

Multidrug-resistant *Serratia liquefaciens* urinary tract infection in chronic kidney disease: a case report

Kaushik Sahoo

Datta Meghe Institute of Medical Sciences

Shital Mahajan

Datta Meghe Institute of Medical Sciences

Gargi Mudey

Datta Meghe Institute of Medical Sciences

Radha Kunjalwar

Datta Meghe Institute of Medical Sciences

Tokeshwar Kumar Sahu

shubhamsahu0057@gmail.com

Datta Meghe Institute of Medical Sciences

Case Report

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Abstract

Background:

Serratia liquefaciens is an uncommon opportunistic Gram-negative bacillus that has been reported in healthcare-associated infections but is rarely implicated as a urinary pathogen in human clinical practice. Its isolation from urine requires careful clinical correlation, particularly in patients with renal disease, urinary tract abnormalities, recurrent healthcare exposure, and limited antimicrobial options.

Case presentation:

A 66-year-old Indian woman presented with a 15-day history of cloudy, foul-smelling urine, generalized weakness, and decreased appetite. She had chronic kidney disease, systemic hypertension, ischemic heart disease, non-obstructive uropathy, bilateral hydronephrosis, and previous emphysematous cystitis. Urine examination showed trace albumin and plenty of pus cells. Imaging demonstrated bilateral pyelitis with cystitis, bilateral small kidneys, and a small cortical cyst with internal debris in the lower pole of the left kidney. Urine culture grew *Serratia liquefaciens*, identified using an automated bacterial identification system. The isolate showed resistance to beta-lactam/beta-lactamase inhibitor combinations, cephalosporins, carbapenems, gentamicin, ciprofloxacin, and trimethoprim-sulfamethoxazole, while susceptibility was reported to tigecycline, fosfomycin, and colistin. Blood culture showed no growth. Empirical piperacillin-tazobactam and vancomycin were started, and antimicrobial therapy was subsequently reviewed according to susceptibility results, renal function, and clinical status.

Conclusions:

This case highlights the potential clinical significance of *Serratia liquefaciens* in urine when supported by symptoms, pyuria, radiological evidence, and host risk factors. Species-level identification and cautious interpretation of susceptibility results are essential for antimicrobial stewardship in high-risk patients with chronic kidney disease and complicated urinary tract disease.

Introduction

Serratia liquefaciens is an uncommon opportunistic Gram-negative bacillus belonging to the genus *Serratia* [1]. Members of this genus are widely distributed in natural and hospital-associated environments, including water, soil, plants, insects, disinfectant solutions, medical equipment, and moist hospital reservoirs, which contributes to their ability to cause healthcare-associated infections [1, 2]. Although *Serratia marcescens* remains the most frequently recognized pathogenic species of this genus, *Serratia liquefaciens* has also been associated with clinically significant infections and outbreaks, particularly in hospitalized or medically vulnerable patients [3].

Human infection caused by *Serratia liquefaciens* is uncommon but clinically important. Published reports have described its involvement in invasive and localized infections, including infective endocarditis, vascular infection, skin and soft tissue infection, catheter-associated infection, bacteremia, meningitis, and urinary tract infection [4–7]. Urinary tract infection due to *Serratia liquefaciens* is rarely reported in human clinical practice; however, a documented nosocomial outbreak after cystometry and cystoscopy showed that this organism can cause urinary tract infection following urological instrumentation [7].

The isolation of *Serratia liquefaciens* from urine requires careful clinicomicrobiological correlation, particularly in patients with urinary tract abnormalities, recurrent healthcare exposure, and underlying renal disease [7]. Antimicrobial management may be challenging because strains within the *Serratia liquefaciens* complex show natural resistance to several antimicrobial agents and variable susceptibility to commonly used drug classes [8]. We report a case of multidrug-resistant *Serratia liquefaciens* isolated from the urine of an elderly woman with chronic kidney disease, bilateral pyelitis, cystitis, and non-obstructive uropathy, highlighting the importance of species-level identification, clinical correlation, and careful antimicrobial selection in high-risk patients.

Case presentation

A 66-year-old Indian woman presented to the medicine ward with a 15-day history of cloudy whitish urine associated with a foul smell. The symptoms were insidious in onset and gradually progressive. She also complained of generalized weakness and decreased appetite for four days. She had been hospitalized multiple times in the past with similar urinary complaints and had previously been managed as a case of urinary tract infection with chronic cystitis.

The patient was a known case of chronic kidney disease and was on conservative management. She also had systemic hypertension, ischemic heart disease, non-obstructive uropathy, bilateral hydronephrosis, and a previous diagnosis of emphysematous cystitis. She was receiving aspirin and atorvastatin for ischemic heart disease and was on regular treatment for hypertension. Based on the clinical and radiological findings, she was diagnosed with pyelitis with cystitis in the background of non-obstructive uropathy and chronic kidney disease.

