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From Gut to Gray Matter: A Rare Brain Abscess Caused by *Salmonella typhi* - A Case Report

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ABSTRACT

Salmonella typhi, a well-recognized cause of enteric fever in the Indian subcontinent, classically presents with bacteraemia and gastrointestinal manifestations. However, its capacity to produce extraintestinal abscesses at sterile sites such as the liver, spleen, bones, and central nervous system illustrates its remarkable invasive potential. We report an exceptionally rare case of *S. typhi* brain abscess in an 18-year-old male who presented with progressive quadriparesis, altered sensorium, and focal neurological deficits. Magnetic resonance imaging (MRI) demonstrated a left fronto-temporo-parietal subdural abscess with a concurrent occipital intraparenchymal abscess, associated with surrounding oedema and mass effect. Craniotomy with surgical drainage was performed, and intraoperative pus cultures yielded *S. typhi*, which was identified by conventional biochemical reactions and the VITEK® 2 Compact automated identification system. Serological tests further corroborated the findings. The isolate was susceptible to multiple first-line, second-line and reserve agents, including third-generation cephalosporins, with intermediate susceptibility to fluoroquinolones.

The patient exhibited marked clinical improvement with parallel radiological resolution following surgical drainage and prolonged intravenous ceftriaxone therapy. This case underscores the pathogenic versatility of *S. typhi* to cause central nervous system abscesses, emphasizes the critical role of early radiological–microbiological correlation in the diagnosis of atypical intracranial abscesses, and reaffirms the therapeutic value of ceftriaxone in the current era of emerging antimicrobial resistance.

Keywords: Brain Abscess; Central Nervous System Infections; Ceftriaxone; Extraintestinal Manifestations; *Salmonella typhi*.

INTRODUCTION

Salmonella enterica subspecies *enterica* serovar Typhi (*Salmonella* ser. Typhi) is a human-restricted pathogen, which is a gram-negative, non–spore forming, facultatively anaerobic bacillus transmitted through the fecal–oral route. Although typhoid fever remains endemic in many low- and middle-income regions, extraintestinal infections caused by *S. typhi* are distinctly uncommon, comprising only a minor proportion of isolations.[1] Documented extraintestinal sites include bone, soft tissue, endocardium, and, rarely, the central nervous system.[1,2] Brain abscess formation by *S. typhi* is exceedingly rare, with only a handful of cases described globally.[3,4] Neuro-salmonellosis is often under-recognized because its clinical and radiological findings mimic pyogenic abscesses of staphylococcal or other gram-negative etiology. Moreover, intracranial salmonellosis may occur even in the absence of classical enteric fever manifestations, further complicating the diagnosis. Focal salmonella infections are typically associated with predisposing factors such as extremes of age, immunosuppression, underlying malignancy, intravenous drug use, or prior trauma.[4,5] The isolation of *S. typhi* from an intracranial specimen therefore demands a high index of suspicion and accurate laboratory confirmation. This report describes a culture-proven case of *S. typhi* brain abscess, emphasizing the diagnostic microbiological approach and its antimicrobial-stewardship implications.

CASE DETAILS

An 18-year-old male presented with progressive weakness of the upper and lower limbs along with slurring of speech for two weeks. He had sustained a severe traumatic brain injury nine months earlier following a fall from a height, resulting in diffuse axonal injury with subdural hemorrhage, for which intensive care support and tracheostomy were required. Initial haematological investigations revealed a haemoglobin level of 9.8 g/dL, total leukocyte count of 11,000/mm³ with neutrophilic predominance (74%), and an elevated erythrocyte sedimentation rate. Liver and renal function parameters, along with serum electrolytes, were within normal limits. Blood cultures were not obtained.

Magnetic resonance imaging (MRI) of the brain revealed a multiloculated cystic lesion involving the left fronto-temporo-parietal and occipital regions, associated with surrounding oedema and mild mass effect, suggestive of abscess formation. The patient subsequently underwent craniotomy with abscess drainage and marsupialization of the cyst wall. Thick purulent material obtained intraoperatively was submitted for microbiological evaluation. The patient was empirically receiving intravenous cefoperazone–sulbactam (1.5 g twice daily) along with metronidazole (500 mg three times daily). He was also maintained on intravenous levetiracetam 500 mg twice daily.

Direct Gram staining of the aspirated pus revealed numerous pus cells with few Gram-negative bacilli (Figure 1). Ziehl–Neelsen staining and KOH mount were negative for acid-fast bacilli and fungal elements, respectively. The specimen was inoculated onto blood agar and MacConkey agar and incubated aerobically at 37°C for 24 hours. Culture yielded smooth, moist, grey, translucent, non-haemolytic colonies measuring 2–3 mm in diameter on blood agar (Figure 2A), along with pale non-lactose-fermenting colonies of similar size on MacConkey agar (Figure 2B). GeneXpert MTB/RIF assay performed on the pus sample was negative for *Mycobacterium tuberculosis* complex and rifampicin resistance, ruling out a tubercular aetiology.

