

## Causes and Risk Factors for Hospital Readmission in Patients with Ureteral Stones Treated With Transurethral Lithotripsy

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ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Original Article</p> <hr/> <p><b>Article History:</b> Received: 13-Aug-2020 Accepted: 16-May-2021</p> <hr/> <p><b>Key words:</b> Readmission, Risk factors, Ureteral stones, Transurethral lithotripsy</p>	<p><b>Introduction:</b> Urinary tract stones are recognized as the third most prevalent disease in urology. Transurethral lithotripsy (TUL) is the most prevalent surgical modality for ureteral stones. Some patients experience hospital readmission and possibly another surgical intervention after TUL. The present study aimed to assess the causes and risk factors of readmission in patients with ureteral stones treated with TUL.</p> <p><b>Materials and Methods:</b> This cross-sectional study was conducted on all the patients who underwent TUL in Imam Reza Hospital in Mashhad, northeast of Iran, from March 2018 to September 2019. The case group consisted of 67 patients who were hospitalized due to primary urinary stone-related complications. The patients who were admitted for the removal of double J (DJ) catheter (n=118) were regarded as the control group.</p> <p><b>Results:</b> The most common causes of hospital readmission were re-TUL for the removal of the remnant urinary stones when patients came back for DJ catheter removal (29.9%). The second and third causes of readmission were fever after DJ catheter removal (20.9%) and fever after TUL (14.9%). The main risk factors for hospital readmission were stone size, age, and male gender.</p> <p><b>Conclusion:</b> As evidenced by the results of the present study, stone size, age, and male gender were the major risk factors for hospital readmission after TUL. The most common causes of readmission were re-TUL at the time of DJ catheter removal, fever after DJ catheter removal, and fever after TUL.</p>
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## Introduction

Urinary system disorders are relatively common health problems (1). The most prevalent Urinary system disorders are urinary tract infections (UTIs), prostate-related symptoms, and urolithiasis, respectively (2). It is believed that about 10% of people will have a urinary stone at some time in their lives (1). The supersaturated status of urine and crystal-forming substances, such as calcium, oxalate, sodium, phosphorus, and uric acid, is a known factor contributing to the formation of urinary stones (3). Urinary calculogenesis is a multifactorial process.

The risk factors for these disorders include intrinsic (such as age, gender, anatomical abnormalities, and heredity conditions) and extrinsic factors, namely climate, hypertension (HTN), lifestyle habits, mineral composition, and water intake (4). The number of patients with urolithiasis has increased, especially in Asia. Some studies attributed this increase to alterations in a healthy lifestyle, poor nutrition, high body mass index (BMI), and some medications (5). The clinical manifestation of urinary stones varies from asymptomatic to complications, such as colic pain, hematuria, nausea, and vomiting. Urolithiasis can also be associated with a higher risk of metabolic syndromes, diabetes, and HTN (4), imposing a considerable economic burden on society due to its expensive treatment (6). One of the most common treatments for these stones is transurethral lithotripsy (TUL). This procedure can lead to such complications as fever and UTI, which may be the leading causes of patient's rehospitalization (7-9).

In light of the aforementioned issues, the present study aimed to evaluate the causes and risk factors of hospital readmission in patients with ureteral stones treated with TUL in Imam Reza Hospital, Mashhad, northeast of Iran, from March 2018 to September 2019.

## Materials and Methods

### Study Populations and Data Collection

This retrospective study assessed the hospital information system (HIS) of Imam Reza Hospital of Mashhad to include the

patients who had transurethral lithotripsy (TUL) from March 2018 to September 2019. Consequently, 424 patients entered the study and were assessed about re-admission in six months after TUL. Some patients were excluded from the study since they were not re-admitted after TUL (n=217) or were re-admitted for other reasons not related to their TUL (n=22). Finally, 118 patients who had been re-admitted just to remove the double J (DJ) catheter were used as the control group. The case group consisted of 67 patients hospitalized again due to major urinary stone-related complications.

