



# Multiple Brain Abscesses Secondary to Odontogenic Infection: A Clinical Case Report

## *Abscessos cerebrais múltiplos secundários à infecção odontogênica: Um relato de caso clínico*

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Arq Bras Neurocir 2021;40(2):e162–e166.

### Abstract

**Introduction** Cerebral abscess is a suppurative infection of the cerebral parenchyma, which may occur due to contiguity, hematogenous dissemination of distant foci, secondary to open traumatic brain injuries, or be idiopathic.

**Clinical Case** A 63-year-old male patient sought assistance due to a severe headache in the frontal region associated with chills and lack of appetite that started four days before. Clinical examination of the patient showed no significant changes. Imaging and laboratory tests on admission showed only nonspecific changes, such as leukocytes 18,540, platelets 517,000, and c-reactive protein 2,0. In such case, magnetic resonance imaging (MRI) of the skull was performed with contrast, showing the presence of expansive lesions compatible with multiple brain abscesses in the right parieto-occipital region.

**Discussion** After excluding the main focus of hematogenous dissemination and in view of the identification of the agent *Streptococcus intermedius* by means of secretion culture collected through a surgical method, the hypothesis of abscess due to contiguous dental pyogenic foci was pointed out.

**Conclusion** Dental evaluation showed multiple foci of infection with periodontitis and dental abscess, which were treated along with the use of antibiotics directed to the etiologic agent.

### Keywords

- ▶ cerebral abscess
- ▶ dental infection
- ▶ *Streptococcus intermedius*

### Resumo

Abcesso cerebral é uma infecção supurativa do parênquima cerebral, podendo ocorrer por contiguidade, disseminação hematogênica de foco a distância, secundário a traumas cranioencefálicos abertos ou ser idiopático. Caso clínico: Paciente do sexo masculino, 63 anos, procura atendimento devido a queixa de cefaleia intensa com início há quatro dias. Exame de imagem realizado evidencia lesões expansivas

received  
September 2, 2020  
accepted  
November 16, 2020  
published online  
March 29, 2021

DOI <https://doi.org/10.1055/s-0040-1722242>.  
ISSN 0103-5355.

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**Palavras-chave**

- ▶ abscesso cerebral
- ▶ infecção odontológica
- ▶ *Streptococcus intermedius*

compatíveis com abscessos cerebrais múltiplos na região parieto-occipital a direita. Discussão: Após a exclusão dos principais focos de disseminação hematogênica e diante da identificação do agente *Streptococcus intermedius* por meio de cultura de secreção coletado por método cirúrgico, foi levantada a hipótese de abscesso por contiguidade de foco piogênico dentário. A avaliação odontológica evidenciou múltiplos focos infecciosos com periodontite e abscesso dentário, que foram tratados conjuntamente com o uso de antibiótico direcionado para o agente etiológico.

**Introduction**

Cerebral abscess is a suppurative infection that affects the cerebral parenchyma.<sup>1</sup> It is the second most common purulent infection in the immunocompetent central nervous system (CNS), followed only by bacterial meningitis.<sup>2</sup> Parenchyma involvement can occur due to contiguous infection mechanisms (between 40 and 50% of cases), hematogenous dissemination of distant focus (25% of cases), secondary to open traumatic brain injuries (10% of cases) or idiopathic (15% of cases).<sup>3,4</sup>

In most cases, the etiologic agent is of bacterial origin; however, it should be noted that these can also occur via other microorganisms, such as protozoa or fungi.<sup>5</sup> The microbiological agent involved in the genesis of the abscess depends on how it is inoculated into the brain tissue. Furthermore, abscesses that occur due to contiguous infection are usually caused by infections in nearby regions, such as otitis, mastoiditis, sinusitis, periodontal disease, among others.<sup>6-8</sup> Among the most common pathogens are: *Staphylococcus aureus*, *Streptococcus sp*, *Haemophilus influenzae*, *Bacteroides* and *Peptostreptococcus*.<sup>4,6</sup>

