Case report

A rare case of *Raoultella planticola* urinary tract infection in an immunocompromised patient with multiple myeloma

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**A B S T R A C T**

**Introduction:** *Raoultella planticola* is a gram-negative rod associated with soil and aquatic environments that has rarely been associated with human infections.

**Presentation of case:** We present the case of a 73 year old female with multiple myeloma and recurrent *Clostridium difficile* infection who was found to have a urinary tract infection with *Raoultella planticola*, which has only been reported to cause 29 cases of human infections and 2 cases of urinary tract infections.

**Discussion and conclusion:** Our case and literature review suggest that immunocompromised patients are predisposed to developing *Raoultella planticola* infection, and that this is a potential emerging pathogen.

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**Introduction**

*Raoultella planticola* is a gram-negative, non-motile rod that was first described in the 1980s as *Klebsiella planticola* and *Klebsiella trevisanii* [1]. It was reclassified into a new genus in 2001, along with *Raoultella ornithinolytica*, and *Raoultella terrigena* [2]. This organism is associated with soil, plant, and aquatic environments, and is a very rare human pathogen. Save for two cases of *Klebsiella trevisanii* in 1986 [3], no other human infections had been reported in the medical literature until 2007 [4], and only 29 cases have been reported to date (with only 7 in the United States). Here, we present a case of *Raoultella planticola* urinary tract infection in an autologous stem cell transplant recipient.

**Case presentation**

The patient is a 73 year old female with a history of stage IIIA IgA kappa multiple myeloma who was treated with four cycles of cyclophosphamide/bortezomib/dexamethasone and subsequently underwent an autologous stem cell transplant following melphalan conditioning. She demonstrated relapse of her multiple myeloma three years thereafter and was treated with two cycles of lenalidomide and dexamethasone, three cycles of carfilzomib on a Southwest Oncology Group study, and three cycles of vincristine/BCNU/cyclophosphamide/prednisone. She underwent another autologous peripheral blood stem cell transplant following melphalan conditioning with her post-transplant course complicated by posterior reversible encephalopathic syndrome (PRES) diagnosed by MRI, hypertension, atrial fibrillation, and *Clostridium difficile* diarrhea treated with oral vancomycin. She presented to the hospital with a fever of 102.7 and no other symptoms other than mild loose stools which she stated she had for months.

Her initial vital signs were pertinent for hypotension to 94/66 mm Hg, tachycardia of 108 bpm, and leukocytosis to 10.1 thou/mm\(^3\) (baseline 3–5 thou/mm\(^3\)). She was started on intravenous vancomycin, cefepime, metronidazole, and oseltamivir. Her oral vancomycin was continued. Two sets of blood cultures and a respiratory viral panel were negative, but *Clostridium difficile* PCR was again positive. Other stool studies including Giardia, Cryptosporidium, Vibrio, Yersinia, and ova & parasites were negative. Fidaxomycin was not started. She was continued on oral vancomycin 125 mg every 6h with plans for a prolonged vancomycin taper and eventually defervesced. Seven days later she became febrile to 102.2 F with associated dysuria.

Urinalysis was positive for nitrite and 230 white blood cells/hpf. She was started on empiric cephalexin awaiting culture results. Urine cultures finalized as >100,000 col/ml *Raoultella planticola* sensitive to amikacin, cefoxitin, ciprofloxacin, levofloxacin, meropenem, nitrofurantoin, piperacillin/tazobactam, and trimethoprim/sulfamethoxazole. It was resistant to ampicillin, cefazolin, ceftazidime, ceftriaxone, gentamicin, and tobramycin. This was confirmed with a Vitrek 2 biochemical identification system with a 99% probability.

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She was started on a 7-day course of nitrofurantoin 100 mg twice daily and her symptoms resolved. She was successfully discharged from the hospital on the remainder of her course of nitrofurantoin and oral vancomycin taper for her *Clostridium difficile*.

