Case Report

Multidrug-resistant *Elizabethkingia anophelis* Septicemia, Meningitis, Ventriculitis, and Hydrocephalus in a Preterm Neonate: A Rare Complication of an Emerging Pathogen

Abhijit Goyal Honavar, Andrew David, Anushri Amladi, Leenath Thomas

Departments of Pediatrics and 1Microbiology, Christian Medical College and Hospital, Vellore, Tamil Nadu, India

**Abstract**

*Elizabethkingia anophelis* is an emerging pathogen causing neonatal meningitis. Here, we describe the challenging course and necessity of a long 14-week duration of antibiotics in a 12-day-old male neonate with *E. anophelis* septicemia and meningitis. He developed ventriculitis and hydrocephalus, and needed a ventriculoperitoneal shunt. At 5-month follow-up he had developmental delay.

**Keywords:** Elizabethkingia anophelis, hydrocephalus, infection, meningitis, neonate, ventriculitis

**Introduction**

*Elizabethkingia anophelis* belongs to the family of *Flavobacteriaceae*, which are Gram-negative, aerobic, and nonmotile rods. The first case of neonatal meningitis with *E. anophelis* was identified in the Central African Republic in March 2011. Three more cases of uncomplicated neonatal meningitis were described in different parts of the world. The development of ventriculitis and hydrocephalus is not yet mentioned. Here we describe a case of neonatal septicemia, meningitis, and ventriculitis leading to obstructive hydrocephalus with multidrug-resistant *E. anophelis* and the challenges involved in its management.

**Case History**

A 12-day-old male neonate presented with high-grade fever for 3 days, nonprojectile vomiting, and decreased feeding for 1 day and one episode of multifocal clonic seizures. After having an uneventful antenatal period, the baby was delivered at 36 weeks of gestation by lower segment caesarean section (LSCS). The indication of LSCS was premature rupture of membranes (PROM) of about 36 h and fetal distress. The birth-weight was 2.5 kg and the immediate postnatal period was uneventful. On physical examination, he was lethargic, febrile, and had stable vitals. The anterior fontanelle was normal. He had weak sucking and rooting reflexes and absent Moro’s reflex.

At presentation, complete blood counts showed neutrophilic leucocytosis, normal coagulation profile, and biochemical parameters. C-reactive protein (CRP) was 99 mg/L. Cerebrospinal fluid (CSF) analysis revealed white blood cells (WBCs) of 7840/mm³ with 92% neutrophils and 8% lymphocytes, protein 376 mg/dL, and glucose of less than 5 mg/dL. The CSF opening pressure could not be measured. The Gram-stained smears of CSF had many neutrophils but no bacteria. CSF culture and blood culture showed growth nonlactose fermenting Gram-negative bacilli (NFGNB). Matrix-assisted laser desorption ionization/time-of-flight MALDI-TOF (Vitek MS, Biomerieux, France) mass spectrometry identified the NFGNB from both specimens as *E. anophelis*. The antimicrobial susceptibility testing revealed that the isolate was resistant to ceftazidime, cefepime, aztreonam, meropenem, imipenem, amikacin, tobramycin, and netilmicin. It was fully susceptible to levofloxacin, trimethoprim-sulfamethoxazole, and tetracycline and had intermediate susceptibility.

**Address for correspondence:** Dr. Leenath Thomas, Department of Pediatrics, Christian Medical College and Hospital, Vellore 632004, Tamil Nadu, India. E-mail: tyleenath@yahoo.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKLHRPMedknow_reprints@wolterskluwer.com

**How to cite this article:** Honavar AG, David A, Amladi A, Thomas L. Multidrug-resistant *Elizabethkingia anophelis* septicemia, meningitis, ventriculitis, and hydrocephalus in a preterm neonate: A rare complication of an emerging pathogen. *J Pediatr Neurosci* 2021;16:79-81.
to cefoperazone-sulbactam. Based on previous reports, the isolate was tested against vancomycin and rifampicin, and the results were interpreted as per *Staphylococcus aureus* MIC breakpoints given by Clinical & Laboratory Standards Institute (CLSI).\(^\text{[7]}\)

The isolate was partially sensitive to vancomycin but susceptible to rifampicin.

After stabilizing the baby, cranial ultrasound was done and it was normal. On day 3, intravenous (IV) antibiotics were changed to cefoperazone-sulbactam (225 mg/kg/day), vancomycin (80 mg/kg/day), oral co-trimoxazole (8 mg/kg/day of trimethoprim), rifampicin (10 mg/kg/day), and ciprofloxacin (10 mg/kg/day). The rationale for five antibiotics was the multidrug-resistant nature of pathogen and lack of knowledge about efficacy of any of these drugs in the treatment of *E. anophelis* meningitis.

