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CASE REPORT

A Rare Case of Laparoscopic Removal of a Giant Renal Pelvic Pus Clot Caused by Citrobacter Freundii Infection

Xiaozhen Li[1,*], Xingfu He[1,*], Xu Zhang[2,*], Shaolin Han[1], Di Wu[1], Fusheng Yu[1], Xiao Chen[1], Nan Qian[1], Haiming Huang[1], Hongna Ding[1]

[1]Department of General Surgery I, Fugong County People's Hospital, Nujiang Lisu Nationality Autonomous Region, Yunnan, People's Republic of China; [2]Department of Urology, Pudong New Area People's Hospital, Shanghai, People's Republic of China

*These authors contributed equally to this work

Correspondence: Xu Zhang, Department of Urology, Pudong New Area People's Hospital, South Road of Chuanhuan No. 490, Chuansha New Town, Pudong New Area, Shanghai, People's Republic of China, Tel +86 159 211 80623, Email zhangxu@shpdph.cn

Abstract: It is extremely rare for renal pelvic pus clot with a diameter of 3 cm that formed by purulent secretions due to bacterial infection. A 37-year-old female patient developed a giant renal pelvic pus clot with a diameter of 3 cm 5 months after percutaneous nephrolithotomy, caused by Citrobacter freundii infection, resulting in lower back pain and fever. Due to the lack of specialized tissue pulverizers for percutaneous nephrolithotomy, laparoscopic pyelotomy via intraperitoneal approach removed the giant renal pelvis pus clot. However, it was found that some small pus clots had formed around the ureteral stent in the third month after surgery. A second surgery was performed using ureteroscopy to remove these small pus clots, and the ureteral stent was only placed for 3 days. Although there was no recurrence of renal pelvic pus clot during follow-up, multiple positive urine cultures suggest that bacteria may have colonized the renal pelvis. After taking oral antibiotics for a month, this complex urinary tract infection was finally cured. When conventional urological endoscopic techniques are not as effective or when critical equipment is lacking, laparoscopic surgery remains a good alternative option. Setting the upper limit of laparoscopic pneumoperitoneum pressure to 11 mm Hg can prevent the spread of infection. This case emphasizes that in the absence of specialized tissue pulverizer for percutaneous nephrolithotomy, transperitoneal laparoscopy to incise the renal pelvis to remove a giant renal pelvic pus clot is safe and will not cause intra-abdominal infection. This case also suggests that ureteral stents should not be left in place for an extended period to prevent the pus clot recurrence, especially in cases where urine culture results are positive. We recommend keeping the ureteral stent for less than 2 weeks. In addition, longer-term anti-infective treatment is required until the urine culture turns negative.

Keywords: bacteria infection, upper urinary tract, surgery, ureteral stent

Introduction

Urinary tract infections (UTIs) are caused by many factors, such as urinary retention, sexual intercourse, prostate hypertrophy, vulvovaginal atrophy, family history, and post-operative.[1] Current approaches for removal of objects from renal pelvis include laparoscopic pyelotomy, ultrasonic lithotripsy, laparoscopic pyeloplasty, and laser lithotripsy.[2,3] Experimental studies have shown that higher renal pelvis pressure is more likely to lead to the spread of infection.[4] Persistent pyelonephritis may occur after kidney stone surgery. Once emphysema pyelonephritis occurs, severe cases may even lead to septic shock and require nephrectomy.[5]

Upper urinary tract infections caused by Citrobacter freundii are less common. It is extremely rare for renal pelvic pus clot with a diameter of 3 cm that formed by purulent secretions due to Citrobacter freundii infection. A middle-aged woman has been successfully removed through a laparoscopic surgery in our hospital. But there was recurrence after 3 months. So a flexible ureteroscopic operation was performed again. Follow-up to now has shown no recurrence.

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Case Presentation

The June of 2024, a 37-year-old female suffered from right kidney stones and underwent percutaneous nephrolithotomy at an external hospital.

