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Original article

Feasibility and outcome of emergency ureteroscopic removal of lower ureteral stone under intravenous sedation: A prospective study



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KEYWORDS

Emergency URS;
Elective URS;
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Abstract

Objective: To compare the efficacy of emergency ureteroscopy (URS) with that of elective URS in the treatment of distal ureteral calculi.

Patients and methods: This prospective study included 132 patients diagnosed with a distal unilateral ureteral stone ≤ 5 mm and treated with either emergency or elective URS between August 2013 and July 2014. The indication for emergency URS was intractable renal pain not responding to narcotic analgesia. Children, pregnant women and patients with bilateral disease were excluded. The patients were categorized into two groups: Group I included 42 patients who underwent emergency URS under intravenous sedation, while Group II included 90 patients who underwent elective URS. The patients' demographic data, the stone criteria, perioperative complications, procedure outcome and degree of patient satisfaction were recorded and statistically analyzed.

Results: The mean stone size was 4.2 ± 0.5 mm in Group I and 4.1 ± 0.6 mm in Group II. The success rate was 90.5% and 97.8% in Groups I and II, respectively with a statistically insignificant difference. Complete stone retrieval without fragmentation was achieved in 83.3% in Group I and in 82.2% in Group II. The stone migrated proximally in 4 patients in Group I and in only 2 patients of Group II; these patients received ureteral stents. Mucosal injury was observed in 3 and 4 patients of Groups I and II, respectively. Thirty-seven patients of Group I (88%) reported that they were satisfied with the procedure and its outcome compared to 78 patients of Group II (87%).

Conclusion: Emergency URS under intravenous sedation is feasible, safe and equally effective when compared to elective URS for small lower ureteral stones.

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Introduction

Calcular obstruction of the ureter is one of the most frequently encountered emergencies in urologic practice [1,2]. The lifetime risk for stone diseases has significantly increased reaching 10–15% in the USA with a recurrence rate reaching 50% [3]. Advances in diagnostic procedures, such as the introduction of multi-detector CT and its widespread use in clinical practice, have changed the diagnostic approach and have increased the accuracy of detecting ureteral stones including radiolucent and small ones [1,4]. The main objectives of the management of ureteral calculi are the relief of symptoms, mainly pain, as well as alleviation of obstruction in order to preserve renal function and, ideally, stone removal [2,5]. The large variety of treatment options for the treatment of renal colic caused by lower ureteral stones includes medical expulsive treatment (MET), double-J stent insertion, emergency SWL and emergency nephrostomy with ureteroscopy (URS) which appears to provide the best results and the most rapid radical solution of the problem [3,6–8]. In this study, we analyzed our experience with emergency URS, comparing the results with those of elective URS.

Patients and methods

In total, 132 patients who presented with acute renal colic to our tertiary-care center between August 2013 and July 2014 and were diagnosed with a single unilateral ureteral stone ≤ 5 mm (stone size \triangleq maximal dimension measured on CT) in the distal ureter (i.e. in the segment below the sacroiliac joint) were enrolled in this prospective study. Children and pregnant women as well as patients with a single functioning kidney, documented urinary tract infection or bilateral disease were excluded.

The approval of the local ethics committee and an informed consent from all patients were obtained, and the patients were informed that they could withdraw from the study at any time. The eligible patients underwent routine laboratory investigations including urinalysis, complete blood count and assessment of the biochemical parameters related to renal function. All patients were subjected to non-contrast-enhanced spiral CT scan in order to confirm the diagnosis and to identify the precise site and size of the stone. Initial pain management consisted of diclofenac sodium 75 mg. Pethidine 1 mg/kg was given to patients who failed to respond to initial pain management.

The eligible patients were divided into two groups. 42 patients with intractable renal pain (score ≥ 7 on the verbal numerical rating scale) despite the administration of narcotic analgesia were assigned to Group I (emergency URS done within 24 hours from presentation). Group II included 90 patients with a pain score ≤ 3 who responded well to pain management but failed to pass the stone although they had undergone medical expulsive therapy for 2 weeks. In all patients of both groups, URS was performed by the same surgical team.

