J Microbiol Immunol Infect
2006;39:255-258

Case Report

# Acute symptomatic hydrocephalus in *Listeria monocytogenes* meningitis

**Chun-Chieh Yang[1], Chao-Hung Yeh[2], Tsung-Chia Tsai[3], Wen-Liang Yu[1,4]**

*Departments of [1]Intensive Care Medicine, [2]Neurosurgery and [3]Radiology, Chi-Mei Medical Center, Tainan County; and [4]Department of Medicine, Taipei Medical University, Taipei, Taiwan*

Received: July 8, 2005 Revised: September 15, 2005 Accepted: October 6, 2005

*Listeria monocytogenes* meningitis appears to have increased in incidence. Although most reported cases of listeriosis involve the central nervous system, brain computed tomography is usually normal. Hydrocephalus is a common complication of tuberculous meningitis, which has a high prevalence in Taiwan. However, patients with *L. monocytogenes* meningitis rarely develop the complication of symptomatic hydrocephalus. We report a patient with *L. monocytogenes* meningitis who presented with persistent alteration of consciousness after appropriate antimicrobial therapy. Follow-up brain computed tomography revealed acute hydrocephalus. An Ommaya reservoir was implanted, and daily drainage of the cerebrospinal fluid was performed. The patient improved gradually and his mental status recovered completely 4 days later. This case should remind physicians to be aware of the possible occurrence of hydrocephalus in *L. monocytogenes* meningitis and that prompt cerebrospinal fluid drainage may achieve a good outcome.

**Key words:** Hydrocephalus, *Listeria monocytogenes*, meningitis

## Introduction

*Listeria* spp. are found in various vegetable and animal foodstuffs. This bacterium is very resistant to common food preservation agents such as heat, salt, nitrite, and acids, and can also grow and multiply in refrigerated foods. Listeriosis is the name of the general group of disorders mostly caused by *Listeria monocytogenes*, which can affect almost any organ of the body, but in adults and newborns the most common infection is meningitis [1].

*L. monocytogenes* meningitis appears to have increased in incidence. Probable causes of this increasing incidence include longer life expectancy, changes in diet or food processing, vaccine-related decline in meningitis due to *Haemophilus influenzae*, and the higher numbers of immunocompromised individuals [2, 3]. Complications due to *L. monocytogenes* meningitis include brain abscess, cerebritis, ventriculitis, and rhomboencephalitis [1,4-8]. Acute hydrocephalus is an unusual complication of *L. monocytogenes* meningitis [1,9].

In most reported cases of listeriosis involving the central nervous system, computed tomography (CT) scans of the brain have been normal. However, because hydrocephalus is a common complication of tuberculous meningitis in Taiwan, its identification as a complication of acute or chronic meningitis leads to its prioritization among etiological hypotheses in the differential diagnosis. We report a case of *L. monocytogenes* meningitis complicated with acute symptomatic hydrocephalus mimicking tuberculous meningitis.

## Case Report

A 42-year-old man presented with fever, headache, and confusion for 3 days. His medical history included type 2 diabetes mellitus, liver cirrhosis, and secondary adrenal insufficiency. He had been taking glibenclamide and metformin for diabetes mellitus and 5 mg of prednisolone daily for adrenal insufficiency for 2 years. On admission, physical examination revealed fever of 40°C, nuchal rigidity and inspiratory crackles in the right upper lung field. Brain CT scan was unremarkable

*Corresponding author: Dr. Wen-Liang Yu, Department of Intensive Care Medicine, Chi-Mei Medical Center, 901, Chung Hwa Road, Yung Kang City, Tainan 710, Taiwan.*
*E-mail: yuleon_md@yahoo.com.tw*

