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## The Unusual Suspect: Citrobacter Infection as a Rare Cause of Renal Abscess

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## The Unusual Suspect: Citrobacter Infection as a Rare Cause of Renal Abscess

### Cover Page Footnote

The authors have no acknowledgments to declare.

# The Unusual Suspect: *Citrobacter* Infection as a Rare Cause of Renal Abscess

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## Abstract

*Citrobacter* infections have emerged as now a common nosocomial pathogen. Most of the infections manifest in patients with underlying medical conditions. The features of infection can range from infections in the lower urinary tract, respiratory tract, gastrointestinal disease, or bacteremia, however renal abscesses remain uncommon. Here we present the case of a 48-year-old female with medical history of diabetes that presented with a right renal abscess secondary to *Citrobacter koseri* infection managed with drainage and antimicrobial treatment.

**Keywords:** *Citrobacter koseri*, Renal abscess, Management, Diagnosis

## 1. Introduction

*Citrobacter* bacteria are opportunistic anaerobic gram-negative rods that can lead to infections involving that urinary tract, respiratory tract, intra-abdominal organs, skin, and soft tissues.<sup>1</sup> Most of the patients with *Citrobacter* infections have an underlying medical condition including diabetes, cardiac disease, pulmonary disease, renal disease, hepatobiliary disease, neurologic disease, malignancy, or structural abnormalities of the urinary tract.<sup>2,3</sup> However, renal abscesses are relatively uncommon.<sup>2,4-9</sup> Diagnosis of abscesses secondary to *Citrobacter* bacteria in a younger population is also relatively uncommon.<sup>5,7</sup> The clinical spectrum can vary from localized symptoms to widespread damage resulting in septic shock.<sup>4,5,7</sup> Additionally, the pathogenesis of the condition has not been widely discussed in literature.<sup>4-9</sup> The incidence of renal corticomedullary abscess ranges from 1 to 10 cases per 10,000 hospital admissions and approximately 75% of renal cortical abscesses occur in males. Pyelonephritis that leads to corticomedullary abscess is rare.<sup>10</sup> Here, we report a case of *Citrobacter koseri* renal abscess in a middle-aged patient with

diabetes, who was treated successfully with drainage and parenteral antibiotics.

## 2. Case presentation

The patient is a 48 years-old female with a past medical history of type 2 diabetes mellitus who presented with a 2-day history of right sided flank pain. She described the pain as sudden in onset, radiating to the right but without any other associated symptoms. Review of systems was not significant for any other symptoms. Social history was not significant for any toxic habits. Family history did not reveal any specific information. Vitals revealed heart rate 127 beats/minute, blood pressure of 153/100 mm Hg, respiratory rate 20/minute, temperature of 98.1 degrees F, and oxygen saturation of 100% on room air. Physical examination was significant for right sided abdominal tenderness. Lab investigations were significant for leukocytosis (WBC: 24.0 k/ $\mu$ L [reference range: 4.8–10.8 k/ $\mu$ L], neutrophil percent: 83.0% [reference range: 40.0–70.0%]), anemia (hemoglobin:10.0 g/dl [reference range: 12–16 g/dl]), thrombocytosis (platelets 763k/ $\mu$ L [reference range: 150-400k/ $\mu$ L]) and transaminitis. Urinalysis revealed leukocyte esterase and bacteria

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suspicious for urinary tract infection. CT scan of abdomen and pelvis without contrast revealed a large  $5.6 \times 7.9 \times 8.4$  cm multiloculated collection arising from the lower pole of the right kidney invading the right psoas muscle and a large 8.4 cm multiloculated collection arising from the lower pole of the right kidney as shown in Fig. 1a.

She was empirically started on vancomycin and piperacillin-tazobactam. Blood and urine cultures were sent before antibiotic administration. Urology recommended drainage of the lesion that was performed by interventional radiology and a drain was left for further drain output as shown in Fig. 1b.

Her urine cultures were significant for *C. koseri*. Blood cultures did not reveal any growth. Cultures from abscess drainage were significant for *C. koseri*, as well. Mycobacterial cultures, PCR for tuberculosis and other microbiological workup was negative. Her antibiotics were de-escalated to ampicillin-sulbactam based on susceptibility report. Repeated imaging revealed mild right hydronephrosis and hydroureter, no obstructing calculus and a 5.3 cm fluid collection with air bubbles in the right flank as Fig. 2.

