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Case Report

Microbiology Section

Meningitis in a Neonate Caused by *Salmonella enterica* Subspecies *Enterica*: A Case Report

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ABSTRACT

A 14-day-old female baby was admitted to the neonatal Intensive Care Unit (ICU) with complaints of fever for one week, along with reduced intake of feeds and weight loss. Routine investigations, blood culture, Cerebrospinal Fluid (CSF) routine analysis, and CSF culture were performed. Both cultures grew non typhoidal *Salmonella enterica* subspecies *enterica*. Magnetic Resonance Imaging (MRI) brain with contrast revealed leptomeningeal enhancement and basal exudates, both suggestive of meningitis, as well as ventriculitis and arachnoiditis. The baby was treated with intravenous Ceftriaxone and Meropenem. Follow-up CSF analysis showed improvement, and the cultures were sterile.

Keywords: Culture, Intensive care unit, Neonate, Non typhoidal salmonella

CASE REPORT

A 14-day-old female baby, first born, was delivered full term by elective caesarean section at a primary healthcare centre, with a birth weight of 3.2 kg. The baby presented to the emergency department of hospital with complaints of persistent fever for one week. This was accompanied by excessive crying, irritability, and decreased intake, resulting in a weight loss of around 1 kg since birth. The fever recurred and subsided upon administration of Paracetamol. Since the baby was unable to breastfeed, top feeds were given using a syringe. These feeds were prepared by mixing the top feed powder in filtered water.

Upon examination, the baby weighed 2.3 kg, exhibited irritability, had generalised mottling with cool extremities, a depressed anterior fontanelle, and a pulse rate of 150 Beats Per Minute (bpm). The baby was tachypnoeic (respiratory rate of 68 breaths per minute) and showed intercostal and subcostal retractions indicative of respiratory distress. A provisional diagnosis of late-onset neonatal sepsis was made. Venous blood gas analysis indicated severe metabolic acidosis. Investigations were conducted as outlined in [Table/Fig-1], and intravenous fluids along with empiric intravenous antibiotics (Piperacillin-Tazobactam 100 mg/kg TDS and Amikacin 12 mg/kg OD) were initiated.

Investigation	Results
CBNAAT assay	Negative
CSF Routine	Sugar- 2 mg/dL (Normal=40-80 mg/dL) Proteins- 1406.7 mg/dL (Normal=20-40 mg/dL) RBCs- 16000/cmm Nucleated cells- 69250/cmm (70% polymorphs)
CBC	Hb- 11.8 g/dL, WBC- 14330/µL*, Platelet- 5,13,000/µL
BioFire (Meningoencephalitis panel)	Negative
CSF and blood culture	*Salmonella enterica subspecies enterica*
Urine routine microscopy and culture	Routine normal and culture negative
Stool culture	No pathogenic organisms isolated
CRP	7.14 mg/L

[Table/Fig-1]: Investigations.
CBNAAT: Cartridge-based nucleic acid amplification test; CSF: Cerebrospinal fluid; cmm: Cubic millimetre; CBC: Complete blood count; Hb: Haemoglobin; CRP: C-reactive protein; RBC: Red blood cells; WBC: White blood cells
*Not corrected for RBC count

In the neonatal ICU, antibiotics were escalated to Meropenem (40 mg/kg TDS) and Vancomycin (15 mg/kg QID) at meningitic doses based on the CSF picture. Serum bicarbonate levels were corrected with Injection Bicarb (1 mL/1 mEq dilution). CSF and blood cultures grew *Salmonella enterica subspecies enterica*, which was susceptible to all antibiotics (Ampicillin, Ceftriaxone, Ciprofloxacin, Cotrimoxazole, Nalidixic acid, Azithromycin, and Meropenem). Therefore, Ceftriaxone (50 mg/kg TDS) was added in place of Vancomycin.

The primary immunodeficiency work-up at a reference laboratory revealed no abnormality. MRI brain with contrast showed leptomeningeal enhancement and basal exudates, both suggestive of meningitis, with features of ventriculitis and arachnoiditis. An Ultrasonography (USG) brain was performed, ruling out hydrocephalus. The mother's stool and blood cultures were also conducted to assess the carrier state. The stool culture did not grow any pathogenic organism, and the blood culture was sterile.

