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UROLITHIASIS

Combined ureterorenoscopy for ureteral and renal calculi is not associated with adverse outcomes

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Introduction We intended to evaluate the feasibility and effectiveness of the simultaneous rigid and flexible ureteroscopic treatment of symptomatic ureteral and ipsilateral small simultaneous calyceal stones. Outcomes of combined therapy were compared with monotherapy alone.

Material and methods In this retrospective study, group 1 consisted of 45 patients with middle or lower ureteral and ipsilateral small simultaneous calyceal stones treated by combined therapy. Group 2 included 45 patients with middle or lower ureteral stones only and treated by monotherapy. Stone characteristics, operative time, hospital stay, stone free rates, and complications were compared between groups 1 and 2. Stone free status was defined as no fragments and/or the presence of asymptomatic fragments smaller than 4 mm.

Results Mean BMI were 29.3 ±0.9 kg/m^2 and 27.6 ±0.6 kg/m^2 in groups 1 and 2, respectively. Mean ureteral stone size (7.6 ±0.4 mm *vs.* 8.0 ±0.4 mm, p = 0.261) and ureteral stone burden (56.0 ±5.5 mm^2 *vs.* 54.8 ±6.1 mm^2, p = 0.487) were similar between groups. Mean renal stone size and renal stone burden for group 1 were 7.1 ±0.8 mm and 83.7 ±11.3 mm^2. The mean operative time was significantly longer (for a mean of 32.5±1.2 minutes) for group 1 (p = 0.001). Ureteral stents were left in 38 (84.4%) and 19 (42.2%) patients in group 1 and group 2 (p = 0.001). Hospital stay and complication rates were similar between groups. SFRs were 100% for ureteral stones in both groups and 88.9% for renal stones within group 1.

Conclusions Simultaneous ureteroscopic treatment of the ureteral and ipsilateral small calyceal stones prolongs operative time and increases use of ureteral stent without leaving any residual renal stones.

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INTRODUCTION

There is no consensus with regard to the management of asymptomatic intrarenal stones. Although some studies have recommended active surveillance, some have suggested Extracorporeal Shock Wave Lithotripsy (ESWL) for these stones [1, 2]. On the other hand, evidence shows that the great majority of asymptomatic renal stones will eventually become symptomatic and some patients will require surgical treatment [2, 3]. It has been reported that stone disease will progress in 77% of patients with asymptomatic intrarenal stones, and require surgical intervention in 26% of patients [1]. Although ESWL is the first-line treatment for renal stones less than 20 mm in size, there are some studies which report poor results with ESWL for small asymptomatic renal stones [2, 4]. With recent developments in endoscopic technology (smaller caliber flexible ureteroscopes, dual deflection, improved

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optics, use of holmium laser, ureteral access sheaths, and new generation stone extractors), retrograde intrarenal surgery (RIRS) has recently been more commonly performed for upper urinary system stones, especially for lower pole and ESWL resistant stones.

Multiple stones are found in 20–25% of patients with urolithiasis [5]. Similarly, there is/are synchronous kidney stone(s) in 25% of patients with ureteral stones. Ipsilateral small simultaneous calyceal stones (SSCS) not causing blockage of the kidney may be encountered in some patients requiring ureteroscopy for ureteral stones. What should be done for the management of patients with SSCS that underwent rigid ureteroscopy for a symptomatic ureteral stone has yet to be answered. Three options should be considered in these cases: active surveillance, ESWL after rigid ureteroscopy, and simultaneous RIRS following ureteral stone removal. There is little data with regard to the management of patients with simultaneous ipsilateral symptomatic ureteral stones and SSCS [6, 7, 8]. The objective of this study was to evaluate the feasibility and effectiveness of simultaneous rigid (for symptomatic ureteral stones) and flexible ureteroscopic treatment (for ipsilateral SSCS). In addition, the outcomes of combined therapy (rigid and flexible ureteroscopy) were compared with monotherapy (rigid ureteroscopy) alone.

