

EFFICACY AND SAFETY OF EMERGENCY URETEROSCOPIC LITHOTRIPSY IN PATIENTS WITH URETERAL STONES: A DESCRIPTIVE STUDY

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ABSTRACT

Background: Urolithiasis is a common cause of obstructive uropathy and one of the leading urological emergencies worldwide. Ureteral stones constitute a significant proportion of urinary tract calculi and frequently present with acute renal colic requiring urgent medical attention. Recent advances in endourological techniques have enabled emergency ureteroscopic lithotripsy (URS) to be performed as a definitive treatment during the initial hospital admission, potentially reducing patient morbidity, repeated hospital visits, and the need for temporary urinary diversion.

Objective: To assess the efficacy and safety of emergency ureteroscopic lithotripsy in patients presenting with ureteral stones.

Materials and Methods: This descriptive study was conducted at the Department of Urology, Lady Reading Hospital, Peshawar, from 6th April 2024 to 6th October 2024. A total of 144 patients aged 16–70 years of either gender presenting with ureteral stones underwent emergency ureteroscopic lithotripsy within the defined study period. Efficacy was assessed by complete stone clearance, while safety was evaluated by the absence of major complications including significant blood loss, abdominal distension, and sepsis.

Results: The mean age of the study population was 45.21 ± 15.45 years. Complete stone clearance was achieved in 124 patients (86.1%). The procedure was considered safe in 127 patients (88.2%), with no major complications reported according to the predefined outcome measures.

Conclusion: Emergency ureteroscopic lithotripsy demonstrated a high stone-free rate with an acceptable safety profile in patients presenting with ureteral stones. The procedure represents an effective definitive treatment option in appropriately selected patients and may reduce morbidity associated with delayed intervention.

INTRODUCTION:

Urolithiasis is a prevalent cause of obstructive uropathy in Pakistan, affecting individuals across all age groups.¹ The universal incidence of urinary tract stones is high, with a 4% to 15% rate worldwide. Ureteral stones account for 20% of urolithiasis, with about 70% of them distally located.² Renal colic

secondary to obstructing ureteral calculi accounts for approximately 1% of all emergency department visits and hospital admissions.³ The management of acute renal colic resulting from ureteric stones is extensively discussed in contemporary literature and guidelines. In cases where pharmacological intervention proves ineffective in alleviating symptoms, the subsequent course of action involves the insertion of a ureteric catheter, double-J stent, or nephrostomy tube.⁴ These uncomplicated procedures are instrumental in swiftly relieving symptoms and are typically succeeded by either ureteroscopic (URS) or shock wave lithotripsy (SWL), both of which stand as primary options for addressing symptomatic ureteral stones. While URS represents a more invasive alternative compared to SWL, it boasts a superior success rate, particularly in the context of mid- and distal ureteral stones.⁵

Recent advancements in small-caliber semi-rigid and flexible deflectable ureteroscopes, along with diminutive intracorporeal lithotripsy probes, have significantly enhanced the feasibility and safety of retrograde access to urinary calculi throughout the entire ureter.⁶ This progress has made the emergency approach, implemented within 24 to 48 hours of presentation to the emergency room, an appealing and cost-effective option. This one-stage definitive solution not only reduces patients' suffering but also provides comparable stone-free rates with minimal complications.⁷ The emergency approach has been recently explored by both the American Urological Association (AUA) and European Association of Urology (EAU) stone management guidelines.⁸

Teichman, in his management algorithm, underscores the value of temporary interventions such as nephrostomy or double-J stenting. He

emphasizes a shift towards non-urgent pathways in handling urgent stone conditions, aligning with the evolving landscape of stone management strategies.⁹

Regarding the success rates of URS, the American Urological Association ureteral stones guidelines panel summary report found a stone-free rate of 56% for stones of <1 cm and a stone-free rate of 44% for stones of >1 cm in the proximal ureter as compared with rates of 89% and 73% for stones in the distal ureter, respectively.¹⁰

Despite widespread use, limited data exist on the use of emergency URS for ureteral colic caused by ureteral stones. The emergency approach within 24 to 48 hours presents an attractive and cost-effective option with the potential to reduce analgesia intake, morbidity, complications from urinary tract obstruction, and the need for prolonged outpatient follow-ups. Notably, significant data on the emergency Ureteroscopic management of ureteral stones in Pakistan is lacking, and no studies have evaluated the safety and efficacy of emergency URS.

OBJECTIVE:

To assess the efficacy and safety of emergency ureteroscopic lithotripsy in patients presenting with ureteral stones.

OPERATIONAL DEFINITIONS:

Emergency Ureteroscopic Lithotripsy:

Definitive ureteroscopic stone fragmentation and removal performed within 24–48 hours of patient presentation with symptomatic ureteral stones.

