

# Brain Abscess in a Patient with Acute Lymphoblastic Leukemia: Case Report

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## Abstract

Brain abscess rarely occurs in a patient with hematologic malignancy. Leukemia is the most common hematologic malignancy and can manifest to CNS as cerebrovascular complications, infections, or metastatic brain tumors. Brain abscess in a patient with leukemia has an unspecified presentation, makes challenging diagnosis processes, and contributing to increased mortality and morbidity. We report and describe in detail an unusual case of a 44-year-old man with brain abscess and ALL. Specifically, the patient underwent a series of tests, brain MRI, and MR Spectroscopy. The results of the tests are reported here. We discuss the occurrence, the clinical presentation, and association between these two diagnoses, possible etiopathogenic mechanisms, management, and prognosis of this condition.

**Keyword:** Brain Abscess, Leukemia, ALL

## Introduction

Brain abscess is a life-threatening disease and leads to lasting neurological deficits and death. A brain abscess can occur from a spreadable infection site, hematogenic, head injury, or brain operative, but in some conditions, an etiology is hard to identify (1–3). A brain abscess can also occur in patients with a medical predisposition, such as hematologic malignancy, with an unspecified presentation and challenging diagnosis process. The frequency of opportunistic cerebral abscess has increased, contributing to increased mortality and morbidity (4).

Leukemia is the most common hematologic malignant disorder (5). Patients with hematologic malignancies have increased opportunistic pathogens infection rates with the probability of spread and lead to invasive disease (4). The rate of neurologic involvement in leukemia has also increased (5). A cerebral abscess that occurs in patients with acute leukemia has not been widely discussed. This paper will report and discuss cerebral abscess in leukemia patients to better understand the pathology and management of cerebral abscess in acute leukemia patients.

## Case Report

The case presented here is a 44-year-old man who had recurrent focal to bilateral motor seizure with tonic-clonic form. He was unconscious between and after the seizure. There was no history of seizure and antiepileptic drug consumption before. The patient had a febrile and productive cough since seven days before. He was previously diagnosed with Acute Lymphoblastic Leukemia (ALL) L-3 based on recurrent pancytopenia history, blood smear analysis, and bone marrow puncture showed 49% lymphoblast.

On the examination, his mental status was somnolence with GCS 10/15, blood pressure 110/70 mmHg, respiratory rate 22 tpm, heart rate 84 bpm, and axillary temperature 36.9 C. Patient looks pale, the pulmonary sound was vesicular with bilateral rhonchi, and neurological examination showed pupils equally reactive bilaterally with no papilledema. There was no decrease in motor strength, and other examinations were within the normal limit.

A series of tests, brain Magnetic Resonance Imaging (MRI), and encephalography perform after admission. Laboratory findings showed decreased hemoglobin concentration of 4.1 g/dL, decreased white blood cell 460/mm<sup>3</sup>, and decreased platelet 46000/mm<sup>3</sup>. Blood urea nitrogen, creatinine, albumin, liver function analysis, and serum electrolyte were within the normal range. Chest radiography showed pneumonia, and sputum culture showed MRSA and *Acinetobacter baumannii* infection. Blood culture was done after antibiotics treatment and showed steril result. Head MRI and Spectroscopy demonstrated intraaxial lesion with increase lipid and lactate suitable for early capsule phase of cerebral abscess at right frontal regio, with cerebral edema and subfalcine herniation (Figure 1). Electroencephalography two weeks after the seizure onset showed a normal result.

### Figure 1. T2-weighted brain MRI showing brain abscess with vasogenic edema

Based on these results, we diagnosed the patient with cerebral abscess, symptomatic epilepsy, ALL, and pneumonia. The patient was treated with ceftriaxone and metronidazole injection and oral phenytoin to control the seizure. The patient's neurological deficit was improved, but he developed pneumonia with respiratory failure and septic shock. The patient was died 30 days after the diagnosis.