The patients of Group I underwent emergency URS under intravenous sedation. They received an injection of diclofenac sodium (75 mg) prior to the procedure. Midazolam 0.03 mg/kg body weight was slowly given immediately before the procedure for sedation, followed by intravenous administration of Fentanyl 50 mcg just before introducing the ureteroscope into the ureter. The patient's vital signs were monitored by the anesthesia staff throughout the

procedure. URS was performed with a 6.5 F semi-rigid ureteroscope under fluoroscopic guidance. Ureteral dilatation was performed when necessary. Forceps or baskets were used for stone extraction. Intracorporeal lithotripsy using the pneumatic lithoclast and placement of a ureteral stent were applied when necessary. In all patients the procedures were tolerable without pain.

Group II included the patients who had failed to pass the stone despite medical expulsive therapy (diclofenac sodium 50 mg twice daily and tamsulosin 0.4 mg once daily) applied for 2 weeks. They underwent delayed elective URS under regional anesthesia. Postoperatively, the patients were discharged home after complete recovery and regaining full activity. Diclofenac sodium 50 mg twice daily as needed was prescribed as discharge treatment.

All patients were subjected to a non-contrast-enhanced CT scan 2 weeks after discharge in order to assess the stone-free status and to measure the size of residual fragments, if there were any. Success was defined as no stones or stone fragments < 3 mm. The duration of the hospital stay was measured from the time of admission until the time of discharge. At the follow-up visits, the patients were asked how satisfied they were with the procedure and at which time they were able to resume their daily activities. The patients' demographic data, the stone criteria and the perioperative complications were calculated and statistically analyzed.

The unpaired student's *t*-test and the chi-square test were used for data analysis when appropriate, and $p < 0.05$ was considered as statistically significant using the MedCalc 14.1.1 software.

Results

The CONSORT flow diagram for this study is shown in Fig. 1. Out of a total number of 249 patients assessed for eligibility, 132 patients were eventually included in the study: 42 patients in Group I and 90 patients in Group II. The patients' demographic data and stone criteria are displayed in Table 1. The success rate was 90.5% (38/42) and 97.8% (88/90) in Groups I and II, respectively, with a statistically insignificant difference ($p = 0.3$). Complete stone retrieval without fragmentation was achieved in 35 patients (83.3%) in Group I and 74 patients (82.2%) in Group II. The stone migrated proximally in 4 patients (9.5%) in Group I and in only 2 patients (2.2%) in Group II. These patients received ureteral stents (Table 2). Mucosal injury was observed in 3 (7.1%) and 4 (4.4%) patients in Groups I and II, respectively. No major complications were encountered in either group. There was no statistical difference between Groups I and II with regard to patient satisfaction (Table 3).

Discussion

Spontaneous passage of ureteral stones with a diameter < 5 mm has been reported to occur in around 68% of the patients, while larger stones (5–10 mm) have a lower incidence of spontaneous passage (47%) [10,11]. The current trend in the management of symptomatic ureteral stones that do not respond to medical therapy is the placement of a ureteral catheter or a nephrostomy tube for pain relief, followed by definite treatment with URS or SWL [3,4]. With the advanced technology of new, small-caliber, semi-rigid and flexible ureteroscopes and small intracorporeal lithotripsy probes, the risk and complications of ureteroscopic manipulation of ureteral stones have decreased significantly, leading to higher success rates

