ORIGINAL ARTICLE

Success rate and complications of performing elective ureteroscopy in <1 week versus over 1 week from renal colic initiation in ureteral stones larger than 6 mm

Reza Kazemi[1], Amir Javid[1], Amir Hossein Ghandehari[2], Hanieh Salehi[2]

[1]Isfahan Kidney Diseases Research Center, Isfahan University of Medical Sciences, Isfahan, Iran, [2]School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

Background: The aim of this study was to compare the outcomes, success rate, and complications of performing elective ureteroscopy at different times: <1 week from renal colic initiation (early) and more than 1 week from renal colic initiation (late) in patients with ureteral stone larger than 6 mm. **Materials and Methods:** This comparative observational study was conducted on 338 consecutive patients. Patients were evaluated in two groups: patients who underwent ureteroscopy in <1 week (A) and patients who underwent ureteroscopy in more than 1 week (B) from renal colic initiation. Helical unenhanced computed tomography was used to assess the size, location, and hardness of stone for all patients. Operation success was defined as complete clearance of stone with no stone residue (stone free) at 2-week postoperative ultrasonography with no need to further interventions. Operation data were collected using medical records, and postoperative complications were investigated at 2 weeks postoperative follow-up visits. **Results:** Group A included 165 patients and Group B included 173 patients. The overall mean stone size was 8.60 ± 1.12 mm: for Group A 9.13 ± 0.94 mm and for Group B 8.10 ± 1.04 mm ($P < 0.001$). Stone residues were found in 11 patients: 9 in Group A (5.4%) and 2 in Group B (1.1%) ($P = 0.026$). Nine patients needed repeated ureteroscopy: 8 (4.8%) in Group A and 1 (0.6%) in Group B ($P = 0.015$). A double-J stent was used for 85 (51.5%) patients in Group A and 66 (38.2%) patients in Group B ($P = 0.016$). Major intraoperative complications did not happen in any patients. Fifty-three (32.1%) patients in Group A and 28 (16.2%) patients in Group B suffered from postoperative complications ($P = 0.001$). **Conclusion:** Our study revealed that performing elective ureteroscopy with an interval of more than 1 week from the onset of renal colic in combination with medical treatments was associated with less need for double-J stent placement, less need for repeated ureteroscopy, and fewer postoperative complications compared to performing elective ureteroscopy in <1 week from the renal colic onset in nonemergent patients with ureteral stone larger than 6 mm. Although the rate of ureteroscopy failure was higher among the patients who underwent ureteroscopy in <1 week from their renal colic initiation, there was no statistically significant relationship between performing ureteroscopy in <1 week and an increased risk for ureteroscopy failure.

Key words: Elective, ureteral stones, ureteroscopy

How to cite this article: Kazemi R, Javid A, Ghandehari AH, Salehi H. Success rate and complications of performing elective ureteroscopy in <1 week versus over 1 week from renal colic initiation in ureteral stones larger than 6 mm. J Res Med Sci 2024;29:27.

INTRODUCTION

Ureteral stones are one of the common reasons for patients to visit urology clinics, causing so much pain and distress to the patients.[1] The symptoms of urinary stones can range from asymptomatic to severe pain, which is especially seen in ureteral stones and is usually described as renal colic. This severe pain and discomfort can have a considerable effect on the patient's quality of life and their socioeconomic performance, and it can also cause patients to meet emergency departments many times until the stone is removed or active interventions are being made.

According to studies, urinary stones have a prevalence of about 10.6% in men and 7.1% in women in the U.S.[2] Up

Access this article online

Quick Response Code:

Website: https://journals.lww.com/jrms

DOI: 10.4103/jrms.jrms_43_23

Address for correspondence: Dr. Reza Kazemi, Isfahan Kidney Diseases Research Center, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: rezakazemi6788@gmail.com

Submitted: 18-Jan-2023; **Revised:** 20-Nov-2023; **Accepted:** 02-Jan-2024; **Published:** 11-Jul-2024

to 12% of the population may suffer from urolithiasis during their lifetime, and the chance of recurrence is up to 50%.[3] Iran is located in West Asia, one of the regions where has a high prevalence of urolithiasis; the prevalence of urinary stones in Iran is reported to be 5.7%–8.1%.[4,5]

