

**Case Report**
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## Brain Abscess of Dental Origin: A Case Report and Literature Review

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### ABSTRACT

**Introduction:** Brain abscess (BA) of dental origin is a rare but potentially life-threatening complication of odontogenic infection that requires immediate neurosurgical attention. It is defined as an encapsulated collection of pus in various areas of the brain.

The infectious process spreads from the dental site and occurs in 2 ways: haematogenous route or by contiguity.

Treatment should ideally be based on the etiological factor excision, combined with drainage and adjuvant antibiotic therapy. The aim of this article was to report a case of frontal brain abscess of dental origin and to review the literature.

**Case report:** We present the case of a 36-year-old man diagnosed with a brain abscess located in the frontal lobe and caused by a periodontal lesion of the right upper first molar.

The final diagnosis was established due to the availability of computed tomography and magnetic resonance imaging.

Drainage of the pus combined with extraction of the tooth and antibiotic therapy was followed by an excellent recovery. Clinical and radiological features, treatment and follow-up data were documented.

A review of the literature using the PubMed database was performed

**Conclusion:** Oral infections can lead to life-threatening infections, such as brain abscesses. Early detection of this condition through correct diagnosis is essential to give the patient the best treatment; in addition, improving of the oral environment and treating oral infections is highly recommended to limit this serious condition.

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### Introduction

Brain abscess (BA) of dental origin is a rare but serious and potentially life-threatening complication of odontogenic infection or dental treatment that requires immediate neurosurgical attention. It is defined as a focal intracerebral infection consisting of an encapsulated collection of pus in various regions of the brain, including the frontal lobe, temporal lobe, occipital region and cerebellum lobes. This condition occurs when oral bacteria from the primary dental infection reach the brain by direct contiguous invasion or by haematogenous route. The incidence of brain abscesses ranges from 0.4 to 0.9 per 100,000, with a high predisposition in immunocompromised patients [1,2].

Recently, advances in neuro-scanning techniques such as CT and MRI, as well as the introduction of more effective antibiotics, have reduced the mortality rate.

The aim of this paper was to report a rare case of a brain abscess caused by a periodontal pocket in a healthy young adult. In the second part of this paper, a literature review is performed to tackle this type of complication.

### Case presentation

A 34-year-old male patient was admitted to the neurosurgery department of Sahloul University Hospital in July 2021 with a 15-day history of headache, vomiting, photophobia and left hemiparesis. Besides heavy smoking there was no relevant medical history. Cranial computed tomography (CT) showed a right frontal mass-like lesion with surrounding vasogenic edema. (fig3)

Magnetic resonance imaging (MRI) revealed a parasagittal lesion located in the right frontal region, 50\*60mm long axis, multilobular with sharp contours and hypointense content in T1, hyperintense in T2, taking the Gado peripherally with perilesional edema. The blood examinations revealed leukocytosis and the C-reactive protein (CRP) level was 11 mg/l. Blood chemistry data were within the normal ranges.

Based on these findings, brain abscess was the primary consideration.

Under general anesthesia, a right paramedian frontal craniotomy was performed. After opening the dura, a greenish viscous fluid

with a foul odor was evacuated and was immediately sent for laboratory analysis, and the abscess drained, the wound was irrigated copiously with saline, and the craniotomy flap was reattached in its normal anatomical position before closing the wound with a 3/0 nylon suture. During follow up, the patient was conscious, with no epileptic crises and was empirically medicated with intravenous Claforan 2g\*6/daily and Metronidazole 2g/daily. In the search for the source of this infection, after examining the whole body for possible “septic” foci with corresponding clinical, imaging and laboratory examinations, the head and neck region was deemed more suspicious. An examination by an otolaryngologist showed no infectious foci.

The patient was therefore referred to the department of oral surgery to assess whether the BA originated from the oral cavity.