MATERIAL AND METHODS

This study was designed as a retrospective controlled study between August 2009 and December 2013. The study group (group 1) consisted of 45 patients who underwent rigid ureteroscopy for symptomatic middle or lower ureteral stones and concomitant ipsilateral flexible ureterorenoscopy for SSCS. The control group (group 2) also included 45 patients who underwent rigid ureteroscopy for symptomatic middle or lower ureteral stones alone in the same time period. Preoperatively, all patients were evaluated by non-contrast CT with stone protocol to assess ureteral and renal stone size, stone location, total stone number, stone burden, and collecting system anatomy. Stone size was defined according to the greatest diameter and the total stone burden was calculated as the sum of all of the stones' surface areas (length x width, mm^2) for both groups. In the case of multiple stones, the total stone burdens were added together. The data collected included stone characteristics, operative time, hospital stay, stone free rates (SFR), and perioperative complications, compared between groups 1 and 2. The primary indication for ureteroscopic treatment was the presence of a symptomatic ureteral stone that failed other treatment modalities in both groups. Patients with symptomatic middle or lower ureteral stones ≤5 mm were treated with medical expulsive therapy for 3 weeks in each group. At the end of this period, ureteroscopy was done when spontaneous passage did not occurred. In the case of middle or lower ureteral stones >5 mm, ESWL or ureteroscopic lithotripsy was recommended according to the clinical condition and patients accepting ureteroscopy were also included.

Inclusion criteria for group 1 included patient's with the greatest renal stone size 4-20 mm, the presence of one or more calyceal stone(s), in addition to distal or mid ureteral stones planned to be removal with rigid ureteroscopy. Patients with upper ureteral stones, urinary tract infection, and also with ureteral stent were excluded. Since we routinely use flexible ureteroscope instead of rigid ureteroscope for the treatment of upper ureteral stones, such patients were also excluded.

Three experienced surgeons performed all of the interventions, with the same endourological techniques applied at each surgical procedure. Ureteral dilatation was not performed if the ureter was shrunk to accommodate the ureteroscope. Rigid ureteroscopy was performed with an 8.5F ureteroscope (Karl Storz 27002 L). All large ureteral stones were fragmented with the holmium laser and fragments were removed with the basket under direct visualization. None of the stone fragments escaped into the kidney, therefore, none had to be chased during disintegration of the ureteral stones. But it is not unusual that fragments might escape during disintegration and this is another reason to use RIRS after rigid ureteroscopy. Once rigid ureteroscopy was completed, a ureteral access sheath (Flexor ureteral access sheath 12/14F 35 cm; FUS- Cook Medical, Bloomington, IN, USA) was introduced into the proximal ureter in cases where the calyceal stone sizes were >4 mm. When the calyceal stone size was smaller than or equal to 4 mm, a flexible ureteroscope over a special guide wire (Roadrunner® catheter guidewire 145 cm, Cook Medical, Bloomington, IN, USA) was advanced into the ureter without an access sheath. Ureteral dilatation and access sheath was not contemplated in these cases, since our belief was simply to catch the stone and take it out with one single movement. However, if a flexible ureteroscope without an access sheath could not be advanced up to the kidney, an access sheath was used.

