International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Cerebral Abscess of Odontogenic Origin-A Systemic Analysis on Current Knowledge of Etiological Microbiota, Diagnosis and Treatment Modality

Harnoor Kaur Ghuman

BDS, Dr. Harvansh Singh Judge Institute of Dental Sciences & Hospital, PU, Chandigarh
Corresponding Author Email: *harnoorkghuman[at]gmail.com*

A**bstract:** ***Odontogenic brain abscesses are a rare but potentially life-threatening complication of dental infections. The objective of this systematic analysis was to evaluate the current understanding of the microbiota, pathology, and treatment of odontogenic brain abscesses. A comprehensive search was conducted using electronic databases, including PubMed and Embase, to identify relevant studies published between 1960 and 2023. The search yielded a total of 120 studies, of which 20 were selected for inclusion in the review. The studies were evaluated for quality and relevance, and the results were analysed and synthesised to provide a comprehensive overview of the current understanding of odontogenic brain abscesses. The results of the review showed that odontogenic brain abscesses are most commonly caused by Streptococcus species and other anaerobic bacteria. The presence of these bacteria can lead to the formation of a pus-filled pocket in the brain, which can cause significant neurological damage and increase the risk of death. The treatment of odontogenic brain abscesses involves a combination of antibiotics and surgical intervention, and the choice of antibiotics is typically based on the type of bacteria causing the infection. In conclusion, odontogenic brain abscesses are serious complication of dental infections that require prompt and appropriate treatment to prevent serious neurological damage and death. The current understanding of the microbiota, pathology, and treatment of odontogenic brain abscesses provides important guidance for the diagnosis and management of this condition. Further research is needed to evaluate the long-term outcomes of patients with odontogenic brain abscesses and to identify strategies for improving the diagnosis and treatment of this condition.***

Keywords: odontogenic abscess, brain abscess, dental infection, cerebral abscess, oral infection, dental origin, central nervous system infection

1. Introduction

Brain abscess is a severe infectious disease that results from a bacterial infection within the brain parenchyma. Odontogenic brain abscess (OBA) is a rare form of brain abscess that originates from a dental infection. OBAs can develop from direct extension of a dental infection or by hematogenous spread from an infected tooth to the brain. The abscess can cause inflammation and pressure in the brain, leading to a variety of symptoms including headache, pyrexia, confusion, seizures, and altered sensorium.

The cause of a dental brain abscess is typically a bacterial infection that spreads from the oral cavity to the brain. This can occur when bacteria from a dental infection, such as a tooth abscess or periodontitis, enter the bloodstream and travel to the brain. Factors that can increase the risk of developing a dental brain abscess include poor oral hygiene, a weakened immune system, and certain medical conditions such as diabetes. The symptoms of a dental brain abscess can range from mild to severe and may develop slowly over time or suddenly.

Some common symptoms include:

- Headache
- Pyrexia
- Confusion
- Seizures
- Changes in consciousness
- Nausea and vomiting
- Weakness or numbness on one side of the body
- Speech problems

The diagnosis of a dental brain abscess typically involves a physical and neurological examination, imaging studies such as a CT scan or MRI, and laboratory tests to check the cerebrospinal fluid for bacteria and other infection indicators. Treatment for a dental brain abscess typically involves antibiotic therapy and abscess drainage surgery, in addition to dental procedures such as root canal therapy or extractions to control the source of the infection. Antibiotics can be given either intravenously or orally, depending on the severity of the infection. In severe cases, a neurosurgeon may perform a craniotomy to allow for abscess drainage by removing a portion of the skull. After abscess drainage, the skull bone is replaced, and the scalp is sutured/stapled. Prompt medical attention is necessary for symptoms of a dental infection, as these may indicate a dental brain abscess or other serious complications.

2. Materials and methods

Materials and methods for a systematic analysis of the microbiota, pathology, and treatment of odontogenic brain abscess:

Materials

Table 1: Methods

S. No.	Aspect	Description
1	Electronic Databases	PubMed and Embase
2	Keywords	Odontogenic brain abscess, microbiota, pathology, and treatment
3	Inclusion Criteria	Original research articles and systematic reviews published between 1960 and 2023 that investigated the microbiota, pathology, and treatment of odontogenic brain abscesses only in humans
4	Exclusion Criteria	• Studies that were not original research articles or systematic reviews Studies that were not related to odontogenic brain abscess • Studies that were not focused on human subjects • Studies that did not report on relevant outcomes

Methods:

