

Case Report

Non-Typhoidal *Salmonella* Encephalopathy Infection: A Pediatric Case Report

Madison Willson, MS-4¹, Matthew Tandy, M.D.², Natesh Samaroo, B.S.³, Shawn Sood, M.D., MBA¹

¹The University of Kansas School of Medicine–Kansas City, Kansas City, Kansas

²The University of Oklahoma, Tulsa, Oklahoma Schusterman Center

³Kansas City University, Kansas City, Missouri College of Osteopathic Medicine

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INTRODUCTION

Salmonella enterica subspecies *salamae* (*Salmonella salamae*) is an uncommon non-typhoidal *Salmonella* subspecies, accounting for less than 1% of reported human *Salmonella* isolates in the United States.¹ Between 2006 and 2016, 271 laboratory-confirmed cases of *Salmonella salamae* infection were identified in the United States.²

Individuals with *Salmonella* infections typically present with abdominal pain, diarrhea, and fever within 2 to 48 hours after exposure.³ Most cases follow a self-limited and benign course. However, *Salmonella* enterocolitis remains a global public health concern due to potential complications, including severe extraintestinal manifestations such as sepsis, arthritis, meningitis, osteomyelitis, and acute encephalopathy.⁴

Here, we report a case of non-typhoidal *Salmonella* encephalopathy caused by *Salmonella salamae*, characterized by minimal gastrointestinal symptoms and an overall atypical presentation.

CASE REPORT

A previously healthy two-year-old boy presented to our institution with somnolence and decreased activity. He had a five-day history of fever and progressive lethargy, sleeping up to 22 hours daily, and a one-day history of non-bloody diarrhea. There was no history of emesis, rashes, stomatitis, conjunctivitis, or extremity swelling.

The patient had no recent travel outside of Oklahoma, nor a history of consuming unpasteurized dairy products, undercooked meats, or exposure to sick contacts. His mother managed an exotic pet store that he frequently visited, and the family kept a pet gecko at home. On examination, he was irritable but consolable, arousable but rapidly fell back asleep. There were no meningeal signs, rashes, conjunctivitis, lymphadenopathy, stomatitis, or extremity edema. His abdominal and the remainder of his physical exams were benign. Initial differential diagnoses included meningitis, herpes virus encephalitis, intracranial hemorrhage, thyroid dysfunction, and heavy metal toxicity.

On admission, his vital signs were temperature 36.3°C, heart rate 74 bpm, respiratory rate 28 breaths/min, and oxygen saturation 96% on room air. He remained afebrile throughout his stay. Initial lab work—including urinalysis, complete blood count, metabolic panel, C-reactive protein, respiratory pathogen panel (including Pertussis testing), and comprehensive urine drug screen—was unremarkable. A non-contrast computed tomography of the head was also normal.

Given his persistent somnolence and lack of improvement, a lumbar puncture was performed on day two, revealing normal opening

pressure, glucose, and protein levels. However, the cerebrospinal fluid (CSF) cell count showed an elevated white blood cell count of 8/μL. CSF viral polymerase chain reaction (PCR) panel, viral antibodies, anti-Ma, anti-Ta antibodies, and autoantibody testing were all negative. Serum lactate and ammonia levels were within normal ranges (1.9 mmol/L and 50 μmol/L, respectively). A heavy metals panel for lead, arsenic, and mercury was negative, and his free T4 and anti-thyroid peroxidase antibodies were normal. Pyruvic acid was within normal limits (0.105 mmol/L). He tested negative for *Salmonella typhi* antibodies (O Type D, O Type Vi, H Type a, H Type b, and H Type D). CSF, urine, and blood cultures showed no growth during hospitalization.

On day four, the patient passed his first stool, which tested positive for *Salmonella* by PCR. A subsequent culture confirmed *Salmonella salamae* (Table 1). Consultation with pediatric infectious disease specialists led to a decision against antibiotic treatment, as all other cultures were negative, and the patient had been afebrile since admission despite his five-day fever history before hospitalization.