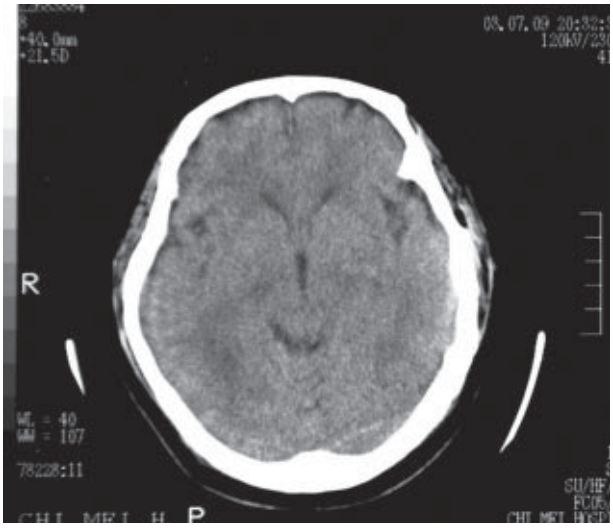


**Fig. 1.** Initial brain computed tomography was unremarkable.

(Fig. 1). Lumbar puncture yielded cloudy cerebrospinal fluid (CSF) with a white blood cell count of 1166/mm$^3$ (46% neutrophils and 54% lymphocytes); protein, 205 mg/dL; glucose, 37 mg/dL (simultaneous blood glucose level, 114 mg/dL); and negative results for acid-fast, Indian ink, and Gram stains. Studies for *Cryptococcus* infection including antigen test in the CSF and blood were also negative. Additional blood data were as follows: leukocyte count, 19,400/mm$^3$ (91% neutrophils and 4% monocytes); hemoglobin, 12.6 g/dL; platelet count, 49,400/mm$^3$; serum urea, 31 mg/dL; and ammonia, 260 μg/dL. Chest X-ray showed newly developed consolidation over the right upper lung field. The initial impression included bacterial meningitis, pneumonia, hepatic encephalopathy, and adrenal insufficiency. Therefore, he was treated with intravenous ceftriaxone (2 g every 12 h), vancomycin (1 g every 12 h) and hydrocortisone (50 mg every 6 h). Polymerase chain reaction (PCR) [Amplicor; Roche Molecular Systems, Branchburg, NJ, USA] for tuberculous bacilli (TB) in CSF was negative. Nevertheless, based on slight lymphocyte predominance in CSF, treatment for tuberculous meningitis was planned if no rapid clinical improvement was observed.

On hospital day 4, both blood and CSF cultures yielded *L. monocytogenes*, so vancomycin was discontinued and intravenous ampicillin (12 g daily) was added. The initial sputum culture revealed *Klebsiella pneumoniae*. On hospital day 5, the patient manifested a flaccid quadriparesis and developed a progressive decline in respiratory pattern, which required intubation and mechanically assisted ventilation. On hospital day 6, consciousness deteriorated despite appropriate management for hepatic encephalopathy. Several episodes of seizure and bradycardia also occurred. The second brain CT scan was done immediately and revealed prominent temporal horns with enlargement of ventricles (Fig. 2). Untreated tuberculous meningitis complicated with hydrocephalus was suspected again.

Ommaya reservoir implantation was performed on hospital day 7. Follow-up CSF profile revealed 5 white blood cells, protein 36 mg/dL, glucose 84 mg/dL (simultaneous blood glucose level, 305 mg/dL), and negative TB PCR results. Ceftriaxone was discontinued on hospital day 8. Daily drainage of CSF from the Ommaya reservoir was done after surgery. The patient improved gradually and had normal mental status 4 days after surgery. The ventilator was removed on hospital day 14. Follow-up brain magnetic resonance imaging 9 days after surgery revealed dramatic improvement of internal hydrocephalus and a small right frontal subdural effusion with diffuse leptomeningeal enhancement (Fig. 3) presumed to be either infection-related or due to an over-shunting mechanism.

After a 16-day course of intensive care and a complete 21-day course of intravenous ampicillin therapy, the patient was discharged on hospital day 25, with normal consciousness and residual mild quadriparesis. At follow-up examination 2 months later, the patient had regained his pre-morbid functional level. Initial and repeated TB cultures for CSF yielded no growth of the organism.

