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CASE REPORT

Laparoscopic ureterolysis with simultaneous ureteroscopy and percutaneous nephroscopy for treating complex ureteral obstruction after failed endoscopic intervention: A technical report



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Abstract *Objective:* Complex ureteral obstruction is refractory to conventional urological intervention. This report describes a case of laparoscopic ureterolysis with simultaneous ureteroscopy and percutaneous nephroscopy for treating complex ureteral obstruction.

Methods: Right-side multiple ureteral stones and complicating ureteral obstruction failed an initial attempt of ureteroscopy lithotripsy with simultaneous percutaneous nephroscopy in a 23-year-old male. Laparoscopic ureterolysis with ureteroscopy and percutaneous nephroscopy was used simultaneously to dissect the periureteral adhesions with the patient placed in the Galdakao-modified supine Valdivia position. The ureter was incised to allow the insertion of a ureteral catheter through the twisted ureter, and a guide wire was advanced into the pelvis using ureteroscopy. A double-J stent was placed into the right-side ureter using antegrade percutaneous nephroscopy.

Results: The laparoendoscopic procedure lasted 330 min with an estimated bleeding volume of 100 mL. The patient underwent an uneventful postoperative course, and postoperative follow-up radiography confirmed good positioning of the double-J stent. The double-J stent was removed 3 months after operation. The patient remained asymptomatic within a 13-month follow-up period.

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Conclusion: Laparoscopic ureterolysis with simultaneous ureteroscopy and percutaneous nephroscopy is an effective and safe treatment option for complex ureteral obstruction.

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1. Introduction

Complex ureteral obstruction is a common urological disorder that results from a variety of benign and malignant causes. Benign ureteral obstruction is mainly caused by calculi, iatrogenic injury, infection, congenital anomaly, radiation, and adjacent tissue disease. A large number of nonsurgical and surgical treatment modalities are available for management of benign ureteral obstruction, including endoureterotomy [1], endoscopic balloon dilation, ureteral stenting [2], endopyelotomy [3], ureteroureterostomy [4], downward nephropexy [5], bladder flap transfer [5], bowel interposition [6], renal autotransplantation [5], nephrectomy, ureteral reimplantation [7], and ureterolysis [8]. Conventional surgical treatment modalities offer definitive treatment outcomes (effective in 91%–97% of patients), but result in some surgical morbidities as well as prolonged postoperative recovery and hospital stay.

The advent of ureteroscopy, nephroscopy and laparoscopy has been revolutionizing current urological practice and emerging as the first-line treatment option for benign ureteral obstruction. In contrast to surgical intervention, endoscopic intervention is minimally invasive and primarily advantageous in expedited postoperative recovery and better esthetic outcome. Endoscopic treatment achieves a success rate of ureteral reimplantation ranging from 46% to 89% with significant clinical benefits, including reduced morbidity, shortened hospital stay, and early return to normal daily activities. However, therapeutic effectiveness of endoscopic intervention remains controversial, and some patients may require a second-look surgical intervention after endoscopic treatment.

In this study, we described a case of symptomatic complex ureteral obstruction with multiple urinary calculosis,

in which the initial attempt of endoscopic intervention failed. Laparoscopic ureterolysis was performed, and concomitant ureteroscopy and percutaneous nephroscopy was used simultaneously to laparoscopically place a double-J stent. The patient remained asymptomatic within a 13-month postoperative follow-up period.

2. Case report

A previously healthy 23-year-old male, with a body mass index of 21.1 kg/m², complained of a history of 20-day lower back pain. He had no previous history of urinary tract infection, urolithiasis, or abdominal surgery. Urinary tract ultrasonography and computed tomography scan showed anterior–posterior diameter of the right renal pelvis was 5 cm. Intravenous pyeloureterography revealed multiple urinary calculus in the lower ureter with complicating ureteral tortuosities in the upper ureter (Fig. 1A). The largest one of the right lower ureter calculus was 1.2 cm in size. His serum creatinine level was 79 μmol/L (reference range, 50.0–110.0 μmol/L) on admission. Technetium-99m diethylene-triamine-pentaacetate scan showed a unilateral renal glomerular filtration rate (lower limit, 62.5 mL/min) of 66.8 mL/min (left) and 19.4 mL/min (right). A diagnosis of right-side multiple ureteral stones with complicating ureteral obstruction was therefore established.

