

Clinical Presentation and Treatment of a *Salmonella bredeney* Epidemic in Shelby County, Alabama

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ABSTRACT

Background. Numerous residents of Shelby County, Alabama, were infected with *Salmonella* when a restaurant unknowingly served food tainted with the bacterium. Because of the similarity in symptoms caused by other gastrointestinal pathogens and the variability in time of presentation, an outbreak such as this could be confused with one of another pathogenic origin. The pathogen identified, *Salmonella bredeney*, is a particularly rare cause of food poisoning. It makes up only 0.1% of the *Salmonella* isolates identified by the Centers for Disease Control and Prevention (CDC) each year.

Methods. We analyzed patient presentations through chart review and combined this information with that obtained from the state laboratories in Montgomery and the Shelby County Health Department.

Results. Symptoms were mostly gastrointestinal and ranged greatly in severity. The total number of patients affected in this incident exceeded 170, making it the largest epidemic of its kind in the recent history of Alabama.

Conclusions. The outbreak in Shelby County was caused by an exceedingly rare species of *Salmonella*. At this time, it is the only outbreak of *S bredeney* reported in MEDLINE-accessible literature since 1983.

THE *Salmonella* genus consists of a group of gram-negative bacteria, most of which are motile and non-spore-forming. The bacterium is commonly found in poultry and on the shells of their eggs, as well as in swine, insects, soil, raw meats, and animal feces.¹ Once ingested, the bacterium colonizes the ileum and colon, subsequently invades the intestinal epithelium by a mechanism that is not completely understood and may ultimately disseminate systemically, though most gastroenteritis-causing infections do not spread beyond the intestine.² Symptoms generally consist of profuse watery diarrhea, nausea, vomiting, and headache. It has been suggested that an enterotoxin produced within the enterocyte causes the gastrointestinal symptoms.¹ While there is some difference among species, most *Salmonella* infections that cause gastroenteritis become clinically apparent within 6 to 48 hours.^{1,2}

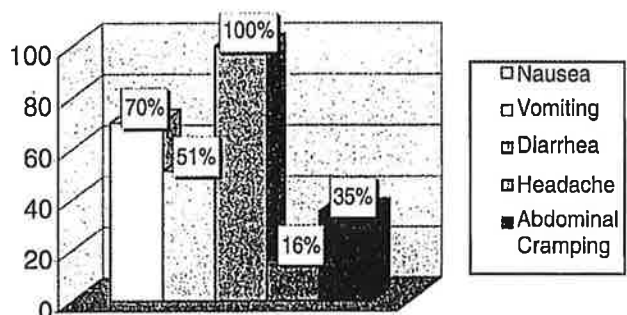
DESCRIPTION OF THE EPIDEMIC

Columbiana, the county seat, is located in south-central Shelby County, Alabama. It is a rural community of approximately 3,000 persons and is considered by some to be a part of the greater Birmingham metropolitan area.

On Sunday, August 2, 1998, the Shelby County Health Department became aware of a number of people who complained of various gastrointestinal symptoms after eating at a local barbecue restaurant. Physicians and hospitals had begun receiving calls from individuals as early as the previous Friday and Saturday (July 31 and August 1). The first patients to complain of the illness did not make a clear connection to the restaurant and were treated as if their illness were viral in origin while waiting for culture results. As calls continued to come in, an association between eating at the restaurant and having the symptoms became clear. Still the origin of the illness was not apparent. Several people complained of symptoms within hours of eating at the restaurant, and a variety of pathogens, including *Staphylococcus*, were considered. It was not until Monday, August 3, that a pattern of 48-hour latency was observed in some patients. At this

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Presenting symptoms in 37 patients infected with *Salmonella bredeney*.

point, on the basis of the clinical presentation, it seemed clear that the likely pathogen was either *Salmonella* or *Shigella*. Ciprofloxacin and trimethoprim/sulfamethoxazole were identified as agents that would cover either pathogen. By Tuesday, August 4, results were back from the health department, identifying *Salmonella* as the causative agent, and confirming its susceptibility to both antibiotics being used. Subsequently, serotyping revealed that *S bredeney* was the specific strain involved. Approximately 170 affected individuals were identified and contacted by the state epidemiologist. The vast majority of those affected were otherwise healthy and ranged greatly in age from young children to young, middle-aged, and elderly adults. Analysis of the restaurant's receipts by the office of the state epidemiologist led them to conclude that >300 people may have been infected, though only 170 sought treatment.

MATERIALS AND METHODS

Both of us conducted history and physical examination of patients during the epidemic. Patients were specifically questioned about the date and time they ate at the restaurant, as well as what specific foods and garnishes they ate. Subsequently, we sampled our patient information by reviewing charts and laboratory findings of those patients who were seen by us, in our clinic, on the second day of patients' reporting symptoms of food poisoning. Additionally, we have gathered information from the Shelby County Health Department and the Alabama Office of the State Epidemiologist. The Shelby County Health Department took samples of a wide variety of foods from the restaurant, including potato salad, baked beans, coleslaw, prepared meat, barbecue sauce, and 13 other foods. Finally, they did cultures of stool samples from the restaurant's 10 employees.

