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Cerebral Abscess In A Child With Unknown Origin Of Infection: A Case Report

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ABSTRACT

Introduction: Cerebral abscess in pediatric with unknown origin of infection may happen in 12%. Early diagnosis and treatment of pediatric cerebral abscess can reduce mobidity and mortality rate. The incidence of brain abscess is higher in developing countries. The classic triad of fever, headache and focal neurological signs was seen in 9–28% of the paediatric cases. Brain abscesses occur infrequently with potentially life-threatening condition.

Case Report: Child 1 year 8 months old with main complaint weakness in left arm and leg progressively for one month. She had local seizure on her left arm and leg in one month before admission with duration of 30 minutes. The strength of upper and lower extremities was 3 respectively. The physiology reflex was hyper reflex on the upper and lower extremities. Head non contrast CT scan showed a hypodense lesion on the right parietal with perifocal oedema lesion. Head contrast CT scan showed a hipodense lesion on the right parietal with ring enhancement measuring approximately 6,2 cm x 4,5 cm. Craniotomy evacuation abscess with near total capsulectomy was done on initial and capsule resection was done.

Discussion: Modern neurosurgical techniques including stereotactic brain biopsy and aspiration along with better culture techniques, newer generation antibiotics have revolutionized the treatment and outcome of brain abscess. The use of broad spectrum antibiotics and repeated aspiration and in some cases excision are the current treatment modality. The level of evidence of steroid use in these patients is not yet clear because it is believed that they slow down the encapsulation process, they increase the risk of necrosis, reduce the penetration of the antibiotic to brain tissue and have a rebound effect. Medical treatment is recommended in patients without increased intracranial pressure, with symptoms of less than 1 week long and abscess of less than 2 cm seen in tomography.

Conclusion: Broadspectrum antibiotic is optimal treatment in postoperative evacuation of cerebral abscess cases with unknown origin infection.

Keywords: Brain abscess, children, broadspectrum antibiotic, parietal lobe

1. Introduction

In 1893, Sir William Macewen published a study about *Pyogenic Infective Diseases of the Brain and Spinal Cord Meningitis, Abscess of the Brain* and *Infective Sinus Thrombosis*. The surgical anatomy, pathology, symptoms, intracranial sinuses, treatment and prevention of abscess by treatment of otitis media and mastoiditis was discussed in his study. Early diagnosis and aggressive treatment are the importance factor in the Macewen's success in treatment of brain abscess. [1]

Based on study of Khanzada K,. et al, in 2016 they concluded that of 120 patients with cerebral abscess, 12 of the cases (10%) have an unknown origin. Although they stated that most of the case documented are in pediatric group with predominant in frontal lobe. They concluded that 17 of cases of brain abscess occurred in parietal lobe with 17 cases of 120 brain abscesses (14.2%).[2] Based on study, incidence of brain abscess representing about 0.9 cases pre 100,000 population in 1981, and many studies concluded that brain abscess has a diminishing cases year after year. In Finland, the incidence is 0.3 per 100.000 cases. [3]

Infection of Central Nervous System in children is rare but severe conditions. Cerebral parenchyma infection may develop a focal infection as a brain abscess. It is usually as a complication of meningitis, otitis media,

mastoiditis, sinusitis, dental infections, bacterial endocarditis, and congenital heart defects. Brain abscess starts as a localized area of cerebritis, which evolves into a collection of encapsulated purulent material. In a literature, the risk factor in children is otitis media, sinusitis, dental infection and osteomyelitis. Other causes such as infected ventriculoperitoneal shunt, tetralogy of fallot. Of all the patients, the most common microorganism isolated were Streptococcus pyogens, followed by Streptococcus intermedius, Streptococcus pneumoniae and coagulase negative staphylococcus. [4] Fever, headache, and focal neurological signs were the classic triad that seen in 9-28% of paediatric cases. In acute cases, common clinical features were headache (89.3%), fever (67.5%), vomiting (38%), focal deficit (31%) and seizure (22.6%) focal and secondary (generalized). Fever, meningism, raised ESR, multilocularity, leptomeningeal or ependymal enhancement, reduction of ring enhancement in delayed scan and finding of gas within the lesion favor a diagnosis of abscess. [5]

