

Hand abscess, phlebitis, and bacteremia due to *Salmonella enterica* serotype Augustenborg

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Soft tissue and superficial venous infections are uncommon extraintestinal manifestations of non-typhoidal *Salmonella* (NTS) infections. In contrast to affected adults, who usually show immunological impairment, the majority of children with extraintestinal NTS infections have no predisposing risk factors. Here, we report a previously healthy infant who developed hand abscess, phlebitis, bacteremia, and impending disseminated intravascular coagulation. Blood and abscess cultures showed *Salmonella enterica* serotype Augustenborg. This organism is an uncommon isolate in humans that can be highly pathogenic and induce rare manifestations of infection as in the present case.

Key words: Abscess, bacteremia, phlebitis, *Salmonella enterica*

Introduction

Non-typhoidal *Salmonella* (NTS) infection in infants and children typically causes self-limiting diarrhea. It occasionally results in extraintestinal infections, such as bacteremia with or without localized infection [1]. It usually occurs in the elderly or very young children, and in immunocompromised subjects [1]. Soft tissue infection is an uncommon manifestation of NTS infection, and localized extraintestinal infection with superficial venous involvement is very rare [2-4]. This report describes a case of an otherwise healthy infant who developed right hand abscess and phlebitis over a previous intravenous (IV) catheter insertion site, accompanied by bacteremia and impending disseminated intravascular coagulation (DIC). *Salmonella enterica* serotype Augustenborg was isolated from pus and blood cultures. *S. Augustenborg* is an uncommon isolate in human infections [5]. There is no report of such rare manifestations of *S. Augustenborg*-induced infections in humans.

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Case Report

A 9-month-old male infant was admitted to our hospital with a 1-day history of high fever, irritable crying, vomiting, and watery diarrhea. His mother stated that he had eaten some undercooked eggs the day before symptom onset. He was otherwise healthy with no history of antibiotic treatment in the past month. Physical examination revealed an ill appearance, hyperactive bowel sounds, and a body temperature of 38.6°C. Complete blood cell count showed a hemoglobin count, 14.2 g/dL; platelet count, 276,000/μL; and white blood cell count, 15,700/μL with 57% neutrophils and 32% lymphocytes. C-reactive protein (CRP) level was within normal limits (0.88 mg/dL) and routine stool tests identified mild occult blood. After supportive treatment, his fever, vomiting, and diarrhea gradually subsided, and his activity level and appetite improved. Stool culture performed after admission was negative for pathogens and he was prepared for discharge. However, drooling, poor appetite, and fever recurred on hospital day 4, and herpangina was impressed thereafter. His right hand became swollen, red, and tender over the dorsal metacarpal vein where an IV catheter had been retained. Due to suspicion of phlebitis, the catheter was

immediately removed. Because he appeared toxic, a blood sample was collected for a complete blood cell count and CRP measurement that showed a leukocyte count of 15,300/ μ L; hemoglobin count, 10.8 g/dL; platelet count, 17,000/ μ L; and CRP level, 20.34 mg/dL. The level of fibrin degradation products (D-dimer) was elevated to >500 μ g/L and a prolonged partial thromboplastin time (activated) was 51.2 sec (control, 31.2 sec). His blood pressure was 80/55 mm Hg; heart rate, 140/min; and body temperature, 39°C. After a series of septic work-ups, platelets, fresh-frozen plasma, and empirical antibiotic (oxacillin) were administered. After 8 h, a fluctuant mass developed over the dorsum of the right hand and a purulent discharge was demonstrated from the site of the previous IV catheter insertion.

Gram stain of the discharge demonstrated some Gram-negative bacilli; hence, ceftazidime was added to the antimicrobial regimen. A second stool culture was also negative for *Salmonella*, but pus and blood cultures both showed *S. Augustenborg* growth that was susceptible to ampicillin, chloramphenicol, trimethoprim/sulfamethoxazole, ceftriaxone, and ciprofloxacin. Platelet count returned to normal and his general condition improved gradually with subsidence of fever after the abscess had been drained completely. He was discharged having made a full recovery after IV ceftriaxone for 13 days.

Discussion

Foods containing raw or undercooked eggs are common causes of NTS outbreak [1]. In cases of culture-proven salmonellosis in the United States, approximately 98% are caused by NTS infection [1]. Although most patients with NTS infection have self-limiting gastroenteritis, 2% to 45% develop bacteremia with or without extraintestinal infections, depending on the patient's age, geographic location, and design of the study (prospective vs retrospective) [1,6,7]. Affected adults are typically immunocompromised hosts and have a higher incidence of extraintestinal involvement, a higher mortality rate, and may develop *Salmonella* bacteremia in the absence of diarrhea. In contrast to children, NTS bacteremia manifests as a basically benign disease; the majority of patients are generally healthy, and bacteremia may develop with or without extraintestinal infections as a complication of acute enteritis [1,6,7]. Extraintestinal NTS infections in children are most common in the first 3 months of life, and in those with sickle cell disease, prior

gastrointestinal surgery, or antibiotic treatment in the month preceding *Salmonella* infection [1,8].