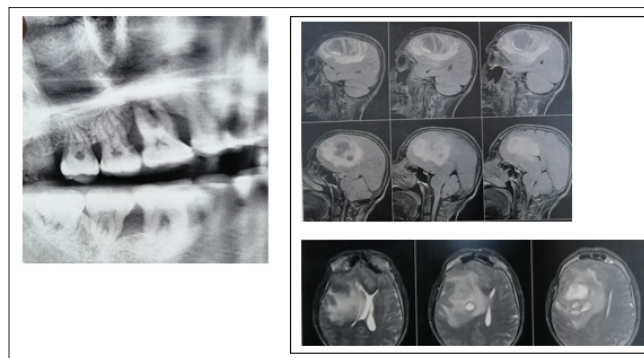
Oral examination revealed bad oral hygiene, generalized gingivitis and halitosis. (fig1)

In particular, the first right upper molar (16) presented a significant mobility and a deep periodontal pocket with a probing depth of 9mm.

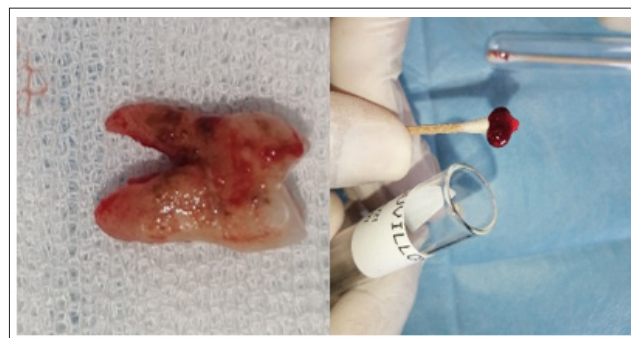
Panoramic radiograph showed severe alveolar bone loss in the tooth 16 as well as a generalized periodontitis. (fig2)

The extraction of the tooth 16 was scheduled 2 weeks after the brain surgery, and was performed under local anesthesia (fig3) and antibiotics.

The follow up was marked with improvement of the overall health status.



**Figure 2:** Panoramic radiograph: generalized periodontal and advanced periodontal bone loss in the first right maxillary molar



**Figure 3:** A. tooth extraction  
B. Specimen collection for microbial analysis

### Discussion

The most common clinical signs suggestive of brain abscess are fever, headache and focal neurological deficits, early symptoms are often non-focal and include headache and nausea [1,5]. In these cases, inflammatory markers may be useful for early detection, although they are not diagnostic. Patients often have leukocytosis and elevated CRP [1]. Our patient presented with headache, vomiting, photophobia and left hemiparesis.

Of the brain abscesses attributed to a head and neck source, which may arise as a consequence of head trauma or cranio-maxillofacial surgery, or be secondary to a “septic” focus, most were located in the frontal lobe, temporal lobe, occipital lobe, multiple locations, frontal lobe and parietal lobe [19]. Brain abscesses are frequently polymicrobial, among the papers reviewed between 2000 and June 2021, *Streptococci viridans* was the most frequently found microorganism, followed by *S. milleri*, *S. sanguis* and *Fusobacterium* [5-7,13]. All of these organisms can be found in the oral cavity and can provide evidence of the etiology of BA. Oral pathogens from an odontogenic infection may enter the brain either by a hematological route (facial, angular, ophthalmic artery, spread through the cavernous sinus), by a lymphatic route or by direct extension through the fascial planes [1,4,7,10]. In both cases presented, the likely cause of brain abscess was hematogenous dissemination of odontogenic bacteremia. The search for the etiological organism in any infection must always be based on solid microbiological methodology. The causative organism must therefore be identified in oral and cranial sites [13,15]. In particular, modern sampling techniques should be used in order to positively confirm the role of an odontogenic infection in the pathogenesis of a brain abscess. BA of dental origin implies adequate treatment consisting of surgical drainage, antibiotic therapy for a long period of time and removal of the dental causative factor by extractions, endodontic treatment or periodontal therapy [1,5]. According to

