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The first case of *Raoultella planticola* infective endocarditis in a 4 year old child: A case report and review of literature

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ABSTRACT

Infective endocarditis is a complication of bacteremia that can lead to serious morbidity and even mortality if not appropriately treated, well known organisms commonly lead to this condition in many repeated scenarios so they are usually recognized and treated, but if it was caused by other organisms its detection and treatment can be harder. *Raoultella planticola*, a low virulent organism used to be part of the *Klebsiella* species, has been found in many reports to cause multiple human conditions. In this article, a novel case of *R. planticola* is reported, and the organism was reviewed in many aspects for clinician to be able to recognize this infection and manage it in a more effective way.

1. Introduction

Raoultella planticola, formerly known as *klebsiella trevisanii* or *klebsiella planticola*, is a gram-negative, oxidase-negative, and facultative anaerobic rod that is part of the Enterobacteriaceae family [1,2]. It used to be recognized as a low virulent organism, which was found in aqueous, soil, and plant environments [3]. It was first described to cause human infection in 1984 in a case report by Freney et al. where *K. trevisanii* caused bacteremia in his patient, who was treated successfully and recovered [4]. Later in the 21st century, especially after 2012, many reports were published finding this organism to appear in multiple clinical presentations, including UTI, bacteremia, biliary tract infection, and pneumonia. *Raoultella planticola* is an organism that rarely causes human infection, especially in the pediatric population, where we only found five previously reported cases in comparison to 33 cases in older populations. To our knowledge, there is no formerly reported case of this organism causing bacterial endocarditis, so this case is the first report of *Raoultella planticola* causing endocarditis.

In this report, the literature was also reviewed for any case reports about *Raoultella planticola*, and all case reports found were reviewed [5–38]. Pediatric cases are summarized in Table 1 [5–9]. For each case, we show the type of antibiotics used and the duration for each course, in addition to the clinical sequalae for each patient.

2. Case report

This patient is a 4-year-old boy with a known case of GERD, hiatal hernia, cleft palate repair at 1 year of age, and esophageal stricture and was admitted for investigation and management as a case of failure to thrive and poor oral intake in the last 2 months. The initial CBC, U/E, coagulation profile, iron profile, thyroid function, and urinalysis were within the normal range. A MRSA screening was done, and his nasal culture was positive for MRSA. Within several days of admission, the patient started to spike a fever, at around 38 °C. Blood and urine cultures were taken, respiratory viral PCR was done for him, and a PICC line was inserted to start TPN. The patient was started empirically on vancomycin and ceftazidime. His multiplex respiratory PCR was positive for adenovirus and bocavirus, his urine culture was negative, but the blood culture isolated a gram-negative rod, and an echocardiogram was done to rule out vegetation where it showed a mobile

Abbreviation: K, *Klebsiella*; R, *Raoultella*; GERD, gastroesophageal reflux disease; UTI, urinary tract infection; CBC, complete blood count; U/E, urea and electrolytes; PCR, polymerase chain reaction; PICC, peripherally inserted central catheter; BSI, bloodstream infection.

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Table 1
Pediatric reported cases of R. planticola.

No	Gender	Age	Clinical Manifestation/s	Identification Specimen/s	Abx used	Course duration	Immunity status	Clinical sequalae	Region	Author	Reported date
1	Female	2 m	UTI	Urine	Cefalexin	10 days	Competent	Recovered	USA	Howell C, Fakhoury J [5]	Apr 04, 2017
2	Female	34 PN*	Conjunctivitis	Eye swab	Piperacillin-tazobactam	14 days	Competent	Recovered	Turkey	S. Atıcı et al. [6]	Jan 01, 2017
3	Female	15 m	CVC exit site infection	Site swab	ampicillin, gentamicin	10 days	Competent	Recovered	KSA	B. Nada and M. Areej [7]	Sep 22, 2013
4	Male	16 y	Oral mucositis	Lesion swab	Amikacin & Ceftazidime	8 days	Competent	Recovered	Italy	E.Bardellini et al. [8]	May 23, 2016
5	Male	16 m	UTI	Urine	Course 1	10 days	Competent	Recovered	South Korea	JH Yoon et al. [9]	Nov 11, 2014

