

Outcome of Laparoscopic Ureterolithotomy in Comparison to Open Ureterolithotomy for the Treatment of Large and Impacted Upper Ureteric Stone

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DOI: [10.36347/sasjs.2023.v09i08.007](https://doi.org/10.36347/sasjs.2023.v09i08.007)

| Received: 27.06.2023 | Accepted: 31.07.2023 | Published: 21.08.2023

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Abstract

Original Research Article

Background: Ureteric stones are a common clinical issue, often necessitating open ureterolithotomy for large and impacted upper ureteric stones. Despite its success, laparoscopic surgery has gained popularity as an alternative approach, offering potential benefits such as reduced morbidity and shorter hospital stays. This study aims to compare the outcomes of laparoscopic ureterolithotomy with open ureterolithotomy for large impacted stones in the upper ureter.

Methods: A prospective quasi-experimental study was conducted from June 2018 to August 2019 at the Department of Urology, Dhaka Medical College Hospital. The study enrolled sixty patients with upper ureteric stones larger than 2 cm. Patients were divided into two groups: Group A underwent laparoscopic ureterolithotomy, while Group B underwent open ureterolithotomy. Demographic data, medical history, examination findings, and investigation reports were recorded for all patients. Post-surgical pain scores, blood loss, complications, and hospital stays were also evaluated.

Results: The study compared the outcomes of Group-A and Group-B patients who underwent ureterolithotomy. Group-A had an average age of 49.66 ± 14.70 years, while Group-B's average age was 51.60 ± 11.93 years. There was no significant difference in gender distribution between the groups (p -value 0.371). Group-A had a mean operative time of 2.11 ± 0.41 hours, while Group-B had a mean operative time of 1.60 ± 0.28 hours. Laparoscopic ureterolithotomy resulted in significantly less blood loss (p -value <0.001). Group-A had a lower mean pain score (59.27 ± 8.56) compared to Group-B (75.50 ± 17.34). Laparoscopic ureterolithotomy also required less Pethidine (p -value <0.001). Group-A experienced 6.7% wound infection and 10% UTI, while Group-B had higher rates (26.7% and 33.3% respectively). Urine extravasation occurred in 16.7% of Group-A, on the hand, in Group-B, it was 6.7%. Group-A had a shorter hospital stay (4.17 ± 1.18 days) compared to Group-B (6.47 ± 1.63 days). Both laparoscopic and open ureterolithotomy achieved a stone-free rate of 100% after one month, but 6.7% of laparoscopic patients were converted to open ureterolithotomy.

Conclusion: Laparoscopic ureterolithotomy offers distinct advantages over open ureterolithotomy, including reduced morbidity, shorter hospitalization time, and fewer perioperative and postoperative complications. Although laparoscopic ureterolithotomy demands longer operative time and advanced intracorporeal knotting skills, it should be considered the preferred standard for managing large impacted upper ureteric stones.

Keywords: Laparoscopic Ureterolithotomy, Open Ureterolithotomy, Upper Ureteric Stones, Large Impacted Stones.

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INTRODUCTION

Extracorporeal shock wave lithotripsy (ESWL) and ureteroscopy stone removal (URS) are two popular methods for treating ureteric stones in the present medical landscape. Percutaneous nephrolithotomy (PCNL) may also be considered for impacted upper ureteric calculi. The choice of treatment depends on

factors like stone parameters, patient characteristics, and the surgeon's expertise [1]. Advancements in fiber optic imaging and flexible ureteroscopy have improved the success and safety of invasive procedures for ureteral stones. However, the optimal treatment for large proximal ureteral stones remains a matter of debate. The American Urological Association (AUA)/European

Citation: Dr. Md. Ashraful Islam, Dr. Md. Masud Parvez, Dr. Munshi Muhammad Fazle Rabbi, Dr. Rajib Kumar Mazumdar, Dr. Tutul Chakma, Dr. Arafat Hossain. Outcome of Laparoscopic Ureterolithotomy in Comparison to Open Ureterolithotomy for the Treatment of Large and Impacted Upper Ureteric Stone. SAS J Surg, 2023 Aug 9(8): 673-677.

