

Enterobacter asburiae and *Aeromonas hydrophila*: Soft Tissue Infection Requiring Debridement

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abstract

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Enterobacter asburiae and *Aeromonas hydrophila* are gram-negative bacilli that have been isolated in soil and water. *Enterobacter asburiae* can cause an array of diseases, and exposure to *A hydrophila* can cause soft tissue infections, including necrotizing fasciitis.

A healthy-appearing 22-year-old man presented with an innocuous soft tissue injury to his leg due to an all-terrain vehicle crash. He received intravenous antibiotics and was discharged with prophylactic oral antibiotics. After the rapid onset of high fevers (102°F-103°F) <24 hours postinjury, he returned to the emergency department. Emergent surgical debridement was performed, and broad-spectrum intravenous antibiotics were started. Fevers persisted, and the patient underwent repeat extensive surgical debridement and antibiotic bead placement <30 hours after the initial surgical debridement and broad-spectrum antibiotics. Intraoperative cultures found *E asburiae* and *A hydrophila* in the wound. Following a long course of antibiotics and a skin graft, he fully recovered and had no functional deficits 1 year postoperatively.

Extensive research revealed that these organisms are rare in soft tissue infections. *E asburiae* is opportunistic but has not been reported as a primary wound organism, and *A hydrophila* infections have been reported following motor vehicle crashes involving wound contamination. At presentation, it is challenging to determine rare organisms in a timely fashion; however, emergent extensive surgical intervention of an accelerated aberrant disease process should be considered to avoid catastrophic outcomes.

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Enterobacter asburiae belongs to the *Enterobacteriaceae* family and is normal flora in the gastrointestinal tract but has also been isolated in water and soil.¹⁻³ *Enterobacter asburiae* is most commonly found in immunocompromised patients and is associated with antibiotic use, debilitated states, and chronic respiratory conditions.^{1,4} Due to the organism's resistance to ampicillin and cephalosporins, it is usually difficult to treat.^{1,4}

Until recently, *Aeromonas hydrophila* was believed to be mainly a marine and amphibian pathogenic organism.⁵⁻⁸ However, these organisms can act as primary pathogens in human hosts. Few reports have been published of *A hydrophila* infections resulting from nonaquatic injuries in healthy patients.⁷⁻¹² Typically, patients who contract *A hydrophila* are immunocompromised or have sustained burns or trauma in an aquatic environment.^{7,9,11,13,14}

This article describes an injury that initially appeared innocuous. However, over the course of 36 hours after presentation, rapid surgical management was necessary to prevent severe complications. The accelerated progression of this disease process and the unusual organisms—*E asburiae* and *A hydrophila*—warrant discussion.

CASE REPORT

A 22-year-old man was transported to a Level I trauma center after sustaining an innocuous-appearing injury to his right leg while riding an all-terrain vehicle in a remote wooded location. Emergency department evaluation found the patient to be afebrile, in mild distress due to pain, and suspicious for a right lower-extremity fracture. However, anteroposterior and lateral radiographs showed no evidence of fracture or radiopaque foreign bodies.

Initial assessment revealed visible debris, but the wound itself was free of gross contamination. Close inspection of the wound revealed an inverted L-shaped, complex laceration of the dermis and subcutaneous fat measuring 4 cm horizon-

tally by 8 cm longitudinally. In the central portion of the wound, a small breach in the gastrocnemius muscle fascia approximately 2 cm in size existed, but the muscle belly was not damaged.

Initial management involved aggressive irrigation and debridement with 1.5 L of sterile saline and a Betadine scrub sponge (Becton Dickinson, Franklin Lakes, New Jersey). The muscle fascia was primarily closed. The patient tolerated the procedure well and was discharged with a prescription for 500 mg cephalexin every 6 hours for 7 days.

The patient returned to the emergency department 12 to 14 hours after initial presentation and reported increasing right leg pain, fever, chills, weakness, and nausea. The wound had mild erythema but no gross purulence, and the compartments were full but compressible. Physical examination revealed a temperature of 104°F, bradycardia, and an elevated white blood cell count of 18.7 E9/L. The patient underwent emergent surgical wound management.

Intraoperatively, exploration showed 3 cm of necrotic skin medial to the laceration; mesomorphic, red, bleeding muscle with contractility; and no evidence of necrotizing fasciitis. Cultures were collected. Due to moderate gram-negative rods reported on the gram stain, vancomycin, ciprofloxacin, and piperacillin/tazobactam were chosen for suspicion of methicillin-resistant *Staphylococcus aureus* while definitive identification was pending. Twenty-four hours postoperatively, the patient spiked fevers between 102°F and 104°F, and purulence was expressed from the wound.

