

# Laparoscopic transperitoneal ureterolithotomy is an effective and safe method for > 15 mm impacted ureteral stones in elderly patients: single center 10-year experience

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**Abstract. – OBJECTIVE:** The aim of our study is to investigate the efficacy and safety of laparoscopic ureterolithotomy operation in elderly patients with large and impacted ureteral stones.

**PATIENTS AND METHODS:** Between January 2011 and July 2021, 66 elderly patients with impacted, > 15 mm upper and middle ureteral stones underwent laparoscopic ureterolithotomy in our center. The data for all patients were evaluated retrospectively.

**RESULTS:** The mean age of the patients was  $65 \pm 5.43$  years. The mean stone size was  $20.2 \pm 2.5$  mm. The mean operation time was  $93.6 \pm 13.2$  minutes. Among patients, 16 (24.2%) had history of unsuccessful shock wave lithotripsy and 12 (18.1%) patients had history of ureterorenoscopy. Stone-free rate was 95.4% in all patients. Modified Clavien grade 1 complications were seen in 18 patients (27.2%), but no significant perioperative and postoperative complications were observed. Urinary extravasation lasting 5, 7 and 9 days was observed in 5 patients (7.5%) who were treated conservatively. The mean hospital stay was  $3.4 \pm 1.52$  days. The patients were asymptomatic at the 6<sup>th</sup> week post-op follow-up, and no stones were seen on direct X-ray and abdominal ultrasonography. Intravenous urography and non-contrast tomography (NCCT) taken 3 months later did not show any obstruction or stenosis in the ureter.

**CONCLUSIONS:** Laparoscopic ureterolithotomy can be considered as the first treatment option for elderly patients with impacted and large ureteral stones, thanks to its high success and acceptable complication rates.

*Key Words:*

Laparoscopy, Ureterolithotomy, Elderly patient, Ureteral stones.

## Introduction

Urolithiasis is the third most common urological disease after urinary tract infection and pros-

tate disease with increasing prevalence. Obesity is closely associated with diabetes and metabolic syndrome<sup>1,2</sup>. Urolithiasis is one of the urological problems that seriously affects the elderly and reduces their quality of life. Although the difficulty experienced during surgical procedures for elderly patients has a negative effect on the decision to have surgery, thanks to developments in health services and medical technological innovations today, elderly patients can be operated easily.

Ureteral stones are seen in 15% of the population and constitute 20% of all urolithiasis cases<sup>3</sup>. For the treatment of ureteral stones, shock wave lithotripsy (SWL) and ureterorenoscopy (URS) are recommended as the first choices. The most important reason for this is the development of lithotripsy and URS techniques. As a result, open or laparoscopic surgical interventions are less frequently chosen. However, the use and success of these techniques for proximal large ureteral stones are controversial. Therefore, open surgery, laparoscopic ureterolithotomy (LUL) and antegrade percutaneous methods come into play for large and impacted proximal ureteral stones<sup>2,4</sup>.

Minimally invasive methods are preferred to open surgeries due to very important innovations in the field of endourology. LUL, which is one of these methods, is frequently applied for the treatment of large multiple and/or impacted ureteral stones that cannot be treated with SWL or URS<sup>5</sup>. Less need for analgesia, shorter hospital stays, less blood loss and rapid recovery have increased the use of this method in the geriatric group, especially when compared to open surgery<sup>6</sup>. In literature, LUL has been treated in a limited way, with a low number of patients. In this study, we aimed at evaluating the success rates and complications of LUL in 66 elderly patients with upper and middle ureteral stones.

