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Case Report

Paediatric midbrain abscess: A case report and literature review

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ABSTRACT

Midbrain abscess is an uncommon pathology, especially in paediatric patients. Establishing a guideline for managing brain-stem abscesses is not yet well described, as few paediatrics patients have been treated for this central nervous system infection type. A 3-year-old boy was admitted for facial paralysis. A brain magnetic resonance imaging showed a brain-stem abscess. He was put on Teicoplanin and cephalosporin third generation for four weeks, with favourable evolution. The prognosis in paediatric brain-stem abscesses is generally favourable. Most patients recover with minor neurologic deficits or improve ultimately.

Keywords: Paediatric midbrain abscess, Brain abscess, Infection

INTRODUCTION

A brain abscess is a focal collection in the brain parenchyma that can occur as a complication of various infections, trauma, or surgery. It appears typically in a devitalised area or affected by poor microcirculation.[1] It occurs rarely, with an estimated incidence of 0.4–0.9/100,000 people/year.[2] It is commonly seen in paediatric patients between 4 to 7 years old.[3] It typically occurs in the frontal, temporal, and parietal lobes and the cerebellum, rarely in the brain-stem 1%.[4] Only 24 cases of brain-stem abscesses have been described in the literature.[5-11] Clinical presentation varies, and the triad of fever, headache, and neurologic deficits has been found in only 28% of cases.[12] Cryptogenic abscesses occur when the primary source of infection cannot be found, which is the case in up to 35% of cases.[13] The most commonly isolated pathogens are streptococci and staphylococci, followed by anaerobes and Gram-negative enterobacteria.[14,15] We report the case of a child diagnosed with pontine abscesses treated with antibiotics without surgery.

CASE REPORT

A 3-year-old boy was admitted to the emergency department because of facial paralysis. He had a history of coughing for three months. One week before admission, he was noted to have facial paralysis, occasional nausea and vomiting, drooling from the left side of the mouth, and low-grade fever. Physical examination revealed hemiparesis of the left face, absent gag reflex, deviation of both eyes to the right, tilt of the head to the left, and mild irritability.

White blood cell count was 3,000, haemoglobin was nine, and C-reactive protein (CRP) was positive 50. A magnetic resonance imaging (MRI) of the brain [Figure 1] showed a brain-stem abscess, hypo-intense in T1-weighted imaging (T1WI) with ring enhancement after contrast injection; the lesion had a high diffusion-weighted imaging (DWI) signal. The child was admitted to our department; an etiological investigation has been made to identify the origin. Pulmonary computed tomography (CT) scan, transthoracic echocardiography, blood culture, and ENT examination were normal. He was put on teicoplanin and cephalosporin third generation for four weeks, with favourable evolution [Figure 2]. The child was free of symptoms. After two months, an MRI of the brain showed that the abscess had disappeared.

DISCUSSION

Epidemiology

Twenty-four cases of paediatric brain-stem abscess have been described in the literature, with the first case reported in 1974. Midbrain and medulla oblongata were second and third places, respectively, only seven patients had an abscess that involved more than one part of the brain-stem. Risk factors were found in 56–86% of paediatric patients. Brain-stem abscesses are usually spread by a haematogenous route from a distant primary site of infection (e.g., heart or lung) or a local infection (e.g., dental, otogenic infection, or meningitis).[16] Sinusitis was not associated with brain-stem abscesses because abscesses due to sinusitis are localised in the frontal lobe.[12] Congenital heart disease was the most common non-infectious risk factor, and other non-infectious risk factors included immunodeficiency and neurosurgical procedures.[17] Cryptogenic brain abscess is defined as when the primary source of infection cannot be identified. Ten of 25 patients had a cryptogenic abscess (40%).

Clinical presentation

The clinical presentation of a brain abscess includes headache, fever, and neurologic deficits.[13] Headache is the most common symptom of a brain abscess, followed by fever. Neurologic deficits in midbrain abscess manifest as cranial nerve palsy or hemiparesis.[18] Facial (VII) and abducens palsy (VI) were the most commonly affected nerves. However, all cranial nerves may be affected except for the hypoglossal nerve (XII). Altered consciousness in the form of somnolence was observed in all patients, but coma did not occur. Seizures occur in half of the patients with a brain abscess but in only one of the patients with a brain-stem abscess.[19]