Colony Gram stain showed Gram-negative bacilli arranged singly, consistent with the direct smear findings. The isolate was subjected to standard biochemical testing and was found to be motile, catalase-positive, and oxidase-negative. It did not produce indole, utilize citrate, or hydrolyse urea. Triple sugar iron (TSI) agar

demonstrated hydrogen sulfide production with blackening along the streak line and an alkaline slant with acid butt (K/A). The organism was subsequently identified as *Salmonella enterica* subspecies *enterica* serovar Typhi using the VITEK 2 Compact automated identification system with 99% confidence.

Antimicrobial susceptibility testing was performed using the VITEK 2 Compact automated system and Kirby–Bauer disc diffusion method, with interpretation according to the latest Clinical and Laboratory Standards Institute (CLSI) M100 guidelines.[6] The isolate was susceptible to ampicillin, cotrimoxazole, ceftriaxone, azithromycin, chloramphenicol, tetracycline, and carbapenems, while intermediate susceptibility was observed for fluoroquinolones. Cascade reporting principles were followed, and susceptibility results were restricted to first- and second-line agents.

Serological correlation demonstrated elevated tube Widal titres for both TO and TH antigens at 1:320. Qualitative rapid serological testing showed positive *S. typhi* IgM and negative IgG antibodies. Serotyping with specific *Salmonella* antisera could not be performed due to non-availability of antisera in the laboratory.

Following receipt of the culture and susceptibility report, the patient was treated with intravenous ceftriaxone 2 g twice daily for 10 days and oral cotrimoxazole (160/800 mg) for 15 days. He was subsequently discharged on oral cefuroxime 500 mg for an additional 5 days. Serial non-contrast CT imaging of the brain showed a reduction in lesion size accompanied by a declining trend in inflammatory markers. The patient exhibited corresponding neurological improvement during the follow-up period.

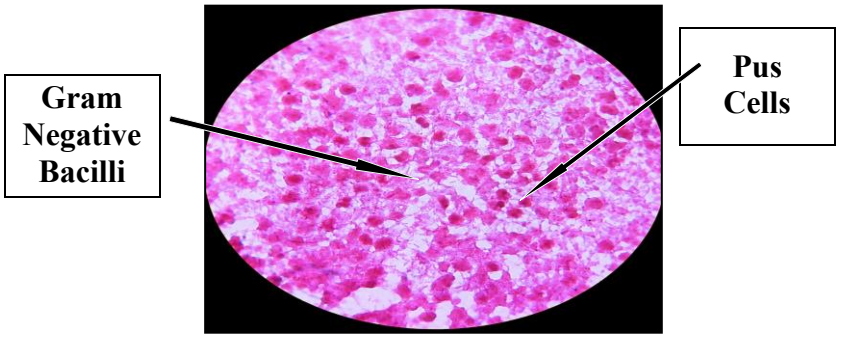

Figure 1: Gram Smear Findings (oil immersion, x100)

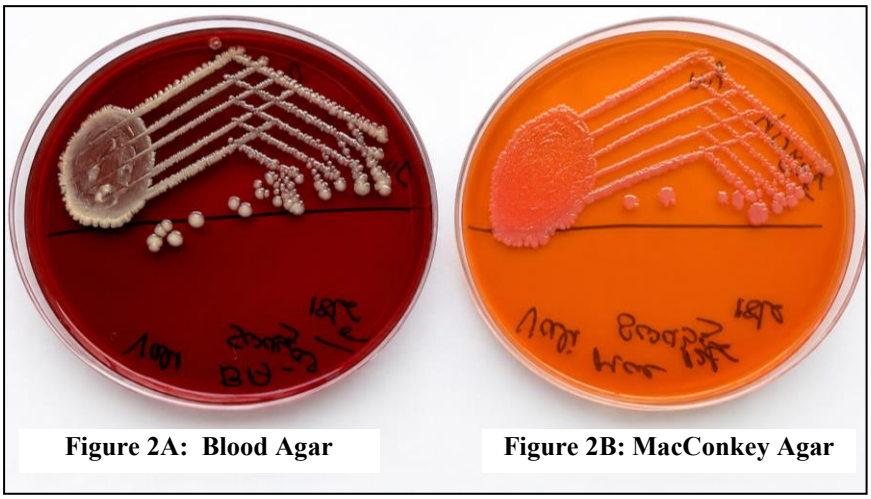

Figure 2A: Blood Agar **Figure 2B: MacConkey Agar**

Figure 2: Colony morphology of the isolate on Blood agar (2A) and MacConkey agar (2B) after 24 hours of aerobic incubation.

