Myonecrosis Caused by *Edwardsiella tarda*: A Case Report and Case Series of Extraintestinal *E. tarda* Infections

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*Edwardsiella tarda* is an unusual human pathogen. It is primarily associated with gastrointestinal disease, although recent reports of extraintestinal disease are broadening the current understanding of the clinical spectrum of *E. tarda*. A series of 11 cases of extraintestinal *E. tarda* infection is presented, including the first reported case of myonecrosis in an immunocompetent patient. Wound infections were the most common manifestation, and 3 of 5 patients with infected wounds had been exposed to a marine environment. One patient had bacteremia, and the remaining 5 patients developed abscesses that required surgical drainage. Four patients had *E. tarda* isolated in pure culture, including the patient with myonecrosis. Although it is often difficult to ascertain the contribution of *E. tarda* to infection when it is isolated as part of a mixed culture, this case series suggests that *E. tarda* is singularly capable of causing limb- and life-threatening infections.

Human infections caused by the bacterium *Edwardsiella tarda* are rare. *E. tarda* has been cultured from samples of human feces, blood, urine, CSF, bile, peritoneal fluid, and wounds [1]. In >80% of cases, the organism is cultured from stool specimens and is associated with gastrointestinal illness. The precise role of *E. tarda* as a pathogen has been obscured by its isolation from fecal samples obtained from persons without gastrointestinal symptoms and by its frequent isolation with other known pathogens. We report the first case to our knowledge of myonecrosis due to infection with *E. tarda* in a presumed immunocompetent patient. We also review the experience with *E. tarda* at the Medical Center of Louisiana in New Orleans during the 7 years from 1993 through 1999.

CASE REPORT AND METHODS

A healthy 48-year-old man fell into brackish water while crab fishing and lacerated his forearm by contact with a submerged brick. His wound was irrigated and sutured in an emergency department. He received no antibiotics. The next day the patient developed pain, swelling, and a purulent drainage from his wound. He returned to the hospital and was treated with iv piperacillin/tazobactam, penicillin, and doxycycline. He underwent a fasciotomy and surgical debridement of necrotic fascia and muscle. Cultures of samples obtained during surgery yielded 1 organism, *E. tarda*. Results of blood cultures were negative. This isolate was sensitive to all antibiotics tested, including ampicillin, ampicillin/sulbactam, ticarcillin, gentamicin, cefazolin, cephalothin, trimethoprim-sulfamethoxazole, piperacillin, imipenem, and ticarcillin/clavulanate. The patient had an uncomplicated postoperative course.

This study was a chart review of all isolates of *E.
tarda cultured from clinical specimens at the Medical Center of Louisiana in New Orleans from 1 January 1993 through 31 December 1999.

RESULTS

Eleven cases were identified (table 1). All infected patients survived. Five cases were associated with wound infections, and 3 of the wounds occurred in a marine environment: an arm laceration that resulted from a fall into brackish water (patient 1), a leg laceration that resulted from a fall into a canal (patient 2), and a puncture wound to a foot that happened after the patient stepped on fish bones (patient 3). Patient 4 had a hand laceration caused by broken glass. Patient 5 had infection of a finger after it was accidentally crushed in a car door. All 5 patients required surgical incision and drainage. In 2 of these patients (patients 1 and 4), E. tarda was isolated in pure culture. Cultures of wound samples obtained from patients 2 and 5 yielded E. tarda and Aeromonas hydrophila, and cultures of samples from the wound of patient 3 yielded E. tarda and Shewanella putrefaciens.

Two women developed gynecologic infections that involved abscess formation. In the first woman (patient 6), E. tarda was isolated in pure culture from a ruptured tuboovarian abscess. The second woman (patient 7) had a Bartholinian abscess; on culture, samples of the abscess yielded isolates of E. tarda, Escherichia coli, and γ-hemolytic streptococci.

Two additional cases in which abscesses were described included a thumb felon (in patient 8), which yielded E. tarda, coagulase-negative staphylococcus, and Fusobacterium species on culture, and a perirectal abscess (in patient 9), which yielded E. tarda and group C streptococcus on culture.