Association of Urology (EAU) guidelines suggest that URS offers a higher chance of becoming stone-free with a single procedure [2].

While extracorporeal methods like SWL, URS, and PCNL have revolutionized ureteral stone management, Ureterolithotomy remains a valuable option for challenging cases. Laparoscopic ureterolithotomy (LU) has advantages in terms of pain management, recovery, hospital stay, and cosmetic outcomes over open surgery. LU can be preferred in cases with large impacted stones, severe hydronephrosis, or anatomical anomalies, resulting in a higher stone-free rate compared to SWL and URS [3].

Defining impacted stones as those remaining in the same location for at least two months, and diagnosing them accurately is crucial for predicting postoperative complications. Impacted stones may lead to strictures with rates as high as 24% after ureteroscopy. The European Urology Guideline on urolithiasis defines large ureter stones as >10mm and very large stones as larger than 15mm in diameter [4]. Laparoscopic techniques have advanced, making laparoscopic ureterolithotomy a popular choice for such cases [5]. Thus, this study aims to compare the open and laparoscopic approaches for ureterolithotomy concerning postoperative complications, analgesic drug requirements, and hospitalization intervals in patients with impacted very large ureteral stones.

OBJECTIVES

General Objective

- To find out the outcome of laparoscopic ureterolithotomy for large and impacted upper ureteric stones in comparison with open ureterolithotomy.

Specific Objective

- To remove the stone by laparoscopic and open ureterolithotomy.
- To compare the stone free rate between laparoscopic and open ureterolithotomy.
- To find out the time required for laparoscopic and open ureterolithotomy.
- To find out the complications (wound infection, UTI, urine extravasation) of laparoscopic and open ureterolithotomy.
- To find out the hospital stay of laparoscopic and open ureterolithotomy.

MATERIALS AND METHODS

This prospective study was conducted from June 2018 to August 2019 in the Department of Urology, Dhaka Medical College hospital to find out the outcome of laparoscopic ureterolithotomy for large and impacted upper ureteric stones in comparison with open ureterolithotomy. A total of sixty (60) patients were evaluated during the study period in above mentioned

institution as per selection criteria. All patients were counselled about the techniques of ureterolithotomy operation and the possibility of using one of them. Patients were divided into two groups alternatively in group A and group B. Patients in group A were treated with laparoscopic ureterolithotomy and group B with open ureterolithotomy.

Follow Up

In the follow-up study at 3 months, every case was evaluated by history, clinical examination, urinalysis, urine culture and sensitivity, renal function test, plain X-ray KUB, and ultrasonography of KUB.

Data Collection

The study subjects were selected on the basis of selection criteria. The demographic information, relevant history, examination findings and investigation reports, per operative and post-operative data of all the study subjects, were recorded in the performed data collection sheet. These data were analyzed statistically by standard procedure to arrive at a definitive conclusion in respect of the hypothesis.

Data Analysis

All the collected data was compiled. Percentages were calculated to find out the proportion of the findings. Further Statistical analyses of the results were obtained by using Microsoft Xcel, 2010 (Microsoft Corporation, Washington, U.S.) and statistical software (SPSS -Statistical package for social sciences, Version - 25). The results were presented in tables, figures and diagrams. Quantitative data were expressed as mean and standard deviation and compared by the t-test. Qualitative data were expressed as frequency and percentage, compared by the chi-square (X²) test and Fisher's exact test. A probability value (p) of less than 0.05 was considered to indicate statistical significance. The summarized findings were then presented in the form of tables and graphs.

Ethical Implications

Before the commencement of the study the protocol was presented and approved by the Research Review Committee (RRC) of the department of urology, DMCH and approval was obtained from the Ethical Review Committee (ERC) of DMC. All the patients were informed about the nature of the risk and benefits of the study and informed written consent was taken. Proper permission was taken from the department and institution concerned for this study.

