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A Rare Case of Catheter-Related Bloodstream Infection Caused by *Cupriavidus pauculus*

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ABSTRACT

Background: *Cupriavidus pauculus* is a gram-negative, aerobic bacillus found in environment. This microorganism can rarely cause serious infections in immunocompromised patients. Catheter-related bloodstream infection caused by *Cupriavidus pauculus* is a hospital acquired infection which is an infrequent state with very few cases reported in the literature. In this research, we report the first case of *Cupriavidus pauculus* infection in Iran.

Methods: Blood cultures were performed using the BD BACTEC (Becton, Dickinson, USA) automated haemoculture system and subsequently the gram negative bacilli with regular borders, smooth consistency and dry appearance colonies were identified as *Cupriavidus pauculus* by the BD Phoenix M50 Compact automated system.

Results: In this paper, we report the first case of *Cupriavidus pauculus* infection in Iran. this strain was susceptible to Piperacillin-Tazobactam, Ceftazidime, Cefepime, Trimethoprim-Sulfamethoxazole, Ciprofloxacin, Levofloxacin and resistant to Cefazolin, Ampicillin and Amoxicillin-Clavulanate and is intrinsically resistant to Aminoglycosides, first generation Cephalosporins, Aminopenicillins, Ampicillin-Sulbactam, Ticarcillin and Ceftriaxone.

Conclusion: There are little evidence in the literature about infections caused by *Cupriavidus pauculus*. Catheter-related bloodstream infection caused by *Cupriavidus pauculus* is an infrequent infection in humans, but this microorganism should be considered as a potential pathogen in hospitalized immunocompromised patients which can cause serious infections in these individuals, requiring broad-spectrum antibiotic therapy.

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Introduction

Sepsis is a serious and life-threatening condition caused by an inappropriate host immune response to an infection (1, 2). Catheter-related bloodstream infection is known as the presence of bacteremia originating from a catheter which is the most common cause of nosocomial bacteremia (3). *Cupriavidus pauculus* (formerly CDC Group IVc-2) is a rarely isolated aerobic, flagellated, gram-negative, non-fermentative bacillus which causes in rare cases severe infections, such as Catheter-related bloodstream infection, meningitis and pneumonia-related to mechanical ventilation, especially in immunocompromised patients. *Cupriavidus pauculus* is an environmental microorganism which can found in water, soil and contaminated plants. This microorganism rarely isolated from hospitalized immunocompromised patients (2, 4-8).

In this research, we report the first case of *Cupriavidus pauculus* in northeast of Iran in a patient who was hospitalized for oliguria and hydronephrosis and blood culture revealed *Cupriavidus pauculus*.

Case presentation

A 43-year-old female with cervical cancer and a complaint of bilateral flank pain in a continuous and intense manner, accompanied by oliguria, hydronephrosis, dysuria, pyuria, hematuria, fever and chills was hospitalized in Internal Department of Imam Reza hospital, Mashhad, northeast of Iran. On admission, the patient was diagnosed with oliguria, hydronephrosis and sepsis symptoms. At that time the patient was admitted to Internal Ward of hospital, her temperature was 39/2 °C, heart rate 119/minute and blood pressure 140/90 mmHg. Further investigations revealed neutrophilia (91%), lymphopenia (4.1%) and elevated C-reactive protein (CRP) levels (150.3 mg/L). The prothrombin time (PT) was within normal range (14.6 seconds) and the Actived Partial Thromboplastine Time (aPTT) was high (67.8 seconds), blood sugar levels were normal (86 mg/dL). Also biochemical tests revealed elevated levels of potassium (7.3 mEq/L), magnesium (2.7 mg/dl), urea (268 mg/dL), uric acid (15.2 mg/dL) and creatinine (10.1 mg/dL) with low levels of albumin (2.7 g/dL). Renal failure was diagnosed upon the examination of biochemical tests, CT scan and abdominal ultrasound. After diagnose of renal failure, dialysis and antibiotic treatment with Vancomycine and Meropenem as empirical therapy was initiated. The administration of parenteral Meropenem, 1g/day, slow infusion within 4 to 6 hours, and Vancomycin, 1g every 48 hours, was initiated. Also due to sepsis symptoms, including fever and chills, blood culture was performed. Blood cultures and bacteriological determinations were performed to confirm the diagnosis of bacteremia. Samples were processed using the BD BACTEC (Becton, Dickinson, USA) automated haemoculture system. After alarming of BD BACTEC, gram stained smear was performed, then the samples were inoculated onto blood agar and EMB agar (Eosin-methylene blue). The blood culture showed bacterial growth after 48 hours of incubation on blood agar and EMB agar, colonies with regular borders, smooth consistency and dry appearance were observed. There was no hemolysis in blood agar, non-lactose fermenting and without oxidase and catalase positive pigmentation. Subsequently the gram negative bacilli were identified as *Cupriavidus pauculus* by the BD Phoenix M50 compact automated system. As a result, microbiological findings confirm the diagnosis of the first case of *Cupriavidus pauculus* sepsis in Iran. This strain was Catalase, Oxidase, Citrate, Acetate and Alpha-Ketoglutaric Acid positive and for Malonate, Sucrose, L-Rhamnose, Dextrose, L-Arabinose, Ornithine, Urea and Esculin was negative. In addition this strain was susceptible to Piperacillin-Tazobactam (≤ 4.4 µg/mL), Ceftazidime (≤ 2 µg/mL), Cefepime (≤ 1 µg/mL), Trimethoprim-Sulfamethoxazole (≤

Table 1. The results of initial patient experiments.