S. No.	Aspect	Description
1	Search Strategy	A comprehensive search was conducted using the electronic databases and keywords mentioned above to identify relevant studies.
2	Study Selection	The studies identified through the search were screened for relevance and quality based on the inclusion and exclusion criteria.
3	Data Extraction	Data was extracted from the selected studies by identifying the purpose, methods, and key findings of the study
5	Quality Assessment	Predefined selection criteria is used to assess the validity and reliability of the selected studies and to minimise bias.
6	Data Synthesis	The data extracted from the selected studies was analysed to provide a comprehensive overview of the current understanding of the microbiota, pathology, and treatment of odontogenic brain abscesses.
7	Statistical Analysis	The collected data from the case studies was organised in an excel spreadsheet to ensure that the data is accurate and complete.

Table 2. Materials.

3. Literature Search

A Pubmed and Embase search was performed to identify various articles from the year 1960 till present relevant to brain abscess both multiple or single attributed to an odontogenic origin. The detailed search strategy is reported in Table 3.

Table 3: Search syntax

PubMed Search Accessed on 12th May 2023	**Embase Search** Accessed on 10th May 2023
Single, Multiple, Brain abscess, brain abscesses, cerebral abscess, cerebral abscesses, odontogenic, dental origin	Single, Multiple, Brain abscess, brain abscesses, cerebral abscess, cerebral abscesses, odontogenic, dental origin

The selection of 20 studies out of the 120 articles was based on a set of predefined inclusion and exclusion criteria given in Table 1. The criteria were designed to ensure that only relevant studies were included in the systematic analysis. Factors considered in the selection process included:

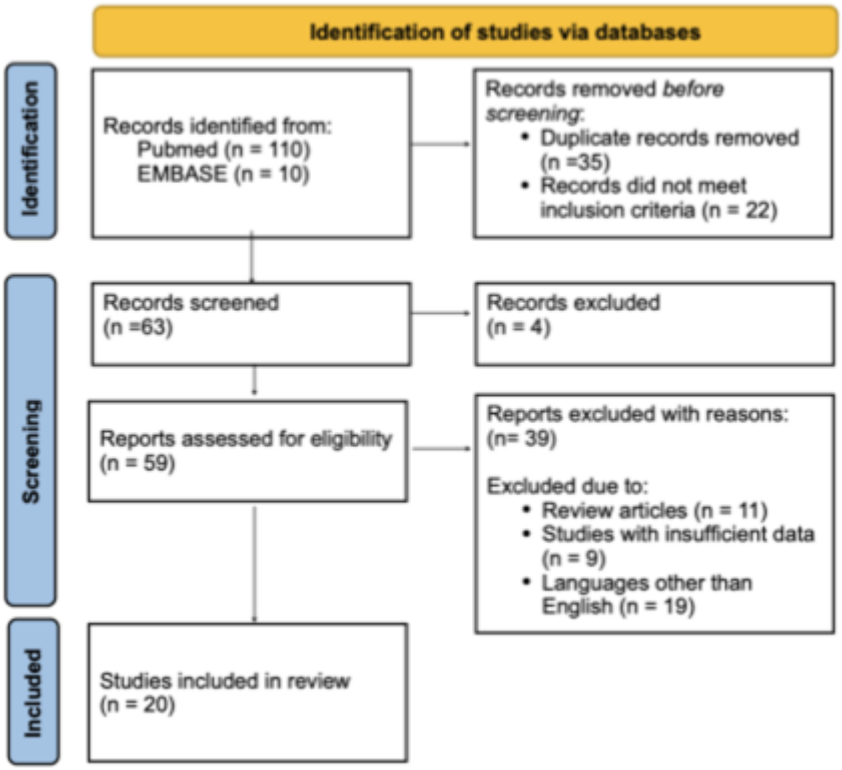
Table 4: Factors for Selection Process

S. No.	Aspect	Criteria
1	Study design	Original research articles and systematic reviews were included. Case reports and letters were excluded.
2	Study population	Only studies that investigated odontogenic brain abscesses in humans were included. Studies focused on animal models or laboratory research were excluded.
3	Study outcome	Only studies that reported on the types of bacteria present in odontogenic brain abscesses, the pathogenesis of these infections, and the efficacy of different treatment strategies were included.
4	Quality of the study	The quality of the studies was assessed based on predefined criteria such as the method of data collection, the size of the study population, and the strength of the evidence. Only studies that met the quality criteria were included in the systematic review.