The patient's drain was, therefore, repositioned and a Foley catheter was placed for urinary obstruction. Cultures from the repeat drain output revealed *Cryptococcus* and *Candida tropicalis*. She was empirically started on fluconazole. Her symptoms began to improve. Repeat cultures were negative. The patient was discharged on 4 weeks of intravenous ceftriaxone 2 g once daily, and oral metronidazole 500 mg every 8 h. She was also started on oral fluconazole 400 mg once daily for a year with close outpatient follow-up with infectious disease clinic. A post discharge CT scan obtained showed a decrease in size of the right kidney fluid collection as shown in Fig. 3.

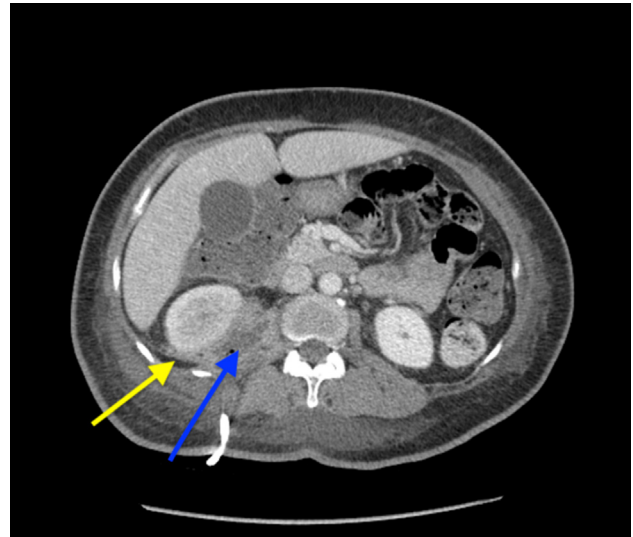


Fig. 2. Mild right hydronephrosis and hydroureter, no obstructing calculus and a 5.3 cm fluid collection (blue arrow) with air bubbles in the right flank (yellow arrow).

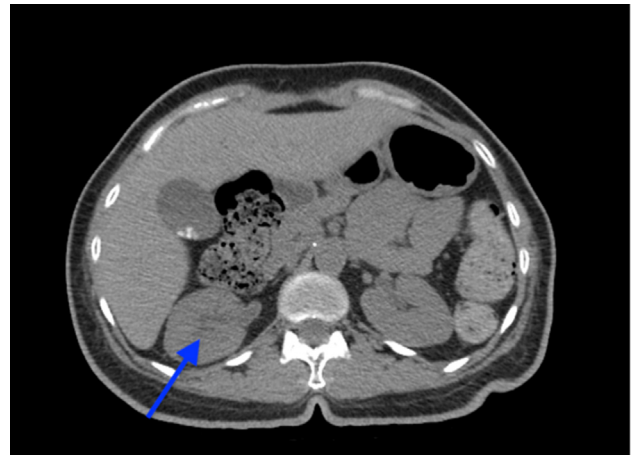
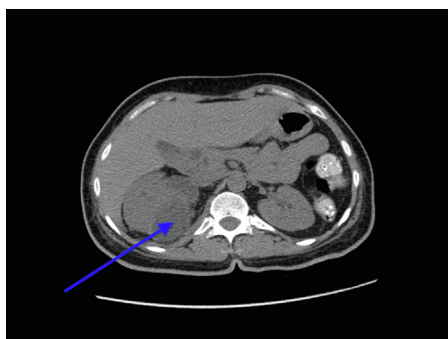


Fig. 3. CT scan at the time of discharge showing a decrease in size of the right kidney fluid collection (blue arrow).



a)



b)

Fig. 1. a) CT scan of abdomen and pelvis without contrast revealed a large  $5.6 \times 7.9 \times 8.4$  cm multiloculated collection arising from the lower pole of the right kidney invading the right psoas muscle and a large 8.4 cm multiloculated mass arising from the lower pole of the right kidney (blue arrow), b) Post percutaneous drainage and nephrostomy tube insertion (blue arrow).

