

Laparoscopic Management of Ureteral Calculi

A Report of 123 Cases

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Introduction: Our aim was to evaluate the efficacy and safety of laparoscopic surgery for the management of ureteral calculi.

Materials and Methods: We performed 123 laparoscopic calculus removal in 103 men and 31 women. Indications for the procedure were extracorporeal shockwave lithotripsy or transureteral lithotomy failure and large calculus. The mean age of the patients was 39.6 ± 13.8 years. The calculi were between 1 and 5.6 cm and located in the upper, middle, and lower ureter in 90 (73.2%), 20 (16.3%), and 13 (10.5%) patients, respectively. Ureteral stent was used in 52 (42.3%) patients. We used 3 ports for camera and instruments. Intraperitoneal approach was used in 104 (84.6%) and extraperitoneal in 19 (15.4%).

Results: The mean operative time was 143.2 ± 60.5 minutes. One hundred and nineteen patients (96.7%) became stone free. Minor complications occurred in 14 (11.4%) patients. Conversion to open surgery was required in 1 patient due to migration of the calculus to the peritoneum after removal from the ureter. Intra-abdominal hematoma led to reoperation 1 day after the surgery in 1 patient. Operative time was different significantly between extraperitoneal and intraperitoneal approaches (171.3 ± 91.3 minutes and 137.3 ± 52.2 minutes, respectively; $P = .02$).

Conclusion: Our results confirm the efficacy and safety of laparoscopic removal of ureteral calculi in selected groups of patients, taking the advantage of this minimally invasive procedure such as better cosmetic results and patient's satisfaction.

Keywords: urinary calculi, ureter, laparoscopy, nephrolithotomy

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INTRODUCTION

Urolithiasis is a very common disease with its management drastically changed over the recent years.⁽¹⁾

Open surgery for the treatment of urinary calculi is almost abandoned today, but still may be indicated in some cases with failure of first-line treatment modalities or cases with some specific characteristics of the calculus (size, composition, or location).⁽²⁾ Most upper or middle ureteral calculi are treated with extracorporeal shockwave lithotripsy

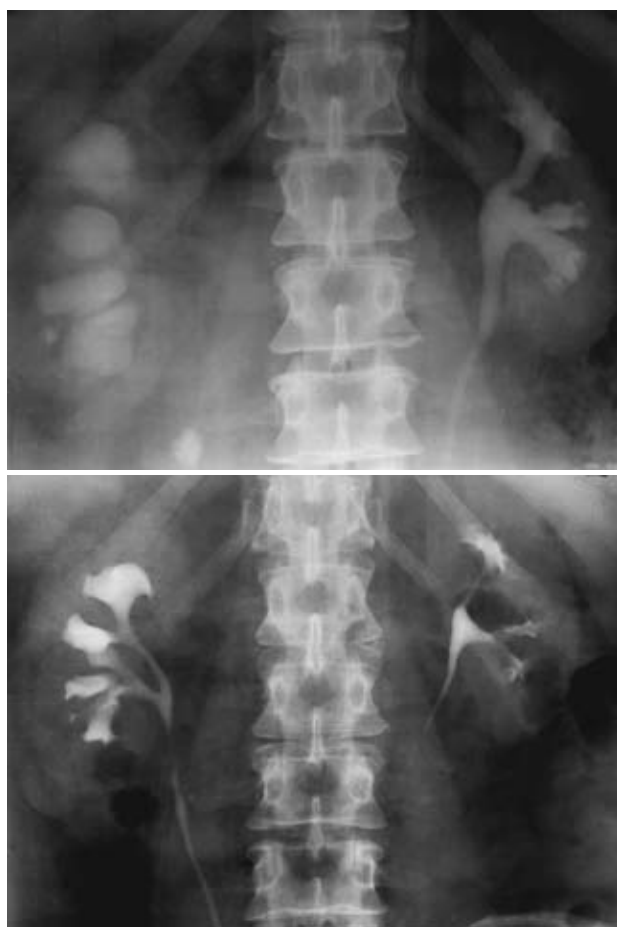
(SWL), percutaneous nephrolithotomy (PCNL), or ureteroscopy.⁽²⁻⁵⁾ Recently, laparoscopic approach has gained footage as another minimally invasive alternative in patients with ureteral calculi. To date, limited numbers of studies have reported laparoscopic removal of the ureteral calculi. There are a few articles on large, hard, and impacted ureteral calculi, all of which with acceptable outcomes.^(1,2) In the current study, we review our experience in laparoscopic removal of the ureteral calculi. To the best of

our knowledge, with 123 cases of ureteral calculi, our series is the largest of its kind.

