

# Prevalence and Management of Complications of Ureteroscopy

## A Seven-Year Experience With Introduction of a New Maneuver to Prevent Ureteral Avulsion

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**Purpose:** To evaluate the prevalence and type of rigid ureteroscopy complications and suggest a new method for ureteral avulsion prevention.

**Materials and Methods:** Between March 2002 and March 2009, we retrospectively evaluated 2955 patients who had undergone diagnostic or therapeutic ureteroscopy for asymptomatic hematuria, migrated ureteral stent, or transurethral lithotripsy. They were enrolled from four hospitals in Ahvaz, Iran.

**Results:** Complications were encountered in 241 (8%) patients, including transient hematuria (4.2%), mucosal erosion (1.4%), stone migration (1.3%), ureteral perforation (1.2%), and fever and/or sepsis (1.0%). Ureteral avulsion occurred in 6 (0.2%) patients. Mostly, complications were managed conservatively, using ureteral stenting. Ureteral avulsions were managed using a new technique.

**Conclusion:** In our series, the complication rate is comparable with the literature. A new technique was used in case of ureteroscope entrapment in the ureter, to lessen the occurrence of ureteral avulsion.

**Keywords:** ureteroscopy, ureteral calculi, treatment outcome, lithotripsy, intraoperative complications

## INTRODUCTION

**T**ransurethral lithotripsy (TUL) is the treatment of choice for lower and middle ureteral calculi.<sup>(1-4)</sup> It has also been used for treatment of upper ureteral and renal stones. Based on recent studies, its use as a treatment modality for upper third ureteral stones has become popular;<sup>(1-3)</sup> however, extracorporeal shockwave lithotripsy (SWL) is still the treatment of choice.<sup>(3)</sup> Besides its therapeutic benefits, TUL may be associated with some minor or major complications, which may range from a subtle flank pain and transient hematuria to ureteral perforation, ureteral avulsion, and sepsis.<sup>(5,6)</sup> Recently, these complications have become less prevalent due to the introduction of semi-rigid and flexible ureteroscopes and increasing experience and familiarity of surgeons with TUL.<sup>(6)</sup> Nonetheless, ureteroscopy is still the most common cause of ureteral injury.<sup>(7)</sup> Therefore, surgeons should be aware of potential complications and their management strategies. In this study, we evaluated the prevalence and type of these complications and also suggested a method to prevent ureteral avulsion.

## MATERIALS AND METHODS

A total of 2955 patients who had undergone diagnostic ureteroscopy were retrospectively evaluated.

They were recruited from four hospitals namely, Golestan, Imam Khomeini, Arvand, and Apadana, in Ahvaz, Iran. The indications for ureteroscopy

were asymptomatic hematuria, ureteral stent migration, and TUL.

Ureteroscopies were performed by eight urologists who had at least ten years of experience. In all the subjects, procedures were performed using a rigid ureteroscope 6.75 to 9.0F, and TUL was carried out by pneumatic Swiss Lithoclast lithotripter.

The pre-operative urine culture was negative and prophylactic antibiotics were administered to all the subjects. The following data were obtained from medical records: age, gender, stone characteristics (volume and location), complications, and management strategies.

## RESULTS

Of participants, 2165 and 790 were male and female, respectively. The mean age of the patients was 38 years (range, 3 to 80 years). The mean stone diameter was 11.5 mm (range, 4 to 20 mm). More than one ureteral stone was treated in 24% of patients and stone street was encountered in 57 (2%). The locations of stones were upper, middle, and lower third of the ureter, in 8%, 25%, and 66.8%, respectively. Renal pelvic stone accounted for 0.2% of cases. Bilateral TUL was performed in 3% of patients. Stones were not amenable to TUL in 7 patients; hence, ureterolithotomy and/or double-J ureteral stent insertion were performed. Complications included fever and/or sepsis, transient hematuria (lasting less than 4 days), stone migration, ureteral mucosal injury (abrasion and false passage formation), ureteral perforation, and ure-

**Table 1.** Distribution of urologists and study population in different hospitals

Hospitals	Urologists (n = 8)*	Study population (n = 2955)	
		Male (n = 2165)	Female (n = 790)
Imam Khomeini	3	867 (29.34%)	316 (10.69%)
Golestan	5	822 (27.82%)	300 (10.15%)
Apadana	3	195 (6.60%)	71 (2.40%)
Arvand	4	281 (9.51%)	103 (3.48%)

\* Some of the urologists work in more than one hospital

**Table 2.** Demographic and clinical characteristics of study population

Variables	Male (n = 2165)	Female (n = 790)
Age (mean ± SD), y	38.1 ± 10.2	37.5 ± 9.8
<b>Indications, No (%)</b>		
Calculus	2081 (70.42%)	758 (25.65%)
Diagnostic	65 (2.20%)	23 (0.78%)
Retained or migrated stent	22 (0.74%)	8 (0.27%)
<b>Complications, No (%)*</b>		
Hematuria	66 (2.23%)	58 (1.96%)
Stricture	0 (0%)	0 (0%)
Perforation	21 (0.71%)	14 (0.47%)
Avulsion	5 (0.17%)	1 (0.03%)
Mucosal erosion/False passages	23 (0.78%)	17 (0.58%)
Fever/Sepsis	16 (0.54%)	13 (0.44%)
Stone Migration	12 (0.41%)	26 (0.88%)
Total	143 (4.84%)	129 (4.37%)

\* Some cases showed more than one complication; overall complication rate was 8.1%.

teral avulsion (Table 2). Death, severe hemorrhage, stone expulsion to retroperitoneum, urinoma, or abscess formation did not occur in any patient. Upward stone migration occurred mostly in patients with upper third ureteral stones and those with severe hydronephrosis.