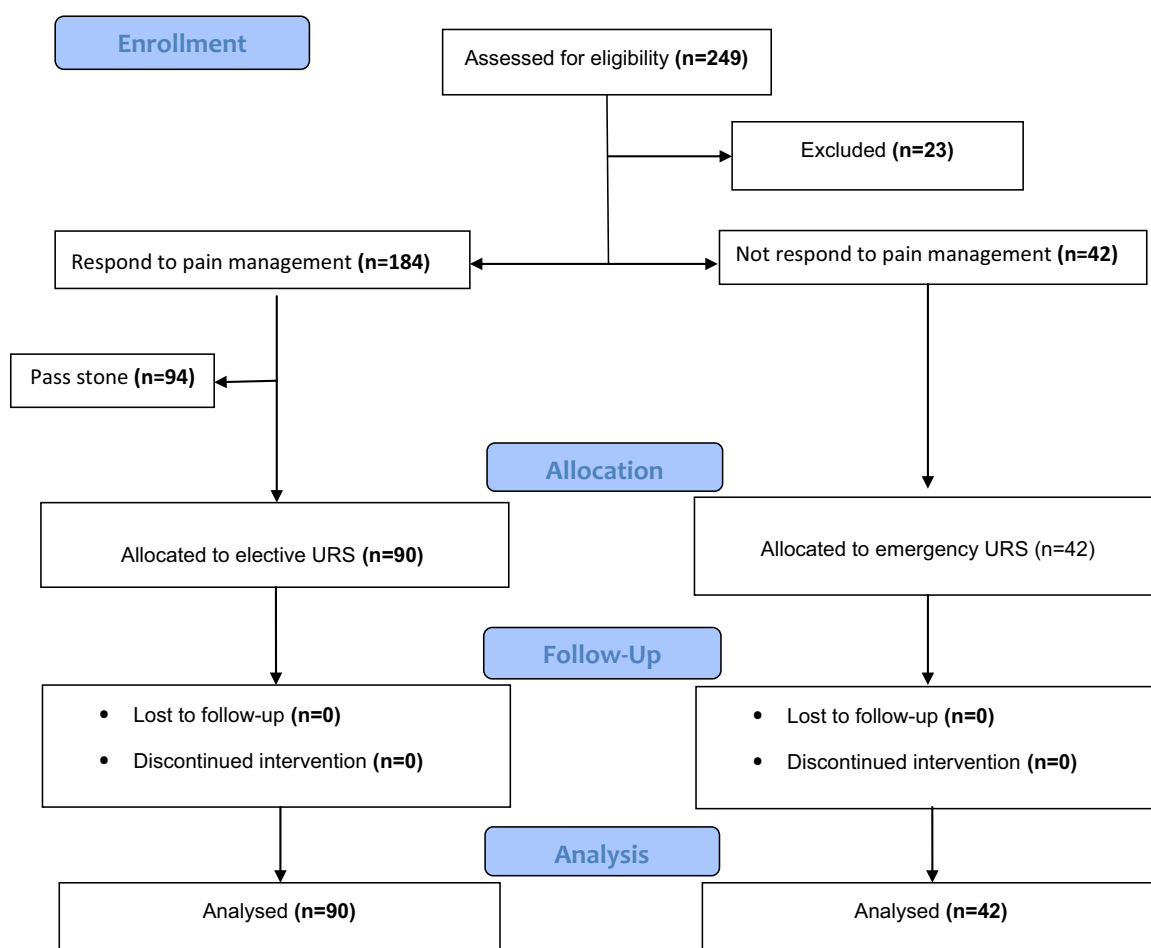


Figure 1 CONSORT flow diagram.

Table 1 Patients demographics and stone criteria.

	Group I (n = 42)	Group II (n = 90)	p-value
Age (mean ± SD) (years)	43.4 ± 12.8	39 ± 9.3	0.0279
BMI (mean ± SD) (kg/m ²)	29.01 ± 2.46	32 ± 3.5	0.0466
Sex			
Male	20 (47.6%)	51 (56.6%)	0.7050
Female	22 (52.4%)	39 (43.4%)	
Laterality			
Right	18 (42.8%)	53 (58.8%)	0.9140
Left	24 (57.2%)	37 (41.2%)	
MSL (mean ± SD) (mm)	4.2 ± 0.5	4.1 ± 0.6	0.2865

Table 2 Peri-operative parameters.