Abbreviations: m: month/s, y: year/s, PN: post-natal day, Abx: Antibiotics, UTI: urinary tract infection, PD: peritoneal dialysis, IOPL: Intraoperative peritoneal lavage, CA: Clavulanic Acid, IV: intravenous, P.O: Oral, IM: intramuscular, CVC: central venous catheter.
Course 1: intravenous cefotaxime and ampicillin/sulbactam for 6 days then oral cefpodoxime for 4 days with total of 10 days.
* Patient is preterm 28 weeks.
Age grouping as follows:
0 to <18 Pediatrics.
18 to <65 Adults.
65 or more Elderly.

flickering structure in the right atrium, which was suspected of being a vegetation or a thrombus. The abdominal ultrasound was normal, and a chest X-ray showed minimal atelectatic changes in the left retrocardiac area and a mild bronchial wall thickening. The line was removed, and the organism was isolated and identified by the lab as *Raoultella planticola*, which was found to be resistant to ampicillin and susceptible to other beta-lactams, so the antibiotics were changed to ceftriaxone and gentamycin for a better synergistic effect. The patient planned to continue antimicrobial therapy, but during the course, the patient left earlier than planned.

3. Discussion

The patient developed a fever a few days after admission, which makes his infection considered to be hospital acquired. In the literature review, it was found that several cases of *Raoultella planticola* were nosocomial infections, and the treatment is usually a continued empirical coverage or included in the antibiotic coverage of other co-existing infections. However, many patients were shifted to different antibiotics due to resistance or better coverage in regard to this organism. In the reviewed case reports, overall, UTI was the most common clinical presentation for *Raoultella planticola* with about eight reports, followed by bacteremia with six, biliary tract infections (cholangitis or cholecystitis) with five, and pneumonia with four. *Raoultella planticola* is usually sensitive to beta lactams (except for ampicillin) and commonly used beta lactams are 3rd generation cephalosporins (Ceftriaxone and cefotaxime). Another antibiotic commonly used is ciprofloxacin, where it was used in about 10 patients reported, and those reports are for adults and the elderly. In regard to pediatrics, there were only 5 cases reported, and the course of antibiotics was different in almost every patient. Extended spectrum beta lactamase (ESBL) and multidrug resistance (MDR) were also reported in several cases of *Raoultella planticola*, and they were occasionally associated with unfavorable outcomes [39,40]. Fortunately, all pediatric cases reported in this article review are well-treated and associated with very good outcomes even though other comorbidities are frequently associated with their infections. This includes other infections and poor immunity status since most of the cases overall were immunocompromised.

A retrospective single-center study published in 2016 over a four-year period in the time between January 2011 and December 2015 evaluated over 1000 culture samples. It reported 42 isolates of *Raoultella planticola* had revealed that nosocomial BSI was the most frequent presentation of *Raoultella planticola*, and the risk factors may include ICU stay and presence of indwelling catheters. In regard to antibiotic susceptibility and resistance, they reported that carbapenems and aminoglycosides were the most effective *against Raoultella planticola* with the possibility of resistance where seven isolates showed ESBL (five blood, two urine) and three isolates showed carbapenems resistance type blaOXA-48 (all from blood). All patients included in their study recovered [41].

Another retrospective single-center study published in 2015 over a five-year period from January 2010 to December 2014 included other *Raoultella* spp. It revealed most infections to be community-acquired. In regard to the 32 *Raoultella planticola* isolates in their study, it showed a predominance of urine isolates. They were 56.3% (18 isolates) followed by blood 12.5% (four isolates), and all isolates were susceptible to third-generation cephalosporins, fluoroquinolones, and aminoglycosides. Furthermore, they did not find any carbapenemase-producing *Raoultella* in their study [42].

4. Conclusion

Raoultella planticola has shown to cause many human infections, and its route of invasion is still undetermined. However, a common factor in many reports is that its infection usually takes place after a foreign body introduction, especially in immunocompromised populations who are more prone to low virulent organisms infections. Other risk factors that were reported were ICU stays and the presence of indwelling catheters.

Further to the reviewed reports, we recommend the following:

- *Raoultella planticola* should be suspected after procedural interventions in immunocompromised patients.
- It should also be suspected in immunocompromised patients who had trauma in or were exposed to soil, plant, or aqueous settings.
- Given its similarities to *Klebsiella* and multiple reports in this review, clinicians should expect multidrug resistance capacity of *Raoultella planticola* and treat it in accordance with its susceptibility.

Conflict of interest

The corresponding author on behalf of all the authors declares that there is no conflict of interest.

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