BANGLADESH JOURNAL OF
UROLOGY
Bangladesh J. Urol. 2022; 25(2): 84-92
www.banglajol.info/index.php/BJU
DOI: https://doi.org/10.3329/bju.v25i2.68585

Original Article
ISSN : 2304 - 8514 (Print)
ISSN : 2304 - 8522 (Online)

Retroperitoneoscopic Ureterolithotomy for the Management of Proximal Ureteric Stones: Initial Clinical Experience

Md. Mostafiger Rahman[1], Fatema-Tuj-Johura[2], Md. Shahidul Islam[3], Mohammad Ibrahim Ali[4], Md. Selim Morshed[5], Mohammad Al Amin[6]

Received: 21 - 01 - 2022
Accepted: 23 - 02 - 2022
Conflicts of interest: None

Abstract

Objective: *Laparoscopic ureterolithotomy provides results equivalent to open ureterolithotomy for proximal ureteric stones, can be performed transperitoneally and retroperitoneally. The study aims to assess the efficacy of retroperitoneoscopic ureterolithotomy for managing proximal ureteral stones.*

Patients and Methods: *It was a retrospective study carried out in the period from March 2018 to November 2021. 14 patients with proximal ureteric stones 16–26 mm (20.07± 02.8), all located above the upper border of the sacroiliac joint. Eleven (78.57%) patients underwent retroperitoneoscopy as a primary procedure, one (07.14%) had a history of failed ESWL, and two patients (14.28%) failed retrograde ureteroscopy. Retroperitoneoscopic ureterolithotomy was performed by lumbar approach with initial access conducted by open technique and creation of space by digital and homemade balloon dissection and secured 10 mm Hasson trocar at the primary port site, and 0° telescope advanced. Two 5-mm trocars were placed under visualization forming a triangle. The stone was removed from the primary port site while visualizing retrieval through the 5 mm. port using a fine 30° Cystoscope. Ureterotomy closure was performed by intracorporeal interrupted sutures of 4-0 polyglactin over 5 fr double-J stent, and a drain was left in the retroperitoneum.*

Results: *Retroperitoneoscopic ureterolithotomy was accomplished in 11 out of 14 cases (78.58%). Three (21.42%) were converted to open surgery (2) and transperitoneal ureterolithotomy (1). The reason for open conversion was the failure to locate the ureter due to severe adhesion in 1 case, technical problems during dissection in 1 case, and another access problem, injury to the peritoneum, which was converted to the transperitoneal route. In 11 successful cases, the mean operative time was 126.5 ± 23.81 (90-170) min. There was no requirement for transfusions. There were no major perioperative and post-operative complications were observed. According to the modified Clavien classification, 07(63.63%) patients were reported to be grade I, whereas 04(36.36%) patients were reported to be grade II. One patient was managed with a course of antibiotics due to post-operative fever. Two patients who developed subcutaneous emphysema and superficial wound infection were treated conservatively. One urinary leakage was subsided by urethral re-catheterization. The drain was removed at 03.81 ±01.25(03-07) days. The mean hospital stay was 04.09 ± 01.13 (03-07) days.*

Conclusion: *Retroperitoneoscopic ureterolithotomy has acceptable overall complication rates. It is an effective, low-morbidity alternative for the treatment of proximal ureter stones.*

Keywords: Ureteric stone, Laparoscopy, Retroperitoneoscopy, Ureterolithotomy

1. Associate Professor, Department of Urology, Prime Medical College, Rangpur, Bangladesh
2. Medical officer, Rangpur Medical College, Rangpur, Bangladesh
3. Professor, Department of Urology, Rangpur Medical College, Rangpur, Bangladesh
4. Resident Surgeon, Department of Urology, Mymensingh Medical College ,Mymensingh, Bangladesh
5. Registrar, Department of Urology, Rangpur Medical College, Rangpur, Bangladesh
6. MO, Department of urology, NIKDU, Dhaka

Address of correspondence: Dr. Md. Mostafiger Rahman, Associate Professor, Department of Urology, Prime Medical College, Rangpur, Bangladesh. mostafiger.bd@gmail.com