CRP: 150.3 mg/L	Creatinine: 10.1 mg/dL
PT: 14.6 seconds	Albumin: 2.7 g/dL
aPTT: 67.8 seconds	Uric acid: 15.2 mg/dL
Blood sugar: 86 mg/dL	Heart rate: 119/minute
Potassium: 7.3 mEq/L	Blood pressure: 140/90 mmHg
Magnesium: 2.7 mg/dl	Neutrophilia: 91%
Urea: 268 mg/dL	Lymphopenia: 4.1%

Table 2. Result of the biochemical tests of *Cupriavidus pauculus*.

Biochemical tests	*Cupriavidus pauculus*
Catalase	+
Oxidase	+
Malonate	-
L-Rhamnose	-
L-Arabinose	-
Citrate	+
Acetate	+
Sucrose	-
Alpha-Ketoglutaric Acid	+
Dextrose	-
Ornithine	-
Urea	-
Esculin	-

1.19 µg/mL), Ciprofloxacin (≤ 0.5 µg/mL), Levofloxacin (≤ 1 µg/mL) and resistant to Cefazolin (≤ 4µg/mL), Ampicillin (8 µg/mL) and Amoxicillin-Clavulanate (≤4.2 µg/mL). *Cupriavidus pauculus* was firstly described as *Ralstonia paucula* and is intrinsically resistant to Aminoglycosides, first generation Cephalosporins, Aminopenicillins, Ampicillin-Sulbactam, Ticarcillin and Ceftriaxone. This pathogen can occasionally leads to serious infections in humans, especially in immunocompromised individuals (2). This patient was the first case of Catheter-related bloodstream infection (CRBSI) caused by *Cupriavidus pauculus* in Iran. Repeated blood culture showing negative results after seven days of targeted antibiotic treatment. Finally clinical and microbiological resolution was achieved by antibiotic therapy which leads to eradication of microorganism and sepsis symptoms.

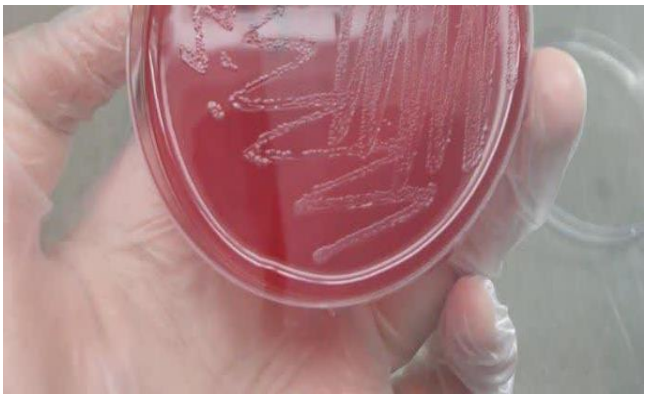

Fig 1. Non-hemolytic colonies on blood agar.

Discussion

We report the first case of *Cupriavidus pauculus* in Iran. *Cupriavidus pauculus* is a Gram-negative, motile bacillus with Catalase and Oxidase positive which can infrequently cause infection in hospitalized immunocompromised patient (9). Also there is few evidence available on the antimicrobial susceptibility of Cupriavidus pauculus (5), Meanwhile, the strain isolated in the present case, was resistant to Cefazolin, Ampicillin and Amoxicillin- Clavulanate but was susceptible to Piperacillin-Tazobactam, Ceftazidime, Cefepime, Trimethoprim-Sulfamethoxazole, Ciprofloxacin and Levofloxacin. In the literature, there are few findings about combined antibiotic therapy of Imipenem, Amikacin and Ciprofloxacin, for this pathogen. In other reported cases positive results

were achieved by treatment with a third generation Cephalosporin (2, 10). Duggal et al. (2013) reported a case of community-acquired Cupriavidus pauculus meningitis and septicemia in a neonate in India (10). Also Carmen Luna Arana et al. (2022) reported a case of hospital-acquired *Cupriavidus pauculus* bacteremia in a neonate in Spain (5). Therefore *Cupriavidus pauculus* is a potential pathogen that can infrequently cause severe hospital acquired infections in immunosuppressed patients (4, 11).

Conclusion

Catheter-Related Bloodstream Infection is an important cause of hospital-acquired infection. There are little evidence in the literature about infections caused by *Cupriavidus pauculus*, Catheter-related bloodstream infection caused by *Cupriavidus pauculus* is a rare infection in humans, but this microorganism should be considered as a potential pathogen in hospitalized immune-compromised patients which can cause serious infections in these individuals, requiring broad-spectrum antibiotic therapy.

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Ethics approval and consent to participate

Not needed.

Conflict of interest

Authors declare no conflict of interest regarding the present study.

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