

CASE REPORT

Brain abscess caused by *Salmonella* Enteritidis following craniotomy for meningioma: A case report and literature review

Ting Siau Mei VALERIE, Chuan Hun DING, Asrul Abdul WAHAB*

Department of Medical Microbiology and Immunology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Cheras, Kuala Lumpur.

Abstract

Salmonella intracranial infection is infrequently encountered in clinical practice. However, with prompt intervention and appropriate antimicrobial therapy, the outcome is usually favourable. A 56-year-old gentleman who worked as an organic fertilizer production supervisor underwent tumour resection for meningioma located at the left frontal temporoparietal region. The surgical procedure went smoothly, and he has prescribed dexamethasone thereafter. He was discharged well. However, a few days after that he developed a fever associated with pus discharged from the surgical wound. A computed tomography (CT) scan of the brain was performed and it revealed an abscess located at the left frontal temporoparietal subdural and subgaleal regions with adjacent cerebritis. Another craniotomy was done to drain the abscess. The bacterial culture of the pus specimen grew *Salmonella* Enteritidis. The bacterium was susceptible to ciprofloxacin, ceftriaxone, and amoxicillin-clavulanic acid. Clinical improvement was evident after surgical intervention with an additional 6 weeks of ceftriaxone therapy.

Keywords: ceftriaxone; dexamethasone; intracranial abscess; *Salmonella* Enteritidis

INTRODUCTION

Salmonella spp. have a predilection for causing gastrointestinal tract infections giving rise to the clinical presentation of diarrhoea and abdominal pain. Extra-intestinal salmonellosis is rare but has been reported to cause pericarditis, aortitis, skeletal and soft tissue, urinary tract, and central nervous system infections. Central nervous system involvement is a rare clinical manifestation of extraintestinal salmonellosis. It was reported to present with meningitis, vertebral infection, and brain abscess. It was commonly observed among those with predisposing factors such as prior meningitis, trauma, and intracranial haemorrhage. Among the common *Salmonella* serovars implicated in brain abscess were *Salmonella* Typhimurium, Typhi, and Enteritidis.¹ Although the condition is rare, it had been reported in all age groups including young children.² Interestingly, it was also reported in an immunocompetent individual.³

CASE REPORT

A 56-year-old gentleman presented with right-

sided body weakness for one month. His family also noticed that he had behavioural changes that started a year ago. He became less sociable and had somnolence which led them to seek medical attention. Computed tomography of the brain was done and revealed the presence of the brain lesion suspected to be a meningioma in the left frontal temporoparietal region. He was subsequently referred for neurosurgical intervention. Pre-morbidly, he had hypertension, gout, and ischaemic heart disease. Craniotomy and tumour excision were performed uneventfully. Concurrently, he was prescribed intravenous dexamethasone 4 mg 6-hourly and levetiracetam 750mg 12-hourly. Histopathological examination of the brain tumour showed meningo-endothelial meningioma Grade 1. He was discharged well on the seventh day post-surgery.

He presented again four days later complaining of fever, swelling, and pus discharge from the surgical wound. His total white blood cell count was elevated at $19.2 \times 10^9/L$, with a predominance of neutrophils and his haemoglobin level was normal at 12.7 g/dL. The CT scan of the brain was repeated and noted

*Address for correspondence: Asrul Abdul Wahab, Department of Medical Microbiology and Immunology, Faculty of Medicine, Universiti Kebangsaan Malaysia, 56000 Cheras, Kuala Lumpur, Malaysia. Phone number: +603-9145 9530. E-mail: saw@ppukm.ukm.edu.my



FIG. 1: Coronal view of CT brain showing left fronto-temporo-parietal collection with mass effect and cerebral oedema.

there was a fluid collection at the left frontal temporoparietal subdural and subgaleal regions measuring 5.1cm×1.2cm×5.5cm with adjacent cerebritis changes (Figure 1). The presence of mass effect and cerebral oedema were also noticed but without intracranial haemorrhage. After discussing the treatment options, another surgical intervention was undertaken to remove the abscess. Thus, he underwent a left craniectomy and the abscess was drained.

Intraoperative findings noted subdural and subgaleal purulent pus collection with fragments of unhealthy temporal tissues. The pus specimen was sent to the microbiology laboratory for bacterial culture.