## Patients and Methods

After our study was approved by the local ethics committee of our tertiary education and research hospital, the data from transperitoneal LUL operations performed on 66 elderly patients over 60 years of age with impacted and > 15 mm upper and middle ureteral stones were retrospectively analyzed. Our study progressed in accordance with the principles of the Helsinki Declaration and informed consent was obtained from each patient. Patients with > 15 mm radiopaque and impacted proximal ureter (the area between the ureteropelvic junction and the upper edge of the pelvis) and middle ureteral stones on computed tomography and intravenous pyelography, and those who had unsuccessful ESWL or URS attempts were included in the study. Patients with distal ureteral stones smaller than 15 mm, nonopaque stones, uncorrected coagulopathy, active urinary tract infection, who were not suitable for general anesthesia, and those diagnosed with acute renal failure were excluded from the study. Stone-free definition (SFR) on CT scan was defined as no residual stone, and prolonged drainage was defined as urinary extravasation lasting more than 3 days. All patients underwent detailed physical examination and anamnesis before surgery. All patients underwent NCCT and direct X-ray (DG) to determine the opacity of the stone. Complete urinalysis and urine culture were requested from all patients. All patients with infection were given antibiotics in accordance with the antibiogram, and then the surgical stage began. At the same time, blood biochemistry measurements and coagulation tests were performed. Stone size was calculated according to the sum

of the maximal diameters on DG (Figure 1). All patients underwent laparoscopic transperitoneal approach procedures.

### *Surgical Technique*

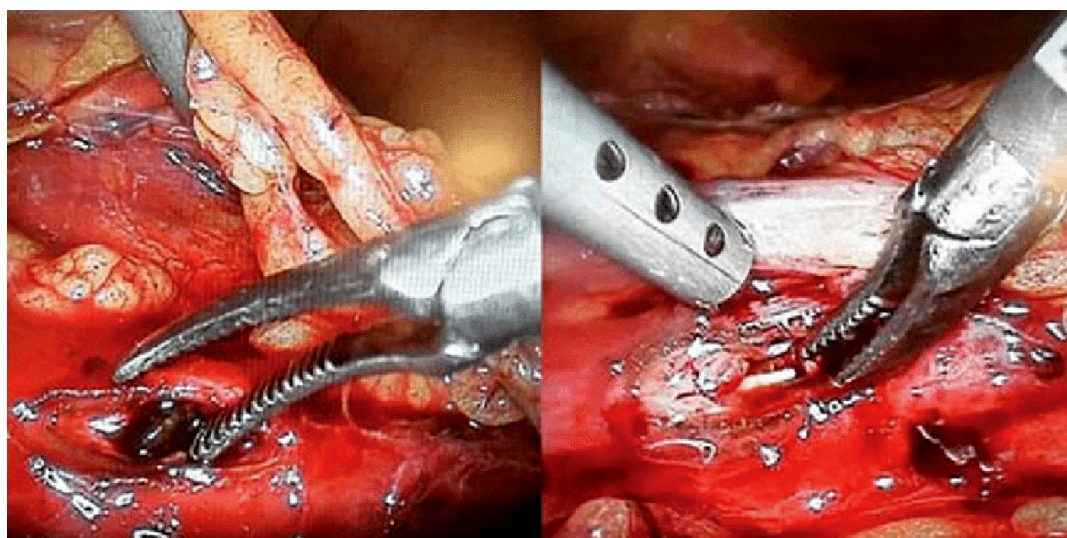
General anesthesia was applied to all our patients. Transurethral foley catheter and nasogastric tube were inserted in the patients and they were placed in lateral decubitus position (70°) while the operating table was flexed. Then, 12-15 mmHg pneumoperitoneum was created by entering at the level of the umbilicus with Hasson open technique and/or Veress needle. A 10 mm camera port was inserted, and a 5 mm port was placed with a 10 mm port camera sight. An extra 5 mm port was emplaced for liver retraction on the right side when necessary. After feeling the stones with an atraumatic instrument, Babcock clamp was used to prevent the stone from escaping. At the ureterotomy stage, electrocautery was used for vertical ureterotomy (Figure 2). Then, a 6 F ureteral catheter was inserted as a double J stent and the ureterotomy line was sutured with 4/0 Vicryl sutures (Figure 2). The stones were placed in the small organ removal bag and removed. At the end of the procedure, after the operation site was checked in detail, a 16-18 Fr silicone drain was inserted, and the port sites were sutured. The drain of patients whose post-op drainage decreased below 20 mL was removed. After 7-10 days, DJ ureter catheter was removed by cystoscopy under local anesthesia.

