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Original Article

Laparoscopic pyelolithotomy/ureterolithotomy combined with flexible ureterorenoscopy for upper urinary tract stones especially in anomalous kidneys

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Abstract

Aim: To determine the feasibility and efficacy of combining laparoscopy with flexible ureteroscopy to achieve stone free status especially in patients having large pelvic renal stones in their anomalous urinary tract.

Material and Methods: We retrospectively reviewed the medical records of all patients who underwent laparoscopic pyelo/ureterolithotomy in our clinic between March 2013 and December 2017.

Results: A total of 24 patients were included the study. The mean age of the patients was 49.7 years ranging from 20 to 75 years. Pyelolithotomy was performed in 17 cases and ureterolithotomy was performed in 7 cases. The mean size of the main upper urinary tract stones (pelvis and upper ureter) was 40 mm and the mean size of the concomitant stones (renal pelvis and calices) was 8.5 mm. Of the pyelolithotomy patients, six had ureteropelvic junction (UPJ) obstruction, seven had a horseshoe kidney and one had a pelvic kidney abnormality. Pyeloplasty was performed concomitant with stone surgery in patients with UPJ obstruction. The mean operative time was 122 min. Estimated blood loss was 55 ml. Stone - free status was 91.6%. There was no intraoperative complication. The mean hospital stay of the patients was 4 days.

Conclusion: Laparoscopic pyelolithotomy/ureterolithotomy combined with flexible endoscopy (cystoscope) for renal pelvis and caliceal stones is a safe and effective procedure to achieve stone free status especially in patients having congenital anomalous kidneys.

Keywords: Anomalous kidney; flexible cystoscope; laparoscopy; nephrolithiasis; pyelolithotomy

INTRODUCTION

Urinary stone disease negatively affects human health and daily quality of life and constitutes an important part of daily urology practice (1,2). The prevalence of urinary stone disease ranges from 1% to 20% in the world and %14 in Turkey (3,4). It is most commonly seen between the ages of 20 and 40, with a recurrence rate of about 50% within 10 years after the first episode (5,6). During the past four decades, extracorporeal shock wave lithotripsy (SWL) and technological developments in endourology such as optics and lasers have reduced the rate of open surgery for urinary stone disease to 1%- 5.4% (7,8). However, open surgery preserves to be a treatment of choice for every urologist for staghorn kidney stones, as stated in the European Association of Urology (EAU) guidelines (6,7). In selected cases, especially for large pelvic and staghorn stones, open surgery presents high stone - free rates. Although high stone - free rates are obtained (9,10), open stone surgery (pyelolithotomy and ureterolithotomy) has potential disadvantages such as cosmetic problems, large incision scar, wound infection, more analgesic need and longer convalescence period. Laparoscopy, a less invasive approach, has begun to be used to overcome these disadvantages. In the literature, firstly Wickham et al. managed ureter stones with laparoscopic retroperitoneal approach in 1979 (11) and Gaur et al. treated renal pelvic stone using the same approach in 1994 (12).

In this study, we aimed to determine the feasibility and efficacy of combining laparoscopy with flexible ureteroscopy to achieve stone free status especially in patients having large pelvic renal stones in their anomalous urinary tract.

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MATERIAL and METHODS

After the approval of Turkiye Yuksek Ihtisas Training and Research Hospital institutional review board (Approval no: 29620911-929) was obtained, we retrospectively reviewed the medical records of all patients who underwent laparoscopic pyelo/uretero- lithotomy in our clinic between March 2013 and December 2017. The patients who underwent laparoscopic pyelolithotomy + flexible cystoscopy also had concomitant caliceal stones in addition to renal pelvis stones, and the patients who underwent laparoscopic ureterolithotomy + flexible ureterorenoscopy had also concomitant renal pelvis and/or caliceal stones in addition to upper ureter stones.

The examined parameters included patients' demographics, pre- and post-operative imaging results, complete blood count and serum biochemical analysis, urine analysis and urine culture results, operation characteristics, per-operative complications and stone-free rate. The direct urinary system graphy of the patients were evaluated before the procedure (Figure 1A).

