Original Article

Semi-rigid ureteroscopy: Proximal versus distal ureteral stones

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Abstract

Objective: To evaluate the safety and efficacy of semi-rigid ureteroscopy in proximal and distal ureteral stones, and to compare the operative and perioperative characteristics between the two stone groups.

Materials and Methods: We retrospectively reviewed the medical records of patients who underwent semi-rigid ureteroscopy for management of ureteral stones at the International Medical Center between June 2007 and September 2012. All stones were fragmented using Holmium: yttrium-aluminum-garnet (YAG) laser lithotripter. Stones located above the pelvic brim are considered proximal and below it are distal.

Results: One hundred and ninety-one patients were included. One hundred and three patients (54%) underwent ureteroscopy for proximal stones and 88 (46%) for distal stones. The stone size in the proximal group was 10 mm (±5.5) versus 8.6 mm (±5) in the distal group. The initial stone-free rate for proximal and distal calculi were 89–98.2%, respectively. The perioperative complication rate was higher in the proximal group 10% compared to the distal group which is 1.5% ($P = 0.06$). Both groups have the same average of hospital stay 1.2 days.

Conclusion: Although there is a clinical difference between proximal and distal calculi groups in terms of complication and stone-free rates, this difference remained statistically insignificant ($P = 0.06$). Using a smaller caliber semi-rigid ureteroscopy combined with Holmium-YAG laser can be carried out as a day care procedure and showed a slightly higher risk in patients with proximal ureteral calculi which should be explained to the patient.

Key Words: Laser lithotripter, ureteral stones, ureteroscopy

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INTRODUCTION

Within the past decades, ureteroscopic treatment of ureteral stone has gained widespread acceptance. It has been strongly advocated for patients with distal ureteral calculi (below the level of iliac vessel), with stone-free rates >95%.[1,2] Some are very cautious in performing semi-rigid ureteroscopy for proximal ureteral stones particularly in male individuals because of longer working distance compared to female, a relatively immobile prostatic urethra, and more developed psoas muscles which make semi-rigid ureteroscopy navigation past the iliac vessels difficult thus putting the ureteroscope at

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risk of fracture.[3]

In this study, we evaluated the safety and efficacy of semi-rigid ureteroscopy in proximal and distal ureteral stones and compared the operative and perioperative characteristics between the two groups.

MATERIALS AND METHODS

We retrospectively reviewed the medical records of patients who underwent semi-rigid ureteroscopy for the management of ureteral stones at the International Medical Center between June 2007 and September 2012. An 8–11 French semi-rigid ureteroscopy was used. The ureteroscope was introduced in all cases without access sheath after balloon dilatation of the ureteral orifice. The irrigation fluid used was normal saline. All stones were fragmented into small pieces using 10 Watt low power Holmium: yttrium-aluminum-garnet (YAG) laser lithotripter at 6–8 Hz. No retropulsion device was used for proximal stones. The fragments were retrieved using Dormia basket. Safety guidewire was used as a routine step in all procedures. Urine cultures were negative in all patients prior to the procedure. They all received prophylaxis antibiotics preoperatively. Stone expulsion therapy was tried first in cases with small stones (≤7 mm). Ureteroscopy was done in patients with persistent renal colics and/or impaired renal function. All patients had imaging studies of the urinary tract to evaluate the site and size of the stone. Patients with steinstrasse, congenital anomalies of the urinary tract, and ureteral strictures were excluded. Stones located above the pelvic brim were considered proximal and below the pelvic brim were distal.

RESULTS

One hundred and ninety-one patients were enrolled in the study [Table 1]. A total of 103 ureteroscopy procedures (54%) were done for the first group of proximal ureteral stones (Group I) and 88 (46%) for the second group of distal stones (Group II). The mean age of the patients was 43 years (±14.2). The mean stone size in Group I was 10 mm (±5.5) at its largest diameter versus 8.6 mm (±5) in the Group II. The composition of the stones was calcium oxalate (87.4%), uric acid (7.4%), calcium phosphate (2%), cystine (2%), and Struvite (2%). The initial stone-free rate for Group I and Group II were 89% and 98.2%, respectively.

A total of 8 intraoperative and postoperative complications occurred (5.8%). The rate was higher in the Group I (7 patients) compared to Group II, which is only one. Complications ranged from perforation (5 patients) that all occurred in Group I and treated with Double-J stents except one patient who required nephrostomy tube placement and laparotomy to intraperitoneal drainage collection. Three patients developed sepsis after the procedure (two in Group I and one in Group II). One of them mandated monitoring in the intensive care unit. After appropriate antibiotics coverage, the infection resolved and discharged home. No statistical difference was found in the complication rates between those with Group I and Group II ($P = 0.06$).

