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Original article

Outcome of ureteroscopy for the management of distal ureteric calculi: 5-years' experience

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KEYWORDS
Ureteroscopy;
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Abstract
Objective: To review our 5 years' experience with ureteroscopy treatment of distal ureteric calculi.
Patients and methods: We reviewed the medical records of 136 patients who underwent ureteroscopic procedures for the treatment of distal ureteric calculi from February 2007 to October 2012. Patient and stone characteristics, treatment modality and outcome were assessed. Procedure's duration, status "stone free" and hospital stay were also evaluated. The mean clinical and radiological follow-up period was 31.8 months for 74.2% of eligible patients.
Results: The stone free rate following an initial ureteroscopy was 79.4. The ultimate success rate for stone removal after "second look" improved to 95.9%. The mean operative duration was 51 minutes.
The intraoperative complication rate was 8.6%, the postoperative complication rate was 7.5%, and the mean hospital stay was 1.1 days.
We could detect one ureteric stricture and one vesico-ureteric reflux (0.9% for each). A significant ureteric perforation was detected in 4.1% and ureteric perforation in 0.7% of the study group.
We could find that the longer the operative duration, the greater the complications.
Stone impaction and size were also found associated with higher morbidity.
Conclusion: Growing skills and experience of ureteroscopy will lead to a significant increase in the success rate and also reducing serious complications.

Introduction

Significant advancement has been made in the medical and surgical management of urolithiasis over the past 20 years. Ureteral stones often cause renal colic and, if left untreated, may steer to obstructive uropathy. Stone removal is indicated for pain, obstruction or associated infection [1].

Minimal invasive techniques for management of ureteric calculi include extracorporeal shockwave lithotripsy (ESWL), ureteroscopy (URS), and laparoscopic ureterolithotomy. The choice of the procedure depends on location and characteristics of the stone, patient's preference, as well as associated costs. According to

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Figure 1 Ureteral stone/unenhanced CT scan shows stone distal ureter.

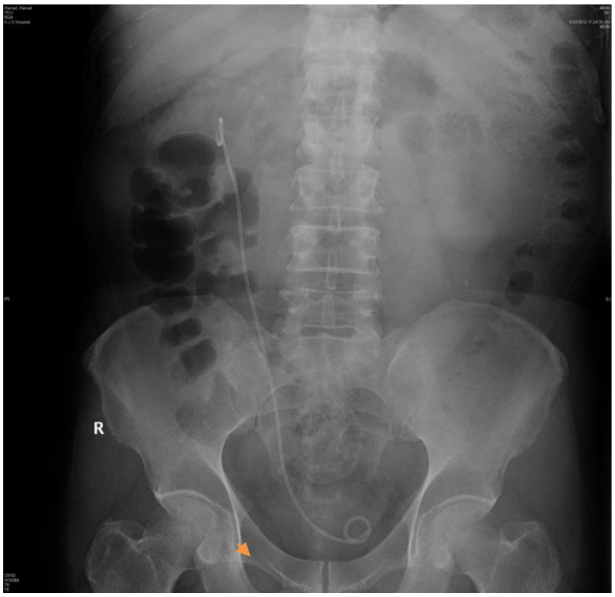

Figure 2 Postoperative ureteric stent with residual stone that passed spontaneously.

European Association of Urology 2007, ureteroscopy is an effective therapeutic modality for distal ureteric calculi [2] (Figs. 1 and 2).

The major technical improvements include endoscope miniaturization, enhanced optical quality plus the introduction of more refined tools and disposables. Therefore, the option of ureteroscopic stone extraction, although most patients require anesthesia, has become more attractive [3].

Ureteric stones should be treated in situ. Ureteroscopy may necessitate time stone clearance making repeated out-patient assessment and/or necessary re-treatment [4].

Ureteroscopy is used to treat ureteric calculi, particularly those that are either unsuitable for ESWL or refractory to that form of treatment [5]. Other treatments include Medical Expulsive Therapy (MET) for stone passage, antegrade ureteroscopy, laparoscopic and open ureterolithotomy [6].

Ureteroscopy remained superior to ESWL for treatment of stones <10 mm and >10 mm. This commendation was centered on the outcomes of stone free status, morbidity, and retreatment rates for each respective therapy. However, costs and patient satisfaction or preference were not addressed [7].

Currently, the morbidity of ureteroscopy has been significantly reduced. The overall complication rate is 9–25%. Ureteral avulsion and strictures used to be greatly feared [8].