Introduction

The surgical management of urinary calculus disease has dramatically evolved over the past 2 decades. Twenty years ago, open surgical procedures for urinary calculi were some of the most frequently performed urologic procedures.[1] The introduction and continuous development of percutaneous nephrolithotomy, the achievement of extracorporeal shock-wave lithotripsy (ESWL), and the advancements in ureterorenoscopy have led to a revolution in the interventional management of urolithiasis.[2] Advances in ESWL and endourological surgery (URS and PCNL) have significantly decreased the indications for open or laparoscopic stone surgery[3]. With the development of laparoscopy, retroperitoneoscopic ureterolithotomy has been offered as an alternative to open surgery for upper ureteric calculi. It has been increasingly performed due to advantages such as less operative morbidity, faster recovery, and better cosmetic results. When expertise is available, laparoscopic ureterolithotomy can be performed for large proximal ureteric stones as an alternative to URS or ESWL.[4,5] Laparoscopic procedures have yielded high stone-free rates (SFR) and lower auxiliary procedure rates.[6] The laparoscopic ureterolithotomy was initially described by Wickham in 1979 and more widely divulged since the early 1990s by Gaur, using the retroperitoneoscopic access.[1,2]The surgical treatment of ureteric stones aims to eliminate stones with minimal morbidity. To achieve it, flexible ureterorenoscopy can be sufficient in most cases, whereas open surgery, laparoscopic ureterolithotomy, and antegrade percutaneous methods can be required for large and impacted proximal ureteric calculi.[7,8] Currently, there is a clear tendency of less ESWL and more URS in the treatment of the patient with urinary stones, even in developing countries.[5] As flexible ureteroscopies are not available in all services, semi-rigid ureteroscopy has been used for the treatment of ureteric stones in all locations, even for those in the proximal ureter. PCNL is a procedure with an inherently high risk of surgical complications, whereas laparoscopic ureterolithotomy has gained some popularity.[9] the present study aims to assess the efficacy of retroperitoneoscopic ureterolithotomy for the proximal ureteric stone.

Patients and Methods

This retrospective study was conducted in the Department of Urology, Prime Medical College, Rangpur, Bangladesh, between March 2018 to November 2021. A total of 14 patients were included in the study with single, unilateral 10 mm or large stones in the proximal ureter and who had a history of failed ESWL or retrograde ureteroscopy. A proximal ureteric stone was located in the retroperitoneum from below the pelvic ureteric junction (PUJ) to the upper border of the sacroiliac joint.

Figure 1: *X-ray of left upper ureteric stone*

The exclusion criteria included a single kidney, multiple ureteric stones, bilateral ureteric stones, renal impairment, UTI, and diabetic patients. All patients were assessed by a detailed history, physical examination, complete blood count, serum creatinine, urine R/M/E & culture, X-ray and ultrasonography of the KUB regions, and IVU. All retroperitoneoscopic ureterolithotomies were done by a single surgeon in the department of urology, prime medical college, Rangpur, Bangladesh. A pre-anesthetic check up was done on all patients. Pre operative prophylactic antibiotics (injection ceftriaxone 1 g IV at intubation) were given in all cases. All the procedures were done as elective surgeries under general anesthesia. The patient's records were recorded concerning gender, age, co-morbidities and past surgical history, the indication of surgery, side of the disease, and transfusions. Operative time was recorded from incision time to the closure of skin and port sites. Intra operative complications, major and minor, conversion to open/reason for the conversion, if any, were recorded. Infection was assessed using clinical

examination and treated as appropriate. Post-operative hospital stay was noted (the day of surgery being day zero). The definition of the duration of urinary leakage was the time between the end of the operation and the cessation of the leak. Patients were called for follow-up at 2 weeks, 4 weeks, and 12 weeks thereafter, and a radiographic control was performed at 4 weeks. Collected data were presented as mean ± SD, range, numbers, and percentages were analyzed using online and SPSS programs.

Surgical Technique

The procedure was a retroperitoneoscopic ureterolithotomy under general anesthesia in all patients. The patient was then placed in the flank position, with the umbilicus over the break in the operating table, similar to open ureterolithotomy. Meticulous part preparation with povidone-iodine 10% was done in all cases to ensure asepsis. In the retroperitoneoscopic procedure, 3 trocars were used. The first port was placed at the junction of the lower edge of the 12th rib and posterior axillary line. In the open technique, a 1.5 cm incision was performed and continued under direct vision to the fascia of the external oblique muscle. The transversus abdominis muscle fascia was opened, and the prerenal fat was identified.

