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Listeria monocytogenes Meningitis in an Immunocompetent Child: a case report

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Case Report

Keywords: Listeria monocytogenes, Meningitis, Ampicillin, Meropenem, Immunocompetent Children

Posted Date: May 26th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9424903/v1

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Additional Declarations: No competing interests reported.

Abstract

Background: Listeria monocytogenes (LM) meningitis is extremely rare in immunocompetent children, with non-specific manifestations and intrinsic resistance to third-generation cephalosporins easily causing misdiagnosis. We report a case of LM meningitis in a healthy 19-month-old Chinese child to provide clinical references for diagnosis and treatment.

Case presentation: A 19-month-old Han female presented with persistent high fever, vomiting and diarrhea for 10 days, which was unresponsive to 5-day intravenous ceftriaxone. LM was identified by cerebrospinal fluid (CSF) culture, and therapy was adjusted to intravenous ampicillin (300 mg/kg/day, q4h) combined with meropenem (120 mg/kg/day, q8h) based on antimicrobial susceptibility testing.

Outcome: The patient's temperature normalized within 48 hours, with gradual normalization of CSF indicators during treatment. The 3-week antibiotic course achieved full recovery, and 1-month follow-up showed no neurological sequelae.

Conclusion: LM should be suspected in pediatric meningitis unresponsive to third-generation cephalosporins. Prompt CSF culture is critical for definitive diagnosis, and ampicillin combined with meropenem is an effective and safe therapeutic option for pediatric LM meningitis.

INTRODUCTION

Listeria monocytogenes (LM) is a gram-positive, facultative anaerobic bacillus and a significant foodborne pathogen. Infection typically occurs through the consumption of contaminated foods such as unpasteurized dairy products, ready-to-eat meats, and raw vegetables[1]. As an opportunistic pathogen, LM primarily infects neonates, pregnant women, the elderly, and immunocompromised individuals, causing clinical manifestations ranging from self-limiting gastroenteritis to severe invasive infections such as sepsis and meningitis[2, 3].

The global incidence of listeriosis was approximately 0.3 per 100,000 population in 2021, with increasing infection rates among infants, children, and other groups[4]. Although the overall incidence is low, the mortality rate of invasive LM infections can reach 24%–62% without timely treatment[5, 6]. In China, LM infections are sporadically reported. Compared to other common meningeal pathogens (e.g., Streptococcus pneumoniae, Neisseria meningitidis), LM has a heightened tropism for the central nervous system (CNS)[4]. LM meningitis in immunocompetent children is extremely rare, and its non-specific clinical manifestations often lead to misdiagnosis or delayed treatment. This article reports a case of LM meningitis in a previously healthy 19-month-old child, combined with a literature review, to explore the disease's clinical characteristics, diagnosis, and treatment, aiming to improve clinicians' understanding and reduce missed diagnoses and misdiagnoses.

CASE PRESENTATION

Clinical History

A 19-month-old female patient of Han ethnicity was hospitalized for evaluation of a ten-day history of high-grade fever (maximum temperature 40℃), accompanied by vomiting and diarrheal symptoms. Despite a five-day regimen of intravenous ceftriaxone and conservative management with enemas at an outside facility, which alleviated the vomiting, the febrile state and loose stools remained unresolved. Her past medical history was non-contributory, with the exception of a transient constipation episode one month prior, following the ingestion of refrigerated pork.

Physical Examination

On physical examination, she was febrile (39.2°C) with a pulse of 98 beats/min and a respiratory rate of 22 breaths/min. She appeared ill but had a soft neck without nuchal rigidity, Kernig's sign, or Brudzinski's sign. Cardiopulmonary and abdominal examinations were normal.

Auxiliary examination

Complete blood count

White blood cell (WBC) count 13.27×10⁹/L, hemoglobin (HGB) 107g/L, platelet (PLT) count 451×10⁹/L, neutrophil (NEU) percentage 67.5%, lymphocyte (LYM) percentage 24.8%, monocyte (MON) percentage 7.4%, C-reactive protein (CRP) 5.84mg/L, serum amyloid A (SAA) 21.03mg/L, procalcitonin (PCT) 0.35ng/ml. Blood smear showed increased and thickened neutrophil cytoplasmic granules.