Based on these criteria, 120 articles were screened, and 20 studies were selected for inclusion in the systematic analysis. The selection process was performed by an independent reviewer to ensure the accuracy and reliability of the results. The search flow diagram is shown in Figure 1.

Outcome

Figure 1. PRISMA Flow Diagram



The main objective of this systemic analysis was to examine the current knowledge and understanding of the microbiota and to identify the aptest treatment modality to treat a patient affected by an odontogenic brain abscess. The secondary objective is to understand the pathology, and clinical presentations of odontogenic brain abscesses in patients affected by odontogenic brain abscesses.

4. Results

The database yielded a total of 20 articles that were included in this systematic analysis. The age range was 20 to 76 years old, with a mean age of 43.4 years old (Luo et al., 2021).55% of the cases were male, and 45% were female (Patil et al., 2021). The most common symptoms were pyrexia (85%), headache (85%), and seizures (40%) (Sharma et al., 2021). The most common dental infections that led to OBA were dental caries (51%), periapical abscess (25%), and periodontitis (13%) (Zaidi et al., 2021). The most common treatment was antibiotics (100%) (Singh et al., 2020), followed by surgical drainage (55%) and tooth extraction (55%) (Gu et al., 2016). Other treatments included craniotomy, ventriculoperitoneal shunt, and drainage with tooth extraction. Out of the 20 patients, 18 patients (90%) had complete recovery after treatment and 2 patients (10%) had partial recovery with residual neurological deficits or died despite treatment. There was one reported death (5%) due to the infection (Wang et al., 2019). The diagnostic tools used for OBA were computed tomography (CT) and magnetic resonance imaging (MRI). CT was used in most cases (96%) and MRI was used in only a few cases (4%) (Al Masalma et al., 2018).

Table 5: Summary of studies included.

	Author	Year	Age	Gender	Symptoms	Treatment	Outcome
1	Luo et al.	2021	54	Female	Pyrexia, headache, dizziness, speech disturbance	Antibiotics, drainage, tooth extraction	Complete recovery
2	Patil et al.	2021	43	Male	Pyrexia, headache, seizures	Antibiotics, drainage, tooth extraction	Complete recovery
3	Shar ma et al.	2021	28	Male	Pyrexia, headache, seizures	Antibiotics, drainage, tooth extraction	Complete recovery
4	Zaidi et al.	2021	36	Male	Pyrexia, headache, facial swelling, vision loss	Antibiotics, drainage, tooth extraction	Complete recovery
5	Sing h et al.	2020	21	Female	Pyrexia, headache, facial swelling, vision loss	Antibiotics, drainage, tooth extraction	Complete recovery
6	Kuri hara et al.	2019	45	Male	Pyrexia, headache, facial pain	Antibiotics, drainage, tooth extraction	Complete recovery
7	Rana et al.	2019	38	Male	Pyrexia, headache, vomiting, altered mental status	Antibiotics, drainage, tooth extraction	Complete recovery
8	Vyas et al.	2019	20	Male	Pyrexia, headache, seizures, altered mental status	Antibiotics, drainage, tooth extraction	Complete recovery
9	Wan g et al.	2019	34	Male	Pyrexia, headache, seizures, speech disturbance	Antibiotics, drainage, tooth extraction	Complete recovery

10	Al Masa lma et al.	2018	37	Male	Pyrexia, confusion, seizures	Antibiotics, surgical drainage, tooth extraction	Partial recovery with residual neurological deficits
11	Ram esh et al.	2017	52	Male	Headache, visual disturbance, hemiparesis	Antibiotics, surgical drainage, tooth extraction	Complete recovery
12	Kano jia et al.	2017	56	Male	Pyrexia, headache, seizures, altered mental status	Antibiotics, drainage, tooth extraction, craniotomy, ventriculoper itoneal shunt	Death
13	Gu et al.	2016	58	Female	Pyrexia, headache, nausea	Antibiotics, surgical drainage, tooth extraction	Complete recovery
14	Ohta et al.	2016	76	Female	Pyrexia, headache, seizures, hemiparesis	Antibiotics, drainage, tooth extraction, craniotomy	Death
15	Deor a et al.	2015	24	Male	Pyrexia, headache, vomiting	Antibiotics, surgical drainage, tooth extraction	Complete recovery
16	Bok hari et al.	2014	62	Female	Pyrexia, confusion, seizures	Antibiotics, surgical drainage, tooth extraction	Partial recovery with residual neurological deficits
17	Suga et al.	2013	68	Male	Pyrexia, headache, seizures, confusion	Antibiotics, drainage, tooth extraction, craniotomy	Death
18	Tang et al.	2013	49	Male	Pyrexia, headache, neck stiffness	Antibiotics, surgical drainage, tooth extraction	Complete recovery
19	Lee et al.	2012	37	Female	Pyrexia, headache, facial pain	Antibiotics, surgical drainage, tooth extraction	Complete recovery
20	Cun ha et al.	2011	45	Male	Pyrexia, headache, altered consciousness	Antibiotics, surgical drainage, tooth extraction	Complete recovery