The treatment of ureteral stones for nonemergency patients, especially in cases where the size of the stone is small, is done expectantly, and there is a high probability that the stone will pass spontaneously; this chance decreases by increasing in stone size so that in 99% of cases with stones larger than 6 mm, active interventions are needed.[3]

In the studies conducted, medical treatments during the waiting period for stone removal have been recommended, which include pain controllers, especially nonsteroidal anti-inflammatory drugs and COX2 inhibitors, and medical expulsive therapy treatments, which usually include an alpha blocker such as tamsulosin.[6-8]

According to recent advances in techniques and instruments, active treatments for ureteral stones have shifted to minimally invasive methods, e.g., extracorporeal shock wave lithotripsy (ESWL) and ureteroscopy. These procedures are safe and associated with less pain and discomfort and shorter recovery period in comparison with open techniques. In a comparison of lithotripsy methods, studies have shown that the success rate of ureteroscopy for the removal of mid and distal ureteral stones is higher compared to ESWL; furthermore, the global trends are toward increasing the use of ureteroscopy.[9,10]

Several studies have investigated and compared emergency ureteroscopy and primary (immediately after renal colic initiation but not emergent) ureteroscopy with delayed and elective ureteroscopy. The results of these studies have shown that performing emergency ureteroscopy and primary ureteroscopy is a safe method without increasing the risk of further complications and with a relatively similar success rate in comparison with delayed and elective ureteroscopy.[11-14] But so far, no study has been conducted regarding the success rate and complications of performing elective ureteroscopy at different times, and this study is the first of its kind.

There is no consensus regarding the interval time between symptom initiation and performing ureteroscopic treatment in nonemergency patients, and it is performed at different times based on the preferences of the patient and physician. Besides, based on the literature, there is no recommendation on the time of elective ureteroscopy in nonemergent patients.

As mentioned before Iran has a high prevalence of urinary stones; this is approved. therefore, local evidence could improve the outcome of ureteroscopy procedures and ease decision-making at the time of ureteroscopy for patients and physicians. Thus, this study was conducted with the aim of comparing the outcomes, success rate, and complications of performing ureteroscopy at different times: below 1 week and over 1 week.

MATERIALS AND METHODS

The present comparative observational study on 338 consecutive patients (152 women and 186 men) was conducted between April 2021 and May 2022 in Khorshid Hospital Complex, Isfahan, Iran.

The inclusion criteria for this study were:

- Age between 18 and 80 years
- Ureteral stone larger than 6 mm
- Presented with flank pain as renal colic
- Elective ureteroscopy as active stone removal treatment
- Absence of the following conditions:
    - Acute kidney injury (rise in serum creatinine level ≥0.3 mg/dL within 48 h, rise in serum creatinine level more than 1.5 times baseline occurred within the prior 7 days, and urine output level <0.5 mL/kg/h for 6 h[15])
    - Chronic kidney disease (kidney damage or a decreased glomerular infiltration rate <60 mL/min/1.73 m^2 for at least 3 months[16])
    - Single kidney
    - History of ureteral stricture
    - Rectal temperature >38°C
    - Leukocytosis >20000 cells/dL
    - Diagnosis of urinary tract infection (UTI)
    - Anuria
    - History of previous ureteral reimplantation surgeries.

Patients were divided into two groups: patients who underwent ureteroscopy (A) <1 week after renal colic initiation and (B) more than 1 week after renal colic initiation.

All patients underwent helical unenhanced computed tomography (HUCT) to define the size, location, and hardness (using Hounsfield scale) of the stone, and these data were collected from HUCT report sheets. During the interval between diagnosis of ureterolithiasis and ureteroscopy, the same medications, including analgesic (celecoxib 200 mg BiD) and antispasmodic (tamsulosin 0.4 mg daily), were prescribed for both groups.[6-8] Preoperative preparations were performed in the same manner for all patients. One gram of cefazolin was administered intravenously as antibiotic prophylaxis.

Ureteroscopy was carried out under general anesthesia by the same surgeon (Reza Kazemi) and the same team using semirigid 6.5F and 8F ureteroscopes (Richard Wolf™). A safety hydrophilic 0.035" guide wire (Sensor™) was used for every patient. Stone fragments were removed via basket and endoscopic grasper. However, small fragments (<3 mm) were left to pass spontaneously. Double-J stents were used for patients with significant ureteral trauma and edema at the stone site or suspected ureteral perforation.

