

Raoultella planticola Bacteremia-Induced Fatal Septic Shock and Sepsis-Induced Coagulopathy in a Patient with Pancreatic Cancer: A Case Report and Literature Review

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Abstract

Background: *Raoultella planticola* is a gram-negative rod-shaped bacterium commonly found in water and soil and considered to be a rare and possibly underestimated cause of severe human infection. Its presence should be suspected in older patients with a history of cancer, immune suppression and recent exposure to traumatic injuries or invasive medical procedures. **Case presentation:** A 78-year-old male with a history of hypertension was diagnosed with pancreatic adenocarcinoma. Whipple procedure (pancreaticoduodenectomy) was performed afterwards. On the 8th day of surgery, the patient was admitted to our tertiary ICU with septic shock. His initial Sequential Organ Failure Assessment (SOFA) score was 12 with predicted mortality 95.7%. Empirical antibiotic therapy with colymycin, meropenem and teikoplanin was administered immediately and two sets of blood cultures were obtained. Patient developed refractory septic shock despite the addition of vasopressin and the patient's condition continued to deteriorate. Patient died on the third day of sepsis. His blood culture was positive for *R. planticola*, which was identified using the VITEK-2 biochemical identification system. **Conclusions:** Clinicians should be aware of fatal unusual infections in immunocompromised patients.

Keywords

Antibiotic Resistance, Bacteremia, Sepsis

1. Introduction

Raoultella planticola is a gram-negative rod-shaped bacterium commonly found

in water and soil and considered to be a rare and possibly underestimated cause of severe human infection [1]. It was previously described as *Klebsiella planticola* and *K. trevisanii*; relatively recently these two were combined into single species in 1986, i.e., *K. planticola*, based on DNA-DNA homology. In 2001, *K. planticola* was renamed *R. planticola* based on 16SrRNA and rpoB gene sequencing [2].

Although *R. planticola* is mainly an aquatic and soil bacterium, it has been clinically isolated from human sputum, stool, wounds, and urine. Its presence should be suspected in older patients with a history of cancer, immune suppression and recent exposure to traumatic injuries or invasive medical procedures. The frequent involvement of the biliopancreatic tract suggests the importance of the gut flora as a bacterial reservoir in clinically relevant infections. Herein, we report a *Raoultella planticola* induced fatal sepsis in an immunocompromised patient with pancreatic cancer.

2. Case Report

A 78-year-old male with a history of hypertension was diagnosed with pancreatic adenocarcinoma. Due to significant mass effect on the biliary tract, jaundice and epigastric pain chemotherapy was planned. Whipple procedure (pancreaticoduodenectomy) was performed afterwards. On the 8th day of surgery the patient became febrile and hemodynamically unstable. Patient was admitted to our tertiary ICU with septic shock. On admission to our unit blood pressure was 70/30 mmHg, heart rate was 135 bpm; oxygen saturation was 72; body temperature was 38.4°C. Patient was intubated. Thoracoabdominal examination showed tenderness in the epigastrium and bilateral reduced breath sounds. Chest x-ray revealed bilateral lung infiltrates (Figure 1). Laboratory tests showed marked elevation of c reactive protein (CRP) (260.5 mg/dl; normal range <6 mg/dl) and procalcitonin (18.13 ng/ml; normal range <0.05 ng/ml). Complete Blood Count evaluated white blood cell 36,470/ μ L with 89.7% neutrophils and platelet count of 47,000. Coagulation tests (Aptt 66.2 sec, PT 24.2 sec, INR 1.88, D dimer 5.59 mcg/ml) supported sepsis induced coagulopathy (Table 1). His initial Sequential Organ Failure Assessment (SOFA) score was 12 with predicted mortality rate was 95.7%.

