



Sheathless, Fluoroless, Tubeless Bilateral Retrograde Intrarenal Surgery (RIRS): A Case Report

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Abstract: This case report presents the management of bilateral urinary tract stones through Retrograde Intrarenal Surgery (RIRS) performed in a single surgical session. We reported a 30-year-old male patient with a history of right flank pain and hematuria diagnosed with bilateral kidney stones with a history of right ureteral DJ stent placement. The RIRS procedure was performed under spinal anesthesia. Multiple ureteral stenoses and stones were found in both kidneys. The stones were fragmented using a Holmium laser and evacuated. Bilateral ureteral catheters were placed at the end of the procedure. The patient recovered well without complications. In conclusion, this case report demonstrates that sheathless, fluoroless, tubeless bilateral RIRS can be a safe and effective treatment option for multiple kidney stone cases in appropriately selected patients.

Keywords: retrograde intrarenal surgery; bilateral kidney stones; ureteral stenosis; Holmium laser

INTRODUCTION

Urinary tract stones or urolithiasis is a condition commonly encountered in urological cases, with prevalence continuing to increase globally in recent decades. This increase is associated with changes in modern lifestyle, including diet, physical activity, and environmental factors.^{1,2} In Indonesia, although accurate epidemiological data remains limited, urinary tract stone cases occupy a significant portion in daily urological practice.

The management of urinary tract stones has undergone rapid evolution since the introduction of minimally invasive techniques. Retrograde Intrarenal Surgery (RIRS) has emerged as a therapeutic modality, particularly for kidney stones less than 2 cm in size. This technique offers several advantages compared to conventional procedures, including minimal trauma, shorter recovery time, and the possibility of treating bilateral stones in a single surgical session.^{3,4}

Although bilateral RIRS in a single surgical session is not a new procedure, its implementation requires careful consideration regarding patient selection, adequate perioperative preparation, and sufficient operator skill. Technical challenges frequently encountered include variations in urinary tract anatomy, ureteral stenosis conditions, and stone burden complexity.³ A thorough understanding of these aspects is crucial to achieve optimal results.

CASE REPORT

A 30-year-old man presented with right flank pain and gross hematuria for eight days before admission. The pain was aggravated by strenuous activity, associated with blood clots and passage of sandy particles in the urine, and radiated to the right lower abdomen, especially at the end of urination. It was not affected by position. He denied fever, nausea, vomiting, and shortness of breath.

He first developed right flank pain in October 31, 2024, and underwent right DJ stent placement at Hermina Hospital Manado in November 18, 2024, for a right ureteral stone. He had been taking silodosin 4 mg twice daily since November 6, 2024, and Renalof one capsule three times daily from November 6 to December 6, 2024.

On admission, December 23, 2024, he was alert and hemodynamically stable. Physical examination was otherwise unremarkable, with no costovertebral angle tenderness, suprapubic distention, or palpable masses. The urinary catheter drained bloody urine.

Laboratory examination in December 23, 2024, showed a leukocyte count of $5.96 \times 10^3/\mu\text{L}$, hemoglobin of 14.4 g/dL, hematocrit of 40.4%, platelet count of $289 \times 10^3/\mu\text{L}$, sodium of 138 mmol/L, potassium of 3.8 mmol/L, chloride of 95 mmol/L, and an eGFR of 120 mL/min/1.73 m². Non-contrast CT demonstrated a DJ stent in the right urinary tract, mild right hydronephrosis, and a stone in the inferior calyx of the right kidney measuring approximately 0.5 cm with a density of about 800 HU. Multiple stones were also seen in the left renal calyces, measuring approximately 0.38 cm and 0.55 cm (Figure 1). No abnormalities were identified in the left ureter, urinary bladder, prostate, or other abdominal organs.

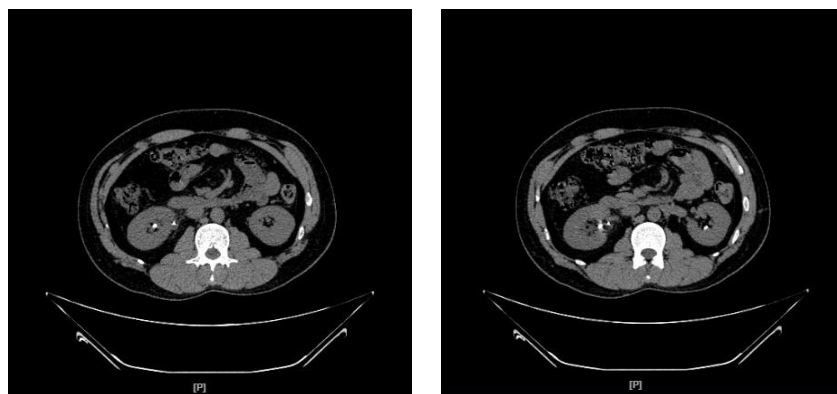


Figure 1. Radiological examination with non-contrast CT

The patient was diagnosed with residual right inferior calyceal stones after right ureteroscopy (URS) lithotripsy and right DJ stent insertion in November 18, 2024, and was scheduled for bilateral RIRS on December 24, 2024 (Figure 2). Preoperative preparation included fasting, informed consent, blood preparation, and regional spinal anesthesia (RA-SAB).

