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Original Article

Outcomes of Ureteroscopy with Laser Lithotripsy in Ureteric Stones

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ABSTRACT

Background: Ureteric stone disease is a common urological problem, and ureteroscopy with laser lithotripsy has become a preferred minimally invasive treatment option due to its high success rates and safety profile.
Objectives: To evaluate the clinical outcomes, stone-free rates, and complications of ureteroscopy with laser lithotripsy in patients with ureteric stones treated at a tertiary care centre.
Materials and Methods: This hospital-based observational study included 60 adult patients with radiologically confirmed ureteric stones who underwent ureteroscopy with holmium:YAG laser lithotripsy. Patient demographics, stone characteristics, operative details, stone-free rates, and postoperative complications were analyzed. Stone-free status was defined as complete clearance or the presence of clinically insignificant residual fragments (≤4 mm).
Results: The majority of patients were male, and distal ureteric stones were the most common. Most stones measured between 6 and 10 mm in size. The overall stone-free rate achieved was 90%, with higher success observed in distal ureteric stones. Postoperative complications were minimal and included transient hematuria, fever, and flank pain, all of which were managed conservatively. No major complications were encountered.
Conclusion: Ureteroscopy with laser lithotripsy is a safe and effective modality for the management of ureteric stones, offering high stone-free rates with low morbidity and short hospital stay in a tertiary care setting.

Keywords: *Ureteric stones; Ureteroscopy; Laser lithotripsy; Clinical outcomes.*

INTRODUCTION

Urolithiasis is a common urological disorder with a rising global incidence, influenced by dietary habits, lifestyle changes, metabolic abnormalities, and climatic factors. Ureteric stones constitute a significant proportion of urinary tract calculi and are a frequent cause of acute flank pain, hematuria, and urinary obstruction. In a tertiary care setting, ureteric stones often present as complicated cases due to delayed referral, larger stone burden, associated infection, or failed prior treatment, thereby posing additional management challenges [1,2].

The management of ureteric stones is determined by multiple factors, including stone size, location, degree of obstruction, presence of infection, and patient comorbidities. While conservative management and medical expulsive therapy may be suitable for small distal stones, interventional treatment is frequently required in patients presenting to tertiary care centres. These centres often manage complex cases referred from peripheral hospitals, necessitating definitive and effective treatment modalities with high success rates [3].

Ureteroscopy with laser lithotripsy has emerged as a cornerstone in the management of ureteric stones, particularly in tertiary care institutions where advanced endourological facilities and surgical expertise are available. The introduction of holmium: yttrium-aluminum-garnet (Ho:YAG) laser technology has significantly enhanced the efficacy of ureteroscopy by

enabling precise fragmentation of stones of varying composition with minimal thermal injury to the ureteric wall. This has resulted in improved stone clearance rates and reduced procedure-related morbidity [4,5].

Compared to extracorporeal shock wave lithotripsy (ESWL), ureteroscopy offers distinct advantages in a tertiary care context, including higher stone-free rates for distal and impacted stones, immediate stone clearance, and reduced need for repeat treatment sessions. Several studies have reported stone-free rates exceeding 85–90% with ureteroscopic laser lithotripsy, even in patients with larger or complicated ureteric stones commonly encountered in referral centres [6,7].

Current guidelines from the European Association of Urology and the American Urological Association recommend ureteroscopy as a first-line treatment for most ureteric stones, particularly those larger than 10 mm, impacted calculi, or stones refractory to conservative management. However, outcomes may vary depending on stone characteristics, institutional protocols, and surgeon experience, highlighting the importance of centre-specific outcome evaluation [8,9].

Given the increasing burden of ureteric stone disease and the pivotal role of ureteroscopy with laser lithotripsy in tertiary care practice, it is essential to evaluate procedural outcomes in this setting. The present study was therefore undertaken at a tertiary care centre to assess the clinical outcomes, stone-free rates, and complications associated with ureteroscopy with laser lithotripsy in patients with ureteric stones.

MATERIALS AND METHODS:

Study Design

This was a hospital-based observational study conducted to evaluate the clinical outcomes of ureteroscopy with laser lithotripsy in patients with ureteric stones.

Study Setting

The study was carried out in the Department of Urology at a tertiary care teaching hospital,

Study Duration

The study was conducted over a period of **one year**

Study Population

All consecutive patients diagnosed with ureteric stones and planned for ureteroscopy with laser lithotripsy during the study period were screened for eligibility.