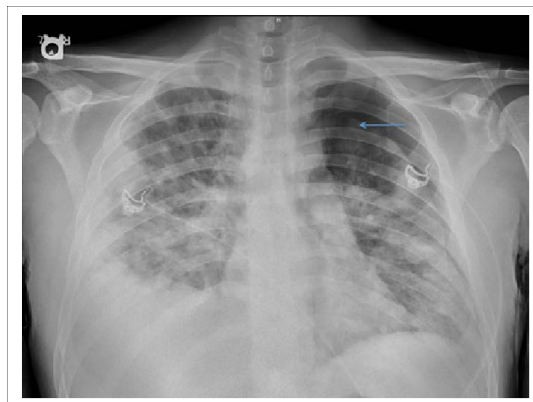


Figure 1. Bilateral pulmonary infiltrates on chest x-ray.

Table 1. Scoring for the diagnosis of sepsis-induced coagulopathy.

Category	Parameter	0 point	1 point	2 points
Prothrombin time	PT-INR	≤1.2	>1.2	>1.4
Coagulation (×10 ⁹ /L)	Platelet count	≥150	<150	<100
Total SOFA	SOFA four items	0	1	≥2

Diagnosed as sepsis induced coagulopathy when the total score is 4 or more with total score of prothrombin time and coagulation exceeding 2. Total SOFA is the sum the four items (respiratory SOFA, cardiovascular SOFA, hepatic SOFA, renal SOFA). The score of total SOFA is defined as 2 if the total score exceeded 2. INR, international normalization ratio; PT, prothrombin time; SOFA, Sequential Organ Failure Assessment.

Noradrenaline infusion was initiated to support blood pressure following adequate fluid resuscitation. Empirical antibiotic therapy with colymicin meropenem and teikoplanin was administered immediately and two sets of blood cultures were obtained. Acute kidney failure and deep metabolic acidosis developed with potassium levels of 6.7 mEq/L and bicarbonate level of 8 mmol/L. Despite the initiation of dextrose and insulin infusion potassium levels remained high and the patient had an episode of ventricular tachycardia (VT). Hemodiafiltration with citrate anticoagulation was started on day 2 of admission. Patient developed refractory septic shock despite the addition of vasopressin and the patient's condition continued to deteriorate. Patient died on the third day of sepsis. His blood culture was positive for *R. planticola*, which was identified using the VITEK-2 biochemical identification system. The strain was susceptible to both colymicin and meropenem. The results of antimicrobial susceptibility testing are summarized in **Table 2**.

3. Discussion

R. planticola is an aquatic, botanical and soil organism that does not typically cause invasive infections in humans. Raoultella species produce histidine decarboxylase and have been implicated in scombroid (histamine) fish poisoning, but the clinical significance of this organism in humans has not been characterized. *R. planticola* is found to have similar pathogenetic features as Klebsiella species. Klebsiella spp. are associated with severe infections in hospitalized and immunocompromised patients, including bacteremias, pneumonias, and urinary tract infections, and have been estimated to cause between 3% and 7% of all nosocomial infections.

The first case report of *R. planticola* infection was described by Freney *et al.* in Lyon, France, of 69-year-old patient with *R. planticola* bacteremia who was admitted to an intensive care unit 9 days following a mitral valve replacement and was treated with cefotaxim and tobramycin [3].

In the past few years, number of *R. planticola* infections, including infections with *K. planticola* and *K. trevisanii* were reported which included cholecystitis, urinary tract infections, bacteremias, central line infection, soft tissue infections,

pancreatitis, cholangitis, and pneumonia [4]-[9]. These infections mainly occurred in immunocompromised patients with conditions such as cancer and hematological malignancies, and those post-transplant and/or with comorbidities including diabetes and alcoholic cirrhosis.

Chun *et al.* summarized 20 cases of *R. planticola* bacteremia, six of which were polymicrobial infections; half of those failed to recover [10]. Although most of the *R. planticola* isolates published in literature are susceptible to carbapenems, carbapenem-resistant *R. planticola* cases have been reported resulting in unfavorable outcomes [11] [12]. The known mechanism of carbapenem resistance in *R. planticola* is production of carbapenemases, including class A-lactamase (KPC), class B metal-lactamase (IMP-8, NDM-1), and class D-actamase (OXA-48).

