Inflammation and Infection

Urinary Tract Infection Caused by *Citrobacter koseri* in a Patient With Spina Bifida, an Ileal Conduit and Renal Caluli Progressing to Peri-nephric Abscess and Empyema

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**A B S T R A C T**

Urological problems are common in spina bifida and are often treated with urinary diversions. Spina bifida and ileal conduits put patients at increased risk for ascending urinary tract infections. Here we present a novel case of a *Citrobacter koseri* urinary tract infection complicated by a perinephric abscess with pleural extension. To our knowledge, no case of an ascending *C. koseri* UTI progressing to peri-nephric abscess and empyema by direct extension exists in the literature.

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**Introduction**

Urologic problems are common in spina bifida. Management begins after birth with an emphasis on preservation of renal function and continues into adulthood as continence becomes an important issue.1 Urinary diversions—often necessary in the spina bifida patient—increase the risk for *Citrobacter* urinary tract infections.2 Here we report the serious complications that can occur from a *Citrobacter koseri* urinary tract infection. To our knowledge, this is the first report of a *C. koseri* urinary tract infection causing empyema by direct extension.

**Background**

Urological problems in spina bifida are common. Management of urological problems in spina bifida begin with preservation of renal function, and if possible, transition to an emphasis on continence.1 A retrospective cohort study of 65 patients with spina bifida found that 97% of them required urological intervention at some point and 34% required surgical intervention, including urinary diversion. Notably, 34% of those patients sustained recurrent UTIs and 10% had issues with renal calculi.3

*C. koseri* is a gram-negative, non-lactose fermenting rod that is often part of normal human flora. It causes infections almost exclusively in neonates and infants—primarily meningitis—and in immune-compromised hosts.4 In the adult patient, the urinary tract is one of the most common sites of infection by *Citrobacter*. One study conducted on 78 patients with *Citrobacter* infections found that 53% of these were urinary tract infections, the majority of which were pyelonephritis. Furthermore, about 20% of the patients had urinary tract abnormalities, including ileal conduits.5

As previously noted, ileal conduits are a risk factor for *Citrobacter* infection. This is logical, as an un-valved urinary tract will not offer the same protection as a physiologically normal urinary tract. A retrospective study of 17 patients who underwent urinary diversion surgery via ileal conduit examined the microbiome of both the stoma and urine from these patients. Of the patients examined, none of them had *Citrobacter* in their urine, and only one had *Citrobacter* in their stoma sample. The one patient with *Citrobacter* on their stoma was sampled only about one month post-operatively and the stoma sample was a poly-microbial one, colonized by many other enterobacteria as well. The two most commonly grown organisms were *Staphylococcus* spp. and *Escherichia Coli*.5

Here we describe a case in which a 52-year-old woman with an ileal conduit secondary to spina bifida developed nephrolithiasis, an ascending urinary tract infection with *C. koseri*—likely a colonist of the stoma—that developed into a perinephric abscess that extended across the diaphragm to cause an empyema as well.

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A 52-year-old woman with a medical history remarkable for spina bifida, ileal conduit (placed in childhood), recurrent nephrolithiasis, and right-sided crossed fused renal ectopia presented to our institution with a chief complaint of abdominal pain. Her pain began about 5 days prior to admission and began to increase in intensity and radiate to her right groin. She was seen in the office of her primary care physician who ordered an outpatient CT scan.

On clinical examination, she had decreased breath sounds in her right lower lobe and her right flank was moderately tender. She was afebrile, normotensive and neither tachycardic nor tachypnic. Her labs were significant for a leukocytosis and acute kidney injury. A urinalysis was positive for many leukocytes and bacteria. We obtained a chest X-ray which demonstrated a right-sided, loculated pleural effusion. The outpatient CT scan was reviewed which demonstrated staghorn calculi in both the upper and lower pole moieties of her fused right-sided kidneys, and, an abnormal increased density abutting the posterior-upper aspect of the right kidney concerning for a large abscess that continued cephalad toward the diaphragm where there was a moderate sized, loculated, right pleural effusion (Figs. 1 and 2). Urine cultures came back positive for infection with *C. koseri*, however, blood cultures were negative.

The patient was begun on broad spectrum antibiotic therapy and underwent percutaneous CT guided drainage of the perinephric abscess (Fig. 3). The abscess fluid culture grew *C. koseri*, consistent with the organism found in the patient’s urine. Sensitivities were obtained and the patient’s antibiotic regimen was narrowed to monotherapy with IV Ceftazadime.

To better characterize the pleural effusion noted on her chest X-ray, a repeat CT scan was performed. Due to the acute kidney injury, this exam was performed without contrast. The repeat CT again demonstrated a small loculated right pleural effusion with adjacent consolidation representative of an empyema. The empyema was refractory to antibiotic therapy and cardiothoracic surgery opted to proceed with Video Assisted Thorascopic Surgery (VATS) to prevent the formation of a fibrothorax. During the VATS, a thick, white, purulent fluid was observed. This fluid was sent for culture and yielded *C. koseri*, consistent with the organism found in both the patient’s urine and the renal abscess.

**Conclusion**

*C. koseri* urinary tract infections are relatively uncommon, but they do have the potential for severe complications. We recommend early treatment of patients with *C. koseri* urinary tract infections, especially in the setting of nephrolithiasis and/or atypical urinary tracts to avoid serious complications and systemic illness.

**Conflicts of interest**

None.
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