The patient's demographic information and medical history, including anatomical disorder, kidney stone location, number of stones, the maximum diameter of stones, antibiotics used at the time of admission, and antibiotics used at the time of discharge, was also retrieved from medical data recorded in Imam Reza Hospital HIS. Laboratory indices of the patients, including serum urea, creatinine, and urine analysis (UA), were also obtained from the laboratory data center of the hospital.

### Statistical Analysis

All statistical analyses were performed in SPSS software (version 22). The results were described as mean±SD for quantitative variables and number (%) for qualitative variables. The Kolmogorov-Smirnov test was used to determine the normality of the variables. The comparison between the two variables was made using an independent sample t-test (or nonparametric Mann-Whitney test). A p-value of less than 0.05 was considered statistically significant (10).

## Results

A total of 424 patients with TUL surgery were recruited in the present study. The demographic characteristics of the participants are presented in Table 1. As illustrated in this table, the majority of patients (69.7%) were male. The mean age of the patients was 44.9±10.6 years. Based on Figure 1, the most common causes of readmission were re-TUL at the time of DJ stent removal to extract the remaining renal stones (29.9%). The second and third causes of

readmission were reported as fever after DJ stent removal (20.9%) and fever after TUL (14.9%), respectively.

As displayed in Table 2, there was no significant difference between case and control groups in medical history (diabetes mellitus and HTN), the number of stones in the urinary tract, and antibiotics prescribed after discharge. Therefore, these variables had no statistically significant effect on re-hospitalization. Furthermore, as documented in Table 1, significant differences were observed between the two

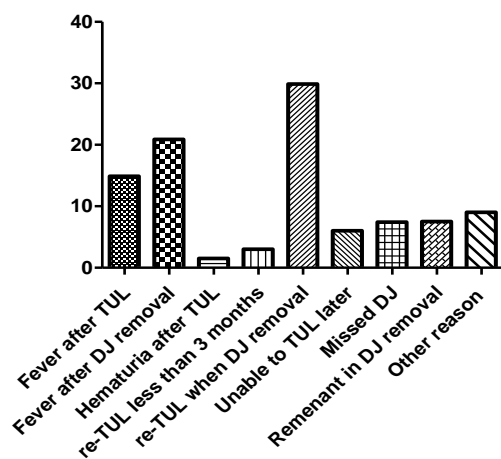
groups in the mean maximum size of the stone reported on imaging modalities, anatomical disorders, such as stenosis and bifid ureter, and the existence of bilateral ureteral stones ( $P < 0.05$ ).

Moreover, as depicted in Table 2, stone size, age, and male gender are the major risk factors for hospital readmission after TUL. In addition, urine culture results were positive in 37.1% of readmitted patients, and *Pseudomonas Aeruginosa* infection (8.6%) was the most common cause of UTI in patients after TUL (Table 1).

