

Salmonella enterica Serotype Choleraesuis var Decatur Gastroenteritis Complicated by Severe Acute Kidney Injury and Neurological Dysfunction

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ABSTRACT

We herein report a case of gastroenteritis due to *Salmonella enterica* serotype Choleraesuis var Decatur following ingestion of ground meat. A 10-year-old child presented with diarrhea and vomiting followed by multi-organ dysfunction in the form of severe acute kidney injury requiring multiple sessions of hemodialysis, transaminasemia, thrombocytopenia, and altered sensorium. Stool cultures were positive for *Salmonella enterica* serotype Choleraesuis var Decatur, and intravenous ceftriaxone was administered for 10 days for the same. She survived with neurological sequelae. Nontyphoidal *Salmonella* is one of the most frequently identified causes of foodborne illness in developing countries. An increased level of awareness is needed to understand the association of severe foodborne illnesses, especially given the prevalence of consumption of such foods in the local cuisine. This case also adds to the spectrum of clinical manifestations associated with this entity. Vaccination of farm animals on a routine basis with live attenuated *Salmonella* vaccine is needed to diminish the transmission of *Salmonella* through the food chain to humans and increased awareness should be created about the preparation of ground meat products to reduce the transmission of infection.

Keywords: Acute gastroenteritis, H₂S-negative *Salmonella*, Nontyphoidal *Salmonella*, *Salmonella* bacteremia, *Salmonella* choleraesuis.

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INTRODUCTION

Nontyphoidal *Salmonella* (NTS) infection is a common cause of acute bacterial gastroenteritis in children. Human infections with *Salmonellae* are most commonly caused by the ingestion of food, water, or milk that is contaminated with human or animal excreta. *Salmonellae* are the primary pathogens of the animals, (e.g., poultry, cows, pigs, pets, birds, seals, donkeys, lizards, and snakes) that are the principal sources of nontyphoidal salmonellosis in humans. An interesting case of *Salmonella enterica* serotype Choleraesuis var Decatur following ingestion of ground meat in some unusual local cuisine is presented.

CASE DESCRIPTION

A 10-year-old child from a small hamlet named Villupuram in South India presented to our tertiary care center with history of watery diarrhea 7–9 times/day (without blood or mucus) and vomiting 6–8 episodes for 3 days. The parents also gave a history of fever for 3 days. She had one episode of generalized tonic-clonic seizure while coming to the hospital and was admitted in the hospital in an unconscious state. The child had been apparently well 3 days before when she consumed food that was made up of ground meat, 24 hours after which she developed these symptoms. There was a history of similar complaints in six other family members who consumed the same food in a local cuisine.

Initial vital signs showed a pulse rate of 102/minute, blood pressure 90/60 mm Hg, respiratory rate 20/minute, and palpable peripheral pulses. On examination, the child was drowsy, with acidotic breathing; also, altered sensorium was present. There was no icterus, petechiae, purpura, dehydration, or edema. Neurological examination revealed the child to be in altered sensorium (E2, M3, V3), with spasticity of all four limbs, neck, and trunk; hyperreflexia of lower limbs; and poor gag reflex. Cardiovascular system was

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normal. There were no signs of meningeal irritation. There was no organomegaly. The child was anuric for 24 hours prior to presentation to the hospital. Complete blood counts revealed hemoglobin level 13.7 g/dl, platelet count 51,000/μL, and white blood cells of 7200/μL with 83% polymorphonuclear cells. Blood glucose was 162 mg/dL, blood urea 150 mg/dL, serum creatinine 2.7 mg/dL, potassium 5.8 mEq/L, sodium 138 mEq/L, bicarbonate 11 mmol/L, serum alkaline phosphatase 143 U/L, and serum albumin 3.2 mg/dL; aspartate aminotransferase and alanine aminotransferase levels were highly elevated (3227 and 1007 U/L, respectively). The prothrombin time and serum bilirubin levels were normal.

The patient did not respond to volume resuscitation and was clinically diagnosed as having acute gastroenteritis complicated by severe acute kidney injury (intrinsic renal type), severe transaminasemia, thrombocytopenia, metabolic acidosis, and encephalopathy. She was initiated on hemodialysis for severe acute kidney injury, and intravenous ceftriaxone was administered 1.5 g 12 hourly for the next 10 days.

Stool sample obtained from the patient was sent to the microbiology laboratory. Macroscopically, the stool sample was watery, not blood stained, and not foul smelling. Microscopic examination of the stool sample revealed the absence of pus cells, red blood cells, ova, cyst, or trophozoite. The sample was inoculated onto MacConkey agar, xylose lysine deoxycholate agar, and thiosulphate citrate bile sucrose agar. The culture growth on MacConkey's agar showed smooth translucent, nonlactose fermenting colonies. The isolate was identified as *Salmonella enterica* subspecies *enterica* by MALDI-TOF MS, and by its biochemical reactions and agglutination pattern with polyvalent O and H antisera. As the isolate showed gas production and no hydrogen sulfide production and based on the agglutination pattern, we narrowed it down to *S. choleraesuis* and *S. typhisuis*. Further biochemical testing revealed that our isolate fermented sorbitol, mannitol, and dulcitol but did not ferment trehalose, and so we came to a conclusion that it is *S. choleraesuis* var Decatur. Antimicrobial susceptibility testing of the isolate was done and was found to be susceptible to ampicillin, ceftriaxone, ciprofloxacin, cefixime, and cotrimoxazole. Blood culture of the patient was sterile.

