

ABSTRACT

Title:

Analysis of etiological factors and differences in the clinical course of brain abscesses in patients with primary foci of infection in the oral cavity

Author: Kamil Abed, DDS

Introduction:

The incidence of odontogenic brain abscesses may be underestimated.

Unfortunately, currently in the available literature, there are no randomized clinical trials reporting the relationship between primary foci of infection in the oral cavity and the formation and clinical course of brain abscesses.

The available information on the relationship between brain abscesses and odontogenic infections in the oral cavity is mainly related to case reports.

Obtaining broader knowledge on the clinical differences of odontogenic brain abscesses seems extremely important due to the possibility of earlier eradication of the primary focus and increasing the effectiveness of empirical antibiotic therapy covering with its spectrum of action pathogens characteristic of CNS abscesses with their primary focus in the oral cavity.

Objectives:

The aim of this study was to identify differences in the course of the disease, reported symptoms, comorbidities, and differences in imaging and laboratory test results in the group of patients with odontogenic brain abscesses compared to the remaining group of patients with brain abscesses.

Identifying such differences would facilitate the identification of patients with oral infections in the group of patients with brain abscesses, enable early treatment of the primary site, and could influence the antibiotic therapy administered.

Material and methods:

The retrospective study included a group of adult patients diagnosed with brain abscess, hospitalized in the Department of Adults Infectious Diseases, Medical University of Warsaw in the period from January 1, 2004, to December 12, 2023, with complete medical documentation including: the results of imaging and laboratory tests, medical documentation from other medical facilities.

The patients included in the study were divided into two groups: patients with brain abscesses of odontogenic origin (study group) - 35 patients and patients with brain abscesses of etiology not related to infection in the oral cavity (control group) - 131 patients.

The following anonymized data were retrospectively analyzed:

- patient demographic data (age, gender)
- duration of hospitalization at the Department of Adults Infectious Diseases, Medical University of Warsaw
- treatment (pharmacological, surgical)
- presence and location of the primary focus of infection
- comorbidities and procedures performed
- previous craniocerebral trauma and neurosurgical procedures
- reported symptoms, their duration, and abnormalities in the physical examination, including an oral examination with an assessment of potential infection foci (including toothache, odontogenic abscess, deep carious lesions, periodontitis)
- laboratory test results of blood and cerebrospinal fluid (e.g., CRP, D-dimers, procalcitonin, leukocytes, red blood cells, hemoglobin, lactic acid, interleukin-6, CSF cytosis)
- Neuroimaging test results (computed tomography, magnetic resonance imaging)
- Dental radiological test results (CBCT, CT, panoramic radiograph)
- microbiological test results of cerebrospinal fluid, blood, and abscess aspirate
- dental procedures used (tooth extractions)
- neurosurgical interventions performed (i.e., stereotactic biopsy, craniotomy, trepanation)
- outcome of treatment

Patients with brain abscesses of odontogenic origin were characterized according to the criteria proposed by C. Edward et al., A. Moazzam et al., and Jespersen et al. [26, 47, 104]. The study excluded adult patients diagnosed with a brain abscess of non-bacterial origin (fungal,

parasitic). Patients with a brain abscess caused by *Mycobacterium tuberculosis* infection were also excluded.

Brain abscesses associated with devices such as brain pacemakers or ventriculoperitoneal shunts (a device enabling CSF outflow) were not included in this study.

Results:

- Most patients were men - 63.9% of all patients.
- The most common location of abscesses was the frontal lobe, with the temporal or parietal lobes being slightly less common.
- Among abscesses identified in the frontal lobe, the most common source of infection was odontogenic infection. In the control group, abscesses located in the frontal lobe were identified in 26% of patients, while in the study group, this location was present in almost 49% of patients – this difference was statistically significant ($p\text{-value} = 0.018$).
- Among the analyzed cases, cryptogenic abscesses were the most common etiology. Odontogenic abscesses were the second most common etiology.
- In 54.5% of individuals whose abscess cultures were obtained during surgical procedures, the cultures were sterile. Gram-positive and Gram-negative facultative anaerobes predominated in the remaining abscess cultures. The number of isolated pathogens did not differ statistically significantly between the study groups.
- Among the 166 patients included in the study, 35 developed odontogenic brain abscesses.
- The most frequently reported symptom was headache, which was more common in the study group (82.9%) than in the control group (57.3%) ($p\text{-value} = 0.010$).
- Among all patients, 101 were treated surgically, while 65 were treated only pharmacologically.
- In the study group, 82.9% of patients were treated neurosurgically, while in the control group, neurosurgical treatment was used in 55% of patients ($p\text{-value} = 0.005$).
- The most common empirical antibiotic therapy used in both surgical and non-surgical patients was penicillin, metronidazole, and third-generation cephalosporins.

- The most common oral infection site was dental caries, occurring in 62.9% of patients in the study group compared to 14.5% in the control group.
- The size of the largest abscess was determined by computed tomography or magnetic resonance imaging (MRI) based on the measurement of the abscess's long and short axes (mm). These measurements were then averaged. The mean abscess axis was 20.35 (+/- 9.73) mm across the entire sample. A statistically significant difference was observed between the study and control groups, with the mean abscess axis being 23.77 (+/- 12.56) mm for the study group and 19.48 (+/- 8.72) mm for the control group (p-value < 0.05).
- C-reactive protein (CRP) values at admission differed significantly between the groups (p-value = 0.004). In the study group, the median C-reactive protein (CRP) value at admission was 17 (4.5; 30.5) mg/L, with a minimum value of 4 mg/L and a maximum of 331 mg/L, while in the control group, the median was 45 (7.5; 76) mg/L, with a minimum value of 1 mg/L and a maximum of 400 mg/L.

Conclusions:

Based on the results presented in this dissertation, the following conclusions were drawn:

1. In patients with brain abscesses, the oral cavity should be considered when searching for the primary site of infection. This should particularly apply to patients reporting headaches, with large abscesses in the frontal lobe, or with moderately elevated C-reactive protein (CRP) levels.
2. Detection of pathogens in the oral flora during microbiological diagnostics may indicate an odontogenic cause of brain abscesses.
3. Symptoms associated with complications of untreated dental caries preceding the onset of neurological symptoms in patients with diagnosed brain abscesses may suggest an odontogenic etiology.

Promotor:

Autor: