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Case Report
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# Urinary Tract Infection Caused by Multidrug-Resistant *Psychrobacter Phenylpyruvicus*: A Case Report

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**Abstract**

**Introduction:** *Psychrobacter phenylpyruvicus* is a rare Gram-negative, aerobic, oxidase- and catalase-positive, non-motile bacterium belonging to the family *Moraxellaceae*. Human infections associated with this microorganism are uncommon and mainly involve immunocompromised patients, causing conditions such as endocarditis, peritonitis, bacteremia, and wound infections. Urinary tract infection caused by this pathogen has been rarely described, and its antimicrobial susceptibility profile remains poorly characterized.

**Materials and Methods:** A 76-year-old female with insulin-dependent type II diabetes mellitus, arterial hypertension, hypercholesterolemia, fibromyalgia, surgically treated uterine cancer, and recurrent urinary tract infections underwent laboratory investigation in a primary healthcare setting. Urinalysis was performed using a ten-parameter Multistix method. Urine culture was carried out on Columbia blood agar, MacConkey agar, and Sabouraud dextrose agar. Microbial identification was performed using the RAPID REMEL® identification system. Antimicrobial susceptibility testing was conducted using the Kirby–Bauer disk diffusion method according to current EUCAST antimicrobial susceptibility testing recommendations, applying surrogate susceptibility criteria where species-specific breakpoints were unavailable.

**Results:** Urinalysis revealed significant pyuria, hematuria, and marked bacteriuria. Urine culture demonstrated monomicrobial growth of *Psychrobacter phenylpyruvicus* (>$10^5$ CFU/mL). The isolate exhibited resistance across multiple antimicrobial classes and fulfilled multidrug-resistant (MDR) criteria, showing susceptibility only to carbapenems and colistin.

**Conclusion:** This case highlights the clinical importance of uncommon opportunistic pathogens in susceptible patients and emphasizes the need for accurate laboratory identification and antimicrobial susceptibility testing to support effective therapeutic management.

**Keywords:** Psychrobacter phenylpyruvicus; multidrug resistance; urinary tract infection; antimicrobial susceptibility; opportunistic pathogen.

## Introduction

*Psychrobacter phenylpyruvicus* is a Gram-negative, aerobic, non-motile coccobacillus belonging to the family *Moraxellaceae*. The organism is catalase-positive and oxidase-positive and was previously classified as *Moraxella phenylpyruvica* before reclassification into the genus *Psychrobacter* [1-3]. Members of the genus *Psychrobacter* are commonly associated with cold environments and have been isolated from marine ecosystems, Antarctic environments, animals, and human clinical specimens [2–4].

Human infections due to *Psychrobacter species* are uncommon and relatively poorly documented in the literature. Reported clinical manifestations include bacteremia, infective endocarditis, peritonitis, surgical wound infections, skin lesions, and central nervous system infections [5–8]. Most reported cases involve immunocompromised patients or individuals with significant underlying diseases [5,8]. Because of the rarity of this organism and its phenotypic similarities with other Gram-negative microorganisms, including *Acinetobacter spp*. and *Pseudomonas spp.*, laboratory identification may be challenging and can potentially lead to underrecognition of clinically relevant infections [1,5]. Furthermore, antimicrobial susceptibility patterns among *Psychrobacter species* remain insufficiently characterized because of the limited number of documented clinical cases and the absence of well-established species-specific susceptibility criteria [5,9].

To the best of our knowledge, reports of urinary tract infections caused by *Psychrobacter phenylpyruvicus* remain extremely limited in the available literature, particularly in association with multidrug resistance.

The purpose of this study was to present the laboratory identification and antimicrobial susceptibility profile of a multidrug-resistant *Psychrobacter phenylpyruvicus* isolate recovered from urine culture in an elderly patient with recurrent urinary tract infections in a primary healthcare setting.

## Case Presentation

A 76-year-old female patient presented to a primary healthcare center because of urinary symptoms and a history of recurrent urinary tract infections. The patient initially reported low-grade fever for three days, which she attributed to a viral illness. On the fourth day, she developed a fever reaching 39°C and sought medical evaluation. Additional symptoms included dysuria, urinary frequency, and a sensation of heaviness in the lower abdominal region.

Past medical history included: former smoker status, insulin-dependent type II diabetes mellitus, arterial hypertension, hypercholesterolemia, fibromyalgia, surgically treated uterine carcinoma eight years previously, and recurrent urinary tract infections (three episodes within the previous eight months).

Laboratory blood investigations revealed elevated inflammatory markers and hematological abnormalities, including CRP 98 mg/L (reference range: 0–10 mg/L), WBC 21.09 $\times 10^3/\mu L$ with 87% neutrophils (reference range: 4.00–9.00 $\times 10^3/\mu L$), ESR 39 mm/h (reference range: 0–10 mm/h), hemoglobin 9.2 g/dL (reference range: 12–18 g/dL), hematocrit 27.1% (reference range: 36–56%), and platelet count 455 $\times 10^3/\mu L$ (reference range: 150–400 $\times 10^3/\mu L$). Renal function tests demonstrated elevated creatinine levels of 1.92 mg/dL (reference range: 0.50–1.10 mg/dL) and urea levels of 112 mg/dL (reference range: 13–50 mg/dL), suggestive of impaired renal function.

Patient characteristics and comorbidities are summarized in Table 1, and timeline of the present case is presented in Table 2.

**Table 1:** Patient's characteristics and comorbidities.

| Variable | Findings |
|---|---|
| Age | 76 years |
| Sex | Female |
| Smoking history | Former smoker |
| Diabetes mellitus | Type II insulin-dependent |
| Hypertension | Present |
| Hypercholesterolemia | Present |
| Fibromyalgia | Present |
| Previous malignancy | Uterine cancer |
| Recurrent UTIs | Three episodes/8 months |

**Table 2:** Timeline of the present case.

| Event | Details |
|---|---|
| Previous 8 months | Three recurrent urinary tract infections |
| Initial symptoms | Dysuria, urinary frequency, lower abdominal heaviness |
| Days 1–3 | Low-grade fever |
| Day 4 | Fever reaching 39°C and medical evaluation |
| Laboratory findings | Pyuria, hematuria, bacteriuria, elevated inflammatory markers |
| Urine culture | Psychrobacter phenylpyruvicus $>10^5$ CFU/mL |
| Susceptibility testing | Multidrug-resistant profile |
| Intervention | Intravenous meropenem treatment |
| Duration of therapy | 10 days |
| Outcome | Clinical improvement and sterile repeat urine culture |

## Materials and Methods

Urinalysis was performed using a ten-parameter Multistix methodology. Urine culture was conducted using the following culture media: Columbia blood agar, MacConkey agar, Sabouraud dextrose agar (Figure 1).


**Figure 1:** Colony morphology of Psychrobacter phenylpyruvicus isolated from the urine specimen of the present case on MacConkey agar (left) and Columbia blood agar (right).

Microbial identification was performed using the RAPID REMEL® identification system (Figure 2).

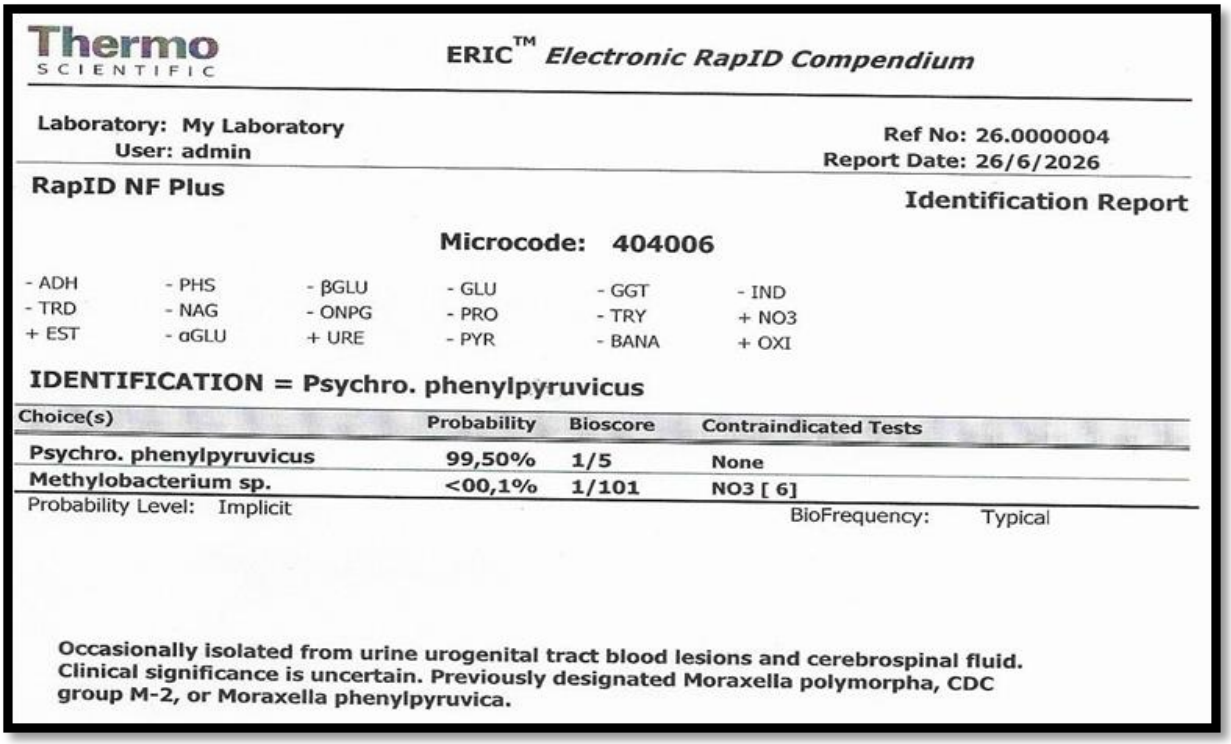


**Figure 2:** RAPID REMEL® identification of Psychrobacter phenylpyruvicus obtained from urine culture.

Antimicrobial susceptibility testing was carried out using the Kirby–Bauer disk diffusion method according to current EUCAST antimicrobial susceptibility testing recommendations. Since species-specific susceptibility breakpoints for *Psychrobacter phenylpyruvicus* are not well established, surrogate interpretive criteria for Gram-negative organisms were applied when necessary.

## Results

Urinalysis revealed significant pyuria, hematuria, and marked bacteriuria. Urine culture demonstrated monomicrobial growth of *Psychrobacter phenylpyruvicus* with bacterial growth exceeding $10^5$ CFU/mL.

Antimicrobial susceptibility testing demonstrated the following profile:

**Sensitive:**

- Carbapenems (Imipenem or Meropenem)
- Colistin

**Resistant:**

- Aminoglycosides (Kanamycin, Tobramycin, Gentamicin)
- Fluoroquinolones (Ciprofloxacin, Norfloxacin, Ofloxacin)
- Ampicillin
- Trimethoprim–sulfamethoxazole

• Tetracyclines
• Cephalosporins (Cefazolin, Cefuroxime, Ceftriaxone, Ceftazidime, Cefepime)
• Amoxicillin–clavulanic acid
• Piperacillin and Ampicillin–sulbactam

The antimicrobial susceptibility profile is summarized in Table 3.

**Table 3:** Antimicrobial susceptibility profile.

| Sensitive | Resistant |
|---|---|
| 1. Carbapenemes (Imipenem or Meropenem) | Aminoglycosides (Kanamycin, Tobramycin, Gentamicin) |
| 2. Colistin | Fluoroquinolones (Ciprofloxacin, Norfloxacin, Ofloxacin)<br>Ampicillin<br>Trimethoprim-sulfamethoxazole<br>Tetracyclines<br>Cephalosporins (Cefazolin, Cefuroxime, Ceftriaxone, Ceftazidime, and Cefepime)<br>Amoxicillin-clavulanic acid<br>Piperacillin and Ampicillin-sulbactam |

The isolate demonstrated non-susceptibility across multiple antimicrobial categories and fulfilled criteria for multidrug resistance, defined as resistance to at least one antimicrobial agent in three or more antimicrobial classes.

Based on the susceptibility findings and the patient's clinical condition, hospital admission was recommended. The patient was admitted to the Nephrology Department of a tertiary care hospital because of impaired renal function and clinical deterioration associated with infection and diabetes mellitus decompensation.

Intravenous meropenem therapy was administered for ten days because carbapenems represented the most appropriate therapeutic option according to the antimicrobial susceptibility profile. Colistin was not selected because of its known nephrotoxic potential and the patient's impaired renal function. Dose adjustment and renal function monitoring were performed throughout hospitalization.

Clinical improvement was observed during treatment. A repeat urine culture performed following completion of therapy demonstrated sterile urine culture findings. The patient was subsequently discharged from the hospital in improved clinical condition.

## Discussion

*Psychrobacter species* have traditionally been regarded as environmental organisms or contaminants with low pathogenic potential. However, accumulating evidence suggests that these microorganisms may act as opportunistic pathogens, particularly among elderly individuals and patients with underlying medical conditions [5,7–9].

Previously reported human infections caused by *Psychrobacter species* have mainly involved bacteremia, endocarditis, peritonitis, wound infections, and central nervous system infections [5–8]. In contrast, the present case describes urinary isolation of a multidrug-resistant strain, representing an uncommon clinical presentation.

A comparison of previously reported human infections caused by *Psychrobacter species* and the present case is summarized in Table 4.

**Table 4:** Literature comparison.

| Reference | Infection type | Species | Outcome |
|---|---|---|---|
| Stepanović et al., 2007 [6] | Surgical wound infection | *P. phenylpyruvicus*-like organism | Recovery |
| Caspar et al., 2013 [7] | Bacteremia | *P. arenosus* | Recovery |
| Kumaria et al., 2022 [8] | Shunt infection | *P. piechaudii* | Recovery |
| Present study | UTI | *P. phenylpyruvicus* | Hospital referral |

The limited number of documented cases in the literature makes the characterization of clinical behavior and antimicrobial resistance patterns of *Psychrobacter species* particularly important.

The patient described in the present report demonstrated several predisposing factors, including advanced age, diabetes mellitus, history of malignancy, and recurrent urinary tract infections. Such conditions may contribute to impaired host defenses and immune responses, facilitating colonization and infection by uncommon opportunistic microorganisms [10].

The isolate fulfilled criteria for multidrug resistance according to the international definition of acquired resistance, namely non-susceptibility to at least one antimicrobial agent in three or more antimicrobial classes [11]. The antimicrobial susceptibility profile observed in the present case is clinically notable because available data regarding resistance patterns among *Psychrobacter species* remain limited. Resistance across multiple antimicrobial categories may complicate empirical therapeutic decisions and further emphasizes the importance of laboratory-guided treatment strategies.

The present case further highlights the diagnostic challenges associated with uncommon microorganisms, as phenotypic identification systems may occasionally misidentify rare bacterial species because of overlapping biochemical characteristics. The rarity of urinary tract infections caused by *Psychrobacter phenylpyruvicus* further underlines the importance of accurate identification and susceptibility testing

in order to guide appropriate antimicrobial management. Early microbiological diagnosis combined with susceptibility-guided antimicrobial therapy may contribute to improved antimicrobial stewardship and help reduce inappropriate empirical antibiotic use.

### Limitations

The present report has several limitations. Molecular confirmation of the isolate using 16S rRNA gene sequencing or MALDI-TOF mass spectrometry was not available. Therefore, identification relied on phenotypic characteristics and the RAPID REMEL® identification system. In addition, species-specific antimicrobial susceptibility breakpoints for *Psychrobacter phenylpyruvicus* are not well established, and surrogate interpretive criteria were applied where necessary. Finally, this report describes a single clinical case; therefore, broader conclusions regarding pathogenicity and antimicrobial resistance patterns should be interpreted cautiously.

## Conclusion

Unusual pathogens such as *Psychrobacter phenylpyruvicus* should be considered in patients with recurrent urinary tract infections and multiple predisposing factors. Accurate laboratory identification and antimicrobial susceptibility testing are essential for appropriate therapeutic management and may contribute to improved clinical outcomes and antimicrobial stewardship.

### Ethics Statement

Formal institutional ethics committee approval was not required because this study represents a retrospective presentation of a single anonymized clinical case.

### Conflict of Interest

The authors declare no conflict of interest.

### Funding

No external funding was received for this study.

### Author Contributions

Christina Seitopoulou performed the laboratory investigations and contributed to microbiological data acquisition and interpretation. Antonia Mourtzikou supervised the study and was responsible for the preparation, drafting, and final revision of the manuscript. Maria Kimouli collected the clinical and laboratory data and contributed to data organization and case documentation. All authors contributed to the interpretation of findings, critically reviewed the manuscript, and approved the final version for publication.

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