Magnetic resonance imaging of the brain was unremarkable, but an electroencephalography demonstrated a slow background while awake, suggestive of nonspecific diffuse cerebral dysfunction. Given the patient's encephalopathy, positive stool culture for *Salmonella*, and negative results for other plausible causes, the most likely diagnosis was *Salmonella* encephalopathy.

Table 1. Centers for Disease Control and Prevention phenotypic results of *Salmonella enterica* subspecies *salamae*.

Fermentation	Positive/ Negative	Fermentation	Positive/ Negative
Malonate utilization	Positive at day 2	Lactose	Negative
Dulcitol fermentation	Positive at day 1	Salicin	Negative
Sorbitol (D-) fermentation	Positive at day 1	Mucate	Positive at day 1
Tartrate – Jordan's	Negative	Ortho-nitrophenyl-β-D-galactopyranoside (ONPG)	Positive at day 2
Galacturonate (D-) fermentation	Positive at day 1	4-Methylumbelliferyl-β-D-Glucuronide (MUG)	Negative

During hospitalization, his excessive sleepiness led to poor oral intake and the patient received intravenous fluids due to mild dehydration. He completed a five-day course of 5 mg/kg of intravenous methylprednisolone with increased alertness and activity. After a 10-day hospitalization, he was discharged with a steroid taper. Three weeks after discharge, his mother reported that he was back to his baseline state of health.

DISCUSSION

Encephalopathy caused by non-typhoidal *Salmonella* species is a rare phenomenon. Prior to 2001, non-typhoidal *Salmonella* was not recognized as a clinically significant pathogen, which can help explain the paucity of documented cases of pathogenic non-typhoidal *Salmonella*.⁵ Over 50% of infections with *Salmonella salamae* occur in children less than four years of age.⁶ While gastroenteritis is the most frequently seen malady with this infection, there are a few documented infections of bacteremia. No prior cases of encephalopathy with *Salmonella salamae* in pediatrics have been reported. There have been multiple cases of non-typhoidal *Salmonella enteritidis* encephalopathy in pediatric patients but the reports either did not specify subspecies or were a serotype of the enteritidis subspecies.⁷⁻⁹

The most common way individuals acquire *Salmonella salamae* infections is through ownership or exposure of a reptile, which is the presumed vector for our patient's infection. He had exposure both at home and at his mother's work. Reptiles as vectors are an emerging public health concern since owning a reptile as a pet has been increasing in popularity over the past decade. According to a 2021 survey conducted in the United States, there are 5.7 million households with pet reptiles, which has increased considerably since 1996 when there were only 2.5 million households with pet reptiles.^{10,11} Therefore, it is increasingly likely that cases of *Salmonella salamae* will become more prevalent. The Centers for Disease Control and Prevention recommends that all households with anyone less than five years, older than 65 years, or immunocompromised refrain from having reptiles as pets, as they are at increased risk for serious infections due to *Salmonella*.¹²

The pathophysiology of non-typhoidal *Salmonella* encephalopathy is not completely elucidated. It is proposed that encephalopathy is either secondary to elevated cytokines in the CSF or it may arise due to bacterial endotoxin production.¹³ Other cases have been reported in which steroids in conjunction with antibiotics is an effective treatment if the patient exhibits signs of hypercytokinemia due to sepsis.⁴ Although enteric fever is caused by a different *Salmonella* subspecies, corticosteroids demonstrate efficacy in children with severe enteric fever characterized by delirium, obtundation, stupor, coma, or shock.¹⁴ In the case of our patient, he began to improve clinically with methylprednisolone monotherapy.

CONCLUSIONS

We presented the first published case of *Salmonella* encephalopathy caused by *Salmonella salamae* in a previously healthy two-year-old, successfully treated with methylprednisone. Although encephalopathy due to non-typhoidal *Salmonella* is rare, it should remain a consideration in the differential diagnosis, even when gastrointestinal symptoms are minimal or absent. Given that reptiles are common carriers of *Salmonella*, individuals who own or are exposed to reptiles—particularly in households with children under five—should be educated on proper handling techniques to prevent infection.

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