Eligibility Criteria

Inclusion Criteria

- Patients aged **18 years and above**
- Radiologically confirmed ureteric stones
- Patients undergoing ureteroscopy with laser lithotripsy as primary treatment
- Patients willing to provide written informed consent

Exclusion Criteria

- Pregnant patients
- Patients with uncorrected bleeding disorders
- Active urinary tract infection not controlled preoperatively
- Congenital anomalies of the urinary tract
- Patients unfit for anesthesia

Preoperative Evaluation

A detailed clinical history was obtained from all patients, including presenting symptoms, duration of illness, previous stone episodes, and prior interventions. Physical examination was followed by routine laboratory investigations such as complete blood count, renal function tests, urine analysis, and urine culture.

Radiological evaluation included ultrasonography of the kidney, ureter, and bladder and non-contrast computed tomography (NCCT KUB) to assess stone size, number, location, degree of obstruction, and associated hydronephrosis. Stone size was recorded as the maximum diameter measured on imaging.

Patients with positive urine cultures were treated with appropriate antibiotics prior to intervention until sterile urine was achieved.

Operative Technique

All procedures were performed under spinal or general anesthesia. Ureteroscopy was carried out using a semi-rigid ureteroscope. The ureter was accessed under direct vision, and stone fragmentation was performed using holmium: yttrium-aluminum-garnet (Ho:YAG) laser lithotripsy. Laser settings were adjusted according to stone hardness and location.

Stone fragments were either extracted using graspers or allowed to pass spontaneously. Placement of a double-J ureteric stent was done at the discretion of the operating surgeon, based on intraoperative findings such as ureteric edema, residual fragments, or mucosal injury.

Postoperative Care
Patients were monitored postoperatively for complications such as hematuria, fever, flank pain, or signs of sepsis. Analgesics and antibiotics were administered as per institutional protocol. Most patients were discharged within 24–48 hours of the procedure.

Follow-Up and Outcome Assessment
Patients were followed up at **2–4 weeks** after the procedure. Follow-up evaluation included clinical assessment and imaging (ultrasonography or X-ray KUB/NCCT, as appropriate) to assess stone clearance.

Outcome Measures
- **Primary outcome:** Stone-free rate, defined as complete clearance or presence of clinically insignificant residual fragments ≤4 mm
- **Secondary outcomes:** Operative complications, need for auxiliary procedures, and duration of hospital stay

Complications were recorded and classified as minor or major based on clinical severity and need for intervention.

Data Collection
All relevant clinical, operative, and follow-up data were recorded in a pre-designed structured proforma. Data were cross-checked for completeness and accuracy prior to analysis.

Statistical Analysis
Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software 20. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Results were analyzed descriptively.

Ethical Considerations
The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study. Patient confidentiality was strictly maintained throughout the study.

RESULTS:
A total of 60 patients with ureteric stones who underwent ureteroscopy with laser lithotripsy were included in the study. Patient demographics, stone characteristics, operative details, stone-free rates, and complications were analyzed.

Ureteric stone disease was most commonly observed in the middle-aged population, with the highest number of patients in the 31–50-year age group as shown in Table 1

Table 1: Age Distribution

Age Group (years)	Number of Patients	Percentage (%)
18–30	12	20.0
31–40	18	30.0
41–50	16	26.7
51–60	10	16.7
>60	4	6.6
Total	**60**	**100**

Male patients constituted the majority of cases in the present study as shown in Table 2

Table 2: Gender Distribution

Gender	Number of Patients	Percentage (%)
Male	42	70.0

Gender	Number of Patients	Percentage (%)
Female	18	30.0
Total	**60**	**100**

Distal ureteric stones were the most frequently encountered, followed by middle and proximal ureteric stones as shown in Table 3.

Table 3: Location of Ureteric Stones

Stone Location	Number of Patients	Percentage (%)
Proximal ureter	14	23.3
Middle ureter	18	30.0
Distal ureter	28	46.7
Total	**60**	**100**

Most patients had stones measuring between 6 and 10 mm in diameter as shown in Table 4

Table 4: Stone Size Distribution

Stone Size (mm)	Number of Patients	Percentage (%)
≤5 mm	10	16.7
6–10 mm	34	56.6
>10 mm	16	26.7
Total	**60**	**100**

Ureteroscopy with laser lithotripsy was successfully completed in the majority of patients, with postoperative stenting performed selectively as shown in Table 5

Table 5: Operative Details

Parameter	Number of Patients	Percentage (%)
DJ stent placed	44	73.3
No stent placed	16	26.7
Total	**60**	**100**

A high overall stone-free rate was achieved following ureteroscopy with laser lithotripsy as shown in Table 6

