Salmonella Newport bacteremia in a 12-day-old infant: A Case Report

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In the United States, Salmonella infections (salmonellosis) cause multiple medical problems. Although the most common presenting symptom is diarrhea, bacteremia can also occur. An estimated 1.4 million cases of salmonellosis occur annually in the U.S. with the most common salmonella species causing infection are *Typhimurium* and *Enteritidis* [1]. The third most common salmonella serotype in the U.S. is *Salmonella Newport* (*S. Newport*) [1]. The number of confirmed *S. Newport* infections reported by the Centers for Disease Control and prevention (CDC) increased from 1,584 (5%) of 34,608 to 3,152 (10%) of 31,607 of all Salmonella infections during the period of 1997-2002 [1]. We present a case of *S. Newport* causing bacteremia in a 12-day-old infant, since there have been no published case reports of *S. Newport* in neonates in the U.S. We discuss the presenting signs, symptoms and management strategies for a patient less than 28 days old (Neonate) with fever and diarrhea.

**Case Report**

A 12-day-old infant was brought to the emergency department at a community hospital by his mother after he had 10 loose, yellowish-green stools with a documented fever of 101°F (38.3 °C) by rectal thermometer. According to his mother, there was no history of any blood or mucus in the stool, and there was no vomiting. The infant lived with his mother, father, uncle and his 1-year-old cousin. His cousin was recently diagnosed with an uncomplicated Salmonella diarrheal disease of unknown salmonella species and was being treated empirically with oral antibiotics. His mother smoked cigarettes but not inside the house. The family had no pets or livestock at home. The prenatal course was uncomplicated and he was born at full term at 39
weeks estimated gestational age by an uncomplicated normal spontaneous vaginal delivery. His birth weight was 3.9 kg. He received his first hepatitis B vaccination and Vitamin K at birth and an uncomplicated circumcision was performed prior to discharge. His mother started him on bottle feedings with Enfamil in the nursery and she continued this after discharge.

In the emergency department, his weight was 3.8kg (a 2.6% decrease from birth weight). On exam, he was crying but easily consolable by his mother. Anterior fontanel was soft and flat. Mucus membranes were moist; extremities were warm and well perfused with capillary refill less than 2 seconds. No neck stiffness was observed, and he had an umbilical stump present with no signs of infection such as erythema or exudates. His neurological, cardiovascular, and respiratory examinations were normal.

Blood, urine, and stool specimens were obtained for analysis and culture. Complete blood count showed a white count of 15.7 thousand/mm$^3$ (normal: 4.5-11.0 thousand/mm$^3$) with a differential of 60 % neutrophils and 20 % lymphocytes. Hemoglobin level was 16.4gm/dl (normal: 14.5 to 24.0 gm/dl). Urinalysis was normal. A lumbar puncture was performed in the emergency department, and cerebral spinal fluid (CSF) was sent for analysis and culture. The CSF showed a glucose level of 68mg/dl (normal: 40 to 70mg/dl), and protein level of 88mg/dl (normal: 20 to 170mg/dl); one red blood cell and four nucleated cells were noted. Chest X-ray was normal. He was euvoletic and did not receive IV fluids as he was tolerating feedings by mouth. Following intravenous administration of 200mg of ampicillin (50mg/kg) and 9mg of gentamicin (2.5mg/kg), he was transported via ambulance to our tertiary referral center for further evaluation and management.
Upon arrival to our facility and after 8 hours from his initial dose of antibiotics, he received intravenously 380mg of ampicillin (100mg/kg) every 8 hours and 16mg of gentamicin (4mg/kg) daily. Patient tolerated formula (Good-Start) and there were no signs or symptoms of volume contraction; therefore he did not receive IV fluids during his hospitalization. By hospital day 3, the diarrhea and fever had resolved. On hospital day 4, the initial blood and stool cultures obtained from the community hospital were reported positive for *S. Newport*. The following day, antibiotic sensitivity and susceptibilities showed the organism was sensitive to ampicillin and cefotaxime. Ampicillin and gentamicin were discontinued and he was treated with Cefotaxime 250mg (50mg/kg) intravenously for the next 10 days. He was discharged after 14 days (total) of intravenous antibiotics. At his outpatient appointment 3 days following discharge, he was doing well without fever, diarrhea, or vomiting, and he was tolerating oral formula. His weight was 4.5 kg (a 15% increase from birth weight).

**Discussion**

Fever in an infant less than 90 days old is defined as a temperature greater than 38°C or 100.4°F with rectal measurement as the gold standard [2]. Approximately 20% of fevers in young children have no apparent source and fever is the third most common reason for emergency department visits among children in the US [3, 4]. Infection is the most common cause of fever in infants, with bacterial and viral pathogens causing most infections [5]. Common bacterial infections include *Group B streptococcus, Escherichia coli, Haemophilus influenza* type B, *Neisseria meningitidis, Listeria monocytogenes, Salmonella, Staphylococcus*
*aureus, and* *Streptococcus pneumoniae* [5, 6]. Most viral infections are self-limited and not associated with significant morbidity or mortality. Common viral pathogens causing neonatal fever include *enterovirus, herpes simplex virus, influenza, respiratory syncytial virus,* and *rotavirus* [5, 6].