On October 24, 2024, she came for treatment due to pain in her lower right back and abdomen for 5 hours. Underwent a CT scan, which showed a pus clot in the right renal pelvis. The urine test showed 3+ white blood cells. We provided emergency surgery. Cystoscopy showed a large amount of white flocculent pus floating in the bladder. After flushing out the pus block, the ureteral opening is exposed, and a ureteral stent is inserted under the guidance of a guidewire. After indwelling catheterization, yellow turbid urine could be seen continuously draining out. The urine culture result shows mixed bacterial growth. After Cefuroxime Sodium anti-infection treatment for about 3 days, the urine color has turned clear. The body temperature was always normal. The patient was discharged on the 6th day after surgery.

On December 5th, 2024, she was readmitted and prepared to remove the ureteral stent. The urine culture result showed Citrobacter freundii. The three-dimensional reconstruction image based on CTU showed the pus clot in the right renal pelvis about 3 cm in diameter. The volume of pus clot is about 23.34 mL (Figure 1). Considered the giant renal pelvis pus clot, it was difficult to quickly and completely remove it through percutaneous nephrolithotomy without a tissue pulverizer. Therefore, after 3 days of intravenous cefoperazone sulbactam sodium for anti-infection treatment, we chose to perform laparoscopic pyelolithotomy via intraperitoneal route to remove the pus clot. No stone was found in the renal pelvis and calyces during the operation, the renal pelvis was filled with soft and fragile white gel-like pus clot. We used biliary stone forceps to clamp the pus block in the renal pelvis in stages and removed it from the puncture sheath (Figure 2). We maintained the laparoscopic pneumoperitoneum pressure below the upper limit of 11 mm Hg during the operation. On the first day after surgery, the highest fever reached 38.6°C. On the second day after surgery, a follow-up CT scan showed neither residual pus clot in the renal pelvis and nor fluid accumulation in the abdominal cavity (Figure 3). After surgery, the patient was given continued intravenous injection of cefoperazone sulbactam sodium for anti-infective treatment for 6 days before being discharged. The postoperative pathology result of the pus clot showed a large amount of degenerated and necrotic tissue. The pathological result of the pus clot was necrotic tissue.

On February 5th, 2025, the ureteral stent was left in place for 3 months. CT showed a small pus mass in the renal pelvis (Figure 4A). The urine culture result showed Citrobacter freundii. The colony count is 9000 cfu/mL. After 4 days of intravenous cefoperazone sulbactam sodium for anti-infection treatment, the small pus mass was removed under flexible ureteroscopy. Two ureteral catheters were left in place after surgery, and the renal pelvis was flushed with physiological saline (Figure 4B). One day later, the urine color was clear and there was no fever. Both ureteral catheters were removed. The patient was discharged after 5 days of postoperative anti-infective treatment.

On April 3, 2025, CT showed that there was neither hydronephrosis, nor any small pus clot in the right renal pelvis (Figure 5A). Has she fully recovered? The urine culture results still showed the presence of Citrobacter freundii. The colony count is 9000 cfu/mL. Due to the patient's lack of discomfort, further anti-infective treatment was refused.

On August 25, 2025, CT showed that there was still neither hydronephrosis nor small pus clot in the right renal pelvis (Figure 5B). But the urine test showed white blood cell esterase 2+ and occult blood 1+. The urine culture results showed that it was still Citrobacter freundii. Considering the possibility of bacterial colonization in the urinary system. Although the patient did not experience any discomfort, based on the results of drug sensitivity testing, we still prescribed oral nitrofurantoin tablets to the patient for 1 month. After 1 month of treatment, the patient's urine test and urine culture results were both negative.