URF P-5 flexible ureteroscope (Olympus, Tokyo, Japan) and Cobra Flexible Dual-Channel Ureteroscope (Wolf, Knittlingen, Germany) were used according to their availability. Having completed inspection of the collecting system, all renal stones ≤4 mm were removed intact with a nitinol basket (N Gage Nitinol stone extractor NGE 2,2F 115 cm basket; Cook Medical, Bloomington, IN, USA), or fragmented with the holmium laser (LISA Sphinx 30 watts, Katlenburg, Germany) if greater than 4 mm. Whenever possible, all lower and mid calyx stones were relocated to an appropriate calyx using the nitinol basket for easier fragmentation. All stones were fragmented into smaller pieces, and relatively greater fragments (≥2 mm) were removed using a nitinol basket. Two different sized (200 μm and 270 μm, Lisa Laser, Katlenburg, Germany) laser fibers were used for flexible ureteroscopy where laser energy were set at 0.5-1.5 J and 5-10 Hz. At the end of the procedure, the entire collecting system was inspected again and a ureteral stent was placed according to the surgeon's discretion. All patients underwent non-contrast CT or urinary ultrasonography (US) 2 months after the removal of the ureteral stent to detect any residual fragments. Our standard follow-up protocol was to assess the residual fragments with non-contrast CT. However, some patients refused to have a CT due to the patients' reluctance to undergo repeat examinations with CT scans. Therefore, we performed a USG examination on these patients. At the third postoperative month, stone free status was defined as no fragments and/or the presence of asymptomatic fragments smaller than 4 mm in the urinary system. All postoperative complications were recorded according to the Clavien-Dindo classification system [9].

Statistical analysis: All analyses were performed using SPSS version 16.0 (Statistical Package for Social Sciences for windows; Chicago, IL, USA). Age, stone number, stone burden, operation times were compared by using Mann-Whitney U test. Additionally, ureteral stent placement and complication rates were compared by using the Pearson Chi-Square test. P-value of <0.05 was considered statistically significant.

RESULTS

Patients' demographics data and preoperative stone characteristics are detailed in Table 1. Group 1 and 2 were comparable regarding gender, age, Body Mass Index (BMI), which were statistically not significant. Ureteral stone number, ureteral stone size, ureteral stone burden, and stone localization were also compared between groups and no statistically significant difference was observed. There were at least 2 renal stones in 23 (52%) of the patients in group 2.

Intraoperative and postoperative data between groups are summarized in Table 2. RIRS for asymptomatic renal stones increased the mean operative time by 32.5 ±1.2 minutes on average. Ureteral stones were removed intact from 8 (17.8%) patients

Table 1. *Patient demographics and preoperative stone characteristics*

	Group 1 (R-URS + F-URS)	Group 2 (R-URS)	p value
Gender (M/F)	28/17	30/15	0.413
Mean age (year)	39.9 ±1.8 (21-73)	42.7 ±2.1 (24-82)	0.341
Mean BMI (kg/m²)	29.3 ±0.9 (19-44)	27.6 ±0.6 (21-37)	0.266
Mean ureteral stone number (n)	1.0 ±0.2 (1-2)	1.1 ±0.6 (1-3)	0.091
Mean renal stone number (n)	2.0 ±0.9 (1-4)		
Mean ureteral stone size (mm)	7.6 ±0.4 (3-18)	8.0 ±0.4 (4-21)	0.261
Mean renal stone size (mm)	7.1 ±0.8 (2-20)		
Mean ureteral stone burden (mm²)	56.0 ±5.5 (9-180)	54.8 ±6.1 (12-210)	0.487
Mean renal stone burden (mm²)	83.7 ±11.3 (12-375)		
Localization for ureteral stone			
– middle ureter	13 (29%)	12 (34%)	
– lower ureter	32 (71%)	23 (66%)	
Localization for renal stone			
– upper calyx	1 (2%)		
– middle calyx	10 (22%)		
– lower calyx	11 (24%)		
– multiple calyx	23 (52%)		
Lateralization			
– right side	18 (40%)	20 (44%)	
– left side	27 (60%)	25 (56%)	