DISCUSSION

S. typhi, the etiological agent of typhoid fever, classically causes systemic infection through intestinal translocation and bacteraemia. Clinical manifestations such as step-ladder fever, abdominal pain, diarrhoea, or constipation constitute the usual presentation of enteric fever.[1,2] However, its ability to produce localized extraintestinal CNS infections, including meningitis, subdural empyema, and brain abscess, remains an unusual manifestation that has been reported only sporadically in the literature.[4,7]

The neurotropism of *Salmonella* species remains poorly understood. Proposed pathogenic pathways of central nervous system invasion include hematogenous dissemination facilitated by blood–brain barrier alteration and pathological neovascularization, as well as intracellular transport via infected phagocytes acting as "Trojan horses".[7,8] In the present case, prior severe traumatic brain injury may have resulted in local tissue disruption, inflammation, and microvascular injury, thereby creating a permissive niche for focal microbial localization; transient impairment of host immune responses at the injury site may have further contributed to this process.[9] The pathogenicity of *Salmonella* is additionally driven by virulence determinants mediating adhesion, immune evasion, and intracellular persistence, many of which are encoded within *Salmonella* Pathogenicity Islands.[2,9]

McClintock reported the first case of *S. typhi*–related brain abscess in the literature in an autopsy report in 1902.[5] In our literature review, we identified only a few dozen such cases in which *S. typhi* was associated with diverse intracranial pathologies— including meningitis, encephalopathy, brain abscess, intracranial dermoid cyst infection, post-neurosurgical infections, and intracranial malignancies such as glioblastoma multiforme and astrocytoma.[5,8,10,11] Although intracranial salmonellosis has more commonly been attributed to non-typhoidal *Salmonella* species such as *S. typhimurium* and *S. enteritidis*, CNS involvement specifically due to *S. typhi* remains distinctly uncommon.[8,11] International reports predominate, although several noteworthy cases have also been described from India.[8,10] Previously reported cases of intracranial infections caused by *Salmonella typhi* spanning several decades are summarized in Table 1.[4,5,9,12-15]

In central nervous system infections, antimicrobial therapy must prioritize agents with reliable blood–brain barrier penetration and sustained bactericidal activity to achieve therapeutic cerebrospinal fluid concentrations.[7] In *Salmonella* infections, antimicrobial selection must consider intrinsic resistance patterns, as aminoglycosides, first- and second-generation cephalosporins, including cephamycins, lack clinical efficacy despite occasional in vitro susceptibility.[6] Published literature has documented declining fluoroquinolone susceptibility in South Asia, largely attributed to qnr genes and gyrA/parC mutations; consequently, third-generation cephalosporins have emerged as the preferred therapeutic agents.[7,8] Accordingly, adherence to antimicrobial stewardship principles, including cascade reporting, remains essential to preserve broader-spectrum agents such as carbapenems for appropriate clinical indications.

Appropriate dosing and prolonged antimicrobial therapy, often combined with surgical drainage for abscesses ≥2.5 cm, remain central to effective treatment and prevention of relapse.[7] In the present case, prompt de-escalation to targeted therapy along with timely surgical intervention resulted in a favourable clinical outcome.

Table 1 : Comparative literature review of various reported cases

Case	Isolate	Site of Involvement	Treatment Given	Outcome
Suzuki et al., 1976[12]	*S. typhi*	Parietal brain abscess with chronic osteomyelitis	Surgical drainage + antibiotics	Survived
Mahapatra & Bhatia, 1987[4]	*S. typhi*	Intracerebral abscess with subdural empyema	Surgical drainage + Crystalline penicillin 1 million units IV 2-hourly + chloramphenicol 30 mg/kg/day IV for 4 weeks; alternate case received chloramphenicol 500 mg IV 4-hourly + ampicillin 1 g IV 6-hourly for 3 weeks	Survived
Hanel et al., 2000[13]	*S. typhi*	Multiple brain abscesses	Surgical drainage + Chloramphenicol	Survived
Siddiqui et al., 2015[14]	*S. typhi*	Multiple skin and brain abscesses	Surgical drainage + Ceftriaxone 4 g/day IV for 2 weeks, followed by cefixime 200 mg BD for 2 weeks	Survived
Nadeem et al., 2019[15]	*S. typhi*	Meningitis with cerebral edema and hydrocephalus	Neurosurgical intervention + Ceftriaxone and levofloxacin	Survived
Shehbaz et al., 2023[5]	*S. typhi*	Post-neurosurgical multiple brain abscesses	Craniotomy + Empirical meropenem + vancomycin followed by high-dose meropenem	Fatal
Mir et al., 2024[9]	*S. typhi*	Infected intracranial dermoid cyst	Craniotomy + Ceftriaxone 2 g/day IV for 14 days	Survived
Present Case	*S. typhi*	Multiple brain abscesses	Surgical drainage + Ceftriaxone 2 g IV BD for 10 days + oral cotrimoxazole (160/800 mg) BD for 15 days, followed by oral cefuroxime 500 mg BD for 5 days	Survived