The child required multiple sessions of hemodialysis over the next two weeks for the management of severe acute kidney injury with anuria. The serum creatinine levels and urine output normalized after three weeks of hospital stay and the child was off dialysis thereafter. The sensorium improved after two weeks of hospital stay. However, she still exhibited spasticity, cortical blindness, aphasia, and poor gag reflex, and therefore, feeding was done by a nasogastric tube. By the second week of illness, the liver enzymes and platelet counts of the patient were normalized. Her vision was normalized by the third week, and she started recognizing her parents and consuming semisolid foods orally at this juncture. Residual neurological sequelae in the form of spasticity, hyperreflexia, and incoherent speech were persisting at the time of writing this report.

DISCUSSION

Nontyphoid *Salmonella* serotypes that are the major cause of morbidity and mortality are often transmitted through the food chain by contamination of poultry and eggs, pork, beef, and dairy products, and by vegetables and fruits that are irrigated with *Salmonella*-contaminated water. *Salmonella enterica* serotype Choleraesuis is a gram-negative host-adapted, facultative intracellular pathogen.^{1,2} It is increasingly recognized as a major cause of systemic salmonellosis with a high mortality rate, is a major disease of the pigs, and causes various symptoms and complications like fever, depression, septicemia, arthritis, diarrhea, pneumonia, hepatitis, meningitis, and other chronic wasting diseases.^{1,3,4}

Serotype Choleraesuis differs from other salmonellae by the frequency with which it invades the bloodstream causing a generalized infection in humans.^{5,6} It also contains the *inv* genes encoding all the invasion functions. Histological examination revealed serotype Choleraesuis predilection for the mucosa of the colon and the luminal surface of ileal M cells of Peyer's patches.¹ *S. choleraesuis* frequently causes diseases in all ages and the most important virulence mechanism in the salmonella is the type III secretion system.⁶ A feared complication of *Salmonella* bacteremia in adults is the development of infectious endarteritis. A study by Forbes and Harding⁷ revealed that most of the *Salmonella* aortitis

were caused by the serotypes Typhimurium, Enteritidis, and Choleraesuis, in decreasing order. Also the carrier rate of *Salmonella enterica* serotype Choleraesuis var Decatur is low when compared to other salmonellae.¹

A study by Chiu et al.¹ demonstrated that most of the serotype Choleraesuis isolates from humans and swines exhibited the same or similar DNA fingerprints that indicated that most of the human infections were acquired from pigs. Traditionally, three biotypes (Choleraesuis, Decatur, and Kunzendorf) have been recognized.⁸ Among salmonellae, it is unusual in being H₂S-negative.

Most of the infection with NTS serotypes results in self-limited acute gastroenteritis that does not require antimicrobial therapy. However, antimicrobial therapy is essential in the treatment of serotype Choleraesuis infection, in view of the high rate of extraintestinal infections caused by this organism.⁸ The duration of therapy for other extraintestinal infections should be considered based on the site of infection. The emergence and increase of resistance to ceftriaxone and ciprofloxacin among *S. choleraesuis* have become a serious therapeutic problem.^{9–11} Unlike earlier reports, our isolate was sensitive to ciprofloxacin and all the other antibiotics tested.⁹

An earlier study has documented several cases of infection due to *Salmonella enterica* serotype Choleraesuis occurring postoperatively following the procedure, such as laparotomy, cystoscopy, antral operation, and drainage of an ischiorectal abscess.⁴ Diffuse and rapidly progressive brain dysfunction and circulatory failure of varying degrees that developed following enteritis constitute the characteristics of NTS encephalopathy. As reported earlier, *S. choleraesuis* has been associated with multi-organ dysfunction (including severe acute kidney injury, encephalopathy, thrombocytopenia, and transaminasemia) followed by neurological dysfunction.^{12,13} A similar neurological dysfunction was noted in this child also leading to neurological sequelae. The overall mortality of NTS reported in several previous studies was in the range of 12.2 to 40.6%.¹⁴ A study by Chen et al.¹⁵ showed that overall mortality rate of patients with *Salmonella enterica* serotype Choleraesuis var Decatur bacteremia was 30%. Thus, early diagnosis and treatment are essential in treating this invasive infection.

It is concluded that the most effective way to diminish the transmission of salmonella through the food chain to humans is by vaccinating farm animals on a routine basis with live attenuated salmonella vaccine. The consumers should also continue to be vigilant about the preparation of ground meat products to reduce the transmission of infection, and enhanced surveillance and investigation should be carried out during outbreaks to trace back the source, thereby decreasing illnesses during an outbreak. This case also adds to the spectrum of clinical manifestations associated with this entity.

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