Table 2. *Intraoperative and postoperative comparisons between groups*

	Group 1 (R-URS + F-URS)	Group 2 (R-URS)	p value
Mean operative time (min)	61.9 ±3.4 (20-95)	29.4 ±2.2 (15-90)	0.001
SFR for ureteral stones (%)	100 (45/45)	100 (45/45)	
SFR for renal stones (%)	88.9 (40/45)		
Ureteral Stent (%) Placement	84.4 (38/45)	42.2 (19/45)	0.001
Mean duration of Ureteral Stent (day)	26.5 ±1.6 (2-60)	20.5 ±2.1 (5-30)	0.020
Mean hospital stay (hour)	24.4 ±0.9 (6-48)	24.0 ±2.8 (12-120)	0.753
Complication rates (%)	17.8 (8/45)	15.5 (7/45)	0.500
Complications (n)			
– Minor ureteral injury	2	2	
– Postoperative fever UTI	1	1	
– Prolonged hematuria	1	1	
– Postoperative pain	2	1	
– Urinoma	–	1	

in group 1, and 4 (8.9%) patients in group 2. Also, renal stones were removed in 10 (22.2%) patients without fragmentation, and holmium laser was used for stone fragmentation in the remaining 35 (77.8%) patients with stone fragments ≥4 mm in diameter. A ureteral access sheath was used in 38 (84.5%) of the procedures. In 6 (13.3%) out of 38 patients who had stones smaller than 5 mm, since a flexible ureteroscope could not be advanced into the ureter due to difficulty in accommodation of the ureteroscope, an access sheath was used. A flexible ureteroscopy was used without access sheath in the remaining 7 (15.5%) patients with a single stone ≤4 mm. All lower calyx stones. except for 3, were relocated in the upper or mid calyx and fragmented. In 3 (6.6%) patients who had greater stones (10, 14, and 16 mm), which could have not been relocated, fragmentations were done in the lower calyx.

There were 87 SSCS in group 1 (n = 45 patients). The patients in this group were divided into two subgroups according to the greatest renal stones size [Subgroup A ≤10 mm (27 patients) *vs.* Subgroup B ≥10 mm (n = 18 patients)]. There were 62 (71.3%) and 25 (28.7%) stones in subgroups A and B, respectively. SFR were 100% and 72.2% in subgroups A and B ($p = 0.007$; $\chi^2 = 8.438$). Residual stone fragments larger than 4 mm remained in 5 patients, all of whom were included in subgroup B. In patients with residual stone fragments, mean stone number, mean stone size, and mean stone burden were 2.6 ±1.1 (range 1-4), 10.5 ±6.1 mm (range 2-20), and 231.4 ±87.3 mm2, respectively. Most of the residual stones had been located in the lower calyx in these patients. Second session RIRS was done on one patient who was symptomatic while the remaining 4 patients underwent ESWL treatment.

Some minor complications were observed (Table 2). There were minor ureteral injuries in 4 patients in both groups, for which procedures were not canceled but a ureteral stent was placed after the operation in each of these patients. The postoperative period was uneventful in these patients. Urinary tract infection and postoperative fever were detected in two patients (Clavien 2) in each group and treated with appropriate antibiotics without hospitalization. Prolonged hematuria was seen in two patients (Clavien 1) in group 1 and in one patient (Clavien 1) in group 2, who were followed-up conservatively. Postoperative pain was seen in 2, and 1 cases in groups 1 and 2, respectively. The ureteral stent was extracted from a patient (Clavien 3a) in group 1 because of persistent pain on postoperative day 2. The other two patients (Clavien 2) were hospitalized for 2 days and treated with parenteral medications. Urinoma occurred in one patient (Clavien 3b) on postoperative day 5 in group 2. This patient was treated with percutaneous drainage for 1 week and concomitant ureteral stent placement, which was removed 4 weeks later. The patient was discharged home in 1 week after complete recovery. Several complications occurred in group 1: in subgroup A; minor ureteral injury (n: 1), UTI (n: 1), and postoperative pain (n: 2) were seen. In subgroup B; minor ureteral injury (n: 1), postoperative fewer (n: 1), prolonged hematuria (n: 2) were seen. Postoperative complications according to Clavien-Dindo classification are summarized in Table 3.