Microbiological culture from the pus specimen grew non-lactose-fermenting gram-negative bacteria. The bacterium was identified biochemically as *Salmonella* spp. by Vitek-2 system (Bio Mérieux, Inc). Serotyping of the *Salmonella* spp. identified the bacteria as *Salmonella enterica* serovar Enteritidis. *In-vitro* antibiogram pattern showed the isolate was susceptible to ciprofloxacin, ceftriaxone, and amoxicillin-clavulanic acid. The HIV serology was negative. He was treated with intravenous ceftriaxone 2g 12-hourly for 6 weeks. The blood and urine cultures taken during admission were negative. The stool specimen which was taken in the ward to look for salmonella carrier was also negative. He was discharged with oral

cefuroxime for another 2 weeks. A repeated CT scan of the brain showed the abscess and oedema had resolved. He managed to return to work with minimal disability.

DISCUSSION

Salmonella spp. is a gram-negative non-lactose-fermenting Enterobacteriaceae that more commonly causes intestinal infection. Cases of extraintestinal salmonellosis are relatively few when compared to intestinal salmonellosis. An intracranial abscess caused by *Salmonella* spp. is even more uncommon and usually associated with prior intracranial tumour excision and steroid therapy.⁴ Previous cases of intracranial salmonella infection among adults that were reported over the last 10 years are as shown in Table 1. Like our patient, the majority of the reported cases had a prior neurosurgical history. Prior surgical intervention could lead to the disruption of the blood-brain barrier and pathological neovascularisation which aid microbes seeding.⁵ Besides that, other risk factors for salmonellosis include diabetes mellitus, rheumatological disorders, and chronic steroid usage.⁴ Steroid use was also noted in this patient but it's unlikely to contribute to this infection as it was prescribed for short-term usage. As noticed in this patient, the mode of acquisition of the infection was not fully understood. The

Table 1: Previous reported cases of intracranial infection caused by *Salmonella* spp.

| Case | Age (years) | Gender | Previous neurosurgical history | <i>Salmonella</i> spp. | Diagnosis and Treatment | Outcome |
|---|-------------|--------|--|---|--|---------------------------------|
| Sait <i>et al.</i> 2011 ⁵ | 57 | Male | Craniotomy and tumour resection of glioblastoma multiforme | <i>Salmonella</i> Enteritidis | Intracranial and subdural abscess. Re-exploration of craniotomy + Intravenous ceftriaxone 2 g 12-hourly for 4 weeks. | Good |
| Siddiqui <i>et al.</i> 2015 ⁶ | 28 | Female | None | <i>Salmonella</i> Typhi | Brain abscess. Intravenous ceftriaxone 4 g for 2 weeks and oral cefixime 200mg 12-hourly for another 2 weeks. | Good |
| Oki <i>et al.</i> 2016 ⁷ | 54 | Male | None | <i>Salmonella enterica</i> serotype Enteritidis | Vertebral osteomyelitis and epidural abscess. Intravenous ceftriaxone 2g and ciprofloxacin 300mg 12 hourly for 2 weeks. Discharged with oral ciprofloxacin for 3 months. | Good. No neurological sequelae. |
| Luciani <i>et al.</i> 2016 ⁸ | 60 | Female | Surgical removal of glioblastoma multiforme | <i>Salmonella enterica</i> serotype Enteritidis | Cerebral abscess mimicking meningitis. Craniotomy + Intravenous ceftriaxone and ciprofloxacin for 6 weeks. Ciprofloxacin was continued for 3 months. | Good |
| Byer <i>et al.</i> 2017 ⁹ | 24 | Female | Frontal craniotomy for grade II astrocytoma | Non Typhi <i>Salmonella</i> spp. Group D | Subgalea abscess. Surgical+ Intravenous ceftriaxone for 6 weeks | Good |
| Akhaddar <i>et al.</i> 2019 ¹⁰ | 36 | Male | Craniotomy for giant cell glioblastoma multiforme | <i>Salmonella enterica</i> serotype Enteritidis | Subgalea and brain abscess. Percutaneous needle aspiration + Intravenous ciprofloxacin for 4 weeks. Discharged with oral ciprofloxacin for 1 month. | Good. |

same issues were noted in the previous reported cases except in one whereby that patient had history of contact with a reptile following a neurosurgical operation.⁹

The most crucial issue that should be taken into consideration when managing this type of infection is the size of the abscess. An abscess size larger than 2.5 cm ought to be coupled with medical and surgical intervention as the treatment of choice.¹¹ Surgical methods can be either craniotomy with abscess excision or stereotactic aspiration of the abscess. Multiple factors such as location and nature of abscess need to be considered when deciding on appropriate surgical methods. However, an open craniotomy was more favoured in most of the cases as it reduced the chances of recurrence and re-accumulation.¹¹ Thus, craniotomy followed by intensive antibiotic therapy was chosen as the treatment of choice in this patient.