The patient was diagnosed with a residual right inferior calyceal stone after right URS lithotripsy and right DJ stent insertion in November 18, 2024, and was scheduled for bilateral RIRS on December 24, 2024. After standard preoperative fasting, informed consent, and spinal anesthesia, the patient was placed in the lithotomy position and prepared under sterile conditions. Cystoscopy showed normal bladder findings and a non-encrusted right DJ stent protruding from the right ureteral orifice, which was removed intact. Right URS identified partial mid-ureteral stenosis but successfully reached the right PCS. A guidewire was inserted and left in place, although insertion of a 10 Fr ureteral sheath was hindered by resistance at the mid ureter.

Flexible URS was advanced into the right PCS, where stones in the inferior calyx were identified and fragmented using a Holmium laser (20 Hz, 1 J, 20 W) until reduced to small fragments. Re-evaluation confirmed complete stone clearance without active bleeding or infundibular laceration. A right ureteral catheter was then inserted over a guidewire through the UAS, and final ureteral inspection showed no mucosal laceration (Figure 3).

A cobra guidewire was inserted into the narrow left ureteral orifice, followed by placement of a second guidewire. Double-wire URS revealed multiple proximal-to-distal ureteral stenoses, which were gradually dilated using rigid URS. With guidewire assistance, flexible URS reached the left pelvicalyceal system, where stones in the middle and inferior calyces were fragmented using a Holmium laser until reduced to small fragments. Re-evaluation confirmed complete stone clearance without active bleeding or infundibular laceration. A left ureteral catheter was then inserted over a cobra guidewire through the UAS (Figure 3).

An 18 Fr Foley catheter with a 15 mL balloon was inserted after the procedure. Surgery was completed without complications, with minimal blood loss (1 mL) and no intraoperative consultation. Postoperative care included monitoring of general condition, vital signs, and urine output, gradual diet and mobilization, administration of ceftriaxone and ibuprofen, and follow-up CT evaluation after 1 month.

DISCUSSION

The diagnostic process was carried out systematically in accordance with medical service standards. Anamnesis revealed classic symptoms of urinary tract stones, including right flank pain, hematuria with blood clots, sandy urine, and pain radiating to the lower abdomen. A history of previous DJ stent placement also provided important information regarding the course of the disease. Physical examination showed that the patient was in stable condition, with normal vital signs, no signs of systemic infection, normal abdominal findings, and no costovertebral angle tenderness.



Figure 2. Bilateral RIRS procedure



Figure 3. Bilateral ureteral catheters were placed at the end of the procedure

The results of supporting examinations strongly confirmed the final diagnosis. Laboratory tests showed preserved renal function, with an eGFR of 120 mL/min/1.73 m². CT imaging clearly demonstrated the anatomical condition of the urinary tract, revealing mild right hydronephrosis, a 0.5 cm stone in the inferior calyx of the right kidney, multiple stones in the left kidney, and a right-sided DJ stent in situ. The integration of these findings enabled an accurate diagnosis and provided a strong basis for subsequent management planning.

The diagnosis of bilateral nephrolithiasis with a history of right ureteral DJ stent placement was established based on clinical manifestations and radiological findings. Non-contrast CT showed a stone in the inferior calyx of the right kidney (approximately 0.5 cm; 800 HU) and multiple stones in the left renal calyces (approximately 0.38 cm and 0.55 cm). Mild right hydronephrosis indicated partial obstruction and the need for prompt intervention to prevent progressive renal parenchymal damage.

