Giant Brain Abscess in a Neonate: Good Outcome with Single Transfontanelle Aspiration and Antibiotic Therapy

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Case report

A 39-day-old boy was admitted for evaluation of a fever lasting one day. He had a history of admission to the neonatal intensive care unit over a period of three weeks due to preterm delivery and low birth weight. Neuroimaging revealed a large, space-occupying lesion in both frontal lobes, which was suspected to be an abscess with the midline shifting to the right. With a single aspiration and abscess drainage along with concurrent prolonged parenteral antibiotic therapy, the patient showed an excellent treatment outcome with normal development. The focus will be placed on minimally invasive surgical management as well as positive outcomes.

Key Words: Brain abscess, Infant, Newborn, Enterobacter cloacae, Fine needle aspiration, Bacterial infections

Introduction

Brain abscesses in neonates are rare complications of bacterial meningitis and sepsis. The most common causative organism is Gram-negative bacteria (Klebsiella, Escherichia coli, Proteus, and Citrobacter species) in neonates; however, brain abscess by Enterobacter cloacae (E. cloacae) has rarely been reported. Although brain abscess mortality is decreasing, morbidities caused by hemiparesis, seizures, visual field defects, and learning difficulties remain high. The current treatment for brain abscess involves combined medical and surgical therapy. In rare cases, surgical therapy is usually an excision or aspiration procedure; however, multiple aspirations are frequently required.

We report on a neonatal patient with a giant brain abscess by E. cloacae infection who underwent treatment with a single bedside aspiration and showed an excellent neurological outcome.

Case report

A 39-day-old boy was admitted for evaluation of a fever lasting one day. He had a history of admission to the neonatal intensive care unit over a period of three weeks due to preterm delivery and low birth weight.
At that time, he had undergone treatment with oxygen for about two weeks, and his brain ultrasonography revealed a periventricular white matter lesion. He was irritable and had not eaten well. He was not lethargic; however, he cried vigorously when lying down, and his parents had not been able to stop his crying.

Examination revealed a well-developed infant with a pale appearance. The anterior fontanelle was prominent and bulging but not tense, and the suture line was widened. He had a neurologically normal appearance, and no focal deficits. A cerebrospinal fluid (CSF) study was performed. Results were as follows: WBC 24,000/mm$^3$, RBC 500/mm$^3$, protein 3.7 mg/dL, and glucose 12 mg/dL, which indicated suspected bacterial meningitis. Brain computed tomography (CT) and magnetic resonance imaging (MRI) revealed lesions occupying space in both frontal lobes with the midline shifting to the right, which indicated suspected abscesses (Fig. 1).

Bifrontal pus drainage was performed at the bedside for relief of increased intracranial pressure and to obtain a specimen for culture. Approximately 175 cc of yellowish green-colored purulent and odorless pus was aspirated: 35 cc from the right side, 110 cc from the left side, and 30 mL of pus was drained from another separated abscess pocket (Fig. 2). Antibiotic agents (cefotaxime, vancomycin, and metronidazole), which began to cover anaerobic organisms, were started empirically.

However, prior to surgical management, he went into a convulsion, and an anticonvulsant (phenobarbital) was given. Electroencephalography (EEG) was performed, which revealed a depressed wave from the left side and a slowing wave from the right side. It presented as a postictal state; therefore, we decided to follow up with anticonvulsant management.

The organism in both the CSF and abscess fluid was ultimately found to be *E. cloacae*. A susceptible antibiotic, meropenem, was continued intravenously for eight weeks until the infection was eradicated.
Repeated spinal tapping was performed after seven days of antibiotic treatment. The results were as follows: WBC 470/mm$^3$, RBC 1,500/mm$^3$, glucose 14 mg/dL, and protein 546 mg/dL; the culture revealed no growth. Serial CT scanning and brain MRI were performed to monitor the efficacy of treatment (Fig. 3).

The baby responded extremely well to antibiotic treatment and promptly returned to normal activity. Before discharge, Brainstem Auditory evoked potentials (BAEP) examination for evaluation of the neurologic deficit was performed, which revealed no hearing defects. He was discharged and had follow-up visits for approximately six months. His developmental state is suitable for his age with no neurological sequelae or additional convulsions.

**Discussion**

Before the late 1800s, brain abscess was a fatal disease until surgical techniques led to cures in selected patients. Further advances in brain abscess management were made after the introduction of antimicrobial therapy, stereotactic brain biopsy, and aspiration and excision techniques.

Recent reports indicate brain abscesses account for approximately 1 in 10,000 hospital admissions in the United States. Incidences of brain abscess occurs primarily in 4- to 7-year-olds and are extremely rare in infants.

Contiguous spread occurring from the middle ear, mastoid, and sinus is the most common cause of brain abscess in children. Approximately 30–60% of cases may be due to polymicrobial infection. Streptococci are the most common cause (70% of cases) in patients with bacterial...
brain abscess. However, in all published cases, neonatal brain abscesses can be caused by Gram-negative pathogens, such as *Citrobacter, Enterobacter, Serratia*, or *Proteus*, and are frequently associated with meningitis. Predictors of Gram-negative infections of newborns are abnormal pregnancy and delivery, preterm delivery, premature rupture of membranes, and maternal infection. In addition, a high frequency of septicemia is a distinct possibility. A right-to-left shunt of the neonatal blood circulation can explain the colonization of the brain during septicemia, as with cyanotic heart disease in older children. In a review by Renier, et al., of 30 cases of neonatal bacterial brain abscess reported in the literature, 90% of cases were caused by Proteus mirabilis. *Escherichia coli* accounted for two cases, and *Serratia marcescens* for one. Meningitis with septicemia occurred in eight cases, and septicemia without meningitis occurred in four. In our case, the patient had a history of preterm delivery and admission to the neonatal intensive care unit. An etiological organism, *E. cloacae*, was detected in blood and CSF culture, which revealed that he had meningitis with septicemia.