Table 3. *Postoperative complications between groups according to Clavien-Dindo classification*

Clavien-Dindo	Group 1 (R-URS + F-URS)	Group 2 (R-URS)
Grade 1	2	1
Grade 2	3	3
Grade 3a	1	–
Grade 3b	–	1
Grade 4	–	–
Grade 5	–	–

DISCUSSION

Treatment options of small asymptomatic intrarenal stones are debatable. While some studies suggest active surveillance, some suggest ESWL for these stones [1, 2]. In a study by Streem et al., asymptomatic residual fragments after ESWL were followed up for over 5 years. In this series, when the stone migrated to the ureter or increased in size, 43% of the patients had developed significant symptomatic episodes that needed intervention such as ureteroscopy or ESWL [10]. On the other hand, active surveillance has some disadvantages including multiple office visits and scanning costs. ESWL can be performed in the management of small calyceal stones following rigid URS for ureteral stones. Some studies demonstrated that ESWL has poor results in the treatment of small asymptomatic renal stones especially lower calyceal stones [2, 11, 12, 13]. With recent developments in endoscopic technology, ureterorenoscopic procedures are becoming more common. Therefore, flexible ureteroscopy has also been used in the management of small intrarenal stones. Ipsilateral SSCS not causing blockage of the kidney may be encountered in some patients requiring ureteroscopy for ureteral stones.

There are only three studies in the English literature about combined RIRS for renal stones associated with ipsilateral ureteral stone removal [6, 7, 8]. In these studies, the SFRs for intrarenal stones were 81-90%. These results are more favorable than single session ESWL in the management of renal stones [14]. We found that SFR for SSCS was 88.9% after single session RIRS, which is similar to that reported in the literature [6, 7, 8, 15]. On the other hand, when the results were evaluated according to the renal stone size; it was observed that RIRS in subgroup A was more effective than in subgroup B ($p = 0.007$). Nonetheless, we found that complication rates were similar between subgroups. In both groups, SFR for ureteral stones was 100%. Our study showed that the use of flexible ureteroscopy to treat SSCS at the time as rigid ureteroscopy for ureteral stones was a safe and effective procedure, which prolonged operative time. We observed that RIRS for SSCS increased the mean operative time for 32.5 ±1.2 minutes ($p = 0.001$), which was 29 minutes in a study by Goldberg et al. [8].

In our study, ureteral stents were left in 38 (84.4%) patients in group 1, and 19 (42.2%) patients in group 2 ($p = 0.001$). There was a statistically significant difference related to ureteral stent placement between groups since none of our patients had pre-procedural ureteral stent placement. In the study mentioned above, since the number of the patients who had pre-procedural presence of ureteral stent was equal ($n = 30$) in both groups, there was no statistically significant difference regarding this parameter [8].

This study showed no increase in complication rates with addition of RIRS for intrarenal stones ($p = 0.500$). No major complication occurred in group 1 or group 2. Perioperative complication rates were similar in both groups, which were 17.8% and 15.5%, respectively (Tables 2 and 3). These complication rates were similar to literature [6, 7, 8]. All findings in the current study are comparable with the results of similar studies, and encourage the usage of flexible ureteroscopy in the treatment of intrarenal stones in patients who are already under general anesthesia and being treated with rigid ureteroscopy for ureteral stone [6, 7, 8]. Moreover, this combination therapy has also some advantages such as cost effectivity, reduced number of hospitalizations, and psychological effects.

There were some limitations of this study. The most important limitation is that it was a retrospective nonrandomized review from a single center. Another limitation was the small number of patients.

CONCLUSIONS

Simultaneous endoscopic treatment of the ureteral and ipsilateral SSCS increases duration of surgery and use of ureteral stent without leaving any residual renal stones. It does not effect hospitalization and complication rates. Combination of rigid and flexible ureteroscopies can be safely performed when the surgeon is experienced in endourology and the equipment is available.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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