Discussion

Citrobacter freundii is a conditionally pathogenic bacterium belonging to the Enterobacteriaceae family. In community-acquired urinary tract infections (UTIs), they are relatively rare (accounting for about 1–5%), but their isolation rates are significantly increased in healthcare-related infections, complex UTIs, long-term indwelling catheters, urinary system

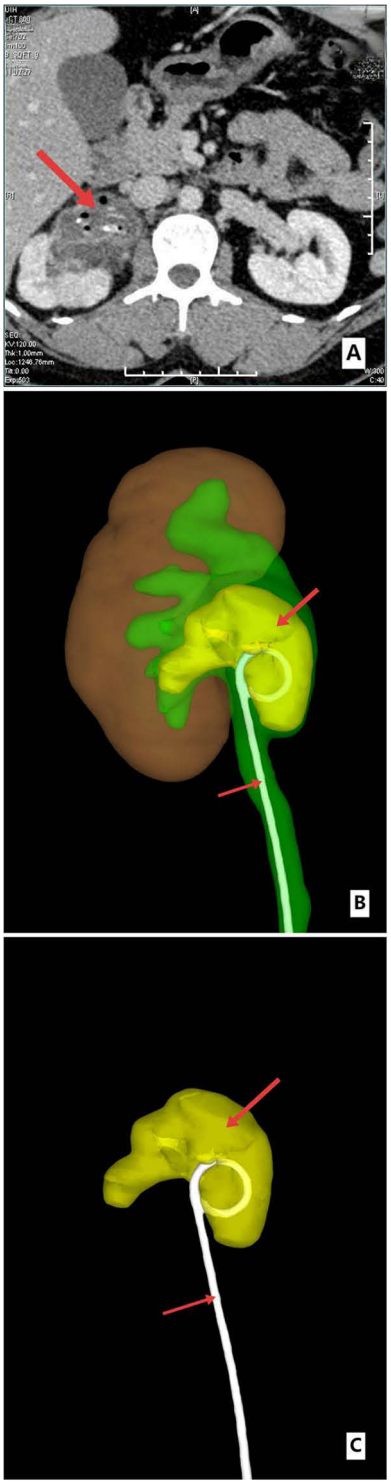

Figure 1 CT showed that the right renal pelvis had mixed density shadow (heavy arrow in (**A**). The three-dimensional reconstruction image based on CTU showed the pus clot in the right renal pelvis about 3 cm in diameter (heavy arrow in **B** and **C**) and ureteral stent in the right ureter (thin arrow in **B** and **C**). The volume of pus clot is about 23.34mL.

structural abnormalities or dysfunction, and immunocompromised patients. It is particularly associated with stone formation and chronic infections, as it has urease activity that can break down urea to produce ammonia, increase urine pH, promote the formation of magnesium ammonium phosphate (guano stone) and calcium phosphate (apatite) stones, thereby creating a favorable microenvironment for bacterial colonization and sustained infection. In the kidneys,

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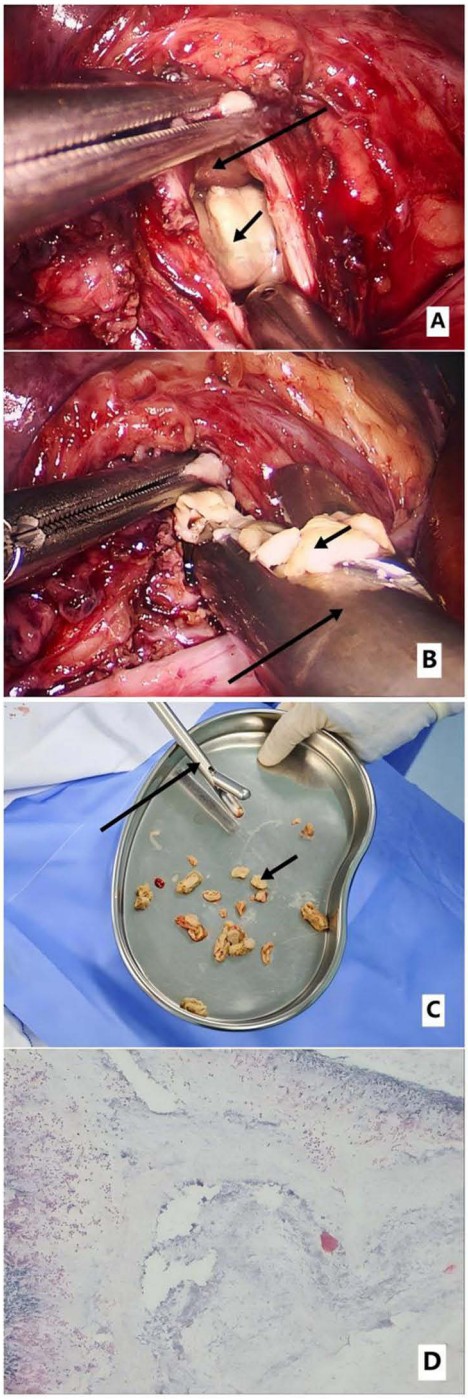