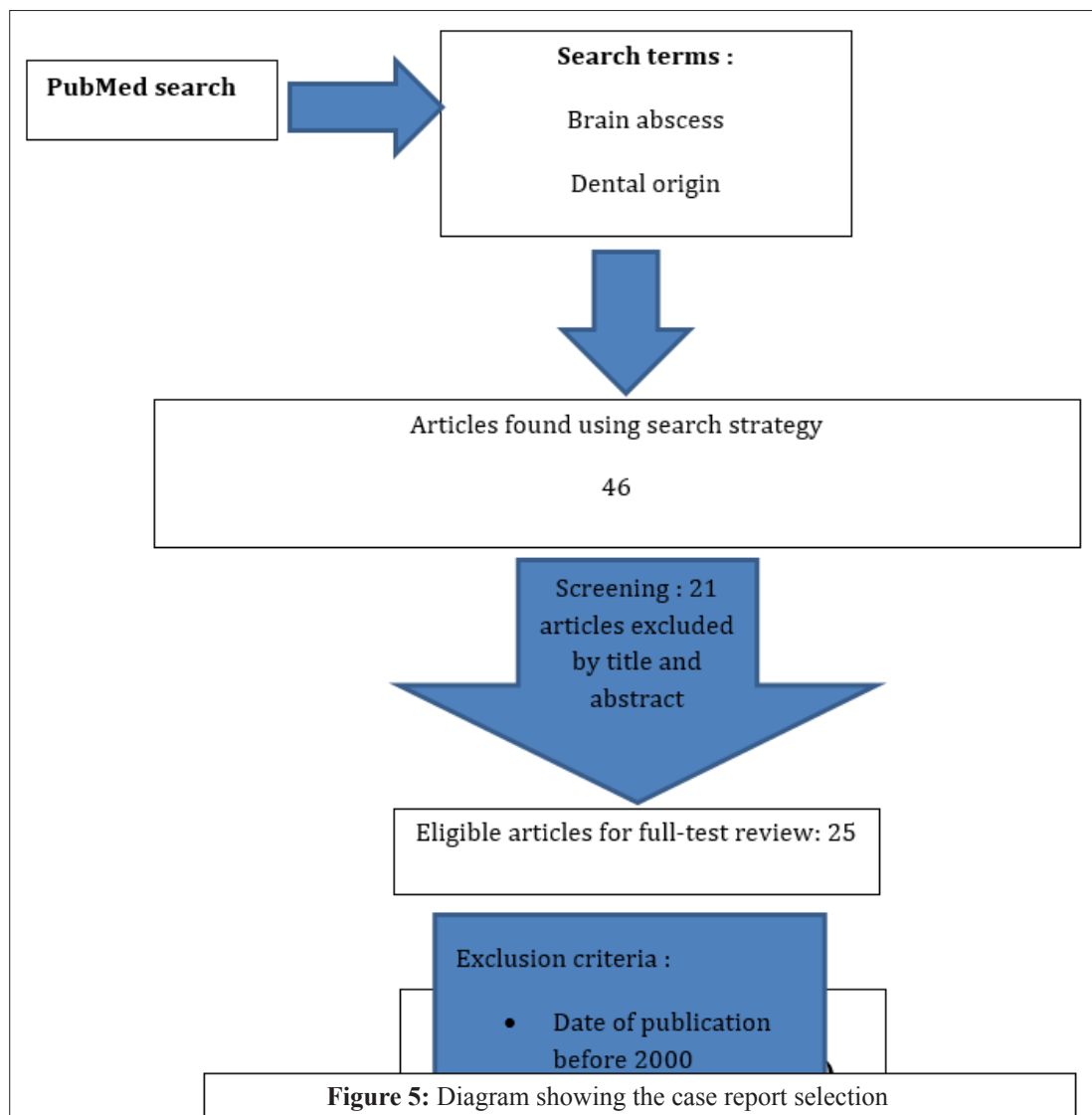


**Figure 1:** Clinical findings and images of the oral cavity showing bad oral hygiene, generalized gingivitis and halitosis

