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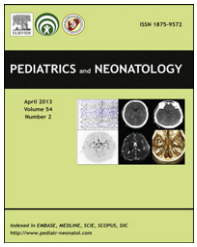

CASE REPORT

Citrobacter freundii Brain Abscess in a Preterm Infant: A Case Report and Literature Review

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Intracranial abscesses are serious conditions but uncommon in preterm neonates. *Citrobacter* species are an uncommon cause of bacterial meningitis in neonates, but are associated with brain abscesses in a majority of cases. We report a preterm infant who developed *Citrobacter freundii* meningitis with brain abscess, who was successfully treated with antibiotics and surgical drainage. The infant had normal neurological outcome at follow-up. We report this case to highlight the importance of serial neuroimaging in the diagnosis of cerebral abscess in infants with *Citrobacter* meningitis.

1. Introduction

Citrobacter species are facultative anaerobic Gram-negative bacteria found infrequently as normal inhabitants of the intestinal tract of humans. *Citrobacter* infection is uncommon among neonates but is often associated with meningitis and intracranial abscesses. Meningitis caused by *Citrobacter* in infants was first reported in 1960.[1] *Citrobacter* species account for about 4% of all Gram-negative meningitis cases in infants.[2] Unlike other Gram-negative organisms causing meningitis, *Citrobacter* species have a propensity for invading the central nervous system, causing brain abscess in 75% of patients with meningitis, and resulting in high mortality (~30%) and morbidity.[3,4] We report a preterm female neonate who developed *Citrobacter freundii* meningitis and brain abscess who was successfully treated with antibiotics and surgical drainage. We also review the literature and highlight the importance of serial neuroimaging in infants with *Citrobacter* meningitis.

2. Case Report

A female neonate was born at 27 weeks of gestation and weighed 1230 g. Apart from preterm labor, the mother had no symptoms or signs of infection. The infant's initial clinical course was complicated by respiratory distress

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syndrome treated with surfactant, jaundice, apnea, and a small patent ductus arteriosus. She received ampicillin and gentamicin for 7 days for suspected sepsis. Blood and cerebrospinal fluid (CSF) cultures were negative. A head ultrasound done at 7 days of life showed a small left germinal matrix hemorrhage. A sepsis workup was done during the second week of life, and the patient was treated with 48 hours of antibiotics. Blood culture was again negative, and CSF analysis was normal. By the third week of life, the patient was on full feeds and required oxygen via nasal prongs.

On Day 31, she was noted to be tachycardic and was having an increasing number of apneas that required intubation and ventilation. Full sepsis evaluation was performed, and treatment with cloxacillin and gentamicin was initiated. CSF analysis showed 681 white blood cells/L with 54% neutrophils, glucose $<$0.5 mmol/L, and protein 5.74 g/L. CSF culture later grew *Citrobacter freundii* sensitive to gentamicin, meropenem, ciprofloxacin and trimethoprim—sulfamethoxazole, but resistant to ampicillin. No organism was isolated from blood cultures. On Day 34, an ultrasound scan of the brain showed diffuse extensive areas of increased echogenicity within the deep and superficial white matter of the posterior occipito-parietal region in the right hemisphere, without any midline shift. Magnetic resonance imaging (MRI) of the brain revealed a right occipito-parietal brain abscess measuring 3.5×3.2 cm (Figure 1A and B) and ventriculitis without midline shift. An electroencephalogram showed seizure activity, which was treated with phenobarbitone. Antibiotics were changed to meropenem and gentamicin, given for 1 week, followed by 5 weeks of meropenem and ciprofloxacin. Serial weekly cranial ultrasound scans were performed to assess the extent of the abscess, along with brain MRI. Over the subsequent 2 weeks, brain MRI showed an increase in the size of the abscess, with midline shift to the left (Figure 1C), right uncal herniation, and a dilated right temporal horn suggesting entrapment (Figure 1D). The abscess was surgically drained, and subsequently diminished in size before disappearing. Culture of the surgically drained abscess fluid was sterile. A follow-up brain MRI scan obtained prior to discharge showed right-sided cortical thinning and atrophy with temporoparietal gliosis and *ex vacuo* dilatation of the temporal horn (Figure 2A and B). The infant was discharged home at 41 weeks' corrected age. At follow-up, she had normal clinical neurologic examination along with normal ophthalmology and hearing evaluations.

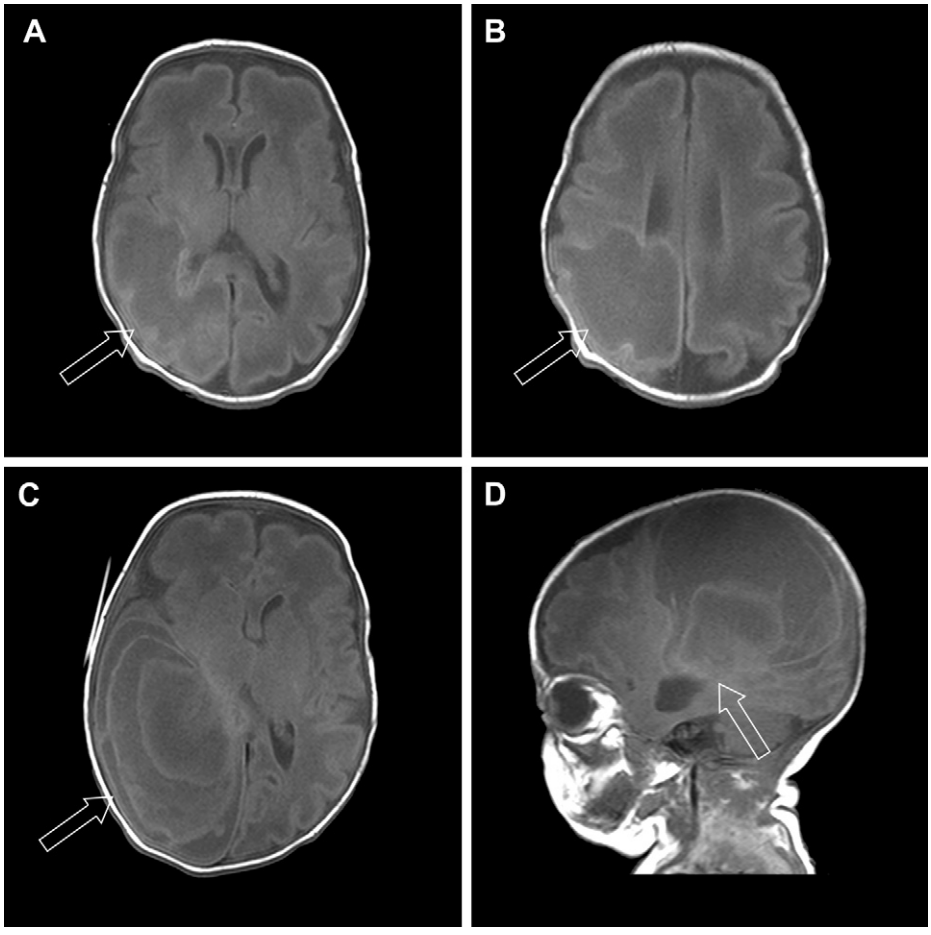

Figure 1 Preoperative magnetic resonance imaging of the brain showing: (A and B) right occipito-parietal brain abscess without midline shift; (C) increase in the size of the abscess with midline shift to the left; (D) right uncal herniation and a dilated right temporal horn suggesting entrapment.