Figure 2 During laparoscopic surgery, the right renal pelvis cavity (long arrow in **A**) was occupied by white clots caused by Citrobacter freundii infection (short arrow in **A**). Removed the giant renal pelvic pus clot (short arrow in **B** and **C**) by using laparoscopic cholangiolithotomy forceps (long arrow in **B** and **C**). Pathological pictures (Hematoxylin and eosin staining): The renal pelvic pus clot were inflammatory necrosis (**D** zoom in 100×).

there were severe renal edema, mixed inflammatory exudation, mainly neutrophils, macrophages, plasmacytes, lymphocytes, fibroblast infiltration in renal parenchyma and renal cortex, extensive renal hemorrhage, edema, as well as fibrosis and severe renal tubular necrosis.[6] Citrobacter freundii adheres to the urinary tract epithelium through its pili and other adhesins, ascending to the kidneys and causing acute pyelonephritis, leading to extensive infiltration of neutrophils and tissue necrosis, resulting in the production of pus. Renal pelvic pus clot is a serious complication of acute pyelonephritis,

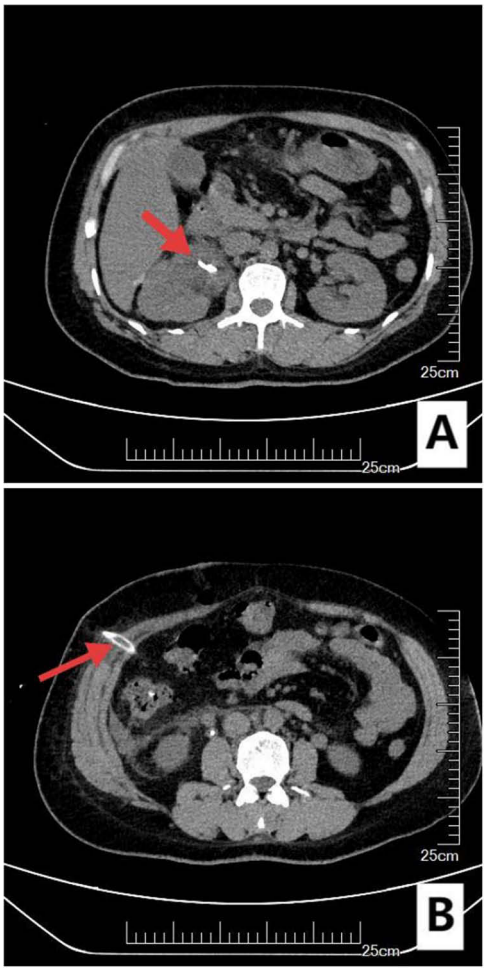

Figure 3 Three days after operation, CT showed neither dilated hydronephrosis in the right kidney nor residual mass in the right renal pelvis. The arrow indicates the ureteral stent in (**A**). The arrow indicates the abdominal drainage tube in (**B**).

which refers to a lump formed by the accumulation of pus, bacteria, inflammatory cells, necrotic tissue, and mineral crystals in the renal pelvis. Pus clot can block the renal pelvis outlet or ureter, leading to posterior renal obstruction, exacerbating infection, increased renal pressure, and renal function damage, and hindering the penetration of antibiotics, making treatment more difficult. Percutaneous nephrolithotomy (PCNL) and ureteral stent placement are commonly used methods for treating such diseases.

