Case Report

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Recurrent Acute Pyelonephritis Associated with Double-J Stent in a High-Risk Patient with Left Multiple Renal Calculi: A Case Report and Literature Review

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ABSTRACT

Background: Double-J (DJ) stents are widely utilized in urology to alleviate ureteral obstruction and maintain urinary drainage. However, their prolonged use may lead to complications such as vesicoureteral reflux (VUR) and recurrent urinary tract infections (UTIs).

Case Report: A 76-year-old female with diabetes, hypertension, and left multiple renal calculi underwent retrograde intrarenal surgery (RIRS) and DJ stent placement. Postoperatively, she developed recurrent episodes of acute pyelonephritis associated with VUR through the DJ stent. The condition was managed with optimized surgical techniques, targeted anti-infective therapy, and comprehensive postoperative care.

Conclusion: This case highlights the risks associated with prolonged DJ stent use in high-risk patients and underscores the importance of individualized management, including infection control, intravesical pressure reduction, efficient stone clearance, and timely stent removal.

Keywords: Double-J Stent; Vesicoureteral Reflux; Recurrent Acute Pyelonephritis; Flexible Vacuum-Assisted Ureteral Access Sheath; Retrograde Intrarenal Surgery

Abbreviations: DJ: Double-J; VUR: Vesicoureteral Reflux; UITs: Urinary Tract Infections; RIR: Retrograde Intrarenal Surgery; ESBL: Extended-Spectrum Beta-Lactamase; FVAUAS: Flexible Vacuum-Assisted Ureteral Access Sheath

Background

Double-J (DJ) stents are a cornerstone in urologic practice, aiding in the management of ureteral obstruction caused by conditions such as urinary calculi, strictures, and postoperative edema. Despite their utility, DJ stents are not devoid of complications, particularly in high-risk patients with comorbidities such as diabetes mellitus, hypertension, and recurrent urinary tract infections. One of the most concerning complications is vesicoureteral reflux (VUR), a condition exacerbated by the disruption of the anti-reflux mechanism at the ureterovesical junction by the DJ stent [1,2]. VUR permits retrograde flow of infected urine into the renal pelvis, leading to recurrent pyelonephritis. High intravesical pressures, as seen in patients with chronic urinary retention or improper voiding mechanics, further increase the risk of infection [3,4]. This case highlights the clinical challenges of managing DJ stent-associated recurrent acute pyelonephritis in a high-risk elderly patient with left multiple renal calculi.

Case Report

Patient Information

A 76-year-old female with a history of diabetes mellitus, hypertension, hyperlipidemia, chronic urinary retention, and post-stroke sequelae presented in July 2024 with left multiple renal calculi and recurrent urinary tract infections (Figure 1).

Initial Surgery and Postoperative Course

She underwent left retrograde intrarenal surgery (RIRS) with DJ stent placement for multiple renal calculi. The procedure was uneventful, and she was discharged two days postoperatively. Two weeks later, she developed fever (up to 39.5 °C) accompanied by left-sided flank pain. Physical examination revealed positive left kidney percussion pain. She was diagnosed with acute pyelonephritis, and her symptoms resolved after anti-infective therapy.

Recurrent Pyelonephritis

In September 2024, the patient experienced another episode of high fever and flank pain. Urine culture revealed extended-spectrum beta-lactamase (ESBL)-producing Escherichia coli, sensitive to cefoperazone-sulbactam. Anti-infective therapy was initiated, leading to symptom resolution. In October 2024, she presented with persistent low-grade fever. CT imaging revealed left renal swelling, a residual calculus (15 mm × 12 mm × 10 mm) in the lower calyx, and an indwelling DJ stent (Figure 1). Post-void residual urine volume was 115 mL. Inflammatory markers were elevated (CRP: 65 mg/L, IL-6: 90 pg/mL). Based on her history and findings, recurrent pyelonephritis was attributed to VUR through the DJ stent. A urinary catheter was inserted to reduce intravesical pressure, and aspirin was discontinued.