CONCLUSION

Isolation of *Salmonella typhi* from a brain abscess represents a rarely encountered etiology that remains clinically significant, particularly in immunocompromised hosts and in regions of high endemicity. This case underscores the importance of submitting pus specimens for microbiological evaluation in all intracranial and post-craniotomy infections to enable targeted antimicrobial therapy. Heightened clinical suspicion and advanced diagnostic approaches are essential in atypical abscesses, as uncommon pathogens may present unexpectedly. Accurate identification of *S. typhi* from sterile CNS specimens requires stringent aseptic collection, prompt processing, and confirmation by biochemical and serological methods. In the era of emerging fluoroquinolone resistance, strict adherence to antimicrobial stewardship principles and continuous surveillance is critical for effective management of extraintestinal salmonellosis.

Declaration by Authors

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REFERENCES

1. Koneman EW, Procop GW, Janda WM, et al. Koneman's color atlas and textbook of diagnostic microbiology. 7th ed. Philadelphia: Lippincott Williams & Wilkins, Wolters Kluwer; 2017.
2. Sastry AS, Bhat S. Essentials of medical microbiology. 4th ed. New Delhi: CBS Publishers & Distributors; 2023.
3. Monteiro FMR, O'Boyle RP, Taylor RR, et al. *Salmonella* brain abscess in sickle cell disease patient: case report. Reports. 2024;7(4):107. doi: 10.3390/reports7040107.
4. Mahapatra AK, Bhatia R. *Salmonella* intracerebral and subdural abscess—report of two cases. Postgrad Med J.

1987;63(739):373-5. doi: 10.1136/pgmj.63.739.373.
5. Shehbaz M, Nizamuddin S, Parveen A, et al. *Salmonella enterica* serovar Typhi (*Salmonella typhi*) brain abscess after brain surgery: A case report. Infect Dis J Pak. 2023;32(2):62-4. http://ojs.idj.org.pk/index.php/Files/article/view/138
6. Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing. 35th ed. CLSI supplement M100. Wayne (PA): CLSI; 2025.
7. Bennett JE, Dolin R, Blaser MJ, editors. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 10th ed. Philadelphia: Elsevier; 2025.
8. Sudhaharan S, Padmaja K, Solanki R, et al. Extra-intestinal salmonellosis in a tertiary care center in South India. J Infect Dev Ctries. 2014;8(7):831-7. doi: 10.3855/jidc.3731.
9. Mir AA, Roohi S, Qadri U, et al. Isolation of *Salmonella enterica* serovar Typhi from infected intracranial dermoid cyst: A case report. Natl J Lab Med. 2024;13(4):MC01-3. DOI:10.7860/NJLM/2024/69962.2878
10. Swamy HS, Shankar SK, Chandramuki A, et al. Neurological complications of *Salmonella typhi*: Clinical, microbiological and pathological study. NIMHANS J. 1990;8(2):111-26.
11. Rodriguez RE, Valero V, Watanakunakorn C. *Salmonella* focal intracranial infections: Review of the world literature (1884-1984) and report of an unusual case. Rev Infect Dis. 1986;8(1):31-41. doi: 10.1093/clinids/8.1.31.
12. Suzuki Y, Sugiyama Y, Ishii R, et al. Brain abscess caused by *Salmonella typhi*. Case report. J Neurosurg. 1976;45(6):709-11. doi: 10.3171/jns.1976.45.6.0709.
13. Hanel RA, Araújo JC, Antoniuk A, et al. Multiple brain abscesses caused by *Salmonella typhi*: Case report. Surg Neurol. 2000;53(1):86-90. doi: 10.1016/s0090-3019(99)00161-5.
14. Siddiqui MR, Islam QT, Rahman YU, Shena TY. Multiple Skin and Brain Abscess Caused by *Salmonella typhi*, First Reported Case in Bangladesh. Bangla J Med [Internet]. 2015 Nov. 10 [cited 2026 May 22];26(2):83-5. Available from: https://www.banglajol.info/index.php/BJMED/article/view/25454
15. Nadeem R, Elahi N, Elhoufi A, et al. *Salmonella typhi* meningitis in an immunocompetent Asian adult. Cureus. 2019;11(11): e6112. doi: 10.7759/cureus.6112.

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