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Research Article

Clinical profile and treatment outcomes of patients with urinary tract ınfections caused by raoultella planticola

Raoultella planticola kaynaklı idrar yolu enfeksiyonu olan hastaların klinik profili ve tedavi sonuçları

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Abstract

Aim: This study aimed to evaluate the clinical characteristics, treatment approaches, and outcomes in patients diagnosed with urinary tract infections (UTIs) caused by Raoultella planticola.

Material and Methods: This retrospective study included 25 adult patients with culture-confirmed Raoultella planticola UTIs admitted between January 2010 to January 2021. Clinical data such as demographics, presenting symptoms, comorbidities, laboratory findings, antibiotic treatments, and patient outcomes were retrospectively analyzed.

Results: The mean patient age was 67.8 ± 16.8 years. The most frequent comorbidities included diabetes mellitus (28%), chronic heart failure (24%) and chronic renal failure (24%). Anemia (64%), bacteriuria (60%), arthritis (56%), and altered sensorium (52%) were the most common clinical presentations. Bacteremia was identified in all patients. Acute cystitis was diagnosed in 80% of cases, while sepsis was identified in 20%. Ceftriaxone (32%) and ciprofloxacin (24%) were the most frequently administered antibiotics. The median hospital stay was 5 days (IQR: 3-14). Two patients died during hospitalization (8% mortality); both had bacteremia without sepsis criteria, and one had underlying pancreatic cancer.

Conclusion: Raoultella planticola UTIs predominantly affect older adults with significant comorbidities. While generally responsive to standard antimicrobial therapy, mortality may occur, particularly in patients with bacteremia and severe underlying diseases.

Keywords: Raoultella planticola, urinary tract infections, bacteremia, antibiotic therapy, clinical outcomes, mortality

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Öz

Amaç: Bu çalışmanın amacı, Raoultella planticola kaynaklı idrar yolu enfeksiyonu (İYE) tanısı alan hastaların klinik özelliklerini, uygulanan tedavi yöntemlerini ve tedavi sonuçlarını değerlendirmektir.

Gereç ve Yöntemler: Ocak 2010 ile Ocak 2021 tarihleri arasında, kültür ile doğrulanmış Raoultella planticola kaynaklı İYE tanısı ile yatırılan 25 erişkin hasta retrospektif olarak incelendi. Hastalara ait demografik veriler, başvuru semptomları, eşlik eden hastalıklar, laboratuvar bulguları, uygulanan antibiyotik tedavileri ve klinik sonuçlar değerlendirildi.

Bulgular: Hastaların ortalama yaşı 67,8 ± 16,8 yıldı. En sık görülen eşlik eden hastalıklar diyabetes mellitus (%28), kronik kalp yetmezliği (%24) ve kronik böbrek yetmezliği (%24) idi. Başvuruda en sık gözlenen klinik bulgular anemi (%64), bakteriüri (%60), artrit (%56) ve bilinç değişikliği (%52) idi. Tüm hastalarda bakteremi tespit edildi. Hastaların %80'inde akut sistit tanısı konurken, %20'sinde sepsis saptandı. En sık uygulanan antibiyotikler seftriakson (%32) ve siprofloksasin (%24) idi. Medyan hastanede kalış süresi 5 gün olarak bulundu (IQR: 3-14). Hastane yatışı sırasında iki hasta (%8) hayatını kaybetti; her iki hastada da bakteremi mevcuttu ancak sepsis kriterlerini karşılamıyorlardı ve bir hastada altta yatan pankreas kanseri vardı.

Sonuç: Raoultella planticola kaynaklı idrar yolu enfeksiyonları çoğunlukla ileri yaşta ve ek hastalığı olan bireyleri etkilemektedir. Bu enfeksiyonlar genellikle standart antibiyotik tedavisine iyi yanıt verse de, özellikle bakteremi ve ağır komorbiditeleri olan hastalarda mortalite görülebilmektedir.