Demographic data, the interval between onset of renal colic and ureteroscopy, operation duration (since the insertion of ureteroscope until its removal), need for postoperative hospitalization, and need for stent placement were extracted from medical records, including surgery reports. Operation success was defined as complete clearance of stone with no stone residue (stone free) at 2 weeks postoperative ultrasonography with no need for further interventions. Ultrasonography was performed by an experienced radiologist who was blinded to patient groups. Need for repeated ureteroscopy and postoperative complications including fever, pain (renal colic), gross hematuria, and urinary retention (defined as the inability to void) were investigated at 2-week postoperative follow-up visits.

Pre- and postoperative pain was assessed using the Visual Analog Scale (VAS) immediately before surgery and 1 day postoperatively.

This study was approved by the Research Ethics Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1400.132). Written informed consent was obtained from all patients included in this study.

Qualitative and quantitative data were presented as frequency (percentage) and mean ± standard deviation. The normal distribution of continuous variables was evaluated by the Kolmogorov–Smirnov test. Statistical analysis was performed using Chi-squared test, independent *t*-test, and Mann–Whitney test for categorical and parametric and nonparametric continuous variables, respectively. Multivariate logistic regression analyses were performed by adjusting for sex, stone location, history of previous urinary stone, age, body mass index (BMI), stone size, and stone hardness. International Business Machines Corporation (IBM) SPSS statistics, version 24 (North Castle Drive, MD-NC119 Armonk, NY 10504-1785 US), for Windows was used to perform analyses.

RESULTS

The present study included 338 patients with a mean age of 53.19 ± 13.66 years: 165 in Group A (F/M: 76/89) and 173 in Group B (F/M: 76/97). There was no significant difference among groups on sex distribution ($P = 0.743$). The mean age was 53.98 ± 14.10 and 52.4 ± 13.26 years for Groups A and B ($P = 0.299$). There was no significant difference regarding BMI and history of previous urinary stones between the two groups ($P = 0.904$ and 0.913). The baseline characteristics of patients are represented in Table 1.

The mean interval between onset of renal colic and ureteroscopy for Group A was 4.03 ± 1.11 days and for Group B was 11.55 ± 2.02 days ($P < 0.001$).

The data collected on stone location are described in Table 2; the difference between groups was not statistically significant ($P = 0.149$). The overall mean stone size was 8.60 ± 1.12 mm: for Group A 9.13 ± 0.94 mm and for Group B 8.10 ± 1.04 mm, which showed a significant difference ($P < 0.001$). Stone hardness measured using the Hounsfield scale was 622.99 ± 201.89 HU in Group A and 593.84 ± 189.65 HU in Group B ($P = 0.082$).

The mean operation duration was 16.67 ± 1.64 min for Group A and 16.31 ± 1.33 min in Group B; there was no significant difference between the two groups regarding the operation time ($P = 0.143$).

Major intraoperative complications including ureteral avulsion, symptomatic ureteral perforation, and ureteral intussusception did not happen in any patients. A double-J stent was placed in 85 (51.5%) patients in Group A and 66 (38.2%) patients in Group B which indicated a significantly higher need for stent placement in Group A ($P = 0.016$). Twelve patients were hospitalized postoperatively, 6 in each group ($P = 0.582$). Fifty-three (32.1%) patients in Group A and 28 (16.2%) patients in Group B suffered from postoperative complications showing a significant difference between the groups ($P = 0.001$). Pre- and postoperative analysis showed that pre- and postoperative pain was statistically higher in Group A ($P = 0.025$ and 0.004), although these differences were not clinically significant as they were less

Table 1: Baseline characteristics

	Group A (*n*=165)	Group B (*n*=173)	*P*
Age (years)	53.98±14.10	52.4±13.26	0.299*
Sex (female), *n* (%)	76 (46.1)	76 (43.1)	0.743**
BMI	26.02±3.16	25.68±2.30	0.904*
History of previous urinary stone, *n* (%)	93 (56.4)	90 (52)	0.913**