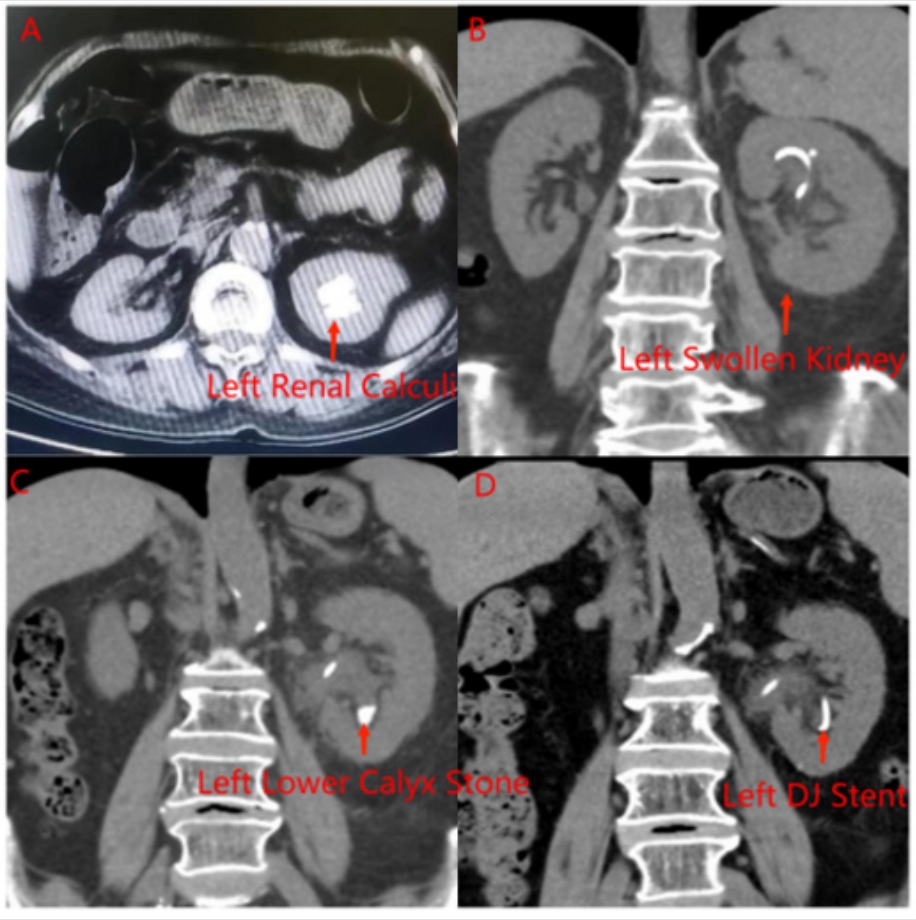

Figure 1: Preoperative and postoperative image.
A. Pre-RIRS CT shows left upper calyx calculi (red arrow).
B. CT after Stage 1 RIRS shows left swollen kidney.
C. CT after Stage 1 RIRS shows left lower calyx calculi.
D. CT after Stage 2 RIRS shows no residual calculi.

Intervention and Follow-Up

After 10 days of targeted anti-infective therapy, the patient underwent a second retrograde intrarenal surgery (RIRS) with DJ stent replacement. Intraoperatively, the left ureter and renal pelvis were noted to have significant mucosal edema, indicative of prior inflammation. To optimize surgical outcomes and reduce renal pelvic pressure, a flexible vacuum-assisted ureteral access sheath (FVA UAS) was utilized, facilitating efficient fluid drainage during the procedure (Figure 2) [5]. Residual stones in the left lower calyx were completely fragmented using a laser and evacuated via the FVA UAS, ensuring thorough stone clearance. The entire procedure was carefully completed within 65 minutes to minimize the risk of postoperative infection [6]. Postoperative management focused on preventing further complications. The urinary catheter and DJ stent were removed on postoperative day three to reduce the likelihood of reflux and subsequent pyelonephritis. The patient was advised to maintain an adequate fluid intake to promote urinary flow and to avoid abdominal straining during voiding, which could increase intravesical pressure and heighten the risk of urinary reflux. At a one-month follow-up, imaging confirmed the absence of residual stones, and the patient reported no recurrent infections or complications, indicating a successful intervention and recovery. Written informed consent was obtained from the patient for treatment and for publication of the case report. This case report was approved by the Ethics Committee of the University of Hong Kong-Shenzhen Hospital, and conforms to the CARE guidelines.

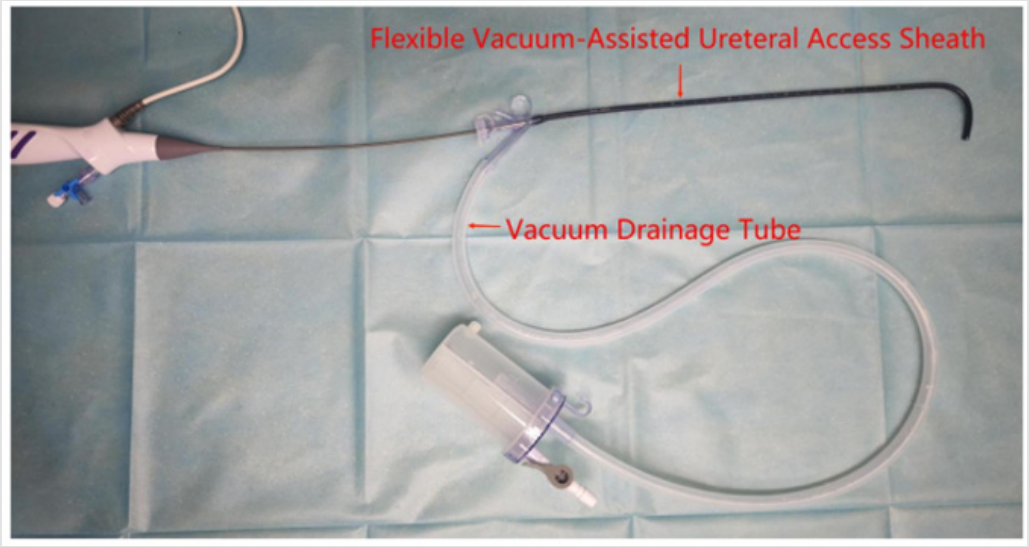

Figure 2: Flexible Vacuum-Assisted Ureteral Access Sheath.