## Discussion

The incidence of leukemia with neurologic lesions has increased caused by improving in therapy and extended survival times (5). In this case, we report a brain abscess that occurred in a 44-year-old male patient with ALL predisposition. The patient complained about first focal seizures as a sign of intracranial problems, followed by a gradual decrease in consciousness. The point of this case is the cerebral abscess that occurs in a leukemia patient. CNS infection signs and symptoms tend to be less specific in immunocompromised patients because of reduced inflammatory response. Patients may present with headaches, seizures, altered consciousness,

and focal neurological deficits. However, this disease tends to be more widespread, challenging to treat, and needs to be managed aggressively (6).

Patients with leukemia have increased infection rates by opportunistic pathogens with the probability of spread and lead to invasive disease (4). Infection can occur by the systemic effects of leukemia or bone marrow suppression by intense chemotherapy as a neurological complication resulting from therapy (5,6). In patients with hematologic malignancies, the significant risk factor for infection is severe neutropenia associated with disease (Absolute neutrophil count <500) for 7 to 15 days or chemotherapy induction. The duration and magnitude of neutropenia determine the risk of infection. However, infection in leukemia patients can occur in neutropenic and non-neutropenic conditions (4,7). Infection risk is also affected by other factors such as low nutritional status, prolonged length of stay in the hospital, catheter use, and mucositis, which predispose individuals to various types of organisms. Often, organisms reach the CNS from other infection sites by hematogenous spread (6).

Several investigations are needed to diagnose the patient. MRI can characterize neurologic lesions caused by leukemia, management of neurologic complications, and neurologic infection due to immunocompromised conditions (5). Gadolinium MRI is the best choice to identify CNS infection. MRI Spectroscopy (MRS) and DWI can assist in further characterization. The focal form of parenchymal infection is usually cerebritis, which can develop into an abscess (6). Hematogenic brain abscess often found at grey and white matter junction as one or more ring-enhancing lesions (8).

Blood culture is useful in small patients, especially in patients who have not undergone surgery, patients with negative abscess fluid cultures, and hematogenous spread suspected abscess. In patients who have delayed surgery and started antibiotic therapy before surgery, abscess fluid cultures may show a negative result, and early blood cultures can provide useful information (9). Blood cultures in immunocompromised cerebral abscess patients often showed negative results, except for *Fusarium* species (4). Despite this, pathological biopsy from brain tissue remains the gold standard (5). The blood cultures performed on this patient showed no aerobic bacteria were found, maybe due to blood culture tests performed after the start of antibiotics.

The stereotactic aspiration method is a minimally invasive procedure for managing brain abscess with low morbidity and mortality. This procedure allows fast and adequate surgical drainage. It allows for a pus culture to identify the etiology and contributes to an improved prognosis for brain abscess (4,9). In the abscess drainage in ALL patients, one should consider the blood coagulation function before the biopsy because many patients with leukemia have blood coagulation dysfunction. Somehow, stereotactic biopsy is still superior because it is comfortable and noninvasive (5). However, a biopsy was not done on our patient.

Antibiotic therapy suggestions are based on possible microorganism etiology, the antimicrobial spectrum of agents, their capability to penetrate the abscess, and antibiotic effectiveness reviews. The empirical antibiotic should be started immediately. Several studies generally using a combination therapy of metronidazole and cephalosporins (9,10). In our case, after diagnosed with a cerebral abscess, the patient received ceftriaxone and metronidazole for the management

of a cerebral abscess. The management of ALL begins when the management of an opportunistic infection has been resolved.

ALL have a predisposition to severe infections and result in significant morbidity (7). Immunocompromised patients with opportunistic cerebral abscesses have a poor prognosis. Cerebral abscesses are challenging to treat caused by non-specific presentation and diagnostic difficulty. Mortality ranges of cerebral abscess from 6% to 24%, with an increased rate in patients with hematologic malignancies (4). Therefore, clinical history, blood analysis, and bone marrow tests, combined with brain lesions pathology, can provide a precise diagnosis and appropriate management.

### Consent for Publication

Written informed consent was obtained from the family of patient in this case report.

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### Competing Interest

The authors have no conflicts of interest to disclose.

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