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Original Research Article

Predictors of febrile urinary tract infection after ureterorenoscopy for urinary stones

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ABSTRACT

Background: Ureterorenoscopy is a frequently used technique for the treatment of urolithiasis which provides high success rates when used under proper indications. Febrile urinary tract infection (FUTI) and urinary sepsis is the most frequent among its scarce complications. It often results secondary to urinary tract obstruction associated with urolithiasis, but also may occur after urinary tract manipulation such as ureterorenoscopy, clinical presentation varies from self-limited fever to the development of septic shock with the need for vasoactive agents or even to the patient's death. This study has been designed to determine our rate of postoperative FUTI and sepsis after ureterorenoscopy, as well as to identify those factors that have been associated with its development.
Method: Prospective study done on 219 patients who underwent ureterorenoscopy for urinary lithiasis in government medical college, Kottayam from February 2021-March 2022. Personal, clinical, surgical and microbiological data were collected. Patients who develop FUTI, urinary sepsis during 30 days following intervention were identified. Statistical analysis will be performed by chi squared test/fishers exact test; logistic regression as appropriate.
Results: Our studies show incidence rates of postoperative FUTI in 11% and sepsis in 1.3%. Following statistical analysis, it was discovered that double J urinary diversion, a positive preoperative urine culture, diabetes, prolonged operational time, and intraoperative dilatation were all high-risk factors for the development of UTI after instrumentation.
Conclusions: Ureteroscopy-associated urosepsis is a nosocomial infection. With the increasing popularity of ureteroscopic procedures, it is imperative that patients with increased risk are addressed appropriately, and suspected sepsis must be speedily and aggressively managed.

Keywords: FUTI, Ureterorenoscopy, Urinary sepsis

INTRODUCTION

Urolithiasis is one of the most common conditions encountered in urology. The 12 % of the population is expected to have urinary stones, out of which 50% may end up with renal damage or loss of kidneys.[6,7] Urolithiasis patients frequently suffer renal or ureteral colic, which causes intense discomfort and is typically accompanied by additional symptoms such as nausea, vomiting, and hematuria, lowering their quality of the life.

Ureteroscopy for the treatment of urinary stones has various advantages thanks to technological advancements, including reduced procedural invasiveness and a high success rate. When done properly, ureterorenoscopy is a widely utilized procedure for the treatment of lithiasis that has a high success rate.

Among the few problems, FUTI and urinary sepsis are not uncommon. According to recent publications, the total complication rate of ureteroscopic surgeries ranges from 9% to 25%.[1-4]

UTI, ureteral injuries, hematuria, and postoperative renal colic have all been documented as common consequences. Infectious complications after URS are a common and serious concern, especially as the criteria for the procedure grow to include elderly or co-morbid patients, as well as individuals with large or difficult stones.

Urosepsis is a systemic response to a urogenital tract infection that can be life-threatening. It usually occurs as a result of urinary tract obstruction, but it can also happen after urinary tract manipulation, such as ureterorenoscopy. Clinical presentation ranges from self-limited fever to septic shock requiring use of vasoactive agents/even death. Morbidity and mortality are unacceptable for this age range in an elective operation due to the typical presentation of urolithiasis in younger individuals. As a result, identifying the elements that contribute to its development is critical in order to avoid or detect it early. Hence this research is critical in current situation, as it aids clinicians in anticipating issues.

There has been a huge increase in the number of studies on risk factors, as urologists have gained a better understanding of urosepsis. Urinary sepsis and a positive preoperative urine culture are the most common characteristics in research with this goal, despite the fact that the outcomes are highly variable. In this view, the presence of a urethral catheter, sex (female), diabetes mellitus, immunosuppressive conditions, are the variables linked to the development of UTI.

It is unclear what impact these factors have in the development of sepsis during ureterorenoscopy. Similarly, a double J stent, as well as antibiotic medication administered before and after surgery, may influence the risk of sepsis following urinary manipulation.

As majority of the affected population with stone disease are adults between age of 30 to 50 years, morbidity and mortality fallowing surgery in these age group have a very bad impact on their family as well as to the society. Hence this study has been designed to determine our rate of postoperative FUTI and sepsis after ureterorenoscopy, as well as to identify those factors that have been associated with its development.

METHODS

This was a prospective Observational study conducted in department of genitourinary surgery, govt. medical college, and Kottayam Kerala from May 2021 to April 2022. No ethical approval required for present study.