### *Post-operative Management*

Post-operatively, all patients were quickly mobilized starting from the evening of the operation, and radiographs were taken the next day for residual stone control. Paracetamol (500 mg orally)



**Figure 1.** Impacted ureteral calculi images.



**Figure 2.** Vertical ureterotomy and then insertion of double J stent.

and/or diclofenac sodium (75 mg intramuscularly) were administered to all patients who needed postoperative analgesia. Complete urinalysis, hemogram and serum BUN, creatinine tests were performed in the first month postoperatively. Ultrasonography (USG) and/or non-contrast tomography were performed for patients if deemed necessary in the first and third month after the surgery. Data were generated as intraoperative, post-operative data, and demographic data. Complications were evaluated according to the Modified Clavien-Dindo classification.

### **Statistical Analysis**

Statistical Package for the Social Sciences (SPSS) 15.0 (IBM Corp., Chicago, IL, USA) package program was used for statistical analysis of the data. Categorical measurements are summarized as numbers and percentages, mean and standard deviation (median and minimum-maximum where necessary) if continuous measurements had normal distribution, and median (IQR) if not normally distributed. Chi-square test was used to assess the potential statistically significant difference. ANOVA was applied to compare the difference of the means between more than two different levels.  $p$ -values  $\leq 0.05$  indicated statistical significance.

### **Results**

A total of 66 elderly patients underwent transperitoneal LUL operation. The age range of the

patients was 60-79 years, and the mean age was  $65 \pm 5.43$  years. Of these patients, 26 (39.3%) were female and 40 (60.7%) were male ( $p = 0.32$ ). While 29 (43.9%) of the stones were in the right ureter, 37 (56.1%) were in the left ureter ( $p = 0.72$ ). The mean stone size was  $20.2 \pm 2.5$  (19-26) mm. The mean BMI of the patients was  $23.22 \pm 35.5$  kg/m<sup>2</sup> (range 19-35). Of patients, 16 (24.2%) had a history of unsuccessful SWL and 12 (18.1%) patients had a history of URS ( $p = 0.36$ ). The most common complaint at the time of admission was flank pain, which was present in 39 (59%) patients ( $p = 0.01$ ). The most common American Society of Anesthesiologists (ASA) score was ASA 3, seen in 33 (50%) patients ( $p = 0.05$ ). All procedures were completed laparoscopically, without switching to open ureterotomy in any of the patients. The mean operation time was  $93.6 \pm 13.2$  minutes. Intraoperative DJ stent was emplaced in all patients. Median hospital stay was  $3.4 \pm 1.52$  days. Our stone free rate at discharge was 95.4%. It was observed that ureteral stones migrated to the pyelocalyxial system in 6 patients (9%) during the operation. Then, a semi-rigid ureteroscope was inserted through one of the ports and the stones were caught in the pyelocalyx system with a ureter incision and removed with stone forceps. The mean drain removal time was 3.1 days (range 2-9). Subfebrile fever was observed in 6 patients (9%) on the first postoperative day, which was relieved by antipyretics. Blood transfusion was given to 3 patients (4.5%) to ensure hemodynamic stability. DJ stent migration was seen in 6 patients (9%). Urinary extrav-

asation lasting 5, 7 and 9 days was observed in 5 patients (7.5%) who were treated conservatively. Again, subileus was observed in 5 patients (7.5%) who were followed-up conservatively. No ureteral stenosis or severe ureteral hydronephrosis was observed in any patient with checks using IVP, USG, or NCCT at 3 months. (Demographic data are shown in Table I, intraoperative and postoperative data are shown in Table II).