The patient voluntarily gave informed consent prior to receiving urological treatment. Holmium laser ureterolithotripsy (Lumenis Ltd., Yokneam, Israel) was performed to remove all ureteral calculi. But after ureteroscopy and lithotripsy of the stones, the double-J stent could not be inserted through the ureter, even with the help of wires or catheters, neither ante- nor retrograde. Only a renal fistula tube was inserted under percutaneous nephroscopy. The



Figure 1 Preoperative radiographic evaluation: (A) intravenous pyeloureterography revealed right-side hydronephrosis, two sites of tortuosity in the upper ureter before ureteroscopy. Posteroanterior (B) and lateral (C) trans-nephrostomy tube pyeloureterography confirmed the presence of ureteral tortuosities after ureteroscopy.



Figure 2 The Galdakao-modified supine Valdivia position.

presence of two S-shaped tortuosities in the upper ureter was shown on trans-nephrostomy tube pyelography (Fig. 1B and C). The patient and his parents refused open surgery and insertion of a nephrostomy for an antegrade study. Eight days later, after adequate preparation, laparoscopic ureterolysis with simultaneous ureteroscopy and percutaneous nephroscopy was subsequently scheduled to eliminate complicating ureteral obstruction.

Under general anesthesia with endotracheal intubation, the patient was placed in the Galdakao-modified supine Valdivia position as previously reported by Scoffone et al. [9] (Fig. 2). The patient was positioned in a 90° flank position on the left side (opposite to the affected side). The ipsilateral upper limb was suspended in an abducted, medially rotated position, while the contralateral arm was secured onto the operating table. The patient was secured using Maquet™ pelvic brackets (Maquet Holding B.V. & Co. KG, Rastatt, Germany), and the operating table was rotated through its full range of motion to ensure that the patient was adequately secured. Allen® Yellofins® Stirrups (Allen Medical Systems, Ashby-de-la-Zouch, Leicestershire, UK) were also used to establish the simultaneous access to the urethra.

The schematic diagram of trocar placement is shown in Fig. 3A. Four laparoscopic ports (Johnson and Johnson, New Brunswick, NJ, USA) were placed in a diamond-like

configuration. A 12-mm trocar was placed through the umbilicus to create a pneumoperitoneum at 15 mmHg and insert a 30° laparoscope (KARL STORZ GmbH & Co. KG, Tuttlingen, Germany). Primary, secondary, and auxiliary dissecting instruments (KARL STORZ GmbH & Co. KG) were inserted through two 12-mm trocars and a 5-mm trocar, respectively.

The white line of Toldt was incised along the medial side to bluntly mobilize the ascending colon until the level of the lower pole of the right-side kidney. The perirenal fascia was dissected to expose the ureter, which was located anterior to the psoas major muscle. The ureter was cautiously dissected from the level of the pelvis towards the crossover point anterior to the iliac vessels with preserving the right-side genital vessels (Fig. 4A). Two tortuosities were localized in the upper ureter, and a tortuosity was in proximity to the pelvis. The periureteral adhesions were dissected (Fig. 4B), and a 0.5-cm incision was made in the ureter superior to the crossover point anterior to the iliac vessels. A guide wire was inserted into the ureteral incision using a 6F transurethral ureteroscope (Fig. 4C: KARL STORZ GmbH & Co. KG). An additional 0.5-cm incision was made in the ureter proximal to the S-shaped ureteral tortuosities (Fig. 4D). An 8F ureteral catheter (KARL STORZ GmbH & Co. KG) was inserted through the tortuosities into the lower incision (Fig. 4E and F). The head end of the