Discussion

Double-J (DJ) stents are extensively utilized in urological practice to manage ureteral obstructions arising from conditions such as nephrolithiasis, strictures, and postoperative edema. These stents facilitate urinary drainage, prevent ureteral blockage, and support healing processes. However, their use is not without risks [7,8]. One significant concern is the disruption of the ureterovesical junction's anti-reflux mechanism by the DJ stent, leading to vesicoureteral reflux (VUR). This retrograde flow of urine into the renal pelvis can introduce pathogens, resulting in pyelonephritis [9]. The pathogenesis involves the stent acting as a conduit for bacteria from the bladder to the upper urinary tract, compounded by biofilm formation on the stent surface, which serves as a reservoir for persistent infections [10]. Certain populations are at heightened risk for DJ stent-associated pyelonephritis. Patients with diabetes mellitus, immunosuppression, or anatomical abnormalities of the urinary tract are particularly susceptible [10]. Additionally, prolonged stent indwelling time, improper stent positioning, and elevated intravesical pressures due to factors like chronic urinary retention or increased abdominal pressure during voiding can exacerbate the risk [11]. The consequences of DJ stent-related pyelonephritis can be severe, potentially leading to urosepsis, renal function impairment, and, in extreme cases, mortality. Therefore, it is imperative to identify high-risk individuals and implement preventive strategies, including meticulous surgical technique, appropriate stent selection, and vigilant postoperative monitoring, to mitigate these risks [12].

In this case, the recurrent episodes of pyelonephritis were primarily driven by several factors. Vesicoureteral reflux (VUR), facilitated by the presence of the DJ stent, created a direct pathway for the retrograde flow of infected urine into the renal pelvis. Elevated intra-

vesical pressure during voiding, particularly exacerbated by abdominal straining, further increased the likelihood of urine reflux. The prolonged placement of the DJ stent also led to the formation of a bacterial biofilm on its surface, which acted as a persistent reservoir for infection and further contributed to the recurrence of pyelonephritis [13]. Additionally, systemic comorbidities such as diabetes and hypertension likely impaired the patient's immune response, making her more susceptible to infections and complicating her overall recovery [14]. To address these complications, the second surgical intervention was carefully optimized using advanced techniques. A flexible vacuum-assisted ureteral access sheath (FVA UAS) was utilized to ensure efficient fluid drainage, significantly reducing renal pelvic pressure and preventing pressure-induced pyelovenous reflux during the procedure. This innovative sheath also allowed for complete stone clearance, as residual fragments were fully fragmented with a laser and successfully evacuated via the FVA UAS, thereby eliminating potential sources of infection. The surgical duration was meticulously controlled and kept under 90 minutes to minimize the risk of postoperative febrile urinary tract infections (UTIs), as recommended by evidence-based guidelines [15].

Furthermore, the DJ stent tail was securely fixed to the urinary catheter with a suture, ensuring stable positioning and effective drainage while facilitating its early removal during the postoperative period to mitigate complications. Postoperative management was critical to the patient's successful recovery. Targeted anti-infective therapy, guided by urine culture and sensitivity testing, effectively treated the ESBL-producing Escherichia coli pathogen, with cefoperazone-sulbactam proving to be highly effective [16]. The DJ stent was removed on postoperative day three, significantly reducing the risk of further VUR and subsequent infections. Comprehensive patient education was provided to promote long-term recovery, emphasizing the importance of maintaining adequate hydration, avoiding abdominal straining during voiding, and refraining from behaviors such as holding urine, which could increase intravesical pressure and promote reflux. This case underscores the importance of meticulous management for high-risk patients with DJ stents. Through the implementation of advanced surgical techniques and vigilant postoperative care, complications such as recurrent pyelonephritis can be effectively mitigated. These strategies highlight the necessity of individualized and multidisciplinary approaches to address both mechanical factors, such as reflux and biofilm formation, and systemic challenges posed by patient comorbidities.

Conclusion

This case highlights the mechanism and management of double-J (DJ) stent-associated vesicoureteral reflux (VUR) leading to recurrent pyelonephritis in a high-risk patient with left multiple renal calculi. Effective outcomes were achieved through targeted interventions, including optimal control of systemic comorbidities such as diabetes and hypertension, precise anti-infective therapy guided by culture and sensitivity testing, and measures to reduce intravesical pressure to minimize urinary reflux. Advanced surgical techniques, such as the use of a flexible vacuum-assisted ureteral access sheath (FVA UAS) for complete stone clearance and reduction of renal pelvic pressure, were critical to eliminating infection sources. Early removal of the DJ stent further reduced the risk of recurrent reflux and infection, supported by proper fixation to the urinary catheter for ease of removal. This case underscores the importance of individualized, multidisciplinary approaches in managing DJ stent-related complications. By addressing both mechanical factors and systemic vulnerabilities, clinicians can mitigate risks and achieve favorable outcomes, even in medically complex patients.

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