On physical examination, the patient was afebrile. Her pulse rate was 72 beats per minute, blood pressure was 90/60 mmHg, and respiratory rate was 18 breaths per minute. Laboratory investigations on admission revealed severe anemia, with hemoglobin of 6.2 g/dL. The total leukocyte count was 8600 cells/ μ L, and the platelet count was 3.15 lakh/ μ L. Renal function tests were markedly deranged, with blood urea of 181 mg/dL and serum creatinine of 13.2 mg/dL. Serum sodium and potassium levels were 145 mmol/L and 5.0 mmol/L, respectively. Liver function tests showed raised alkaline phosphatase of 145 U/L, while alanine aminotransferase, aspartate aminotransferase, and total bilirubin were within normal limits.

Urine examination showed pale yellow urine with trace albumin and plenty of pus cells. Ketone bodies, crystals, and red blood cells were not seen. A Foley catheter was inserted on the day of admission. The

patient was transfused with packed red cells in view of severe anemia. Blood culture was sent on the second day of admission and showed no growth. Ultrasonography of the abdomen and pelvis was suggestive of bilateral hydronephrosis and cystitis. Nephrology consultation was obtained, and hemodialysis was advised.

Computed tomography of the kidney, ureter, and bladder region showed bilateral pyelitis with cystitis and bilateral small kidneys. A small cortical cyst measuring 11 × 10 mm was noted in the lower pole of the left kidney, with an exophytic component and internal debris suggestive of an infected cyst (Fig. 1).

Microbiological findings and antimicrobial susceptibility testing

Urine culture showed growth of *Serratia liquefaciens*. On blood agar, the colonies were non-hemolytic, convex, mucoid, and greyish. On MacConkey agar, non-lactose-fermenting, convex, shiny, mucoid colonies were observed. Growth was also observed on nutrient agar. Gram staining from the culture showed short Gram-negative bacilli, consistent with an organism belonging to the order Enterobacterales (Fig. 2).

The isolate was identified as *Serratia liquefaciens* using an automated bacterial identification system. Antimicrobial susceptibility testing was performed using VITEK, and the results were interpreted according to Clinical and Laboratory Standards Institute 2024 guidelines, as applicable. The isolate showed resistance to multiple antimicrobial classes, including beta-lactam/beta-lactamase inhibitor combinations, cephalosporins, carbapenems, aminoglycosides, fluoroquinolones, and trimethoprim-sulfamethoxazole. Susceptibility was reported to tigecycline, fosfomycin, and colistin. The antimicrobial susceptibility profile is shown in Table 1.

Table 1
Antimicrobial susceptibility profile of *Serratia liquefaciens* isolated from urine

Antimicrobial agent	MIC	Interpretation
Amoxicillin-clavulanic acid	≥ 32	R
Piperacillin-tazobactam	≥ 128	R
Cefuroxime	≥ 64	R
Cefuroxime axetil	≥ 64	R
Ceftriaxone	≥ 64	R
Cefoperazone-sulbactam	≥ 64	R
Cefepime	≥ 32	R
Ertapenem	≥ 8	R
Imipenem	≥ 16	R
Meropenem	8	R
Gentamicin	32	R
Ciprofloxacin	≥ 4	R
Tigecycline	≤ 0.5	S
Fosfomycin	≤ 16	S
Colistin	≤ 0.5	S
Trimethoprim-sulfamethoxazole	≥ 320	R
MIC, minimum inhibitory concentration; R, resistant; S, susceptible.		

During hospitalization, the patient was managed with close monitoring of hydration status, daily input-output charting, blood pressure, and oxygen saturation. Packed red cell transfusion was given in view of severe anemia. Nephrology consultation was obtained because of advanced chronic kidney disease with markedly elevated urea and creatinine levels, and hemodialysis was advised.

Empirical antimicrobial therapy was started with intravenous piperacillin-tazobactam and intravenous vancomycin while awaiting culture and antimicrobial susceptibility results. After the urine culture identified *Serratia liquefaciens* and the susceptibility profile became available, the antimicrobial regimen was reviewed and further treatment was guided by the susceptibility report, renal function, and clinical status of the patient. The patient remained vitally stable during the hospital stay.

Discussion

Serratia liquefaciens is an uncommon opportunistic Gram-negative bacillus widely distributed in environmental sources such as water, soil, plants, and food products. Although *Serratia marcescens* is more frequently implicated in human disease, *Serratia liquefaciens* has also been reported in clinically significant infections, including bacteremia, endocarditis, catheter-associated infections, meningitis, and urinary tract infection.

The clinical significance of *Serratia liquefaciens* isolated from urine should be assessed in relation to the patient's symptoms, underlying risk factors, and laboratory findings. In the present case, the patient had chronic kidney disease, recurrent hospitalization, non-obstructive uropathy, bilateral hydronephrosis, cystitis, pyuria, and radiological evidence of bilateral pyelitis. These findings supported the interpretation of the isolate as clinically relevant rather than a contaminant. The sterile blood culture suggested that the infection was localized to the urinary tract at the time of evaluation.