MATERIALS AND METHODS

We performed a total of 123 laparoscopic surgical operations on patients with ureteral calculi from September 1999 to April 2006. The patients had ureteral calculi larger than 1.5 cm or those with failed transureteral lithotripsy (TUL) or SWL. All of the calculi were radio-opaque and diagnosed by plain abdominal radiography of the kidneys, ureters, and bladder (KUB). Ultrasonography and intravenous urography (IVU) had also been performed in all of the patients (Figure). The demographic and clinical characteristics of the patients are demonstrated in the Table.

Patients with upper and middle ureteral calculi were secured in the flank position and those with lower ureteral calculi were secured in the supine position.



Intravenous urography in a patient with a right upper ureteral calculus. **Top**, Urography before laparoscopic calculus removal. **Bottom**, Urography after laparoscopic calculus removal.

Demographic and Clinical Characteristics of Patients With Laparoscopic Urinary Calculus Removal*

| Characteristics | Values |
|--------------------------------|-----------------------|
| Number of patients | 123 |
| Mean age (range), y | 39.6 ± 13.8 (3 to 75) |
| Sex | |
| Male | 102 (82.9) |
| Female | 21 (17.1) |
| Calculus location | |
| Upper ureter | 90 (73.2) |
| Middle ureter | 20 (16.3) |
| Lower ureter | 13 (10.5) |
| Side of Calculus | |
| Right | 70 (56.9) |
| Left | 53 (43.1) |
| Mean calculus size (range), cm | 1.75 ± 0.6 (1 to 5.6) |

*Values in parentheses are percents unless otherwise indicated.

Routinely, 3 ports were used for introduction of the instruments, and laparoscopic operation was performed intraperitoneally in 104 (84.6%) patients and extraperitoneally in 19 (15.4%), according to the personal preference of the surgeon. Also, based on the surgeon's preference, ureteral stent was placed in 52 patients (42.3%).

We reviewed the hospital and follow-up records of the patients and evaluated their surgical data and complications. Statistical analysis was done to compare the 2 groups with intraoperative and extraperitoneal approaches using the *t* test (for normally distributed continuous variables), chi-square test, and Fisher exact test, where appropriate. A *P* value less than .05 was considered significant.

RESULTS

The mean operative time was 143.2 ± 60.5 minutes. Oral intake was started 22.39 ± 13.60 hours, postoperatively. The mean hospital stay was 5.86 ± 3.51 days. Double-J stent was removed cystoscopically in all patients except for 1, in whom percutaneous removal was done.

On the first postoperative day, 119 (96.7%) patients were stone free. Surgical complications occurred in 14 (11.4%) patients and conversion to open surgery was required in 1 (0.8%) due to migration of the calculus to the peritoneum after removal from the ureter. Re-operation was carried out in 1 patient (0.8%) with intra-abdominal hematoma and hemoglobin decrease, 2 days postoperatively. Abdominal wall hematoma was detected in 1 patient (0.8%). There were 3 cases

(2.4%) of urinoma, all responded to double-J stent insertion. Acute tubular necrosis and cholecystitis were seen in 1 patient (0.8%) on the second postoperative day, which were resolved conservatively. Hemoglobin decrease requiring blood transfusion was reported in 4 patients (3.3%), but intra-operative transfusion was not needed in any of the patients. Hydrocele developed in 1 patient (0.8%).

Of the 4 patients with failed treatment, 1 underwent TUL and 3 underwent SWL, all of which were successful. One patient experienced gastrointestinal bleeding that was treated conservatively. Pyelonephritis was seen 2 weeks after the operation in 1 patient (0.8%) who was re-hospitalized and treated. Ileus was seen in 20 patients (16.3%) and 59 (48.0%) had significant leakage that required dressing more than once. Five patients with significant leakage were treated by double-J stent insertion. Ureteral stricture was reported in 4 patients. One of them underwent retrograde ureteroscopy and then open surgical repair. The other 3 patients were treated successfully by double-J stent placed for about 1 month.

