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Case Report

A rare case of non-typhi salmonella meningitis in an immunocompetent adult: a case study

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ABSTRACT

Salmonella, a gram-negative motile bacillus, is commonly associated with typhoid fever, septicemia, and diarrhea. Non-typhi Salmonella (NTS) can cause bacteremia, meningitis, focal septic infections, pneumonia, and osteomyelitis, although NTS meningitis is rarely reported in immunocompetent adults and is more common in immunocompromised patients, infants, and children. NTS infections are typically transmitted through contaminated food or water, and clinical presentations often lack specific symptoms, making diagnosis challenging. Due to the higher mortality rates, aggressive management with proper antibiotic susceptibility testing is advised. The risk of antibiotic resistance, recurrence, and the invasive nature of the infection make early diagnosis and treatment crucial. The treatment approach should be guided by performing proper antibiotic sensitivity testing. The higher risk of complications, including hydrocephalus, seizures, and empyema, highlights the importance of close follow-up. We describe a case of NTS meningitis that possibly occurred after the consumption of guinea pig meat, where early presentation and appropriate management led to a favorable outcome without progression to further complications.

Keywords: Salmonella meningitis, NTS, Non-typhi salmonella, Non-typhi salmonella meningitis, Non-typhoidal Salmonella, Guinea pig

INTRODUCTION

Salmonella is a gram-negative motile bacillus which usually causes typhoid fever, septicemia, diarrhea, focal septic infections and meningitis which is being extremely rare and mostly prevalent in infants and young children. Salmonella has two different types includes Non-typhi Salmonella (NTS) and Typhi salmonella.[1–3] NTS causes bacteremia, focal septic infections and meningitis by invading normal sterile sites which also known as invasive non-typhoidal Salmonella disease.[4] In adults, NTS meningitis has rarely reported at the incidence of 7.5 per 100,000 population with more commonly affecting co-morbid diseases including people living with HIV infection, elderly people and childrens.[5] Approximately mortality rates of 40% has been reported in children so far with higher risk of complications including hydrocephalus, seizures, subdural empyema and retardation etc. Fatality of NTS is depends on the serotype of NTS by which it is caused. Most commonly involved serotype amongst them are salmonella Enteridis and Typhimurium, other subtypes with a risk of complications includes Dublin, Newport, Infantis, Virchow etc.[1,6] Non-typhi salmonella infections usually transmitted via contaminated food or water.[7] Most commonly, NTS (Non-Typhoidal Salmonella) presents as gastroenteritis. NTS causes this by invading the healthy intestinal epithelium, which triggers an inflammatory

response with the migration of neutrophils. Intracellularly, it resides in phagocytes in the lamina propria. Many virulence genes, known as Salmonella Pathogenicity Islands (SPIs), have been identified. These genes allow the bacteria to be engulfed by forming a channel between the epithelial and bacterial cell membranes, leading to the invasion of bacteria into the circulation and causing bacteremia. This bacteremia can result in extra-intestinal manifestations such as pneumonia, osteomyelitis, and meningitis.[2,8]

Clinically, invasive NTS infections do not present with typical diarrhea. Instead, they usually present as non-specific febrile illnesses, making them clinically indistinguishable from other febrile illnesses. Patients typically present with symptoms such as headache, myalgias, fever, stupor, vomiting, delirium, and confusion.[4,9]

The diagnosis of non-typhi Salmonella meningitis is based on CSF (cerebrospinal fluid) culture and analysis. This helps identify the causative organism and determine its antibiotic susceptibility, which is crucial for effective treatment, as this condition is life-threatening. Blood culture with a positive Gram stain also aids in the diagnosis.[10] Since Salmonella is a facultative intracellular organism, improper treatment can worsen the infection. The treatment for NTS meningitis is a combination of ceftriaxone or cefotaxime and ciprofloxacin. Due to their bactericidal activity in the CSF, this combination achieves better outcomes.[10–12] Ceftriaxone in combination with amikacin has also provided better outcomes. However, due to the increasing incidence of drug resistance, it is advisable to perform drug susceptibility tests before starting treatment.[13]

Here, we describe a case of a 37-year-old immunocompetent male patient with non-typhi Salmonella meningitis, possibly sourced from eating a guinea pig.

