ORIGINAL ARTICLE

After a urological laparoscopic training programme, which laparoscopic method is safer and more feasible in the management of proximal ureteral stones: Transperitoneal or retroperitoneal?

Deniz Abat,[1] Adem Altunkol,[2] Faruk Kuyucu,[3] Durmus Alparslan Demirci,[4] Ediz Vuruskan,[5] Yildirim Bayazit[6]

Abstract

Objectives: To compare the results of the management of the first 25 transperitoneal laparoscopic ureterolithotomies with the first 25 retroperitoneal laparoscopic ureterolithotomies performed by two surgeons who had just completed a laparoscopic training programme.

Methods: The retrospective study was conducted at Adana Numune Teaching and Research Hospital and comprised retroperitoneal laparoscopic ureterolithotomies and transperitoneal laparoscopic ureterolithotomies performed by two different surgeons on patients with proximal ureteral stones between November 2011 and March 2013. The transperitoneal and retroperitoneal procedures were categorised as Groups A and B, respectively. Patients in Group A were operated on by the same surgeon (DA) and those in Group B were operated on by the other surgeon (FK). Groups were compared according to operative time, duration of drainage and urethral catheter, hospital stay, stone size, surgical success and complications.

Results: There were 50 patients in the study; 25(50%) in each of the two groups. Success rates in Group A and B were 21(84%) and 20(80%), respectively (p>0.05). Complications were seen in 8(32%) and 11(44%) patients in Group A and B, respectively (p>0.05).

Conclusion: The transperitoneal approach was more advantageous than the retroperitoneal approach for less-experienced surgeons because it provided a wider operating field, a more familiar anatomy and more convenient suturing.

Keywords: Laparoscopic ureterolithotomy, Laparoscopy, Ureteral stone. (JPMA 66: 971; 2016)

Introduction

Laparoscopic ureterolithotomy (LU) is a feasible alternative to open surgery in the treatment of large, impacted, and/or multiple ureteral stones that cannot be treated by shockwave lithotripsy (SWL) and ureteroscopy. Other indications for LU are economic and social issues that necessitate stone removal in a single treatment session.[1] The laparoscopic approach is more advantageous than open surgery in terms of the use of analgesia, length of hospital stay, convalescence and cosmetically. Transperitoneal and retroperitoneal approaches have been used in all segments of the ureter. Although similar results have been reported in literature, but the details of the differences between the laparoscopic techniques originate from the surgeon factor. Although the transperitoneal approach is reported to be a more convenient technique for less-experienced surgeons, some factors such as the learning curve, surgeon's experience, available instruments and access techniques affect the complication rates.[2,3]

The current study was planned to compare the results of the management of proximal ureteral stones with two different laparoscopic approaches performed by two surgeons who had just completed a laparoscopic training programme.

Material and Methods

The retrospective study was conducted at Adana Numune Teaching and Research Hospital and comprised retroperitoneal laparoscopic ureterolithotomies (RPLU) and transperitoneal laparoscopic ureterolithotomies (TPLU) performed by two different surgeons on patients with proximal ureteral stones between November 2011 and March 2013. The surgeons (DA and FK) had completed their urological laparoscopic training and laparoscopy learning curve almost in the same time period at different hospitals. All the patients were managed and followed up based on the European Association of Urology (EAU) guidelines.[4] All the patients gave written informed consent before the operation. Each patient underwent surgery with a transperitoneal or retroperitoneal approach, depending on the preference of the surgeon. The tranperitoneal and retroperitoneal

Department of Urology, [1-5]Ministry of Health, Adana Numune Teaching and Research Hospital, [6]Faculty of Medicine, Cukurova University, Adana, Turkey.
Correspondence: Adem Altunkol. Email: ademaltunkol@hotmail.com

approach were grouped as Groups A and B, respectively. The patients in Group A were operated upon by the same surgeon (DA), and those in Group B were operated upon by the other surgeon (FK). The exclusion criteria were stones located in the distal or middle ureter and the paediatric age group. All patients underwent plain radiography of the kidney, ureter, and bladder (KUB), ultrasonography (USG), intravenous urography (IVU) and/or non-contrast computed tomography (NCCT) in addition to routine preoperative tests. The largest diameter of a stone observed on the KUB was accepted as the dimension of the ureteral stone, and the patients with non-opaque stones were evaluated using the dimension of the stone in NCCT. The patients were discharged after removal of the drain, when there was no drainage after the urinary catheter was removed. The stents in patients in whom Double-J (JJ) stents were placed during surgery were removed 3-4 weeks later by cystoscopy under local anaesthesia. The patients were followed up using KUB and/or USG in the second month after surgery. Subsequent follow-up of the patients was performed at six months. If the patients were symptomatic, IVU or NCCT was performed.