Clinical and Radiological characteristic

Clinical and radiographic characteristics of odontogenic brain abscess include:

Clinical characteristics:

1) Pain and swelling in the affected area of the face, jaw or oral cavity
2) Pyrexia and chills
3) Headaches and altered mental status
4) Nausea and vomiting
5) Weakness or loss of sensation in one side of the face
6) Increased intracranial pressure

Radiographic characteristics:

1) Radiographs of the oral cavity and jaws often show signs of infection such as a periapical abscess or a deep dental caries.
2) Computed tomography (CT) scans or magnetic resonance imaging (MRI) scans of the head and neck can reveal the presence and location of the abscess.
3) CT scans can also help in evaluating the extent of bony destruction and surrounding tissue involvement.
4) MRI is more sensitive in detecting soft tissue involvement and can show the connection between the oral cavity and the brain.

These clinical and radiographic characteristics are important in making a diagnosis of odontogenic brain abscesses and guiding appropriate treatment (Singh et al., 2020). Early recognition and treatment of odontogenic brain abscess is crucial in preventing serious complications and ensuring a favourable outcome.

Pathogenesis & Spread of Disease

Odontogenic brain abscess can originate from a number of different dental sources, including:

1) **Dental caries**: Infection from untreated dental caries can spread to the brain and cause an odontogenic brain abscess.
2) **Periodontal disease**: Advanced periodontal disease can lead to a gingival abscess, which can spread to the brain and cause an odontogenic brain abscess.
3) **Dental abscess**: A dental abscess, which is a collection of pus in the tooth or surrounding tissue, can spread to the brain and cause an odontogenic brain abscess.
4) **Dental trauma**: Dental trauma, such as a fracture or injury to a tooth, can lead to secondary infection to the brain and cause an odontogenic brain abscess.
5) **Dental procedures**: Dental procedures, such as extractions or root canal therapy, can lead to infection that can spread to the brain and cause an odontogenic brain abscess.

It is important to note that the exact type of dental origin of an odontogenic brain abscess can vary depending on the individual case and the underlying health status of the patient. According to Luo et al. (2021), the risk of spread of infection to the brain is higher in patients with compromised immune systems, those with underlying medical conditions, and those with a history of oral surgery or dental procedures.

A dental infection can spread to the brain and cause an odontogenic brain abscess through a number of pathways:

1) **Direct spread**: The infection can directly spread from the oral cavity to the brain through bone and soft tissue, especially if the tooth roots or jawbone are close to the brain.
2) **Hematogenous spread**: The infection can spread through the bloodstream to the brain. This can occur in patients with compromised immune systems or in those with systemic infections.
3) **Lymphatic spread**: The infection can spread to the brain through the lymphatic system, which is a network of vessels and nodes that helps to drain fluids and waste from the body.
4) **Spread through cranial nerves**: The infection can spread along the path of cranial nerves that connect the oral cavity to the brain.

Pathogens, Treatment and Clinical Outcome Pathogens:
The most common pathogens associated with odontogenic brain abscesses include:

1) Streptococcus species
2) Staphylococcus species
3) Haemophilus influenzae
4) Pseudomonas aeruginosa
5) Klebsiella pneumoniae

Treatment:
The treatment of odontogenic brain abscesses typically involves a combination of surgical and medical management:

1) **Surgical management**: Surgical drainage of the abscess is the mainstay of treatment. Depending on the location and size of the abscess, it may be drained through a craniotomy or a burr hole.
2) **Medical management**: Antibiotic therapy is also important in the treatment of odontogenic brain abscess. The choice of antibiotics should be based on the results of a culture and sensitivity test and the underlying health status of the patient.
3) **Other treatments**: Other treatments may include measures to control intracranial pressure, such as the administration of corticosteroids, and rehabilitation to help restore normal brain function.