Abscesses related to dental infections typically have polymicrobial derivation, highlighting the *streptococci*, *staphylococci species*, *Actinomyces sp*, *Actinobacillus sp*, *Fusobacterium sp*.<sup>9</sup> Secondary spreads to otitis, mastoiditis or sinusitis are more related to streptococcal (especially *Streptococcus pneumoniae*), *Enterobacteriaceae*, *S. aureus* and some anaerobes such as *Prevotella sp.*, *Bacteroides sp*.<sup>1</sup> Abscesses caused by otitis and/or mastoiditis have a greater coefficient of temporal lobe and cerebellum infection, while the secondary to rhinosinusitis or periodontal infection most commonly affect the frontal lobe.<sup>2,4,10</sup> In addition, abscesses originating from hematogenous dissemination are usually multiple and tend to affect, predominantly, regions irrigated by the middle brain (posterior frontal lobe and parietal lobe).<sup>2,3,10</sup>

In relation to the most common focus of hematogenous dissemination, it could be mentioned: infective endocarditis, cardiac alterations such as tetralogy of Fallot, patent foramen ovale, cyanotic heart disease; lung abscess or bronchiectasis.<sup>2,3,10</sup> The foci of the spread of infectious endocarditis are often related to *S. Aureus*, species of streptococcus and bacteria of the HACEK group (*Haemophilus spp*, *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens* and *Kingella kingae*).<sup>1</sup> Infections of pulmonary dissemination focus or heart diseases that involve formation of arteriovenous

shunts are generally polymicrobial, and involve streptococcus, anaerobic species (*Actinomyces sp.*, *Prevotella sp.*, *Bacteroides sp.*, *Fusobacterium sp*), *staphylococci* and *Enterobacteriaceae*.<sup>1,10</sup>

Infections linked to neurosurgical procedures due to nosocomial infections have *Meticycline-resistant S. Aureus* as its main cause, but other species such as propionibacterium and coagulase-negative staphylococcus may also be involved.<sup>4,10</sup> In trauma-related abscesses, it is known that *Cranioencephalic S. Aureus* is the main agent.<sup>4,11</sup>

**Objective**

To report a clinical case to identify the etiology and other cause and effect relationships involved in the genesis of a rare case of brain abscess.

To analyze the diagnostic approach performed and correlate it with the main current diagnostic protocols.

