

# Nosocomial *Citrobacter koseri* urosepsis in an 87-year-old woman: a case-report

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## ABSTRACT

— **Introduction:** We present a case of urosepsis by *Citrobacter koseri* in an 87-year-old woman affected by hypertension, myocardial ischemia and chronic renal failure. The patient had been previously hospitalized for pneumonia and pyelonephritis caused by *K. pneumoniae*. The isolation of *Citrobacter*, although uncommon, is clinically relevant in the majority of cases. We analyzed the risk factors, the clinical features, the resistance profile and the treatment of this mostly nosocomial infection, comparing our case with other cases of urosepsis due to *Citrobacter* found in literature from 1990.

— **Keywords:** *Citrobacter koseri*, Sepsis, Urinary tract infections, Nosocomial infection, Healthcare associated infections.

## INTRODUCTION

The genus *Citrobacter* belongs to the family of *Enterobacteriaceae*. It includes 11 different species; *Citrobacter koseri* (formerly named *C. diversus*), *Citrobacter freundii*, *Citrobacter youngae*, *Citrobacter braakii* and *Citrobacter amalonaticus* are the most commonly isolated in human. Severe infections are usually caused by *C. koseri* and *C. freundii*<sup>1,2</sup>. *Citrobacter* strains colonize the human gastrointestinal tract, but they can be responsible for infections in other organs and systems, such as urinary tract, respiratory tract, abdominal cavity, skin wound, bone and bloodstream. In particular, *C. koseri* is known to cause meningitis in neonates and infants and it can be isolated from abscesses in affected patients<sup>3,4</sup>. *Citrobacter* infections cause severe clinical

syndromes in elders, weakened patients with multiple comorbidities, who have an increased risk of acquiring this microorganism during their hospital admission<sup>5,6</sup>. We present a case report of an 87-year-old woman with comorbidities and previous hospitalization, who developed *Citrobacter* urosepsis. The objective of this case report is to focus on this nosocomial agent, which can cause different organ localizations and severe complications, and to compare clinical cases of urosepsis due to *Citrobacter* found in literature from 1990.

## CASE REPORT

An 87-year-old woman, affected by hypertension, myocardial ischemia and chronic renal failure, came to our

attention complaining of fever for a few days, asthenia and dysuria, accompanied by a decrease in urine output. She had been recently discharged from the Pneumology Unit of our hospital after an episode of pneumonia and pyelonephritis by *Klebsiella pneumoniae* MDR. At the admission, the patient was alert and oriented in time and space. She had a fever (38.5°C), and her heart rate (HR = 95 bpm) and respiratory rate (RR = 24 acts per minute) were increased, while her blood pressure was normal (115/75 mmHg). The physical examination highlighted a mild suprapubic pain and severe costovertebral angle tenderness. Laboratory tests showed neutrophilic leukocytosis (WBC 13.400/μl, Neutrophils 87%), an increased C Reactive Protein (CRP = 6.60 mg / dl, normal <0.5 mg / dl), an increased Procalcitonin (PCT = 38.60 ng / ml, normal < 0.5 ng / ml) and a slightly increased creatinine (1.3 mg / dl, normal <1.00 mg / dl). Creatinine Clearance (CrCl), estimated with CKD-EPI equation, was 37 ml / min. Except for the presence of 25-30 cells, leukocytes and an intense bacteriuria, urinalysis resulted not significant. Chest x-ray highlighted bilateral basal opacity and a reticular interstitial thickening. Blood cultures at the febrile peak, and urine cultures from a Foley catheter were performed. Hypothesizing a urinary tract infection, empirical antibiotic therapy was started with Trimethoprim/sulfamethoxazole 5 mg/kg/12 h and folic acid 5 mg/die. The abdomen ultrasound showed small cysts in the left kidney and a 8 mm kidney stone in the medium calyceal group. In the right kidney some calculi were found: especially important was a mold calculus in the upper calyceal group with a maximum diameter of 30 mm. It was associated with hydroureteronephrosis (anterior posterior diameter of the renal pelvis: 12 mm, proximal ureter: 6 mm). *Citrobacter koseri* sensitive to Trimethoprim/sulfamethoxazole grew both in blood and urine culture, so the empirical therapy was only adjusted for the renal function.