RESULTS

In this study, according to selection criteria, a total of 60 (sixty) patients with large (>2cm) impacted stones in upper ureter age from 25-70 years were included. Patients were divided into two groups, Group A: Laparoscopic Ureterolithotomy and Group B: Open Ureterolithotomy. Per-operative and postoperative data

were collected and analysed. The results are presented in tables.

Table 1: Distribution of gender and age Group A and Group B (N=60)

Categories	Group A (n=30)	Group B (n=30)	P-value
Age (years)			
25 - 34	6 (20.0%)	2 (6.7%)	
35 - 44	5 (16.7%)	6 (20.0%)	
45 - 54	8 (26.7%)	9 (30.0%)	
55 - 64	5 (16.7%)	9 (30.0%)	
65 - 74	6 (20.0%)	4 (13.3%)	
Mean \pm SD	49.66 \pm 14.70 years	51.60 \pm 11.93 years	0.578
Gender			
Male	21 (70.0%)	24 (80.0%)	0.371
Female	9 (30.0%)	6 (20.0%)	

Table 2: Comparison of operative time between Group A and Group B (N=60)

Comparison	Groups	Measurements	P-value
Operative Time	Group A (Laparoscopic Ureterolithotomy)	2.11 \pm 0.41 hours	<0.001
	Group B (Open Ureterolithotomy)	1.60 \pm 0.28 hours	
Blood Loss	Group A (Laparoscopic Ureterolithotomy)	201.67 \pm 34.70 ml	<0.001
	Group B (Open Ureterolithotomy)	318.33 \pm 79.04 ml	
Postoperative Pain (First 24 Hours)	Group A (Laparoscopic Ureterolithotomy)	59.27 \pm 8.56	<0.001
	Group B (Open Ureterolithotomy)	75.50 \pm 17.34	
Postoperative Analgesic Usage	Group A (Laparoscopic Ureterolithotomy)	1.80 \pm 0.81	<0.001
	Group B (Open Ureterolithotomy)	3.70 \pm 0.95	

Table 3: Post-Operative outcome with Complications Group A and Group B (N=60)

Variable	Group A (n=30) (%)	Group B (n=30) (%)	P-value
Wound Infection	2 (6.7)	8 (26.7)	0.038
UTI	3 (10.0)	10 (33.3)	0.028
Urine Extravasation	5 (16.7)	2 (6.7)	0.228
Hospital Stay (days)	4.17 \pm 1.18	6.47 \pm 1.63	<0.001
Stone Free Rate	30 (100.0)	30 (100.0)	

The study findings indicate that laparoscopic ureterolithotomy (Group A) is a favourable option compared to open ureterolithotomy (Group B) for the management of large (>2cm) impacted upper ureteric stones. Group A demonstrated significantly lower rates of wound infection (6.7% vs. 26.7%), and urinary tract infection (10.0% vs. 33.3%), compared to Group B, but urine extravasation is higher in laparoscopic ureterolithotomy Group A, (16.7% vs. 6.7%), compared to Group B.

Additionally, Group A exhibited a significantly shorter hospital stay (4.17 \pm 1.18 days vs. 6.47 \pm 1.63 days) ($p < 0.001$). Remarkably, both groups achieved a stone-free rate of 100% after one month of the procedure. These results underscore the benefits of laparoscopic ureterolithotomy as a standard management approach for large impacted upper ureteric stones, offering reduced morbidity and improved post-operative outcomes.

DISCUSSION

The treatment of ureteral calculi has been transformed by minimally invasive techniques such as

ureteroscopy (URS), shock wave lithotripsy (SWL), and percutaneous renal surgery. However, in cases of large, hard, long-standing, and impacted ureteral calculi, open surgical lithotomy remains a necessary option [6]. Particularly, upper ureteral stones or those located over the pelvic brim may still require open surgery. Nevertheless, with advancements in technique and experience, laparoscopy has emerged as an effective modality for treating complicated ureteral stones. Laparoscopic ureterolithotomy (LU) is considered a reasonable minimally invasive alternative to open ureterolithotomy for stones not amenable to endoscopic techniques.