## Discussion

The number of elderly patients is increasing day by day. According to the estimates of the World Health Organization, the elderly population will be over 1.5-2 billion in 2050<sup>7</sup>. Therefore, the need for surgery in these patients will increase day by day. However, elderly patients have high surgical risk and comorbidity. Therefore, they should be treated with less aggressive and minimally invasive methods. Urolithiasis is one of the most common causes of hospitalization in elderly patients, and since complicating factors are more common in these patients, it is important to determine the appropriate treatments as soon as possible in order to prevent serious complications<sup>8</sup>. In fact, although SWL and

URS are recommended as the primary treatment modalities for the treatment of ureteral stones in all patients, regardless of old or young age<sup>9</sup>, there is no clear consensus for the treatment of impacted middle and upper ureteral stones. SWL, URS, PNL and LUL are current treatment options with different success rates and morbidities. In fact, the location and size of the stone, the presence of urinary drainage depending on the degree of obstruction, and the severity of pain<sup>10</sup> can be factors that determine treatment. Especially for impacted stones, the success rates of SWL and URS are low, and if the stone size is > 1 cm, the success rates decrease significantly<sup>11</sup>. LUL is recommended in the guidelines for multiple or impacted > 1.5 cm ureteral stones in which URS and SWL have failed or are likely to fail<sup>12</sup>. There are studies comparing the success of LUL, SWL, and URS for upper ureteral stones. Lopes Neto et al<sup>2</sup> compared SWL, semi-rigid URS and LUL in 48 patients with > 1 cm proximal ureteral stones and found the success rates of these methods were 35.7%, 62.5% and 93.3%, respectively. In the same study, they reported that additional surgical procedures were lower in favor of LUL with a high stone-free rate. Similarly, Ko et al<sup>13</sup> compared LUL with URS in their study. Stone-free rates in a single

**Table I.** Characteristics of the patients.

Variable		p-value
Gender (male/female) <sup>x</sup>	40/26	0.32
Age (year) <sup>x</sup>	65 ± 5.43 (60-79)	
BMI (kg/m <sup>2</sup> ) <sup>x</sup>	23.22 ± 35.5 (19-35)	
Stone size (mm) <sup>x</sup>	20.2 ± 2.5 (19-26)	
History of failed (ESWL/URS) <sup>y</sup>	16 (24.2%)/12 (18.1%)	0.36
Main symptoms of presentation <sup>y</sup>		0.01*
Flank pain	39 (59%)	
Nausea and vomiting	21 (31.8%)	
Hematuria	18 (27.2%)	
Fever	15 (22.7%)	
Creatinine rise	9 (13.6%)	
Abdominal pain	8 (12.1%)	
Indication for laparoscopy <sup>y</sup>		0.04*
Primary procedure	38 (57.5%)	
History of failed ESWL	16 (24.2%)	
History of failed URS	12 (18.1%)	
Laterality (right/left)	29/37	0.72
ASA scores (n, %) <sup>y</sup>		0.05*
ASA 1	6 (9%)	
ASA 2	11 (16.6%)	
ASA 3	33 (50%)	
ASA 4	16 (24.2%)	

<sup>x</sup>Data were presented as Mean ± SD, range, and <sup>y</sup>Data were presented as n (%). BMI; body mass index, ESWL; Extracorporeal shock wave lithotripsy, URS; Ureteroscopy. \* $p \leq 0.05$ .

**Table II.** Intraoperative and postoperative data.

Variable		p-value
Operation time (minutes) <sup>x</sup>	93.6 ± 13.2 (90-105)	
Stone free rate <sup>y</sup>	63 (95.4%)	
Hospital admission (days) <sup>x</sup>	3.4 ± 1.52 (3-9)	
Post-op hemoglobin (mg/dL) <sup>x</sup>	12.10 ± 1.08 (10.5-14.5)	
Drain removal (days)	3, 1 (2-9)	
Blood loss (mm) <sup>x</sup>	85.86 ± 43.23, (25-1,250)	
Early complications <sup>y</sup>		0.94
Stone migration	6 (9%)	
Blood transfusion	3 (4.5%)	
Fever/UTI confirmed	6 (9%), 2 (3.3%)	
Subileus	5 (7.5%)	
Urinary leakage	5 (7.5%)	

Data were presented as Mean ± SD, range, and <sup>y</sup>Data were presented as n (%). UTI; Urinary tract infection. \* $p \leq 0.05$ .

session were determined as 93.8% and 68.8%, respectively, and they suggested that LUL can be applied as first-line treatment without increasing the complication rate.