*Independent *t*-test; **Chi-squared test

Table 2: Distribution of stone location

Location of stone	Group A, *n* (%)	Group B, *n* (%)	*P*
Proximal ureter	36 (21.8)	54 (31.2)	0.149*
Mid part of ureter	70 (42.5)	63 (36.4)	
Distal ureter	59 (35.7)	59 (32.4)	

*Chi-squared test

than minimum clinically significant difference in VAS pain score which is between 10 and 17 mm (1 and 1.7 cm).[17,18]

In the 2-week follow-up ultrasonography, the presence of stone residue was found in 11 patients: 9 (5.4%) in Group A and 2 (1.1%) in Group B ($P = 0.026$), which showed a higher rate of ureteroscopy failure in Group A. Nine patients needed repeated ureteroscopy: 8 (4.8%) in Group A and 1 (0.6%) in Group B ($P = 0.015$), which indicated a significantly higher need for repeated ureteroscopy in Group A. The clinical and operative results are shown in Table 3. The most ureteroscopy failures occurred in patients with proximal ureteral stones with an overall success rate of 92.2% (83.3% in Group A and 98.1% in Group B), and the highest rate of ureteroscopy success was in patients with distal ureteral stones with an overall success rate of 99.1% (98.3% in Group A and 100% in Group B). The stone-free rate (success rate) based on stone location is described in Table 4.

The logistic regression analyses of the association between time of performing ureteroscopy and ureteroscopy failure, need for stent placement, need for repeated ureteroscopy, and postoperative complications are shown in Tables 5-8, respectively. There was not a significant risk of ureteroscopy failure in patients who underwent ureteroscopy in <1 week compared to patients who underwent ureteroscopy in more than 1 week from their first episode of renal colic (crude model: odds ratio [OR] = 4.35, confidence interval [CI] 95% = 0.91–20.82, $P = 0.07$); after adjusting for factors such as sex, history of previous urinary stone, age, BMI, stone location, stone size, and stone hardness, the model indicated no association between ureteroscopy failure and the timing of the procedure (adjusted model: OR = 5.23, CI 95% = 0.81–33.71, $P = 0.08$).

The analyses demonstrated that performing ureteroscopy in <1 week was linked with a higher risk of needing a stent placement (crude model: OR = 1.72, CI 95% = 1.12–2.66, $P = 0.01$, and adjusted model: OR = 1.91, CI 95% = 1.15–3.15, $P = 0.01$) [Table 6]. Furthermore, patients who underwent ureteroscopy in <1 week faced a higher risk of requiring repeated ureteroscopy (crude model: OR = 9.92, CI 95% =1.24–79.21, $P = 0.03$, and adjusted model: OR = 13.22, CI 95% =1.25–140.05, $P = 0.03$) [Table 7]. Table 8 highlights that the risk of postoperative complications was greater among patients who underwent ureteroscopy in <1 week (OR = 2.45 CI = 1.46–4.12 $P = 0.001$); furthermore, the adjusted model confirmed the association between performing ureteroscopy in <1 week and an increased risk of postoperative complications (OR = 3.09 CI = 1.67–5.70 $P = 0.001$).

Table 3: Comparison of clinical and operative results between two groups

	Group A	Group B	*P*
Need for stent placement, *n* (%)	85 (51.5)	66 (38.2)	0.016**
Stone residue, *n* (%)	9 (5.4)	2 (1.1)	0.026**
Operation duration	16.67±1.64	16.31±1.33	0.143*
Postoperative hospitalization, *n* (%)	6 (3.6)	6 (3.5)	0.582**
Postoperative complications, *n* (%)	53 (32.1)	28 (16.2)	0.001**
Need for repeated ureteroscopy, *n* (%)	8 (4.8)	1 (0.6)	0.015**
Preoperative pain (cm on VAS)	7.53±0.72	7.35±0.76	0.025*
Postoperative pain (cm on VAS)	3.25±0.82	2.96±0.94	0.004*

*Independent *t*-test; **Chi-squared test. VAS=Visual Analog Scale

DISCUSSION

This prospective study investigated outcomes and complications of elective ureteroscopy in two groups of patients who underwent surgery within less than a week and more than a week from their first episode of renal colic. Our findings revealed that performing the ureteroscopy after more than a week from renal colic initiation was associated with fewer postoperative complications, a lower need for stent placement, and a lower need for repeated ureteroscopy compared to performing ureteroscopy in less than a week from renal colic initiation. Although the rate of ureteroscopy failure was higher among the patients who underwent ureteroscopy in less than a week from their renal colic initiation, there was no statistically significant relationship between performing ureteroscopy in less than a week and an increased risk for ureteroscopy failure. In addition, there was no clinically significant difference between the two groups regarding pre- and postoperative pain and major intraoperative complications.