Table 1: Comparison between proximal and distal ureteral stone groups in terms of demographic data, complications, and stone clearance

Characteristic	Proximal (*n*=103)	Distal (*n*=88)	*P*
Age (year)	43.55±14.62	42.68±13.83	0.67
Sex (*n*)			
Male	75	63	0.85
Female	28	25	
Height (m)	1.62±0.30	1.55±0.43	0.23
Weight (kg)	84±22.42	79.58±26.77	0.21
BMI	29.87±7.38	27.40±10.15	0.05
Size (mm)	9.89±5.52	8.61±5.06	0.09
Complication *n* (%)	Documented in 69 patients	Documented in 67 patients	0.19
Minimal perforation	4 (5.8)	0	
Perforation that required laparotomy and drainage	1 (1.4)	0	
Sepsis	1 (1.4)	1 (1.5)	
Septic shock	1 (1.4)	0	
complication (summation)	7 (10)	1 (1.5)	0.06
Stone clearance *n* (%)	Documented in 64 patients	Documented in 57 patients	0.06
No success	7 (10.9)	1 (1.8)	

BMI: Body mass index

On the other hand, both groups have the same average of hospital stay 1.2 days (range of 1–7). No ureteroscope fracture was encountered during the whole period.

DISCUSSION

The development of semi-rigid ureteroscopes and efficient lithotripsy, such as Holmium-YAG laser has simplified treatment of ureteral calculi in an atraumatic fashion.[4,5] We assessed whether this technology has facilitated the treatment of more proximal ureteral stones and whether it has comparable efficacy and safety to ureteroscopies performed for distal calculi.

Some older data reported a high success rate in distal ureteral stones ureteroscopies; greater than 95%[1,2] which is comparable to our study of 98.2%.

The proximal stone-free rate has shown an apparent improvement over the past years. In 1990, the stone-free rate was reported to be around 79%.[1] The AUA 2007 guidelines stated that recent analysis revealed a stone-free rate of 81% for the ureteroscopic treatment of proximal ureteral stones, with surprisingly little difference in stone-free rates according to stone size (93% for stones 10 mm and 87% for stones

10 mm). The flexible ureteroscope is largely responsible for improved access to the proximal ureter; superior stone-free rates are achieved using flexible ureterorenoscopy (URS) (87%) compared to rigid or semi-rigid URS (77%).[6]

Stones in the proximal ureter have been associated with lower success rates than those in the distal ureter, this is attributed to a more difficult access as well as the proximal migration of stone fragments difficult to reach as seen in our study.

We attribute this improvement to increase experience in handling ureteroscopies and to advance in the endoscopic technology field including smaller caliber semi-rigid ureteroscopes with enhanced optical quality and to the introduction of devices to prevent stone migration as well as the frequent use of Holmium-YAG laser in lithotripsy.

Some urologists recommend placement of a safety wire, even though some groups have demonstrated that ureteroscopy can be performed without it.[7,8] Our opinion is that safety wire may significantly decrease false passage and perforation, and ensures that a Double-J stent can be easily inserted in difficult situations, thus avoiding more serious complications.

The overall complication rate of ureteroscopy is 9–25% (Preminger *et al*. 2007)[6] which ranges from simple mucosal injury (1.5%), ureteral perforation (1.7%), significant bleeding (0.1%), and ureteral avulsion (0.1%).[9]

In our study, the overall complication rate is 5.8%. The Higher rate in proximal calculi group (10%) compared to the distal group (1.5%). Despite this difference, it did not reach statistical significance ($P = 0.06$) and within an acceptable rate when compared to the available international data. Using a smaller caliber semi-rigid ureteroscopy combined with Holmium-YAG laser for stone fragmentation facilitates the access to the upper ureter without adding major complications. The procedure can be carried out as a day care procedure and showed a slightly higher risk with proximal ureteral calculi which should be explained to the patient.

The limitation of our study comes from its retrospective design, and lack of long-term follow-up to explore the long-term complications such as ureteral strictures. To improve judgment on the safety and outcome of this procedure, we need a larger sample size to be compared with flexible ureteroscopy in the prospective, randomized controlled study.

CONCLUSION

Although statistically insignificant, there is a clinical difference between proximal and distal calculi groups in terms of complications and stone-free rates and should be interpreted cautiously. Using a smaller caliber semi-rigid ureteroscopy combined with Holmium-YAG laser for proximal ureteral calculi is safe and can be carried out as a day care procedure. Future advances will continue to improve the current success and complication rates.

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Conflicts of interest
There are no conflicts of interest.

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