



Clinical case

Frontal bilateral brain abscess, hyperbaric medicine, surgery and antimicrobial therapy in rare germ. Case report and literature review

Absceso cerebral bilateral frontal, medicina hiperbárica, cirugía y terapia antimicrobiana en germen extraño. Reporte de caso y revisión de la literatura

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ABSTRACT

Brain abscesses are rare in immunologically competent patients, usually secondary to infectious processes in the skull cavities, mainly in the paranasal sinuses, mastoid cells, and middle ear. Different management schemes have been proposed in the presence of microorganisms that, day by day, are more resistant to pharmacological treatments. Depending on their size and location, brain abscesses require medical and surgical management in conjunction with newfangled techniques such as hyperbaric therapy. We present the clinical case of a 20-year-old male with intense headaches and compromises in his neurological state secondary to two large abscesses in the frontal cerebral lobes with a satisfactory resolution with the patient's neurological and functional state with 100% eradication of the collection.

Keywords: Brain abscess, *Streptococcus intermedius*, hyperbaric therapy, brain surgery.

RESUMEN

El absceso cerebral es un evento extraño en el paciente inmunológicamente competente, por lo general secundario a procesos infecciosos en cavidades craneales, principalmente en senos paranasales, celdillas mastoideas y oído medio. Diferentes esquemas de manejo han sido propuestos en presencia de microorganismos que día a día son más resistentes a los tratamientos farmacológicos. Dependiendo del tamaño y la localización, los abscesos cerebrales requieren tratamiento médico y quirúrgico en conjunto con técnicas modernas como la terapia hiperbárica. Presentamos un caso clínico de un hombre de 20 años con cefalea intensa y compromiso del estado neurológico secundario a dos abscesos en lóbulos frontales con erradicación del 100% de las colecciones y mejoría del estado neurológico y funcional del paciente.

Palabras clave: Absceso cerebral, *Streptococcus intermedius*, terapia hiperbárica, cirugía cerebral.

INTRODUCTION

Brain abscesses (BA) are focal lesions that pass through multiple stages during their development, considered early cerebritis, late cerebritis, early abscess, and late abscess.¹

BA is associated with soft tissue infections in the cranial cavities, such as the middle ear, and sometimes of idiopathic character. The predominant pathogens involved are gram-positive germs.² Its diagnosis is based on characteristic imaging findings and culture samples of the lesion specifying

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antimicrobial management, usually between 4-8 weeks of treatment according to antimicrobial resistance, clinical evolution, and imaging follow-up.^{2,3} Surgical drainage should be considered to reduce the mass effect and favor intracranial dynamics depending on the size and location.⁴ Treatment adjunct with hyperbaric oxygen therapy (HBOT) has been used since 1980 and has shown good results in comparison with patients who have not been treated with HBOT.⁵ BA are central nervous system infections the last in terms of research priority, nevertheless, is a fascinating disease that requires further research studies.⁶

We present a patient with two frontal abscesses requiring prolonged antimicrobial therapy, surgical drainage, and management with hyperbaric medicine to favor the lysis of infectious pathogens, obtaining good results and pathology solution.

CASE DESCRIPTION

A 20-year-old patient who consulted for an 8-day moderate-intensity headache with asthenia, adynamia, behavioral changes, and postural tone loss without presenting sphincter relaxation, no fever or clinical signs of intracranial hypertension were documented. Brain computed tomography (Figure 1) and contrasted cerebral magnetic resonance imaging was performed (Figure 2) that shows well-defined round intra axial lesions T1 hypointense and T2 hyperintense in the right and left frontal subcortical white matter; the lesions have a thick wall with dual rim sign best seen

on T2WI, ring enhancement in post-contrast T1 sequence and restricted diffusion on DWI images (low signal on ADC) associated with an important vasogenic perilesional edema. Findings were highly suggestive of BA.

Blood studies were requested to increase the white hematological series and inflammatory reactants. In the cerebrospinal fluid sample, we find proteinorachia associated with high-level lactate and procalcitonin suggestive of meningitis.