Zuberbuhler *et al.* reported the first case of conjunctivitis caused by *R. planticola* in a 58-year-old woman [13]. There was no known contact with the soil or water in this patient. It was a mild ocular infection and treated with the antibiotic eye drop. After this eye infection episode, the same organism was detected in the blood. Young Jun Cho *et al.* reported a case of pneumonia caused by *Raoultella planticola* in a 52 years old patient with severe left ventricule disfunction which was treated with piperacilin/tazobactam and levofloxacin [14].

Table 2. Results of antimicrobial susceptibility testing of *Raoultella planticola* isolated strain.

Name of antimicrobial substance	VITEK 2 result EUCAST interpretation
	R
	R
	R
Cefazolin	I
Cefuroxime	S
Gentamicin	R
Ciprofloxacin	S
Trimethoprim-Sulphamethoxazole	R
Ceftazidime	R
Ertapenem	R
Amikacin	R
Tazobactam Piperacillin	S
Ceftriaxone	S
Meropenem	S
Colistin	R
Ampicillin	R
Tigesiklin	S
Cefoxitin	S
Cefuroxime Axetil	R
	S
	R
	R

R resistant, S sensitive, I intermediate Results of antimicrobial susceptibility testing (AST) was done by using Vitek biochemical identification system in Memorial Ankara Hospital, Ankara, Turkey. Results were interpreted by using European Committee on Antimicrobial Susceptibility Testing (EUCAS).

Yumoto T. *et al.* reported a first case of fatal septic shock due to *R. planticola* bacteremia after flame burn injury. Patient's blood culture was positive for *R. planticola*, which was susceptible to both piperacillin/tazobactam and meropenem. The patient died due to refractory septic shock and subsequent multiple organ failure on day 12 of antibiotic treatment [15].

Cases of *Raoultella* infections can occur in many organ systems (e.g. urinary tract, gastrointestinal tract, respiratory tract) or at surgical sites. Bacteraemia, osteomyelitis, meningitis, cerebral abscess, mediastinitis, pericarditis, conjunctivitis, mandibular osteomyelitis and otitis caused by *Raoultella* have also been reported [16] [17]. Reported cases of gastrointestinal, and specifically biliary, infections with *Raoultella* are often depicted as affecting mainly individuals with an altered immune system either by a malignant condition or a chronic disease. Nonetheless, although the majority of reported cases are susceptible to standard antibiotic regimens, the emergence of multi-drug resistant strains may pose a serious risk to debilitated patients, and thus requires due consideration to further prevent increased virulence, especially in frail individuals.

Here we described a case of refractory sepsis caused by *Raoultella planticola* in a patient with history of cancer on current chemotherapy and recent abdominal surgery. The patient's gastrointestinal tract has probably been colonized with *R. planticola* and the leakage of intestinal luminal contents and gut flora after anastomosis insufficiency was the likely route of the infection. Even though, *R. planticola* as a sole pathogen had been isolated from blood cultures in the present case, intestinal bacterial translocation could also accelerate the patient's development of refractory septic shock. In the present case, empiric administration of colymicin, meropenem and teikoplanin had been initiated prior to the development of septic shock and isolated organisms were susceptible to both colymicin and meropenem. To the best of knowledge this report is the first description of a fatal septic shock caused by *R. planticola* with multidrug resistance (MDR) in Turkey. As limited data is available regarding this pathogen and its virulence, the mechanism of its pathogenesis in the present case with poor outcome remained unclear. We cannot assert whether the clinical course was associated with *R. planticola* bacteremia; however, it may have played a critical role in the development of fatal septic shock. Further research regarding its virulence is necessary.

4. Conclusion

We reported a rare case of fatal sepsis caused by *Raoultella planticola* in a patient with pancreatic cancer on current chemotherapy and recent abdominal surgery. This paper contributes to the growing body of research on the negative effect of the *R. planticola* bacteria on immunocompromised patients by significantly increasing the likelihood of antibiotic resistance and septic shock, thus resulting in fatal outcomes. As limited data is available regarding this pathogen and its virulence, our paper aims to highlight the importance of further research on this subject.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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