several authors [1,4,10,15] penicillin is still effective against most of the pathogens presented in these infections, and for this reason it is the first choice as an antibiotic, combined with ceftriaxone or cefotaxime and metronidazole these drugs have been shown to be effective against microorganisms involved in dental BA such as streptococci, gram-negative aerobes and strict anaerobes. In the literature, there are different opinions on the duration of administration of these antibiotics. Recommendations vary from a few weeks according to some authors to a few months according to others [1]. According to C. Ewald et al, normalization of the creative protein and white blood cells, as well as complete resolution of inflammatory changes on MRI, are mandatory before stopping antibiotic therapy [15]. The empirical treatment of our patient consisted of CEFOTAXIME 12g/day and metronidazole 2 g/day. With regard to the dental origin of the infection, prophylaxis is of utmost importance to avoid these serious and life-threatening infections.

### Literature review

We searched the literature at Pubmed.com from 2000 to June 2021 using the terms “Brain abscess” and “Dental origin”. We retrieved 12 papers (18 cases) of intracerebral BA from odontogenic causes.



Reference	Year	Title of publication	Dental pathology	BA location	Microorganisms	Treatment
Corson MA, Postlethwaite KP, Seymour RA. Are dental infections a cause of brain abscess? Case report and review of the literature. <i>Oral Dis.</i> 2001 Jan;7(1):61-5.	2001	Are dental infections a cause of brain abscess? Case report and review of the literature		Frontoparietal lobe	Streptococcus milleri and S. sanguis	Antibiotic therapy + drainage of abscess
Ewald C, Kuhn S, Kalf R. Pyogenic infections of the central nervous system secondary to dental affections—a report of six cases. <i>Neurosurg Rev.</i> 2006 Apr;29(2):163-6; discussion 166-7.	2006	Pyogenic infections of the central nervous system secondary to dental affections—a report of six cases		Occipital/ multiple location/central area/parietal	Not mentioned	Abscess excision and medication
Mylonas AI, Tzerbos FH, Mihalaki M, Rologis D, Boutsikakis I. Cerebral abscess of odontogenic origin. <i>J Craniomaxillofac Surg.</i> 2007 Jan;35(1):63-7.	2007	Cerebral abscess of odontogenic origin	periodontal disease	Parietal lobe	Not mentioned	high dose intravenous antibiotics, craniotomy and resection of the abscess cavity
Antunes AA, de Santana Santos T, de Carvalho RW, Avelar RL, Pereira CU, Pereira JC. Brain abscess of odontogenic origin. <i>J Craniofac Surg.</i> 2011 Nov;22(6):2363-5.	2011	Brain Abscess of Odontogenic Origin	devitalized teeth with deep caries in the upper left quadrant	left temporal region	Streptococcus viridans Actinobacillus actinomycetemcomitans, and Staphylococcus species	surgical drainage of the infection. Removal of necrotic tissue
Rahamat-Langendoen JC, van Vonderen MG, Engström LJ, Manson WL, van Winkelhoff AJ, Mooi-Kokenberg EA. Brain abscess associated with Aggregatibacter actinomycetemcomitans: case report and review of literature. <i>J Clin Periodontol.</i> 2011 Aug;38(8):702-6.	2011	Brain abscess associated with Aggregatibacter actinomycetemcomitans: case report and review of literature	caries profunda in multiple teeth and severe periodontal break down	Multiple	Actinobacillus actinomycetemcomitans	Surgery and medication
Haggerty CJ, Tender GC. Actinomycotic brain abscess and subdural empyema of odontogenic origin: case report and review of the literature. <i>J Oral Maxillofac Surg.</i> 2012 Mar;70(3):e210-3.	2012	Actinomycotic Brain Abscess and Subdural Empyema of Odontogenic Origin: Case Report and Review of the Literature	2 anterior maxillary teeth	left parietal lobe	The operative specimen examination was suspicious for actinomyces,	the abscess was drained+intravenous antibiotics drained+intravenous antibiotics