Efficacy:

Successful complete stone clearance following emergency ureteroscopic lithotripsy, confirmed according to the study protocol.

Safety:

Absence of major procedure-related complications including significant blood loss, abdominal distension, and sepsis during the study period.

OPERATIONAL DEFINITIONS:

Ureteral Stone: A radiologically confirmed calculus located within the ureter associated with symptoms of acute renal colic or urinary obstruction.

Efficacy: Complete stone clearance following emergency ureteroscopic lithotripsy as confirmed by postoperative imaging.

Safety: Absence of major perioperative complications, including significant blood loss, abdominal distension, and postoperative sepsis.

MATERIAL AND METHODS:

Study Design: Descriptive study.

Study Setting: Department of Urology, Lady Reading Hospital, Peshawar.

Duration Of Study: 6 months (6th April 2024 – 6th October 2024).

SAMPLE SIZE: The sample size was calculated using the WHO sample size calculator based on an expected efficacy of emergency URS from previous studies, with a 95% confidence level and an acceptable margin of error, resulting in a final sample size of 144 patients.⁽¹⁰⁾

SAMPLING TECHNIQUE: Consecutive non-probability sampling.

ETHICAL APPROVAL: The study was approved by the Institutional Research and Ethics Committee of Lady Reading Hospital, Peshawar.

RESULTS:

A total of **144 patients** with ureteral stones who fulfilled the inclusion criteria underwent emergency ureteroscopic. The mean age of the patients was 45.21 ± 15.43 years. The mean height was 1.68 ± 0.02 m, mean weight was 71.26 ± 3.91 kg, mean stone size was 0.90 ± 0.24 cm, and mean body mass index (BMI) was 25.27 ± 1.44 kg/m².

SELECTION CRITERIA:

Inclusion criteria:

- ❖ Age 16–70 years.
- ❖ Male and female patients.
- ❖ Radiologically confirmed ureteral stones.
- ❖ Patients requiring emergency ureteroscopic intervention.

Exclusion criteria:

- ❖ Active urinary tract infection or urosepsis.
- ❖ Pregnancy.
- ❖ Bleeding disorders.
- ❖ Ureteral stricture or congenital urinary tract anomalies.
- ❖ Previous ureteral surgery on the affected side.

DATA COLLECTION PROCEDURE:

After obtaining informed consent, demographic and clinical data were recorded on a structured proforma. Emergency ureteroscopic lithotripsy was performed under spinal or general anesthesia by experienced urologists. Stone fragmentation was achieved using intracorporeal lithotripsy, and a double-J stent was inserted when indicated. Patients were monitored postoperatively for stone clearance and complications.

DATA ANALYSIS PROCEDURE:

Data were analyzed using IBM SPSS version 26. Mean $\pm$ SD was calculated for numerical variables, while frequencies and percentages were determined for categorical variables. Stratification was performed for age and gender, and a p-value of <0.05 was considered statistically significant.

Table 1. Baseline characteristics of the study population (n = 144)

Variable	Mean $\pm$ SD
Age (years)	45.21 $\pm$ 15.43
Height (m)	1.68 $\pm$ 0.02
Weight (kg)	71.26 $\pm$ 3.91
Stone size (cm)	0.90 $\pm$ 0.24
BMI (kg/m ²)	25.27 $\pm$ 1.44

Among the 144 patients, the majority belonged to the middle-aged population and of the total study population, 80 (55.6%) were males, while 64 (44.4%) were females. Age and gender distribution is shown in Table 2.

Table 2: Age and Gender distribution

Variable	Category	Frequency	Percentage (%)
Age group (years)	17-35	46	31.9
	36-50	37	25.7
	51-70	61	42.4
	Total	144	100
Gender	Male	80	55.6
	Female	64	44.4
	Total	144	100

Distal ureteric stones constituted the largest proportion of cases (78, 54.2%), followed by proximal (41, 28.5%) and mid-ureteric stones (25, 17.4%) (Table 3).

Table 3. Site of ureteral stone

Site	Frequency	Percentage
Proximal	41	28.5
Mid ureter	25	17.4
Distal	78	54.2
Total	144	100

Procedure-related complications were uncommon. Blood loss occurred in 3 (2.1%) patients, sepsis in 9 (6.2%), and ureteric injury in 5 (3.5%) patients (Table 4).

Table 4. Procedure-related complications

Complication	Frequency	Percentage
Blood loss	3	2.1
Sepsis	9	6.2
Ureteric injury	5	3.5

Complete stone clearance following emergency ureteroscopic lithotripsy was achieved in 124 (86.1%) patients, whereas 20 (13.9%) patients had residual stone fragments (Table 5).