CASE REPORT

A 37-year-old male presented to the emergency department with complaints of a severe, acute onset frontal headache. The headache initially started a week ago but worsened significantly this morning. He also complained of fever (100.6°F), neck pain, neck stiffness, dizziness, and had two episodes of vomiting. There was no history of seizures, numbness, tingling, or abdominal pain. Upon further history taking, it was found that the patient had eaten a guinea pig a few days earlier.

Physical examination revealed an ill-appearing and diaphoretic look. Apart from this, the systemic examination, including the cardiovascular system, pulmonary system, musculoskeletal system, nose, throat, and ears, was unremarkable. Laboratory tests were ordered, including CBC, complete metabolic panel, spinal fluid cell count, CSF glucose and protein, blood culture, CSF meningitis PCR panel for bacteria, viruses, and yeast, CSF culture, cryptococcal antigen (CSF and serum), Coccidioides antibody, and VDRL. The laboratory examination reports showed significant changes as detailed below (Table 1, 2).

Table 1: Complete blood counts and complete metabolic panel.

CBC and CMP	%
WBC (mm^3)	12.4
RBC (million/mm^3)	4.64
HCT (%)	41.7
MCV (μm^3)	89.9
MCH (pg/cell)	30.2
MCHC (Hb/cell)	33.6
RDW	12.7
GRAN %	86
GRAN #	10.6
Lymph %	9
Lymph #	1.1
Mono %	5
Mono #	0.6
Sodium (mmol/l)	133
Glucose (mg/dl)	120

Table 2: Spinal fluid counts.

Spinal fluid count	Result
RBC	No result
WBC (µl)	648
Lymphcyte	32
Monocyte	3
Clarity	Clear
Color	Colourless
Glucose (mg/dl)	45
Protein (mg/dl)	95

Based on the clinical features and physical examination, a list of possible differential diagnoses was made, including tension headache, migraine, cluster headache, subarachnoid hemorrhage, meningoencephalitis, meningitis, mass, and vascular dissection. To rule out some of these differentials, a CT head angiography with and without IV contrast was performed, which showed no acute intracranial or vascular abnormalities. In the performed LP, clear fluid was obtained. The analysis revealed a glucose level of 45 mg/dl, a protein level of 95 mg/dl, and a significantly increased WBC count of 648/µl.

CSF samples were also sent for culture and antibiotic sensitivity testing. Considering meningitis as a possible diagnosis, hospitalization was advised for further management. The patient was empirically started on vancomycin 1750 mg in 500 ml of 5% dextrose and ceftriaxone 2 g in 100 ml of 5% dextrose. The patient's condition deteriorated, and he became more lethargic.

Peripheral blood cultures revealed gram-negative rods of non-typhi Salmonella species, and CSF cultures also identified gram-negative rods of non-typhi Salmonella species. The bacteria were found to be susceptible to ampicillin, ceftriaxone, ciprofloxacin, and trimethoprim/sulfamethoxazole. Based on the clinical features and laboratory findings, a final diagnosis of non-typhi Salmonella meningitis was made.

Treatment was adjusted to ceftriaxone 2 g in 100 ml of 5% dextrose every 12 hours for 5 days, acetaminophen 650 mg every 6 hours, ondansetron 4 mg intravenously every 6 hours, and enoxaparin 40 mg daily, with close monitoring of vitals. Routine blood cultures were performed throughout the course of the admission. After 2 days of treatment, the blood cultures showed a decreasing trend in non-typhi Salmonella, eventually leading to the bacteria becoming undetectable. Despite this improvement, the complete course of treatment was advised. The patient did not develop any complications during his hospital stay and, after significant improvement, was discharged with no neurological deficits. On follow-up a week later, the patient reported no recurrence of symptoms or neurological sequelae.

DISCUSSION

Gram-negative bacilli Salmonella are categorized into two types: Salmonella typhi and non-typhi Salmonella. While non-typhi Salmonella typically causes diarrheal disease, it can rarely lead to extra-intestinal conditions such as meningitis, osteomyelitis, and bacteremia.[2,3] Transmission of NTS typically occurs via fecal-oral transmission from contaminated food or water sources. In this case, the patient had a history of consuming guinea pig a week before presenting to the ER. Initially, he experienced a mild headache that was managed with paracetamol.