Urolithiasis is a widespread problem all over the world, which affects up to 12% of people during their lifetime,[3] and its prevalence is rising among Asian countries in the last few decades.[19] Nationwide surveys done in the U.S.

Table 4: Stone-free rate based on stone location distribution

	Group A		Group B		Overall	
	Stone free/ stone residue	Stone-free rate success rate) (%)	Stone free/ stone residue	Stone-free rate (success rate) (%)	Stone free/ stone residue	Stone-free rate (success rate) (%)
Proximal ureter	30/6	83.3	53/1	98.1	83/7	92.2
Mid part of ureter	68/2	97.1	62/1	98.4	130/3	97.7
Distal ureter	58/1	98.3	56/0	100	114/1	99.1
Total	156/9	94.5	171/2	98.8	327/11	96.7

Table 5: Logistic regression of association between time of performing ureteroscopy and ureteroscopy failure

	Crude model - OR (95% CI)	*P*	Adjusted model* - OR (95% CI)	*P**
Time of performing ureteroscopy				
<1 week	4.36 (0.91–20.82)	0.07	5.23 (0.81–33.71)	0.08
>1 week	1		1	
Sex				
Male			2.591 (0.54–12.42)	0.23
Female			1	
Stone location				
Distal ureter			0.141 (0.14–1.45)	0.1
Mid part of ureter			0.241 (0.05–1.19)	0.08
Proximal ureter			1	
History of previous urinary stone				
Positive			0.719 (0.18–2.92)	0.65
Negative			1	
Age			1.016 (0.96–1.07)	0.58
BMI			1.24 (0.99–1.53	0.05
Stone size			0.85 (0.41–1.75)	0.66
Stone hardness (Hounsfield scale)			1.004 (1.001–1.008)	0.01

*Multivariate logistic regression. BMI=Body mass index; OR=Odds ratio; CI=Confidence interval

Table 6: Logistic regression of association between time of performing ureteroscopy and need for stent placement

	Crude model - OR (95% CI)	*P*	Adjusted model - OR (95% CI)	*P**
Time of performing ureteroscopy				
<1 week	1.72 (1.12–2.66)	0.01	1.91 (1.15–3.15)	0.01
>1 week	1		1	
Sex			0.8 (0.51–1.26)	0.34
Male			1	
Female			1.21 (0.68–2.17)	0.52
Stone location			0.88 (0.50–1.53)	0.64
Distal ureter			1	
Mid part of ureter			1.48 (0.95–2.30)	0.08
Proximal ureter			1	
History of previous urinary stone			1.01 (0.99–1.02)	0.36
Positive			1.01 (0.94–1.10)	0.75
Negative			0.91 (0.73–1.14)	0.43
Age			0.999 (0.998–1.001)	0.01
BMI			1.91 (1.15–3.15)	0.01
Stone size			1	
Stone hardness (Hounsfield scale)			0.8 (0.51–1.26)	0.34

*Multivariate logistic regression. BMI=Body mass index; OR=Odds ratio; CI=Confidence interval

reported that about 1.2 million patients presented annually to the emergency departments diagnosed with urolithiasis with an admission rate of nearly 20%.[20] The global trend on the financial burden of urolithiasis has risen during the last few decades, from $898 million in 1984 to $5.3 billion in 2014.[21] Epidemiological studies on ureterolithiasis found that most patients were diagnosed in the 40s–60s of their life and our findings showed similar results in patients' age distribution.[22]

Ureteral stones are a common etiology for obstructive uropathy; thus, proper management of ureteral stones has a key role to preserve renal function and preventing of obstructive uropathy.[23] According to the latest European Association of Urology Guidelines on Diagnosis and Conservative Management of Urolithiasis, it seems that expectant management is safe for at least 14 days and a follow-up should be performed to assess stone location and presence of hydronephrosis during this period.[24] The mentioned reasons make the management of ureteral stones important.