In laparoscopic retroperitoneal approach, after urethral catheter placement, each patient was placed in a lateral decubitus position under general anaesthesia, and a pad was placed under the back at the flank region. Three or four ports were used for the operation. A horizontal 15mm incision was made just below the tip of the 12th rib. The lumbodorsal fascia was accessed and traversed bluntly. A balloon dilator (Pajunk-medizintechologie / Geisingen, - Germany) was placed and insufflated for working space in the retroperitoneum. Then, a Hasson trochar was placed, and visualisation was performed with a 10mm 30° laparoscope. Additionally, two or three 5mm trochars were placed. After the port placement, the ureter was identified. Ureteral bulging caused by a stone was recognised, and a Babcock forceps was placed at the proximal site of the ureteral bulging to prevent stone migration. A ureteral incision was made longitudinally over the stone with a needle-point laparoscopic electrode. The stone was extracted using a right-angled clamp and placed in an endobag. The stones that migrated into the kidney during laparoscopic surgery were retrieved using a basket through the more convenient caudal 5mm port using a flexible cystoscope (11272C115.5 FR Karl-Storz, Tuttlingen, Germany), which was introduced into the ureter through a proximal ureterotomy. Intraoperative JJ stents were inserted through the laparoscopic port and were placed in the ureter. The ureterotomy was sutured with 4/0 polyglactin sutures. A drain was placed in the retroperitoneal space, and the port sites were closed.

In laparoscopic transperitoneal approach, the patients underwent bowel preparation with oral laxatives on the day prior to the operation and a rectal enema on the morning of the operation. Each patient was placed in an 80° lateral decubitus position with the side of the ureteral stone facing up, following urethral catheter placement after the induction of general anaesthesia. A pneumoperitoneum was created with a Veress needle, which was introduced through a pararectal incision 2cm cranial to the umbilicus. A 10mm trocar was transperitoneally introduced, and visualisation was performed with a 30° lens. Two 5mm ports were placed at angles convenient to the working angle, as follows: one in the pararectal region, 7-8cm cranial to the umbilicus, and one in the mid-clavicular region, 4-5cm caudal to the umbilicus. The ureter was found following the medial dissection of the colon and cut using laparoscopic scissors through the protrusion that was created by the stone or in the location where the stone was felt by an atraumatic grasper. The stone was removed using a dissector and retrieved from the body in a tissue and organ retrieval bag (Figure). The ureteral incision was closed using a continuous suturing technique by a laparoscopic needle holder with a 4/0 polyglactin suture following the placement of a 6F JJ stent in an antegrade fashion through the incision on the ureter. The operation was terminated after inserting a drain through the 5mm caudal port.

In cases in which a stone, total or partial, migrated into the kidney during the operation or when a renal stone was present simultaneously, those stones were retrieved using a basket through the more convenient 5mm caudal port using a 9.5F semi-rigid ureteroscope (Karl Storz, Tuttlingen, Germany), which was introduced into the ureter through an incision in the ureter.

JJ stents were placed in the ureter using a 14F Amplatz renal dilator (Microvasive, Natick, MA) through the 5mm port. JJ stents, with a guide wire inside that was introduced in the Amplatz renal dilator, were forwarded into the bladder through the incision in the ureter. The proximal end of the stent was placed into the renal collective system with the help of a laparoscopic dissector following the retrieval of the guide wire and the Amplatz dilator. However, it was straightforward to manipulate the stent when the 5mm port was manipulated forward and approximated to the ureteral incision in somewhat thin patients, in whom the Amplatz dilator was not used during stent placement.

SPSS 20 was used for statistical analysis. Mann-Whitney U-

test and Student's t-test were used for nonparametric variables and parametric variable, respectively. P<0.05 was accepted as statistically significant.