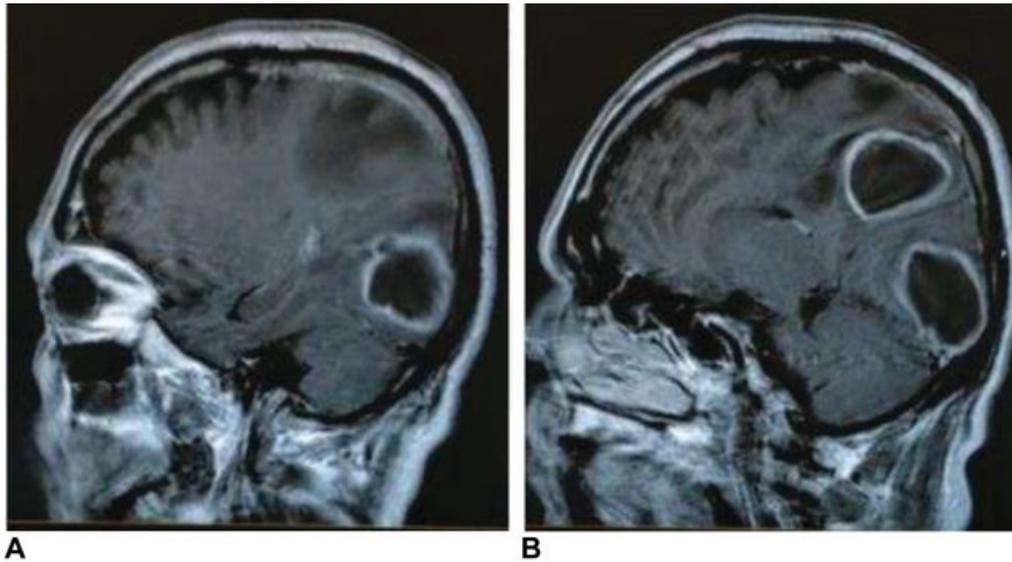
**Clinical Case Report****Anamnesis**

A 63-year-old male patient sought assistance due to complaints of low back pain and severe headache. He reported that 4 days before he presented with severe headache in the frontal region, associated with chills and lack of appetite. He sought care at the local Emergency Unit, where he received symptomatic medication, resulting in partial improvement of symptoms. He also reported that 24 hours before he noticed the onset of pain in the lumbar region, of the prick type, associated with paresis in the lower limbs and partial paresthesia in sporadic moments.

General physical examination did not show any particularity and, at the neurological examination, he was bedridden, with no signs of meningeal irritation, with muscle strength and reduced tactile sensitivity in the left lower limb.

Laboratory admission tests were requested, namely: Leukocytes 18,540 without deviation presence of rods, platelets 517,000, urea 54, creatinine 0.9, sodium 140, potassium 4.5, lactate 17.20, ionic calcium 1.2, magnesium 2, 3, c-reactive protein 2, urine test unchanged. Simple chest radiographs did not show any significant changes. In such case, magnetic resonance imaging (MRI) of the skull was performed with contrast (► **Fig. 1**).

After referral to blood cultures and echocardiography, to rule out possible foci of hematogenous dissemination, no



**Fig. 1** Shows the magnetic resonance of the skull, performed with the patient under discussion, showing expansive lesions compatible with multiple brain abscesses. Source: The authors (2020).

underlying changes were demonstrated. Then, antibiotic therapy with ceftriaxone and metronidazole was started.

Seven days after admission, the patient showed an evolution with a lower level of consciousness, requiring orotracheal intubation and urgent surgery. Therefore, craniotomy was performed to remove cystic lesions, with the collection of material for culture. Six days after the surgery, the secretion culture followed, positive for *Streptococcus intermedius*. In view of the identified etiologic agent, an oral and maxillofacial surgeon evaluation was requested, since the existence of signs of gingivitis with severe periodontitis and dental abscess in two teeth was confirmed, associated with mucositis in the soft structures. Finally, the region was cleaned, in addition to maintaining the use of intravenous antibiotics for 21 days.

## Discussion

When facing a patient with a headache complaint, the first step is to identify whether this is a primary or secondary disorder.<sup>12</sup> Primary headaches refer to chronic and continuous disorders of a dysfunctional nature, not involving anatomical or structural changes,<sup>13</sup> while secondary headaches are symptoms of an underlying, neurological or systemic disease (meningitis, brain tumor, among others).<sup>14</sup>

The main premonitory for identifying a secondary headache is the presence of alarm signs: change in the pattern of pre-existing headache, progressive intensity headache, sudden onset, associated focal neurological deficit, decreased level of consciousness, seizure, systemic manifestations (fever, toxemia, immunodepression, skin rash), beginning after 50 years of age.<sup>12,14</sup> It is evident that, in the face of a headache with alarm signs, it is necessary to use imaging exams for better diagnostic clarification, with computed tomography (CT) being the exam of choice.<sup>12</sup>

The patient presented several alarming signs that indicated it was a secondary headache: sudden onset, progressive

intensity, onset after 50 years of age, focal neurological deficit (reduced strength in the left lower limb), signs of toxemia with fever and chills. As for the other clinical manifestations, here we show all three classic manifestations of brain abscesses: headache, fever and focal neurological deficit.