## Discussion

*L. monocytogenes* is a potential pathogen for both humans and animals. Listeriosis, mainly foodborne, is

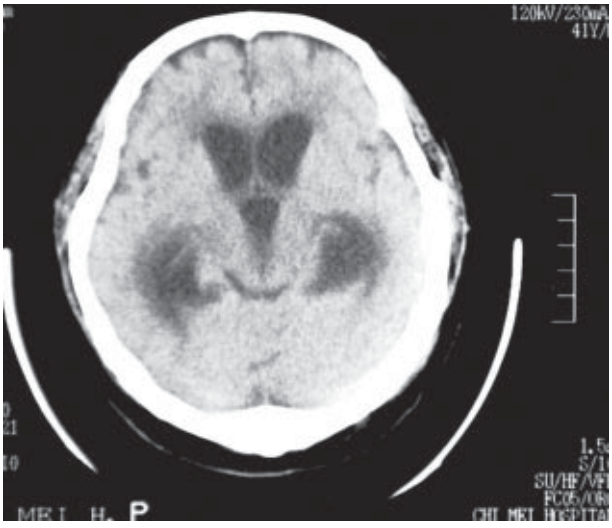

**Fig. 2.** Follow-up brain computed tomography reveals prominent temporal horns and enlargement of ventricles.

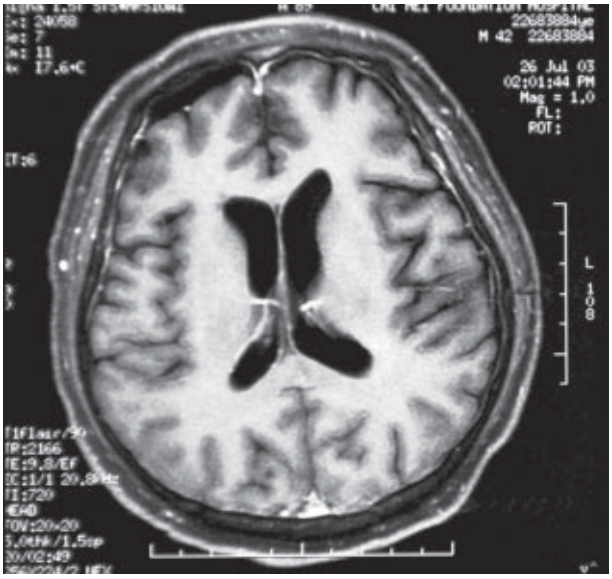


**Fig. 3.** Post-shunting enhanced magnetic resonance imaging reveals a dramatic improvement of internal hydrocephalus with diffuse leptomeningeal enhancement and small subdural effusion over the right frontal area.

a rare but severe human disease with a mortality rate of greater than 30% [1]. *L. monocytogenes* contributes to 2-11% of meningitis in Taiwan, resulting in mortality rates of 17-50% in reported cases [10,11]. Most human cases of listeriosis develop in newborns, pregnant women, the elderly and people with compromised immune function including patients with cancer, diabetes, cirrhosis, kidney disease, acquired immunodeficiency syndrome, and/or patients receiving immunosuppressive therapy [1]. Our patient could be regarded as having immunocompromised status based on underlying conditions of diabetes mellitus and cirrhosis, and prolonged use of prednisolone.

Initial empirical therapy for bacterial meningitis in patients above 50 years of age or with immunosuppression should include coverage for *L. monocytogenes* [12]. Ampicillin is the preferred antimicrobial agent for the treatment of *L. monocytogenes* meningitis and the addition of an aminoglycoside for possible synergistic activity has been recommended [1,8,12]. Trimethoprim-sulfamethoxazole may be an alternative when penicillin is contraindicated [1,8,10]. Treatment for bacterial meningitis should be prolonged beyond the usual 2 weeks to between 2 and 3 weeks [1,12]. Repeated CSF examination in our patient showed a significant reduction of white cell counts from baseline, suggesting the effectiveness of antibiotic treatment and drainage of CSF.

Complications due to *L. monocytogenes* meningitis include brain abscess, cerebritis, ventriculitis, and rhomboencephalitis. Hydrocephalus complicating *Listeria* meningitis in adults has been reported infrequently [1,6,8,9]. In contrast, hydrocephalus is a common complication of tuberculous meningitis and the need for aggressive surgical treatment is well documented [13]. Due to the higher prevalence of TB than listeriosis in Taiwan, anti-tuberculous therapy is likely to be started if *L. monocytogenes* is not isolated. The indication for empirical anti-tuberculous therapy may include persistent fever, no improvement in repeated CSF profile or worsening neurological status after antimicrobial therapy. However, anti-tuberculous therapy was not given to our patient due to dramatic clinical improvement after adequate CSF drainage from the Ommaya reservoir. This clinical response to drainage and antimicrobial therapy without anti-tuberculous agents, combined with the negative results of acid-fast stain, TB PCR and TB culture for CSF led to the exclusion of TB meningitis. Because a CSF profile of lymphocytic pleocytosis may occur in either *Listeria* or tuberculous meningitis, *Listeria* meningitis should be considered in the differential diagnosis of meningitis with hydrocephalus, particularly in an immunocompromised patient with poor clinical response to initial anti-tuberculous therapy.