**Table 1:** Clinical characteristics of the study participants.

Variable	Total (n=185)	Case (n=67)	Control (n=118)	P value
Age	44.97 ± 10.61	43.25 ± 13.97	46.52 ± 7.77	0.054
Gender				
Male	129 (69.7%)	54 (41.9%)	75 (58.1%)	0.019
Female	56 (30.3%)	13 (23.2%)	43 (76.8%)	
Past Medical History				
Diabetes Mellitus	22 (11.9%)	11 (50%)	11 (50%)	0.163
Hypertension	18 (9.7%)	9 (50%)	9 (50%)	0.208
TUL History	46 (24.9%)	21 (45.7%)	25 (54.3%)	0.157
Anatomical Disorder				
Stenosis	10 (5.4%)	6 (60%)	4 (40%)	0.043
Bifid	2 (1.1%)	2 (100%)	0 (0%)	
Urinary Stone Location				
Right	91 (49.2%)	37 (40.7%)	54 (59.3%)	0.034
Left	85 (45.9%)	24 (28.2%)	61 (71.8%)	
Bilateral	9 (4.9%)	6 (66.7%)	3 (33.3%)	
Urinary Tract Location				
Upper	54 (29.2%)	18 (33.3%)	36 (66.7%)	0.866
Middle	67 (36.2%)	24 (35.8%)	43 (64.2%)	
Lower	63 (34.1%)	24 (38.1%)	39 (61.9%)	
Number of Stones	1.17 ± 0.38	1.23 ± 0.42	1.14 ± 0.35	0.177
Maximum Size	11.78 ± 2.62	12.31 ± 2.52	10.82 ± 2.53	<0.001
Urea	-	38.73 ± 19.80	-	NA
Creatinine	-	1.02 ± 0.55	-	NA
Urine Culture				
Negative	4 (2.1%)	4 (5.9%)	-	NA
<i>Pseudomonas</i>	16 (8.6%)	16 (23.8%)	-	
<i>Escherichia coli</i>	6 (3.2%)	6 (8.9%)	-	
<i>Enterococcus</i>	2 (1.0%)	2 (2.9%)	-	
<i>Candida albicans</i>	1 (0.5%)	1 (1.4%)	-	
Antibiotic When Admitted				
Tazosin	29 (15.6%)	29 (43.2%)	-	NA
Ceftazidim	7 (3.7%)	7 (10.4%)	-	
Ceftriaxon	23 (12.4%)	23 (34.3%)	-	
Meropenem	6 (3.2%)	6 (8.9%)	-	
Antibiotic When Discharged				
Cefixim	168 (90.8%)	60 (89.5%)	108 (91.5%)	0.792
Levofloxacin	17 (9.1%)	7 (10.4%)	10 (8.4%)	

Data are presented as means ± SD.  $P < 0.05$  is considered as statistically significant.



**Figure 1:** Causes of hospital readmission after TUL

## Discussion

Urinary stones are a relatively common urologic disorder affecting about 12% of the world population (11). Today, various treatment options are available for urinary tract stones, including open surgery, TUL, extracorporeal shock wave lithotripsy, percutaneous nephrolithotomy, and medical expulsive therapy (12). The TUL is an endoscopic modality used for the extraction of upper urinary calculi unless the stone is too large to be fragmented and extracted endoscopically (13).

Huffman et al. reported successful endoscopic fragmentation of two large renal pelvic and five large ureteral stones using transurethral ureteropyeloscopy and ultrasonic lithotripsy (14). Nevertheless, this procedure is less efficient in huge stones (15). It has been reported that the TUL procedure can lead to some early complications, such as ureteral perforation and avulsion, as well as late complications, including ureteral constriction (9).

The current study assessed the risk factors and causes of patients' hospital readmission within six months after the initial lithotripsy using the TUL method.

The obtained results pointed out that the most common cause of re-hospitalization was the need for re-TUL when a patient does not have any specific complication and is only referred to the hospital for DJ catheter removal. Fever after DJ catheter removal and fever after TUL were the other causes of

hospital readmission, respectively. In a similar vein, Taei k et al. reported fever as a complication of ureteroscopic lithotripsy (15).

Furthermore, the findings of the present study pointed to significant differences between the two groups in the maximum size of the stone reported on imaging modalities, anatomical disorders, such as stenosis and bifid ureter, and the existence of bilateral ureteral stones ( $P < 0.05$ ). In line with the results of the current study, EL-Nahas et al. reported that patients with medical co-morbidities, large stones, stenting, and hydronephrosis were more liable to post TUL complications requiring hospital re-admission (16).

Moreover, in agreement with the obtained results of our research, in their study on risk factors for post-operative hospitalization after ureteroscopy in patients with urinary stones, Southern et al. indicated that older age, higher BMI, bilateral and larger stones, and pre-stenting are the main risk factors for re-hospitalization (17).

## Limitations

Among the notable limitations of the present study, we can refer to the retrospective nature of the study which did not allow us to monitor the patient's laboratory parameters before and after TUL. The second important limitation was the limited availability of urine cultures which were performed before the TUL.

## Conclusion

As evidenced by the obtained results, stone size, age, and male gender were the major risk factors for hospital readmission after TUL. Furthermore, the most common causes of readmission were re-TUL at the time of DJ catheter removal, fever after DJ catheter removal, and fever after TUL.

## Conflicts of Interest

The authors declare that they have no conflict of interest regarding this manuscript.

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