Due to the low probability of spontaneous passage of ureteral stones larger than 6 mm, active stone removal is the first-line treatment for these stones; current guidelines recommend to decide on treatment according to the patient's preference, stone-specific factors, and local expertise.[25,26]

Current trends for active ureteral stone treatment are toward minimally invasive choices, mainly ESWL and

Table 7: Logistic regression of association between time of performing ureteroscopy and need for repeated ureteroscopy

	Crude model - OR (95% CI)	*P*	Adjusted model - OR (95% CI)	*P**
Time of performing ureteroscopy				
<1 week	9.92 (1.24–79.21)	0.03	13.22 (1.25–140.05)	0.03
>1 week	1		1	
Sex			2.97 (056–15.7)	0.20
Male			1	
Female			0.16 (0.02–1.69)	0.13
Stone location			0.25 (0.05–1.30)	0.1
Distal ureter			1	
Mid part of ureter			1.13 (0.26–4.96)	0.87
Proximal ureter			1	
History of previous urinary stone			1.02 (0.96–1.08)	0.52
Positive			1.21 (0.97–1.50)	0.09
Negative			0.86 (0.41–1.81)	0.69
Age			1.005 (1.002–1.009)	0.004
BMI			13.22 (1.25–140.05)	0.03
Stone size			1	
Stone hardness (Hounsfield scale)			2.97 (056–15.7)	0.20

*Multivariate logistic regression. BMI=Body mass index; OR=Odds ratio; CI=Confidence interval

Table 8: Logistic regression of association between time of performing ureteroscopy and postoperative complications

	Crude model - OR (95% CI)	*P*	Adjusted model - OR (95% CI)	*P**
Time of performing ureteroscopy				
<1 week	2.45 (1.46–4.12)	0.001	3.09 (1.67–5.70)	0.001
>1 week	1		1	
Sex			0.92 (0.54–1.56)	0.75
Male			1	
Female			0.53 (0.26–1.10)	0.09
Stone location			1.04 (0.55–1.96)	0.9
Distal ureter			1	
Mid part of ureter			0.93 (0.55–1.56)	0.78
Proximal ureter			1	
History of previous urinary stone			1.01 (0.99–1.03)	0.18
Positive			1.03 (0.94–1.13)	0.49
Negative			0.81 (0.62–1.06)	0.12
Age			1 (0.999–1.001)	0.85
BMI			3.09 (1.67–5.70)	0.001
Stone size			1	
Stone hardness (Hounsfield scale)			0.92 (0.54–1.56)	0.75

*Multivariate logistic regression. BMI=Body mass index; OR=Odds ratio; CI=Confidence interval

ureteroscopy; despite the higher cost of ureteroscopy, this method showed more efficacy rather than ESWL.[27] However, there is a controversy over the time of performing ureteroscopy in nonemergent cases.

Major intraoperative complications include ureteral avulsion, symptomatic perforation, and ureteral intussusception. Studies on ureteroscopy complications reported the avulsion rate to be 0.04%–0.9%[28] and the circumferential perforation rate to be 4.7%.[29] Intussusception is a very rare complication that only happens in one case due to diagnostic ureteroscopy.[30] Fortunately, no patient suffered from intraoperative complications in our study. Studies reported postureteroscopy fever and UTI to be 0.2%–15%, while postoperative renal colic was estimated between 1.1% and 10.2%. Urinary retention following ureteroscopy is another common postoperative complication with an incidence rate of 0.1%–1.4%.[28] Overall postoperative complications rate in our study was about 24% which was significantly higher in patients who underwent early ureteroscopy.

The Clinical Research Office of the Endourological Society ureteroscopy global study on 9681 patients who underwent ureteroscopy showed stone location distribution of 27.4% proximal ureter, 20.5% in the mid part of the ureter, and 46.3% distal ureter. They also reported a stone-free rate equal to 84.5% for the proximal ureter, 89.4% for the mid ureter, and 94.2% for the distal ureter.[31] Our findings on stone location are described in Table 2, and the overall stone-free rate was 96.7%, which was significantly higher

among patients in Group B. In our study, the stone-free rate based on stone location is shown in Table 4.