Anahtar kelimeler: Raoultella planticola, idrar yolu enfeksiyonları, bakteremi, antibiyotik tedavisi, klinik sonuçlar, mortalite

Introduction

Raoultella (R.) planticola, previously known as Klebsiella planticola, is a gram-negative, aerobic, non-motile bacterium that belongs to the Enterobacteriaceae family (1, 2). Initially considered innocuous, it is commonly found in soil and aqueous environments. However, in recent years, there has been an increasing number of reports highlighting severe infections associated with R. planticola (3, 4). Despite being known as a pathogen for several decades, the management of R. planticola infections continues to pose challenges for clinicians due to limited published data, similar to the predicament faced with other rare pathogen infections (4).

Though R. planticola has rarely been implicated in urinary tract infections (UTIs) (5, 6), it has caused a range of opportunistic infections in humans, including cases of bacteremia, pneumonia, hepatobiliary infections, and UTIs (7, 8). Most reported patients have had underlying immunosuppression, comorbid illnesses, or recent invasive procedures, suggesting that R. planticola primarily causes infection in vulnerable hosts (6). These features raise concerns about missed identification and appropriate management of this unusual pathogen. The main concern for the physicians lies beneath carbapenem-resistant nosocomial R. planticola infections, thus originating from a resistant strain of genes (9, 10).

To date, published data consist mainly of individual case reports and small case series, highlighting a substantial knowledge gap. A recent 5-year review from a single center identified only 37 cases of R. planticola bacteriuria, u nderscoring the rarity of this infection even in large hospitals (11). Research on R. planticola urinary tract infections in Turkey primarily comprises case reports (12-14), and detailed demographic and clinical profiling of affected patients remains insufficiently studied.

We hypothesized that UTIs caused by R. planticola, though rare, have distinct clinical characteristics and outcomes that have not been fully described in the literature. In light of the gaps in current knowledge, the aim of the present study was to investigate the clinical profile and treatment outcomes of UTI patients with R. planticola in Turkey. By characterizing these cases, we seek to provide the first detailed account of the patient demographics, risk factors, clinical course, and responses to therapy for this unusual uropathogen in our region.

Material and Methods

A retrospective study was conducted on patients who were diagnosed with UTIs and whose urine cultures were positive for R. planticola, in the Internal Medicine Department of Maltepe University Faculty of Medicine from January 2010 to January 2021. The study was approved by the Maltepe University Clinical Research Ethics Committee (Date: 02.05.2023, Approval No: 2023/900/26) and was carried out in accordance with the relevant ethical guidelines and the Helsinki Declaration (2013 Brazil revision). The need for informed consent was waived under the approval of the Local Ethics Committee due to the retrospective design.

During the study period, patients diagnosed with UTIs were retrospectively evaluated. Inclusion criteria included patients over 18 years of age with confirmed R. planticola in urine cultures and complete demographic and clinical data. Patients younger than 18 years, those without bacterial growth, and cases with incomplete data were excluded. Twenty-five patients meeting the defined inclusion and exclusion criteria were selected for the analysis.

Data Collection

The hospital's electronic information system and patient files were used to gather demographic and clinical data at both the admission and discharge periods. Demographic data collected included age, gender, body mass index (BMI), and comorbidities. Patients' clinical symptoms were documented as bacteremia, anemia, bacteriuria, arthritis, altered sensation, fatigue, fever, dysuria, increased urination frequency, and flank pain. Clinical data comprised blood parameters such as white blood cell (WBC) count, platelet count, and creatinine levels, antibiotic types, duration of hospitalization, presence or absence of sepsis, and survival outcomes.

Diagnosis

Identification of the isolate as R. planticola was achieved by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) using the VITEK MS system (bioMérieux, Marcy l'Étoile, France). Antimicrobial susceptibility testing was conducted with the VITEK-2 Compact System. The VITEK 2 GN card (REF 21341) was used for identification, and the VITEK 2 AST-N420 card (REF 424039) was employed to determine antimicrobial susceptibility, including testing for carbapenem sensitivity. The microorganism was isolated from both blood and urine cultures. Interpretation of susceptibility results was based on the criteria defined by the European Committee on Antimicrobial Susceptibility Testing (EUCAST).