The index finger was inserted through the incision and used for blunt digital dissection to create space in the retroperitoneum and sweep the peritoneum anteriorly. The potential working space was then created with a homemade balloon made from a surgical glove. The commercial balloon for creating the retroperitoneal space is costly. For this purpose, the cuff of sterile gloves rather than the finger of the gloves was used. One end is tied with a piece of silk. Then through another open end, a 14 Fr feeding tube of appropriate length is introduced; this end of the balloon is tied with silk so that there is no air leakage. A 50 cc disposable syringe is connected to the other open end of the feeding tube. A medium-sized hemostat is intermittently applied over the feeding tube to prevent air leakage during the inflation of the balloon. After removal of the balloon, A 10 mm Hasson trocar was inserted in this space and fixed to the musculature with a purse-string suture in order to avoid air leakage and development of subcutaneous emphysema, and CO2 insufflation was performed until reaching 12-mm Hg tension.

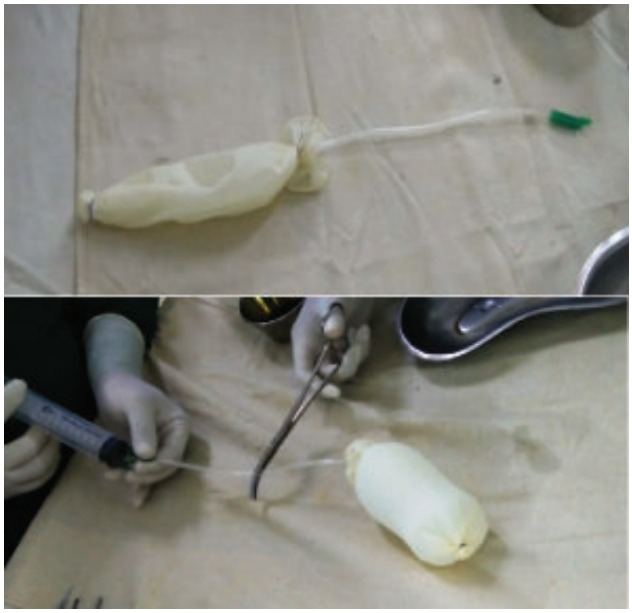

Figure 2: *Balloon made out of a surgical glove*

Finally, the secured Hasson cannula was at the primary port site, and the 0° telescope advanced, when needed, the working space was completed using the optics under visualization. Two 5-mm trocars were placed under visualization forming a triangle. The second port is at the level of the anterior axillary line, 2 cm superior and 2 cm medial to the anterior superior iliac spine. The third port was placed 1 cm anterior to the 11th rib. An additional 5-mm trocar for retraction was placed at an anterior position at the hemiclavicular line just below the costal margin when necessary. The first step was to identify the psoas muscle and psoas tendon.

Figure 3: *Retroperitoneoscopic ureterolithotomy*

From the psoas tendon, medial dissection revealed the ureter. The ureter was initially identified in its middle portion within the retroperitoneal fat and dissected up to the level of the pelvic ureteric junction. The accurate location of the intra-ureteral stone was achieved by palpation with laparoscopic forceps. Identifying the stone was also relatively easy in cases with upstream dilation of the urinary tract.

The protrusion of the stone was palpated & caught with grasping forceps from the side close to the renal pelvis if needed. Ureterotomy was done over the bulge of the ureter due to stone. In the last two cases, the ureter was opened with a longitudinal incision using a laparoscopic scalpel. At the beginning of this study, due to the unavailability of tools, the opening was performed using laparoscopic scissors or diathermy & surgical blade no.11 held by a laparoscopic needle holder. The stones were temporarily kept in the retroperitoneal space and removed from the primary port site (10mm) at the end of the surgery while visualizing retrieval through the 5 mm. port using a fine 30° cystoscope.