We obtained the normalization of body temperature on the third day after the admission with progressive reduction of inflammation rates. On the sixth day of antibiotic treatment, laboratory tests showed leukocyte count 6500/mm<sup>3</sup> neutrophils 67% PCT 3.20 ng / ml. At discharge, the patient continued therapy at home, with Trimethoprim/sulfamethoxazole for a total of 14 days.

## DISCUSSION

*Citrobacter* is often associated with nosocomial infections. In a study of 2008, *Citrobacter spp* was isolated from 70 hospitalized patients; only 23.1% were *C. koseri* and the most common associated clinical syndrome was urinary tract infections<sup>7</sup>. Mohanty et al<sup>9</sup> showed 185 cases of *C. koseri*, of these, 92 were isolated by urogenital tract. A review published in Internal Medicine in 2011 described abscesses by *C. koseri*<sup>8</sup>; in particular, there were 12 cases in the literature and, of these, only two cases involved kidneys. These patients had diabetes, coronary artery disease, nephrolithiasis such as in our case and one patient had undergone kid-

ney transplantation. Several studies demonstrated that comorbidities and, even more, a long hospitalization are important risk factors for the onset of *Citrobacter* infections. Our patient was previously hospitalized for 15 days due to pneumonia and pyelonephritis, she has been catheterized with Foley catheter for several days and she had many comorbidities such as hypertension, cardiovascular diseases and kidney stones. Our patient developed urosepsis, and *C. koseri* was isolated from blood and urine cultures. Probably, the main risk factors for the onset of this infection were the previous long hospitalization, the presence of Foley catheter and kidney stones that, alone, can predispose to recurrent urinary infections. As observed in literature, the main source of *Citrobacter* urosepsis is a permanent Foley catheter<sup>10</sup>. Moreover, men are more often affected due to the presence of prostate hyperplasia<sup>7,10</sup>. Other studies<sup>9</sup> showed that urinary tract infections were often polymicrobial. In particular, *C. koseri* was associated to *E. coli*, *Enterococcus spp.*, *Klebsiella spp.* Polymicrobial *Citrobacter* infections were related to a more prolonged course of hospitalization. Although this nosocomial bacterium can give very rare complications such as endophthalmitis, emphysematous pyelonephritis, and rare cases of pneumorrhachis, in our case there were no other complications<sup>11-13</sup>. An antimicrobial therapy based on susceptibility testing is mandatory in case of infection due to *C. koseri* because *Citrobacter* encodes chromosomal and inducible ampC, which can be expressed constitutively. When ampC is overexpressed, it confers resistance to multiple antibiotics<sup>14</sup>. Urinary tract infections can be treated with different antibiotics, both in mono- and in combination therapy<sup>15</sup>. Some studies<sup>2,7</sup> used 2<sup>nd</sup> and 3<sup>rd</sup> generation cephalosporins as first line of treatment; quinolones are used for treatment of kidney abscesses, while carbapenemes are useful when there are many antimicrobial resistances<sup>8</sup>. In particular, they are used alone or as a component of a combination therapy for the treatment of sepsis and pyelonephritis due to *C. koseri*<sup>13,16</sup>. In the suspicion of a urinary tract infection, considering the patient's comorbidities such as old age, heart problems and renal failure, we have chosen empirically Trimethoprim/sulfamethoxazole associated with folic acid. The isolated *C. koseri* in our samples, unlike the strains described in other studies on hospitalized patients<sup>2,7,9,14,15</sup> was sensitive to all the antibiotics tested, and the patient continued with trimethoprim/sulfamethoxazole for 14 days. She had no complications. Trimethoprim/sulfamethoxazole reaches an excellent concentration in the urinary tract and several studies show that this antibiotic was successfully used in the treatment of *Citrobacter* infections<sup>17,18</sup>.

## CONCLUSIONS

Urinary tract infections caused by *C. koseri*, although rare and poorly described in literature, are highly dangerous, as they can lead to severe complications especially in elder patients affected by other pathologies who underwent a long time of hospitalization.

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None required.

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The patient signed a standard form of consent, expressing her informed consent for the scientific use of her clinical data.

**CONFLICT OF INTEREST:**

The authors declare that they have no conflict of interests.

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