

# SALMONELLA ENTERICA SEROVAR *TYPHI* (SALMONELLA *TYPHI*) BRAIN ABSCESS AFTER BRAIN SURGERY: A CASE REPORT

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## ABSTRACT

*Salmonella typhi* (*Salmonella enterica* serovar *Typhi*) is one of the pathogens responsible for typhoid fever, a major public health problem in low and middle-income countries like Pakistan. Typhoid fever caused by *S. typhi* can result in severe disease with protean complications like gastrointestinal hemorrhage and perforation, endocarditis, pancreatitis, hepatitis, pneumonia or typhoid encephalopathy but focal intracranial infections like brain abscess is a rare occurrence. We are reporting a case of *S. typhi* brain abscess in an eleven-year-old boy who was operated for brain tumor and developed *S. typhi* brain abscess in the post-operative period.

**Key Words:** *Salmonella Typhi*, Gram negative rods, Brain abscess

## BACKGROUND

*Salmonella species* are gram-negative, non-spore-forming, facultative anaerobic bacilli and are well known pathogens of gastroenteritis in humans. Intracranial infections are out of ordinary manifestations of salmonellosis in general and brain abscesses in particular<sup>1</sup>

Brain abscess is a focal pyogenic infection of the brain parenchyma; the major predisposing factors are an associated neighboring focus of infection, trauma, and hematogenous spread from a distant focus. The most common attributable microbial agents are anaerobic bacteria, aerobic and microaerophilic *Streptococci*, *Enterobacteriaceae*, *Staphylococcus aureus* while *Aspergillus* and *Nocardia* are commonly seen in immunocompromised patients. A variety of other microbial agents may also cause brain abscesses depending upon the site of primary infection, age, and immune status of the patient.<sup>2</sup>

Typhoid fever is an acute febrile illness caused by *Salmonella enterica* serovar *typhi* (*S. typhi*) and to a less extent by *Salmonella paratyphi* A, B and C, collectively called typhoidal salmonella. The typical presentation of clinical syndrome caused by *S. typhi* comprise of acute febrile illness with or without

gastrointestinal symptoms. Intracranial involvement with meningitis and encephalitis can occur but focal intracranial infection like brain abscess is rare. We report a case of *S. typhi* related brain abscess in an 11-year-old boy after surgery for brain tumor.<sup>3</sup>

## CASE REPORT

An 11-year-old boy visited Shaukat Khanum Memorial Cancer Hospital and Research Center's emergency in Lahore with history of fevers for the last fifteen days associated with seizures and altered mental status. Recently, he was diagnosed with a right temporoparietal lobe fibrous tumor and had tumor debulking surgery at some other hospital in Lahore Pakistan. Neurological examination revealed altered mental status, neck rigidity and mild dysarthria but no other focal neurological deficit.

He was empirically started on meropenem and vancomycin. An urgent computed tomography of the brain performed that revealed postsurgical hemorrhage, and multiple brain abscesses in the right parietotemporal lobe. Blood examination revealed white blood cells (WBC) 15700/μl with lymphocytes at 12 % of total leukocytes, hemoglobin 14g/dl, platelets 143000/μl, C-reactive protein (CRP) 154 mg/l and erythrocyte sedimentation rate 70 mm/hr. Blood culture also remained negative for any bacterial growth. Other laboratory workup was unremarkable.

Magnetic resonance imaging of brain confirmed the findings of brain abscess Figure-I. Surgical drainage of abscess was performed on 4<sup>th</sup> day of hospital admission by craniotomy, which confirmed the diagnosis of abscess at tumor resection site in right temporal lobe.

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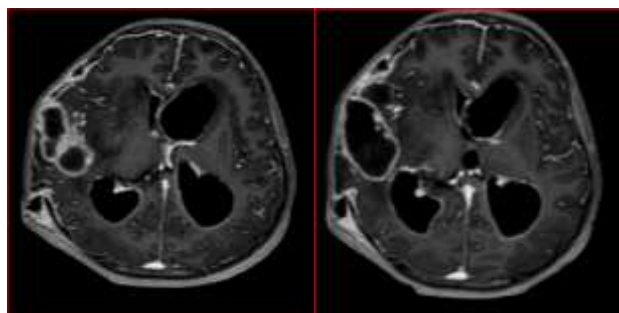
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The pus specimen collected from the drained abscess was sent for culture to the hospital's onsite microbiology laboratory. Bacterial cultures from the pus grew non-lactose fermenting gram negative bacteria. This isolate was identified as *S. typhi* an API 20E (Bio Mérieux, Inc). Serotyping was done to confirm the isolate. This isolate was found to be susceptible only to meropenem, azithromycin and chloramphenicol on standard disk-diffusion testing. Evaluation of the cerebrospinal fluid drained during surgery revealed the following values; WBCs 0 /mm<sup>3</sup>, RBCs 0 /mm<sup>3</sup>, proteins 210 mg/d and glucose 22 mg/dl. Although CSF and blood cultures remained negative for any bacterial growth Table-I, the patient was treated with high dose meropenem. Unfortunately, the patient deteriorated during the post-operative period due to the large residual aggressive tumor and he died in next few days due to advanced intracranial disease and sepsis.