In most cases, a stone was removed using laparoscopic forceps, and one large stone was placed in a bag made out of a surgical glove. In all cases, 5 Fr double-J stent was positioned using a guide wire through 3rd ports (5mm). Ureterotomy was then closed using a non-absorbable 4 0 polyglycolic acid suture with single stitches or taking interrupted sutures, the suturing being done intracorporeally. Suture of the ureter was performed in all cases. A drainage tube was placed in the periureteric area through the 2nd port, which was the most dependent port, followed by the relaxation of retropnuemoperitonuem and removing trocars, and the closure of port sites. A Foley catheter was put per urethra at the beginning of the procedure. Post-operative care for immediate post-operative pain relief, injectable ketorolac tromethamine 30mg intramuscular was used. Later, oral ketorolac 10 mg was used. Patients were made ambulatory on the same day of operation in the evening. Orals were usually started on the 1st post-operative day. Foley's catheter was removed the day when the drain was minimal. Then the drain tube was removed when the drainage was lower than 30 ml/24 hours. The DJ stent was removed on average 4 weeks after the procedure after discharge from the hospital.

Results:

Characteristics of patient

A total of 14 patients were included in this study. The age interval of the patients was 26-56 years, and the mean age was 38.14 ± 8.34 years. Nine (64.28%) of these patients were male, whereas 5 (35.72%) were female.

Table I: *Patient Demographics and Stone Characteristics (N = 14)*

Characteristics	Results
Age, years,mean ± SD (range)	38.14 ± 8.34(26-56)
Sex, n (%)	
Male 09(64.28)	
Female	05(35.72)
BMI (kg/m2), mean ± SD	24.07± 03.21
Stone size mm	16–26 (20.07± 02.8)
Stone location n (%)	
Right side	08 (57.14)
Left side	06(42.86)
Indication of operation n (%)	
Primary ureteric stone	11(78.57)
Failed URS	01(07.14)
Failed ESWL	02(14.28)

Characteristics of stone

Characteristics of stone

The calculi size was 16–26 mm & their mean size was 20.07± 2.8 mm. Eight (57.14%) were right-sided, and six (42.86%) were left-sided. The most common indication was as a primary procedure for large impacted proximal ureteric stones 11(78.57%), failed URS 01(07.14%), and failed ESWL 02(14.28%)

Operative findings

Retroperitoneoscopic ureterolithotomy was accomplished in 11 out of 14 cases (78.58%). Three (21.42%) were converted to open surgery (2) and transperitoneal ureterolithotomy (1). The reason for open conversion was the failure to locate the ureter due to severe adhesion in 1 case, technical problems during dissection in 1 case, and another access problem, injury to the peritoneum, which was converted to the transperitoneal route. In 11 successful cases, the mean operative time was 126.5 ± 23.81 (90-170) minutes. Perioperative bleeding was negligible. There was no requirement for transfusions. There were no major intraoperative complications.

Table II. *Characteristics of Retroperitoneal Ureterolithotomy (N= 11)*

Characteristics	Results
Success rate, n (%)	11(78.58)
Conversion rate n (%)	03 (21.42)
Operation time in minutes, mean ± SD (range)	126.5 ± 23.81 (90-170)
Post-operative hospital stays in days, mean ± SD (range)	04.09 ± 01.13 (03-07)
The analgesic requirement in mg mean ± SD (range)	110.0 ± 17.88 (90-150)
Post-operative oral intake during a day	01
Post-operative drain removal in days, mean ± SD (range)	03.81 ±01.25 (03-07)
Post-operative stent removal in days, mean ± SD (range)	31.90 ±04.36 (28-42)

Post-operative findings

According to the modified Clavien classification, 07(63.63%) patients were reported to be grade I, whereas 04 (36.36%) patients were reported to be grade II. There were no major post-operative complications were observed. One patient was managed with a course of antibiotics due to post-operative fever. Two patients who developed subcutaneous emphysema and superficial wound infection were treated conservatively. One urinary leakage was subsided by urethral re-catheterization. Patients were made ambulatory on the same day of operation in the evening. Orals were usually started on the 1st post-operative day. Post-operative care for immediate post-operative pain relief, injectable ketorolac tromethamine 30mg intramuscular was used. Later, oral ketorolac 10 mg was used. The mean analgesic requirement was 110.0 ± 17.88 (90-150) mg. ketorolac. The mean drain removal time was 03.81 ±01.25 (03-07) days.