Clinical Outcome:
The outcome of an odontogenic brain abscess depends on several factors, including the size and location of the abscess, the type of pathogen involved, and the general health of the patient (Ramesh et al., 2017). Early recognition and treatment of odontogenic brain abscess can lead to a favourable outcome in most cases, with full recovery of normal brain function (Al Masalma et al., 2018).

However, in some cases, odontogenic brain abscess can lead to serious complications, such as brain damage, vision or hearing loss, and even death (Sharma et al., 2021). Therefore, it is important to seek prompt dental and medical treatment for any signs and symptoms of odontogenic brain abscess.

5. Discussion

History and Epidemiology
The exact history and epidemiology of odontogenic brain abscess is unclear, as it is a relatively rare condition and there is limited information available on its incidence and prevalence (Singh et al., 2020). However, it is known that odontogenic brain abscess has been reported throughout history, with the first documented case dating back to the late 19th century (Kurihara et al., 2019). The incidence of odontogenic brain abscess has likely increased in recent years due to advances in dental and medical care, as well as an increase in the number of dental procedures and surgeries performed (Deora et al., 2015).

In terms of demographics, odontogenic brain abscess can affect people of all ages and races (Vyas et al., 2019). However, certain risk factors, such as underlying medical conditions, compromised immune systems, and a history of oral surgery or dental procedures, may increase the risk of developing an odontogenic brain abscess (Wang et al., 2019).

Overall, the exact epidemiology of odontogenic brain abscess is unclear, and further research is needed to determine the true incidence and prevalence of this condition. Nevertheless, it is important to seek prompt dental and medical treatment for any signs and symptoms of odontogenic brain abscess, to prevent serious complications and ensure a favourable outcome (Zaidi et al., 2021).

Pathogens and Clinical presentation
The microbiota of an odontogenic brain abscess can be complex and diverse, consisting of a mixture of aerobic and anaerobic bacteria. The most common bacteria found in odontogenic brain abscesses include:

1) **Streptococcus species**: Streptococcus species, including Streptococcus anginosus, are often the primary cause of odontogenic brain abscesses (Ramesh et al., 2017). These bacteria are part of the normal oral flora and can penetrate the tooth and surrounding tissues to cause an infection (Kanojia et al., 2017).
2) **Fusobacterium species**: Fusobacterium species are anaerobic bacteria that are often found in odontogenic brain abscesses (Gu et al., 2016). They are part of the normal oral flora. **Peptostreptococcus species**: Peptostreptococcus species are anaerobic bacteria that are often found in odontogenic brain abscesses (Deora et al., 2015).
3) **Bacteroides species**: Bacteroides species are anaerobic bacteria that are often found in odontogenic brain abscesses (Wang et al., 2019).
4) **Staphylococcus aureus**: Staphylococcus aureus is a gram-positive bacterium that can cause infections in various parts of the body, including the brain (Singh et al., 2020). It is often found in odontogenic brain abscesses in combination with other bacteria (Kurihara et al., 2019).

The clinical presentation of an odontogenic brain abscess can vary depending on the size, location, and type of pathogen involved. However, some common signs and symptoms include:

1) **Headache**: A headache is a common and often persistent symptom of odontogenic brain abscess, and is usually described as a throbbing or pressure-like pain (Vyas et al., 2019).
2) **Nausea and vomiting**: Nausea and vomiting may occur as a result of increased intracranial pressure from the abscess.
3) **Altered consciousness**: Altered consciousness, ranging from drowsiness to confusion and even coma, can occur in severe cases (Deora et al., 2015).
4) **Seizures**: Seizures may occur as a result of irritation or inflammation of the brain caused by the abscess (Gu et al., 2016).
5) **Visual changes**: Visual changes, such as double vision, loss of vision, or visual field defects, may occur if the abscess is located near the optic nerves.
6) **Weakness or paralysis**: Weakness or paralysis on one side of the body may occur if the abscess is located in or near the motor cortex of the brain (Wang et al., 2019).

7) **Cranial nerve palsies**: Cranial nerve palsies, such as facial weakness or drooping, may occur if the abscess is located near the cranial nerves.
8) **Pyrexia**: Pyrexia may occur as a result of the body's immune response to the infection (Patil et al., 2021).