Objective

To review our 5-years' experience with ureteroscopic management for distal ureteral stones and to look over the impact of the technique on the success and complications of the procedure.

Patients and methods

We reviewed the medical records of 136 patients who underwent ureteroscopic procedures for the treatment of distal ureteric calculi between November 2007 and October 2012 at urology departments of National Institute of Nephrology and Urology, Cairo, and hospitals in the private sector (Al Mana general hospital, Hofuf and KJO hospital, Khafji, KSA).

Patients presented with clinical features suggesting ureteric urolithiasis. They were considered eligible if the evaluation revealed single or multiple stone(s) measuring 7 mm or more in the lower ureter. The radiologic anatomy of pelvic ureter is defined to be at or below the level of the sacroiliac joint.

Those who showed obstructing stones/sepsis urgent decompression of the collecting system was done using either percutaneous drainage or ureteral stenting. Then definitive ureteroscopy had been delayed for 2 weeks until sepsis been resolved.

Patients enrolled when aged more than 18 years, failed expulsion medical treatment (EMT), have contraindications to ESWL, bleeding diathesis, uncontrolled and recurrent urinary tract infection, severe skeletal malformations and obesity, and anatomical obstruction distal to the stone.

The exclusion criteria comprised anesthesia difficulties, untreated urological infection, ureteric strictures, anatomical hip limitations that may prevent successful retrograde stone management, antiplatelet drugs, and stones size more than 2 cm.

The patients were subjected to preoperative work-up that include history taking, physical examination to detect anatomical or congenital abnormalities, urinalysis, colony count, urine for culture and sensitivity CBC& coagulation profile, kidney function tests, and imaging procedures of KUB/(IVU) or non-enhanced computed tomography (CT urography).

On the day of surgery, a prophylactic antibiotic was administered. Patients were sent to operating room and put in dorsal lithotomy position with legs supported in stirrups with minimal flex at the hips. The procedure was performed under general or spinal anesthesia.

The equipment included rigid ureteroscopy (semi-rigid ureteroscopy, Karl Storz, Germany), fluoroscopy (C-arm

fluoroscopy), video monitor, stone grasping baskets and forceps, lithoclast (Swiss lithoclast, Electro Medical Systems, Switzerland with 2.4 Ch. Probes) and irrigation devices.

Retrograde access to the upper urinary tract is usually obtained under endoscopic guidance and imaging. We used to place a safety guide wire. Balloon and/or plastic dilators were used if necessary. In cases where ureteral access was not possible, insertion of a ureteric stent was the option followed by ureteroscopy after 14 days. Continuous irrigation fluid (normal saline) maintaining a low-pressure system was the routine.

Stones were extracted by grasping forceps or baskets under visualization. Stones that cannot be extracted directly were disintegrated using intracorporeal pneumatic lithotripter.

After completing the procedure, ureteral JJ-stents or ureteric catheters were fixed in patients who were at an increased risk of complications (e.g. residual fragments/large residual stone burden, bleeding, perforation, ureteral injury or obstructive uropathy) according to surgeon's judgment. Two weeks later, patients were readmitted to the theater either to remove stent or to redo ureteroscopy.

Intraoperative complications of perforation, a migrating/lost stone or avulsion were monitored and repeated separately in the surgical notes. Submucosal tear was observed by direct visualization during the procedure, whereas avulsion and perforation were documented by intraoperative retrograde ureterorenography.

On postoperative day +1, patient was subjected to a control film/ultrasonography scanning assessing residual radio-opaque shadows. Term of complete removal of the stone(s) was defined as total clearance one day after the initial ureteroscopy.

Assessment for bleeding, vital signs and clinical evaluation during hospital stay was planned for average ± one day. Radiological follow-up have been tailored to the characteristics of the patient.

Success of the procedure was also documented in terms of stone size. Causes of the failure of the procedure were reported. Complications were also recorded.

Results

Among 136 patients, there were 91 (67%) males and 45 (33%) females. Age of the patients ranged between 21 and 47 years (mean age was 34 ± 14 years). Left and right ureteric stones were present in 63 (54%) and 54 (46%) patients, respectively. Bilateral ureteric stones were found in 19 patients (14%). For all these bilateral cases, one side's procedure was operated upon, and the therapies for contralateral side were not included in the results of the study.