Statistical Analysis

The SPSS 26.0 (IBM Corporation, Armonk, New York, United States) program was used to analyze the variables. The conformity of the data to the normal distribution was evaluated with the Shapiro-Wilk test. Quantitative variables were summarized as mean ± standard deviation (SD) and categorical variables as frequency and percentage. Data exhibiting a normal distribution were presented as mean ± standard deviation, and comparisons between groups were made using the Student's T-test. Non-normally distributed data were displayed as median (interquartile range (IQR): 25-75 percentiles) and comparisons between groups were conducted using the Mann-Whitney U test. A p-value below 0.05 was considered statistically significant.

Results

The mean age of the patients was 67.8 ± 16.8 years (range: 26 – 91 years). The mean BMI was 26.6 ± 2.7 kg/m^2 (range: 18.1–37.2 kg/m^2). None of the subjects were alcohol users, and only six of them (24%) were former or current smokers. The most frequent comorbidities included diabetes mellitus (28%), chronic heart failure (24%) and chronic renal failure (24%) (Table 1). Additionally, one patient (a 76-year-old male) was using steroids and undergoing chemotherapy.

Table 1. Demographic profile of patients.

Variables	All population n = 25
Age, years	67.8 ± 16.8
Female gender, n (%)	9 (36.0)
BMI, kg/m2	26.6 ± 2.7
Smoking, n (%)	6 (24.0)
Comorbidities, n (%)	
No	3 (12.0)
Yes	22 (88.0)
Diabetes mellitus	7 (28.0)
Chronic heart failure	6 (24.0)
Chronic renal failure	5 (20.0)
Chronic obstructive pulmonary disease	4 (16.0)
Rheumatoid arthritis	3 (12.0)
Asthma	2 (8.0)
Dementia	1 (4.0)
Lymphoma	1 (4.0)
Paraplegia	1 (4.0)
Pancreatic cancer	1 (4.0)

The data are expressed as the mean ± SD, median (IQR), or frequency (%).

Clinical symptoms and laboratory findings of the 25 patients are summarized in Table 1. Anemia (64%), bacteriuria (60%), arthritis (56%), and altered sensorium (52%) were the most commonly observed clinical symptoms, with fatigue and fever noted less frequently (each 40%). Dysuria and increased urinary frequency occurred in 20% of cases, while flank pain was rare (8%). At hospital admission, 24% (n=6) of patients had a glomerular filtration rate (GFR) below 50 mL/min, and 4% (n=1) had a GFR below 10 mL/min. Bacteremia was identified in all patients. Acute cystitis was diagnosed in 80% of cases, while sepsis was identified in 20%. It is important to note that these percentages indicate overlapping diagnoses, as patients often presented simultaneously with multiple clinical conditions (e.g., bacteremia with acute cystitis or sepsis) (Table 2).

Table 2. Clinical symptoms, laboratory findings and diagnosis of patients.	
Variables	All population n = 25
Clinical symptoms, n (%)	
Anemia	16 (64.0)
Bacteriuria	15 (60.0)
Arthritis	14 (56.0)
Altered sensorium	13 (52.0)
Fatigue	10 (40.0)
Fever	10 (40.0)
Dysuria	5 (20.0)
Increased urinary frequency	5 (20.0)
Flank pain	2 (8.0)
Laboratory findings	
HgA1C, %	6.1 ± 1.1
GFR	70.0 ± 24.9
< 50 mL/min	7 (28.0)
WBC, ×103/uL	9.8 (9.0-11.2)
Platelets, ×103/uL	255.0 (189.0-325.0)
Creatinine, mg/dL	1.0 (0.9-1.2)
Lactic acid, mmol/L	1.6 ± 0.3
Diagnosis, n (%)	
Bacteremia	25 (100.0)
Acute cystitis	20 (80.0)
Sepsis	5 (20.0)
The data are expressed as the mean ± SD, median (IQR), or frequency (%).	

