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Incidence of Febrile UTI after Ureteroscopic Lithotripsy for Patients with Ureteric Stones in Rizgary Teaching Hospital: A Single Center Experience

Wisam Sedeeq Omar*, Pishtewan Hashim Al-Bazzaz and Muhammad Suhaib Al-Mufty

Department of Urology, Rizgary Teaching Hospital, Erbil, Iraq

**Corresponding e-mail: wisamsedeeq85@gmail.com*

ABSTRACT

Purpose: *To identify the incidence and evaluate the risk factor for the development of febrile UTI after ureteroscopic lithotripsy for ureteric stones.* ***Materials and methods:*** *A hospital-based prospective study. Data of 100 patients who underwent ureteroscopic lithotripsy between October 2017 and January 2018 were recorded prospectively. Mean patient age was (40.22 ± 11.354) years. Mean operative time was (25.55 ± 9.585) minutes. Follow-up duration was 1 month. Complete follow up was achieved in 86.9% of the cases.* ***Results:*** *Overall the stone free rate was 75%. The incidence of febrile UTI within the first month was 13%. Significant risk factors were found to be positive preoperative urine culture (53.3% vs. 5.9%, p<0.001), history of DM (46.7% vs. 7.1%, p<0.001), presence of renal stone (46.2% vs. 8.0%, p<0.001) and female gender (60.9% vs. 27.6%, p=0.016).* ***Conclusion:*** *The incidence of febrile UTI was higher than recorded in other studies. A number of significant risk factors were found to be associated with the development of febrile UTI. Judicious measures should be taken both pre and postoperatively in order to eliminate or at least minimize the risk of developing febrile UTI after ureteroscopy.*

Keywords: Febrile UTI, Ureteroscopic lithotripsy, Ureteric stone

INTRODUCTION

Ureteroscopy has progressed from a cystoscopic examination of a dilated ureter in a child with posterior urethral valves by Young, et al., and the initial use of a rigid ureteroscope by Perez-Castro et al., in the early 1980s, to the current state of small caliber semi-rigid and flexible instruments [1-3]. Nowadays ureteroscopy has become the treatment of choice for managing ureteric stones, especially mid and distal ureteric stones [4]. Ureteroscopy has been accepted as the treatment of choice for lower ureteric stones, with stone clearance in up to 80% to 100% of cases, often with 100% stone-free rates by the second day [5]. Despite improved stone-free rates and reduced complication rates through the evolution of the surgical instruments used, perioperative and postoperative complication rates remain moderate. The incidence of immediate, unplanned readmission due to post-URS complications ranges from 1.5% to 14.3% in Western countries [6,7]. Urinary tract infections are among the common complications associated with the ureteroscopic management of stone disease. Infections lead to an increased postoperative hospital stay, readmission rates, and the use of antibiotics leading to increased cost and medication use. Contrarily, overuse of antibiotics can lead to several health issues among this *Clostridium difficile* colitis, bacterial and fungal infections and the emergence of resistant microorganisms are the most common. Recommendations with respect to proper control of comorbidities, appropriate preoperative antibiotic prophylaxis and use of preoperative urine preceding endoscopic intervention have expanded over time.

To better define febrile UTI after ureteroscopy and to identify and eliminate the risk factors associated with postoperative febrile UTI after URS, this prospective study has been done to review the impact of preoperative factors on postoperative infectious complications. The study aims to aid urologists to implement the most appropriate and standardized strategies to reduce the rate of postoperative febrile UTI and unscheduled re-admissions after URS.

PATIENTS AND METHODS

Between October 2017 and January 2018, 100 patients who underwent ureteroscopy for ureteric stones were included