The diagnosis of multiple BA was confirmed, initiating broad-spectrum antimicrobial management with metronidazole, ceftriaxone, and vancomycin; considering the large mass effect and greater diameter of 2.5 cm, neurosurgical management with drainage of the two lesions was indicated, obtaining abundant fetid purulent material (Figure 3). The cultures isolate a multi-sensitive *Streptococcus intermedius*.

During his hospitalization, he required antimicrobial management until completing four weeks. By the persistence of residual collections and not a remarkable improvement in his clinical condition, new drainage of the collections was required, obtaining less purulent material with the same pathogen's isolation. Further, the patient needs 10 sessions of hyperbaric medicine at 2.5 atmospheres of pressure.

A bilateral mastoiditis was considered the origin of the infection, which was evident in the imaging studies during his hospitalization. After completing a 6-week schedule of antimicrobial management and improving his neurological

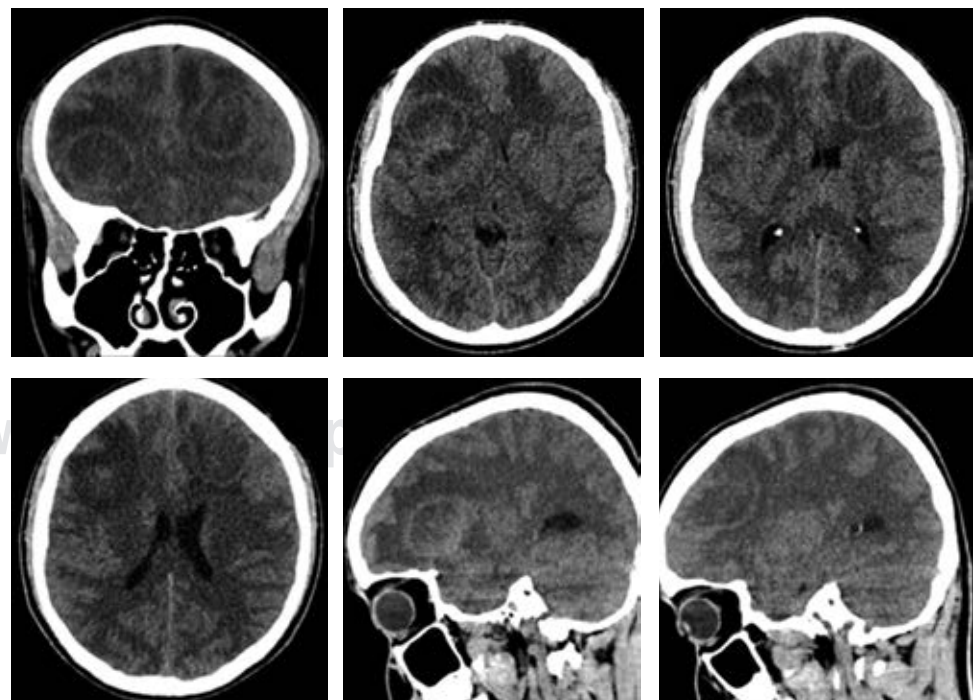


Figure 1:

Cerebral CT-scan with two frontal lobes lesions with hiperdens and central hipodens well defined images.

