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Case Report

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Obstructive Pyelonephritis Caused by *Kocuria kristinae*

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Abstract

Introduction: *Kocuria kristinae* is a gram-positive coccus bacterium not previously known to cause infections in immunocompetent humans. Such infections are frequently reported in immunocompromised hosts and involve multiple organs. To our knowledge, obstructive pyelonephritis with *Kocuria kristinae* has not been reported in healthy and immunocompetent individuals in the absence of any urologic interventions. We report a unique case of *Kocuria kristinae* causing an obstructive pyelonephritis in an immunocompetent man in his forties.

Case report: The patient had mainly fever and abdominal discomfort. His laboratory tests showed high serum creatinine, high C-reactive protein, and leukocyturia. The unenhanced abdominopelvic CT scan revealed an obstructive stone at the left ureteropelvic junction. The diagnosis of acute obstructive pyelonephritis was then prioritized. The patient has been treated successfully with IV antibiotics and Double J stent insertion. *Kocuria kristinae* was later identified in the urine and blood cultures.

Conclusion: *Kocuria kristinae* might cause obstructive pyelonephritis in immunocompetent people. Its microbiological identification is challenging. For appropriate treatment and better outcomes, specialized identification systems can solve the misidentification issue.

Keywords: Case report, *Kocuria kristinae*, Pyelonephritis, Urolithiasis

Introduction

Kocuria kristinae (*K. kristinae*) is a gram-positive coccus. It is arranged in pairs, short chains, tetrads, cubical packets of eight, and irregular clusters. It belongs to the *phylum Actinobacteria*, class *Actinobacteria*, order *Actinomycetales*, suborder *Micrococcinae*, and family *Micrococcaceae* [1,2]. *K. kristinae* bacteria was first described by Miroslav Kocur, a Slovakian microbiologist, in 1974 [3]. Currently, there are seventeen species of *Kocuria* identified using genome analysis by 16S rRNA gene sequencing [1]. *K. kristinae* has been recognized as an opportunistic bacterium among immunocompromised patients. In contrast, emerging infections among immunocompetent individuals have become more common. This raises serious questions regarding laboratory misidentifications and mechanisms of infection [4]. While several cases of *K. kristinae* infections of ophthalmic, cardiothoracic, biliary, and meningeal origin have been published to date, obstructive pyelonephritis associated with *K. kristinae* among immunocompetent individuals have not been yet reported in the absence of urological interventions or urinary catheterization [5].

The purpose of this paper is to present the first case of an acute obstructive pyelonephritis caused by *K. kristinae* in a healthy male patient. The latter consented to report his case. Since the data is completely de-identified and the patient consent was taken, the Institutional Review Board office of the Lebanese American University (IRB Registration # IRB00006954 LAUIRB#1) approved the publication as exempt from IRB review.

Case presentation

A man in his forties, with a known history of recurrent urolithiasis presented to the out-patient department with a three-day history of fever, chills, night sweats, headache, polymyalgia, low back pain, and one episode of sore throat. He was also complaining of nausea, vomiting, constipation, abdominal discomfort, and minimal cough. He did not report dysuria, urinary frequency, dyspnea, chest pain, or any neurological symptoms. Significant exposures include the consumption of raw meat and white cheese. He reports no recent travel history or contact with any sick individuals. Of note, he reported a two-day history of left-sided flank pain, dysuria, and hematuria associated with the passing of multiple small urinary stones almost four months prior to his current presentation.

Upon presentation, his physical examination was remarkable for a stable hemodynamic status. His blood pressure was 140/70 mm Hg and his heart rate was 84 beats/minute. His oxygen saturation was 96% on room air. He was afebrile. Although he didn't seem to be in any distress, he was observed to have a pale complexion and sweating. Additionally, the physical examination did not reveal any lymphadenopathy, organomegaly, or a skin rash. The cardio-pulmonary examination was normal.

His laboratory testing revealed a normal white blood cell count and normal liver function tests. Compared to previously documented normal baseline values, his serum creatinine was noticed to be elevated at 24 mg/l (normal range: 8-12 mg/l) on presentation. The C-reactive protein (CRP) was also elevated at 300 mg/l (the normal value being less than 5 mg/l). The urinalysis showed leukocyturia (14-16 white blood cells/high power field) with negative nitrites.

The patient was referred to the emergency department and was subsequently hospitalized for acute kidney injury. An abdominopelvic helical CT scan without intravenous contrast demonstrated a 24x15x11 mm stone at the level of the left ureteropelvic junction, a dilatation of the left pelvicalyceal system, an asymmetrical perinephric fat stranding, and thickening of the anterior pararenal fascia.