in the study which has been conducted in the urology department, Rizgary Teaching Hospital, Erbil, Iraq. Clinical data were recorded prospectively. Pregnant women, patients with indwelling stents and patients younger than 18 years old were excluded from the study. Patients demographic characteristic including age, gender, BMI, history of DM, stone factors including stone size, location, laterality, presence or absence of hydronephrosis, and preoperative evaluation (history and physical examination to detect any anatomical or congenital abnormalities, urinalysis, urine culture and sensitivity, CBC and renal function tests) were included in the study. Imaging studies included KUB and US or non-enhanced computed tomography (CT urography). Informed consent was obtained from all patients. Patients were admitted on the 1st day preoperatively. Preoperative prophylactic broad-spectrum antibiotics were routinely administered. All procedures were performed under general anesthesia by experienced urologists using a 9.5 Fr semirigid ureteroscope. Stone fragmentation was done by pneumatic lithoclast (Swisslithoclast, Electro Medical Systems, Karl Storz). Continuous low-pressure irrigation system (using normal saline) was used routinely. Stone basket and forceps were used to retrieve stone fragments. A ureteric stent was inserted whenever necessary, but routinely in cases of a solitary kidney, bilateral procedures, renal insufficiency, and ureteric injury. Intraoperative factors including the duration of the procedure, residual stones, placement of DJ or urethral catheters, any mucosal injuries and postoperative antibiotics were recorded. Postoperative febrile UTI was defined as the body temperature of more than 38°C and a positive urine culture (>105 CFU/ml). The patients were divided into two groups according to the absence or presence of postoperative febrile UTI: Group 1 with postoperative febrile UTI, and Group 2 without postoperative febrile UTI. The study protocol was approved by the ethical and scientific committee of the Kurdistan Board of Medical Specialties.

Statistical Analysis

The statistical package for social sciences (SPSS) version 20 was used for data entry and scientific analysis. Chi-square (X^2) was used to compare properties and $p \leq 0.05$ was considered statistically significant.

RESULTS

Of 100 patients included, 64 (64.0%) were males and 36 (36.0%) were females. The age range was 18-74 years with mean age of (40.22 ± 11.354) years. Follow-up duration was 1 month. Mean operative time was (25.55 ± 9.585) minutes. Overall SFR was 75%. Complete follow up was achieved in 86.9% of the cases. Baseline characteristic of the patients is shown in (Table 1).

Table 1 Baseline characteristic of patients included in the study

Characteristics	Mean value (%)
Age (yr)	40.22 ± 11.354
BMI (kg/m^2)	26.39 ± 4.515
Sex	
Male	64 (64.0%)
Female	36 (36.0%)
Hydronephrosis	
Yes	58 (58.0%)
No	42 (42.0%)
DM	
Yes	15 (15.0%)
No	85 (85.0%)
Preoperative Urine Culture	
Positive	15 (15.0%)
Negative	85 (85.0%)
Postop Urethral Catheter	
Yes	6 (6.0%)
No	94 (94.0%)
Stone Level	

Upper	32 (32.0%)
Middle	16 (16.0%)
Lower	52 (52.0%)
Stone Location	
Right	49 (49.0%)
Left	48 (48.0%)
Bilateral	3 (3.0%)
Stone Remnant	
Yes	25 (25.0%)
No	75 (75.0%)
Use of Lithotripsy	
Yes	63 (28.9)
No	37 (71.1)
Operation time (minute)	25.55 ± 9.585
DJ Stent	
Yes	37 (37.0%)
No	63 (63.0%)
Presence of Renal Stones	
Yes	13 (13.0%)
No	87 (87.0%)

Among the 100 patients, 13 patients developed febrile UTI within the first month of the follow-up period, one patient developed urosepsis. Positive preoperative urine culture (53.3% vs. 5.9%, p<0.001), history of DM (46.7% vs. 7.1%, p<0.001), presence of renal stone (46.2% vs. 8.0%, p<0.001) and female gender (60.9% vs. 27.6%, p=0.016) were significantly associated with development of postoperative febrile UTI (Table 2). Stone free rate was lower in Group 1 compared to Group 2 (61.5% vs. 77.0%) but that was statistically insignificant. Presence of preoperative hydronephrosis was more in Group 1 compared to Group 2 (69.2% vs. 56.3%) but also was statistically insignificant. Postoperative DJ stent placement in Group 1 was more compared to Group 2 (38.4% vs. 36.7%). Mean age, BMI, stone size, operative time, stone location, laterality and postoperative placement of Foleys catheter were not shown to be a risk factor for the development of postoperative febrile UTI (Table 3).