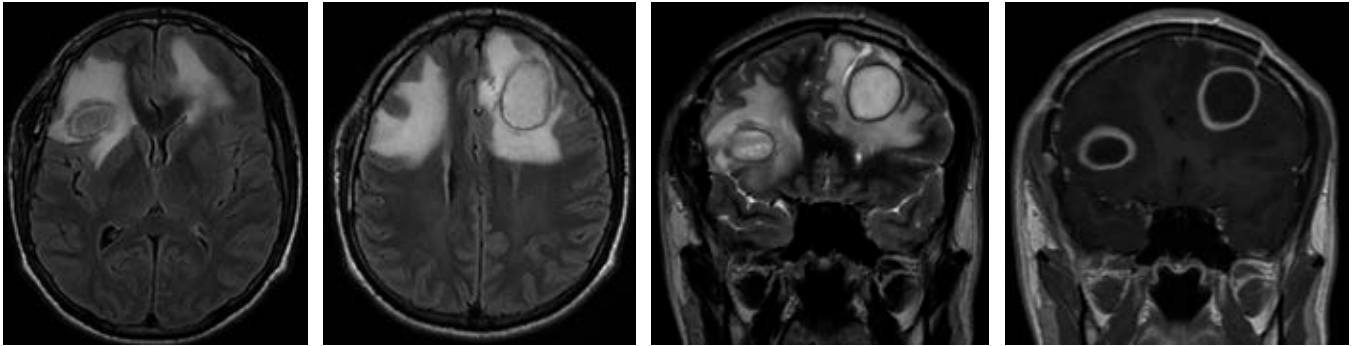


Figure 2: Well-defined round intra axial lesions T1 hypointense and T2 hyperintense in the right and left frontal subcortical white matter; the lesions have a thick wall with dual rim sign best seen on T2WI, ring enhancement in post-contrast T1 sequence and restricted diffusion on DWI images (low signal on ADC) associated with an important vasogenic perilesional edema.



Figure 3:

Brain abscess purulent material and patient positioning during surgery (scheme).

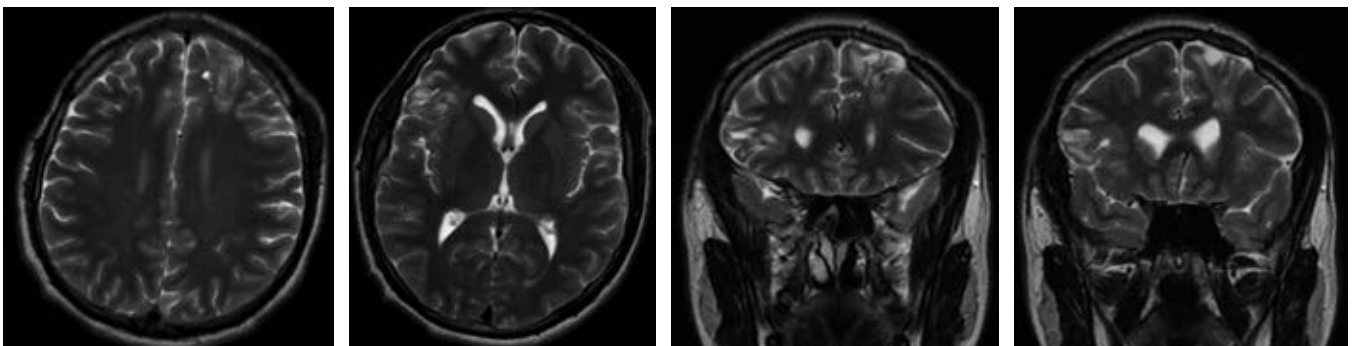


Figure 4: Postoperative MRI without presence of abscess and little frontal bilateral gliosis area.

condition, the patient was sent home with antimicrobial management until completing 10 weeks of treatment.

A brain MRI control image was accomplished showing gliosis-encephalomalacia with full BA resolution (Figure 4).

DISCUSSION

BA are a disease that affects a population between 0.3 and 0.9 people per 100,000 habitants, with a 70% predominance of males,⁷ mainly affecting patients with immunological compromise or who consume medication that

immunosuppresses the human defense system, besides all patients in whom the protective barriers of the brain are compromised are also affected, either by infections in the cranial cavities or associated with surgical procedures, trauma or other systemic infections such as endocarditis or bacteremia.⁸

Some predisposing factors in developing BA are extreme age, open traumatic brain injury (OTBI), otitis, or infections of the cranial cavities associated with immunosuppressed patients either by HIV or by post-transplant stages, with a higher frequency infection by Toxoplasma,

mycobacteria, and *Nocardia*.⁹ Germs such as *Staphylococcus*, *Streptococcus*, Gram-negative bacilli, or polymicrobial infection are more frequently found in patients with OTBI or who have undergone surgical procedures, however, cultures are sterile in 25% of patients.¹⁰