### 3. Discussion

*Citrobacter* species, a type of anaerobic gram-negative rod bacteria, can lead to infections affecting different body systems such as the urinary tract, respiratory tract, skin, and soft tissues.<sup>2,3</sup> A study examining 205 patients with *Citrobacter* infections found that 46.2% of them had the bacteria present in their urine.<sup>2</sup> Additionally, abscess formation as a result of *Citrobacter* infection is rare. To date, there have been seven cases reported in literature regarding the disease.<sup>4-9</sup>

Usually, patients with *Citrobacter*-induced abscesses have underlying risk factors including diabetes mellitus, structural urological diseases, pulmonary disorders or hepatobiliary disorders.<sup>2,3</sup> The age of the patients range from 50 to 70 years of age.<sup>4,5,7</sup> Our patient was comparatively younger without any significant past medical history except for type 2 diabetes mellitus. The clinical features on presentation vary from localized ipsilateral pain to sepsis.<sup>4,5</sup>

The pathogenesis of renal abscess formation remains unclear. It has been hypothesized that increased permeability or damage to mucosal surface in bacteremic patients might lead to a complicated infection but the role of this mechanism in renal abscess formation has not been discussed.<sup>11</sup> However, our patient was not bacteremic and cultures had been obtained prior to antibiotic administration. Additionally, none of the cases mentioned in literature had concomitant fungal infection as in our case. Diabetes mellitus, as observed in our patient, was commonly observed in patients with renal abscesses secondary to *Candida* species.<sup>12,13</sup> However, another important factor to note was the development of further immunosuppression driven by the initial *Citrobacter* infection that could have been responsible for the subsequent fungal infection. Cryptococcal infections are usually observed in immunocompromised patients, specifically transplant patients.<sup>14</sup> Regardless, in immunocompromised patients, as seen in our case, the organism releases substances that prevent the build-up and penetration of infected tissues by white blood cells, allowing the species to thrive and localize into a mass called a cryptococcoma.<sup>14</sup>

Imaging, particularly CT scan, remains the standard for diagnosis and surveillance. Findings suggestive of abscess formation include collections and tracking of the collection to underlying tissues.<sup>9</sup>

Management of renal abscess involves adequate drainage and parenteral antimicrobial therapy. There are a few options when treating for the organism including third-generation cephalosporins, piperacillin–tazobactam, fluoroquinolones, and carbapenems.<sup>15</sup> The size of the abscess is important in determining mode of therapy. Usually, abscess size

less than 3 cm are treated solely with antibiotics and drainage is warranted for larger abscesses.<sup>16</sup> A few predictive factors which may determine poor outcomes include obstructive uropathy, diabetes and old age. In our patient, obstructive uropathy and type 2 diabetes were both present leading to a prolonged hospital stay and course of antibiotics.<sup>17</sup> However, despite having a longer hospital stay, antimicrobial therapy and abscess drainage, as observed in prior studies, led to resolution of the infection.<sup>5-7</sup> Fungal infections leading to renal abscesses, as observed in our case, are usually treated by fluconazole unless there is evidence of hemodynamic instability or resistance to azoles in which case voriconazole or echinocandins may be considered.<sup>18</sup> In cases with isolated renal abscesses owing to *Candida* species, the treatment duration ranged from 1 to 3 months.<sup>12,13</sup> However, for cryptococcomas, the duration might be as long as 1 year.<sup>14</sup> In our case, considering both the persistence of abscess and immunocompromised state, the duration of therapy was 1 year.<sup>14</sup>

Complications of *Citrobacter* infection include endophthalmitis, nephrocutaneous fistula and brain abscess.<sup>8-10</sup> Mortality, however, is dependent upon factors such as hemodynamic instability, presence of complications, extent of immunosuppression, and response to antibiotics with most patients having a favourable outcome.

### 4. Conclusions

*Citrobacter* can be a cause for renal abscess and is an important pathogen to consider in complicated urinary tract infections. The management of renal abscess involves effective drainage and intravenous antimicrobial treatment. The size of the abscess is crucial in determining the treatment approach, with smaller abscesses typically treated with antibiotics alone, while larger ones requiring drainage. Additionally, for superimposed infections, it is important to consider additional therapies, for example antifungals for fungal infection.

### Disclaimers

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### Conflicts of interest

The authors have no conflicts of interest to declare.

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