The incidence of brain abscesses in the western population is approximately 1500-2500 cases/year. It is higher in developing countries. The male to female ratio varied from 1.3:1 to 3.0:1 in the literature. The patients ranged from infancy to elderly ages. Most brain abscesses occurred in the first two decades of life. [6] The most common organism isolated from a brain abscess was Staphylococcus aureus in the pre-antibiotic era. Now, Streptococcus spp. have replaced Staphylococcus spp. as the most common organisms. [7]

A rapid diagnosis and early treatment are necessary because cerebral abscess has potential for rapid clinical deterioration and fatal outcome8. Although the diagnosis and treatment are advancing, brain abscess is still a disease with significant morbidity and mortality in children. [9] The improvement of imaging, neurosurgical technique and new antibiotic regimen may decrease the mortality rate of brain abscess. [5]

In a literature, the mortality of patient in 30 days are decreased, and with a meta-analysis, the case fatality rate remains in 10% in recent years. This may be caused by increased use of CT and MRI and likely contributing directly to the decrease of incidence and fatality of cases. [3]

In this study, we present a case of brain abscess in a child with significant improvement after doing operative and optimal antibiotic treatment. Intracranial infections in children are rare but severe conditions. Brain abscesses are focal infections that develop within the cerebral parenchyma, usually as a complication of meningitis, otitis media, mastoiditis, sinusitis, dental infections, bacterial endocarditis, and congenital heart defects. Because of the potential for rapid clinical deterioration and fatal outcome, a rapid diagnosis and early treatment are necessary.

2. Case Report

This study presents a child 1 year 8 months old female came with chief complaint of weakness in left arm and leg progressively for one month. The weakness began after the seizure. She had local seizure on her left arm and leg in one month ago with duration of 30 minutes. She was irritable for the last two weeks. There is no fever and local source infection.

The patient is compos mentis with normal general physical examination. Patient has normal milestone development. The strength of upper and lower extremities was 3 respectively. The physiology reflex was hyper reflex on the upper and lower extremities. The pathology reflex was found on the upper and lower extremities. Meningeal sign was negative. The laboratory of blood test showed leukocyte was 11.710 and procalcitonin 0,18. Head non contrast CT scan (Figure 1) showed a hipodens lesion on the right parietal with perifocal oedema lession.

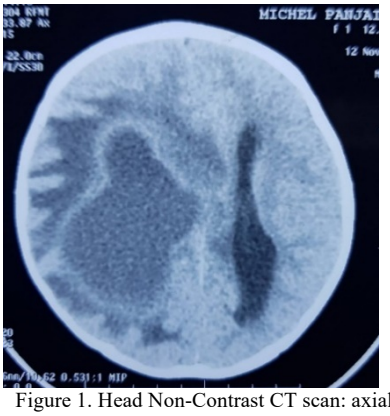

Figure 1. Head Non-Contrast CT scan: axial

Head contrast CT scan (Figure 2) showed a hypodense lesion on the right parietal with ring enhancement measuring approximately 6,2 cm x 4,5 cm. Echocardiography evaluation showed normal function and structure of cardiac.

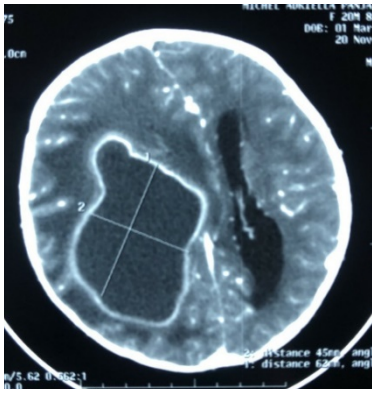

Figure 2. Head Contrast CT scan: axial

The position of the patient was supine with the head was on the headrest. After general anesthesia was done, the skin incision was prepared by shaving the hair, marking the skin, and dropping with povidone-iodine. The skin incision was made. The hemostasis was applied with cauterization. Burr holes were made and then bone osteotomy was cut by cutting drill bit. Tack-up suture of dura was done followed by opening dura. Non eloquent corticectomy was done followed aspiration of pus. Dissection of capsule was done followed by near total capsulectomy. The dura and skin were closed in layers with placing a subgaleal drain tube