Table III: *Post-operative complications of retroperitoneal ureterolithotomy (N=11)*

Post operative Complications	Results
Clavien complication category, n (%)	
Grade I	07(63.63)
Grade II	04(36.36)
Complications, n (%)	04(36.36)
Sup. wound infection	01(09.09)
Urine leak	01(09.09)
Fever	01(09.09)
Subcutaneous emphysema	01(09.09)

The mean duration of post-operative hospital stay was 04.09 ± 01.13 days (range 03-07 days), and patients were discharged as soon as they became ambulant, tolerated orals, and after removal of the drain. DJ stent was removed on 31.90 ±04.36 (28-42) days. All patients became stone-free, and no case of urinary tract stenosis was observed during the short follow-up period.

Patient Satisfaction

The follow-up ranged up to 12 weeks. Patients undergoing laparoscopic surgery were overall satisfied. They were usually surprised by the results of the laparoscopic surgery in the post-operative period, with no incision and only three small dressings at the port sites.

Costs

The laparoscopic surgery was significantly costly due to the use of disposable trocars & dissectors. However, due to a homemade balloon made out of a surgical glove, reusable trocar, brief hospital stay, lesser morbidity, and shorter convalescence, the overall costs associated are expected to be reduced.

Discussion

Minimal-invasive surgery is the mainstream surgery in the world. Minimally invasive methods such as ESWL, PCNL, and URS have replaced the conventional surgical approach to managing ureteric stones. However, the ideal treatment is still debatable, particularly for patients with complex ureteral stones or anatomic abnormalities. Studies recommend that ESWL should not be used as the first line treatment option for the management of large ureteral stones with severe hydronephrosis.[10] Large ureteral stone burdens, neither URS nor ESWL will likely accomplish stone clearance in a reasonable number of procedures.[3]

PCNL or antegrade URS may allow for more expeditious stone clearance, as larger and more efficient instrumentation can be utilized. Ureterolithotomy, which has been considered as an alternative therapy in this situation. Both laparoscopic and robotic-assisted ureterolithotomy provide results equivalent to open surgery but with reduced morbidity. Although 7% of ureteral calculi cases treated endourologically require a repetition of the treatment, open surgery might be required in 1–10% of these cases.[11] According to the EAU Guidelines, indications for laparoscopic calculi surgery include the presence of large impacted ureteral calculi, failure of minimally invasive procedures, different surgical needs for a concurrent indication, and technological shortcomings.[10] The success rate of laparoscopic ureterolithotomy is the same as that of open surgery. It can even be considered superior to open surgery regarding reduced need for analgesics, shorter hospital stays, and positive recovery and cosmetic results. [12,13,14.] Laparoscopic surgery performed for ureteral calculi can be performed retroperitoneally or transperitoneally. Both methods are equally effective, but the first technique is associated with a shorter recovery period.[17,22] Retroperitoneoscopic ureterolithotomy, compared to the transperitoneal approach, has some advantages concerning sparing of peritoneum and mobilization of internal organs. It also protects the peritoneal space from urinary contamination. In a randomized prospective study[15] in which both approaches were compared, it was concluded that their success rates are similar. However, in patients who underwent the procedure transperitoneal, pain, need for analgesics, the incidence of ileus, and duration of hospital stay were found to be significantly higher. The advantages of the transperitoneal approach are that it ensures a larger working site, better visibility, and better definable anatomical markers.[16] The most significant disadvantage of the retroperitoneal approach is the limited working site. Apart from this disadvantage, there is no need for colon mobilization, and the risk of visceral organ damage is still lower via the retroperitoneal approach than via the transperitoneal approach. Furthermore, the risk of peritoneal cavity contamination owing to post-operative urinary incontinence and the rate of post-operative ileus is lower via the retroperitoneal approach.[8,12] Goel and Hemal[17] reported the experience of 81 patients with ureterolithiasis (55 undergoing laparoscopic retroperitoneal surgery and 26 open intervention) from the All India Institute of Medical Sciences. They concluded that in the laparoscopic group average operating time was 98.8 min against 108.8 min in the open group. The results also showed that the hospital stay (3.3 vs 4.3 d) was less in the laparoscopic group compared to the open group. The study also revealed that convalescence (3 vs. 5 weeks) was better in laparoscopic ureterolithotomy patients than the patients undergoing open ureterolithotomy. In this study, the mean operative time was 128.21± 26.86 minutes. Concerning the operative time, in published literature, there is no significant difference in average operative times. Topaloglu Hikmet et al.[19] reported mean operative time was significantly longer in the retroperitoneal laparoscopic ureterolithotomy group Vs. percutaneous antegrade ureteroscopy (102.1 ± 45.5 min versus 80.1 ± 44.6 min p = 0.039). Wani and Durrani et al.[18] reported the average blood loss in this study was 39.83 ml. In this study, there was no requirement for transfusions. Patients from the laparoscopic ureterolithotomy reported less post-operative pain, and the mean analgesic requirement in laparoscopic was 110.0 ± 17.88 (90-150) mg of ketorolac. Patients in retroperitoneoscopic ureterolithotomy had an earlier resumption of oral intake by 1 day. These factors, in addition to early ambulation, resulted in a shorter hospital stay. The mean hospital stay was 04.09 ± 01.13; (03-07) days.