In our case, the causative organism was *E. cloacae*, which can colonize the gut of neonates and cause opportunistic septicemia and meningitis. *E. cloacae* nosocomial infection may occur later in approximately 2.5–19.2% of stable and well-fed neonates. However, unlike neonatal *Enterobacter sakazaki* sepsis, which is associated with a high incidence of brain abscess, brain abscesses have rarely been reported in *E. cloacae* sepsis.

In infants and children, the clinical presentation can be nonspecific and indolent. Toxic signs may be minimal, with fevers being low grade. Often, no overt clinical signs of sepsis or any clue as to causative infection are present due to infants having fontanelles and opened suture lines. Imaging techniques, such as cranial CT scanning and brain MRI, allow prompt confirmation of the clinical diagnosis and determination of the abscess location and number. Today, MRI is the study of choice.

Once the diagnosis is confirmed, additional studies for identification of the causative organism will be guided by the patient’s history, physical examination, and blood, CSF, and aspiration material cultures. In older children and adults, blood cultures and CSF cultures are rarely positive. CSF study by lumbar puncture may reveal mild mononuclear pleocytosis, slight protein elevation, and a normal concentration of glucose. However, in neonates, the etiological organism is identified from the CSF or blood cultures in most cases. Thus, surgical procedures are not necessary to identify causative organisms.

Treatment of a brain abscess involves aspiration of pus or excision of the abscess, followed by parenteral antibiotic therapy. Stereotactic aspiration of an abscess is generally a safe, accurate, and rapid procedure. It is associated with low morbidity and mortality and is frequently successful. Narendra et al. reported the optimal management of brain abscess involves surgical drainage for medium to large abscesses with eradication of the primary source. Surgical drainage was performed in 97.1% of the cases; the outcomes were good for 81.3% of them. However, craniotomy and excision are recommended for abscesses that remain enlarged after two weeks of antibiotic therapy, fail to shrink after 3–4 weeks of antibiotic treatment, are multiloculated, or are too large.

However, the usefulness of aspiration in treatment of brain abscesses in neonates requires discussion since in most cases, the etiological organism is identified from CSF or blood cultures and because no sign of raised intracranial pressure is present. YA Koo et al. reported successful treatment of multiple *Candida* brain abscesses in a neonate with only antifungal agents. The outcome was good, and no neurological sequelae remained. Venkataseshan et al. also reported successful treatment of a *Klebsiella abscess* with antimicrobial agents. An abscess smaller than 2–3 cm may be managed without surgery if no signs of increasing intracranial pressure are present.

Antibiotics of choice include crystalline penicillin, chloramphenicol, and metronidazole, followed by definitive therapy based on the sensitivity pattern of the causative organisms. Use of third-generation cephalosporins and
avoidance of chloramphenicol have been recent trends. If staphylococci are suspected, an antistaphylococcal penicillin should be administered, with vancomycin being the alternative in cases of antibiotic resistance or patient intolerance to penicillin. In neonatal Gram-negative bacterial brain abscesses, use of third-generation cephalosporins in conjunction with aminoglycosides have shown very good results with regard to survival.

In our case, the brain abscess was too large to treat with only antibiotics.

Therefore, we did bedside drainage, which is a minimally invasive procedure. Fortunately, the size of the abscess decreased successfully without neurological sequelae, even though the patient’s abscess was huge.

한글요약

신생아의 뇌 농양은 극히 드문 경우로 특정 선행 요인을 가지고 있는 경우가 많다. 가장 흔한 원인 균주는 그람 음성 균주이며 치료법의 발달로 사망률은 감소하였지만 반신 마비, 경련, 발달 장애 등의 후유증이 남을 수 있다.

39일 된 남아가 하루 전부터 시작된 발열을 주소로 내원하였다. 환아는 조산, 저 체중 출산아로 신생아 중환자실에 입원했던 경력이 있었다. 신체 검진상 대천문이 팽창된 것 외에 다른 신경학적 증후는 보이지 않았다. 신경 촬영 검사상 양측 전두엽에 정중선이 오른쪽으로 치우쳐 있는 뇌 농양으로 의심되는 거대한 병변이 있었다. 왜 농양이 매우 컸음에도 불구하고 수술장으로 이동하지 않고 환자의 잠상에서 직접 단순 흡입 치료를 시행하였고 항생제 치료를 병행하였다. 원인균은 Enterobacter cloacae로 판명되었고 meropenem을 8주간 투여하였다. 환아는 빠른 회복을 보이며 이후 어떤 신경학적 휴유증도 보이지 않았다.

저자들은 Enterobacter cloacae 감염에 의한 거대한 뇌 농양이 발견된 신생아를 단순 흡입과 항생제 만으로 치료하였고 이 후 좋은 결과를 보인 1례를 경험하였기에 보고하는 바이다.

References