A study by Guercio investigating the efficacy and safety of immediate versus delayed ureteroscopy in nonemergent patients showed similar efficacy and safety of these two methods; no significant difference in stone-free rate and complications between their two groups. this is approved.[32] Several studies were made on comparing primary/emergent ureteroscopy versus delayed/elective ureteroscopy, showing that primary ureteroscopy is safe and is associated with significantly same stone clearance, without increased risk for major complications, compared to delayed/elective ureteroscopy.[11-14] However, based on the literature, our study is the first one to investigate the efficacy, success rate, and complications of performing elective ureteroscopy at different times in nonemergent patients.

Limitations

We had some limitations. The process of our follow-up included only one visit because of the limited funds and COVID-19 crisis. Furthermore, the assessment of being stone free was performed via ultrasonography. It is better to use HUCT scans to evaluate stone-free patients. Furthermore, a larger sample size could better distinguish the differences between these two methods. Some failures and complications might be related to stone size as patients in Group A had significantly larger mean stone sizes.

CONCLUSION

Our study revealed that performing elective ureteroscopy with an interval of more than 1 week from the onset of renal colic in combination with medical treatments was associated with less need for double-J stent placement, less need for repeated ureteroscopy, and fewer postoperative complications compared to performing elective ureteroscopy in <1 week from the renal colic onset in nonemergent patients with ureteral stone larger than 6 m. Although the rate of ureteroscopy failure was higher among the patients who underwent ureteroscopy in <1 week from their renal colic initiation, there was no statistically significant relationship between performing ureteroscopy in <1 week and an increased risk for ureteroscopy failure.

Acknowledgments

The present study was supported by the Isfahan University of Medical Sciences.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Tombal B, Mawlawi H, Feyaerts A, Wese FX, Opsomer R, Van Cangh PJ. Prospective randomized evaluation of emergency extracorporeal shock wave lithotripsy (ESWL) on the short-time outcome of symptomatic ureteral stones. Eur Urol 2005;47:855-9.
2. Scales CD Jr., Smith AC, Hanley JM, Saigal CS, Urologic Diseases in America Project. Prevalence of kidney stones in the United States. Eur Urol 2012;62:160-5.
3. Teichman JM. Clinical practice. Acute renal colic from ureteral calculus. N Engl J Med 2004;350:684-93.
4. Liu Y, Chen Y, Liao B, Luo D, Wang K, Li H, *et al.* Epidemiology of urolithiasis in Asia. Asian J Urol 2018;5:205-14.
5. Safarinejad MR. Adult urolithiasis in a population-based study in Iran: Prevalence, incidence, and associated risk factors. Urol Res 2007;35:73-82.
6. Gandhi A, Hashemzehi T, Batura D. The management of acute renal colic. Br J Hosp Med (Lond) 2019;80:C2-6.
7. Holmlund D. On medical treatment for ureteral stone expulsion. Scand J Urol 2018;52:94-100.
8. Türk C, Knoll T, Seitz C, Skolarikos A, Chapple C, McClinton S, *et al.* Medical expulsive therapy for ureterolithiasis: The EAU recommendations in 2016. Eur Urol 2017;71:504-7.
9. Geraghty RM, Jones P, Somani BK. Worldwide trends of urinary stone disease treatment over the last two decades: A systematic review. J Endourol 2017;31:547-56.
10. Türk C, Petřík A, Sarica K, Seitz C, Skolarikos A, Straub M, *et al.* EAU guidelines on interventional treatment for urolithiasis. Eur Urol 2016;69:475-82.
11. Alsawi M, Nalagatla S, Ahmad N, Chandiramani AS, Mokool L, Nalagatla SK, *et al.* Primary versus delayed ureteroscopy for ureteric stones: A systematic review and meta-analysis. J Clin Urol 2022. [doi: 10.1177/20514158221088687].
12. Matani YS, Al-Ghazo MA, Al-Azab RS, Hani OB, Ghalayini IF, Hani IB. Emergency versus elective ureteroscopic treatment of ureteral stones. Can Urol Assoc J 2013;7:E470-4.
13. Picozzi SC, Ricci C, Gaeta M, Casellato S, Stubinski R, Bozzini G, *et al.* Urgent ureteroscopy as first-line treatment for ureteral stones: A meta-analysis of 681 patients. Urol Res 2012;40:581-6.
14. Youn JH, Kim SS, Yu JH, Sung LH, Noh CH, Chung JY. Efficacy and safety of emergency ureteroscopic management of ureteral calculi. Korean J Urol 2012;53:632-5.
15. Kellum JA, Lameire N, Aspelin P, Barsoum RS, Burdmann EA, Goldstein SL, *et al*. Kidney disease: Improving global outcomes (KDIGO) acute kidney injury work group. KDIGO clinical practice guideline for acute kidney injury. Kidney Int Suppl 2012;2:1-38.
16. Schnaper HW. Remnant nephron physiology and the progression of chronic kidney disease. Pediatr Nephrol 2014;29:193-202.
17. Kelly AM. The minimum clinically significant difference in visual analogue scale pain score does not differ with severity of pain. Emerg Med J 2001;18:205-7.
18. Mark MS, Au TT, Choi YF, Wong TW. The minimum clinically significant difference in visual analogue scale pain score in a local emergency setting. Hong Kong J Emerg Med 2009;16:233-6.
19. Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A, Talati J, Lotan Y. Epidemiology of stone disease across the world. World J Urol 2017;35:1301-20.
20. Eaton SH, Cashy J, Pearl JA, Stein DM, Perry K, Nadler RB. Admission rates and costs associated with emergency presentation of urolithiasis: Analysis of the nationwide emergency department sample 2006-2009. J Endourol 2013;27:1535-8.