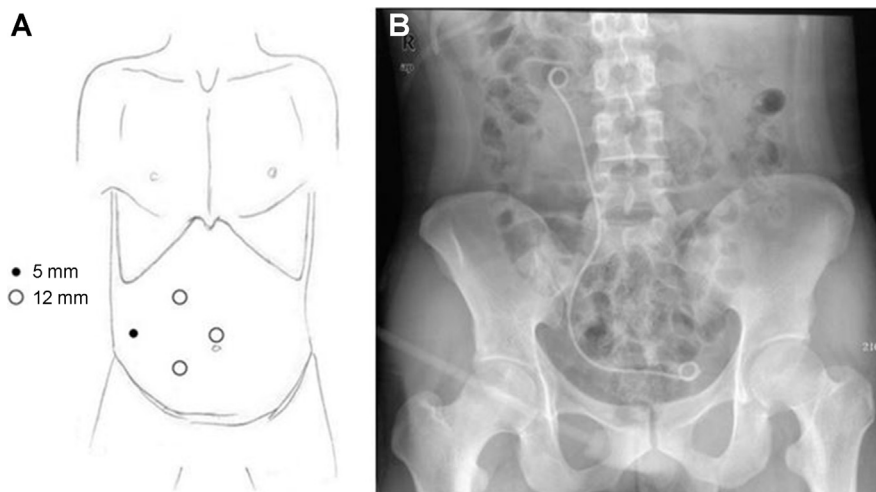


Figure 3 (A) Schematic diagram for trocar placement and (B) postoperative follow-up kidneys—ureters—bladder radiography.