E. tarda and Klebsiella pneumoniae were isolated from a patient with necrotic cholecystitis (patient 10). The final patient (patient 11) was a previously healthy man who presented with diarrhea, melena, and abdominal pain. He received a diagnosis of upper gastrointestinal hemorrhage secondary to peptic ulcer disease. Cultures of blood samples yielded E. tarda.

Susceptibility testing, done by use of semiautomated broth microdilution method (VITEK; bioMérieux Vitek), revealed that all of the E. tarda isolates were sensitive to the following antibiotics: ampicillin, ampicillin/sulbactam, ticarcillin, gentamicin, ofloxacin, cefazolin, cephalothin, piperacillin, ticarcillin/clavulanate, and imipenem.

DISCUSSION

E. tarda, a member of the family Enterobacteriaceae, exists widely in nature. It is associated with freshwater environments and has been cultured primarily from the samples of stool of animals that inhabit these ecosystems, including fish, lizards, toads, snakes, turtles, crayfish, and alligators [2–5]. It has also been cultured directly from samples from lakes, rivers, wells, catfish ponds, and from sewage water [2, 4]. Although E. tarda has not been directly cultured from seawater, it has been cultured from autopsy specimens of ocean inhabitants, such as sea lions and penguins [5, 6]. Almost all isolates of E. tarda are uniformly susceptible to antibiotics with activity against gram-negative bacteria (i.e., aminoglycosides, cephalosporins, β-lactams, and fluoroquinolones).

The most frequently reported manifestation of infection caused by E. tarda in humans is gastrointestinal disease. The organism has been cultured from stool samples obtained from patients with diarrheal illness in Asia, Australia, and Central America [7]. One early report described 4 different clinical presentations: mild gastroenteritis, a typhoid fever–like illness, bacteremia, and an asymptomatic or carrier state [8]. Later reports confirmed the isolation of E. tarda from cultures of stool samples obtained from patients with gastrointestinal illness as well as those without symptoms [3, 9]. The role of E. tarda in acute gastrointestinal illness in some patients may be confused by the concurrent isolation of other known gastrointestinal pathogens, such as Salmonella and Shigella species [10].

Extraintestinal infection with E. tarda is considered unusual. E. tarda–associated sepsis, although uncommon, has a mortality rate that approaches 50%. In one review, 11 of 14 cases of E. tarda sepsis occurred in patients with significant underlying medical conditions, particularly hepatobiliary disease or hemoglobinopathies [11]. E. tarda has also been implicated in a variety of infections, including reports of isolates from patients with osteomyelitis, peritonitis, cholecystitis, and salpingitis [7].

Wound infections with this organism often involve abscess formation following trauma. Several cases have occurred in previously healthy people who were exposed to E. tarda in an aquatic environment, such as a patient with an infected foot laceration acquired while walking on the shore of a lake [12] and a patient with an infected puncture wound caused by a catfish [13]. In both cases, E. tarda was isolated with A. hydrophila, an organism known to cause infection in wounds that are exposed to fresh water [14].

The only patient with a necrotic deep soft-tissue infection caused by E. tarda was a 67-year-old man with cirrhosis and hepatocellular cancer who was admitted to the hospital with massive ascites and edema of his lower extremities. On day 15 of hospitalization, he became febrile and developed diarrhea. Cellulitis with hemorrhagic bullae of the legs followed, and he died of septic shock. Histopathological examination revealed necrotizing fasciitis. Cultures of samples of blood and fluid obtained from the bullae yielded E. tarda [15].

