



Listeria monocytogenes Presenting as Hydrocephalus in an Immunocompetent Adult: A Case Report

Sher Muhammad Sethi^{1*}, Muhammad Sohaib², Samina Shamim³ and Amber Sabeen Ahmed⁴

¹Department of Internal Medicine, Aga Khan University Hospital, Pakistan

²Department of Critical Care, Aga Khan University Hospital, Pakistan

³Department of Medicine, Ziauddin University Hospital, Pakistan

⁴Department of Medicine and Critical Care, Aga Khan University Hospital, Pakistan

Abstract

Listeria monocytogenes is a gram positive bacillus that affects the central nervous system and causes meningitis, meningoencephalitis, rhomboencephalitis and brain abscess. *Listerial* meningitis can cause hydrocephalus, a rare complication. About 3% of patients with neurological symptoms develop this complication. An elderly gentleman 68 years old with diabetes mellitus and hypertension presented to the emergency department in June 2020 with fever for seven days and altered mental status for two days. He had a stiff neck. He was slow to respond, confused but oriented to the surroundings. His sensation and powers were intact. The Kernig sign was present. Deep tendon reflexes were exaggerated. He was initially managed on meningitic doses of ceftriaxone, vancomycin and acyclovir. On the third day, his conscious level worsened and magnetic resonance imaging of the brain was done which confirms moderate non-communicating hydrocephalus. His CSF bio-fire film array confirmed that *Listeria monocytogenes* was present, and he was switched to ampicillin and gentamycin. Later, his initial blood culture grew *Listeria* and was susceptible to high dose ampicillin. In conclusion, our patient had a lethal *Listeria* infection which presented with hydrocephalus. Early diagnosis and targeted treatment is the mainstay to fight against these infections.

Keywords: *Listeria*; Meningitis; Hydrocephalus; Meningoencephalitis

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*Correspondence:

Sher Muhammad Sethi, Department of Internal Medicine, Aga Khan University Hospital, Karachi, Pakistan, E-mail: sher.sethi@gmail.com

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Background

Listeria monocytogenes is a gram positive bacillus that affects the central nervous system and causes meningitis, meningoencephalitis, rhomboencephalitis and brain abscess [1]. The main route of transmission to humans is contaminated food and water [2]. *Listeria* predominantly involves immunosuppressed patients, pregnant women, and those who are at the extreme of their ages i.e. neonates and the elder population [3]. *Listerial* meningitis can cause hydrocephalus, a rare complication. About 3% of patients with neurological symptoms develop this complication [4]. *Listeria* is associated with a high mortality rate of around 30% [3,5]. In this case report, we describe a case of an immunocompetent adult with a *Listeria* infection and a non-communicating hydrocephalus.

Case Presentation

An elderly gentleman 68 years old with diabetes mellitus and hypertension presented to the Emergency Room (ER) in June 2020 with fever for seven days and altered mental status for two days. Fever was described as high grade, with rigors, around 103°F, intermittent, relieved with antipyretics, associated with body ache, headache and persistent malaise. His mentality has been altered for the past two days. The alteration included irrelevant information, getting acquainted with familiar people, and feeling sleepier. Past medical history includes longstanding diabetes and hypertension for around ten years. Diabetes was well controlled with oral hypoglycemic and had an HbA1c of 6.9%. Hypertension was also well stable on amlodipine. He had no surgical history to note. He denied smoking, addiction, allergies, or high-risk behaviors. On presentation in the ER, he had a heart rate of 84 beats/min, respiratory rate of 22 breaths/min, blood pressure of 110/65 mmHg and temperature of 100°F. Glasgow Coma Scale (GCS) was 11/15 (E4 M6 V1). The pupils were an-isochoric with right 1mm and left 3 mm. He had a stiff neck. He was slow to respond, confused but oriented to the surroundings. His sensation and powers were intact. The Kernig sign was present. Deep tendon reflexes were exaggerated. On examination of his respiratory

Table 1: Initial investigations.

	Patient's parameter	Normal range
Hematology		
• Hemoglobin (g/dL)	13.2	12.3–16.6
• White Cell Counts ($\times 10^9/L$)	12.4	4.8–11.3
• Neutrophils (%)	83.9	34.9–76.2
• Lymphocytes (%)	8	17.5–45
• Platelets ($\times 10^9/L$)	194	154–433
Coagulation Profile		
• Prothrombin Time (seconds)	11.1	9.3–12.8
• Internationalized Ratio (ratio)	1.1	0.9–1.2
• Activated Partial Thromboplastin Time (seconds)	21.2	22.9–34.5
Biochemistry		
• Blood Urea Nitrogen (mg/dl)	17	6–20
• Serum Creatinine (mg/dl)	1.1	0.8–1.3
• Sodium (mmol/L)	135	136–145
• Potassium (mmol/L)	4.2	3.5–5.1
• Chloride (mmol/L)	94	98–107
• Bicarbonate (mmol/L)	22.5	20–31
• Alanine Transaminase (IU/L)	37	<45
• Aspartate Transaminase (IU/L)	57	<35
Inflammatory Markers		
• C-reactive Protein (mg/L)	160.81	0–10
• Serum Ferritin (ng/ml)	555	22–322
• Lactate Dehydrogenase (I.U./L)	355	120–246
• Procalcitonin (ng/ml)	0.560	<0.5 low risk >2 high risk for bacterial infections