The patient in this case had previously undergone percutaneous nephrolithotomy, and 5 months later, due to mixed bacterial infection, a purulent mass appeared in the renal pelvis. Seek medical attention for acute onset of lower right back and abdomen pain. Emergency placement of a ureteral stent was performed to relieve pain, but the giant renal pelvic pus clot could not be drained. We knew that only surgery can remove the pus clot. However, due to the lack of a specialized tissue pulverizer for percutaneous nephrolithotomy in our hospital, performing percutaneous nephrolithotomy surgery will inevitably lead to prolonged operation time, sustained high pressure in the renal pelvis, and a significantly increased risk of postoperative sepsis. A study suggested that renal pelvis pressure exceeding 37 mm Hg can easily lead to the spread of infection.[1] If we set the upper limit of pneumoperitoneum pressure for laparoscopy to 11 mm Hg, the pressure during laparoscopic pyelolithotomy to remove the pus clot will be significantly lower than that during percutaneous nephrolithotomy, which can avoid the spread of infection. Therefore, we chose laparoscopic pyelotomy via intraperitoneal approach to remove the giant renal pelvis pus clot. The postoperative follow-up CT scan and the extremely low drainage volume of the abdominal drainage

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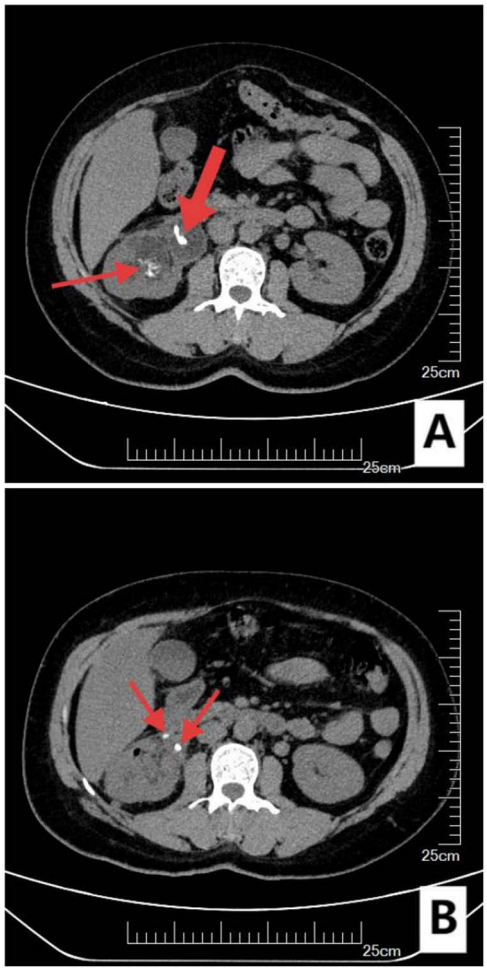

Figure 4 On December 5th, 2024, the ureteral stent was left in place for 3 months. CT scan shows a small pus mass in the renal pelvis (thin arrow in **A**). The heavy arrow indicates the ureteral stent (**A**). The small pus mass was removed under flexible ureteroscopy. Two ureteral catheters (the two arrows in **B**) were left in place after surgery, and the renal pelvis was flushed with physiological saline.

tube confirmed that the selection of this surgical plan was correct. The patient did not experience bacteremia or abdominal infection after surgery.

Biofilm formation in Citrobacter is totally dependent on the temperature; strong biofilms were formed at room temperature but not at 37°C, which can play an important role in the colonization of hospital surfaces.[7] This suggests that although bacteria have already colonized the renal pelvis, their adhesion may not be as strong as we imagine. Therefore, oral administration of sensitive drugs can clear it.