The primary treatment options administered were ceftriaxone in 32% of cases, followed by ciprofloxacin in 24%, ertapenem in 16%, levofloxacin in 12%, and meropenem in 12%. Five subjects (20%) received combination therapy. The median length of hospital stay (LOS) was 5 days, ranging from 1 to 40 days (IQR: 3-14). Treatment outcomes resulted in 92% of patients being discharged from the hospital, with an overall mortality rate of 8% (Table 3).

Table 3. Treatment and patient outcome.	
Variables	All population n = 25
Antibiotic, n (%)	
None	3 (12.0)
Ceftriaxone	8 (32.0)
Ciprofloxacin	6 (24.0)
Levofloxacin	3 (12.0)
Ertapenem	4 (16.0)
Meropenem	3 (12.0)
Combination therapy, n (%)	5 (20.0)
Length of hospital stay, days	5 (3-14)
Mortality, n (%)	2 (8.0)
The data are expressed as the median (IQR) or frequency (%).	

Discussion

In the current literature, data regarding urinary tract infections associated with R. planticola prior to 2021 is notably limited. However, in 2021, Alampoondi Venkataramanan identified a total of 37 R. planticola isolates over a 5-year study period (11). Our series of 25 patients thus represents one of the largest clinical cohorts to date, enabling a more robust characterization of the infection's features. Overall, our findings confirm that R. planticola UTIs tend to occur in older adults with significant comorbidities, and they generally respond well to appropriate antimicrobial therapy, in line with the scattered case reports and small series available for comparison.

The demographic profile in our cohort reinforce that R. planticola UTIs tend to occur opportunistically in vulnerable hosts – typically elderly individuals with comorbid conditions – rather than healthy populations. Risk factors such as older age, cancer, diabetes mellitus, immunosuppression, and impaired kidney function were identified as significant for R. planticola UTIs, consistent with risk factors for UTIs from other organisms (15-17). Alampoondi Venkataramanan et al., in their five-year retrospective review of R. planticola infections, reported a mean patient age of 77 years, highlighting a notable prevalence of diabetes mellitus and chronic kidney disease among these cases (11). Most literature cases likewise describe hosts with significant comorbidity or immune compromise. The first ever reported UTI due to R. planticola occurred in an 89-year-old man with multiple chronic conditions – including heart failure, chronic kidney disease, coronary artery disease, anemia, and other ailments (6) – illustrating the typical complexity of such patients. In a similar manner, many of our patients exhibited comorbidities, including diabetes, older age, and diseases potentially causing immunosuppression such as rheumatoid arthritis, asthma, pancreatic cancer, and lymphoma. These conditions align with known risk factors for R. planticola infection in general, such as immunosuppression, end-stage renal disease (especially dialysis dependence), malignancy, and recent medical interventions (6). Additionally, our series included a 76-year-old male patient who was receiving steroid therapy and chemotherapy. This observation echoes the findings of Venkataramanan et al., who noted that overt immunosuppressive therapy (e.g. chronic steroid use) was present in only 3 of 37 R. planticola UTI cases (11).

The clinical manifestations of R. planticola UTI in our series were largely similar to those of UTIs caused by more common gram-negative organisms, with some nuances due to patient age and comorbid status. The majority of patients presented with lower urinary tract symptoms such as dysuria, urinary frequency, and fever, often indistinguishable from routine UTI caused by

organisms like E. coli (18, 19). Notably, a substantial proportion of our patients – especially the very elderly – exhibited altered sensorium or confusion at presentation. This finding is in line with the report by Venkataramanan et al., where altered mental status was the most common presenting complaint among UTI patients with R. planticola, followed by fever (11).