All cases of fever and hematuria were managed successfully using conservative management. Ureteral perforation, ureteral mucosal trauma, and false passage formation were also successfully managed with double-J ureteral stent insertion for 4 to 6 weeks in all of the patients except one, who underwent open surgery since ureteral stenting was impossible.

Ureteral avulsion occurred in 6 patients (1 woman and 5 men), of whom 4 had upper third ureteral stones, one had impacted ureteral stone, and one had large stone. In all subjects with ureteral avulsion, the avulsed ureter exited from the urethral

meatus, coating the ureteroscope, while the surgeon was attempting to pull back the ureteroscope with force.

The ureter has been detached from ureterovesical junction (UVJ) in 1 patient; and in 5 patients simultaneous UVJ and ureteropelvic junction (UPJ) avulsion occurred. Management consisted of nephrectomy (1 patient), ureteral re-implantation (1 patient), using Boari flap (2 patients), and ileal interposition (1 patient). In a patient with complete ureteral avulsion, we performed proximal anastomosis and distal refluxing ureteral re-implantation. Double-J ureteral stent was inserted in all the 6 patients. The last patient, who had undergone proximal anastomosis with distal re-implantation, underwent SWL consequently due to renal stones, but unfortunately, stone fragments did not pass completely. Double-J stent was inserted for the patient and was replaced every 3 to 6 months. The

patient was followed up for 2 years, but he was not compliant enough. He did not return for further follow-up; therefore, he missed the chance of reconstructive surgery and finally underwent nephrectomy in another center because of ureteral stricture and severe renal damage.

## DISCUSSION

Compared with SWL, TUL is more effective in treatment of the lower third ureteral stones.<sup>(1-3)</sup> Although SWL is still the modality of choice in the treatment of upper and middle third ureteral stones, TUL is being performed increasingly with the same efficacy.<sup>(1-4,8)</sup> Today, open surgery is rarely done for treating ureteral and renal stones, since these may also be treated with flexible ureteroscopy and holmium laser. Besides its therapeutic benefits and despite its widespread use, TUL may be associated with a number of complications, especially when used for treating proximal ureteral stones.<sup>(4,9)</sup> Diagnosing these complications and managing them have utmost importance for surgeons undertaking this procedure.

In a study by Gleavlete and associates, 2735 TUL procedures were assessed with regards to the rate and type of complications. Immediate complications occurred in 10.64% of patients, including fever and sepsis (1.13%), persistent hematuria (2.04%), renal colic (2.23%), transient vesicoureteral reflux (4.58%), and ureteral stent migration (0.66%). Intra-operative complications happened in 3.6% of subjects and included ureteral mucosal trauma (false passage formation) (1.0%), abrasion (1.50%), ureteral perforation (0.65%), stone expulsion (0.18%), bleeding (0.10%), and ureteral avulsion (0.11%).<sup>(5)</sup>

In another study, Elashry and colleagues stated that with increasing surgeon's experience and evolving devices, the rate of ureteral perforation and avulsion have decreased from 3.3% to 0.5% and from 1.3% to 0.1%, respectively.<sup>(6)</sup> In a study of 2273 patients who had undergone ureteroscopy, Bultler reported 1% complication rate, which was mostly

ureteral trauma and managed conservatively while 22% required open surgery due to ureteral perforation or avulsion.<sup>(10)</sup>

In our study, 8% of patients developed complication, which were mostly minor complications, including transient hematuria, stone migration, false passage formation, and ureteral mucosal trauma. Except for one patient, all the cases of ureteral perforation were managed by ureteral double-J stent insertion for 6 weeks. Fever and sepsis were also treated with conservative therapy. Ureteral avulsion was the most serious complication, which occurred in 0.2% of patients, and resulted in nephrectomy in 1 out of 6 subjects. The affected kidney was salvaged in the other 5 patients with open surgery.

Our complication rate is comparable with previous studies. The most catastrophic complication of ureteroscopy is ureteral avulsion. Although it occurred in only 0.2% of patients, appropriate strategies should be considered to prevent it due to its serious consequences and potential sequel. Once it occurs, however, proximal anastomosis and distal re-implantation of the avulsed ureter may be done as a temporary option until further reconstructive procedures can be undertaken in more suitable settings.

If ureteroscope is trapped in the ureter, it cannot be taken out and ureteral avulsion may occur in case of excessive force. The authors suggest the following *maneuver* to prevent ureteral avulsion:

**a.** Increase irrigation pressure in the ureter; hence, the ureteral mucosa would be released from the ureteroscope.

**b.** Perform rectal examination in men with your left index finger or insert two fingers in the vaginal fornix in women, and try to push UVJ and the lower ureteral segment upward and against the ureteroscope's sheath. While the ureter is dilated, wave and rotate the ureteroscope 45° clockwise and counter clockwise gently and remove it if no resistance is encountered. At the same time, control

ureteral mucosal movement proximally against the direction of ureteroscope. Retry if it was not successful.

Writers of this study have tried this maneuver in many cases, and in all cases ureteroscope could be released easily.

### CONCLUSION

In case of ureteral avulsion, proximal anastomosis and distal refluxing re-implantation of the avulsed ureter and double-J stent insertion can buy the patient's time for reconstructive surgery in a more suitable situation.

### CONFLICT OF INTEREST

None declared.

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