Results

There were 50 patients in the study; 25(50%) in each of the two groups. Six (24%) patients had stones in the right ureter and 19(76%) patients had stones in the left ureter in Group A. In Group B, the ureteral stones were localised in the right and left ureters in 11(44%) and 14(56%) patients, respectively. Besides, 16(64%) patients in Group A were operated upon using three ports, and 9(36%) patients were operated upon using four ports. In Group B, three ports were used in 9(36%) patients and four ports in 16(64%). JJ stents were placed intraoperatively in 23(92%) patients in Group A, and postoperatively in 1(4%) patient because drainage had continued for five days after surgery. Stones migrated into the kidney in 4(16%) patients in Group A. In 3(12%) patients who had simultaneous renal stones in Group A, the stones were retrieved using a semi-rigid ureteroscope and a basket catheter. A stone migrated into a kidney in 1(4%) patient in Group B. The stones of 4(16%) patients dropped into the retroperitoneum in Group B, and the duration of surgery was lengthened in those patients because of the search for the stones. One (4%) patient had paralytic ileus and 1(4%) had a pulmonary embolus in Group A. The paralytic ileus was resolved spontaneously, and the patient with a pulmonary embolus was treated in the intensive care unit (ICU) (Table-1).

Conversion to open surgery was not required for the patients from either group. Two units of blood were transfused to 1(4%) patient in Group A because of a 5-6mm vena cava injury, which was laparoscopically sutured. Blood transfusion was not necessary for any Group B patient. The operation was accepted as unsuccessful if the patient required an additional operation for a migrated ureteral stone. According to this criterion, the success rates in Groups A and B were 21(84%) and 20(80%), respectively (p>0.05). However, when the stone-free rate was evaluated, all the patients in both groups (100%) were brought to a stone-free status after surgery because of the use of ureteroscopy for a migrated stone. There was no ureteral avulsion, retroperitoneal haematoma, bowel injury, or mortality in any group, and no trocar site hernia was observed in any case during the follow-up period. Prolonged urinary drainage was observed in 3(12%) patients in Group B. In 1(4%) patient, the JJ stent inserted during surgery was changed because of encrustation. JJ stents were placed in

Table-2: Complications rates in groups.

Complications	Group A (n=25)	Group B (n=25)	P Value
Stone Migration	4 (16%)	1 (4%)	
Prolonged Urinary Drainage	1 (4%)	3 (12%)	
Ureteral Stricture	0	3(12%)	
Bleeding	1(4%)	0	
Ileus	1 (4%)	0	
Pulmonary Embolism	1 (4%)	0	
Retroperitoneal or Peritoneal Stone Expulsion	0	4 (16%)	
Total	8 (32%)	11 (44%)	0,387

P<0,05 statistically significant.

Table-1: Group Demographics and Statistical Comparison.

	Group A (n=25)	Group B (n=25)	P Value
Mean Age (Years)	38.96±17.01	47.8±14.1	0.051
Gender (Male/Female)	6/19	15/10	0.141
Stone Side (Right Ureter/Left Ureter)	6/19	11/14	NA
JJ SStent Placement (number)	24	17	NA
Number of Port	16 patient---→3 port (%64) 9 patient---→4 port (%36)	9 patient--→3 port (%36) 16 patient--→4 port (%64)	NA
Mean follow-up period (Month)	14.84±7.46	35.56±9.11	*0.0001
Mean Operation Time (Minute)	147±36.54	106.4±38	*0.0001
Drainage catheter duration (Day)	1.82±0.82	6.12±4.47	*0.0001
Urethral catheter duration (Day)	1.68±1.17	2.76±3.63	*0.0001
Mean Hospital Stay (Day)	2.94±1.69	7.12±4.47	*0.0001
Mean Stone Size (mm)	16.62±4.78	20.12±5.18	*0.013
Surgery Success Rate (%)	84	80	0.716
Stone Free Rate (%)	100	100	

*P<0,05 statistically significant
JJ: Double J
NA: Not Applicable.

Table-3: Classification of the Complications of the Groups According to Satava and Modified Classification System.

