Brain Abscess

Definition
A brain abscess is defined as an intraparenchymal infection caused by bacteria, mycobacteria, fungi, protozoa, or helminthes that evolve to an encapsulated purulent collection. Brain abscess is a rare disease. The incidence of brain abscess was 1.3/100,000 per year. The male to female ratio was approximate 3:1.

Epidemiology
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Pathophysiology
Brain abscesses are serious, life-threatening conditions. Despite advances in diagnostic imaging, surgical interventions, and antimicrobial treatment, the mortality (5.9% to 20%) and morbidity rate of brain abscess remain high. Approximately 35% children with brain abscesses do not return to their predisease state after treatment. Brain abscesses are mostly related to the invasion of infectious organisms that were transmitted from an infection focus in other part of the body. Spreading of infection from a remote site can occur through contiguity (close proximity) or via the blood stream. The most common predisposing conditions for brain abscess are infections from contiguous foci such as otitis media or mastoiditis, sinusitis, meningitis, and odontogenic foci. Thirty three percent of brain abscess are resulted from hematogenous spread. Common sources for hematogenous spread are pulmonary infection, gastrointestinal tract, congenital heart diseases, and endocarditis. Fourteen percent are resulted from penetrating head injuries. Eighteen percent of the abscesses are due to unknown origin. Brain abscesses begin with a local infection that evolves into a collection of pus surrounded by a well vascularized capsule. Approximately 80% of brain abscesses are located in the cerebral hemisphere. Approximately 50% - 76% of the causative organisms of brain abscesses are streptococci. Other causative organisms include anaerobic bacteria, staphylococci, gram-negative bacteria, and fungus.

Diagnostic Tests
Computerized tomography (CT) scan, magnetic resonance imaging (MRI), completed blood count, blood culture, echocardiogram, and teeth examination are the most common tests for diagnosing brain abscess and to detect the source of infection. In laboratory tests, signs of infection such as leukocytosis, elevated C-reactive protein concentration, and elevated erythrocyte sedimentation rate may be revealed. Blood cultures are useful to detect the source of microorganism from hematogenous spread. Computerized tomography is non-invasive and has a sensitivity of 95% - 99%. It is used to identify the location and size of the abscess and any mass effect. A CT scan can also view the sinuses, middle ears, and orbits to search for a potential source of infection.

A CT scan showing the brain abscess (arrow)

Magnetic resonance imaging is able to demonstrate more anatomical detail and has better resolution than CT scan. Magnetic resonance imaging is useful to detect early cerebritis and alterations of the blood brain barrier. It is also able to differentiate brain abscess from brain tumor or infarcts.

A T-2 MRI showed a brain abscess (arrow) with cerebral edema

Lumbar punctures are frequently performed when patients are suspected to have concomitant meningitis and/or ventriculitis. Cultures of the CSF obtained from lumbar puncture may grow the microorganism responsible for the brain abscess. Lumbar punctures should not be performed when patients have increased intracranial pressure in order to prevent cerebral herniation.

Manifestations
The classic triad presentation for brain abscess are headache, fever, and neurological deficits. However, only 20% of patients present with the classic triad. Approximately 30% of patients with brain abscess are apyrexia. Manifestations of brain abscess can vary based on the location and size of the abscess. The most common...
presentations include headache, fever, nausea and vomiting, seizures, motor or sensory dysfunction, visual field deficits, memory loss, and personality changes2,4,7,12.

Treatment Options

The treatment choice for brain abscess depends on different factors. It includes the signs and symptoms of the patient, the number, size, and location of the abscess, and health condition of the patient18. Treatment options include medical treatment, and surgical intervention12,16.

Medical treatment involves administration of antibiotic, antiepileptic agent, and corticosteroid therapy. Medical treatments are appropriate for patients who have small lesions (< 2-3 cm in diameter), are clinically stable, have no signs of increased intracranial pressure, have been diagnosed within 2 weeks after the initial presentation, abscesses in an inaccessible location, or patients who are critically ill2,18.

Broad spectrum antibiotics are used in medical treatment or combined with surgical interventions. The most commonly used antibiotics include penicillin, ceftriaxone/cefotaxime, metronidazole, or carbapenem. Antibiotic therapies are normally continued for 4 to 8 weeks 2,7,12.

Surgical interventions are invasive, but it has several advantages. It is able to remove the pathogens and necrotic tissues, and reduce the mass effect and intracranial pressure. In addition, pus sample can be obtained and send for bacteriological analysis during the surgical procedure19.

The advantages of aspiration are, it is minimal invasive, can be performed under local anesthetic, and has less potential morbidity. Sterotactic aspiration provides a more precise and rapid access to the abscess19. It is more useful in deep-seated abscess or abscess located in eloquent areas20. Very often, aspiration may require repeated aspirations to clear the abscesses9.

Craniotomy and excision of abscess is more invasive. Craniotomy and excision of abscess is recommended for patients with multiple abscess, larger lesions with significant mass effect, or recurrent pus collection after several aspiration19. Patients after craniotomies and excision of abscesses often do not require second surgeries9.

Corticosteroids are often prescribed for reducing cerebral edema. Fifteen percent to twenty eight percent of patients with brain abscesses present with seizures. It is also the most common post-operative complication. Anti-epileptic agents are frequently used as seizure prophylaxis2,4.

Nursing Implication

Frequent neurological assessment such as level of consciousness, motor and sensory function, and cranial nerve function should be performed to monitor for any signs of complications such as increased intracranial pressure or cerebral herniation1.

Due to patients with brain abscess requiring long term intravenous antibiotic therapy, long term central venous catheters are recommended to avoid risks of infections such as phlebitis21.

References