RESULTS

On reviewing the chart notes and laboratory reports on patients seen in our clinic on August 3, we found the following information. Of the 37 charts reviewed, the symptom seen most commonly was diarrhea; it was the single symptom common to all the patients reviewed. Other common presenting features included nausea, vomiting, headache, and abdominal cramping. A few patients had less common complaints including backache, weakness, and generalized malaise. The Figure gives a numerical comparison of the most common presenting symptoms. Laboratory data were available for 30 of the patients, whose mean white blood cell count was 7,760/mm³, with a range of 3,700/mm³ to 16,100/mm³. The blood counts were most often noncontributory, though a left shift was occasionally seen. Physical examination was generally noncontributory. The most common physical finding was mild abdominal tenderness consistent with the patient's symptoms. Although most of the patients reported clearing of symptoms within days of their initial visit, two patients were symptomatic as long as 2 weeks after ingestion. Both of these patients complained of crampy abdominal pain, nausea, and resolved diarrhea.

According to the office of the state epidemiologist, the causative agent from an epidemiologic standpoint appeared to be the sauce, but cultures of it did not grow *Salmonella*. Cultures of prepared meat grew *S bredeney*. Further analyses by the state epidemiology office indicated that the relative risk for those who ate the prepared meat was approximately six times that for individuals who did not eat the meat. Stool cultures from one of the restaurant workers grew *S bredeney*, while cultures from the other nine workers grew only normal flora. None of the workers were symptomatic at any time during the epidemic.*

DISCUSSION

Salmonellosis is caused by the ingestion of any of a variety of *Salmonella* species. Infection can occur with an ingestion as small as 10 bacteria, resulting in mild symptoms; however, a sufficiently large ingestion could potentially kill a healthy adult.³ The epidemic in Shelby

*Information regarding state and county government test results was obtained by telephone conversations with Ron Stutz, BS, of the Shelby County Health Department and J. P. Lofgren, MD, the Alabama State Epidemiologist. Epidemiology statistics were also provided by Dr. Lofgren.

County is the largest food poisoning epidemic ever recorded in the county and is thought to be the largest bacterial food poisoning epidemic the state has had during the past 5 years. Studies have shown that in general, *Salmonella* species can be isolated in as much as 5% to 36% of uncooked meats, depending on the type of meat.⁴ The CDC receives reports of approximately 40,000 cases of salmonellosis annually. Of this number, only 0.1% are caused by *S. bredeney*. Clearly, an epidemic involving an estimated 300 people infected by *S. bredeney* is a significant occurrence.

Salmonella bredeney was first serotyped in 1937 by Kauffmann⁵ and has received little attention since then. Not unexpectedly, the available literature on *S. bredeney* is sparse. We used MEDLINE to identify potentially useful articles, and found fewer than 30 that listed *S. bredeney* anywhere in the title, abstract, or subject headings. The last identified case report of *S. bredeney* as the causative agent in a major food poisoning epidemic was in 1983 in Araraquara, Brazil.⁶ A French study examined 100 butchers' blocks for the presence of *Salmonella* and found *S. bredeney* among the top eight species of *Salmonella* identified.⁷

Although rare, *S. bredeney* has been shown to be somewhat more hardy than other *Salmonella* sp. An Italian study examining the effectiveness of disinfectant and antibiotic agents against various species of *Salmonella* found that controlling *S. bredeney* required a higher minimal inhibitory concentration of a mercury-based disinfectant than other species.⁸ The authors found the resistance of *S. bredeney* to be plasmid mediated and always associated with some degree of antibiotic resistance. Other literature further attests to the polyresistant nature of this species.⁹

In the Shelby County outbreak, meat is the only food that grew bacteria on culture. However, it has been suspected that the sauce may have acted as a transmission vector. The sauce, with a pH of 4, would not readily serve as a growth medium for the bacteria.[†] However, once brought in contact with even a small amount of meat, it could transmit the bacteria to individuals who did not consume meat directly, thus accounting for a number of people who were symptomatic but did not eat

the meat. In general, *Salmonella* food poisonings are the result of either undercooked or improperly handled meat (ie, meat kept at too low a holding temperature). It has been proposed that *S. bredeney* may be more heat resistant than other forms of *Salmonella*.^{**} This, combined with its other known resistant behavior, leads one to question whether the meat was actually handled improperly. The restaurant involved has had high health inspection ratings for more than 20 years. If improper handling was the cause, it would be in stark contrast to the restaurant's history.

The fact that one of the restaurant's workers had a stool culture positive for *Salmonella* raises other important questions. Was the asymptomatic worker infected by handling infected meat or could this individual be an asymptomatic carrier of the bacteria? Even if the individual was infected by handling the meat, could this person now be an asymptomatic carrier? Unfortunately, the state laboratories did not have raw meat available to be tested, and these questions will remain unanswered. Nonetheless, Alabama law mandates that a stool test free of pathogens must be obtained before the individual's return to work.

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[†]Oral communication with J. P. Lofgren, MD, Alabama State Epidemiologist.

^{**}Oral communication with Ron Stutz, BS, Shelby County Health Department.