Accordingly, the patient was diagnosed with acute left obstructive pyelonephritis. Since we are in a country with emergent multi-drug resistant bacterial infections, empiric therapy with broad spectrum antibiotics was initiated, and Meropenem was given intravenously at a dose of 1g twice a day, adjusted to the creatinine clearance. A left double J ureteral stent was inserted, and a selective left renal urine specimen was collected during the procedure for microbiological culture.

Two sets of blood cultures specimens, BACT/ALERT FA PLUS and BACT/ALERT FN PLUS, were sent for the detection of aerobic and facultative anaerobic microorganisms. The media formulation in the blood culture bottles is FAN Plus media with Adsorbent Polymeric Beads, (Biomerieux – France). All 4 bottles were inserted in the BACT/ALERT 3D instrument (automated microbial detection system, Biomerieux - France), and were incubated at 37 °C. The alarm for both anaerobic cultures went off after 48 hours signaling positive cultures. No aerobic growth was seen in both cultures for 5 days and gram-positive cocci, with irregular and tetrads arrangement were identified on gram stains from anaerobic cultures. The sample was then plated on blood, Chapman, and MacConkey agar (bioMerieux, France) culture media. Forty-eight hours later, small pale white and raised round colonies grew with no hemolysis on blood agar. A catalase-positive reaction was observed during the catalase test. Using the Vitek2 automated identification system (bioMérieux, France), ***K. kristinae*** was identified with a confidence level of 93%. Antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method. The results showed that ***K. kristinae*** was sensitive to **Penicillin, Cefotaxime, Levofloxacin, Gentamicin, Clindamycin, Rifampicin, Linezolid, Erythromycin, Teicoplanin, Vancomycin, and Fusidic Acid**, but resistant to **Trimethoprim-Sulfamethoxazole**. Furthermore, **CLSI M100-Ed32** guidelines were used to interpret the breakpoints. All antibiotics demonstrated sensitivity except for Trimethoprim-Sulfamethoxazole, which showed resistance.

The inoculum from the urine sample was spread on UriSelect™4 (Bio-rad, USA) and MacConkey agar (bioMerieux, France). Likewise, gram-positive cocci with irregular and tetrads arrangements were identified on gram stain. Two days later, colonies with the same morphology as the colonies (catalase positive) that appeared in the blood culture grew on UriSelect™4 (Bio-rad, USA) medium with an estimated count more than 100,000 CFU/ml. Similarly, *K. kristinae* was identified using the Vitek2 automated identification system (bioMerieux, France). Antibiotic susceptibility was identical to the micro-organism isolated from the blood cultures.

The hospital course of the patient demonstrated gradual improvement. His serum creatinine improved to 12.2 mg/l on his second postoperative day, and he was discharged on Amoxicillin/Clavulanic acid one gram twice a day for three weeks based on sensitivity results. The urine culture of the sample selectively collected from the left kidney during JJ stent insertion was negative. The patient CRP and creatinine levels decreased to 13,8 mg/l and 11.9 mg/L respectively on the sixth day post hospital discharge. After stopping the antibiotic, the patient remained asymptomatic and his urine culture, requested before stone fragmentation, showed no growth. The timeline of the different events is stated in table 1.

Table 1: timeline of events.

Date	Tests
February 4, 2023	First presentation to the outpatient clinic for fever and chills. Blood tests are ordered.
February 6, 2023 AM	Laboratory tests, done in a private laboratory, shows elevated Creatinine (24 mg/L), elevated CRP (300 mg/L), Leukocyturia (14-16 white blood cells/HPF), and normal white blood cell count and normal liver function tests.
February 6, 2023 PM	Urgent Hospitalization for acute kidney injury. An unenhanced abdominopelvic CT scan shows an obstructive stone at the level of the left ureteropelvic junction with ipsilateral hydronephrosis and perirenal fat stranding. Two blood and one urine cultures were taken. Meropenem is started for possible acute left obstructive pyelonephritis.
February 7, 2023	Selective left renal urine specimen with left JJ stent insertion.
February 9, 2023	Creatinine= 12.2 mg/L Blood and urine cultures, taken in the emergency department, shows *Kocuria kristinae* with similar antibiogram sensitivity profile. Discharge on Amoxicillin/ Clavulanic acid 1 g twice per day for 3 weeks
February 10, 2023	The selective left renal urine culture, collected 24 hours after Meropenem initiation, shows no growth.
February 15, 2023	Creatinine= 11.9 mg/L, CRP = 13.8 mg/L
April 14, 2023	Urine culture (pre-fragmentation) doesn't show growth of bacteria

Discussion

We report the first case of obstructive pyelonephritis caused by *K. kristinae*. To our knowledge, this has not been reported previously among immunocompetent individuals in the absence of any urologic interventions. This case emphasizes the value of accurate laboratory identification of uncommon pathogenic micro-organisms, and the importance of future microbiological studies to better understand the underlying pathobiological mechanisms causing such infections.