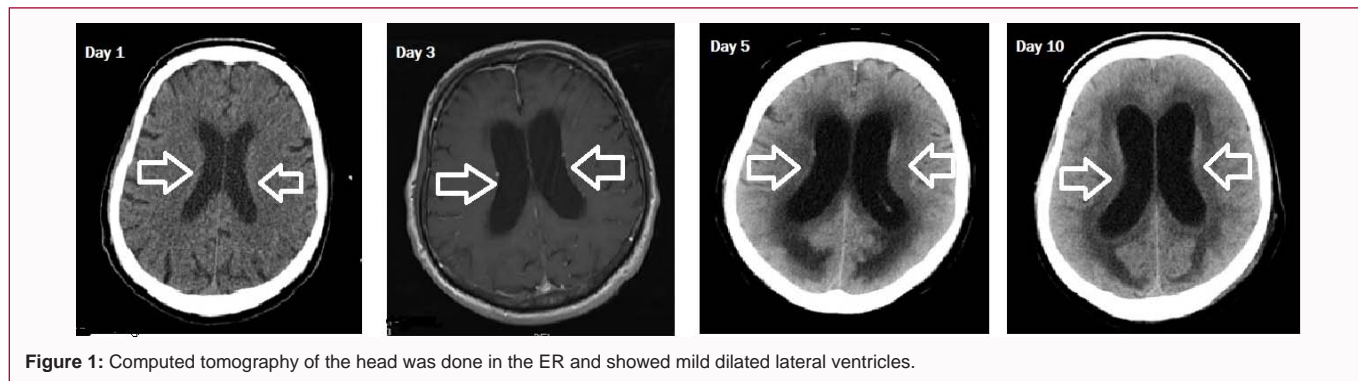


Figure 1: Computed tomography of the head was done in the ER and showed mild dilated lateral ventricles.

system, he showed normal bilateral vesicular breathing and cardiac auscultation did not reveal any additional sounds or murmurs. He had a hemoglobin of 13.2 g/dL, leukocytosis with white blood cell count of $12.4 \times 10^9/L$ with neutrophilic shift and platelet counts were 194. His CRP was raised (160.81 mg/dL). Initial investigation has been shown in Table 1. Computed tomography of the head was done in the ER and showed mild dilated lateral ventricles as shown in Figure 1. Because of the ongoing pandemic, a tracheal aspirate was sent for COVID-19 polymerase chain reaction, which came back negative. He was initially managed on meningitic doses of ceftriaxone, vancomycin and acyclovir. On the third day, his conscious level worsened and magnetic resonance imaging of the brain was done which confirms moderate non-communicating hydrocephalus (Figure 2). On the same night, patient dropped GCS

(7/15) and was electively intubated and shifted to the Intensive Care Unit (ICU). During his ICU stay, lumbar puncture was done twice. The cerebrospinal fluid initially showed low glucose levels of 38 mg/dL and high white cell counts of $0.437 \times 10^3/uL$. Table 2 shows the comparison of second cerebrospinal fluid values taken two days apart. His CSF bio-fire film array confirmed that *Listeria monocytogenes* was present, and he was switched to ampicillin and gentamycin. Later, his initial blood culture grew *Listeria* and was susceptible to high dose ampicillin. Unfortunately, he developed signs of raised intracranial pressure with high blood pressures (180/110 mmHg) and low heart rate (55 beats/min). So, a repeat CT scan of the head was done on the fifth day which showed gross hydrocephalus and trans-ependymal seepage (Figure 1). The neurosurgery team was brought in and an Extra-Ventricular Drain (EVD) was inserted. In the next 24 h, his

Table 2: Comparison of second cerebrospinal fluid values taken two days apart.