**Table-I: Cerebrospinal fluid analysis report.**

CSF parameters	Value	Normal Range
CSF glucose	22 mg/dl	66% of serum glucose
CSF proteins	210 mg/dl	15 -45 mg/dl
WBC	0	0-5 cells all lymphocytes
RBC	0	Not present
CSF culture	No bacterial growth	

CSF, cerebrospinal fluid WBC, White blood cells RBC, Red blood cells



**Figure-I: MRI brain with contrast of our patient showing brain abscess.**

## DISCUSSION

*Salmonella species* are an uncommon cause of post-operative intracranial infections such as meningitis, subdural empyema, encephalitis and brain abscess. We report a case of post-operative *S. typhi* brain abscess in a patient after surgery for brain tumor. McClintock reported the first case of *S. typhi* related brain abscess in literature in an autopsy report in 1902<sup>4,5</sup>

In our literature review, we found twelve such cases in which patients with various intracranial malignancies had *S. typhi* related brain abscesses. Out of these twelve cases, eight patients developed *S. typhi* related brain abscess in the postsurgical period following surgery for brain tumor while in remaining four cases there was no history of recent brain surgery<sup>6</sup>.

The review of those previously reported cases of *S. typhi* brain abscess further revealed that five cases had glioblastoma multiform; two cases were with craniopharyngioma, two cases were metastatic adenocarcinomas; two with astrocytoma's and one had oligodendroglioma as primary brain malignancy. Our case is unique in this aspect that we found *S. typhi* related brain abscess in association with an aggressive skull based fibrous tumor.<sup>7</sup>

Literature review also revealed that *S. typhi* species related intracranial infection usually occurs in those with various precipitating conditions such as immunocompromised states (e.g., HIV infection and AIDS, with prolong use of corticosteroids or chemotherapy etc.) blood disorders, previous brain surgery or infarcted brain tissue.<sup>3</sup> Among immunocompetent individuals, we also found one case report of *S. typhi* brain abscess following cerebral infarction. Based upon our review of literature related to salmonella brain abscess specifically in patients with brain tumor, the most important predisposing factors are immune compromised status and the presence of structural brain damage.<sup>4</sup>

Both innate and adaptive immune systems furnish resistance against salmonella infections in humans. Acidic pH of stomach, normal microbiota of intestine and mucosal lymphoid tissue provide innate immunity against infection after intestinal ingestion while T and B lymphocytes mediated adaptive responses are equally important. Our patient had uncontrolled malignancy and he was also on corticosteroids to mitigate the effects of tumor related brain edema, the factors that have high potential to impair both innate as well as adaptive immune responses.<sup>8</sup>

Intracranial salmonella infection tends to involve diseased tissue such as hematomas, fracture sites and neoplasm due to the organism tropism for dead tissue. In our case the tumor or postsurgical hematoma may have acted as a culture medium for salmonella typhi growth. The prolonged use of corticosteroids and presence of malignancy may have predisposed our

patient for the dissemination of salmonella typhi to brain after initial infection.<sup>9</sup>

Tissue cultures are most sensitive way to make microbial diagnosis while yields of blood and CSF cultures are low. Patients with *S. typhi* related brain abscess have poor prognosis without adequate drainage of abscess as in the previous literature almost all patient who died had inadequate drainage or did not undergo drainage of abscess. In our case, as already mentioned that he was treated with Meropenem but our patient died in few days, inadequate drainage of abscess and aggressive nature of primary tumor likely contributed to the patient poor clinical outcome.<sup>10</sup>

## CONCLUSION

Although *S. typhi* related brain abscess is rare, and is usually associated with immunocompromised conditions it can occur in patients with intracranial malignancies as a result of chemotherapy or tumor related immune dysfunction, presence of necrotic tissue at tumor site or due to prolonged use of corticosteroids. Neuroimaging has a significant role in the diagnosis of such cases. Adequate drainage of pus, bacterial cultures along with culture guided postsurgical antibiotics therapy are the mainstay of treatment, although the nature of patient primary diagnosis also has significant impact over prognosis.

## CONFLICT OF INTEREST

There is no conflict of interest to declare by any authors.

## AUTHOR CONTRIBUTION

**Muhammad Shehbaz:** Primary author

**Summiya Nizamuddin:** Reviewer and contributed to manuscript writing as well

**Azra Parveen:** Contributed to manuscript writing as well

**Salma Muhammad Abbas: supervisor.** Reviewer and contributed to manuscript writing as well

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