Biochemical and serological examinations

Liver and kidney function, electrolytes, triglycerides, and coagulation function were all within normal ranges. Urine routine, respiratory pathogen detection, autoimmune disease screening, and infectious disease tests (including HIV) were negative.

Immunological screening

Cellular immunity (total T cells and subsets), humoral immunity (immunoglobulin levels and IgG subclasses), and complement (C3, C4) were all normal.

Other examinations

Admission blood culture was negative. Stool immunochromatographic analysis detected rotavirus antigen, and intestinal microecological examination revealed severe intestinal flora disturbance. Head MRI showed abnormal signal changes in bilateral periventricular white matter, consistent with myelination disorder, and electroencephalogram was normal.

After admission, ceftriaxone treatment was continued, but fever persisted. Repeated complete blood count showed WBC 9.13×10⁹/L, HGB 112g/L, PLT 464×10⁹/L, MON 4.5%, NEU 51.8%, LYM 43.3%, CRP < 10 mg/L, PCT 0.31ng/ml. Lumbar puncture was performed, and CSF examination results are shown in Table 1.

Table 1
Serial cerebrospinal fluid examination results of the patient during hospitalization

Lumbar puncture	Day 1	Day 8	Day 15	Day 21	Reference ranges
WBC(×10^6/L)	138	185	35	13	0–15
RBC(×10^6/L)	0	0	0	0	0–10
Single nucleus(%)	49.30	71.90	85.70	100	40–80
Multiple nucleus(%)	50.70	28.10	14.30	0	0–8
Protein (g/L)	0.49	0.87	0.57	0.25	0.2–0.8
Glucose(mmol/L)	1.70	1.92	1.84	2.57	2.5–4.46
Chloride compound (mmol/L)	121	121	122	120	120–130
CSF culture test	Listeria monocytogenes	negative	negative	negative	negative

Diagnosis and Treatment

Based on clinical manifestations, auxiliary examinations, and CSF culture results, the child was diagnosed with Listeria monocytogenes meningitis. Referring to the "Expert Consensus on the Diagnosis and Treatment of Community-Acquired Bacterial Meningitis in Children (2019)" and "Clinical Practice Guidelines for the Diagnosis and Treatment of Community-Acquired Bacterial Meningitis in Children (2025)"[7, 8], intravenous ampicillin combined with meropenem was administered. The dosage regimen was ampicillin 300 mg/kg/day (q4h) and meropenem 120 mg/kg/day (q8h).

Treatment Outcome

The child's temperature returned to normal within 48 hours of treatment and did not recur. CSF re-examinations during treatment showed a gradual decrease in WBC count and normalization of protein and glucose levels. The total treatment course was 3 weeks. A 1-month follow-up revealed normal mental status, good appetite, and normal growth and development without neurological sequelae.

DISCUSSION

Clinical Characteristics and Diagnosis

LM meningitis mainly affects children aged 7 months to 10 years[9]. Most patients present with leukocytosis, neutrophilia, and elevated CRP, which is consistent with the early laboratory findings of this case. However, the clinical symptoms of LM meningitis are non-specific, overlapping with other viral or bacterial meningitis, including fever, headache, vomiting, diarrhea, and altered mental status. Some cases may also present with peripheral nerve paralysis and nystagmus[10, 11], making early diagnosis challenging.

CSF examination and culture are the key to diagnosing LM meningitis[4]. Typical bacterial meningitis is characterized by turbid CSF, increased pressure, elevated protein, reduced glucose, or a decreased CSF-to-peripheral blood glucose ratio. However, in the early stage of the disease or after antibiotic treatment, CSF changes may be atypical[9], increasing diagnostic difficulty. In this case, the initial CSF glucose level was lower than the normal range, and protein was slightly elevated, which was consistent with the characteristics of bacterial meningitis. CSF culture confirmed LM, providing a definitive diagnosis.

Notably, blood cultures of some LM meningitis patients may be negative, possibly due to prior antibiotic use[9]. In this case, the child received ceftriaxone treatment before admission, which may have contributed to the negative blood culture result. Therefore, for children with suspected CNS infection unresponsive to conventional antibiotics, lumbar puncture should be performed promptly to obtain CSF for culture, even if blood culture is negative.