	Initial (on 2 nd day of admission)	Repeated (on 4 th day of admission)	Normal Ranges
Glucose (mg/dl)	38	31	40–70
Protein (mg/dl)	329	274	15–40
White Cell Counts (x 10 ³ /uL)	0.437	0.508	0–0.005
Neutrophils (%)	65	37	-
Lymphocytes (%)	35	63	-

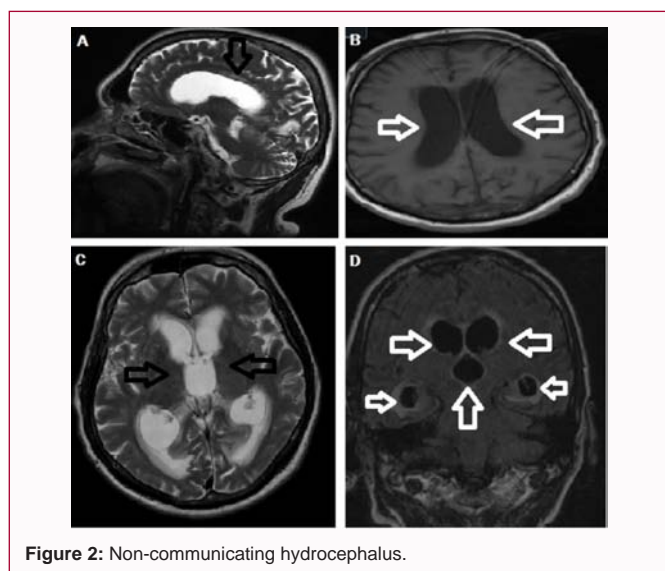


Figure 2: Non-communicating hydrocephalus.

heart rate improved and there was slight improvement in GCS (10/15). However there was minimal to no output in the EVD for the next 72 h and no further improvement in GCS was observed. He then again dropped GCS (7/15) and the repeat CT scan of the head on the 10th day was done which showed no changes (Figure 1). His repeated blood cultures were also negative. During the next 48 h there was no improvement in condition. A multi-disciplinary opinion was sought (ICU, neurology, neurosurgery) and consensus was reached that his current neurological state is the result of extensive damage from *Listeria* and he is likely to remain in a chronic, functionally dependent state. Family was offered the option of a tracheotomy to allow chronic recovery, if any, for his neurological state. However, after discussion, the family opted for withdrawal of care. He was compassionately extubated and passed off. His death was announced to the family, and condolences were offered.

Discussion

We report an interesting case of complicated *Listeria* meningitis leading to hydrocephalus in an immunocompetent adult. *Listeria* meningitis is a rare entity but had a very high mortality rate of around 24% [6]. It is known to affects infants and children, elderly patients, pregnant patients, patient with uncontrolled diabetes, and immunosuppressed patients [7]. There are few case reports that report an immunocompetent patient and a child that had acquired *Listeria* meningitis [1,8]. Not to our surprise, our patient was an immunocompetent patient and had a well-controlled diabetes as reflected by his HbA1c of 6.9%. Despite that, he acquired *Listeria* infection and presented with hydrocephalus. Bacterial meningitis causes severe inflammatory reactions which disrupts the absorption of CSF. This leads to dangerous complication of hydrocephalus

[9]. The incidence of hydrocephalus is around 15% in patients with *Listeria* meningitis [5]. This shows that *Listeria* infections had a tendency to form hydrocephalus. In our case, the patient presented with mild hydrocephalus which gradually increased and required extra ventricular drainage. The duration from meningitis to the development of hydrocephalus often requires several days [10]. There are recent cases that had reported early hydrocephalus. Early hydrocephalus is defined as developing hydrocephalus within 4 to 5 days of the initiation of the symptoms [7]. In our patient he presented seven days after the onset of symptoms and was initially not covered for *Listeria*. This might make him more prone to develop hydrocephalus.

Combination of meningitis and hydrocephalus is deadly in *Listeria* infection. Kasanmoentalib had reported three out of four patients had a fatality while Pelegrin reports mortality of 29% [5,9]. Similarly, our patient had a complex complicated course and despite of treatment and surgical drainage we were unable to save his life. Broad spectrum cephalosporins are the first line therapy for the patients who are suspected to have bacterial meningitis. Unfortunately, this group of antibiotic doesn't cover *Listeria* and is resistant to it [11]. In our case, the patient was also initially treated with ceftriaxone i.e. a third generation cephalosporin. It was later switched to ampicillin. This could be the reason of increasing white cell counts in the CSF specimen despite of the treatment. This brings us to think what could have been done differently to save the patient life. Definitely, if the patient seeks early medical attention the outcome could be different. Treating with ampicillin in upfront along with other antibiotics is always a challenging decision. Early extra-ventricular drainage role has to be study in patients who have meningitis and hydrocephalus. Early treatment of a *Listeria* infection may help prevent complications like hydrocephalus and help quick recovery. We recommend considering *Listeria* in the high risk population or those patients who present with complicated meningitis. Though such kind of cases had been reported in the past but it highlight the importance that *Listeria* can be lethal and quick and early response is warranted. With this, we conclude that the patient had a lethal *Listeria* infection that manifested as hydrocephalus. The possibility of *Listeria* infection should be considered in all patients with complicated neurological sequela. An early diagnosis and empirically targeted treatment is the most effective way to combat these infections.

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