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BRIEF REPORT

# First Case Report of Human Bacteremia With *Malacobacter* (*Arcobacter*) *mytili*

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*Arcobacter* spp. are commonly associated with shellfish and have been increasingly implicated in human gastrointestinal disease. We report the first case of human bacteremia with *Malacobacter* (previously *Arcobacter*) *mytili* acquired after exposure to Maryland crab. *Arcobacter* spp. should be considered in febrile illnesses when the history indicates exposure to seafood.

**Keywords.** *Arcobacter*; bacterial infections; *Malacobacter mytili*; Maryland; United States.

## CASE PRESENTATION

A 65-year-old man presented to the emergency department (ED) with 1 day of generalized weakness, chills, and difficulty ambulating. He denied any other significant symptoms. His exposure history was unremarkable except for having had multiple painful, swollen, red wounds on his hands while handling live crabs within the past couple of weeks that persisted for approximately 4 days before resolving. His medical history included ischemic cardiomyopathy (EF 35%), coronary artery disease (status post–remote stenting), non-insulin-dependent diabetes mellitus, and cirrhosis due to nonalcoholic steatohepatitis requiring a transjugular intrahepatic portosystemic shunt (TIPS).

Upon arrival to the ED, he was febrile (38.5°C), tachycardic (111 bpm), and normotensive (95/61 mmHg). He had scleral icterus and mild pitting edema of the lower extremities. Labs showed neutrophil-predominant leukocytosis (11.78 k/mm$^3$, 88% neutrophils) and acute kidney injury (creatinine, 2.1 mg/dL); a set of peripheral blood cultures was drawn. Computed tomography imaging showed left greater than right loculated pleural effusions with associated atelectasis, hepatosplenomegaly, and trace ascites. A molecular multiplex respiratory viral panel (NxTAG Respiratory Pathogen Panel, Luminex Molecular Diagnostics, Toronto, ON, Canada) was negative. He was administered empiric intravenous (IV) cefepime and vancomycin, given IV fluids, and admitted for observation.

The patient's symptoms resolved during the 24 hours after admission. Empiric antimicrobials were discontinued, and he was discharged on hospital day 1 with a diagnosis of "acute renal injury due to dehydration." Soon thereafter, the initial blood culture set (2 of 2 bottles) became positive for growth with a Gram-negative bacillus. The patient was notified and instructed to return to the ED for re-initiation of IV antibiotic therapy. Upon return, he was afebrile and his leukocytosis had resolved (7.85 k/cu mm). He underwent additional diagnostic procedures including thoracentesis of the left pleural effusion, which was transudative with negative cultures, and a transthoracic echocardiogram with no vegetations. A second set of blood cultures was collected and was negative for growth. After microbial work-up of the initial cultures (see below), the organism was identified as *Malacobacter* (*Arcobacter*) *mytili*. Given the patient's continued clinical stability, he was discharged on a 14-day regimen of oral ciprofloxacin and doxycycline based upon organism identification and antibiotic susceptibilities.

## MICROBIAL WORK-UP AND ORGANISM IDENTIFICATION

The isolate was initially recovered from an aerobic resin blood culture bottle (BACTEC-FX, Becton Dickinson, MD) after approximately 24 hours of incubation at 35°C. Gram stain of the positive bottle showed a medium-sized, slightly curved, Gram-negative bacillus. The isolate was subcultured to 5% sheep blood agar (SBA; Remel Inc., Lenexa, KS) and incubated at 35°C in 5% $CO_2$. Minimal growth was seen at 24 hours' incubation.

At 48 hours, small (2–4 mm) gray, smooth, convex, and shiny colonies were noted. The edges of the colonies were slightly undulating, suggesting a spreading pattern, and weak alpha hemolysis was noted. The colonies were non-lactose-fermenting following subculture to MacConkey agar (MAC) plates (Remel Inc., Lenexa, KS). Initial attempts to identify the organism using matrix-assisted laser desorption ionization time-of-flight mass spectrometry analysis (BioTyper, Bruker Daltonics, Billerica, MA) failed to produce an acceptable identification (ie, an identification with a score ≥2.00). Subsequent sequencing of the first 500 bp of the 16S-rRNA gene (Life Technologies, Foster City, CA, and SmartGene, Raleigh, NC) successfully identified

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the isolate as *Arcobacter mytili* (Genbank accession number CP031219 and MG195898 with 100% agreement scores and EU669904 and FJ156092 with 99.80% scores).

Cellular fatty acid analysis by gas-liquid chromatography (GLC; MIDI Inc., Newark, DE) revealed major fatty acids of sum feature 3 (16:1w7c/16:1w6c) at 31%, 16:0 at 26%, and 18:1 w7c at 21%. The isolate was catalase- and indole-negative but oxidase-positive. After 7 days of incubation at 35°C and an additional 2 days at room temperature, the isolate was negative for urease and gelatin, ortho-nitrophenyl-β-D galactosidase (ONPG), lysine, arginine, indoxyl acetate, hippurate, and esculin hydrolysis. No acid production occurred in oxidative/fermentative media containing dextrose, maltose, or lactose. There was no utilization of citrate, acetamide, sodium acetate, or malonate.

Antimicrobial susceptibility testing by gradient diffusion strips (E-test, bioMérieux, Marcy-l'Étoile, France) of the isolate demonstrated susceptibility to all tested agents based on the CLSI non-*Enterobacteriaceae* interpretive guidelines (Table 1).