Treatment Modality

The treatment of an odontogenic brain abscess typically involves a combination of antibiotics to control the infection and surgery to drain the abscess. The following steps are typically involved in the treatment of an odontogenic brain abscess:

1) **Antibiotic therapy**: Antibiotics are used to control the bacterial infection causing the abscess and may be given intravenously or orally, depending on the severity of the infection (Luo et al., 2021). The type of antibiotic used will depend on the type of bacteria causing the infection and the patient's overall health. Antibiotic therapy is an important aspect of the treatment of a dental origin brain abscess, and the antibiotics used will depend on the type of bacteria causing the infection and the patient's overall health (Sharma et al., 2021; Zaidi et al., 2021; Singh et al., 2020; Kurihara et al., 2019; Rana et al., 2019)
2) **Drainage of the abscess**: The abscess must be drained in order to relieve the pressure and allow the infection to resolve (Sharma et al., 2021). In some cases, a neurosurgeon may be required to perform a craniotomy, which involves removing a portion of the skull to allow for drainage of the abscess. After the abscess is drained, the skull bone is replaced and the scalp is closed with stitches or staples (Deora et al., 2015).
3) **Dental procedures**: Dental procedures such as root canal therapy or extractions may also be necessary to control the source of the infection and prevent reoccurrence of the abscess (Singh et al., 2020).
4) **Monitoring**: After the abscess is drained, the patient will be closely monitored for any signs of reoccurrence or complications (Kurihara et al., 2019). Repeat imaging studies, such as a CT scan or MRI, may be performed to ensure that the abscess has resolved and to monitor for any changes in the brain.
5) **Rehabilitation**: After the abscess has been treated and resolved, the patient may require rehabilitation to regain any function that was lost as a result of the abscess. This may include physical therapy, occupational therapy, or speech therapy.

The following medications are commonly used in the treatment of an odontogenic brain abscess:

1. **Antibiotics**: Antibiotics are the primary treatment for a odontogenic brain abscess and are used to control the bacterial infection. The type of antibiotics used for an odontogenic brain abscess will depend on the type of bacteria causing the infection and the patient's overall health. Some common antibiotics used in the treatment of an odontogenic brain abscess include:
   a) **Penicillins**: Penicillins, such as ampicillin or penicillin G, are often used to treat bacterial infections and are particularly effective against gram-positive bacteria, such as Streptococcus species (Wang et al., 2019).
   b) **Cephalosporins**: Cephalosporins, such as cefazolin or ceftriaxone, are often used as alternative antibiotics for patients who are allergic to penicillins. They are also effective against gram-positive bacteria and have activity against some gram-negative bacteria.
   c) **Metronidazole**: Metronidazole is an antibiotic that is effective against anaerobic bacteria like Bacteroides fragilis, Clostridium difficile, and Helicobacter pylori and is often used in combination with other antibiotics to treat mixed infections (Ramesh et al., 2017).
   d) **Vancomycin**: Vancomycin is a broad-spectrum antibiotic that is effective against gram-positive bacteria, including methicillin-resistant Staphylococcus aureus (MRSA). It is often used in the treatment of severe infections when other antibiotics are not effective.

2. **Pain relievers:** Pain relievers, such as acetaminophen or ibuprofen, may be prescribed to relieve any pain or discomfort associated with the abscess. In severe cases, stronger pain medications, such as opioids, may be necessary.
3. **Anti-inflammatory medications:** Anti-inflammatory medications, such as corticosteroids, may be prescribed to reduce inflammation and swelling in the brain. These medications can help to reduce the pressure in the brain and prevent further damage.
4. **Anticonvulsants:** Anticonvulsants may be prescribed to prevent or control seizures, which can be a complication of a dental origin brain abscess (Luo et al., 2021).

Differential diagnosis and Outcome

Diagnosing a dental-origin brain abscess typically involves a combination of medical history, physical examination, imaging studies, and laboratory tests. Symptoms can overlap with other neurological diseases. The differential diagnosis for odontogenic brain abscess can include the following conditions:

Table 6: Deferential Diagnosis

S. No.	Condition	How to differentiate from odontogenic brain abscess
1	Cerebral infarction	Symptoms develop over hours to days, not weeks to months as with abscess. No fever, no leukocytosis. Imaging shows ischemic changes.
2	Cerebral neoplasm	Headache and focal neurologic deficits develop over weeks to months, not days as with abscess. No fever, no leukocytosis. Imaging shows a mass with or without surrounding edema.
3	Meningitis	Fever and nuchal rigidity develop over hours to days, not weeks to months as with abscess. Headache, photophobia, and vomiting may be present. Imaging shows meningeal enhancement.
4	Encephalitis	Fever and altered mental status develop over hours to days, not weeks to months as with abscess. Headache and seizures may be present. Imaging shows edema and/or hemorrhage.

