



Salmonella meningitis, an unusual complication of salmonella species: a case report from Nepal

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Introduction: Salmonella meningitis, caused by a Gram-negative bacillus of the Enterobacteriaceae family, is an uncommon but serious complication of Salmonella infection that can result in high mortality rates, significant neurological damage, and a high relapse rate, and has become a leading cause of Gram-negative bacterial meningitis in the developing world.

Case presentation: A 16-year-old boy presented with high-grade fever and altered sensorium for 2 days associated with vomiting, headache, and photophobia.

Case discussion: After invading the abdominal barrier, Salmonella can enter bloodstream and rarely present with meningitis. Cerebrospinal fluid analysis and culture supported with other investigations can diagnose bacterial meningitis and its causative agent. Adequate treatment is essential to completely cure and prevent relapse.

Conclusion: Given its invasive nature and potential serious consequences, such as relapse and antibiotic resistance, prompt, and appropriate treatment of Salmonella meningitis is essential.

Keywords: Salmonella, meningitis, typhoid

Introduction

Salmonella meningitis is caused by Salmonella, a Gram-negative bacilli of the Enterobacteriaceae family^[1]. Salmonellosis usually manifests as a mild self-limiting diarrhoeal illness, particularly in young children,² but occasionally it manifests as an invasive disease, causing syndromes such as bacteremia and meningitis^[2]. Meningitis is an unusual complication of typhoid fever in developed countries and is associated with high mortality, significant neurological sequelae in those who survive, and a high relapse rate^[3]. *Salmonella* species now represent a leading cause of Gram-negative bacterial meningitis in the developing world and a major cause of death and brain damage in many parts of the world^[4]. Patients are more likely to die from Salmonella

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HIGHLIGHTS

- Salmonella meningitis is rare in adults and older children.
- Cerebrospinal fluid (CSF) analysis and culture are necessary for diagnosis, and susceptibility testing is recommended due to emerging drug resistance.
- Prompt treatment with bactericidal antibiotics is necessary for a favourable outcome.
- Prolonged treatment is recommended to prevent relapse or recurrence.

meningitis than from meningitis due to the other major bacterial pathogens^[5]. Patient usually manifests with headache, fever, altered level of consciousness, and stiff neck. The diagnosis is made by a positive Gram stain or culture of the CSF. Acute meningitis caused by Salmonella species is a rare clinical issue occurring mostly in newborns and young infants, where it is related with significant mortality^[6]. Sporadic cases in adults have been extremely rare^[7]. We present a case of a 16-year-old male presented with signs and symptoms of meningitis. The following article is presented in accordance with CARE guidelines for case reports^[8].

Case presentation

A 16-year-old male from Nepal presented to the emergency department with a 2-day history of high-grade fever with altered sensorium. Fever was associated with vomiting for single episode and headache was associated with photophobia. He had a history of abdominal discomfort and pain for 1 week with the passage of loose stools and loss of appetite. There was no history of cough, ear discharge, jaundice, the passage of dark urine, and burning micturition or seizure.

At the time of presentation, he was on semi-conscious with glasgow coma scale of 12/15(EVM 345) with oxygen saturation 87% at room temperature, respiratory rate 30/min, blood pressure 80/60 mmHg, pulse rate 150 beats per min, low in volume, regular and normal in character with recorded body temperature of 103° F. Physical examination revealed a well-nourished male with a blank, vacant look. Neurological examination revealed mild neck stiffness, global hypertonia, and hyperreflexia. Other systemic examinations including respiratory and cardiovascular systems including ears, nose and throat were unremarkable.

Haematological studies revealed white blood cell count of 13 000/mm³ with 52% neutrophils and 35% lymphocytes. Partial thromboplastin time 43 sec, CSF glucose 32 mg/dl (concomitant blood sugar 120 mg/dl), CSF protein 150 mg/dl, total leucocyte count 26 mm³ with 35% lymphocytes and 16% polymorphonuclear cells and 11 RBC/mm³. Latex agglutinations test were all negative. CSF culture on MacConkey Agar obtained after 24 h of incubation at 37 °C produces colourless pale colonies suggestive of non-lactose fermenters that is *Salmonella* species (Fig. 1) and two sets of blood cultures grew *S. paratyphi* A on the sixth day, susceptible to ceftriaxone, amikacin, and ceftazidime.

Gram stain and biochemical testing revealed Gram-negative motile rods, catalase positive, oxidase negative, citrate positive, urease negative, and indole negative. Serology revealed Typhoid IgM positive. Stool sample revealed no bacterial pathogen. Computed tomography scan of head was normal.

Patient was stabilized with intravenous fluid, and oxygen therapy via facemask along with hydrocortisone 200 mg two times a day (BD). He was hospitalized and kept in ICU for 1 week and was commenced empirically on ceftriaxone 400 mg and amikacin, all given intravenously at 12-hourly intervals.