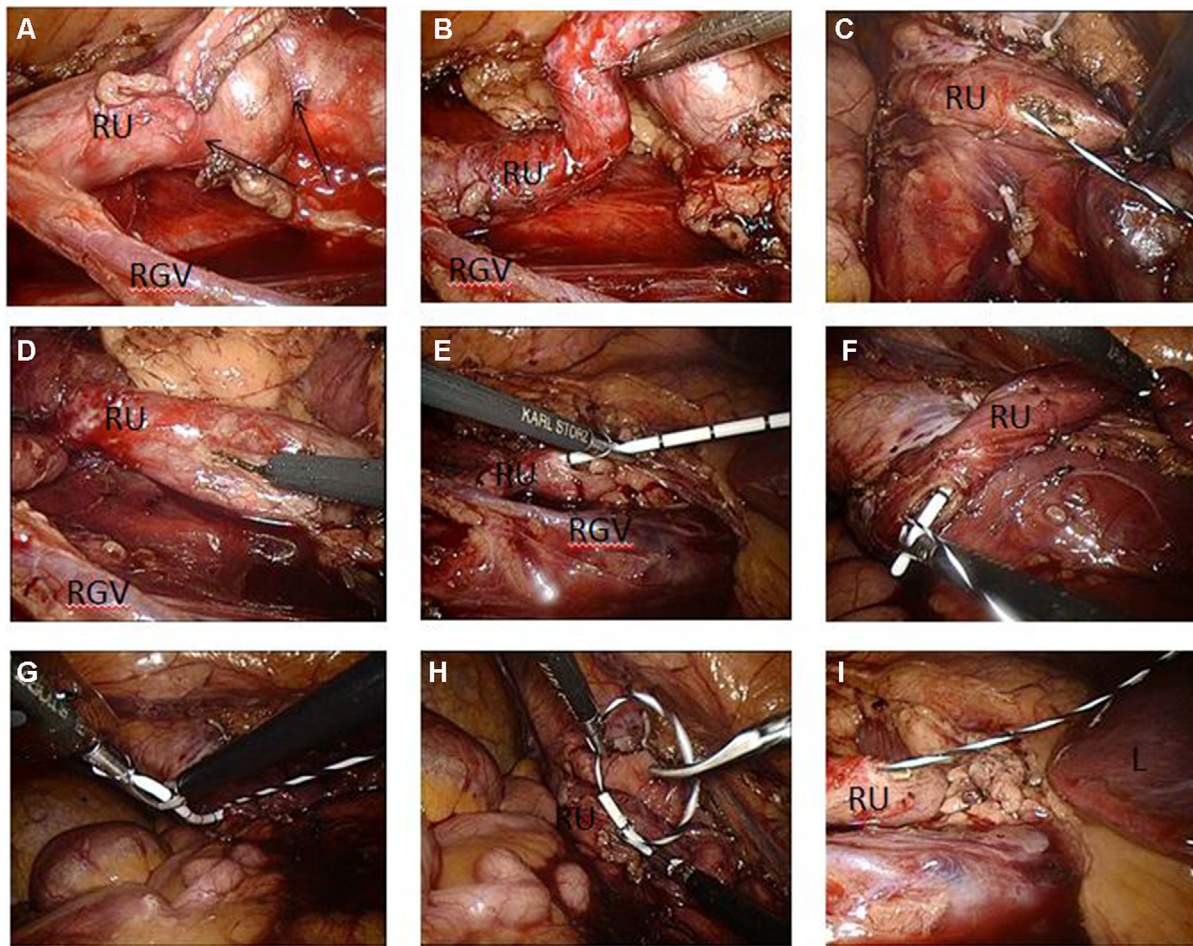


Figure 4 Key procedures of laparoscopic ureterolysis: (A) mobilization of the ureter (the arrows indicate the tortuosities of the right ureter); (B) dissection of periureteral adhesions; (C) incision of the ureter superior to the crossover point anterior to the iliac vessels and insertion of the guide wire into the ureteral incision using ureteroscopy; (D) additional incision of the ureter superior to the upper ureteral tortuosities; (E) and (F) insertion of a 8F ureteral catheter through the ureteral tortuosities into the lower incision; (G) removal of the head end of the ureteral catheter; (H) and (I) placement of a double-J stent into the ureter using percutaneous nephroscopy. RU, right-side ureter; RGV, right-side gonadal vessels; L, liver.

ureteral catheter was transected (Fig. 4G), and a bottom-inserted guide wire was pulled out from the upper incision (Fig. 4H and I). A double-J stent (Cook Medical, Bloomington, IN, USA) was antegrade advanced through the guide wire into the ureter using percutaneous nephroscopy, and a 12F peritoneal drain was placed in the ipsilateral pericolic gutter. A 16F urethral catheter (KARL STORZ GmbH & Co. KG) and a 14F nephrostomy tube (KARL STORZ GmbH & Co. KG) were placed, and the trocar incisions were closed using silk sutures in a full-thickness manner.

The laparoendoscopic procedure was successfully and uneventfully completed, and the operative procedure lasted 330 min with an estimated bleeding volume of 100 mL. The patient underwent an uneventful postoperative course, and kidneys–ureters–bladder radiography performed during postoperative follow-up confirmed good positioning of the double-J stent (Fig. 3B). Serum creatinine levels were 62 $\mu\text{mol/L}$, 80 $\mu\text{mol/L}$, and 69 $\mu\text{mol/L}$ on postoperative days 1, 6, and 21, respectively. The peritoneal drain and nephrostomy tube was removed on postoperative days 2 and 6, respectively. The patient was discharged from the hospital on postoperative day 8. The ureteral catheter was

removed 3 weeks after operation, and the double-J stent was removed 3 months after operation. Six months after operation, the Technetium-99m diethylene-triamine-pentaacetate scan showed a unilateral renal glomerular filtration rate (lower limit, 62.5 mL/min) of 47.2 mL/min (left) and 49.2 mL/min (right). Urinary tract ultrasonography and computed tomography scan showed the dilation of the right-side collecting system was much better than before (3.0 cm). The patient remained generally well and asymptomatic within a 13-month follow-up period.

3. Discussion

Management of complex ureteral obstruction has historically been a huge challenge facing urologists. Marmar [10] reported in the 1970s the use of a silicone rubber splint catheter for treating ureteral obstruction. However, Docimo and Dewolf [11] reported a high failure rate of indwelling ureteral stent placement among patients with extrinsic ureteral obstruction, mainly due to ureteral peristalsis, venting side hole and high flow rate. In contrast

to a conventional ureteral stent, a permanent indwelling self-expanding ureteral stent is technically easier for placement and associated with a higher long-term success rate [12]. Therefore, placement of a metallic stent has been accepted as an effective treatment alternative for management of benign ureteral obstruction [13].