Several mechanisms may be responsible for the development of meningitis-associated hydrocephalus, such as blockade of the CSF pathway by leptomeningeal inflammation and/or impaired CSF absorption due to the obliteration of subarachnoid space by meningeal exudates. Previously reported cases of *L. monocytogenes* meningitis-related hydrocephalus were mainly treated by ventricular-peritoneal shunt-based management, and had good clinical outcomes [1,6,9]. In addition, hydrocephalus caused by TB and/or *L. monocytogenes* was successfully resolved after either temporary drainage of CSF from the Ommaya reservoir or permanent implantation of the ventricular-peritoneal shunt [1,6,9,13].

In conclusion, we report a case of acute symptomatic hydrocephalus as a complication of *L. monocytogenes* meningitis. Complete recovery occurred after appropriate antimicrobial therapy and temporary CSF drainage from the Ommaya reservoir. Brain imaging study to identify possible hydrocephalus is warranted in patients with *Listeria* meningitis presenting with persistent alteration of consciousness after appropriate antimicrobial therapy.

## References


1. Mylonakis E, Hohmann EL, Calderwood SB. Central nervous system infection with *Listeria monocytogenes*. 33 years' experience at a general hospital and review of 776 episodes from the literature. Medicine (Baltimore) 1998;77:313-36.
2. Peltola H, Kilpi T, Anttila M. Rapid disappearance of *Haemophilus influenzae* type b meningitis after routine childhood immunisation with conjugate vaccines. Lancet 1992; 340:592-4.
3. Schuchat A, Robinson K, Wenger JD, Harrison LH, Farey M, Reingold AL, et al. Bacterial meningitis in the United States in 1995. Active Surveillance Team. N Engl J Med 1997;337: 970-6.
4. Mahony JF, Tambyah JA, Dalton VC, Wolfenden WH. Pontomedullary listeriosis in renal allograft recipient. Br Med J 1974;2:705.
5. Lechtenberg R, Sierra MF, Pringle GF, Shucart WA, Butt KM. *Listeria monocytogenes*: brain abscess or meningoencephalitis? Neurology 1979;29:86-90.
6. Nieman RE, Lorber B. Listeriosis in adults: a changing pattern. Report of eight cases and review of the literature, 1968-1978. Rev Infect Dis 1980;2:207-27.
7. Brun-Buisson CJ, de Gialluly E, Gherardi R, Otterbein G, Gray F, Rapin M. Fatal nonmeningitic *Listeria* rhombencephalitis. Report of two cases. Arch Intern Med 1985;145:1982-5.
8. Armstrong RW, Fung PC. Brainstem encephalitis (rhomboencephalitis) due to *Listeria monocytogenes*: case report and review. Clin Infect Dis 1993;16:689-702.
9. Raps EC, Gutmann DH, Brorson JR, O'Connor M, Hurtig HI. Symptomatic hydrocephalus and reversible spinal cord compression in *Listeria monocytogenes* meningitis. Case report. J Neurosurg 1989;71:620-2.
10. Tang LM, Chen ST, Hsu WC, Lyu RK. Acute bacterial meningitis in adults: a hospital-based epidemiological study. QJM 1999;92:719-25.
11. Fang CT, Chang SC, Hsueh PR, Chen YC, Sau WY, Luh KT. Microbiologic features of adult community-acquired bacterial meningitis in Taiwan. J Formos Med Assoc 2000;99:300-4.
12. Lorber B. *Listeria monocytogenes*. In: Mandell GL, Bennett JE, Dolin R, eds. Mandell, Douglas and Bennett's Principles and Practice of Infectious Diseases. Philadelphia: Churchill Livingstone; 2000:2208-15.
13. Damany BJ. Surgery in tuberculous meningitis. Prog Pediatr Surg 1982;15:181-5.