A study demonstrated that early ureteral stent removal (that is, not later than 3 weeks) could significantly decrease the incidence of urinary tract infections without affecting incidence of major urological complications. They suggest that the appropriate timing of stent removal should be within 14 to 21 days.[8] In our case, after laparoscopic removal of the giant renal pelvic pus clot, the placement of a ureteral stent for 3 months resulted in the patient experiencing a small amount of renal pelvic pus clot again, confirming that prolonged placement of the ureteral stent cannot solve the problem of bacterial colonization. If there is no obstruction, it is best to remove the ureteral stent as soon as possible. So we recommend keeping the ureteral stent for less than 2 weeks.

Due to the urease activity, biofilm formation, and drug resistance of Citrobacter freundii, upper urinary tract infections (such as pyelonephritis) caused by it should be alert to the occurrence of complex complications such as renal pelvis pus clot or infectious stones. Effective antibiotics (based on drug sensitivity testing) and possible urological interventions (such as drainage and stone/pus removal) are often used in combination for treatment.

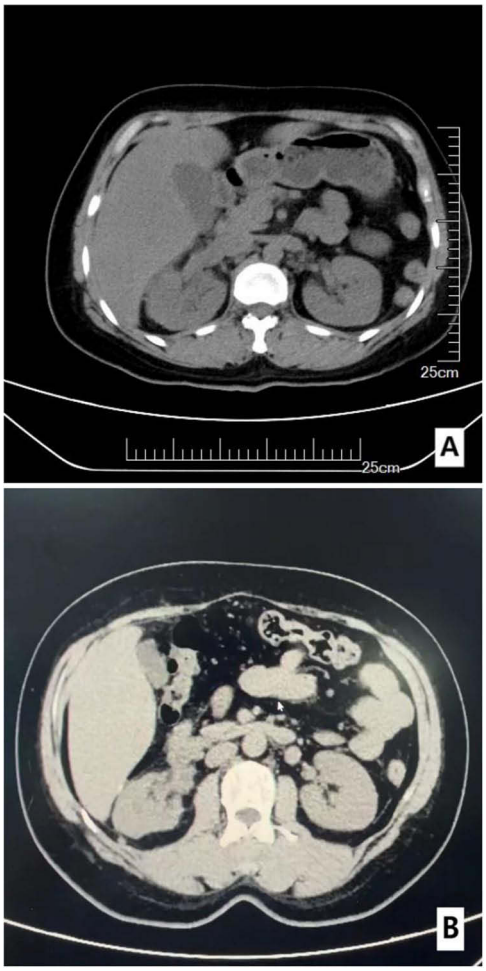

Figure 5 On April 3, 2025, CT showed that there was neither hydronephrosis, nor any small pus clot in the right renal pelvis (**A**). On August 25, 2025, CT shows that there is still no hydronephrosis or small pus clot in the right renal pelvis (**B**).

Conclusion

When conventional urological endoscopic techniques are not as effective or when critical equipment is lacking, laparoscopic surgery remains a good alternative option. Setting the upper limit of laparoscopic pneumoperitoneum pressure to 11 mm Hg can prevent the spread of infection. This case emphasizes that in the absence of specialized tissue pulverizer for percutaneous nephrolithotomy, laparoscopic pyelotomy via intraperitoneal approach removed a giant renal pelvic pus clot is safe and will not cause intra-abdominal infection. This case also suggests that ureteral stents should not be left in place for an extended period to prevent the pus clot recurrence, especially in cases where urine culture results are positive. We recommend keeping the ureteral stent for less than 2 weeks. In addition, longer-term anti-infective treatment is required until the urine culture turns negative.

The limitation of this study lies in a single case study. It may not be universally applicable.

Abbreviations

UTIs, urinary tract infections; CT, computed X-ray tomography; CTU, CT urography; PCNL, percutaneous nephrolithotomy.

Ethical Approval

Ethical approval is not required for individual case reports at our institution if the patient has provided informed consent for publication.

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Consent

Informed consent was obtained for publication of this case report from the patient.

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Disclosure

The authors report no conflicts of interest in this work.

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