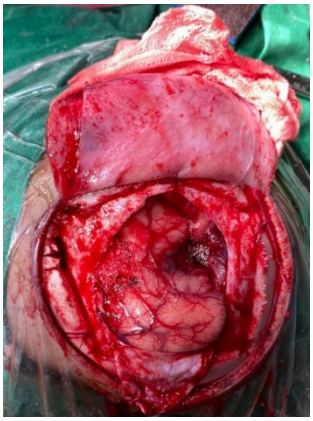

Figure 3. Post evacuation abscess and capsulectomy

Craniotomy evacuation abscess with near total capsulectomy was done (Figure 3). Capsule (Figure 4) and pus (Figure 5) of abscess were sent to microbiologic laboratory examination.

Figure 4. Capsule abscess

The patient was sent to neurosurgical pediatric intensive care unit for observation and recovery postoperative. Laboratory examination of gene expert pus was negative, culture of pus was negative, and culture of capsule was negative. Inward, the patient was evaluated for the TB screening with negative result.

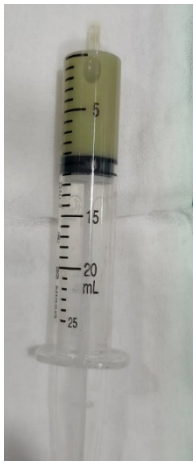

Figure 5. Pus of Abscess

The patient was given intravenous broadspectrum antibiotic (Meropenem) and Metronidazol for one month. The patient underwent physiotherapy and mobilization. Observation inward room for one month showed improvement of sign and symptom. The strength of extremities was improved to be 4

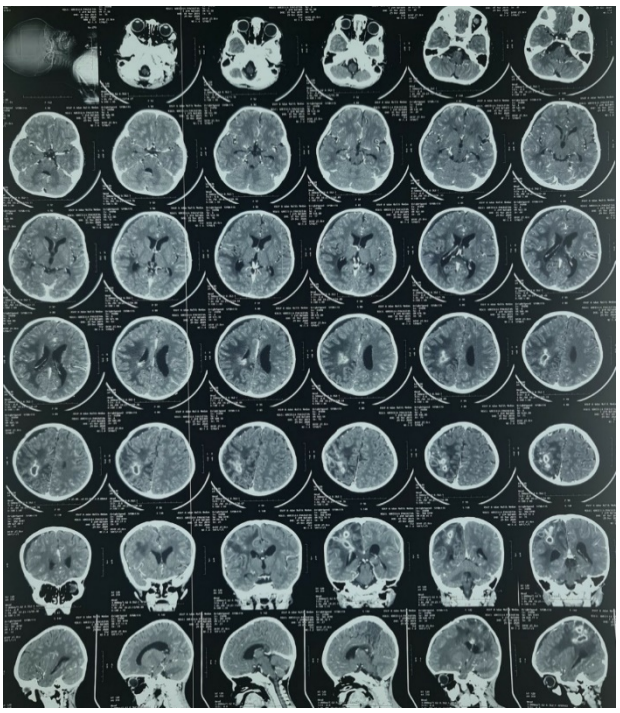

Figure 6. Head Contrast CT scan after giving Intravenous Antibiotic for one month

Head contrast CT scan was done for evaluating the intracranial lesion after administrating intravenous antibiotic for one month. The head contrast CT scan (Figure 6) showed near total abscess evacuation. The patient discharged from hospital with given oral antibiotic for 2 weeks more. Next six weeks, evaluation with head

contrast CT scan was done (Figure 7). The last head contrast CT scan showed complete resolution of abscess. The strength of the left of upper and lower extremities was improved to be 5.