Groups	Satava Classification			Modified Clavien Classification						
	1	2	3	1	2	3a	3b	4a	4b	5
Group A (n)		5			1	1		1		
Group B (n)		5				3	3			

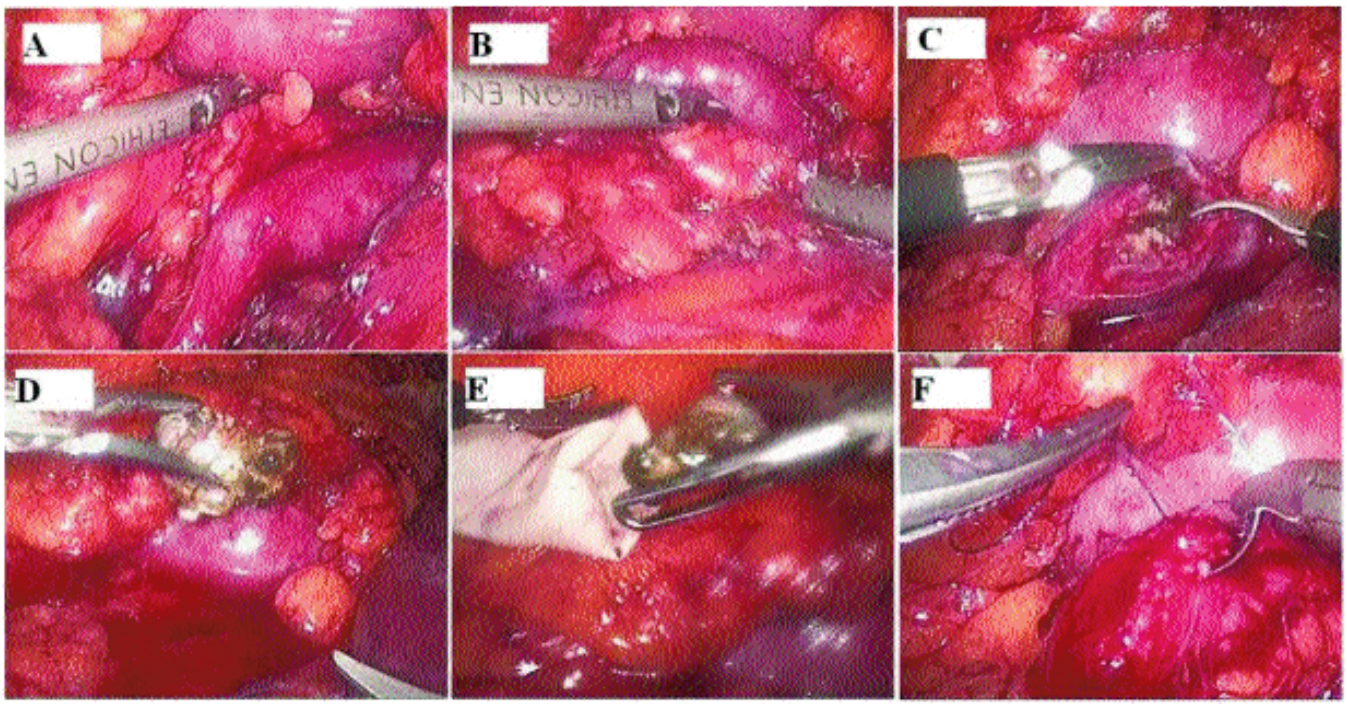

Figure: A-B: Dissection of the ureter. C: The ureter is incised with laparoscopic scissors. D: Stone extraction. E: The stone is inserted to the retrieval bag. F: Suturing of the ureter.

the 2(8%) other patients as well, and urinary drainage was stopped in those patients. As a result, JJ stents were placed in 24(96%) and 17(68%) patients in Group A and B, respectively. The mean duration of follow-up was 14.84±7.46 and 35.56±9.11 months in groups A and B, respectively. Complications were observed in 8(32%) and 11(44%) patients in Groups A and B, respectively (p>0.05) (Table-2). Intraoperative and postoperative complications were graded according to the Satava classification and modified Clavien classification (Table-3).

Discussion

The treatment of urinary system stones has changed dramatically in the last decade. Diversity in the minimally invasive treatment methods such as SWL, transurethral lithotripsy and laparoscopy have diminished the role of open surgery. The first laparoscopic retroperitoneoscopic ureterolithotomy was performed by Wickham in 1979, and the first laparoscopic transperitoneal ureterolithotomy was performed in 1992 by Raboy et al.[5,6] Laparoscopic surgery developed markedly in recent years, and the indications for open surgery have thus significantly decreased in patients with renal stones.[4] A shorter convalescence period, less analgesic requirement, early mobilisation and early oral feeding are advantages of laparoscopic surgery.[7]