The patient gradually improved within 3 days except mild nuchal rigidity that gradually subsided. He did not develop any complications during hospital stay for 2 weeks and was discharged home with no residual neurological deficit. Following the recovery, the patient was discharged on ceftriaxone for 2 weeks. On follow-up after a week, he was improving and there were no fresh issues.



Figure 1. Mac Conkey agar showing pale colourless colonies suggestive of non-lactose fermenters; *Salmonella* Sp.

Discussion

The first report of meningitis due to the genus *Salmonella* was made by Gohn in 1907^[1]. *Salmonella* accounts for 0.8–6% of all cases of bacterial meningitis, the majority of which occur in infants^[1]. In a review conducted by Owusu-Ofori *et al.*^[4], 89.7% of infections occurred in children less than 1 year old. *Salmonella* sepsis with meninges involvement is an uncommon complication in adults and older children. *Salmonellosis* typically presents with various clinical manifestations such as enteric fever, gastroenteritis, bacteremia, and other extraintestinal complications^[9]. Most common way of infection with *Salmonella* is through the feco-oral route. The source of infection is unclear in this patient. It uses virulence factors such as intracellular invasion, polysaccharide capsule, and fimbriae to colonize the mucosa, survive intravascularly, invade the meninges, and persist in the sub-arachnoid space. The host's inflammatory response and immune system activation contribute to these effects^[5]. After invading abdominal barrier, bacteria enters bloodstream and rarely presents intracranial infections, which can cause meningitis, subdural effusion, empyema, or brain abscess^[5]. Focal infections including brain abscess and empyema have been reported^[10]. In our case no any evidence of underlying pathology seen on computed tomography imaging.

CSF analysis and culture are the most reliable methods of diagnosing meningitis. It is critical to identify the causative organism in the CSF in order to provide appropriate treatment, prevention, and epidemiological studies. Bacterial meningitis is life-threatening and is distinguished by specific effects on the CSF white blood cell count, CSF protein levels, and the glucose ratio in the CSF and serum^[11]. Gram-negative rods were identified in CSF by microscopic examination, and *Salmonella* species were cultured in our case supported by biochemical testing. Blood examination revealed leukocytosis and positive inflammatory reactions like in other bacterial meningitis. Serology suggests it as typhoid *Salmonella*.

Prompt treatment should be initiated immediately in suspected cases for intact survival without neurological sequel. Patients with pneumococcal or Gram-negative bacillary meningitis who are treated with bacteriostatic antibiotics may have poor result. Thus it is recommended to use antibiotics with bactericidal activity in the CSF to achieve better outcome^[11]. The recommended treatment for *Salmonella* meningitis is combination of ciprofloxacin (especially in adults) and ceftriaxone/cefotaxime^[12]. But due to emerging drug resistance, susceptibility test is advisable. Ceftriaxone combined with amikacin provide better bactericidal activity, prevent drug resistance and relapse rate in salmonella infections^[1]. A study by Dellagrammaticas *et al.*^[13], strongly advocates the use of third generation cephalosporins and amikacin in combination for the treatment of neonatal Gram-negative bacterial meningitis. In our case, isolate was susceptible to ceftriaxone, amikacin and ceftazidime, and hence treated accordingly. Favourable response to *Salmonella* meningitis has been confirmed in numerous cases^[14,15]. Since *Salmonella* is a facultative intracellular microorganism, inadequate drug penetration may cause the infection to worsen^[10]. A minimum of 3 weeks of treatment is required to effectively treat meningitis caused by Gram-negative bacilli. If a patient has a cerebral abscess that cannot be drained, broad-spectrum antibiotics should be taken for 4–5 weeks, or until all abscesses in the brain are no longer visible on radiological imaging. Based on the slow

response and high frequency of reported relapses in the literature, it is recommended to undergo prolonged treatment for Salmonella meningitis^[16,17]. Inadequate or incomplete treatment of Salmonella meningitis or brain abscess can result in recrudescence, relapsing, or recurrence^[18].

Conclusion

Our case was of Salmonella meningitis in male who had a healthy immune system. If a patient displays signs of bacterial meningitis such as high fever, neck stiffness, headache, and altered mental state, prompt and appropriate treatment should be initiated. They must be aware that this pathogen is invasive and has the potential to have serious consequences and long-lasting effects, like brain abscesses. Since Salmonella infections have a propensity to relapse and develop resistance to numerous antibiotics, it is crucial to administer the proper care and ensure that patients are monitored frequently until they have fully recovered.

Ethical approval

None.

Consent

Written informed consent was obtained from the parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

H.B.B., S.R., M.B., and S.B. wrote the original manuscript, reviewed, and edited the original manuscript. S.A., M.U., S.Y., G.K., S.B., and S.J. reviewed and edited the original manuscript.

Conflicts of interest disclosure

None.

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