

***Listeria* meningitis with rapid progression of hydrocephalus: a case of a 16-month-old girl with febrile status epilepticus as the first symptom**

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Listeria monocytogenes is a rare cause of bacterial meningitis, particularly beyond the neonatal period. This article describes a 16-month-old girl who presented with a new-onset febrile status epilepticus, and subsequently developed altered mentality and lethargy. *L. monocytogenes* was detected on a point-of-care, multiplex polymerase chain reaction using the cerebrospinal fluid. On day 3, she developed a rapidly progressive hydrocephalus. Her consciousness improved after placement of an external ventricular drain. After 3-week antibiotic therapy, she was successfully discharged without residual complications.

Key words: Hydrocephalus; *Listeria*; Meningitis; Multiplex Polymerase Chain Reaction; Seizures, Febrile

Introduction

Listeria monocytogenes is a facultatively anaerobic, non-spore-forming, motile, gram-positive bacillus that typically affects pregnant women, newborns, immunocompromised individuals, and older adults¹⁾. The common route of transmission is the gastrointestinal tract. Except in neonates, *Listeria* infections usually present as acute gastroenteritis, but rarely do as meningitis. *Listeria* meningitis differs from other bacterial meningitis in the regimen of empirical antibiotics. Although it is rare in immunocompetent children, hydrocephalus can rapidly complicate the outcome. It is critical to diagnose and treat the disease enti-

ty in a timely manner²⁾. Here, we report a toddler with *Listeria* meningitis with rapidly progressive hydrocephalus that started with febrile status epilepticus (FSE). This study was approved by the institutional review board of Kangdong Sacred Heart Hospital with a waiver for informed consent (IRB no.2022-09-023).

Case

A previously healthy, fully vaccinated 16-month-old girl visited another emergency department (ED) with 1-day history of fever and a new-onset FSE lasting 25 minutes (5 days before the visit to us). After the arrival, the generalized seizure stopped spontaneously. She was discharged without further evaluation because she became alert. Subsequently, she had poor oral intake and decreased activity. Three days before the visit to us, vomiting and diarrhea had been started. She visited our ED with lethargy 5 days after the FSE.

The initial vital signs were as follows: blood pressure, 100/60 mmHg; heart rate, 150 beats/minute; respiratory rate, 20 breaths/minute; temperature,

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39.2°C; oxygen saturation, 99% on room air; and a Glasgow Coma Scale of 12, with normal pupil light and deep tendon reflexes. Physical examination showed no other signs, such as focal weakness, setting sun sign, respiratory distress or skin lesions. The girl did not eat contaminated foods or make contact domestic animals. Initial laboratory findings were as follows: white blood cells, $8.5 \times 10^3/\mu\text{L}$ with 71% neutrophils; hemoglobin, 11.6 g/dL; erythrocyte sedimentation rate, 32 mm/hour; C-reactive protein, 133.5 mg/L; glucose, 206 mg/dL; serum sodium, 127 mEq/L; and urine sodium, 8 mEq/L. After 0.9% saline hydration for 2 hours, the serum sodium concentration was 129 mEq/L, but she remained stuporous. Brain computed tomography (CT) scan showed asymmetry of the left lateral ventricle without a remarkable hydrocephalus (Fig. 1A).

On day 2, the girl continued to have intermittent spikes in fever and diarrhea. Given the persistent stupor and fever, lumbar puncture (LP) was performed. Cerebrospinal fluid (CSF) profile suggested bacterial meningitis as follows: white blood

cells, $146/\text{mm}^3$ with 85% neutrophils; red blood cells, $80/\text{mm}^3$; glucose, 3 mg/dL; and protein, 266 mg/dL. She received intravenous ampicillin-sulbactam (ampicillin, 300 mg/kg/day), cefotaxime (300 mg/kg/day), and vancomycin (60 mg/kg/day). She had difficulty sitting up on her own, and was irritable all day. *L. monocytogenes* was positive on a point-of-care, multiplex polymerase chain reaction (PCR) (RFIT-ASY-0119, RFIT-ASY-0118; BioFire Diagnostics, Salt Lake City, UT) using the CSF. Subsequently, amikacin (20 mg/kg/day) was added to, and cefotaxime was removed from the empirical antibiotics. The PCR finding was confirmed by CSF culture. Immunoglobulin concentrations were within the normal ranges for her age.

On day 3, her fever decreased, but due to worsening mental status (Glasgow Coma Scale, 11), we performed magnetic resonance imaging (MRI) 42 hours after the CT (Fig. 1B). The MRI showed rapidly progressing communicating hydrocephalus with diffuse periventricular edema. Given the unavailability of emergency decompression of the hydrocephalus in our hospital, she was transferred to a