	Group I (n = 42)	Group II (n = 90)	p-value
Operative time (mean ± SD) (min)	41.6 ± 4.1	39.9 ± 5.1	0.13
Hospital stay in hours	6.3 ± 1.7	11.8 ± 3.8	0.0001
Success rate	38 (90.5%)	88 (97.8%)	0.8781
Residual fragment	3 (7.1%)	2 (1.1%)	0.4054
Stenting	4 (9.5%)	5 (5.5%)	0.9556
Need of analgesia	4 (9.5%)	12 (13.3%)	0.7868

Table 3 Postoperative complications according to Modified Clavien system [9] and patients' satisfaction.

	Group I (n = 42)	Group II (n = 90)	p-value
Minor complications			
Urosepsis	3 (7.1%)	2 (2.2%)	0.4054
Gross hematuria	2 (4.7%)	3 (3.3%)	0.9177
Mucosal injury	3 (7.1%)	2 (2.2%)	0.4054
Major complications			
Ureteral perforation	0	0	
Ureteral avulsion	0	0	
Patient satisfaction n (%)	37 (88.1%)	78 (86.66%)	0.9596
Mean time to resume daily activity \pm SD (days)	1.9 \pm 0.8	2.7 \pm 1.6	0.0027

[3,7,11]. Emergency URS can provide both immediate decompression of the system and pain relief by disintegration and removal of the obstructing stone [2,3].

When comparing the results of emergency URS with those of delayed elective URS in this study, we found a success rate of 90% for emergency URS which was slightly, but insignificantly lower than that of delayed elective URS. This finding is comparable to the results reported by other authors [3,4,12].

Residual fragments were present in 7.1% of our patients who underwent emergency URS compared to 1.1% of the patients with elective URS without any significant difference. Sarica et al. [7] noted a similar insignificant difference in the incidence of residual fragments (6.5% for emergency vs. 5.7% for elective URS).

The need for ureteral stenting was higher in Group II (73%) than in Group I (65%). Al-Ghazo et al. [3] and Osario et al. [12] reported similar post-URS stenting rates of 69.4% and 69.8%, respectively. Our concept was the same as that adopted by Elashry et al. who had the same concerns of post-URS mucosal edema and partial urinary obstruction with subsequent flank pain, even in uncomplicated URS [13]. On the other hand, Sarica et al. reported a much lower stenting rate of 14.5% in patients subjected to emergency URS, while their stenting rate of 65% for patients subjected to elective URS is comparable to our results. They assumed that the lower stenting rate for emergency URS may have been related to the early management after early presentation, as the stone had not been present in the ureter for a long time, and therefore the reactionary changes of the ureteral wall such as edema, bleeding and inflammatory processes were still limited [7]. Despite this fact which was also noticed in our study, we do not believe that it would have such a significant impact on the need of post-URS stenting.

We found no significant difference between the two groups concerning minor intraoperative complications. We encountered mucosal injury in 3 patients (7.1%) of Group I and 2 patients (1.1%) of Group II, while hematuria was seen in 2 patients (4.7%) of Group I and in 4 (4.4%) of Group II. These results are comparable to those reported by Sarica et al. who found no significant difference between the two groups in terms of intraoperative complications [7]. No major complications such as perforation or avulsion were encountered in our study. This compares favorably to the results of Matani et al. who reported serious complications in 0.7% of their patients [6].

The fact that we did not conduct a comparison of the cost effectiveness of both procedures may be a limitation of this study.

We recommend conducting prospective studies on a larger scale to confirm the efficacy of emergency URS.

Conclusion

Emergency URS with immediate removal of the stone is a feasible treatment option for patients who present with an intractable attack of renal colic due to a distal ureteral stone. Emergency URS under intravenous sedation is feasible, safe and effective when compared to elective URS

Ethical committee approval

An approval of local ethics committee and an informed consent from all patients were obtained. Patients were permitted to withdraw from study at any time.

Authors' contributions

Dr. Waleed Shabana (surgeon, author): statistical analysis and editing.

Dr. Mohamed Teleb (surgeon, author): collection of data.

Dr. Tamer Dawod (surgeon, author): statistical analysis and editing.

Dr. Ehab Elsayed (surgeon, author): analysis of data.

Dr. Esam Desoky (surgeon, author): tabulation.

Conflict of interest

The authors have no conflict of interest to declare.

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None.

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