Human urinary tract infection due to *Serratia liquefaciens* is rarely reported. Previous reports have described healthcare-associated urinary tract infection due to this organism, particularly following urological procedures. The present case adds to the limited clinical literature by documenting multidrug-resistant *Serratia liquefaciens* isolated from urine in an elderly patient with chronic kidney disease and complicated uropathy.

The antimicrobial susceptibility profile showed resistance to several commonly used antimicrobial classes, including beta-lactam/beta-lactamase inhibitor combinations, cephalosporins, carbapenems, aminoglycosides, fluoroquinolones, and trimethoprim-sulfamethoxazole. This multidrug-resistant phenotype highlights the therapeutic difficulty posed by such isolates. The reported susceptibility to fosfomycin, tigecycline, and colistin should be interpreted in the context of infection site, renal function, and testing limitations. In particular, automated colistin susceptibility results should be interpreted cautiously and ideally confirmed by a reference method before being used to guide therapy.

This case emphasizes the importance of correlating urine culture findings with clinical and radiological evidence, especially when uncommon organisms are isolated in high-risk patients. Early species-level identification and careful antimicrobial selection are essential for managing multidrug-resistant urinary isolates in patients with chronic kidney disease and complicated urinary tract disease.

Conclusion

Serratia liquefaciens is an uncommon urinary isolate, but it may be clinically significant in patients with chronic kidney disease, urinary tract abnormalities, and recurrent healthcare exposure. This case highlights the importance of correlating urine culture results with clinical symptoms, pyuria, and radiological findings before interpreting an uncommon organism as a pathogen. The multidrug-resistant susceptibility profile in this case further emphasizes the need for early species-level identification, careful interpretation of antimicrobial susceptibility results, and individualized antimicrobial therapy based on the site of infection, renal function, and patient condition. Awareness of rare multidrug-

resistant urinary pathogens is important for timely management and antimicrobial stewardship in high-risk patients.

Declarations

Ethics approval and consent to participate

Ethics and Consent to Participate declarations: not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

KS and TKS conceived the case report and contributed to the acquisition and interpretation of the clinical and microbiological data. KS, SM, GM, RK, and TKS contributed to the literature review and preparation of the manuscript. TKS drafted the initial manuscript. SM, GM, and RK critically reviewed and revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analyzed during this case report are included in this article.

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Figures



Bilateral
small kidneys

Figure 1

Computed tomography (CT) kidney-ureter-bladder (KUB) showing bilateral pyelitis with cystitis and bilateral small kidneys

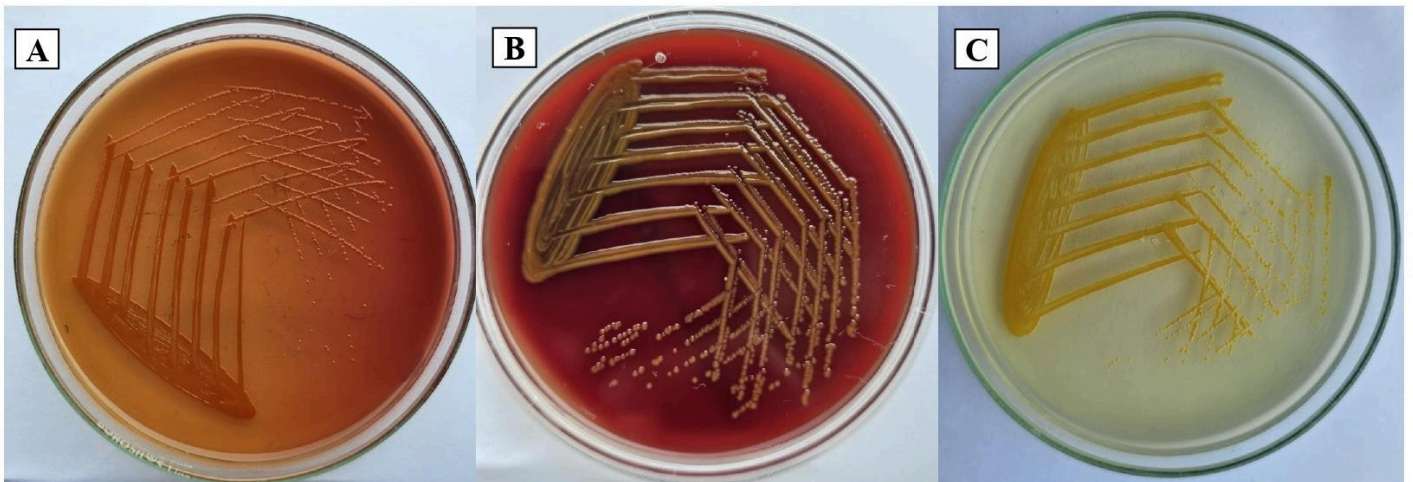


Figure 2

Culture characteristics of *Serratia liquefaciens*. A, non-lactose-fermenting colonies on MacConkey agar; B, non-hemolytic greyish mucoid colonies on blood agar; C, growth on nutrient agar.