Elderly patients have high surgical risk and comorbidity. Therefore, they should be treated with less aggressive and minimally invasive methods. The standard laparoscopy method creates pneumoperitoneum through the insufflator that adjusts pressure, and high intra-abdominal pressure occurs during the procedure. As a result, many side effects may occur as a result of positive intraperitoneal pressure<sup>14,15</sup>. In addition, laparoscopy has some disadvantages such as prolonged operation time and the effects of carbon dioxide pneumoperitoneum on the circulatory and respiratory system<sup>16</sup>. Despite this, the advantages of laparoscopy have allowed it to be routinely applied for many diseases affecting elderly patients. There are several studies<sup>17,18</sup> in the literature confirming the safe application of laparoscopy even in elderly patients.

One of the most important benefits of laparoscopy for ureteral stones is that the stone or all stones can be removed in a single session. In our study, all cases had a transperitoneal approach used, and it could also be done retroperitoneally. Although there is no difference in success rates between the two techniques, the transperitoneal approach is one step ahead in terms of the wide working area and near-perfect anatomical markers<sup>19</sup>. However, although there is a narrow field of view and workspace in the retroperitoneal approach, the risk of ileus and visceral organ injury is lower because there is no need for colon mobilization and no contact with visceral organs, and it is frequently used by some surgeons<sup>20</sup>.

When we compare the data in our study with the literature, our operation time was 93.6 ± 13.2 minutes, which was shorter than the studies<sup>21-23</sup> in the literature. Al-Sayyad<sup>21</sup> found that the mean operation time was 107 ± 49.5 minutes, while in the study by El-feel et al<sup>22</sup> it was 145 ± 42 minutes. We think that the fact that all operations were performed by two surgeons with significant experience in the field of laparoscopy contributed to the short duration of our operation. Our stone-free rate was 95.4%, which is consistent with the above-mentioned studies. In their study in which they compared retroperitoneal LUL and transperitoneal LUL with 123 patients, Skolarikos et al<sup>23</sup> found the stone-free rate for both arms was 96.7%, similar to our study. While no major intraoperative or postoperative complications were observed in this study, all laparoscopic procedures were successfully completed without opening. This high success rate can be attributed to the carefully selected patient profile, apart from the surgeons' experience. The strongest aspect of our study is that, as far as we know, it is one of the first studies about transperitoneal LUL for the treatment of multiple and/or large impacted ureteral stones in elderly patients, and it has the highest number of patients for this age group.

### Limitations

The main limitations of the study are that it is a retrospective study that represents a single center and does not have a control group. However, we think that there is a sufficient number of patients to evaluate success in the elderly age group.

## Conclusions

Laparoscopic ureterolithotomy can be considered as the first treatment option for elderly patients with impacted and large ureteral stones due to high success and acceptable complication rates. Additionally, it can also be considered a salvage procedure after failed SWL and URS.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

### Ethics Approval

In accordance with the 1964 Helsinki Declaration, our study was approved by the clinical research ethics committee of the Health Sciences University, Adana city Training and Research Hospital (Date: 24.03.2022, number: 1852).

### Informed Consent

Informed written consent was obtained from all individual participants included in the study.

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No financial support has been received for this study.

### Authors' Contribution

K.K. and E.V. made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data. K.K. and G.G. been involved in drafting the manuscript or revising it critically for important intellectual content. All authors approved the final version of the final manuscript.

### Data Availability Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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