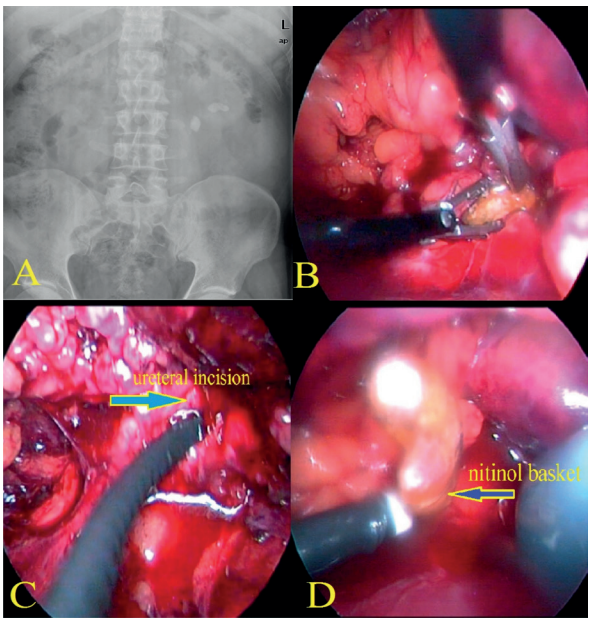

Figure 1. A. Direct urinary system graphy. B. Ureterolithotomy. C. Flexible cystoscope inserts in the ureteral incision. D. Renal calyx stone was removed with the help of the nitinol basket

Surgical technique

All surgeries were performed by a single surgeon with 9 years of laparoscopic surgery experience. A transperitoneal laparoscopic approach was preferred in all cases. Under general anesthesia, an incision was made lateral to the rectus abdominalis muscle at the umbilicus level and a veress needle was inserted at an angle of 60 degrees to achieve pneumoperitoneum. After achieving pneumoperitoneum by inflating the abdomen with CO2 gas up to 12 mm Hg, one 12 mm and two 10 mm trocars were placed. The colon was freed from Toldt's line and the fascia of the gerota was opened. The pelvis/ureter was opened with scissors at the level of the stone. We do not use any energy source while preparing pelvis/ureter. We used 16F flexible cystoscope (Karl Storz Endoscopy - America, Inc., Culver City, CA) to remove concomitant caliceal stones in laparoscopic pyelolithotomies. Because flexible cystoscope has better image quality and bigger working channels than flexible ureterorenoscope. To remove concomitant renal pelvis or caliceal stones in laparoscopic ureterolithotomies, we also used 8.5F flexible ureterorenoscope (Karl Storz Endoscopy - America, Inc., Culver City, CA) because the flexible cystoscope is not suitable to work in ureters. As shown in Figure 1B the pelvis/ureter was incised with scissors and the large stone was removed first. Then, a flexible cystoscope was inserted throughout the 10 mm trocar to reach the renal or caliceal stone(s) through the same incision (Figure 1C, Figure 2). Concomitant stones were removed with the aid of a 3F nitinol basket (NGage® nitinol stone extractor, Cook Medical, Bloomington, USA) (Figure 1D). A ureteral double J stent (DJS) was inserted and the ureteral incision was sutured with 4/0 polyglactin suture and the operation was completed. The double J stent was removed under local anesthesia on postoperative day 15.

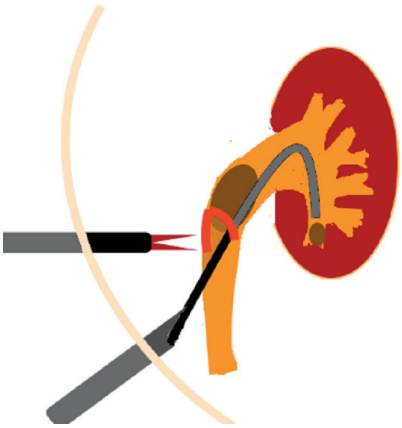

Figure 2. Schematic view of laparoscopic pyelolithotomy combined with flexible cystoscope

RESULTS

The records of 49 patients were reviewed and a total of 24 patients were included the study. Among 24 patients 17 were male and 7 were female. The mean age of the patients was 49.7 years ranging from 20 to 75 years-old. There are concominant calices stone in all patients who have pelvis/ureter stone. Most of the renal stones were in the renal pelvis and then in the renal calices. All of the ureteral stones were located in the upper ureter. Stones were on the right side in 8 patients (seven renal pelvis, one upper ureter) , on the left sides in 16 patients (ten renal pelvis, six upper ureter). The distribution of all calices stones were; 12 in upper calices, 8 in middle calices and 4 in lower calices.