**Discussion**

This patient developed dysuria on the twelfth day of hospitalization while being treated with antibiotics for recurrent *Clostridium difficile* infection. Further workup revealed that this was due to a *Raoultella planticola* urinary tract infection, the third case reported thus far in the medical literature [5,6]. This rare pathogen has been isolated from soil and aquatic environments, but has not been commonly associated with human infections. *Raoultella planticola* infections have been most frequently reported in patients with malignancy [7–12], or were otherwise immunocompromised (diabetes [13,14], dialysis-dependent renal failure [15], and post-transplant [16]).

A comprehensive literature search reveals a total of 29 published cases of *Raoultella planticola* infections in humans (Table 1). *Raoultella planticola* has been associated with four cases of pneumonia [3,7,8,17], five cases of conjunctivitis [18,19], two cases of urinary tract infection [5,6], one case of cystitis [20], two cases of prostatitis [16,21], four cases of cholangitis [9-11,22], two cases of cholecystitis [14,23], one case of peritonitis [15], one case of necrotizing fasciitis [13], one case of cellulitis [24], one case of pancreatitis [4], two cases of soft tissue post-surgical infection [8,25], and three cases of bacteremia [3,12,26]. Of the 29 reported cases, three patients died (10.3%), 22 had full recovery, and four patients had unknown outcomes. In addition, it is interesting to note that epidemiologically, 7 cases (24.1%) occurred in the United States, with 4/7 in the northeast. This particular case of *Raoultella planticola* infection marks the first reported case in the Southeastern United States.

The earliest reported human infection with *Klebsiella trevisanii* (later classified as *Raoultella planticola*) was in 1986, bacteremia in a 69 year old patient [3]. The first human infection after genus reclassification to *Raoultella planticola* was in 2007, pancreatitis in a 45 year old male [4]. While the number of cases have relatively been on the rise recently, this cannot be explained on its reclassification from a Klebsiella genus to Raoultella genus as this change occurred in 2001, and the Vitek 2 biochemical identification system is highly sensitive in differentiating between Raoultella and Klebsiella.

Upon isolating this organism on urine culture, further conversation with the patient revealed that although she did occasionally garden, she did not have any open wounds, did not handle soil, did not ingest or wash her clothes with well or stream water, or have any other risk factors which would have predisposed her to a *Raoultella planticola* UTI. She worked with a consulting business and did not have any occupational exposures. Although no urine culture was performed on admission, the fact that she did not develop dysuria until 12 days after admission (along with continuing her course of oral Vancomycin for *Clostridium difficile*) suggests that this infection was not present on admission.

It is likely that immunosuppression (due to her chemotherapy as well as autologous peripheral stem cell transplant within the past 3 months) gives a possible explanation as to why this patient was predisposed for this specific infection, either as a dormant colonizer or opportunistic infection, as has been postulated in the literature [14]. As there is limited data regarding this pathogen, especially in humans, the mechanism of its pathogenesis remains unclear. Additionally, in the aforementioned 29 cases of human infection, a variety of organ systems are affected, with no predilection for a particular organ system.

