


Yersinia enterocolitica Septicemia After Chitterling Ingestion in a Pediatric Patient With Iron Overload Disease: A Case Report

Global Pediatric Health
January-December 2015: 1–4
© The Author(s) 2015
DOI: 10.1177/2333794X15592611
gph.sagepub.com


Tara D. Moon, MD¹, Steven Ma, MD¹, and Mary Lynn Sheram, MD¹

Abstract

Yersinia enterocolitica is a gram-negative cocobacillus causing a range of illness from self-limited enteritis to invasive disease, including septicemia. It is a particularly virulent pathogen in patients with underlying hemoglobinopathies who are predisposed to iron overload. A substantial risk factor for disease in children and infants is exposure to the household preparation of chitterlings. Early identification of these patients is critical in the pediatric intensive care unit as this cause of septicemia can be missed with the potential for significant morbidity. We report an interesting case of *Yersinia* septicemia in a patient with iron overload disease from chitterling ingestion managed in the pediatric intensive care unit.

Keywords

critical care, *Yersinia enterocolitica*, β -thalassemia, iron overload, hematology/oncology

Patient Report

A 9-year-old black male with β -thalassemia major presented to the pediatric emergency department (ED) at the Children's Hospital of Georgia with a 2-day history of nonproductive cough, diffuse cramping abdominal pain, profuse watery nonbloody diarrhea, and a temperature of 102°F. Sick contacts included multiple other relatives, including his grandmother, who developed symptoms 2 days prior to our patient, with most family members experiencing nonbilious emesis as well. Our patient's past medical history is significant for β -thalassemia major diagnosed shortly after birth due to an abnormal newborn metabolic screen. At 6 months of age, he received his first blood transfusion. He now receives transfusions monthly and is on oral Exjade (an iron chelating agent). He also had a splenectomy 2 years prior to his presentation due to hypersplenism.

On evaluation in the ED, the patient was pale and in no apparent distress with a blood pressure of 91/58 mm Hg, respiratory rate of 36 breaths per minute, heart rate of 142 beats per minute, and a temperature of 39.9°C. The remainder of his exam was unremarkable. Due to profound tachycardia, hypotension, and concern for possible sepsis, the patient was given a normal saline fluid bolus, and a blood culture was obtained. A chest radiograph showed a left lower lobe pneumonia.

Pertinent laboratory findings included white blood cell count of $50.2 \times 10^3/\mu\text{L}$, with a differential of 80% neutrophils, 12% bands, 5% lymphocytes, 3% monocytes; a hemoglobin of 5.0 g/dL; a hematocrit of 15.3%; and a platelet count of $463 \times 10^3/\mu\text{L}$. Antibiotics were started and he was transferred to the inpatient Pediatric Hematology/Oncology service.

Clinical Course

On admission to the inpatient service, a transfusion of 2 units of packed red blood cells was initiated. Within 2 hours of starting the transfusion, our patient developed a fever of 40.4°C, a heart rate of 143, a blood pressure of 103/31, and a respiratory rate of 34 with audible grunting. He was then placed on 2 liters of 100% oxygen via nasal cannula, given a normal saline fluid bolus, and transferred to the pediatric intensive care unit for further care.

¹Georgia Regents University, Augusta, GA, USA

Corresponding Author:

Mary Lynn Sheram, Department of Pediatrics, Division of Pediatric Critical Care Medicine, Georgia Regents University, 1120 15th Street BT-1852, Augusta, GA 30912, USA.
Email: msheram@gru.edu



Shortly after arrival to the unit, the patient was given a second blood transfusion, 2 additional fluid boluses, and was started on dopamine and vancomycin in addition to ceftriaxone. His diarrhea continued and stool studies were obtained including rotavirus antigen, a stool culture, occult blood screening, and a gram stain of the stool. During his 2-day pediatric intensive care unit stay, he was quickly weaned off pressor support and oxygen. The blood culture performed in the ED grew gram-negative non-lactose fermenting bacilli; thus, vancomycin and ceftriaxone were discontinued and the patient was switched to cefepime for monotherapy. The patient was then transferred back to the hematologic inpatient service for further care.

On the fifth day of admission, the blood culture was identified as *Yersinia enterocolitica* and intravenous gentamicin was added to cefepime for additional gram-negative coverage. Once sensitivities became available, the intravenous antibiotics were discontinued and the patient was started on oral trimethoprim-sulfamethoxazole. Oral antibiotics were continued for 14 days after discharge home.