Table 5. Efficacy of emergency ureteroscopic lithotripsy

Outcome	Frequency	Percentage
Effective (Stone free)	124	86.1
Not effective	20	13.9
Total	144	100

DISCUSSION:

The management of ureteral calculi, particularly in emergency situations, has become a critical aspect of urological practice. Emergency ureteroscopy stands out as a minimally invasive procedure that allows for the direct visualization and removal of stones in the ureter, offering a rapid solution to relieve obstruction and alleviate symptoms. The efficacy of this approach is often measured by the stone free rate, while safety is evaluated based on complications such as sepsis, blood loss, and abdominal distention.¹¹

Efficacy in the context of emergency ureteroscopy is predominantly reflected in the stone-free rate, which is the percentage of patients who are completely free of stones following the procedure. Multiple studies have reported varying success rates, but a stone-free rate of over 90% is commonly achieved in the hands of experienced urologists. Factors influencing this high efficacy include the size and location of the calculi, the technique employed, and the overall health of the patient.

For instance, smaller stones (typically less than 10 mm) located in the distal ureter tend to have higher clearance rates compared to larger stones or those located in more proximal regions. The use of adjunctive technologies such as laser lithotripsy can also enhance the efficacy of the procedure, allowing for better fragmentation and removal of stones.¹²

Beyond the stone-free rate, the rapid relief of symptoms such as pain, hematuria, and urinary obstruction underscores the clinical effectiveness of emergency ureteroscopy. This immediacy in symptom management is crucial, especially in patients presenting with acute renal colic, where timely intervention can prevent complications such as hydronephrosis or renal impairment. In this regard, emergency ureteroscopy serves not only as a therapeutic measure but also as a preventive one, reducing the risk of longer-term kidney damage associated with prolonged obstruction.¹³

However, the efficacy of emergency ureteroscopy must be balanced against its safety profile. Safety is an essential consideration, as the procedure is

not without risks. Common complications include sepsis, significant blood loss, and abdominal distention, among others. The incidence of sepsis, for instance, has been reported to occur in a small percentage of cases, often correlating with the presence of infected stones or pre-existing urinary tract infections. Adequate preoperative evaluation and management of these conditions are critical in minimizing this risk. Prophylactic antibiotics are routinely administered to reduce the incidence of post-procedural infections, which is a standard practice aimed at enhancing patient safety.¹⁴ Blood loss during ureteroscopy is typically minimal, with most studies indicating that significant hemorrhage is rare. The risk of bleeding can be influenced by several factors, including the patient's coagulation status and the extent of stone manipulation required during the procedure. Intra-operative monitoring and careful surgical technique can further mitigate this risk. In the event of significant bleeding, the ability to perform ureteroscopy in a controlled environment allows for immediate intervention, such as cauterization or the use of balloon dilation to address any vascular injury.¹⁵ Abdominal distention, while less commonly discussed, can occur postoperatively, particularly in cases where there is significant manipulation of the ureter or in the presence of pre-existing conditions such as hydronephrosis. Distention may result from retained urine due to transient obstruction or from the use of irrigation fluids during the procedure. This condition usually resolves spontaneously, but awareness and monitoring are necessary to prevent complications.¹⁶

We observed that in our study we achieved the stone clearance in 124 (86.1%) who underwent emergency ureteroscopy, we also observed that there were lower incidences of complication such

as blood loss 3 (2.1%), sepsis 9 (6.2%) and ureteric injury 5 (3.5%) which affirms that emergency ureteroscopy is a safe procedure for ureteral stone removal. The overall safety of emergency ureteroscopy is further supported by

its low complication rates when compared to alternative interventions such as percutaneous nephrolithotomy or open surgical approaches. These alternatives, while effective, often come with a higher burden of morbidity and longer recovery times. Emergency ureteroscopy offers a less invasive option that can be performed with shorter hospital stays and quicker return to normal activities, thereby enhancing patient satisfaction and quality of life.¹⁷

The emergency ureteroscopic management of ureteral calculi demonstrates a compelling balance between efficacy and safety. With high stone-free rates and a relatively low incidence of serious complications, it stands out as a first-line treatment in acute settings. The procedure not only addresses the immediate concerns of pain and obstruction but does so with a favorable safety profile, particularly when guided by experienced practitioners who can anticipate and manage potential risks. As techniques and technologies continue to advance, the role of emergency ureteroscopy in managing ureteral stones is likely to expand, further solidifying its position in contemporary urology.¹⁸

CONCLUSION

Emergency ureteroscopic lithotripsy demonstrated a high success rate in the management of symptomatic ureteral stones in this study. Complete stone clearance was achieved in patients, while the procedure was considered safe, with only a small proportion experiencing procedure-related complications. These findings indicate that emergency ureteroscopy is an effective and safe definitive treatment option for carefully selected patients presenting with ureteral calculi.

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