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 was 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 sequelae 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...
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 those reports are for adults and the elderly. The course of antibiotics was different in almost every patient. In regard to pediatrics, there were only 5 cases reported, and those reports are for adults and the elderly. The 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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