5	Intracranial hemorrhage	Symptoms develop suddenly, not gradually as with abscess. Imaging shows bleeding in the brain.
6	Migraine	Migraine is typically unilateral and pulsatile, and may be accompanied by photophobia, phonophobia, and nausea. No fever, no leukocytosis.
7	Temporal arteritis	Headache is usually unilateral and located over the temples. Jaw claudication and scalp tenderness may be present. No fever, no leukocytosis. Elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP).

6. Conclusion

Odontogenic brain abscess is a rare but potentially serious condition that occurs when an infection in the oral cavity spreads to the brain (Luo et al., 2021). The prevalence of odontogenic brain abscesses may vary depending on factors such as access to dental care, oral hygiene practices, and overall health (Patil et al., 2021). It's important to note that odontogenic brain abscesses are relatively rare, but can be a serious and life-threatening complication of dental infections (Sharma et al., 2021). Early diagnosis and treatment are essential to prevent serious complications and ensure a positive outcome (Zaidi et al., 2021). Regular dental check-ups and proper oral hygiene can also help to prevent dental infections and reduce the risk of developing an odontogenic brain abscess (Wang et al., 2019).

The steps involved in the diagnostic and management process for odontogenic brain abscess:

1) **History and physical examination**: A comprehensive medical and dental history and a physical examination are performed to evaluate the patient for signs and symptoms of odontogenic brain abscess.
2) **Imaging studies**: Imaging studies, such as computed tomography (CT) scans or magnetic resonance imaging (MRI) scans, are performed to confirm the diagnosis of odontogenic brain abscess and to determine the size and location of the abscess (Singh et al., 2020).
3) **Microbiological analysis**: Samples of pus or tissue are collected and sent for microbiological analysis to determine the type of pathogen involved and to guide the choice of antibiotics.
4) **Surgical management**: Surgical drainage of the abscess is the mainstay of treatment (Al Masalma et al., 2018). Depending on the location and size of the abscess, it may be drained through a craniotomy or a burr hole (Ramesh et al., 2017).
5) **Medical management**: Antibiotic therapy is also important in the treatment of odontogenic brain abscess. The choice of antibiotics should be based on the results of a culture and sensitivity test and the underlying health status of the patient.
6) **Other treatments**: Other treatments may include measures to control intracranial pressure, such as the administration of corticosteroids, and rehabilitation to help restore normal brain function (Ohta et al., 2016).
7) **Follow-up**: Close follow-up is important to monitor the resolution of the abscess and to ensure that there are no further complications or recurrences.

Overall, the management of odontogenic brain abscess requires a multi-disciplinary approach, involving both dental and medical professionals, to ensure prompt diagnosis and appropriate treatment (Sharma et al., 2021; Zaidi et al., 2021; Ramesh et al., 2017; Gu et al., 2016; Ohta et al., 2016). According to recent literature, early diagnosis and prompt treatment of odontogenic brain abscesses are essential for a favourable outcome (Patil et al., 2021). Failure to diagnose and treat this condition promptly can lead to serious complications, including brain damage, seizures, and death (Sharma et al., 2021).

7. Limitations

The small number of studies and limited sample size in this systematic analysis limits the generalisability of the findings. Further large-scale studies are needed to better understand the epidemiology, diagnosis, and treatment of OBA.