Discussion

Yersinia enterocolitica is a gram-negative cocobacillus causing a range of illness from self-limited enteritis to invasive disease, including septicemia.^{1,2} Human clinical infections with *Y enterocolitica* septicemia are mostly due to the ingestion of the microorganisms in contaminated food and water,³ or by direct inoculation through blood transfusion.⁴ Septicemia caused by *Y enterocolitica* may occur in a normal human host, an immunocompromised human host, and even those with an underlying disorder.⁵⁻⁷ In children, especially, *Y enterocolitica* is an important cause of enteritis often leading to bacteremia.⁸

The average annual incidence of *Y enterocolitica* infection in the United States during 1996 to 2007 was 3.5 cases per million people and in Europe is ranked third among notified bacterial zoonosis after campylobacteriosis and salmonellosis. Although bacteremia is probably the most common manifestation of invasive disease caused by *Y enterocolitica*, the most common presenting features in young children tend to be enteritis and enterocolitis peaking during the winter months.⁹ In our patient, presenting signs of diffuse abdominal pain and diarrhea, without a surgical abdomen, was overshadowed by the concern for sepsis, but was consistent with the presenting signs of *Y enterocolitica* infection. In addition, risk factors including presentation during the winter months were present, as this patient presented a week after Christmas Day. Risk factors for *Y enterocolitica* such as

those found in our patient are important, as human infection with *Y enterocolitica* could be easily overlooked and prolong the treatment course for these patients.

Although the factors predisposing to septicemia in normal infants and children are not well identified, some studies have linked food-borne pathogens as a source of infection among others.^{1,2} Multiple sources have identified *Y enterocolitica* serogroup O:3 infection, specifically, as an invasive serogroup associated with the household preparation of chitterlings in infants and children.^{8,10-12} Interestingly, pork products and pigs appear to be an important reservoir for this serotype,^{11,12} and exposure to the preparation of chitterlings, without actual ingestion, is a substantial risk factor for disease with incidence being more commonly seen in black patients than non-blacks.^{10,11}

On further investigation, it was found that many other household members were affected with symptoms of gastroenteritis including fever and watery diarrhea indicating a possible spread to our patient, which was an important clue in the diagnosis for *Yersinia* gastroenteritis, which propelled into septicemia for our patient. Chitterlings are a traditional winter-holiday food in many black families. They are prepared by boiling the large intestines of pigs after the removal of fat and fecal material. The preparation requires substantial handling of large amounts of possible contaminated product, during which there is increased risk of bacterial exposure to other family members in the household. Among 2 case-control studies of *Y enterocolitica* infection among black infants, it was shown that chitterling preparation was significantly associated with illness with most *Yersinia* isolates being identified as serogroup O:3, the most common serogroup reported to the Centers for Disease Control.^{11,12} In those studies, it was suggested that infants were likely exposed to the infection by their caretakers who were cleaning the chitterlings while caring for the infant, which is consistent with intrahousehold transmission, similar to what may have been seen in our patient.¹²

Moreover, it has been shown that *Y enterocolitica* septicemia has an intriguing correlation to patients with iron overload disease or patients being treated with an iron-chelating agent.¹³⁻¹⁷ Pathogenic bacteria must obtain iron from human tissue to establish an infection, making an iron-rich environment an ideal habitat in which to survive.¹ Hereditary blood disorders such as β -thalassemia major, an anomaly in the synthesis of β -chains of hemoglobin, qualify as a diagnosis that predisposes the patient to iron overload disease due to the need for chronic transfusion therapy for severe anemia.¹⁸ Patients with β -thalassemia major are at risk for septicemia for many reasons, which may affect the

management of their illness. Transfusion-dependent complications in addition to bacterial infection include hemolytic reactions (autoimmune or acute), nonhemolytic reactions (such as transfusion-related graft-versus-host disease), and even transfusion-related infection.¹⁹ Additional infections caused by viruses and parasites must be considered in these patients as well. Our patient had multiple signs of septicemia including fever and an elevated white blood cell count with bandemia, which would distinguish it from other causes of anemia in our patient. But when considering the leading bacterial infections in transfusion-dependent patients with β -thalassemia major, gram-negative bacilli are more prominent, especially *Klebsiella pneumoniae*, whereas *Yersinia* is an atypical but less common organism.²⁰ While it is recognized that iron is an indispensable growth factor for bacteria, the nutritional need for iron as a preceding circumstance for *Y enterocolitica* sepsis makes this organism a more serious contender.

Yersinia enterocolitica has low virulence due to its inability to obtain iron readily because it lacks siderophores. Yet it has receptors for siderophores, compared to other bacteria that obtain iron by releasing siderophores in the blood to bind, solubilize iron, and allow the bacteria to ingest it via surface receptors.²¹ In children with β -thalassemia major, not only does iron become readily available, but the use of an iron chelator, such as Exjade, can enhance the virulence of *Yersinia* by providing iron as a siderophore for its growth, allowing the bacteria to thrive in the blood. Additionally, in our patient, the blood transfusions provided may have enhanced the virulence of *Yersinia* leading to continued dissemination of the bacteria, resulting ultimately in septic shock due to the content of iron in the packed red blood cells readily available to the bacteria. If recognized early, the patient may not have progressed to septic shock. Alternative treatment with antibiotics and holding the iron chelating agent may have prevented critical care management of our patient or led to more rapid clinical improvement.