Various studies have demonstrated that the feasibility and advantages of laparoscopic ureterolithotomy result in the superiority of both transperitoneal and retroperitoneal approaches over open surgery.[2] A wider operating field, the presence of anatomical landmarks and sufficient length between the port sites provide a better orientation and easier movement for the surgeon during the transperitoneal approach. The duration of hospitalisation and the rate of complications are lower in the retroperitoneal approach, though this approach enables a limited and narrow operating field.[8] In addition,

retroperitoneal interventions could be applied easily in patients with prior abdominal surgery. Important aspects of the selection of the transperitoneal or retroperitoneal method are the experience and preference of the surgeon.[9]

We suggest that a narrow operating field results in difficulty in suturing the ureter in the retroperitoneal approach. The transperitoneal approach facilitates the suturing of the ureter by providing a wider operating field. In a two-centre study, Bove et al. compared both approaches to laparoscopic management of ureteral stones. A statistically significant difference was observed between the groups in terms of the time for access to the operating field, time for suturing the ureter and total operative time, in favour of the transperitoneal approach. They concluded that surgeons in training for laparoscopy should perform laparoscopic ureterolithotomies using a transperitoneal route; however, for expert surgeons, the approach selected depends on personal preference.[2] The transperitoneal approach for management of ureteral stones would be easier in the first cases performed by a surgeon having just completed urological laparoscopic training.

Vishwajeet Singh et al. performed transperitoneal and retroperitoneal laparoscopic ureterolithotomies in 48 patients divided into two groups, and compared the demographics, clinical properties and postoperative findings in their cases. They found that the transperitoneal approach resulted in more pain, a longer duration of ileus, more analgesic requirements, and a longer duration of hospitalisation compared with the retroperitoneal approach and that the success rate of stone retrieval was similar in both techniques. They reported that the retroperitoneal approach was more suitable for proximal and mid-ureteral impacted and large stones.[10] This study revealed that the length of the hospitalisation period and the duration of drainage and urethral catheter were shorter in the transperitoneal approach than in the retroperitoneal approach with statistical significance between the groups. This finding could be attributed to the easier manipulation resulting from the wider operating field and, thus, the more convenient placement of the watertight sutures in the transperitoneal approach. The most frequently observed postoperative complication was found to be urine leakage at the ureteral incision site.[11] Watertight sutures prevent urinary leakage and provides a shorter duration of drainage and urethral catheter placement. Additionally, this condition provides early discharge of patients.

The stone-free rate after laparoscopic ureterolithotomy is 100% in general, and the rate of conversion to open surgery is quite low. Conversion to open surgery is controversial in some conditions such as migration of a stone to the kidney, intra-abdominal organ injury and loss of the pneumoperitoneum.[11-13] In this series, no case required conversion to open surgery. As a result of the surgeons having less laparoscopic ureterolithotomy experience, they performed the dissections more carefully and slowly, which might be the reason that complications necessitating conversion to open surgery were not encountered. These careful and slow dissections lengthened the duration of the operations.

El-Moula et al., in their study on their laparoscopic ureterolithotomy experience, reported that they used a flexible ureteroscope as an additional treatment for the removal of a renal stone in one case; thus, they completed the operation without conversion to open surgery.[14]

The stone was reached through the ureterolithotomy incision and retrieved in a basket catheter in patients with simultaneous ureteral and kidney stones or ureteral stones that had migrated into the renal collecting system. This study did not require conversion to open surgery using such additional minimally invasive methods in the patients. The wider operative field provided in the transperitoneal approach allows use of a semi-rigid ureteroscope, whereas the use of a flexible cystoscope was required in the retroperitoneal approach because of a narrow operating field. In this study, using additional devices such as a semi-rigid ureteroscope or flexible cystoscope during laparoscopic surgery increased the stone free rate to 100% for both groups.

When the patient groups in this study were evaluated, the researchers used four ports in nine patients in Group A and four ports in 16 patients in Group B. This fact originates from the requirement of retraction in the retroperitoneal approach. During surgeries, an additional port (or ports) might be needed for dissection or retraction.[15] This situation might be frustrating for less-experienced surgeons during surgery.

Conclusions

The transperitoneal approach is more advantageous than the retroperitoneal approach for less-experienced surgeons because it provides a wider operating field, a more familiar anatomy and more convenient suturing. This approach would affect the hospitalisation time and an early removal of drainage and urethral catheter. A surgeon's preference for a laparoscopic approach might depend on his surgical experience, which increases with time. Further prospective randomised studies involving greater numbers of patients are needed in this field.

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