Laparoscopic ureterolithotomy shares potential risks with open surgery; however, there are differences in the type and presentation of these complications. Complications can arise at each step of the procedure. Access related problems such as solid organ injury, bowel injury, abdominal wall hematoma, and injury to epigastric vessels have been reported. In addition, reported common complications include an incisional hernia, transient thigh numbness, prolonged ileus, pulmonary embolus, pneumonia, brachial nerve injury, and unrecognizable injury.[18] In this study, Grade II category Clavien complications occurred 36.36% (04) in the retroperitoneoscopic ureterolithotomy, where grade I was 63.63% (07). One patient was managed with a course of antibiotics due to post-operative fever. Two patients who developed subcutaneous emphysema and superficial wound infection were treated conservatively. One urinary leakage was subsided by urethral re-catheterization. Ding-Yuan Chen et al.[21] have revealed Minor complications account for 87.5–92% of the overall

complications in ureteral stone surgery. Topaloglu Hikmet et al.[19] reported that post-operative complications were mostly wound-related. Wound site and urinary infections are more common, at a rate of 7%, than other procedures. Wani and Durrani et al.[18] reported a total of two (6.66%) minor intra operative complications occurred in the laparoscopic retroperitoneal ureterolithotomy group where two patients had a breach in peritoneum where a veress needle was used to let the air out of the peritoneal cavity and maintain the pressure and space in the retroperitoneum; the rent is closed primarily. This study accomplished retroperitoneoscopic ureterolithotomy in 11 out of 14 cases (78.58%). Three (21.42%) were converted to open surgery (2) and transperitoneal ureterolithotomy (1). The reason for open conversion was the failure to locate the ureter due to severe adhesion in 1 case, technical problems during dissection in 1 case, and another access problem, injury to the peritoneum, which was converted to the transperitoneal route. Goel and Hemal[17] have reported 55 patients with large stones (mean diameter, 21 mm) who underwent retroperitoneal laparoscopic ureterolithotomy. The complications encountered were one injury to the external iliac artery, three peritoneal tears, two cases with fever, two wound infections, and 10 conversions to open surgery. Guar et al.[33] also reported a high complication rate of 31% because of prolonged urinary leakage (20 of 93 patients). Topaloglu Hikmet et al.[19] reported prolonged urinary leakage (12%), usually defined as a urinoma formation of persistent urine discharge from the periureteral drain for more than 2 to 4 days. Even though most series have used periureteral drains, others have not used drain, stent, or either. Stents and drains were recommended for prolonged urinary leakage. The major complication of laparoscopic ureterolithotomy is stricture formation, which has been reported to have a rate of 15– 20% in different series.[23,24] In this study, no complications were observed as strictures at a short-term follow-up duration of 12 weeks. The etiology of post-operative ureteral strictures is unclear. Keeley et al.[23] considered that strictures developed in their 2 patients related to suturing during ureterotomy. Nouira et al.[25] suggested that too-tight sutures cause ureteral strictures by creating ischemia. They argue that the suturing method should always aim to approximate ureter ends to facilitate healing, and they should not purport water resistance. Gaur et al.[20] ureter incision with an electric hook in cutting mode will be easier. Nouira et al.[25] reported that an incision made with a cold knife is more widely accepted since it offers better wound healing and fewer strictures. Harewood et al.[26] used a diathermy hook electrode for opening ureters in 6 patients and observed no ureter stricture. Mitchinson and Bird[27]suggested that prolonged urinary leakage concurrent with retroperitoneal fibrosis might be the possible cause of ureteral strictures.