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**Table 1**

**Summary of reported cases of *Raoultella planticola* human infections.**

| Author                  | Date reported | Clinical manifestation | Culture site            | Age/Sex | Region | Outcome   |
|-------------------------|---------------|------------------------|-------------------------|---------|--------|-----------|
| Freney et al. [3]       | 1986 May      | Bacteremia             | Blood                   | 69/F    | France | Recovered |
| Freney et al. [3]       | 1986 May      | Pneumonia              | Blood, sputum           | 57/F    | France | Recovered |
| Alves et al. [4]        | 2007 May      | Prostatitis            | Peritoneal fluid        | 45/M    | Brazil | Recovered |
| Castanheira et al. [8]  | 2009 December | Pneumonia              | Blood                   | 83/F    | Ohio   | Died      |
| Castanheira [8]         | 2009 December | Soft-tissue            | Blood                   | 64/M    | New Jersey | Died |
| O’Connell et al. [28]   | 2010 August   | Cellulitis             | Wound                   | 30/M    | Ireland| Recovered |
| Wolcott and Dowd [25]   | 2010 August   | Soft-tissue            | Unknown                 | 66/M    | Texas  | Unknown   |
| Yokota et al. [9]       | 2012 March    | Cholangitis            | Blood                   | 65/M    | Japan  | Improved, transferred |
| Kim et al. [13]         | 2012 March    | Necrotizing fasciitis  | Abdominal fluid         | 66/M    | South Korea | Recovered |
| Teo et al. [23]         | 2012 May      | Cholecystitis          | Gallbladder fluid       | 62/F    | UK     | Recovered |
| Hu et al. [10]          | 2012 October  | Cholangitis            | Blood                   | 59/M    | Ontario, Canada | Recovered |
| Olson et al. [5]        | 2013 February | UTI                    | Urine                   | 89/M    | New Mexico | Recovered |
| Puerta-Fernandez et al. [26] | 2013 May       | Bacteremia             | Blood                   | 63/M    | Spain  | Recovered |
| Koukoulaki et al. [16]  | 2014 June     | Prostatitis            | Urine                   | 67/M    | Greece | Recovered |
| Lam and Salt [12]       | 2014 July     | Bacteremia             | Blood                   | 56/F    | Ontario, Canada | Recovered |
| Zuberbuhler et al. [18] | 2014 October  | Conjunctivitis         | Conjunctival swab       | 58/F    | UK     | Recovered |
| Salmaggi et al. [11]    | 2014 November | Cholangitis            | Blood                   | 70/M    | Italy   | Recovered |
| Ershadi et al. [14]     | 2014 December | Cholecystitis          | Biliary fluid           | 49/M    | Connecticut | Recovered |
| Gonzalez-Gonzalez et al. [22] | 2015 March | Cholangitis           | Unknown                 | Unknown | Unknown | Unknown |
| Xu et al. [7]           | 2015 April    | Pneumonia              | Sputum                  | 60/M    | China  | Died      |
| Ganguanugo and Saul [6] | 2015 October  | UTI                    | Urine                   | 92/F    | Connecticut | Recovered |
| Yoon et al. [20]        | 2015 October  | Cystitis               | Urine                   | 1/M     | South Korea | Recovered |
| Kim et al. [15]         | 2015 December | Pyelonephritis         | Peritoneal fluid        | 65/M    | South Korea | Recovered |
| Cho et al. [17]         | 2016 January  | Pneumonia              | Sputum                  | 58/M    | South Korea | Recovered |
| Vassallo et al. [19]    | 2016 April    | Conjugative            | Conjugative swab        | 88/F    | Malta  | Recovered |
| Vassallo et al. [19]    | 2016 April    | Conjugative            | Conjugative swab        | 71/M    | Malta  | Unknown   |
| Vassallo et al. [19]    | 2016 April    | Conjugative            | Conjugative swab        | 15/F    | Malta  | Unknown   |
| Vassallo et al. [19]    | 2016 April    | Conjugative            | Conjugative swab        | 69/F    | Malta  | Recovered |
| Gian and Cunha [21]     | 2016 May      | Prostatitis            | Prostatic fluid         | 53/M    | New York | Recovered |
| Skelton                 |               |                        |                         |         |        |           |
|                        |               |                        |                         |         |        |           |
Conclusion

In conclusion, *Raoultella planticola* is a rare human pathogen which can cause a variety of infections. Patients who are exposed to contaminated soil products or are immunocompromised are at increased risk to developing this infection. While it is unclear why the number of human *Raoultella planticola* infections are on the rise, it is prudent to be aware of this potential pathogen in this patient population, and like all human pathogens, closely monitor its patterns of antibiotic resistance.

Conflict of interest statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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