The size of the stone in the treated patients was 7–21 mm. Size of 0.7–1 cm was found in 89 patients (65.4%), and 1.1–2.1 cm in 47 patients (34.6%). All stones were located in the lower part of the ureter that lies below sacroiliac joint. Radiopaque stones were found in 105 patients (77.2%), while the radiolucent ones were interpreted in 31 (22.8%) patients.

Out of the group, only 109 patients had completed clinical and radiological follow-up (74.2%) for a mean of 31.8 months. Among these eligible patients, one stricture and vesico-ureteric reflux cases were reported (0.9%) for each.

The initial stone free rate following a single procedure was 79.4% (108/136). Status "stone free" was judged by KUB film in the first day postoperatively. All remaining 28 patients had been diagnosed to have residual fragments/lost stones, i.e. 3 cases passed stones spontaneously, 14 cases migrating/lost stones and subsequently underwent ESWL. The remaining 11 cases have proceeded for a "second look" after 2 weeks. So, a total of 119 ureteroscopic procedures, i.e. 108 initial and 11 "second look" were completed in the study. Among them, the overall stone free rate improved to 95.9%, i.e. 114/119 cases.

Postoperative stenting for the operated ureters was done in a total of 84.4%, i.e. 72.8% and 11.6% with internal and external catheters, respectively. In the remaining procedures (15.6%), the stones have been retrieved straightforwardly and then the ureters were left unstented.

The collected data displayed substantial different results as regards retrieval modalities, stone size, success, and complication rate.

Table 1 URS and variables of stone size, aborted procedure, and stone handling.

Stone size	No. procedures	Median diameter (mm)	Stone free no.	%
7–10 mm	92	9.2	90	97.2
11–21 mm	55	13.2	51	92.3
Total	147	–	141	95.9

Failed initial URS	Stone migration	Fragmentation fail	Failed URS insertion	Perforation	Total
No. procedures	14	7	1	6	28
secondary procedure	JJ + ESWL	Spontaneous passage (3)		JJ + Redo	
	all	+Redo URS (4)	1	all	

Modality	Pneumatic	G. Basket	G. Forceps	Total
No. procedures	47	43	57	147
No. stone free	44	41	56	141
% Stone free	93.7	95.4	99.2	95.9
No. perforation	4	1	1	6
% Perforation	8.5	2.3	1.7	4.1

Table 2 Ureteroscopic treatment results for distal ureteral calculi. Ureteroscopic treatment results for distal ureteral calculi in the literature.

Study	No. of patients	Mean stone size (mm)	Stone free rate (%)
Pearle et al. [9]	32	6.4	91
Sofer et al. [10]	237	10.3	99
EAU/AUA Guidelines [7]	Overall population 59/552	<10 mm and >10 mm	94 (93–95)
Sozen et al. [11]	464	8.8	95
Young and Dong [12]	231	–	96.9

Table 3 Complications among 147 URS procedures[a] (total: initial and second look procedures = 136 + 11 = 147).

	No	Rate %
Intraoperative	*10*	*6.8*
Mucosal injury	2	1.4
Ureteral perforation	6	4.1
Significant bleeding	1	0.7
Ureteral avulsion	1	0.7
Early	*9*	*6.1*
Fever/urosepsis	3	2.1
Persistent hematuria	2	1.4
Renal colic	6	4.1
Late	*2*	*0.2*
Persistent vesicoureteral reflux	1[a]	0.9
Ureteral stricture	1[a]	0.9

[a] 109 = the total eligible number who completed F.U. period.

Among 28 showed unsuccessful procedures, we encountered different reasons for residual stone/fragments (Table 1).

Table 2 shows comparable reports of different authors.

We could detect ureteral perforation in 4.1% (6/147 procedures). All perforations were associated with impaction of stone. Four perforations occurred with electrohydraulic lithotripsy. One case associated with a retrieving basket and one was detected with a grasping forceps. No perforation happened following balloon dilation.

Discussion

The patients enrolled in our study have been operated with ureteroscopy as a definitive treatment for distal ureteric stones. They were followed-up postoperatively.

Our records showed an incidence of 79.4% for the initial stone free status following a single treatment and 95.9% for the overall stone free rate. We could notice that there is an upgrading for the procedures' outcomes among the last 50 cases of the studied group. These findings were matched up to that published [13,14] where they detected 96% and 99%, respectively. They considered that the stone size and location are independent predictors of treatment failure. Also guidelines on urolithiasis [7] reported stone free rates for size <10 mm and >10 mm in the overall population were 97% (96–98%) and 93% (88–96%), respectively. The vast majority of patients rendered stone free in a single procedure (Table 2).