All procedures were completed laparoscopically with no conversion to open surgery. Pyelolithotomy was performed in 17 cases and ureterolithotomy was performed in 7 cases.

The mean size of the main upper urinary tract stones (pelvis and upper ureter) was 40 mm ranging from 15 to 65 mm and the mean size of the concomitant stones (renal pelvis and calices) was 8.5 mm ranging from 5 to 11 mm (Table 1).

Table 1. Demographics and Preoperative characteristics of the patients

Variables	Values
Number of Patients	24
Age, years (range)	49.7 (20 - 75)
Male: female	17 : 7
Side, right: left	8 : 1 6
Primary Stone size (Pelvis + upper ureter), mm; mean (range)	40 (15 - 65)
Concomitant stone size (pelvis + caliceal), mm; mean (range)	8.5 (5 -11)

Table 2. Intra- and post-operative data of the patients

Variables	Values
Mean Operation time, min. (range)	122 (80 - 180)
Mean Estimated Intraoperative Blood loss, ml (range)	55 (20 - 250)
Intraoperative DJ insertion, (n)	24
Mean hospital stay, days (range)	4 (2 - 12)
Intraoperative complications	None
Postoperative complications, (n)	Ileus (1)
Conversion to open surgery	None
Mean DJS catheterization time, days	15 (14-20)
Stone free rate (%)	91.66

Of the pyelolithotomy patients, six had ureteropelvic junction (UPJ) obstruction, seven had a horseshoe kidney and one had a pelvic kidney abnormality. Pyeloplasty was performed concomitant with stone surgery in patients with UPJ obstruction. Four of ureterolithotomy patients had a history of unsuccessful SWL or ureterorenoscopy (URS) history. The mean operative time was 122 minutes varies between 80 and 180 min. Estimated blood loss was 55 ml ranging from 20 to 250 ml. While stone - free status was achieved in 22 of the cases, in 2 ureterolithotomy cases stone - free status could not be achieved such that the lower caliceal stones in the kidney could not be reached by the flexible cystoscope. There was no intraoperative complication. A patient with pelvic kidney stones developed ileus due to herniated bowel segments from trocar site on the 4th day after operation. This patient was managed conservatively for 12 days. The mean hospital stay of the patients was 4 days ranging between 2 and 12 days. (Table 2).

DISCUSSION

The main goal in the management of urinary tract stone disease is to achieve stone free status with minimum morbidity and mortality while maximally preserving the renal function. Urinary tract stone disease management has been subject to significant improvements during the past 40 years such as the first use of SWL, rigid/flexible ureterorenoscope, laser lithotripters and development in imaging (13). The majority of stones are now being treated with minimally invasive approaches like SWL, retrograde intrarenal surgery (RIRS) and percutaneous nephrolithotomy (PCNL). While these approaches are superior to open surgical interventions in terms of convalescence and hospitalization time, they might result in residual stone regarding to the location, number, size and attenuation of renal stones (14). In long term, residual stones have been shown to necessitate a second intervention in 50% of the cases. Additionally, they might cause pain, obstruction or infection (15) which increase morbidity and treatment cost. For this reason, it is very important to remove all stones at first intervention.