Table 2 Variables associated with a high incidence of post-URS febrile UTI

Patient characteristic		Febrile UTI	Non-febrile UTI	p-value
DM	Yes	7 (46.7%)	8 (53.3%)	≤0.05
	No	6 (7.1%)	78 (92.9%)	
Gender	Male	4 (6.3%)	60 (93.8%)	≤0.05
	Female	9 (25.0%)	27 (75.0%)	
Renal Stone	Yes	6 (46.2%)	7 (53.8%)	≤0.05
	No	7 (8.0%)	80 (92.0%)	
Pre-Op Culture	Positive	8 (53.3%)	7 (46.7%)	≤0.05
	Negative	5 (5.9%)	80 (94.1%)	

Table 3 Variable not significantly associated with post-URS febrile UTI

Patient Characteristic		Febrile UTI	Non-febrile UTI	p-value
Age (Year)		39.23 ± 12	40.35 ± 11	0.438
BMI		28.69 ± 4.8	26.04 ± 4.4	0.186
Operation Time/minutes		24.23 ± 9.54	25.74 ± 9.63	0.911
Hydronephrosis	Yes	9 (15.5 %)	49 (84.4%)	0.734
	No	4 (9.5%)	38 (90.4%)	
Location	Upper	4 (12.5%)	28 (87.5%)	0.99
	Mid	2 (12.5%)	14 (87.5%)	
	Lower	7 (13.5%)	45 (86.5%)	

Laterality	Right	8 (16.3%)	41 (83.7%)	0.546
	Left	5 (10.4%)	43 (89.6%)	
	Bilateral	0 (0.0%)	100 (100.0%)	
Postoperative Foley Catheter	Yes	1 (16.7%)	5 (83.3%)	0.783
	No	12 (12.8%)	82 (87.2%)	
DJ Stent insertion	Yes	5 (13.5%)	32 (86.5%)	0.907
	No	8 (12.7%)	55 (87.3%)	
Stone Remnant	Yes	5 (20.0%)	20 (80.0%)	0.229
	No	8 (10.7%)	67 (89.3%)	

DISCUSSION

Advancements have been made in the field of ureteric stones management, constituting the majority of urologic conditions. Although it is considered to be a safe procedure, a number of complications are associated with ureteroscopy. Ureteroscopy related complications are divided into early and late complications. Early complications included intraoperative injuries (as perforation, mucosal tears, false passage, avulsions, and bleeding) and postoperative infectious complications. Late complications included the development of ureteric structure and vesicoureteral reflux [8-10]. Febrile urinary tract infection is a major complication associated with ureteroscopic manipulation, sometimes leading to serious unwanted events. The EAU guidelines identified general and specific risk factors associated with the development of postoperative infectious complications that are important in the preoperative assessment (Table 4), of which an indwelling ureteric stent, previous UTI, and a long preoperative hospital stay are the most important [11].

Table 4 Accepted risk factors for infectious complications of urological procedures

General risk factors	Special risk factors associated with an increased bacterial load
Older age	Long preoperative hospital stay or recent hospitalization
Deficient nutritional status	History of recurrent urogenital infections
Impaired immune response	Surgery involving bowel segment
Diabetes mellitus	Colonization with microorganisms
Smoking	Long-term drainage
Extreme weight	Urinary obstruction
Coexisting infection at a remote site	Urinary stone
Lack of control of risk factors	

Symptoms of postoperative infection range from a low-grade fever to pyelonephritis and bacteremia and urosepsis. Significant infections in the presence of sterile preoperative urine and use of preoperative prophylactic antibiotics are rare, occurring in 0.3% to 1.3% of patients in a large series [12-14]. However, low-grade fever is much more common, which occurs in as many as 6.9% of patients in one series [15]. Positive history of urinary tract infection or infectious stones is associated with an increased risk of postoperative infection rates [16]. The lowest reported rate of fever after ureteroscopy was 1% but it might be as high as 20% [17,18]. The incidence of post-URS febrile UTI in this study was 13%, this study revealed that positive preoperative urine culture, history of DM, the presence of renal stone and female gender were significant risk factors for the development of postoperative febrile UTI. A Korean group reviewed their experience with infectious complications following ureteroscopy and identified several risk factors. They noted an overall UTI rate of 3.8%. Furthermore, they found hydronephrosis, bacteriuria, and an indwelling ureteral stent or nephrostomy tube was associated with an increased risk of post-procedural fever [19]. In our study, preoperatively positive urine culture was found to be the most significant risk factor for the development of postoperative febrile UTI ($p<0.001$) (Figure 1).