Pathogenesis Analysis

Although LM is an opportunistic pathogen that mainly infects immunocompromised individuals, it can also cause infections in immunocompetent children[10]. The pathogenesis of this case may be related to multiple factors: First, the child had a history of consuming refrigerated pork 1 month before illness, which may have been contaminated with LM. Second, stool examination detected rotavirus antigen, indicating concurrent rotavirus enteritis. Rotavirus infection can damage intestinal mucosal epithelial cells, leading to changes in mucosal structure, shortened villi, and epithelial cell shedding[12]. This intestinal barrier damage may promote LM translocation from the gastrointestinal tract to the bloodstream, thereby causing secondary bacteremia and CNS invasion. Additionally, rotavirus-induced intestinal inflammation can disrupt the intestinal microecological balance, reduce colonization resistance, and enhance the adhesion and invasion of LM[13]. These factors may have synergistically contributed to the development of LM meningitis in this immunocompetent child.

Treatment Strategy

The choice of antibiotics for LM meningitis is critical. LM is inherently resistant to third-generation cephalosporins, which explains the ineffectiveness of initial ceftriaxone treatment in this case.

According to current guidelines[7, 8]. Ampicillin and aminoglycosides are the preferred empirical antibiotics for LM meningitis. However, aminoglycosides have ototoxicity and nephrotoxicity, and should be used with caution in children under 4 years old. Therefore, ampicillin is often the first choice for pediatric LM infections. In this case, based on drug sensitivity test results, ampicillin was combined with meropenem for treatment, achieving a good outcome. Meropenem, a carbapenem antibiotic, has a broad antibacterial spectrum and strong penetration of the blood-brain barrier. Studies have shown that carbapenems alone or in combination with aminoglycosides are effective for LM infections[14, 15]. For refractory LM meningitis, trimethoprim-sulfamethoxazole can be used as an alternative treatment[16]. Vancomycin is less effective for LM meningitis due to its poor penetration of the blood-brain barrie[14], and is not recommended as a first-line drug.

The duration of treatment for LM meningitis is generally 3 weeks to ensure complete eradication of the pathogen and reduce the risk of recurrence and sequelae[7]. This case achieved a cure with a 3-week treatment course, and no sequelae were found during follow-up, which is consistent with the recommended treatment course in guidelines.

Prognostic Factors

LM meningitis progresses rapidly, and delayed diagnosis and treatment can lead to high mortality and sequelae. For immunocompetent children, early diagnosis, timely initiation of effective antibiotic treatment, and sufficient treatment course are key to improving prognosis. In this case, the child was transferred to our hospital promptly after ineffective initial treatment, and LM infection was considered early. Lumbar puncture and CSF culture were performed to confirm the diagnosis, and a targeted antibiotic regimen was implemented, resulting in a favorable prognosis.

Clinical Implications

This case reaffirms that LM must be included in the differential diagnosis of community-acquired bacterial meningitis in immunocompetent children with poor response to third-generation cephalosporins. CSF culture is the gold standard for diagnosing LM meningitis, and empirical antibiotic therapy should be timely adjusted according to pathogenic and susceptibility results to avoid disease progression. In pediatric LM meningitis, the combination of ampicillin and meropenem has excellent efficacy and safety, which is an ideal alternative for children who need to avoid aminoglycoside-related toxicities.

CONCLUSIONS

Although uncommon, LM meningitis can occur in immunocompetent children and may be associated with preceding gastrointestinal infection. Clinicians should maintain a high index of suspicion in cases of meningitis with atypical presentation or poor response to empirical cephalosporins. Prompt CSF analysis and culture are essential for diagnosis and directing targeted antimicrobial therapy, thereby improving outcomes and preventing severe complications.

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of Gansu Provincial Maternity and Child-care Hospital. Written informed consent was obtained from the parents of the patient for participation in this study.

Consent for publication

Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was received for this work.

Acknowledgements

The authors thank the medical team involved in the patient's care and the patient's family for their cooperation.

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