Laparoscopy is a method that reproduces the steps of open surgery and can be indicated as an alternative in cases of therapeutic failure using less invasive methods.[17,29] However, in cases where the risk of failure using such a method is high, such as anatomic anomalies and voluminous and impacted ureteral stones, laparoscopy can be indicated as a primary procedure.[20] Soares RS et al.[13] revealed in cases of pelvic stones, the retroperitoneoscopic procedure is an alternative that allows the removal of the intact stone with a lower risk of residual fragments and without requiring transparenchymal access, thus reducing the risk of bleeding. The cost factor needs to be addressed concerning the retroperitoneoscopic ureterolithotomy. The main contributor to the cost of laparoscopy is the disposable nature of trocars. However, the overall costs are expected to be less due to a homemade balloon made out of a surgical glove, reusable trocar, briefer hospital stay, lesser morbidity, and shorter recovery.

Limitations

There are some limitations in this study. First, only 14 cases were included in this study. Studying the clinically significant risks requires a much larger sample size. Although the most extensive period of development of ureteral stricture after retroperitoneoscopic ureterolithotomy was not investigated, the follow-up period in this study is considered short. In the future, long-term and large-scale studies may be needed.

Conflicts of interest

There are no conflicts of interest regarding the publication of this paper

References

1. Marguet CG, Springhart WP, Auge BK, Preminger GM. Advances in the surgical management of nephrolithiasis. Minerva Urol Nefrol. 2004 Mar;56(1):33-48. PMID: 15195029.

2. Honeck P, Wendt-Nordahl G, Krombach P, Bach T, Häcker A, Alken P, Michel MS. Does open stone surgery still play a role in the treatment of urolithiasis? Data of a primary urolithiasis center.

J Endourol. 2009 Jul;23(7):1209-12. doi: 10.1089/end.2009.0027. PMID: 19538063.