Azenha MR, Homs G, Garcia IR Jr. Multiple brain abscess from dental origin: case report and literature review. <i>Oral Maxillofac Surg.</i> 2012 Dec;16(4):393-7.	2012	Multiple brain abscess from dental origin: case report and literature review	two focus of infection associated to teeth 12 and 44	Multiple: the frontal lobe, central brain area, and occipital lobe	Streptococcus viridians and Bacteroides	Teeth extraction+ Antibiotic therapy + drainage of abscess
Greenstein A, Witherspoon R, Leinkram D, Malandreni M. An unusual case of a brain abscess arising from an odontogenic infection. <i>Aust Dent J.</i> 2015 Dec;60(4):532-5.	2015	An unusual case of a brain abscess arising from an odontogenic infection	extraction site 28 periapical pathology associated with 18	temporal lobe	Not mentioned	Abscess drainage and medication
Sato J, Kuroshima T, Wada M, Satoh A, Watanabe S, Okamoto S, Shiga T, Tamaki N, Kitagawa Y. Use of FDG-PET to detect a chronic odontogenic infection as a possible source of the brain abscess. <i>Odontology.</i> 2016 May;104(2):239-43.	2015	Use of FDG-PET to detect a chronic odontogenic infection as a possible source of the brain abscess	left upper second premolar and first molar,	the right occipital lobe	Staphylococcus species	Antibiotic therapy + drainage of abscess
Al moussawi H, Krzyzak M, Awada Z, et al. (January 13, 2018) Streptococcus Intermedius Brain and Diverticular Abscesses After Dental Manipulation: A Case Report. <i>Cureus</i> 10(1): e2061. DOI 10.7759/cureus.2061	2018	Streptococcus Intermedius Brain and Diverticular Abscesses After Dental Manipulation: A Case Report	Tooth extraction	the right cerebellar hemisphere	Streptococcus intermedius	Antibiotic therapy + drainage of abscess
Kawase S, Okada Y, Isono K, Iwasaki H, Kuno T, Matsumura K, Fu Y, Harada Y, Ogasawara T. Cerebral abscess following the self-extraction of teeth in patient with Ebstein's anomaly: a case report. <i>BMC Oral Health.</i> 2019 Aug 30;19(1):200.	2019	Cerebral abscess following the self extraction of teeth in patient with Ebstein's anomaly: a case report	left lower deciduous central and lateral incisors	the right temporal lobe	the Streptococcus milleri group	Antibiotic therapy + drainage of abscess

<p>Shibata T, Hashimoto N, Okura A, Mase M. Brain abscess of odontogenic origin in patients with malignant tumors: A report of two cases. Surg Neurol Int. 2021 Aug 16;12:417.</p>	<p>2021</p>	<p>Brain abscess of odontogenic origin in patients with malignant tumors: A report of two cases</p>	<p>1- the right maxillary second premolar and second molar had chronic suppurative apical periodontitis 2- tooth extraction of the right mandibular second molar</p>	<p>1- left frontal lobe 2- two lesions in the left frontal and right parietal lobes</p>	<p>1- S. intermedius 2- S. intermedius</p>	<p>1- surgical drainage and antibiotic treatment  2- surgical drainage and antibiotic treatment</p>
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**Conclusion**

Brain abscesses developing from odontogenic infection are fortunately rare and should be considered in cases of fever, headache and neurological disturbance associated with poor dental hygiene. Recognition of these warning signs should direct the surgeon to a timely management strategy to expedite effective treatment and prevent a life-threatening emergency [16-19].

In addition, the current case highlights the importance of identifying the pathogen by bacteriological examination to guide diagnosis and therapy. The prognosis is excellent with early drainage, removal of the dental infection site and administration of appropriate antibiotics for an adequate period of time.

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