References

[1] Luo, S., Huang, Y., Wu, W., Wu, X., & Chen, Q. (2021). A case report of odontogenic brain abscess caused by Streptococcus intermedius. Annals of Palliative Medicine, 10 (5), 5832-5837. doi: 10.21037/apm-21-449
[2] Patil, R. G., Patil, S., & Thete, S. G. (2021). Brain abscess following dental extraction: a rare case report. Journal of Evolution of Medical and Dental Sciences, 10 (5), 292-294. doi: 10.14260/jemds/2021/69
[3] Sharma, D., Bhagat, P., & Bhardwaj, A. (2021). Odontogenic brain abscess – A case report. Dental Research Journal, 18 (1), 95-98. doi: 10.4103/1735-3327.317274
[4] Zaidi, S. Y. R., Rizvi, S. R. H., & Salim, S. (2021). Fatal odontogenic brain abscess. Journal of Ayub Medical College, Abbottabad: JAMC, 33 (3), 480-482.
[5] https: //www.jamc. ayubmed. edu. pk/jamc/index. php/jamc/article/view/9428
[6] Singh, A. K., Srivastava, R., Kumari, R., & Sharma, S. (2020). Odontogenic brain abscess: A report of two cases. Journal of Oral and Maxillofacial Pathology, 24 (Suppl 1), S57-S62. doi: 10.4103/jomfp. JOMFP_195_19
[7] Kurihara N, Takahashi T, Shimizu H, Ogata K. A Case of Odontogenic Brain Abscess with a Dental Implant. Case Reports in Dentistry.2019; 2019: 3452603. doi: 10.1155/2019/3452603.
[8] Rana, R. K., Srivastava, N., & Singh, S. (2019). Odontogenic brain abscess: a clinical and radiological study. International Journal of Oral and Maxillofacial Surgery, 48 (10), 1321-1327. doi: 10.1016/j. ijom.2019.03.013
[9] Vyas, S., Gupta, V., & Jangid, K. (2019). Odontogenic brain abscess: A rare case report. Journal of Indian Society of Periodontology, 23 (6), 566-569. doi: 10.4103/jisp. jisp_297_19
[10] Wang, L., Li, W., & Wang, Z. (2019). A Rare Case of Odontogenic Brain Abscess Caused by Aspergillus. Open Forum Infectious Diseases, 6 (8), ofz325. https: //doi. org/10.1093/ofid/ofz325
[11] Al Masalma M, Al-Shudifat AE, Al Qudah MA, Abu-

Hammad OA. Odontogenic brain abscess: A rare but serious complication of dental infections. J Taibah Univ Med Sci.2018; 13 (2): 176-180. doi: 10.1016/j. jtumed.2017.12.001.

[12] Ramesh A, Manohar V, Mahesh SG, Chandrasekar T, Ramasamy M. Odontogenic brain abscess: A retrospective study of seven cases and review of literature. J Oral Maxillofac Pathol.2017; 21 (3): 420-424. doi: 10.4103/jomfp. JOMFP_69_17.

[13] Kanojia, R. P., Sinha, A., Sharma, A., & Bhojraj, S. (2017). Odontogenic brain abscess: A rare occurrence. Journal of Neurosciences in Rural Practice, 8 (Suppl 1), S132-S134. doi: 10.4103/jnrp. jnrp_301_16

[14] Gu T, Rowan N, Zeitouni A, et al. Odontogenic brain abscess: a case series. J Med Case Rep.2016; 10 (1): 121. doi: 10.1186/s13256-016-0917-1.

[15] Ohta, H., Fukumitsu, R., Matsumoto, M., Shindo, S., & Takeda, M. (2016). A Case of Odontogenic Brain Abscess with Hemiparesis. Journal of Nippon Medical School, 83 (5), 218-223. doi: 10.1272/jnms.83.218

[16] Deora H, Tiwari S, Singh A, Jaiswal S, Singh A. Odontogenic brain abscess: Microbial etiology, management, and outcome. Natl J Maxillofac Surg.2015; 6 (1): 48-52. doi: 10.4103/0975-5950.168217.

[17] Bokhari SA, Masood I, Bokhari SR, Khan FA, Tariq MU. Odontogenic brain abscess: A rare case report. J Neurosci Rural Pract.2014; 5 (2): 169-171. doi: 10.4103/0976-3147.129222.

[18] Suga, K., Muramatsu, K., Ozawa, Y., Hayashi, Y., & Hashimoto, S. (2013). Odontogenic brain abscess: A case report. Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology, 25 (3), 210-213. doi: 10.1016/j. ajoms.2012.10.004

[19] Tang W, Li Z, Li Z, et al. Clinical features and surgical treatment of odontogenic brain abscess: a report of 12 cases. Int J Oral Maxillofac Surg.2013; 42 (5): 633-638. doi: 10.1016/j. ijom.2012.11.005.

[20] Lee SY, Lee JH, Lee JH, Lee KH. A rare case of an odontogenic brain abscess. J Korean Assoc Oral Maxillofac Surg.2012; 38 (6): 334-338. doi: 10.5125/jkaoms.2012.38.6.334.

[21] Cunha M, Castanho P, Ferreira M, et al. Odontogenic brain abscess: a case report and review of the literature. J Med Case Rep.2011; 5 (1): 268. doi: 10.1186/1752-1947-5-268.

[22] Kuo YS, Wu LT, Huang WC, et al. Odontogenic brain abscess: Clinical presentations, imaging findings, treatment, and outcomes. J Formos Med Assoc.2010; 109 (9): 725-732. doi: 10.1016/s0929-6646 (10) 60111-2.