3. European Association of Urology.(2019). EAU-Guidelines-on-Urolithiasis [ISBN 978-94-92671-13-4]. https://uroweb.org/wp-content/uploads/EAU-Guidelines-on-Urolithiasis-2019.pdf
4. Kumar, A.,et al. A Prospective Randomized Comparison between Laparoscopic Ureterolithotomy and Semirigid Ureteroscopy for Upper Ureteral Stones >2 cm: A Single-Center Experience. J Endourol, 2015. 29: 1248. https://www.ncbi.nlm.nih.gov/pubmed/25177768 320.
5. Torricelli FC, Monga M, Marchini GS, Srougi M, Nahas WC, Mazzucchi E. Semi-rigid ureteroscopic lithotripsy versus laparoscopic ureterolithotomy for large upper ureteral stones: a meta-analysis of randomized controlled trials. Int Braz J Urol. 2016 Jul-Aug;42(4):645-54. doi: 10.1590/S1677-5538.IBJU.2015.0696. PMID: 27564273; PMCID: PMC5006758.
6. Prakash J, Singh V, Kumar M, Kumar M, Sinha RJ, Sankhwar S. Retroperitoneoscopic versus open mini-incision ureterolithotomy for upper- and mid-ureteric stones: a prospective randomized study. Urolithiasis. 2014 Apr;42(2):133-9. doi: 10.1007/s00240-013-0624-1. Epub 2013 Nov 23. PMID: 24272062.
7. Wickham JEA: The Surgical Treatment of Urinary Lithiasis. In Wickham JEA (ed.), Urinary Calculus Disease. New York, Churchill Livingstone. 1979; pp.145-98.
8. Gaur DD: Retroperitoneal laparoscopic ureterolithotomy. World J Urol. 1993; 11: 175-7.
9. Simforoosh N, Aminsharifi A. Laparoscopic management in stone disease. Curr Opin Urol. 2013;23:169-74.
10. Lee YH, Tsai JY, Jiaan BP, Wu T, Yu CC. A prospective randomized trial comparing shock wave lithotripsy and ureteroscopic lithotripsy for management of large upper third ureteral stones. Urology
11. El-Moula MG, Abdallah A, El-Anany F, et al. Laparoscopic ureterolithotomy: our experience with 74 cases. Int J Urol. 2008;15:593–597
12. Feyaerts A, Rietbergen J, Navarra S, et al. Laparoscopic ureterolithotomy for ureteral calculi. Eur Urol. 2001;40:609–613.
13. Soares RS, Romanelli P, Sandoval MA, et al. Retroperitoneoscopy for treatment of renal and ureteral stones. Int Braz J Urol. 2005;31:111–116.
14. 14 El-Feel A, Abouel-Fettouh H, Abdel-Hakim AM, et al. Laparoscopic transperitoneal ureterolithotomy. J Endourol. 2007;21:50–54
15. Singh V, Sinha RJ, Gupta DK, et al. Transperitoneal versus retroperitoneal laparoscopic ureterolithotomy: a prospective randomized comparison study. J Urol. 2013;189:940–945
16. Harewood LM, Webb DR, Pope AJ. Laparoscopic ureterolithotomy: the results of an initial series, and an evaluation of its role in the management of ureteric calculi. Br J Urol. 1994;74:170–176
17. Goel A, Hemal AK. Upper and mid-ureteric stones: a prospective unrandomized comparison of retroperitoneoscopic and open ureterolithotomy. BJU Int 2001;88:679–82.
18. Wani MM, Durrani AM. Laparoscopic ureterolithotomy: Experience of 60 cases from a developing world hospital. J Min Access Surg 2019;15:103-8.
19. Topaloglu Hikmet, Karakoyunlu Nihat, Sari Sercan, Ozok Hakki Ugur, Sagnak Levent, Ersoy Hamit (2014). Comparison of Antegrade Percutaneous and Laparoscopic Approaches in the Treatment of Proximal Ureteral Stones.BioMed Research International, 2014(), 1-5. , Doi: 10.1155/2014/691946 (Yayýn No : 1111497
20. Gaur DD, Trivedi S, Prabhudesai MR, Madhusudhana HR, Gopichand M. Laparoscopic ureterolithotomy: technical considerations and long-term follow-up. BJU Int 2002;89:339–43
21. Ding-Yuan Chen, and Wen-Chi Chen. "Complications Due to Surgical Treatment of Ureteral Calculi" Urological Science, vol. 21, no. 2, 2010. doi:10.1016/s1879-5226(10)60017-6
22. K. Kijvikai and S. Patcharatrakul, "Laparoscopic ureterolithotomy: its role and some controversial technical considerations,"International Journal of Urology, vol. 13, no. 3, pp. 206–210, 2006

23. F. X. Keeley Jr., I. Gialas, M. Pillai, M. Chrisofos, and D. A. Tolley, "Laparoscopic ureterolithotomy: the Edinburgh experience," BJU International, vol. 84, no. 7, pp. 765–769, 1999.

24. W. C. Lee and H. H. Hsieh, "Retroperitoneoscopic ureterolithotomy for impacted ureteral stones.," Chang Gung Medical Journal, vol. 23, no. 1, pp. 28–32, 2000

25. Y. Nouira, Y. Kallel, M. Y. Binous, H. Dahmoul, and A. Horchani, "Laparoscopic retroperitoneal ureterolithotomy: initial experience and review of literature," Journal of Endourology, vol. 18, no. 6, pp. 557–561, 2004

26. L. M. Harewood, D. R. Webb, and A. J. Pope, "Laparoscopic ureterolithotomy: the results of an initial series, and an evaluation of its role in the management of ureteric calculi," British Journal of Urology, vol. 74, no. 2, pp. 170–176, 1994

27. M. J. Mitchinson and D. R. Bird, "Urinary leakage and retroperitoneal fibrosis.," Journal of Urology, vol. 105, no. 1, pp. 56–58, 1971

28. Sahin A, Akan S. Laparoscopic surgery for upper ureteral calculi in geriatric patients: 5 years experience. Aging Male. 2020 Dec;23(5):941-945. doi: 10.1080/13685538.2019.1638897. Epub 2019 Jul 10. PMID: 31291128.

29. Skrepetis K, Doumas K, Siafakas I, Lykourinas M: Laparoscopic versus open ureterolithotomy. A comparative study. Eur Urol. 2001; 40: 32-6.