

Isolation of *Salmonella enterica* Serovar Typhi from Infected Intracranial Dermoid Cyst: A Case Report

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ABSTRACT

Salmonella Typhi is a versatile pathogen that can infect almost all organs of its host. There has been an increase in the number of cases of extraintestinal infection caused by *Salmonella* species during the past decade. Present case is of a 17-year-old immunocompetent female admitted to the hospital with complaints of a general tonic-clonic seizure and diagnosed with a Suprasellar hypodense lesion with Hydrocephalus (HCP) documented on a Computed Tomography (CT) scan of the head. Magnetic Resonance Imaging (MRI) revealed signs of an intracranial dermoid cyst. Placement of a right Ventriculoperitoneal (VP) Shunt was performed, followed by a right craniotomy with decompression, during which 5 mL of pus was collected from the lesion. The pus was received in the Department of Microbiology and subjected to culture, which grew *Salmonella enterica* serovar Typhi. The patient had been empirically receiving injection cefoperazone-sulbactam 2g/2g twice daily and injection vancomycin 1g 12 hourly before the isolation of *Salmonella* Typhi. She had also been receiving injection levetiracetam 500 mg i.v. twice a day and inj. phenytoin 500 mg i.v. thrice a day. Following the positive culture report, injection ceftriaxone 2 g daily was started. The patient was discharged on the fifth postoperative day while on injection ceftriaxone, oral levetiracetam 500 mg, and phenytoin 100 mg and was asked to report to the neurosurgery department after seven days for follow-up. On follow-up, she showed improvement, and there were no complaints of fever, seizure, or loss of consciousness. In conclusion, proper clinical, radiological, and microbiological evaluation is very much necessary, and clinicians should be aware of the relatively rare manifestations of *Salmonella* Typhi infections.

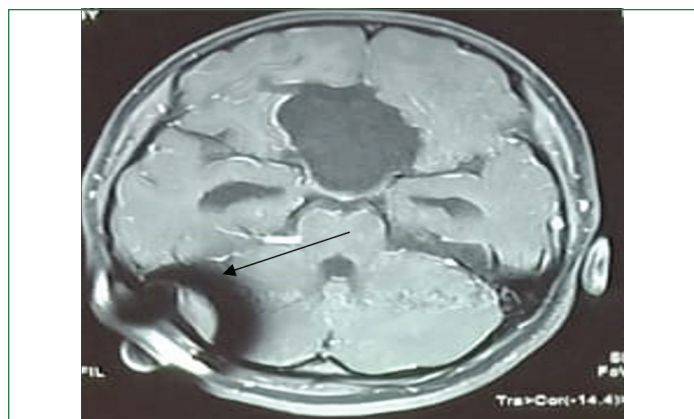
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CASE REPORT

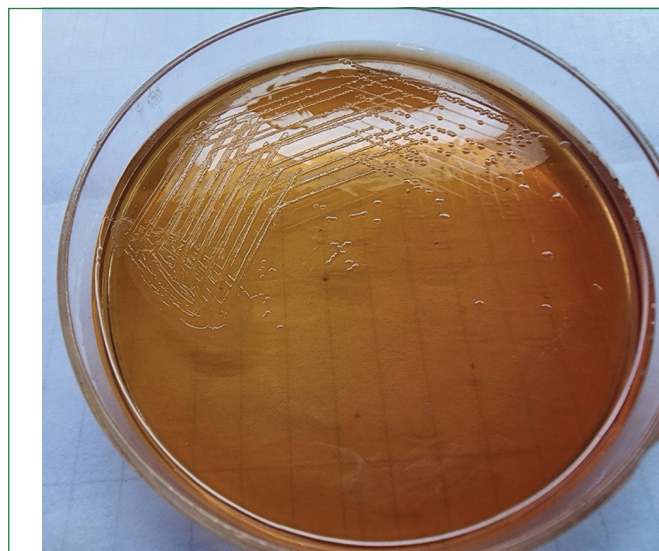
A 17-year-old immunocompetent female was admitted to the Department of Neurosurgery with the chief complaint of a single episode of a generalised tonic-clonic seizure, presenting as the loss of consciousness and stiffening and jerking of the muscles. There was no previous history of fever, headache, photophobia, vomiting, head injury, or a similar episode of seizure in the past. A CT scan of the head revealed a suprasellar hypodense lesion with HCP. An MRI revealed signs of an intracranial dermoid cyst [Table/Fig-1], and placement of a right VP shunt was performed. She was subsequently admitted for the definitive procedure, which was a right craniotomy with decompression. During the procedure, 5 mL of pus was collected from the lesion present in the anterior and middle cranial fossa. The patient had been empirically receiving injection cefoperazone-sulbactam 2g/2g twice daily and injection vancomycin 1g 12 hourly prior to the isolation of *Salmonella* Typhi for three days. She was also receiving inj. levetiracetam 500 mg i.v. twice a day and injection phenytoin 500 mg i.v. thrice a day.

The patient's total leukocyte count was $5.2 \times 10^9/L$, with neutrophils at 74%. The haemoglobin level was 8.0 g/dL, and the platelet count was 180,000/cumm. A blood culture had not been done as the patient was afebrile.

The pus sample was received in the Department of Microbiology for culture and gram staining. In the Microbiology laboratory, the sample was inoculated on 5% sheep blood agar and MacConkey agar. Gram staining performed on the pus sample showed numerous pus cells but no bacteria. The plates were incubated at 37°C and inspected for bacterial growth after 24 hours. Grey opaque moist colonies grew on 5% sheep blood agar, and non lactose fermenting colonies grew on MacConkey agar from the aspirated pus [Table/Fig-2].