Ureterolysis has been introduced to urological practice for treating extrinsic ureteral obstruction over the last 2 decades. However, guide wire passage is necessary to place metallic stent, so it is impossible to insert metallic stent if the guide wire passage is failed due to severe stricture or ureteral kinking. In 1992, Kavoussi et al. [14] reported laparoscopic ureterolysis for the first time, after which laparoscopy has been well accepted as an effective and safe treatment alternative to open surgery due to its minimal invasiveness. Laparoscopic ureterolysis was reported to achieve a success rate of nearly 100% over a 1-year follow-up period [15], which has been arousing great enthusiasm and growing interest in laparoscopic intervention for treating ureteral obstruction. Minimally invasive laparoscopic ureteroureterostomy and ureteral reimplantation with endoureterotomy have replaced open surgery as the standard of care for ureteral obstruction, even in complex cases [16]. However, in case of more complicated ureteral obstruction, laparoscopic only approach may not guarantee the success of procedure, so simultaneously combined retrograde ureteroscopic with or without antegrade nephroscopic approach can be an option in this case. To the best of our knowledge, the present work was the first report regarding laparoscopic ureterolysis with ureteroscopy and percutaneous nephroscopy for treating complex ureteral obstruction.

Ureteral stones occurs concomitant with complex ureteral obstruction, as seen in our patient. Complicating ureteral tortuosities, which was located in the upper ureter, failed both antegrade and retrograde approaches using rigid/ureteroscopy with percutaneous nephroscopy. Laparoendoscopic intervention remained the only treatment option with a definitive treatment outcome in this scenario. Siegel et al. [17] reported in the 1980s a combined endoscopic and percutaneous approach for treating ureterocolic stricture. A prone split-leg position was incorporated by Scarpa et al. [18] to the combined endoscopic and percutaneous approach in 1997, while a modified lithotomy position was reported in a patient undergoing laparoscopy-assisted transperitoneal percutaneous nephrolithotomy for treating renal calyceal diverticular calculi [19]. The Valdivia-Galdakao decubitus position, a specially modified lithotomy position previously reported by Scoffone et al. [9] and Daels et al. [20], enables urologists to perform laparoscopy with concomitant ureteroscopy and percutaneous nephrostomy. Moreover, the use of Allen® stirrups allowed simultaneous access to the urethra in our patient, and the 90° flank position facilitated intraoperative percutaneous nephroscopy. A more flexed hip and knee of the contralateral lower limb should provide more space for rigid ureteroscopy, especially when advancing the ureteroscope through the pelvic curve. Iatrogenic injury associated with the Valdivia-Galdakao decubitus position may result in serious adverse effects; however, these adverse outcomes can be prevented with proper preparation and care in most cases.

In the process of laparoscopic ureterolysis, two incisions were made in the ureter to introduce the ureteral catheter through the ureteral tortuosities and subsequently insert the guide wire along the ureteral catheter; the double-J stent was antegrade placed along the guide wire using percutaneous nephroscopy. This laparoscopic maneuver of inserting the guide wire greatly helped stenting of the ureteral tortuosities. There were also some technical precautions in laparoscopic ureterolysis. First, dissection of the ureter should be minimized to avoid disruption of the ureteral adventitial sheath and its vascular supply [5,21]. Second, incision of the ureter should be restricted as possible. Third, a fourth trocar was needed to advance the guide wire through the ureteral catheter. Moreover, the angle between the nephroscope access and the gallery level for percutaneous nephrostomy should be maintained under 0°, at which nephroscopy offered a clear view and adequate pelvic perfusion.

4. Conclusion

Laparoscopic ureterolysis with ureteroscopy and simultaneous percutaneous nephroscopy can be an effective and safe treatment option for complex ureteral obstruction, which fails conventional endoscopic intervention. This laparoendoscopic technique can relieve patients' symptoms and preserve renal function. The major limitation of this laparoendoscopic technique is the relatively long operative time and the requirement of two surgical teams' participation due to the technical complexity. Large-scale, randomized, controlled studies are needed to validate the therapeutic benefit of this laparoscopic technique, especially in the sense of long-term patient outcome.

Conflicts of interest

The authors declare no conflict of interest.

Acknowledgments

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