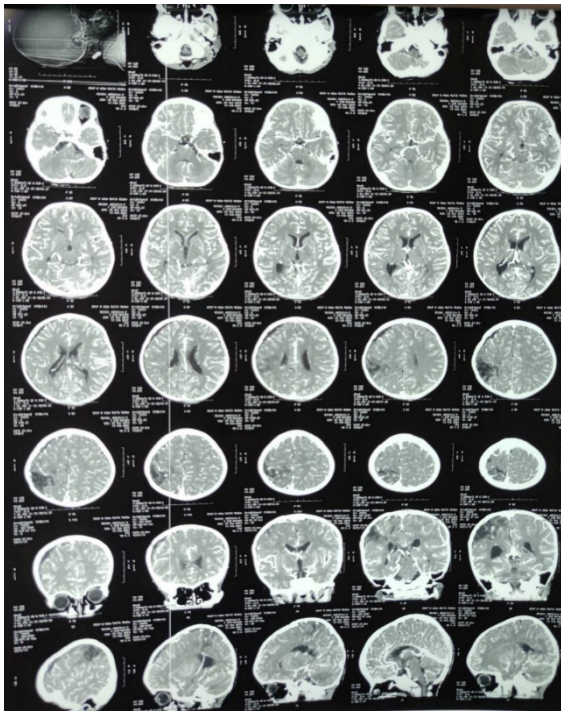

Figure 7. Head Contrast CT scan 6 weeks after continuing oral Antibiotic for 2 weeks

3. Discussion

Brain abscess is a focal pyogenic infection of the brain parenchyma, and frontotemporal lobe is the most common site of brain abscess, followed by frontal-parietal, partial, cerebellar, and occipital lobes. [5] The pathophysiology is based on the right-to-left shunting present in cyanogenic cardiopathies that allows bacteria colonizing the airway to pass through the cerebral circulation. Secondly, the polycythemia that these patients develop leads to tissue hypoxia and ischemia that together with the viscosity of the blood, creates a niche for the growth of bacteria. [1] In 40–50% of cases, pathogens reach the brain via a contiguous site, such as during middle ear, mastoid and paranasal sinus infections, or through a skull discontinuity due to head trauma or neurosurgery. In 30–40% of cases, they spread through blood flow from a distant focus of infection (e.g., dental abscess, endocarditis, lung, or cutaneous infections) (Prasad, 2020). Brain abscess development can be divided into four stages: 1) early cerebritis (1e4 days); 2) late cerebritis (4-10 days); 3) early capsule formation (11-14 days); and 4) late capsule formation (>14 days). [6]

The most common risk factors that predispose a child to the formation of a brain abscess include congenital heart disease, sinus and otogenic infections, poor dental hygiene and complications from dental procedures, infancy, immunosuppression, neurosurgical procedures such as implantation of ventriculoperitoneal shunts, penetrating skull injury and comminuted fracture of the skull, congenital lesions of the head and neck (such as dermal sinuses), and as a rare complication of meningitis. It is reported that single brain abscess in children accounts for 69.49%, and multiple abscesses account for 30.5-42%. Multiple abscess is more common in children with cyanotic congenital heart disease. [5]

Regarding the clinical presentation, the most prevalent symptoms are fever (90%), headache (85%) and vomiting (80%); seizures (30%) are less frequent. The triad that includes: headache, fever and neurological symptoms is only present in (15%) of the cases reported (Gaskill, 2008). The median duration from the onset of symptoms to the diagnosis is 7–11 days. Fever is frequent, often associated with neurological symptoms in isolation or combination, such as new onset headache (typically associated with vomiting), seizures, hemiplegia, cranial nerve palsies and altered level of consciousness ranging from drowsiness to coma. [10]

Frequently, the first type of imaging performed is a computed tomography (CT), as this is available as urgent and it is able to clarify the characteristics of the suspected lesion; it is often performed before lumbar puncture in the case of a patient presenting with Glasgow Coma Scale < 10, focal neurological deficits, new-onset seizures, and severe immunocompromised state.3 Contrast Enhanced CT or Magnetic Resonance Imaging (MRI) usually confirms the diagnosis and management. [11]

Modern neurosurgical techniques including stereotactic brain biopsy and aspiration along with better culture techniques, newer generation antibiotics have revolutionized the treatment and outcome of brain abscess. The use of broad spectrum antibiotics and repeated aspiration and in some cases excision are the current treatment

modality. The level of evidence of steroid use in these patients is not yet clear because it is believed that they slow down the encapsulation process, they increase the risk of necrosis, reduce the penetration of the antibiotic to brain tissue and have a rebound effect. Medical treatment is recommended in patients without increased intracranial pressure, with symptoms of less than 1 week long and abscess of less than 2 cm seen in tomography. The suggested time of treatment is between 6 and 8 weeks with intravenously administered antibiotics. If the surgery is performed, antibiotic treatment can be shortened to 4 weeks. For the follow up of these patients, imaging studies (CT scan or MRI) should be done every 2 weeks until the 6th week of antibiotic treatment, after the surgical drainage or if the patient has neurologic deterioration. [1]