In differential diagnosis evaluation, several pathological entities need to be systematically considered. Although acute pyelonephritis can present with similar symptoms, it can be ruled out based on the absence of systemic manifestations such as fever, leukocytosis, or elevation of acute-phase reactants. Renal neoplasms, particularly renal cell carcinoma, can be excluded based on imaging characteristics that are pathognomonic for stones (high density, clear borders). Musculoskeletal flank pain complaints can be distinguished through pain characteristics that are not affected by position changes and radiological confirmation of stone presence.^{5,6}

The selection of endourological intervention modality is based on algorithms considering multiple variables including stone burden, anatomical location, stone characteristics, and host factors. Retrograde Intrarenal Surgery (RIRS) with flexible instrumentation becomes the optimal choice for stones with diameter <2 cm, especially in superior and middle calyx locations. The effectiveness of RIRS has been validated through various prospective studies with stone-free rates reaching 85-95% in well-selected cases.⁷

In this case, intraoperative findings of multiple ureteral stenoses required a systematic gradual dilatation strategy to prevent iatrogenic trauma to the ureteral mucosa. The use of Holmium laser with optimized parameters (frequency 20 Hz, energy 1 J) enabled efficient stone fragmentation while minimizing retropulsion risk.

Perioperative management includes broad-spectrum antibiotic prophylaxis according to local resistance patterns, precise fluid management to maintain adequate urine output, and multimodal analgesic protocol. Hemodynamic monitoring and vital parameters are conducted strictly for early detection of potential complications such as urosepsis or significant bleeding.⁷⁻⁹

Post-operative follow-up involves serial clinical evaluation and control imaging at predetermined intervals. CT evaluation at one month post-operation aims to confirm stone clearance and evaluate pelvicalyceal system dilatation. Long-term metabolic management, including serial crystalluria analysis and 24-hour urine biochemical parameter evaluation, becomes an important component in recurrence prevention strategy.

In literature, the standard RIRS approach is initiated with diagnostic cystoscopy for evaluation of urethral anatomy, bladder, and visualization of ureteral orifices. The next crucial stage is ureteral cannulation with guidewire that functions as a safety rail for subsequent instrument insertion. The use of presenting and ureteral access sheath (UAS) has become gold standard in modern practice as it provides several significant advantages: decreasing intrarenal pressure, facilitating adequate irrigation flow, and enabling multiple ureteroscope passages with minimal trauma to ureteral mucosa.³

Holmium:YAG laser stone fragmentation has become the standard due to its superior safety profile and high effectiveness. Laser parameters must be optimized based on stone composition and location, considering the balance between ablation efficiency and retropulsion risk. Modern fragmentation techniques adopt a "dusting" strategy that produces submillimeter fragments that can be spontaneously excreted, compared to conventional "basketing" techniques that require active stone fragment extraction.¹⁰

In this case, the operative procedure showed higher complexity than standard due to bilateral characteristics and anatomical complications. On the right side, the procedure began with extraction of previously installed DJ Stent. The finding of partial stenosis in the right mid ureter required technique modification in the form of gradual dilatation to prevent iatrogenic trauma. Insertion of a 10 Fr ureteral access sheath was performed with atraumatic technique to minimize ureteral avulsion risk.

In the right collecting system, the use of flexible ureteroscope enabled optimal access to the inferior calyx where the stone was located. Selected laser parameters (frequency 20 Hz, energy 1 J, power 20 Watts) showed careful consideration between fragmentation effectiveness and procedure safety. Stone clearance confirmation was performed through systematic evaluation of all calyces to ensure no residual fragments remained.

The procedure on the left side faced greater technical challenges with the discovery of multiple stenoses from proximal to distal ureter. The chosen approach of double wire insertion and gradual optical dilatation showed appropriate technical adaptation to complex anatomical conditions. Management of multiple stones in the middle and inferior calyces was performed with identical laser parameters, indicating consistent technique standardization.

Bilateral ureteral catheter placement at the end of the procedure represents a preventive strategy to maintain ureteral patency and facilitate adequate collecting system drainage. Minimal intraoperative blood loss (1 mL) confirms precise technical execution with minimal tissue trauma.

The RIRS procedure in this case demonstrates several aspects related to the management of bilateral ureteral stenosis and multiple stone burden. However, adherence to basic endourology principles and appropriate technique modification enabled procedure completion without significant complications.

CONCLUSION

This case report demonstrates the management of bilateral urinary tract stones through RIRS performed in a single surgical session. Despite facing several challenges such as ureteral narrowing in multiple locations and stones present in both kidneys, the surgical procedure proceeded well and in accordance with endourology technical principles. The success of this procedure was supported by comprehensive pre-operative preparation, adaptation of surgical technique according to encountered conditions, and strict post-operative monitoring. This case proves that sheathless, fluoroless, tubeless bilateral RIRS can be a safe and effective treatment option for multiple kidney stone cases in appropriately selected patients.

Conflict of Interest and AI-assisted Technologies

The authors declare no conflict of interest and AI-assisted technologies used in this study.

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