Patients usually manifests with the complaints of fever, myalgia, headache, vomiting, stupor, and confusion etc.[9] Our patient presented to the ER with a high fever of 100.6°F, headache, vomiting, neck pain, neck stiffness, and dizziness. NTS meningitis is rarely reported in adults, and when it does occur, it is more common in immunocompromised individuals, including those with HIV, the elderly, and children.[5] To our knowledge, non-typhi Salmonella meningitis in an immunocompetent individual following the consumption of a guinea pig has not been previously reported.

The pathophysiology behind the involvement of extra-intestinal systems begins with NTS invading the healthy intestinal epithelium. This invasion triggers an inflammatory response, leading to the migration of neutrophils that attempt to engulf the bacteria. As a facultative intracellular organism, NTS possesses virulence genes known as Salmonella Pathogenicity Islands (SPIs), which help form a channel between the epithelial and bacterial cell membranes. This facilitates the bacteria's entry into systemic circulation, allowing them to migrate to different organs and cause conditions such as osteomyelitis, pneumonia, and meningitis.[2,8] In this case, the possible route of transmission is the fecal-oral route from eating guinea pig. After invading the intestinal mucosa, the bacteria may have led to meningitis following bacteremia, as indicated by the positive blood culture for gram-negative rods of non-typhi Salmonella. Additionally, focal brain parenchymal involvement was not observed on the CT scan performed.

CSF analysis and culture are the best methods for diagnosing the causative agents of meningitis and determining antibiotic susceptibility. Blood cultures also assist in identifying bacteremia.[10] In our case, peripheral blood culture and CSF culture both identified gram-negative rods of non-typhi Salmonella species. Based on these culture results, a final diagnosis of non-typhi Salmonella meningitis was made. Since Salmonella is a facultative intracellular organism, improper treatment can lead to further progression of the infection. Additionally, increasing resistance to specific drugs makes it advisable to perform susceptibility tests to ensure better outcomes.[11,13] CSF culture in our case indicated that the organism was susceptible to ampicillin, ceftriaxone, ciprofloxacin, and trimethoprim/sulfamethoxazole.

Consequently, treatment with ceftriaxone 2 g in 100 ml of 5% dextrose every 12 hours for 5 days was initiated. After 2 days of treatment, the patient began to improve, and his blood culture showed a decreasing trend in bacteremia, eventually becoming non-detectable. According to the literature, due to the higher risk of recurrence, prolonged treatment is recommended for Salmonella meningitis cases. The duration of treatment can range from 3 weeks to 4-5 weeks, especially in the presence of complications such as brain abscess.[14,15] The prognosis of NTS meningitis is generally poor, particularly among infants and neonates.

Many patients either die or present with further complications during follow-up. These complications can include seizures, subdural collections, hydrocephalus, empyema, intracranial abscesses, masses, and cranial nerve palsies.[16] Despite the higher mortality and morbidity associated with NTS meningitis, early presentation, timely diagnosis, and prompt treatment led to a better outcome in our patient. During follow-up, the patient had no recurrence of symptoms or neurological sequelae. Probably, no cases have been reported to date where non-typhi Salmonella caused meningitis in a healthy, immunocompetent individual after consuming guinea pig.

CONCLUSION

A 37-year-old male presented to the ER with complaints of a severe, acute onset headache. Thorough history taking led to the identification of guinea pig consumption as the possible route of transmission. The patient reported

high fever, headache, neck stiffness, vomiting, and dizziness. CSF culture confirmed the diagnosis of non-typhi Salmonella (NTS) meningitis. Based on the CSF susceptibility test, treatment with ceftriaxone was initiated, resulting in timely recovery without complications. Given the rarity and high mortality and morbidity associated with non-typhi Salmonella meningitis, an aggressive treatment approach is recommended. There are no official guidelines for treating such cases, so the treatment approach should be based on the organism's susceptibility to antibiotics. Our case suggests that invasive forms of NTS may cause meningitis in healthy, immunocompetent individuals. It also highlights the need for monitoring for life-threatening complications and potential recurrence.

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