After *Salmonella* enters the bloodstream, focal suppurative infection can occur in almost any organ [1]. The common sites of metastatic dissemination in *Salmonella* bacteremia are the vascular system, lungs, joints, pleura, and meninges [4]. Almost 10% of cases of invasive salmonellosis have endothelial surface involvement, and this incidence ranges from 25% to 40% in patients over 50 years of age [4,9]. The endocardium or previously damaged arterial walls, especially aneurysms of the abdominal aorta, are the most commonly involved sites [2]. Involvement of the superficial venous system is, however, quite rare [3,4, 10]. Occasional cases of focal salmonellosis at the site of previous venous endothelial damage (e.g., IV catheter insertion) have been reported, but only in adults [10-12]. Soft tissue infection with superficial venous system involvement caused by NTS, as in the present case, has not been previously reported. As shown in Table 1, all but one of the previously reported cases (case 6) had underlying disease or predisposing factors that increased their susceptibility to extraintestinal NTS infection. Fever and diarrhea developed in 5 cases, all of which were males. Upper limb veins were involved in 5 of the 7 cases and the same proportion of cases had vascular risk factors. Five of the seven cases had bacteremia, but only two had stool cultures positive for *Salmonella*. The infection caused mortality in 2 of the 7 cases; case 1 developed chest wall abscess formation combined with *Pseudomonas* pneumonia and staphylococcal bacteremia; and case 5 developed empyema with lodgment of septic emboli in the lungs. Cases 2 and 3, the most mildly affected patients, developed abscesses without thrombophlebitis and recovered fully without antibiotics after abscess drainage. An abscess nevertheless recurred over a previous surgical scar, 9 months later in case 3. The occurrence of infection at catheterization or injection sites and at surgical scars or varicose veins is consistent with the predilection of *Salmonella* for abnormal tissues [10].

In the present case, the infant developed a rare extraintestinal infection along with NTS bacteremia and impending DIC. Although hospital-acquired infection could have occurred as a result of contact of the patient or another carrier with the IV cannula, the negative stool cultures and lack of other cases of NTS in the ward during the period of his admission do not support this infection route. In addition, herpangina may have predisposed this patient to the development of

Table 1. Extraintestinal non-typhoidal salmonellosis of the superficial venous system

Case	Age (years)	Gender	Predisposing factors	Clinical presentation	Clinical manifestations involving venous system/location	Vascular risk factors	Organism isolated	Positive cultures	Outcome	Reference
1	54	Male	Diabetes, renal failure	F, D	Thrombophlebitis with pus/both arms	IV insertion	<i>Salmonella</i> Heidelberg	Pus, blood, stool, urine	Died	12
2	18	Male	Surgery	F, D	Abscess/right hand	IV insertion	<i>Salmonella</i> enteritidis	Abscess	Recovery	11
3	16	Female	Renal transplant, pregnancy, surgery	Nil	Abscess/right arm	IV injection	<i>Salmonella</i> typhimurium	Abscess	Recovery	10
4	30	Male	Renal transplant, surgery	F, D	Pus, phlebitis, thrombus/left axillary vein	-	<i>Salmonella</i> typhimurium	Blood, pus, thrombus	Recovery	10
5	73	Male	Gastric adenocarcinoma	F, D	Thrombus/left saphenous vein	Varicose veins	<i>Salmonella</i> enteritidis	Thrombus blood, empyema, sputum, stool	Died	4
6	66	Male	-	F	Abscess, thrombophlebitis/left saphenous vein	-	<i>Salmonella</i> serogroup E	Abscess, blood	Recovery	3
7	9 months	Male	Herpangina	F, D	Abscess, phlebitis/right hand	IV insertion	<i>Salmonella</i> Augustenborg	Abscess, blood	Recovery	Present case

Abbreviations: IV = intravenous; F = fever; D = diarrhea

bacteremia, which suggests that the hand abscess and phlebitis were secondary to NTS bacteremia.

Hsu et al [9] demonstrated that group C *Salmonella* infection was a positive predictor for endovascular infection. *Salmonella* Choleraesuis is the most common pathogen among *Salmonella* serogroup C, and the most virulent serotype to humans in Taiwan [9,13]. In Taiwan, *S. Choleraesuis* was the second most common serotype among all *Salmonella* serogroups isolated and showed the greatest ability to cause extraintestinal infections [13]. Su et al [14] found that *S. Choleraesuis* had the highest rate of resistance to ampicillin and chloramphenicol among all *Salmonella* isolates in Taiwan in 2003. In the present case, *S. Augustenborg* was isolated, which is an uncommon pathogen in humans and belongs to *Salmonella* serogroup C1 [5]. *S. Augustenborg* is relatively sensitive to antibiotics and it was described as a new *Salmonella* species in 1966 [15]. There is no report in the literature of *S. Augustenborg*-induced soft tissue and superficial vein infections accompanied with bacteremia and impending DIC.

In conclusion, although it is uncommon in previously healthy infants with diarrhea and recurrent fever, *Salmonella* induces a soft tissue abscess and phlebitis over a site of previous endothelial damage

(such as an IV catheter insertion site) should be considered even if stool culture is negative for *Salmonella*. *S. Augustenborg* is an uncommon pathogen in humans and can cause considerable morbidity including the rare manifestations of abscess and phlebitis as in this case.

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