Diagnosis

Imaging

Brain CT scan is the imaging of choice in patients with suspected brain abscesses.[14,18] CT allows localisation, identification of the number of abscesses, assessment of brain area, and mass effect. MRI of the brain is the imaging modality of choice in differentiating between a brain abscess and a tumour. DWI allows differentiation of an abscess from cystic or necrotic lesions, with sensitivity and specificity of DWI estimated at 96%.[20] The abscess appears hyperintense in DWI and hypointense in ADC. Their appearance on brain CT or MRI depends on their phase or aetiology. Typically, they are hypointense in CT and T1WI and show regular ring enhancement after contrast injection, hyperintense in T2-weighted imaging, and usually, cerebritis is visible in the surrounding tissue. Other techniques, such as magnetic resonance spectroscopy in combination with DWI and ADC, increase the sensitivity and specificity to 100%.[21] Most brain-stem abscesses were diagnosed based on the CT scan (11 patients); eight patients were diagnosed by MRI, and five were diagnosed by pneumoencephalography before the invention of the CT scan.

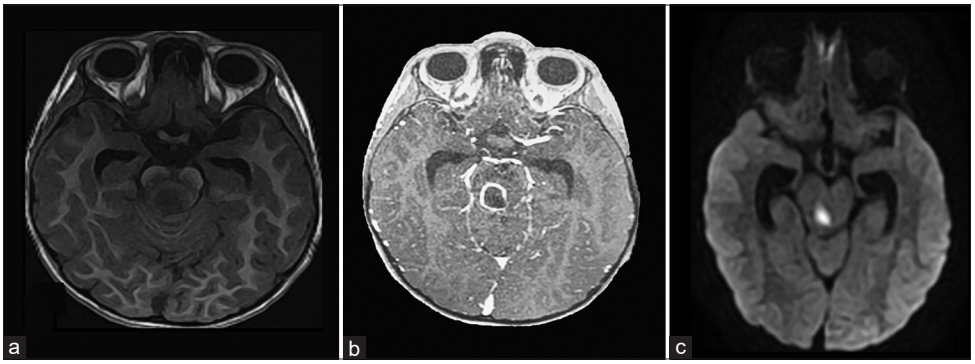

Figure 1: Brain magnetic resonance imaging (a) T1-weighted imaging show lesions in midbrain hypointense, (b) with ring contrast enhancement after gadolinium injection, (c) the lesion had a high diffusion-weighted imaging signal.

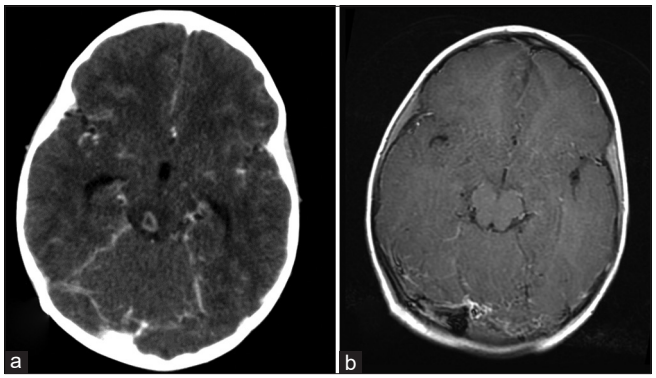

Figure 2: (a) Brain computed tomography scan show regression of the lesion after 1 week of treatment. (b) Brain magnetic resonance imaging showing total abscess regression after 4 weeks of treatment.

Laboratory findings and microbiology

If a brain abscess is suspected, inflammatory markers such as CRP in the blood, erythrocyte sedimentation rate, and leukocyte count should always be determined. They are positive in 60% of all cases, so blood tests cannot rule out a brain abscess. Lumbar puncture is contraindicated in most cases with suspected brain abscess, and cerebrospinal fluid (CSF) culture is usually negative with a positive rate between 2.8% and 44% unless the abscess has invaded the ventricular system or there is concurrent meningitis. Blood cultures are rarely positive (2.8–28%).[22] Pus culture is crucial because identification of the causative pathogen is critical for antimicrobial treatment. The patient's age, source of infection, and underlying comorbidities can determine the pathogen type. The culture was positive in two-thirds of patients not taking antibiotics and positive in one-third of patients who had received antibiotic therapy. When pus cultures were compared with blood or CSF cultures, neither blood nor CSF cultures were helpful in identifying pathogens compared with pus cultures.[6] The isolated germs were monomicrobial in most cases, multi-microbial cultures were mostly found in otogenic sources of infection, Gram-positive cocci (streptococci and staphylococci) and anaerobes were the most common isolated germs; however, in brain-stem abscesses, Gram-positive cocci were the dominant isolated germs, followed by anaerobes and Gram-negative non-enteric bacteria were less common. Identifying the source of infection is essential because it helps in the selection of the empiric antibiotic by guessing which group of bacteria is the cause. *Streptococcus* was the most common isolated pathogen in endocarditis, which is the most common cause of brain-stem abscesses, followed by *Staphylococcus*, which occurs after neurosurgery, trauma or in association with endocarditis.[19] Dental infections, pyogenic lung disease or sinusitis are the source of anaerobic pathogens. *Fusobacteria* has been isolated after middle ear infections, Staphylococci have been associated with meningitis and *Haemophilus Paraphrophilus*-positive cultures for dental sources.