In the present series, only extraintestinal sites of infection
<table>
<thead>
<tr>
<th>Patient</th>
<th>Age, y</th>
<th>Sex</th>
<th>Organism(s)</th>
<th>Site</th>
<th>Medical history</th>
<th>Antibiotic(s) received</th>
<th>Date of presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48</td>
<td>M</td>
<td>E. tarda</td>
<td>Arm wound with myonecrosis after a fall in brackish water</td>
<td>None</td>
<td>Penicillin, doxycycline, piperacillin/tazobactam</td>
<td>8/99</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>M</td>
<td>E. tarda, Aeromonas hydrophila</td>
<td>Leg wound after a fall in a canal</td>
<td>Sickle cell trait</td>
<td>Cefazolin, cephalaxin</td>
<td>10/96</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>F</td>
<td>E. tarda, Shewanella putrefaciens</td>
<td>Foot wound after patient stepped on fish bones</td>
<td>Asthma</td>
<td>Doxycycline</td>
<td>8/95</td>
</tr>
<tr>
<td>4</td>
<td>28</td>
<td>M</td>
<td>E. tarda</td>
<td>Hand laceration</td>
<td>None</td>
<td>Imipenem vs. ticarcillin/clavulanate (drug study)</td>
<td>1/94</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>M</td>
<td>E. tarda, A. hydrophila</td>
<td>Finger wound</td>
<td>None</td>
<td>Cephalexin</td>
<td>11/98</td>
</tr>
<tr>
<td>6</td>
<td>39</td>
<td>F</td>
<td>E. tarda</td>
<td>Tuboovarian abscess</td>
<td>Hepatitis C virus</td>
<td>Ampicillin, gentamicin, clindamycin; followed by ticarcillin/clavulanate</td>
<td>6/98</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>F</td>
<td>E. tarda, γ-hemolytic streptococci, Escherichia coli</td>
<td>Bartholinian abscess</td>
<td>None</td>
<td>Doxycycline</td>
<td>6/96</td>
</tr>
<tr>
<td>8</td>
<td>58</td>
<td>M</td>
<td>E. tarda, Staphylococcus epidermidis, Fusobacterium species</td>
<td>Felon</td>
<td>None</td>
<td>Doxycycline, ciprofloxacin</td>
<td>5/93</td>
</tr>
<tr>
<td>9</td>
<td>40</td>
<td>M</td>
<td>E. tarda, group C streptococcus</td>
<td>Perirectal abscess</td>
<td>None</td>
<td>None</td>
<td>5/99</td>
</tr>
<tr>
<td>10</td>
<td>62</td>
<td>F</td>
<td>E. tarda, Klebsiella pneumoniae</td>
<td>Cholecystitis</td>
<td>Peptic ulcer disease</td>
<td>Cefoxitin</td>
<td>3/93</td>
</tr>
<tr>
<td>11</td>
<td>57</td>
<td>M</td>
<td>E. tarda</td>
<td>Blood</td>
<td>None</td>
<td>Multiple</td>
<td>1/98</td>
</tr>
</tbody>
</table>

**NOTE.** F, female; M, male.

with E. tarda were identified. The microbiology laboratory at the Medical Center of Louisiana in New Orleans does not routinely isolate and identify all gram-negative bacilli recovered from cultures of stool samples. Salmonella, Shigella, Yersinia, Campylobacter, Vibrio, Aeromonas, and Plesiomonas species and E. coli O157 are identified and reported. No isolates of E. tarda were recovered from stool samples. However, it is likely that this practice results in underreporting. In fact, 2 of the patients we studied who had E. tarda in pure culture, 1 patient with tuboovarian abscess (patient 6), and 1 patient with sepsis (patient 11) experienced bloody diarrhea. It is possible that E. tarda could have been isolated from samples of their stool had it been sought.

Our case series includes the first report of E. tarda as a cause of myonecrosis in an immunocompetent patient. Of interest, 3 of the 5 cases in which E. tarda was isolated from wound infections (in patients 1–3) involved exposure to a marine environment, a likely source of the organism. In addition, 3 patients with wound infections (patients 2, 3, and 5) had cultures that yielded other known waterborne pathogens (i.e., A. hydrophila and S. putrefaciens). Patients 1 and 2 had wounds that were exposed to brackish water, and their cultures yielded E. tarda alone and E. tarda with A. hydrophila, respectively. Although it is not common, serious soft-tissue infections that follow exposure to fresh- or saltwater environments, such as those due to Vibrio vulnificus, are well described, and some authors recommend prompt surgical debridement and antibiotic therapy to reduce the risk of posttraumatic wound infection [16].