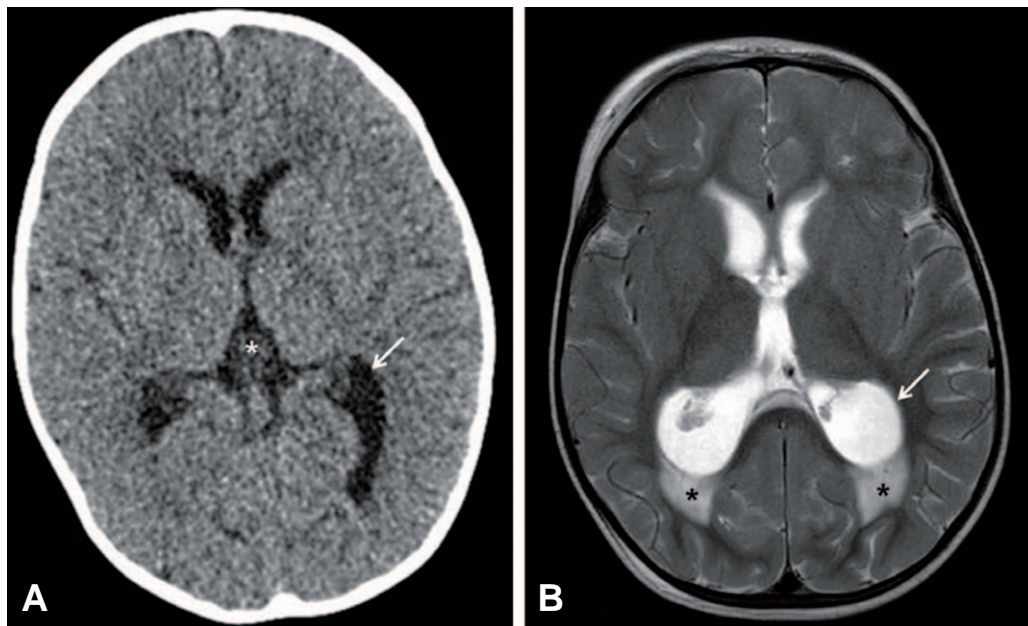


Fig. 1. Rapid progression of hydrocephalus due to *Listeria* meningitis. Computed tomography scan on day 1 shows asymmetry of the occipital horn of the left lateral ventricle (arrow, **A**) and dilated third ventricle (asterisk, **A**). T2 fluid-attenuated inversion recovery magnetic resonance imaging on day 3 shows both lateral and third ventricles enlarged, particularly the occipital horns (arrow, **B**). There is also diffuse periventricular edema just posterior to the horns (asterisks, **B**).

tertiary hospital on the same day.

On the day after the transfer, an external ventricular drain was inserted. Antibiotics were changed to ampicillin (300 mg/kg/day) and gentamicin (5 mg/kg/day) with no growth on follow-up cultures of the CSF and blood. After the insertion, she became able to move per the physicians' directions. On post-operative day 12, the drain was removed. On post-operative day 19, a follow-up CT showed the improved hydrocephalus. After 3-week antibiotics therapy, she was discharged from the tertiary hospital, without a residual complication (23 days after the visit to our hospital).

Discussion

At EDs, children with new-onset febrile seizure aged 12–18 months need clinical assessment, observation, and selective LP for timely diagnosis of bacterial meningitis. CSF profile is needed to differentiate meningitis if a seizure lasts longer than 30 minutes, or is followed by prolonged postictal state or focal neurologic deficits³. In the present case, we performed LP 6 days after the FSE, recognizing the persistent stupor after the FSE. This indicates the importance of 2- or 5-day observation for children hospitalized with FSE.

In cases of bacterial meningitis suspected on initial CSF profiles, commonly used empirical antibiotics for children older than 2–3 months do not cover *L. monocytogenes* due to its rarity. For the bacterium, ampicillin and aminoglycoside are preferred⁴. Administration of beta-lactam antibiotics may reduce the odds of 3-month mortality of *Listeria* bacteremia or meningitis to 0.1⁵. The aforementioned multiplex PCR can detect 14 pathogens, e.g., *Escherichia coli* and *L. monocytogenes*, in CSF samples within a few hours. In our case, despite the delayed timing of LP, it was possible to detect *L. monocytogenes* with the PCR and adjust antibi-

otic regimen in time⁶.

Listeria meningitis infection initially presents with atypical symptoms, such as fever, diarrhea, headaches, nausea, vomiting, and myalgia. However, it may cause hydrocephalus, cerebritis, ventriculitis, and brain abscess⁵. The case patient developed rapid progressive communicating hydrocephalus on the MRI performed 42 hours after the initial CT. Serial neuroimaging is helpful in determining the insertion of external ventricular drain or other measures to reduce intracranial pressure if the consciousness worsens, even after the antibiotic therapy.

In conclusion, our case shows that *Listeria* meningitis should be considered in immunocompetent children even with the new-onset febrile seizure, and that novel multiplex PCR allows rapid detection of bacterial pathogens, such as *L. monocytogenes*.

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Conflicts of interest

No potential conflicts of interest relevant to this article were reported.

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References

1. Radoshevich L, Cossart P. *Listeria monocytogenes*: towards a complete picture of its physiology and pathogenesis. *Nat Rev Microbiol* 2018;16:32-46.
2. Ulloa-Gutierrez R, Avila-Agüero ML, Huertas E. Fulminant *Listeria monocytogenes* meningitis complicated with acute hydrocephalus in healthy children beyond the newborn period. *Pediatric Emergency Care* 2004;20:233-7.
3. Batra P, Gupta S, Gomber S, Saha A. Predictors of meningitis in children presenting with first febrile seizures. *Pediatr Neurol* 2011;44:35-9.
4. Murray TS, Baltimore RS. *Listeria monocytogenes*. In: Kliegman RM, Stanton B, St. Geme JW, Schor NF, Behrman RE, et al., editors. *Nelson Textbook of Pediatrics*. 21th ed. Philadelphia, PA: Elsevier; 2020. p. 1464.
5. Charlier C, Perrodeau É, Leclercq A, Cazenave B, Pilmis B, Henry B, et al. Clinical features and prognostic factors of listeriosis: the MONALISA national prospective cohort study. *Lancet Infect Dis* 2017;17:510-9.
6. Lindström J, Elfving K, Lindh M, Westin J, Studahl M. Assessment of the FilmArray ME panel in 4199 consecutively tested cerebrospinal fluid samples. *Clin Microbiol Infect* 2022;28:79-84.