Management

The establishment of a guideline for the management of brain-stem abscesses is not yet well described, as there are few paediatric patients who have been treated for this type of central nervous system infection. Therapeutic management includes a mandatory drug component in the form of antibiotics and a neurosurgical component that should always be considered but cannot be performed in some cases. There is no risk-free formula for performing such surgery; even with the minimally invasive technique, stereotactic or neuro-navigation-assisted surgery is considered safer and more beneficial compared with open craniotomy, although there is no argument for the superiority of any surgical procedure. However, the goal remains the same, which is to assess the nature of the lesion by biopsy if the diagnosis cannot be fully confirmed preoperatively and to perform aspiration of the pus to reduce the volume of the abscess and achieve immediate relief, which allows better penetration of antibiotics and an increase in their concentration, improving the efficacy and extent of antimicrobial treatment. The surgical approach allows for assessing the microbiology of the lesion, minimising the number of pathogens, and rupturing the abscess capsule.[23] Patients with a focal neurologic deficit at admission (87.5%) or presenting clinical decline or else a growth display in radiological control[24] should always be considered to undergo surgical treatment to decrease the mass effect on the brain-stem. However, fatal complications can always occur, like the menace of intra-ventricular rupture and bleeding from the abscess capsule.[5] Once the diagnosis of brain-stem abscess is made, empiric antibiotics that include a broad spectrum covering Gram-positive, Gram-negative bacteria and anaerobes, an antibiotic with better penetration through the blood-brain barrier such as cephalosporins with metronidazole, should be administered intravenously and antibiotic therapy should then be adjusted according to the antibiogram of the positive culture.[22,25] For at least 6–8 weeks of treatment time, eventually after spotting the vanishing cavity on the brain MRI. The management of the brain-stem abscess should solidly include identifying the source of infections and curing it. Arlotti *et al*. suggest antibiotic therapy only. In patients who have a Glasgow Coma Scale >12, a small abscess at least 2.5 cm in diameter, multiple abscesses, or culture from other sources (CSF/blood).[26] Jamjoom suggested conservative treatment in children who are in stable clinical conditions and who can be monitored by imaging. Publications on this topic show that standard craniotomy was performed in 14 patients (56%), antibiotics only in seven patients, including our patient (28%), and stereotactic abscess aspiration in four patients (16%). Both standard craniotomy and stereotactic aspiration showed good results, safety, and immediate clinical improvement without surgical complications, so we believe that the use of a surgical procedure should always be considered. Further studies need to be performed to evaluate which surgical procedure is most efficient in these patients.

Prognosis

In a recent analysis of brain-stem abscesses, improvement was noted in 80.0% of patients, with complete resolution of symptoms in 36.0%. Incomplete neurologic recovery was seen in 44.0% of the total group; mortality was estimated at 12.0%. In conclusion, the prognosis for brain-stem abscesses is good and almost similar to the entire group of brain abscesses, considering that significant disability at follow-up was almost not described. As described in the literature on brain abscesses, no neurologic deficits or only minor sequelae are reported in only 70% of cases. Nevertheless, the pathology remains a serious condition associated with high morbidity.[14,22]

CONCLUSION

Brain-stem abscesses are rare findings. The neurologic appearance is typical of a pathologic mass occupying the brain-stem and showing cranial nerve palsy. The prognosis for paediatric brain-stem abscesses is generally favourable. Most patients recover with minor neurologic deficits or improve completely.

Ethical approval

The research/study complied with the Helsinki declaration of 1964.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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