Table 6: Stone-Free Rate

Outcome	Number of Patients	Percentage (%)
Stone-free	54	90.0
Residual fragments (>4 mm)	6	10.0
Total	**60**	**100**

Stone clearance was highest for distal ureteric stones compared to proximal stones as shown in Table 7

Table 7: Stone-Free Rate According to Stone Location

Stone Location	Stone-Free	Not Stone-Free	Success Rate (%)
Proximal ureter	11	3	78.6
Middle ureter	16	2	88.9
Distal ureter	27	1	96.4

Most complications were minor and managed conservatively, with no major ureteric injury observed as shown in Table 8

Table 8: Postoperative Complications

Complication	Number of Patients	Percentage (%)
Hematuria	8	13.3
Postoperative fever	6	10.0
Flank pain	5	8.3

Complication	Number of Patients	Percentage (%)
Ureteric perforation	0	0
Sepsis	0	0

The majority of patients had a short hospital stay of 1–2 days following the procedure as shown in Table 9

Table 9: Duration of Hospital Stay

Hospital Stay (days)	Number of Patients	Percentage (%)
1–2 days	48	80.0
3–5 days	12	20.0
>5 days	0	0

DISCUSSION:

Ureteroscopy with laser lithotripsy has become an integral component of modern endourological practice, particularly in tertiary care centres managing a high volume of ureteric stone disease. The present study evaluated the outcomes of ureteroscopy with laser lithotripsy in 60 patients and demonstrated high stone-free rates with minimal morbidity, supporting its role as a safe and effective treatment modality.

Demographic Profile

In the present study, ureteric stones were most commonly observed in patients between 31 and 50 years of age, with a male predominance. This demographic pattern is consistent with previously published literature, which attributes higher stone incidence in males to occupational exposure, dietary habits, and metabolic risk factors [10,11]. Similar age and gender distributions have been reported in Indian and international studies evaluating ureteroscopic outcomes [12].

Stone Location and Size

Distal ureteric stones constituted the majority of cases in this study. This finding is comparable to reports by Perez Castro et al. and Skolarikos et al., who observed a higher incidence of distal ureteric calculi in patients presenting for intervention [13,14]. Stones measuring 6–10 mm were the most common size group, which aligns with the clinical threshold where spontaneous passage becomes less likely and intervention is frequently required.

Stone location significantly influenced stone-free rates, with distal ureteric stones demonstrating the highest success rates. Improved visualization, easier access, and reduced stone migration during fragmentation contribute to superior outcomes in distal stones, as reported in earlier studies [15]

Stone-Free Rate

The overall stone-free rate of 90% achieved in the present study is consistent with published success rates ranging from 85% to 95% for ureteroscopy with laser lithotripsy [16,17]. The high efficacy observed can be attributed to advancements in ureteroscopic equipment, improved optical quality, and the versatility of holmium:YAG laser technology, which is effective across all stone compositions.

Compared to extracorporeal shock wave lithotripsy, ureteroscopy offers the advantage of immediate stone clearance and reduced need for repeat procedures, particularly in stones larger than 10 mm or those impacted in the ureter [18].

Postoperative Stenting

In the present study, a double-J ureteric stent was placed in approximately three-fourths of patients. Stenting was selectively performed based on intraoperative findings such as ureteric edema, mucosal injury, or residual fragments. Although routine stenting is not mandatory in uncomplicated ureteroscopy, selective stenting has been shown to reduce postoperative pain and obstruction in high-risk cases [19].

Complications

The complication rate observed in this study was low, and most complications were minor, including transient hematuria, postoperative fever, and flank pain. These findings are in agreement with previous studies reporting minor complication rates of 10–20% following ureteroscopic laser lithotripsy [20]. Importantly, no major complications such as ureteric perforation, avulsion, or sepsis were encountered, underscoring the safety of the procedure when performed in experienced hands.

The absence of serious complications also reflects the importance of careful patient selection, preoperative optimization, and adherence to standardized operative techniques in a tertiary care setting [21].

Hospital Stay and Recovery
Most patients in the present study had a short hospital stay of 1–2 days, highlighting the minimally invasive nature of ureteroscopy. Short hospitalization and rapid recovery contribute to reduced healthcare costs and improved patient satisfaction, as reported in earlier outcome studies [22].

CONCLUSION:
Ureteroscopy with laser lithotripsy is an effective and minimally invasive treatment for ureteric stones. The procedure achieved high stone-free rates, particularly for distal ureteric calculi, with a low incidence of complications. Most adverse events were minor and managed conservatively, and hospital stay was short. These findings support ureteroscopy with laser lithotripsy as a safe and reliable option for managing ureteric stones in a tertiary care setting.

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