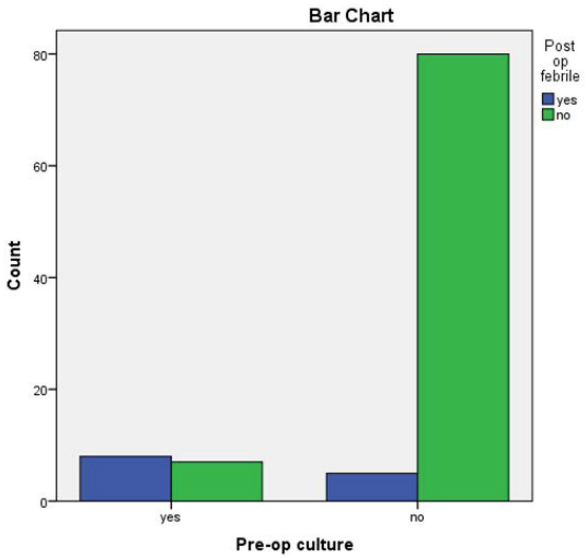

Figure 1 Relationship between positive preoperative urine culture and Post-URS febrile UTI

A positive preoperative urine culture could be considered as being a more significant risk factor for UTI and may influence the development of febrile UTI following the management of stones. Patients with preoperative bacteriuria or UTIs should receive treatment with antibiotics despite the controversy over whether patients with sterile urine should receive prophylactic antibiotics [20]. Kofteridis, et al., showed that an elderly patient with DM showed an increased risk of bacteremia, long hospitalization, and mortality [21]. Another study found that DM could affect urinary stone activity and the recurrence of UTI after the management of infection and stone [22]. Similarly, in this study, DM was another risk factor shown to be significantly associated with postoperative febrile UTI ($p<0.001$) (Figure 2).

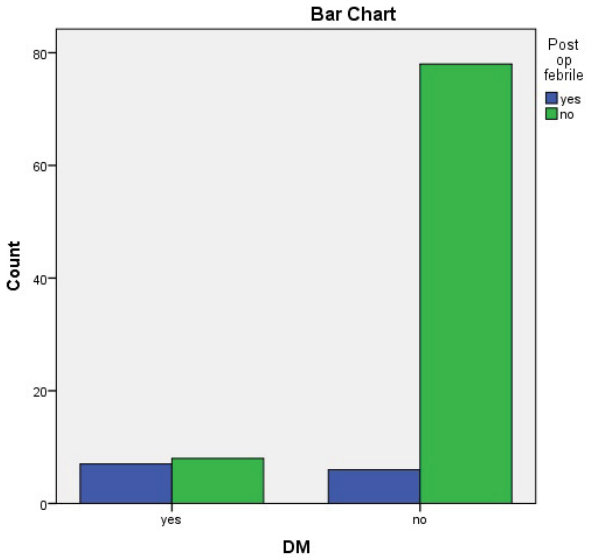

Figure 2 Relationship between DM and post-URS febrile UTI

The finding of the study revealed that there is a higher frequency of postoperative febrile UTI in female population as compared to males (69.2% vs.30.7%, p=0.007) (Figure 3). It is well established, in the general population, that UTIs are more frequent in females compared to males, apparently due to shorter urethra allowing easier bacterial colonization, females also have a higher frequency of infectious stones, which are formed when the urinary tracts are colonized with urease-producing bacteria (e.g. *Proteus SPP*) [23,24].

