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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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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 $\leq$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 $\geq$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 $\leq$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