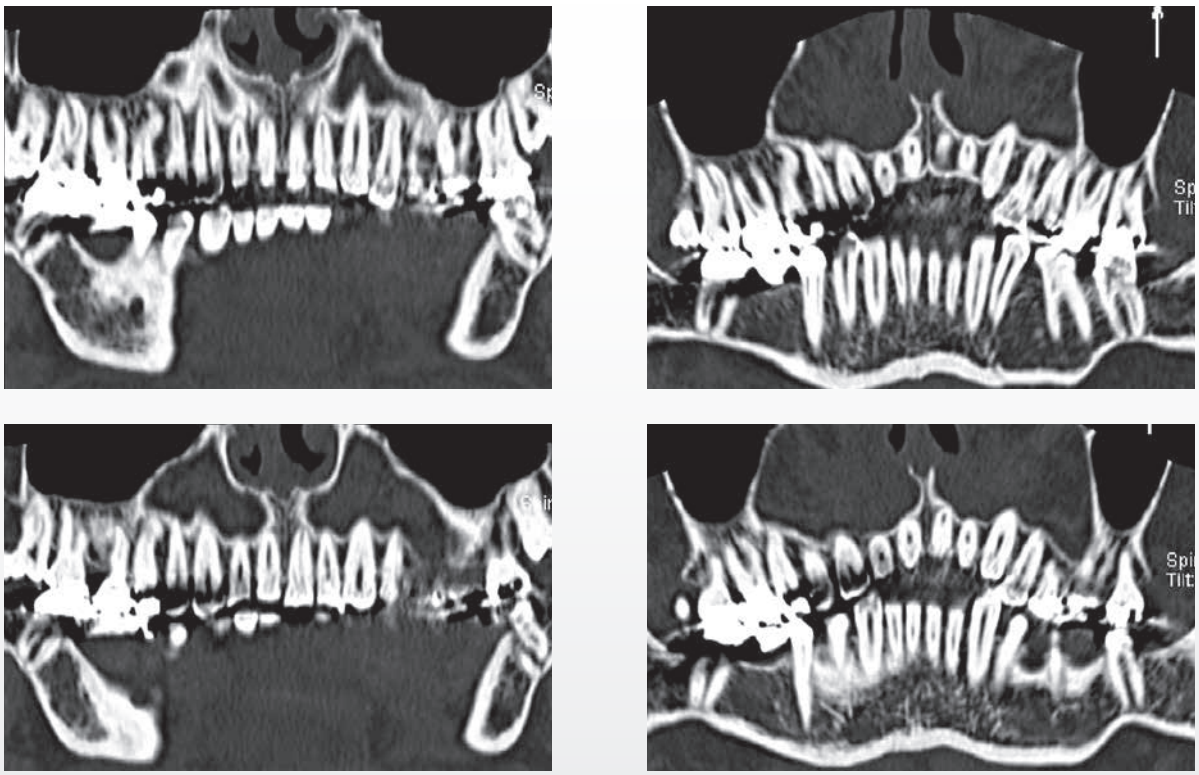

Fig. 4. A series of images made by means of a dental reformatting computed tomography program (DentaScan, GE Healthcare, Milwaukee) showing a restored dental status. Despite the presence of artifacts from dental restorations, the cancellous and cortical alveolar bones of the maxilla and mandible show no evidence of the inflammation typically seen in apical or marginal periodontitis. No mucosal swelling in the maxillary sinus is evident.

described the occurrence of a brain abscess in a patient after routine periodontal recall therapy, but the patient was immunocompromised owing to a hepatitis A infection and a hepatitis B infection and had a history of having various periodontal diseases and of undergoing periodontal procedures (22). The authors of another case report described a brain abscess due to *Eikenella corrodens* in a patient with "overzealous dental cleaning"; however, they did not report having conducted a diagnostic work-up to exclude alternative sources of infection and, in particular, did not rule out endocarditis (23).

Our case report has limitations. First, an oral and maxillofacial surgeon (H.L.) conducted an examination of our patient after he was admitted to our hospital after undergoing the tooth-cleaning procedure. As a result, we could not determine the patient's baseline oral health status. Furthermore, no additional information was available from the patient's dentist regarding the specific type of oral interventions that had been performed. In particular, we could not obtain any detailed information regarding whether any form of scaling or root planing had been carried out.

Conclusion

This case we present suggests that, in individual cases, prophylactic professional tooth cleaning may cause transient bacteremia that may lead to brain abscesses even in patients who are immunocompetent. Specific precautions are not known. Treatment of these patients should be interdisciplinary and involve neurologists, neurosurgeons, dentists and oral and maxillofacial surgeons.

Abbreviation key: CT: Computed tomography. **HIV:** Human immunodeficiency virus. **MRI:** Magnetic resonance imaging.

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