Evaluation of an infant with fever should include a complete history and physical examination [6]. The physician should ask how the temperature was taken as the accuracy of the temperature depends on the method of measurement. The physician should ask about recent medication use, including antipyretics and prior antibiotics. The history should include information on immunization status, prior medical history, or prematurity. Social history should include any exposure to sick contacts and travel history. The review of systems includes questions regarding sweating, decreased appetite, lethargy, irritability, and seizures. Physical examination should rule out toxic appearance, e.g., pale skin, cyanosis, lethargy, inconsolability, tachypnea, and poor capillary refill [7]. Other concerning exam findings are reduced skin turgor, bulging or sunken fontanelle, neck stiffness or rigidity, dry mucous membranes, nasal flaring, or focal neurologic signs [7].

Blood culture, urinalysis, and urine culture are recommended for all febrile infants less than 90 days old. In addition, a white blood cell count with differential and CSF cell count and culture should be considered in infants less than 60 days old [6]. Additional testing is recommended as clinically indicated, e.g., chest x-ray if respiratory signs, or stool culture if diarrhea is present [6]. Intravenous antibiotics are recommended for infants less than 28 days old or in infants with a toxic appearance, high risk for serious bacterial infection, abnormal
complete blood cell count, urinalysis test results, or uncertain or unreliable follow up [6]. A typical empiric regimen is ampicillin (50 mg/kg IV or 100 mg/kg IV for suspected meningitis) plus either a third-generation cephalosporin, e.g., cefotaxime (50 mg/kg IV or 75-100 mg/kg IV for suspected meningitis) or gentamicin (2.5 mg/kg IV). Ceftriaxone is not recommended in infants less than 28 days old secondary to the risk of unconjugated hyperbilirubinemia [6].

*S. Newport* is a gram-negative, facultative intra-cellular rod that infects cattle and is often transmitted by fecal-oral contamination, consuming unpasteurized milk, or undercooked meat or eggs [8]. Several case reports have indicated severe neonatal infections with *S. Newport* in African countries such as Kenya, Morocco, and Tanzania [9]. This case report is unique because in our review of the literature, we did not find any published case reports of *S. Newport* in neonates in the U.S. The CDC has reported antibiotic resistance of *S. Newport* in the U.S. due to the development of multidrug resistance from the use of antibiotics given to cattle [10]. Reservoirs for non-typhoidal Salmonella serotypes are poultry, livestock, reptiles (turtles, lizards, iguanas, frogs, snakes) and other pets, and the incubation period for Salmonella infection in humans is 12-36 hours for gastroenteritis and 7-14 days for enteric fever.

Management of salmonellosis with antibiotics is not indicated in non-invasive gastroenteritis since this can prolong colonization [11]. Treatment for salmonella bacteremia is recommended in infants less than 3 months of age, patients with chronic gastrointestinal diseases, malignancies, hemoglobinopathies, and HIV infection. Broad-spectrum intravenous antibiotics, such as third generation cephalosporins, should be initiated, in patients with osteomyelitis, abscess, meningitis, and bacteremia [14]. Specific antibiotic susceptibility will be...
determined by culture and sensitivity assays, and the appropriate antibiotic administered intravenously for 2-4 weeks [11]. For invasive but nonfocal infections such as bacteremia or enteric fever, treatment with 10 to 14 days of cephalosporin or fluoroquinolones is recommended [11]; however, fluoroquinolones are contraindicated in children due to the risk of complications such as tendon rupture [12]. Prevention of Salmonella disease is the most effective way to avoid infection and is achieved by washing hands, avoiding close contact with pets such as lizards and turtles, avoid drinking unpasteurized milk, and avoiding consuming undercooked meats and eggs [1][13].

**Conclusion**

Neonatal fever is a common cause for emergency department visits. Appropriate workup of neonatal fever often includes Complete blood count, urinalysis, evaluation of CSF, blood culture, urine culture, CSF culture and chest x-ray and stool cultures as clinically indicated [5]. Immediate management with intravenous antibiotics should be initiated in cases of suspected sepsis pending culture results. Once culture results are obtained, antibiotics with adequate susceptibilities should be continued for the next 10-14 days [5].

Salmonella is the most common preventable diarrheal illness in the U.S but the prophylactic use of antibiotics in the farming industry has led to development of antibiotic-resistant strains of Salmonella [6][14]. No antibiotics are recommended in asymptomatic non-invasive gastroenteritis unless the infant is less than 90 days of age, or has chronic gastrointestinal diseases, hemoglobinopathies, or is immunocompromised [11]. Noninvasive
infections such as bacteremia and enteric fever can be treated with cephalosporins or fluorquinolones for 14 days although the use fluorquinolones should be avoided in children due to the risk of complications [11]. Treatment with cephalosporins is recommended for invasive salmonellosis, e.g., osteomyelitis or abscess for 4 weeks [11]. Prevention is the best way to avoid Salmonella infections can be accomplished by frequent hand washing and avoiding consuming undercooked meat, and unpasteurized milk [1].
REFERENCES