The mean operative times for intraperitoneal and extraperitoneal approaches were 137.3 ± 52.2 minutes and 171.3 ± 91.3 minutes, respectively ($P = .02$). Minor urine leakage was seen in 47 (45.2%) of the patients with intraperitoneal and in 12 (63.2%) with extraperitoneal surgical methods ($P = .11$). Also, there was no difference between the 2 surgical methods regarding ileus; 18 (17.3%) versus 2 (10.5%), respectively ($P = .48$). Finally, 4 cases of ureteral stricture were seen in the patients, all with intraperitoneal surgical approach (3.8% versus zero; $P = .52$).

DISCUSSION

Wickham was the first who introduced extraperitoneal ureterolithotomy in 1979,⁽⁶⁾ and in early 90's, Raboy and colleagues were the first to perform intraperitoneal laparoscopic ureterolithotomy.⁽⁷⁾ The panel on ureteral stones clinical guideline of the American Urological Association⁽⁴⁾ suggested that the treatment of choice, even for calculi greater than 1 cm, should be shockwave lithotripsy, ureteroscopy, or percutaneous removal. The panel also suggested that open surgery might be appropriate in complicated cases and as a salvage therapy. However, laparoscopic

ureterolithotomy was not proposed, since ample evidence were not available in the literature until then.⁽⁴⁾

Reportedly, laparoscopic ureterolithotomy is usually done either intraperitoneally or extraperitoneally. The main disadvantage of extraperitoneal laparoscopy is the small surgical field which needs to be expanded to create a viable working area.⁽¹⁾ Nonetheless, Goel and Hemal reported that retroperitoneoscopy was an acceptable option for removal of large upper and middle ureteral calculi with a reasonable operative time (mean, 108.8 minutes).⁽⁸⁾ Demirci and colleagues reported 21 cases of laparoscopic removal of the ureteral calculi in 2004.⁽¹⁾ All of their patients had upper or middle ureteral calculi which were operated extraperitoneally. The median operative time was 105 minutes and 5 patients had leakage requiring DJ stent insertion. They also observed 2 cases of pneumoscrotum and 1 wound infection. The average hospital stay was 6 days. Hemal and associates⁽⁹⁾ performed laparoscopic surgery on 31 upper ureteral calculi with extraperitoneal approach. They reported a mean operative time of 67 minutes and a mean hospital stay of 2.4 days. Only 2 patients required DJ stent placement.

Vallee and coworkers achieved a mean operative time of 80 minutes and hospitalization of 3.86 days in 18 patients with extraperitoneal approach ($n = 15$) and intraperitoneal ($n = 3$).⁽¹⁰⁾ The calculi in their patients were intradiverticular in 1, inferior caliceal in 1, and ureteral in 16. One case of urinoma and 15 DJ stent placements were reported. Finally, Nouria and colleagues performed extraperitoneal lithotomy for 6 upper ureteral calculi within 160 minutes in average. No major complication occurred in their series.⁽¹¹⁾

We demonstrate a large series of laparoscopic management of the ureteral calculi with a lower rate of conversion to open surgery in comparison with that in other studies.⁽¹⁾ We achieved a mean operative time of 143.2 ± 60.5 minutes that seems relatively long, but we considered the operative period from anesthesia to sending the patient to recovery room. Thus, the time spent for set up of laparoscopic instruments was a part of the operative time. Furthermore, the operations were performed in an academic center along with a surgical team under training. This time was shorter in intraperitoneal operations, mostly due to our greater experience in

this approach. Overall, 84.6% of our surgeries were intraperitoneal. Complication rate was not significant, consistent with other series reported.^(1,8-11)

CONCLUSION

Our findings confirm the efficacy and safety of laparoscopic management of ureteral calculi, having the advantages of this minimally invasive procedure such as the better cosmetic results and patient's satisfaction. We also demonstrated that intraperitoneal laparoscopic surgery was a rapid and easy method with a low learning curve and a low complication rate.

CONFLICT OF INTEREST

None declared.

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