After 15 days, the baby's weight increased to 3.93 kg, with improved sucking reflex and intake. CSF studies were repeated after three weeks of therapy, demonstrating improvement (sugar- 31.5 mg/dL, proteins- 138.1 mg/dL, nucleated cells- 182/cmm), with the culture being sterile after five days of incubation. The treatment protocol was continued for 30 days. Intravenous Vitamin K was given weekly due to prolonged antibiotic therapy. At discharge, the child was afebrile, haemodynamically stable, active, with adequate weight gain. CSF routine on discharge had returned back to normal, and the culture was sterile. During regular Outpatient Department (OPD) follow-up, the child remained active with adequate weight gain, good intake, and no neurological deficit.

DISCUSSION

In infants, acute bacterial meningitis is a medical emergency that requires prompt action. In developed countries, Salmonella meningitis accounts for approximately 1% of cases in infants, while in developing countries, it accounts for 5-13% [1,2]. The most common *Salmonella* serotypes responsible for neonatal meningitis include *S.typhimurium, S.paratyphi B, and S.typhi* [3].

Such cases are often associated with a high rate of complications, increased mortality, and relapse. Survivors frequently experience complications such as seizures, hydrocephalus, subdural empyema, and permanent disabilities including retardation, paresis, and visual disturbances [4]. Therefore, timely diagnosis and treatment are

essential. Localised intracranial infections caused by *Salmonella* species, particularly non typhoidal strains, are uncommon [5]. However, they occur predominantly (83%) in children under two years of age, of which 50% of cases involve infants aged two months or younger [6].

Neonates primarily acquire non typhoidal salmonellosis through the ingestion of contaminated food or water. Factors such as hypochlorhydria and rapid gastric emptying in infants contribute to their increased vulnerability to salmonellosis. The incidence of Salmonella meningitis is highest in infancy and may be associated with high mortality and neurologic sequelae in survivors [7]. A review by West SE et al., on acute neurological complications of *Salmonella* meningitis revealed that up to 43% of cases had hydrocephalus, 39% had subdural empyema and ventriculitis, and 21% had chronic neurological abnormalities, with a relapse rate of 64% [8].

In the present case, the BioFire Meningoencephalitis (ME) panel was negative, prompting the need for cultures. Both the blood and CSF cultures grew *Salmonella enterica subspecies enterica*. MRI brain revealed meningitis, ventriculitis, and arachnoiditis. Unfortunately, it was not possible to determine the specific serotype of the organism. The Vitek 2 compact system typically identifies typhoidal Salmonella serotypes such as *typhi, paratyphi A*, and *paratyphi B*. Therefore, it was concluded that this strain was most likely non typhoidal.

Wu HM et al., demonstrated a mortality rate of 13% with complicated clinical outcomes in 75% of cases. Among the survivors, up to 71% experienced epilepsy, motor disabilities, intelligence impairment, and language delay. High-risk factors included altered consciousness, seizures during hospitalisation, CSF/blood glucose ratio <0.5, CSF protein >200 mg/dL, ventriculitis, localised intracranial infection, and cerebral infarction [2]. In present case, despite having a high CSF protein level (1406 mg/dL) as a high-risk factor, accurate diagnosis and timely intervention resulted in complete cure with no neurological sequelae during follow-up.

A cure rate of 41.2% and a mortality rate of 44.7% have been observed with monotherapy using chloramphenicol, ampicillin, and cotrimoxazole [9]. Third-generation cephalosporins combined with fluoroquinolones have shown a cure rate of over 80% and reduced associated mortality to less than 10% [2]. Therefore, the drugs of choice are third-generation cephalosporins for a minimum duration of four weeks [1,10]. When necessary, early surgical intervention of intracranial lesions leads to a better prognosis.

CONCLUSION(S)

Salmonella meningitis, being a rare condition, can lead to significant neurological complications, emphasising the need for a high level of suspicion. Prompt diagnosis and appropriate antibiotic therapy are essential for ensuring a favourable prognosis. Cultures remain the gold standard for diagnosis since the BioFire ME panel only covers the common causative agents. Practicing good hand hygiene, boiling water adequately, adopting hygienic methods of cooking food, and providing health education to caregivers can help reduce the transmission of such cases.

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