Initially, a CT scan of the skull was performed. However, it became necessary to perform an MRI to better assess the lesion. This last examination showed multiple brain abscesses in the parieto-occipital region. As reviewed, multiple abscesses are more common in hematogenous foci, and tend to occur in the middle cerebral artery supply region, predominating in the posterior region of the frontal lobe and in the anterior region of the parietal lobe. Foci of hematogenous dissemination to the occipital lobe may occur, but are less common.

Under suspicion of hematogenous dissemination, it is mandatory to find the primary focus. The most common focus of hematogenous dissemination are endocarditis, cardiovascular malformations and pyogenic lung infections. The complete absence of pulmonary symptomatology, associated with an admission-free X-ray of the chest, practically rules out the latter form of dissemination, resting the hypotheses in the probable cardiac focus. The echocardiogram is the exam of choice for the assessment of endocarditis or cardiac structural changes. In this case, the echocardiogram showed no changes, making it necessary to investigate further to find the primary focus of the infection.

While the specific agent is not identified, the guidelines indicate the beginning of empirical antibiotic therapy. Third and fourth cephalosporins generation are the first choice for coverage of gram positive and gram negative germs, while the combination with metronidazole provides adequate coverage against anaerobic germs. It is a given fact that the choice of antibiotic therapy in this case, performed with ceftriaxone and metronidazole, was appropriate.

After surgical removal and material collection, the culture showed the etiologic agent involved in the infection of

the parenchyma: *S. intermedius*. This agent is a highly positive, facultative anaerobic bacterium that is part of the commensal flora of the oropharynx and gastrointestinal tract. Their involvement in polymicrobial and suppurative infections is common.<sup>15</sup> Faced with an infection by a common agent in the oral mucosa, the hypotheses now fall on a probable odontogenic spread.

The evaluation of the oral health team showed multiple foci of oral infection, with the presence of severe periodontitis and dental abscess. Periodontitis is a chronic inflammatory process of bacterial etiology, which affects a dental structure (connective tissue, periodontal fiber and bones).<sup>16,17</sup> The most common etiological agents associated with periodontitis are *Aggregatibacter actinomycetemcomitans* and *Porphyromonas gingivalis* species.<sup>16</sup>

*Streptococcus* is the group of bacteria most related to oral diseases.<sup>18</sup> Some species such as *Streptococcus mutans* are related to the occurrence of dental caries, while *S. Intermedius* and *Streptococcus constellatus* usually colonize dental biofilm in patients with untreated chronic periodontitis.<sup>18,19</sup> The colonization of previous periodontal foci by bacteria of the species *S. Intermedius* and *S. constellatus* exacerbate the initial infectious process, which can trigger tooth loss and pyogenic complications such as brain abscess, liver abscess and bacteremia.<sup>19–21</sup> Despite being part of the normal flora of the oropharyngeal, genitourinary and gastrointestinal tracts, evidence of reports of involvement of these species in purulent infections such as brain and liver abscesses, as well as the occurrence of bacteremia caused by *S. Intermedius* after dental manipulation, even without the presence of an infectious process active gingival.<sup>20–22</sup>

The finding of a common bacterium of the oral flora in the culture of the abscess, associated with several foci of dental infection liable to spread, reinforces the hypothesis that this abscess was caused by contiguous infection from these multiple odontogenic foci.

## Final Considerations

The reported case was a rare case of cerebral abscess secondary to odontogenic infection. In agreement with the literature, abscesses caused by the spread of contiguous foci tend to be single abscesses, keeping a close relationship between the dissemination focus and the location of the abscess formation. Furthermore, this type of case affects the frontal lobe, and rarely causes multiple abscesses.

We can conclude from the consultation of the literature and the report of the case presented that it is not common for odontogenic infections to complicate with the formation of abscesses in the parieto-occipital region, even more so with multiple involvement. The immediate treatment of the abscess and its source with multidisciplinary care allows the full recovery of the patient.

### Conflict of Interests

The authors have no conflict of interests to declare.

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