In our cohort, sepsis developed in one-fifth of the patients. According to the study by Venkataramanan et al., 2 of 37 patients developed urosepsis, and another 2 progressed to septic shock (11). Previous studies have shown that approximately 10% to 30% of all sepsis cases could be attributed to UTIs (20-22). Although R. planticola has been historically viewed as a low-virulence environmental organism, our data and published cases make it clear that it can cause clinically significant illness, including frank sepsis, when host defenses are sufficiently compromised. Fager and Yurteri-Kaplan noted that R. planticola cystitis often occurred in immunocompromised or post-operative settings, and they identified cystitis as the single most common infection type associated with this organism (23).

R. planticola demonstrates inherent resistance to ampicillin through chromosomally encoded overexpression of class-A β-lactamase (24, 25). The pathogen's antimicrobial susceptibility pattern mirrors that of other Enterobacteriaceae such as Klebsiella. R. planticola isolates are generally susceptible to aminoglycosides, most cephalosporins, fluoroquinolones, and carbapenems (6, 14, 26). The treatment outcomes in our series were generally favorable. All patients received targeted antimicrobial therapy once R. planticola was identified, and the infection was cleared in the vast majority of cases. This is consistent with many cases reported in the literature (6, 9, 11, 22). However, mortality occurred in two patients. Both patients who died had concurrent R. planticola bacteremia, although notably neither met clinical criteria for sepsis at the time. One of these cases involved a patient with advanced pancreatic cancer, a serious comorbidity likely contributing to the poor outcome. This parallels case reports in high-risk patients: for instance, a fatal R. planticola sepsis was reported in an immunocompromised patient with pancreatic cancer (27). Moreover, evidence from R. planticola bacteremia studies supports the role of host factors in determining mortality. Chun et al. reviewed 20 cases of R. planticola bacteremia and found that 85% of patients had underlying malignancies; all infections that were monomicrobial responded to antibiotics with recovery, whereas the only fatalities occurred in polymicrobial or complicated cases (5).

This study has several limitations inherent to its design. First, the retrospective nature of the study introduces potential biases, particularly concerning data completeness and accuracy, as patient information was gathered from electronic records and clinical files. Some clinical details or patient outcomes might have been inadequately documented, potentially influencing the study's reliability. Second, the small sample size limits the generalizability of our findings due to the rare occurrence of Raoultella planticola infections. Third, being a single-center study further restricts the external validity, as the findings may not represent the clinical and microbiological characteristics seen in different geographic regions or healthcare settings. Lastly, due to the retrospective design, long-term follow-up and recurrence rates could not be evaluated, which are critical aspects for understanding the clinical course of infections caused by this rare pathogen. Future prospective, multicenter studies with larger cohorts and long-term follow-up are warranted to validate and expand upon these preliminary findings.

Conclusion

Our findings indicate that urinary tract infections caused by R. planticola typically occur in elderly patients with significant comorbidities, such as diabetes mellitus, chronic heart failure, and chronic renal failure. Although the clinical outcomes are generally favorable with appropriate antimicrobial therapy, the frequent association with bacteremia and potential for severe systemic complications, including sepsis, necessitate heightened clinical vigilance. The variable antimicrobial resistance patterns observed underline the importance of timely microbiological identification and susceptibility testing for optimal therapeutic management. Given the rarity and limited clinical awareness of R. planticola, clinicians should maintain a high index of suspicion in vulnerable patient groups, recognizing the potential severity and ensuring early initiation of targeted treatment.

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Conflicts of Interest

The author declare they have no conflicts of interest.

Ethics Approval

The study was performed in accordance with the Declaration of Helsinki, and was approved by the Maltepe University Clinical Research Ethics Committee (Date: 02.05.2023, Approval No: 2023/900/26).

Informed Consent

The need for informed consent was waived under the approval of the Local Ethics Committee due to the retrospective design.

Availability of Data and Material

The data that support the findings of this study are available on request from the corresponding author.

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