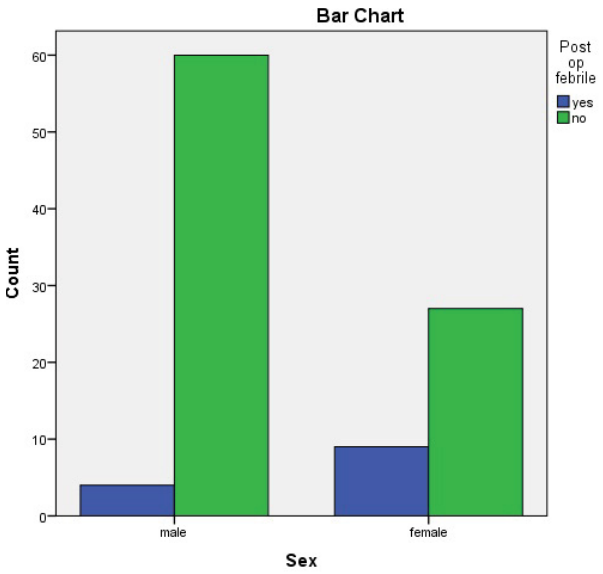

Figure 3 Relationship between gender and post-URS febrile UTI

Concomitant renal stone was associated with a higher rate of febrile UTI (46.2% vs. 8.0%, p<0.001) (Figure 4). Renal stone patients are at elevated risk of developing infected stone (struvite stone and calcium carbonate apatite stone). Patients with an accompanying renal stone had a higher risk of having a remnant stone that had previously been exposed to infected urine, and acting as a source of bacteria placing the patient at a higher risk of developing post-operative febrile UTI.

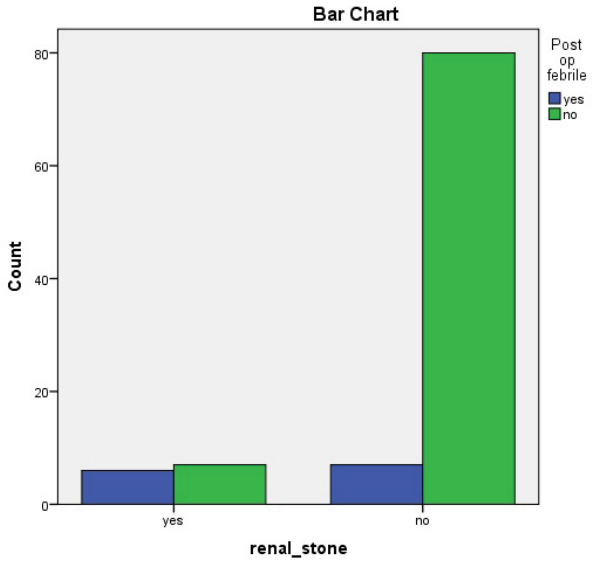

Figure 4 Relationship between concomitant renal stone and post-URS febrile UTI

A recent meta-analysis showed that ureteric stenting is associated with a higher rate of bothersome LUTS [25]. The risk of pyuria or pyelonephritis in non-stented patients tended to be lower but not significantly so (risk ratio=0.55, 95% CI 0.29-1.07; p=0.08). In the study of Ibrahim, et al., early postoperative complications, including low-grade fever and urinary tract infection were observed in 22 patients (20%) with no ureteric stent placement and 19 (19%) in patients with ureteric stent placement, a non-significant difference [26]. The present study also showed that placement of DJ stent was not significantly associated with the development of postoperative febrile UTI (13.5%) in stented patients and (12.7%) in non-stented patients. A study showed that postoperative UTI rate was lower in stone-free patients than in patients with remnant stone (38% vs. 64%) [22]. However, in our study, there was not much difference

between the two groups for the stone-free rate (61.5% vs. 77.0%). EAU guidelines suggest that the risk of developing postoperative infections in patients with a proximal ureteric stone is similar to that in patients with renal stones [27,28]. In this study, the risk of developing postoperative febrile UTI was not different between proximal and lower ureteric stones (4 (12.5%) vs. 7 (13.5%), p=0.990).

Limitation of the study might be the relatively small number of the patient enrolled in the study, and additional information regarding the status of infection (stone culture, blood culture) or stone analysis were lacking, of paramount importance is a stone culture which has shown to be superior to urine culture in predicting the occurrence of sepsis.

CONCLUSION

The present study showed that the incidence of post-URS febrile UTI is much higher than what is mentioned in other literature. Certain risk factors were shown to be associated with the increased incidence of post-ureteroscopy febrile UTI. In particular, preoperative positive urine culture, DM, concomitant renal stones and female gender were significant risk factors. The study results suggest that more active infection control strategies should be considered and patients with the aforementioned risk factors should be given adequate attention, including good control of blood sugar, preoperative urine culture and appropriate pre-operative and postoperative antibiotics to prevent or at least decrease the incidence of post-URS febrile UTI.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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