Fever subsided on day 4, sensorium improved and breast feeding was initiated. On day 10, he developed status epilepticus while on phenobarbitone and had to be intubated for impending respiratory failure and compensated shock. With addition of IV levetiracetam, seizures got controlled and he was mechanically ventilated for the next 3 days. A repeat cranial ultrasound done on day 13 showed minimal hydrocephalus involving the bilateral lateral ventricles and third ventricle, probable obstruction at the level of the aqueduct of Sylvius. Breast feeding was re-established on day 18. CSF analysis which was supposed to be done after initial 7 days of antibiotics was deferred at that point and was performed after 21 days. It showed WBCs of 360/mm\(^3\), 18% neutrophils, 80% lymphocytes, protein 371 mg/dL, glucose 45 mg/dL, and sterile culture. As the meningitis was still persisting, the antibiotics were continued for another 21 days. At the completion of 6 weeks of antibiotics, a computerized tomography (CT) scan of the brain was done, which showed obstructive hydrocephalus. A repeat CSF analysis done by ventricular tap showed partially treated meningitis with WBCs of 10/mm\(^3\), lymphocytic predominance, protein 90 mg/dL and glucose 40 mg/dL. Co-trimoxazole, ciprofloxacin, and rifampicin were continued for eight more weeks (altogether 14 weeks). At the end of 14 weeks of antibiotics, another CSF analysis was done by ventricular tap and it showed WBCs of 2/mm\(^3\), 4% neutrophils, 96% lymphocytes, protein 53 mg/dL and glucose 38 mg/dL (blood sugar of 56 mg%). He continued to have worsening of hydrocephalus and hence a ventriculoperitoneal (VP) shunt was inserted in right side at the age of 4 months. When he was brought for follow-up at the age of 6 months, VP shunt was functioning well, the hydrocephalus had stopped progressing, but had global developmental delay (developmental age of 4 months).

**DISCUSSION**

The route of transmission of *E. anophelis* infection is largely unclear. Most of the cases documented in the past had acquired infection from a hospital environment.\(^\text{[4]}\) In neonates, there is a case report of vertical transmission of *E. anophelis* from mother to fetus.\(^\text{[5]}\) The risk factor for septicemia in our neonate was prematurity and PROM. We could not do a culture of the maternal genital swab to ascertain the source of infection. *E. anophelis* could have been misidentified in the past due to the failure of MALDI-TOF mass spectrometry in identifying these strains, as the databases were lacking.\(^\text{[6]}\)\(^\text{[8]}\) This organism appears to be commonly resistant to multiple drug classes, including aminoglycosides, third-generation cephalosporins, and carbapenems.\(^\text{[9]}\) The unusual role of vancomycin for treatment of infection with *Elizabethkingia* species, a Gram-negative organism has been reported.\(^\text{[7]}\) Despite the prolonged treatment with susceptible antibiotics, our patient developed ventriculitis and hydrocephalus, a complication not mentioned in the previous case reports. The long-term prognosis of neonatal infection is not yet known. This case highlights the severity, complexity and the necessity of prolonged antibiotic course in a neonatal multidrug-resistant *E. anophelis* meningitis.

**Acknowledgement**

The authors would like to acknowledge Urmii Ghosh, Sophy Korula, Chinta Annie Jyothirmayi, and Praveen George Paul who were involved in treating the patient and Annsmol Markose for the contribution to manuscript.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Kim KK, Kim MK, Lim JH, Park HY, Lee ST. Transfer of *Chryseobacterium meningosepticum* and *Chryseobacterium miricola* to *Elizabethkingia* gen. Nov. As *Elizabethkingia meningoseptica* com. Nov. and *Elizabethkingia miricola* comb. Nov. Int J Syst Evol Microbiol 2005;55:1287-93.

2. Frank T, Gody JC, Nguyen LB, Berthet N, Le Fleche-Mateos A, Bata P, et al. First case of *Elizabethkingia anophelis* meningitis in the central african republic. Lancet 2013;381:1876.

3. Lau SK, Chow WN, Foo CH, Curreem SO, Lo GC, Teng JL, et al. *Elizabethkingia anophelis* bacteremia is associated with clinically significant infections and high mortality. Sci Rep 2016;6:26045.
4. Figueroa Castro CE, Johnson C, Williams M, VanDerSlik A, Graham MB, Letzer D, et al. Elizabethkingia anophelis: clinical experience of an academic health system in southeastern wisconsin. Open Forum Infect Dis 2017;4:ofx251.

5. Lau SKP, Wu AKL, Teng JLL, Tse H, Curreem SOT, Tsui SKW, et al. Evidence for Elizabethkingia anophelis transmission from mother to infant, Hong Kong. Emerg Infect Dis 2015;21:232–41.

6. Nielsen HL, Tarpgaard IH, Fuglsang-Damgaard D, Thomsen PK, Brisse S, Dalager-Pedersen M. Rare Elizabethkingia anophelis meningitis case in a danish male. JMM Case Rep 2018;5:e005163.

7. Jean SS, Hsieh TC, Ning YZ, Hsueh PR. Role of vancomycin in the treatment of bacteraemia and meningitis caused by Elizabethkingia meningoseptica. Int J Antimicrob Agents 2017;50:507-11.

8. Lau SK, Tang BS, Curreem SO, Chan TM, Martelli P, Tse CW, et al. Matrix-assisted laser desorption ionization-time of flight mass spectrometry for rapid identification of Burkholderia pseudomallei: importance of expanding databases with pathogens endemic to different localities. J Clin Microbiol 2012;50:3142-3.

9. Lin J-N, Lai C-H, Yang C-H, Huang Y-H. Elizabethkingia infections in humans: from genomics to clinics. Microorganisms 2019;7:295.