Although previously regarded as an innocuous micrococcus, *Kocuria* species are ubiquitously found in the environment, and can be isolated from the oral mucosa and the skin of humans and animals. Although it was thought to be non-pathogenic, *K. kristinae* has been recently associated with an increasing number of both superficial and deep invasive infections involving different organ systems [3].

K. kristinae is a catalase positive, coagulase negative, facultative anaerobe cocci. Spheres (0.7-101 mm) occur in tetrads which may form cubical large irregular clusters. Colonies are circular and convex. Their color ranges between pale cream to pale pink. With time the color becomes more intense [6] Due to difficulties in its microbiological identification, *K. kristinae* infections have been frequently misdiagnosed [2,6].

K. kristinae have been isolated from Central catheter bloodstream infections (17 cases), where it has been successfully treated with catheter removal and antibiotic therapy [6,7] Additionally, *K. kristinae* [9-12] and other *Kocuria* variants (5 cases) [13] have been previously associated with iatrogenic peritonitis among patients receiving peritoneal dialysis. It has also been associated with acute cholecystitis and was treated successfully with cholecystectomy and Levofloxacin [13]. *K. kristinae* infections have also been associated with bacterial endocarditis [8,14-16], meningitis (3 cases) [17-19], catheter related urinary tract infections [5,23], mediastinitis [24], and pneumonia [2,25]. Eye infections caused by *K. kristinae* involving the anterior chambre (hypopyon), the lens (in the setting of cataract surgery), the vitreous body, and the lacrimal sac have also been reported [2,8,20-22]. Finally, two cases of *K. kristinae* have been reported among immunosuppressed patients following chemotherapy [7,26].

Since *K. kristinae* is a rare uropathogen, it would not have been accurately diagnosed if the laboratory had relied solely on the media routinely used for urine samples and biochemical tests. The automated identification system was essential for correctly identifying this pathogen, highlighting the value of automation in improving diagnostic accuracy, particularly for rare infections. Inaccurate results could confuse treating physicians, potentially leading to suboptimal treatment. Inappropriate antibiotic therapy may expose patients to unnecessary side effects and increase the risk of uncontrolled infections. This emphasizes the importance of effective laboratory methods and protocols to accurately identify uncommon microorganisms and ensure appropriate management.

While *K. kristinae* is infrequently identified in healthy patients' specimens, the updated VITEK2 database includes a broader range of taxa that improved its accuracy. Like other investigators [2, 27], we relied on Vitek2 only for *K. kristinae* identification; however, 16S rRNA sequencing could offer further confirmation [28]. The unavailability of this method at our institution could be a limitation for our reported case. However, the acquisition of 16S rRNA sequencing method will certainly improve our identification process of *K. kristinae* in the future. Moreover, our findings are based on the data of one patient. Therefore, our conclusions cannot be generalized and might not apply in different settings and patients with different behavior and lifestyle.

Conclusion

Kocuria kristinae is an opportunistic micro-organism known to infect immunosuppressed patients. We report the first case of acute obstructive pyelonephritis in an immunocompetent individual caused by *K. kristinae*. Identifying such uncommon pathogens could be challenging without using specific identification techniques. Otherwise, patients' management could be suboptimal.

List of abbreviations

K. kristinae: *Kocuria kristinae*
CRP: C-reactive protein

Declarations

Ethics approval: The Institutional Review Board office of the Lebanese American University (IRB Registration # IRB00006954 LAUIRB#1) approved the publication as exempt from IRB review.
Consent for publication: written informed consent was obtained from the patient to publish this paper.
Availability of data and material: data is de-identified and provided within the manuscript to protect patient privacy.
Competing interests: all authors declare that they have no competing interests.

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Authors' contributions: N.R.A. and N.Y.Y. have made substantial contributions to the conception and design of the work. They have drafted the work and substantively revised it. H.Y.R. has drafted the part related to microbiological cultures and substantively revised the work. J.G.Z. has substantively revised the work.

All authors have reviewed and approved the submitted version. All authors have agreed to be personally accountable for their own contributions and to ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated, resolved, and the resolution documented in the literature.

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