Guided by the predisposing conditions, common infecting pathogens can be assumed and therefore empirical antibiotics can be administered before getting the definitive causative agent.¹² For our immunocompetent patient, the recent neurosurgical procedure predisposed him to get either *Staphylococcus aureus*, *Streptococcus* spp., *Enterobacteriaceae*, or *Clostridium* spp. infections. With these organisms in mind, empirical antibiotics including vancomycin, third or fourth-generation cephalosporins, and metronidazole can be initiated. Once the definitive organism is known, the antimicrobial should be tailored accordingly. As noted in Table 1, the antibiotic therapy was given for the total duration of at least 6 weeks in all cases.⁵⁻¹⁰ Similarly, our patient received 6 weeks of ceftriaxone plus another 2 weeks of cefuroxime. The combination of surgical removal of an abscess larger than 2.5 cm and an antibiotic treatment duration of at least 6 weeks was noted to have a treatment success rate of at least 90%.¹¹

CONCLUSION

Salmonella Enteritidis is a rare bacterial cause of infection in post-craniotomy patients. Thus, it is imperative to send the pus specimen in all cases of post-craniotomy-related infections to identify the causative agent for the appropriate antimicrobial therapy to be administered.

Acknowledgements: The authors would like to thank the Dean of Faculty of Medicine Universiti Kebangsaan Malaysia for his support to publish this paper.

Authors' contribution: TSMV and AAW involved in initial drafting of the manuscript. TSMV involved in writing the clinical history and patient's progression. TSMV, AAW and DCH provided the microbiological report. AAW and DCH edited the final draft of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

REFERENCES

- 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.
- Al-Yaqoobi M, Al-Khalili S, Mishra GP. Salmonella brain abscess in an infant. *Neurosciences.* 2018; 23(3): 250-3.
- Bonvin P, Ejlertsen T, Dons-Jensen H. Brain abscess caused by Salmonella enteritidis in an immunocompetent adult patient: successful treatment with cefotaxime and ciprofloxacin. *Scandi J Infect Dis.* 1998; 30(6): 632-4.
- Sarria JC, Vidal AM, Kimbrough RC. *Salmonella enteritidis* brain abscess: case report and review. *Clin Neurol Neurosurg.* 2000; 102: 236-9.
- Sait M, Rahmathulla G, Chen TL, Barnett GH. Rare case of intracranial Salmonella enteritidis abscess following glioblastoma resection: Case report and review of the literature. *Surg Neurol Int.* 2011; 2: 149.
- Siddiqui MR, Islam QT, Rahman YU, Shena TY. Multiple skin and brain abscess caused by *Salmonella* Typhi, first reported case in Bangladesh. *Bangladesh J Medicine.* 2015; 26: 83-5.
- Oki M, Ueda A, Tsuda A, Yanagi H, Ozawa H, Takagi A. *Salmonella* Enterica serotype enteritidis vertebral osteomyelitis and epidural abscess complicated with meningitis. *Tokai J Exp Clin Med.* 2016; 41(3): 169-71.
- Luciani L, Dubourg G, Graillon T, Honnorat E, Lepidi H, Drancourt M, Seng P, Stein A. Salmonella enterica serovar Enteritidis brain abscess mimicking meningitis after surgery for glioblastoma multiforme: a case report and review of the literature. *J Med Case Rep.* 2016; 10: 192.
- Byer L, Rutledge C, Wallender E, Osorio JA, Jacobs R, Theodosopoulos PV. Salmonella infection after craniotomy. *Cureus.* 2017; 9(8): e1566.
- Akhaddar A, Hall W, Boucetta M. Subgaleal and brain abscesses due to *Salmonella enteritidis* following craniotomy for giant cell glioblastoma multiforme: A case report and literature review. *Surg Neurol Int.* 2019; 10(37): 1-5.
- Çavuşoğlu H, Kaya RA, Türkmenoglu ON, Çolak I, Aydın Y. Brain abscess: analysis of results in a series of 51 patients with a combined surgical and medical approach during an 11-year period. *Neurosurg Focus.* 2008; 24(6): E9.
- Brouwer MC, Tunkel AR, McKhann GM, Van De Beek D. Brain abscess. *New Engl J Med.* 2014; 371 (5): 447-56.