Achieving stone – free status is the most desirable condition in urinary stone disease management. From this point of view, stone - free rate is higher in open surgery for the large renal and ureteral stones than that of is in minimally invasive approaches (16). On the other hand, open surgery has disadvantages such as cosmetic issues and long convalescence period. In order to minimize these disadvantages, laparoscopic pyelolithotomy / ureterolithotomy have been performed and accepted with their reliable and successful results (17). In a study, comparing laparoscopic pyelolithotomy (LPL), PCNL and RIRS for ureter upper stones greater than 1.5 cm, Basiri et al. found that the SFR was highest in the LPL group; SFR's were 90%, 86%, and 76% for LPL, PCNL and RIRS respectively (18). Similar studies found higher stone - free rates in LPL (19,20). In another study by Tefekli et al. comparing LPL (n: 26) and PCNL (n: 26), the SFR was reported to be 100% for LPL and 88.4% for PCNL. In the same study, it was reported that the long duration of the surgery and need for experienced surgeons might be disadvantages of LPL. However, it has many advantages such as less operative bleeding and being feasible in congenital renal anomalies like UPJ obstruction and ectopic kidneys (21). In our study, among 17 cases that pyelolithotomy were used, six had UPJ obstruction, seven had horseshoe kidney abnormality and one had pelvic kidney anomaly. And we performed pyeloplasty

concomitant with stone surgery in all patients having UPJ obstruction. In EAU guidelines, it is stated that SWL, PCNL, and endoscopic procedures are often failed in the management of renal stones in kidneys with congenital anomaly thus laparoscopic approach by experienced surgeon could be preferred in that cases (22).

The laparoscopic approach in urological stone surgery can be performed either transperitoneal or retroperitoneal, and both approaches have pros and cons. The advantages of the transperitoneal approach are wider operative field, easier use of laparoscopic instruments, identification of anatomical landmarks and suturing, while it has the disadvantages of intestinal organ injury and the possibility of peritonitis in the case of urinary extravasation. The retroperitoneal approach provides direct ureteral access without the need of colon mobilization and related to fewer intestinal complications. In the literature, both approaches are considered to be safe, and the preference of approach depends on the experience of the surgeon and the patient. (22). In our study, we preferred transperitoneal approach as the flexible endoscopic device could be used more easily.

While the renal pelvic/ureteral stone can be removed with the laparoscopic approach, it is not possible to reach and remove the stones in the calices. The use of flexible endoscope can be used to overcome this issue and achieve stone- free status. In 2007, El - Kappany et al. performed pyelolithotomy using a rigid nephroscope via laparoscopic approach in a pelvic ectopic kidney (23). In 2008, Mason et al. and in 2012, Garcia- Seguia et al., successfully treated renal stones by combining laparoscopic stone surgery and flexible endoscopy (24,25). These three studies reported that combined techniques were effective for treatment renal stones. Sahin et al. conducted a study with 19 patients who underwent laparoscopic retroperitoneal ureterolithotomy with concomitant pyelolithotomy using a flexible cystoscope (26). In their study, the stone - free rate was 100 % and no intraoperative complications were noted. One patient developed postoperative ileus and subcutaneous emphysema was seen in another patient. Same stone - free rate and no preoperative or postoperative complication were reported in another study which was combining laparoendoscopic single-site ureterolithotomy and flexible cystoscope in the treatment of concurrent large upper ureteral stones and renal stones (27). In both studies, authors reported that their techniques were safe and effective. In another study by Pastore et al. combining laparoscopic pyelolithotomy and pyelolithotripsy with using of flexible cystoscope for staghorn stone, the stone - free rate was 80% (28). We think that this outcome is acceptable since the cases had staghorn stones. In the present study, we used a laparoscopic approach combined with flexible endoscope (cystoscope) and achieved a stone - free rate of 91.6% (22/24) in cases most of whom had anomalous kidneys. There was no preoperative or postoperative complication except one patient with ileus in our study.

We believe that by using a flexible endoscopic instrument, with utilizing the dilatation in the ureter and collecting system, it is possible to remove the stones in the renal calices, increase the stone- free rate and eliminate the possibility of re-operation.

Also, our study is not without limitations. First of all this is a retrospective study and we had relatively small number of patients. Further studies with large patient numbers and patients matched according the stone size and location will improve our knowledge and will aid to identify a well-established technique.

CONCLUSION

Laparoscopic pyelolithotomy/ureterolithotomy combined with flexible endoscopy (cystoscope) for renal pelvis and caliceal stones are a safe and effective procedure to achieve stone free status especially in patients having congenital anomalous kidneys.

Competing interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical approval: Approval of the Turkey Yuksek Ihtisas Education and Research Hospital Ethics Committee (approval number: 29620911-929).

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