We could notice that the success rate was reduced as the stones enlarged, as more proximal and as the hydronephrosis degree increased. No significant correlation has been found between symptoms' severity and the outcome.

A review of data [15], identified that the severity of symptoms, number, location and diameter of the stones were independent predictors of complete stone removal in a first procedure. Achieving the stone free status was easier in female compared to male patients without statistical significance. They reported a perforation rate of 2.6%. Taking into account their results and those of other authors [16,17], ureteroscopic lithotripsy can be considered a safe and useful treatment modality.

Routine placement of stent was a not mandatory task in work. The reason that merits stenting included mucosal damage, perforation, impaction or high stone burden. It was considered as more safe with less morbidity. Similar conclusion reported [18,12], and also reported that short-term ureteric catheterization in uncomplicated ureteroscopy is safe. Contrarily, Makarov et al. [19] proved insignificant variance in the outcome, among patients who underwent stenting and those who do not and recommended preoperative patient education for the likelihood of stenting.

The complications amid our patients were detected in 9.9% (Table 3). They occurred as intraoperative, early or late postoperatively and almost were minor and did not require intervention. Early postoperative fever, renal colic and persistent hematuria went on for few days and were treated conservatively, i.e. fever and sepsis in 6.1%. Significant bleeding happened once and the procedure was terminated. Stricture ureter was detected in one patient (0.9%) and fortunately treated successfully with endoscopic intramural incision (Table 2). We also could detect six cases (4.1%) and one case (0.7%) with perforation and ureteral avulsion, respectively.

The complication rates with ureteroscopy for distal ureter was 2% for postoperative sepsis, 1% for stricture ureter, 3% for ureteral injury and 4% for UTI [7]. Another trial reported an incidence fluctuating between 9% and 25%. Avulsion and strictures ureter used to be greatly feared, it is less than 1% [20].

Different reports [21] showed that the overall complication rate was found to be 10.64% with fever, sepsis accounting for 1.1%, persistent hematuria in 2.04%, renal colic in 2.23%, transient vesicoureteral reflux in 4.58% and 0.66% for stone migration. Intra-operative complications took place in 3.6% (i.e. false passage in 1.0%, abrasion in 1.5%, perforation in 0.65%, stone expulsion in 0.18%, bleeding in 0.10%, and ureteral avulsion in 0.11%).

We have noticed easier extraction of the stones in patients who were subjected to ureteral dilation. In consensus with our study, a previous trial [19] also stated that it is intensely associated with perforation. Contrarily, a recent study documented that, in some selected cases, ureteroscopy can be done with and without ureteral dilatation with similar success and morbidity [22].

Our experience showed that the use of pneumatic lithotripter was associated with lower stone free status, i.e. 93.7%, compared to 99.2% when grasping forceps was used. In consensus, a trial identified higher complication outcome when using lithotripsy (4.1%) [24,25]. The most notable complication, i.e. ureteral perforation, has been reduced to an incidence less than 5%, and long-term complications such as stricture formation also reduced to an incidence of 2% or less [21]. This is incompatible with reports that have shown that lithotripsy is the most efficient and has a role in reducing early postoperative morbidities [17,20,22,23].

Our findings revealed an incidence of 4.1%, perforation where highest incidence was occurring with lithoclast maneuvering. Impacted stones seemed to be the primary risk element for stricture formation (8.5%). Similarly, Taş et al. [26,27] noticed that ureteroscopic manipulation for impacted calculi was associated with a higher incidence of perforation and stricture.

Alternative investigators noted that an incidence of perforation and avulsion has decreased from 3.3% to 0.5% and from 1.3% to 0.1%, respectively, with strict indications and skillful techniques. They also considered that success rate is not related to stone dimension, but to the procedure's time [28].

Ureteral avulsion occurred in 0.9% among this series. It occurred due to kink and trapping of guide wire in the lower ureter with vigorous pulling, and then failure to release. A diversion nephrostomy was inserted for 4 weeks followed by uretero-vesical re-implantation [29].

Conclusion

The current study of ureteroscopic management for distal ureteric calculi displayed an outcome and complications comparable with other recent reports. We think that handling of the stone(s) is better to be judged on individual surgical basis. Improvements in skills and experience's curve shall lead to a significant progress in the success rate and decreased complication.

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