CT facilitates early detection, exact localization, and accurate characterization, determination of number, size and staging of the abscess. It also detects hydrocephalus, raised ICP, edema and associated infections like subdural empyema, ventriculitis and thus helps in treatment planning. It is invaluable in assessment of adequacy of treatment and sequential follow up. Hematogenous abscesses, which can be seen in the setting of endocarditis, cardiac shunts, or pulmonary vascular malformations, are usually multiple, identified at the grey white junction, and located in the middle cerebral artery territory. In the earlier phases, a non-contrast CT may show only low-attenuation abnormalities with mass effect. In later phases, a complete peripheral ring may be seen. On contrast CT, uniform ring enhancement is virtually always present in later phases. On early phases the capsule will be difficult to visualize via conventional techniques, and double contrast CT often is helpful in defining encapsulation of abscess. [6]

Empirical therapy for the brain abscess is based on aspiration of pus and specimen. Metronidazole and cephalosporine of third generation is the most common regiment used. If the S. aureus was suspected to be the main pathogen, adding vancomycin into regimen is recommended. If the *P. aeruginosa* is suspected, adding ceftazidime, cefepime or meropenem is recommended. If Nocardia is suspected, adding thrimethropim/sulfamethoxazole or sulfadiazine might be needed in the regimen. If Aspergillus is suspected, use variconazole in the regimen. If patien has HIV infection. Adding anti-retroviral therapy for the patient is needed in regimen. [12]

Surgical treatment may be either aspiration or excising the brain capsule, but aspiration of pus has a low surgery-related morbidity and mortality rates, and low rates of relapse. CT-guided stereotactic can be advantageous in deep-seated brain abscess and eloquent areas of brain such as brain stem, thalamus, and basal ganglia. Image-guided craniotomy for excision of abscess also has a lower recurence rate. Excision is useful in large abscess with more than 25 mm size, multiloculated abscesses, failure in aspiration, lesion in posterior fossa, fungal abscesses, post-traumatic abscess and gas-containing abscess. [13]

According to these recommendations, medical treatment alone may be considered in patients without severe neurological impairment at admission (GCS > 12), with a small abscess (< 2.5 cm) or with multiple abscesses, with a diagnosed etiology and in case of contraindications to surgery; moreover, antibiotics represent an adjuvant therapy after surgery for large brain abscess or brain abscess causing mass effect. Depending on the characteristics, location, and number of the abscesses, there is the possibility to perform a stereotactic or endoscopic aspiration of the abscess rather than an open surgery (craniotomy with excision). Aspiration is frequently considered the gold standard neurosurgical treatment and aspiration has been associated with a lower overall mortality rate when compared to excision. Stereotactic aspiration is indicated in the case of abscesses ≥ 2.5 cm, deep or multiple lesions, eloquent areas involvement, and high risk of complications; excision can be indicated in the case of posterior cranial fossa location, posttraumatic lesions, multilobulated or superficial abscesses, and in the case of aspiration failure. A full recovery rate from the infection of about 60–70% is reported in the case of early diagnosis and proper therapy. [10]

Research by Raffaldi showed that Clinical sequelae were recorded in 31(39,2%) children. Twenty-one of them had a single sequela: nine (42,9%) epilepsy, five (23,8%) focal motor deficits, three (14,3%) visual impairment, three (14,3%) hydrocephalous, one (4,7%) language disease. The mortality is markedly declined in the last decades: we have reported a mortality rate of 1,2%, lower than the other European studies. In our survey, the recurrence rate was 7,5 %. [14]

4. Conclussion

Cerebral abscess in pediatric with unknown origin of infection may happen in 12%. Early diagnosis and treatment of pediatric cerebral abscess can reduce mobidity and mortality rate. Broadspectrum antibiotic is optimal treatment in postoperative evacuation of cerebral abscess cases with unknown origin infection.

Acknowledgements
None.

Conflict of Interest
The authors declare no conflicts of interest in preparing this article.

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