Seven of the 11 cases in this series, including the 3 that involved marine exposure, were identified during the warmer weather months of May through October. This association may reflect an increase in recreational aquatic exposure during warmer weather, increased proliferation of E. tarda in warmer water, or both. In a study reported elsewhere, cultures of samples of mud and water from ponds in Texas yielded E. tarda, and the quantity of this organism increased during the summer months [4]. No seasonal distribution of E. tarda gastroenteritis has been demonstrated [7], and no information regarding the time of year of previously reported cases of extraintestinal E. tarda infection is available.

Two patients in this series presented with gynecologic infections (patients 6 and 7). Only 3 other cases of gynecologic infection associated with E. tarda have been reported. The first occurred in a young woman with salpingitis, for whom no further information was provided [2]. The second involved a healthy 42-year-old native Hawaiian woman with a tuboovarian abscess [17]; the authors speculated that the infection was re-
lated to colonization of the gastrointestinal tract after ingestion of raw fish. The third patient described was a 46-year-old woman who was admitted to the hospital with fever, watery diarrhea, abdominal pain, and vaginal spotting [18]. Culture of blood yielded *E. tarda*. She received treatment with iv antibiotics and eventually underwent hysterectomy; histopathology revealed a uterine myoma with infarct and abscess formation [18]. This patient had a history of hepatobiliary disease, and she had a habit of eating raw meat, suggesting a possible association of infection with the gastrointestinal system. The patient in our series with a tuboovarian abscess (patient 6) also experienced fever, abdominal pain, and diarrhea. However, she had no exposure to freshwater or saltwater environments, she rarely ate seafood, she always cooked her food, and she had not recently handled any wild animals or reptiles. The portal of entry for infection remains unknown.

Four patients in our series had *E. tarda* isolated in pure culture (patients 1, 4, 6, and 11), which establishes the capability of this organism to cause limb- and life-threatening infection. Three wound infections (in patients 2, 3, and 5) were polymicrobial and included other pathogens that are known to cause waterborne wound infections (*A. hydrophila* and *S. putrefaciens*). In the 4 remaining cases of *E. tarda* infections (in patients 7–10), other bacterial pathogens were also isolated. The precise role of *E. tarda* in the cases of mixed infection is not clear. Because this case series also demonstrates the ability of *E. tarda* alone to cause serious extraintestinal infection, it is likely that the organism is a copathogen in the mixed infections rather than a commensal organism.

None of the 11 patients in our series had significant underlying medical conditions. Although 1 patient had sickle cell trait (patient 2) and 1 tested positive for hepatitis C antibody (patient 6), both were clinically well and neither exhibited signs or symptoms of their diseases. The antibiotics administered for treatment in this series varied (table 1).

In conclusion, human infection with *E. tarda* is uncommon and manifests a diverse clinical spectrum ranging from colonization of the gastrointestinal tract to life-threatening necrotizing soft-tissue infections and sepsis. Eleven patients with extraintestinal infection are reported, including 1 patient with sepsis and 10 patients with abscess formation that required surgical drainage. Seven of the 11 cases occurred during the warmer weather months of May through October. Underlying immunosuppressive conditions (i.e., hematologic or hepatic disease) have previously been reported as risk factors for infection, although none of the patients in this series had chronic illnesses. Exposure to marine environments appears to be a risk factor for wound infections. *E. tarda* can be isolated with other pathogenic bacteria in culture, which can create some confusion regarding its role as a pathogen. However, increasing numbers of reports (including 4 patients in this series) describe serious infections secondary to *E. tarda* alone, which provides evidence that this organism can cause significant morbidity and death. All isolates of *E. tarda* were susceptible to commonly used antimicrobial agents directed against gram-negative organisms, which is consistent with previous reports. This case series contributes to a small but growing body of literature that establishes *E. tarda* as an unusual but potentially life-threatening pathogen.

Acknowledgment

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References