## LITERATURE REVIEW

*Malacobacter* (*Arcobacter*) *mytili* [1] was initially described in 2009 by Collado et al. as an oxidase- and weakly catalase-positive, motile, slightly curved Gram-negative bacillus associated with mussels and brackish water in Catalonia, Spain [2]. Its inability to hydrolyze indoxyl acetate, lack of urease, and susceptibility to cefoperazone differentiate it from other species of *Arcobacter*. 16S rRNA gene RFLP analysis generated a pattern suggesting that the strain could belong to a novel species, and this was confirmed by 16S rRNA and *rpoB* gene sequencing [3]. To our knowledge, we present the first reported case of symptomatic human bacteremia due to *Malacobacter* (*Arcobacter*) *mytili*.

Numerous and diverse *Arcobacter* species have been described in marine microbiology and are commonly associated with shellfish [4–6]. These organisms are not commonly associated with disease in humans, although a few members of the *Arcobacter* genus (*A. butzleri*, *A. cryaerophilus*, and *A. skirrowii*) have been implicated in variably severe acute gastrointestinal infections after exposure to shellfish and/or ingestion of contaminated water or inadequately cooked meat/shellfish [5–10]. Notably, *A. cryaerophilus* and *A. butzleri* have been identified as rare causes of bacteremia in patients with gangrenous appendicitis, liver cirrhosis, secondary pneumonia due to hematogenous spread of the organism, and in a case of neonatal sepsis [11–14]. Although most *Arcobacter* infections tend to be mild and self-resolving, severe cases do occur and may require antimicrobial therapy. There are no established treatment guidelines for *Arcobacter* spp. infection; however, several strains have shown reliable susceptibility to fluoroquinolones and tetracyclines [7].

## DISCUSSION

This patient, a 65-year-old man, with underlying ischemic cardiomyopathy and cirrhosis, presented with acute-onset weakness, chills, fever, and tachycardia, prompting a sepsis work-up. The combination of a lack of localizing symptoms and an initial work-up (laboratory tests and imaging) that failed to identify a source of the infection created this diagnostic dilemma. Unfortunately, this contributed to his being discharged with a noninfectious disease diagnosis before the initial blood cultures became positive, and he had to be re-admitted.

Spontaneous bacterial peritonitis was considered, although this was thought to be less likely, as only trace ascites were seen on imaging and the patient had no abdominal complaints. Other considerations included an empyema or parapneumonic effusion, endocarditis, or infected TIPS. However, thoracentesis yielded negative pleural fluid cultures, no vegetations were seen on transthoracic echocardiography, and his documented bacteremia was relatively short-lived (one day), all of which argue against a persistent endovascular nidus of infection.

Additional history revealed extensive exposure to live Maryland crabs, which is consistent with possible exposure to *M. mytili*, given the organism's abundance in these animals

**Table 1. *Malacobacter mytili* Isolate Antimicrobial Susceptibility Testing Results**

| | | CLSI Interpretive Breakpoints, µg/mL | | |
|---|---|---|---|---|
| Antimicrobial Agent | Minimum Inhibitory Concentration, µg/mL | S | I | R |
| Amikacin | 2 | ≤16 | 32 | ≥64 |
| Cefepime | 2 | ≤8 | 16 | ≥32 |
| Ceftazidime | ≤0.12 | ≤8 | 16 | ≥32 |
| Ciprofloxacin | 0.25 | ≤1 | 2 | ≥4 |
| Gentamicin | ≤1 | ≤4 | 8 | ≥16 |
| Imipenem | ≤0.25 | ≤4 | 8 | ≥16 |
| Meropenem | ≤0.06 | ≤4 | 8 | ≥16 |
| Tobramycin | 1 | ≤4 | 8 | ≥16 |
| Trimethoprim-sulfamethoxazole | ≤0.12/2.4 | ≤2/38 | | ≥4/76 |

Abbreviations: CLSI, Clinical and Laboratory Standards Institute; I, intermediate; R, resistant; S, susceptible.

(crustaceans, shellfish) and their environment. The bacteria could have been directly introduced into the blood through breaks in his skin while he was handling the crabs. Alternatively, he may have acquired the bacteria through ingestion of infected crabmeat; however, the lack of gastrointestinal symptoms makes this less probable. The patient's underlying cirrhosis likely put him at increased risk for developing bacteremia from such an exposure, given the well-documented association between chronic liver disease/cirrhosis and other less common infections, including those associated with water and/or shellfish exposure (eg, *Vibrio vulnificus*) [15]. The acuity of his symptoms and rapid improvement favor transient, rather than persistent, bacteremia. This relatively benign clinical course is consistent with other reports of *Arcobacter* spp. bacteremia.

## CONCLUSIONS

*Arcobacter* species are increasingly being recognized as emerging human pathogens, causing gastrointestinal and rare bloodstream/systemic infections. We report the first case of human bacteremia due to *Malacobacter* (*Arcobacter*) *mytili*. It is important for clinicians to consider *Arcobacter* spp. when a patient has a history of exposure to seafood and/or the aquatic environment. Further investigation is necessary to better establish the pathogenic potential of *M. mytili* and *Arcobacter* spp. in humans.


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