This prospective study, conducted at the department of urology of Dhaka Medical College Hospital, aimed to compare the outcomes of laparoscopic ureterolithotomy with open ureterolithotomy for large impacted upper ureteral stones. The study examined the perioperative and postoperative findings, focusing on related previous studies to support the study's objectives.

The demographic and baseline characteristics of the subjects in both groups were almost identical. The

mean age of patients undergoing laparoscopic ureterolithotomy and open ureterolithotomy was 49.66 ± 14.70 and 51.60 ± 11.93 years, respectively, with no significant difference between the groups ($p > 0.05$). Similar studies by Bayar *et al.*, [4], reported comparable mean age values in their respective groups. The study found that blood loss was significantly less in laparoscopic ureterolithotomy (201.67 ± 34.70 ml) compared to open cases (318.33 ± 79.04 ml) ($p < 0.05$). A study by El-Moula *et al.*, [7] reported a mean blood loss of 90.6 ml for laparoscopic ureterolithotomy, while Goel *et al.*, reported blood loss of 58.5 ml and 50.5 ml for retroperitoneoscopic ureterolithotomy (RPUL) and open surgery, respectively [8].

Regarding postoperative pain, the study found that pain intensity in the first 24 hours after ureterolithotomy was significantly less in the laparoscopic group ($p < 0.05$). Laparoscopic ureterolithotomy required less pethidine (1.80 ± 0.81 doses) compared to open cases (3.70 ± 0.95 doses). Bayar *et al.*, also reported lower analgesic requirements for laparoscopic ureterolithotomy compared to open cases [4]. The mean operative time for laparoscopic ureterolithotomy was 2.11 ± 0.41 hours, while for open ureterolithotomy, it was 1.60 ± 0.28 hours, with operative time significantly lower in open ureterolithotomy ($p < 0.05$). Skrepetis *et al.*, reported operative times of 130 min for transperitoneal laparoscopic ureterolithotomy (TLU) and 85 min for open ureterolithotomy [9].

Laparoscopic ureterolithotomy resulted in shorter hospital stays (4.17 ± 1.18 days) compared to open ureterolithotomy (6.47 ± 1.63 days) ($p < 0.05$). Studies by Feyaerts *et al.*, also reported shorter hospital stays for laparoscopic procedures [10]. Wound infection and urinary tract infection (UTI) were significantly less in laparoscopic ureterolithotomy, while urine extravasation was less in open ureterolithotomy. Skrepetis *et al.*, observed urinary leaks in the TLU group and urinary tract infections in the open ureterolithotomy group [9].

The stone-free rate after one month of the procedure was 100% in both laparoscopic ureterolithotomy and open ureterolithotomy. Similar findings were reported by Bayar *et al.*, In some cases, laparoscopic ureterolithotomy was converted to open surgery due to technical difficulties or complications [4]. In this study, two patients (6.7%) underwent conversion to open ureterolithotomy. El-Moula *et al.*, reported a conversion rate of 5.4%, while reported a 50% conversion rate [7].

In this study, laparoscopic ureterolithotomy is a viable and effective alternative to open ureterolithotomy for the treatment of large impacted upper ureteral stones, with advantages including reduced blood loss, less postoperative pain, shorter hospital stay, and comparable stone-free rates. However, the procedure requires

experienced surgeons and has a learning curve that may lead to longer operative times. It is essential to consider patient and stone characteristics when deciding on the most suitable surgical approach for ureteral calculi treatment.

CONCLUSION

Laparoscopic ureterolithotomy is favored over open ureterolithotomy for large impacted upper ureteric stones (> 2 cm) due to lower morbidity, shorter hospital stays, and fewer complications. Despite longer operation times and skill requirements, the laparoscopic approach is recommended as the standard management for such stones.

Limitations

The limitations of this study were:

- It was done on a small group of patients
- Non-randomized sample
- May be bias
- The study period was short.
- Operations were performed by different urologists.

Recommendations

According to the findings of the present study, the following recommendation is put forward for consideration by the relevant authority.

- Laparoscopic ureterolithotomy should be taken as the first priority for the management of large impacted upper ureteric stones as it is a better option than open surgery.

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