[Table/Fig-1]: MRI showing intracranial dermoid cyst (arrow).



[Table/Fig-2]: MacConkey agar showing pale colourless colonies suggestive of non lactose fermenters.

The organism was found to be catalase positive and oxidase negative. It was found to produce hydrogen sulfide in triple sugar iron agar and ferment glucose and mannitol. It did not produce indole, utilise citrate, nor hydrolyse urea [Table/Fig-3]. Motility was determined by placing a drop of culture broth medium on a clean microscopic slide, adding a coverslip, and viewing it under a microscope using a high-dry objective (40x) [1]. Agglutination reactions with antisera were performed, and the organism was identified as *Salmonella enterica* serovar Typhi. The isolate was further subjected to confirmatory identification by the Vitek 2 compact system, which confirmed the detection of *Salmonella* Typhi. AST was performed on Mueller Hinton agar according to the CLSI guidelines [2]. The isolate was sensitive to ampicillin, ceftriaxone, chloramphenicol, and azithromycin but was resistant to fluoroquinolones.



[Table/Fig-3]: Biochemical panel of *Salmonella typhi*. From left: Hugh Leifson-Fermentative pattern, Phenyl pyruvate -negative, Indole-negative, TSI-K/A with H₂S, Citrate-Not utilised, Glucose-fermented, Lactose- not fermented, Mannitol-Fermented, Sucrose- not fermented, Urea- not hydrolysed, Arginine- not decarboxylated, Ornithine-not decarboxylated, Lysine decarboxylated, Control for decarboxylase.

After the culture report, the patient was put on injection ceftriaxone 2 g daily for a total period of 14 days and was discharged on the 5th postoperative day on tab levetiracetam 500 mg twice a day and tab phenytoin 100 mg thrice a day for a period of three weeks. The patient was asked to follow-up in the neurosurgery OPD. On follow-up after three months, she was improving, and there were no complaints of any febrile episodes, loss of consciousness, or seizures.

DISCUSSION

Salmonella enterica serovar Typhi is a human-specific bacterium responsible for causing typhoid fever, and this infection is acquired through ingestion of contaminated food or water [3]. The pathogen is able to cause disease in hosts by evading defense systems, adhesion to epithelial cells, and survival in host cells in the presence of several virulence factors, mediated by virulence plasmids and genes clustered in distinct regions known as *Salmonella* Pathogenicity Islands (SPIs). The infectious dose for *Salmonella* infection is around 10,000 organisms [4]. Bacterial invasion takes place through microfold cells, following which systemic dissemination and a transient primary bacteraemia occur, and fever begins to rise in a classical stepwise manner [5]. Metastatic infective lesions are seen in patients with underlying chronic disease or immunosuppressive states [6]. Apart from intra-abdominal infections, *Salmonella* is also responsible for causing abscesses in the liver, spleen, gallbladder, ovary, chest wall, and has the ability to colonise diseased tissues [7]. *Salmonella typhi* has been reported as a causative agent of parotid gland infection [7,8]. Case reports stating the isolation of *Salmonella* Typhi in cases of septic arthritis of the hip, sternal wound infection, pyonephrosis, ovarian abscess, osteomyelitis, and breast abscess have been published from different parts of the world [9-14]. Another unusual complication of typhoid fever in developed as well as developing countries is meningitis, which manifests as headache, fever, altered level of consciousness, and a stiff neck.

Salmonella species can also cause acute meningitis, a rare clinical issue occurring mostly in newborns and young infants [15]. It accounts for <1% of cases in developed countries and up to 13% in developing countries. *Salmonella* meningitis case reports have been reported from different parts of the world [16-19]. Additionally, a study carried out by Rodriguez RE et al., analysed the clinical data for 34 documented cases of focal intracranial infections caused by *Salmonella*. They found that 11 patients had brain abscess, 19 had subdural empyema, three had an epidural abscess, and one had both subdural empyema and brain abscess [Table/Fig-4] [15-19].

Author name Reference	Publication year	Findings
Owusu-Ofori A and Scheld WM, [16]	2003	A medline electronic search to find and retrieve articles published since 1987. <i>Salmonella</i> Typhimurium was the commonest organism reported and 89.7% of infections occurred in children <one-year-old.
Rabinowitz SG and MacLeod NR, [17]	1972	Three cases of <i>Salmonella</i> meningitis in Yale-New Haven hospital.
Dower J et al., [18]	2018	<i>Salmonella</i> meningitis in a 75-year-old female with a history of rheumatoid arthritis.
Bhattarai HB et al., [15]	2023	A case of <i>Salmonella</i> meningitis in 16-year-old boy with healthy immune system.
Rodriguez RE et al., [19]	1986	A review of the <i>Salmonella</i> focal intracranial infections from 1884 to 1984. Eleven patients had brain abscess, 19 had subdural empyema, three had epidural abscess, and one had both subdural empyema and brain abscess.

[Table/Fig-4]: Compilation of some studies/case reports published in the literature related to *Salmonella* meningitis [17-21].

In the present case, the patient was afebrile throughout. This could be due to the consumption of antibiotics upon admission to the hospital prior to the surgical intervention. There was no history of recent typhoid fever, and serological evidence of the same was not available. Since the patient had undergone a VP shunt, it could have resulted in trauma to the tissues and made it favourable for the bacteria to survive and multiply [9].

CONCLUSION(S)

The present case report suggests that *Salmonella* Typhi can be the causative agent of an infected intracranial dermoid cyst. A combination of medical and surgical management helps in such cases when supported by a microbiological culture and sensitivity report, and physicians should be aware of the rare manifestations of *Salmonella* Typhi infections, not only the common signs and symptoms.

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