The second debridement revealed purulence tracking down to the Achilles tendon insertion on the calcaneus. Small amounts of necrotic muscle existed but no frank necrotizing fasciitis. Tobramycin-impregnated polymethylmethacrylate beads (Stryker, Kalamazoo, Michigan) were placed in the wound, which was provisionally closed with an Ioban occlusive dressing (3M, St Paul, Minnesota) and

vacuum-assisted closure (Renasys; Smith & Nephew, St Petersburg, Florida). These events occurred within 36 hours of initial presentation.

The cultures were positive for moderate *E asburiae*, resistant to cefazolin and cefoxitin. For *A hydrophila*, sensitivity studies were not performed because interpretive standards do not exist. When the infection resolved, a full-thickness skin graft was placed by a plastic surgeon. Over the next 8 months, healing occurred at the skin graft and donor sites. At 1 year follow-up, no residual deficits existed, and full function of the right lower extremity was regained.

DISCUSSION

After a comprehensive literature review, no definitive number of specific cases per year could be identified, but the incidence of *A hydrophila* soft tissue infections are rare and are often reported in case studies.^{7,8,11,14-17} Gold and Salit¹⁵ reported the incidence of *A hydrophila* soft tissue infections in California between May 1988 and April 1989 to be 0.7 per 1 million people. The current authors examined the microbiology records of 3 sister facilities located in Northeast Ohio between 2000 and 2010. During that time, 284,904 microbiology samples were processed. Ten (0.004%) samples yielded *Aeromonas hydrophila*, and 16 (0.006%) samples yielded *E asburiae* (Tables 1, 2).

Cases reported in the literature often include an injury in an aquatic environment^{8,9,13,18}; however, water and soil are reported as common sites for *Aeromonas* and *Enterobacter*.^{1,10,14} *A hydrophila* infections have been reported following motor vehicle crashes, farmyard injuries, puncture injuries, and mud football injuries involving wound contamination from aquatic and nonaquatic environments.^{5,10,14,19,20}

Literature on *E asburiae* is equally anomalous. A literature search yielded 1 case report concerning a primary respiratory infection with *E asburiae*.⁴ In the report by Brenner et al,⁴ which declares *E*

asburiae as its own species, most isolates studied were obtained from men, one-fourth of the isolates were from people aged 16 to 44 years, and approximately 10% of the isolates were obtained from wounds and exudates. No reports have been published of *E asburiae* being a primary organism in a wound infection. In the current patient, because wound cultures were not obtained on first presentation and the patient was discharged for 12 hours before he returned, it is unknown whether the organism was present in the wound on presentation or if it was community-acquired. The host environment for this organism is still unknown,⁴ but it has been isolated from water and soil samples^{1,3} and may have been present in the wooded area where the patient was injured. It is also plausible that *E asburiae* was opportunistic in this case due to the concomitant infection of *A hydrophila*. To the authors' knowledge, this is the first reported incidence of *A hydrophila* and *E asburiae* as primary wound organisms appearing simultaneously in a healthy, young man who was not injured in an aquatic environment.

Literature reviews and case reports note fever as a primary clinical presentation, along with other nonspecific signs of infection that present within 8 to 48 hours after injury.^{6,14} After initial discharge, the current patient developed high fevers within 12 hours postinjury, even with thorough wound cleansing and routine antibiotic administration. Pyrexia and wound purulence persisted despite emergent surgical debridement and broad-spectrum antibiotic administration. The decision to explore the wound and provide an extensive debridement after the previous treatment and intravenous antibiotics was critical to the favorable outcome in this case.

CONCLUSION

Although it is impossible to know the exact organism at presentation and prophylactic treatment for a rare organism is impractical, rapid identification of an ab-

Table 1			
<i>Aeromonas hydrophila</i> Cases (n=10) from Tri-facility Sample, 2000-2010			
Year	Source	Sex	Age
2001	Stool	F	42
2001	Stool	F	35
2003	Wound	F	12
2005	Sputum	M	29
2006	Stool	M	75
2008	Wound	F	44
2009	Wound	M	22
2010	Wound	M	18
2010	Wound	F	37
2010	Wound	M	64

errant disease process is paramount. When presented with an innocuous-appearing injury and rapidly progressive symptoms, emergent extensive surgical intervention should be considered, especially in instances where high fevers persist despite appropriate antibiotic therapy. □

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Table 2			
<i>Enterobacter asburiae</i> (n=16) Cases from Tri-Facility Sample, 2000-2010			
Year	Source	Sex	Age
2007	Sputum	M	26
2007	Sputum	F	84
2008	Sputum	M	53
2008	Urine	M	56
2008	Sputum	F	90
2009	Wound	F	54
2009	Wound	M	22
2009	Urine	M	66
2009	Wound	F	48
2009	Wound	F	85
2009	Urine	M	66
2010	Blood	M	50
2010	Wound	M	9
2010	Sputum	F	81
2010	Urine	F	49
2010	Wound	F	84

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