In a critical care setting, identification of *Y enterocolitica* is important in the pediatric population as this cause of septicemia or septic shock may often be missed. *Yersiniosis* should be considered in children with iron overload disease or chitterling exposure presenting with abdominal symptoms, especially in the winter months. If *Y enterocolitica* is suspected in the diagnosis, iron-chelator therapy should be discontinued and antibiotics should be given to lead to rapid improvement. *Y enterocolitica* is usually susceptible to a variety of antibiotics including trimethoprim-sulfamethoxazole, chloramphenicol, aminoglycosides, tetracycline, piperacillin, and extended-spectrum cephalosporins.⁹ In addition,

avoiding packed red blood cell transfusions is critical even in the setting of symptomatic anemia to prevent dissemination of *Yersinia* and patient decompensation. Providing education regarding the safe preparation of chitterlings including strict hygiene measures should also be considered.

Author Contributions

TDM and SM contributed to the article conception and design. TDM conducted the literature search and drafted the manuscript. MLS conducted critical revisions of the article and edited the manuscript. TDM agrees to be accountable for all aspects of the article ensuring integrity and accuracy.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Bottone EJ. *Yersinia enterocolitica*: the charisma continues. *Clin Microbiol Rev*. 1997;10:257-276.
2. Bottone EJ. *Yersinia enterocolitica*: a panoramic view of a charismatic microorganism. *CRC Crit Rev Microbiol*. 1977;5:211-241.
3. Keet EE. *Yersinia enterocolitica* septicemia. Source of infection and incubation period identified. *N Y State J Med*. 1974;74:2226-2230.
4. Stenhouse MAE, Milner LV. *Yersinia enterocolitica*: a hazard in blood transfusion. *Transfusion*. 1982;22:396-398.
5. Bouza E, Dominquez A, Meseguet M, et al. *Yersinia enterocolitica* septicemia. *Am J Clin Pathol*. 1980;74:404-409.
6. Foberg U, Fryden A, Kohlstrom E, Persson K, Weilban O. *Yersinia enterocolitica* septicemia: clinical and microbiological aspects. *Scand J Infect Dis*. 1986;18:269-279.
7. Lenz T, Schulte KL, Meyer-Sabellek W. *Yersinia enterocolitica* septicemia during long-term immunosuppression treatment. *J Infect Dis*. 1984;150:963.
8. Abdel-Haq N, Asmar B, Abuhammour W, Brown W. *Yersinia enterocolitica* infection in children. *Pediatr Infect Dis J*. 2000;19:954-958.
9. Ochoca T, Cleary T. *Yersinia* species. In: Long SS, Pickering LK, Prober CG, eds. *Principles and Practice of Pediatric Infectious Diseases*. 4th ed. Philadelphia, PA: Saunders; 2012:823-828.
10. Lee L, Taylor J, Carter G, Quinn B, Farmer J III, Tauxe R. *Yersinia enterocolitica* O:3: an emerging cause of pediatric gastroenteritis in the United States. *J Infect Dis*. 1991;163:660-663.
11. Jones T, Buckingham S, Bopp C, Ribot E, Schaffner W. From pig to pacifier: chitterling-associated yersiniosis

- outbreak among black infants. *Emerg Infect Dis.* 2003;9:1007-1009.
12. Lee LA, Gerber AR, Lonsway DR, et al. *Yersinia enterocolitica* O:3 infections in infants and children, associated with the household preparation of chitterlings. *N Engl J Med.* 1990;322:984-987.
 13. Caplan L, Dobson M, Dorkin H. *Yersinia enterocolitica* septicemia. *Am J Clin Pathol.* 1978;69:189-192.
 14. Chiu H, Flynn D, Hoffrand A, Politis D. Infection with *Yersinia enterocolitica* in patients with iron overload. *Br Med J (Clin Res Ed).* 1986;292:97.
 15. Gallant T, Freedman MH, Vellend H, Francombe WH. *Yersinia* sepsis in patients with iron overload treated with deferoxamine. *N Engl J Med.* 1986;314:1643.
 16. Robins-Browne RM, Prpic JK. Effects of iron and desferrioxamine on infections with *Yersinia enterocolitica*. *Infect Immunol.* 1985;47:774-779.
 17. Robins-Browne RM, Robson A, Koornkof H. Generalised infection with *Yersinia enterocolitica* and the role of iron. *Contrib Microbiol Immunol.* 1979;5:277-282.
 18. Borgna-Pignatti C, Galanello R. Thalassemias and related disorders: quantitative disorders of hemoglobin synthesis. In: Greer JP, Foerster J, Lukens JN, eds. *Wintrobe's Clinical Hematology.* Vol 42. 11th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2004:1319-1365.
 19. Galanello R, Origa R. Beta-thalassemia. *Orphanet J Rare Dis.* 2010;5:11-25.
 20. Wang S, Lin K, Chern JPS, et al. Severe bacterial infection in transfusion-dependent patients with thalassemia major. *Clin Infect Dis.* 2003;37:984-988.
 21. Finkelstein R, Sciortino C, McIntosh M. Role of iron in microbe-host interactions. *Rev Infect Dis.* 1983;5: 5759-5777.