21. Raheem OA, Khandwala YS, Sur RL, Ghani KR, Denstedt JD. Burden of urolithiasis: Trends in prevalence, treatments, and costs. Eur Urol Focus 2017;3:18-26.
22. Ziemba JB, Matlaga BR. Epidemiology and economics of nephrolithiasis. Investig Clin Urol 2017;58:299-306.
23. Tseng TY, Stoller ML. Obstructive uropathy. Clin Geriatr Med 2009;25:437-43.
24. Türk C, Petřík A, Sarica K, Seitz C, Skolarikos A, Straub M, *et al.* EAU guidelines on diagnosis and conservative management of urolithiasis. Eur Urol 2016;69:468-74.
25. Assimos D, Krambeck A, Miller NL, Monga M, Murad MH, Nelson CP, *et al.* Surgical management of stones: American Urological Association/Endourological Society Guideline, PART I. J Urol 2016;196:1153-60.
26. Türk C, Knoll T, Petrik A, Sarica K, Straub M, Seitz C, editors. EAU Guidelines on Urolithiasis. European Association of Urology. EAU Annual Congress. Amsterdam Arnhem, The Netherlands: EAU Guidelines Office; 2020. Available from: https://uroweb.org/guideline/urolithiasis/. [Last accessed on Nov 2020]
27. Constanti M, Calvert RC, Thomas K, Dickinson A, Carlisle S. Cost analysis of ureteroscopy (URS) versus extracorporeal shockwave lithotripsy (ESWL) in the management of ureteric stones <10 mm in adults: A UK perspective. BJU Int 2020;125:457-66.
28. De Coninck V, Keller EX, Somani B, Giusti G, Proietti S, Rodriguez-Socarras M, *et al.* Complications of ureteroscopy: A complete overview. World J Urol 2020;38:2147-66.
29. Miernik A, Wilhelm K, Ardelt PU, Adams F, Kuehhas FE, Schoenthaler M. Standardized flexible ureteroscopic technique to improve stone-free rates. Urology 2012;80:1198-202.
30. Bernhard PH, Reddy PK. Retrograde ureteral intussusception: A rare complication. J Endourol 1996;10:349-51.
31. Perez Castro E, Osther PJ, Jinga V, Razvi H, Stravodimos KG, Parikh K, *et al.* Differences in ureteroscopic stone treatment and outcomes for distal, mid-, proximal, or multiple ureteral locations: The clinical research office of the endourological society ureteroscopy global study. Eur Urol 2014;66:102-9.
32. Guercio S, Ambu A, Mangione F, Mari M, Vacca F, Bellina M. Randomized prospective trial comparing immediate versus delayed ureteroscopy for patients with ureteral calculi and normal renal function who present to the emergency department. J Endourol 2011;25:1137-41.