BA are classified according to stages: early cerebritis, late cerebritis, early abscess, and late abscess; its pathogenesis is described as the beginning in a focus of central necrosis surrounded by a perivascular inflammatory process that is led by white matter edema, later the necrotic center increases in size with the recruitment of fibroblasts, and neovascularization generated a capsule which with the passage of days is thickened with a collagen sheet. Finally, its necrotic center presents a state of liquefaction and leukocyte accumulation presence of edema and inflammation.^{7,11}

Its diagnosis is made mainly by contrasted CT and contrasted MRI, which allows us to observe a ring enhancement with the contrast of the capsule with diffusion restriction due to the high protein concentration.¹² No laboratory data could be considered pathognomic of BA.¹³ Frequently, patients show normal leukocyte counts, erythrocyte sedimentation rate elevated or normal, in LCR blood cultures are positive in rare cases, elevated protein level, elevated cell count, and c-reactive protein-positive but is an unspecific test in the diagnosis of BA.^{14,15}

The management of BA is a multimodal concept between surgical drainage of BA, repair of the primary source, and antimicrobial management, which should be directed with broad-spectrum medication (3rd and 4th generation cephalosporins) added to metronidazole and vancomycin if it is associated with OTBI; its duration is approximately 6-8 weeks and if required to prolong it orally until completing 10 weeks according to the resolution of the symptoms;^{7,9,16} the surgical treatment should be considered if lesions are bigger than 1 cm. Any lesion more than 2.5 cm must always be drained. A biopsy of the lesion could be taken for culture via stereotaxic surgery for isolating the pathogen to guide antimicrobial treatment.^{6,11} Total resection through craniotomy is rarely used, only for patients with large multi-lobulated abscess and cranial hypertension, stereotactic aspiration by neuronavigation is a good election for BA bigger than 1 cm, for BA bigger than 2.5 cm is an indication for drainage if existing documentation of microbiology agents and periventricular lesions or infections with a difficult treatment for bacteria or fungi drainage must be discussed for high risk of treatment failure and complications like ventriculitis.⁶

Nowadays, hyperbaric medicine has been implemented in BA as an adjunctive treatment based on the theory of eliminating pathogens by increasing atmospheric pressure resulting in hyperoxygenation of perfused tissues,¹⁷ generating lysis of cell barriers favoring antimicrobial

management, bactericidal effect in anaerobic and mixed infections, enhanced leukocyte bacteria-killing action and vasoconstriction which cause a minor blood volume and intracranial pressure¹⁵⁻¹⁷ and regenerating the surrounding tissue.¹⁸ HBOT therapy is defined as a treatment consistent in breathing 100% of FiO₂ under pressure bigger than one atmosphere of pressure.¹⁷ Complications of HBOT include barotrauma, oxygen toxicity, ocular effects, and claustrophobic anxiety.¹⁹ Many studies show better outcomes in patients who received HBOT for less morbidity, less reoperation ratio, and fewer failure therapies.^{19,20} HBOT was approved by the Undersea and hyperbaric medical society (UHMS) in 1996, however, its lack evidence about outcomes, protocols of use, and viability.²⁰ The UHMS establish the treatment protocol administering O₂ at a pressure of 2.0 to 2.5 atmospheres for 60 to 90 minutes per treatment, usually, one or two sessions per day always according to the condition of the individual patient, the optimal number of sessions is unknown, in absence of osteomyelitis the average number could be 13 sessions.

CONCLUSIONS

BA is an important cause of central nervous system infection that shows a good prognosis with a multimodal strategy of treatment including surgical management, use of antibiotics, and adjuvant therapies like hyperbaric oxygen.

HBOT could get better outcomes for patients with BA, however, there is not sufficient evidence and protocols for recommending the use in all cases.

BA requires further research studies to establish recommended universal optimal diagnosis, pharmacologic treatment, surgical treatment, and adjuvant treatment.

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