Sample size

Based on the result studied by Mitsuzuka et al 153 patients undergoing ureterorenoscopy for renal and/or ureteral stones between 2011-2013 at a single centre were reviewed to detect factors predicting postoperative FUTI and sepsis.[1] After ureterorenoscopy, 28 (18.3%) developed FUTI. considering the above values, a total of 226 patients are required for the present study.

Sample size $=Z^2P(1-P)/D^2$

Z=Standard normal variant (1.96)

P=Expected proportion in population based on previous studies

D=Absolute error.

$N=(1.96)^2 \times 0.18(1-0.18)/(0.05)^2$

N=226

Inclusion criteria

Patients undergoing ureterorenoscopy for urinary lithiasis in our center will be included for evaluation.

Exclusion criteria

Patients undergoing combined treatment with percutaneous nephrolithotomy (PCNL), lithiasis treatment in kidney transplant, performance of another endoscopic procedure together with ureterorenoscopy (transurethral resection of the prostate or bladder) were excluded.

Materials and methods

The covariates consisted of general information (age, gender, BMI, co morbidities), history taking and physical examination will be done. pre-operative laboratory tests (white blood cell-WBC, urine culture, renal function tests), non-enhanced computed tomography (NECT-KUB) will perform in every patient before surgery to note stone characteristics (stone burden, location) and surgery-related information (operation time, technique, complications) and postoperative events if any with postoperative antibiotics, urine culture and blood tests (when indicated) are collected in Performa. Informed written consent will be taken from all the study participants. The stone burden was calculated by multiplying the longest diameter by the perpendicular diameter of the stone, and the sum of each stone as the total stone burden in cases of multiple stones. The presence of Postoperative fever was defined as a body temperature over 38-degree celsius. Sepsis referred to the state of acute circulatory failure characterized by persistent arterial hypotension.

Patients who develop FUTI, urinary sepsis during 30 days fallowing intervention were identified. Statistical analysis will be performed by chi squared test or fishers exact test; logistic regression as appropriate.

RESULTS

A total of 219 patients enrolled in study after assessment for inclusion criteria and exclusion criteria after taking an informed consent. With detailed history and examination, all patients underwent necessary blood, urine chemistries, and were subjected to undergo non contrast CT KUB. In 219 patients age distribution ranged from 17-70 years, maximum cases in age group of 41-50 years (74 cases, 33.8%) followed by more than 50 years (57 cases, 26%). In all 219 patients, 70% were males and 30% females.

Table 1: Patients with diabetes mellitus.

Diabetes	Frequency	Percentages (%)
Absent	169	77.2
Controlled	37	16.9
Uncontrolled	13	5.9
Total	219	100

The 219 patients, 20 (23%) patients were diabetic of which 13 (6%) patients had uncontrolled sugars.

Table 2: Pre-operative urine culture.

Variables	Frequency	Percentages (%)
Present	19	8.9
Absent	200	91.1
Total	219	100

The 219 patients, 20 (9.1%) had urine culture positive.

Table 3: Pre-operatively DJ stented patients.

DJ stent	Frequency	Percentages (%)
Present	45	20.5
Absent	174	79.5
Total	219	100

In 219 patients 45 (20%) patients were stented.

Table 4: Duration of surgery.

Duration (Min)	Frequency	Percentages (%)
<90	189	86.3
>90	30	13.7
Total	219	100

In 189 (86%) patients, surgery was done within 90 min and 30 (13%) patients it took more than 90 min.

Table 5: Post-operative outcome in <24 hours.

Post-op outcome	Frequency	Percentages (%)
No	195	89
Yes	24	11
Total	219	100

Of 219 patients, 24 (11%) had post-op fever in day 1.

Table 6: Fever persisting beyond 24 hrs up to 7 days.

Variables	Frequency	Percentages (%)
No	207	94.5
Yes	12	5.5
Total	219	100

Of 219 patients, 12 (5.5%) patients had fever beyond day 1. 3 patients went to sepsis requiring ICU care.

Sixteen patients who had post-op fever had diabetes, of which 6 uncontrolled. There is significant association between DM, post-op FUTI as p is significant (Table 7).

Twenty patients who had post-op fever were stented pre-op. There is significant association between pre-op stenting and post-op FUTI as p is significant (Table 8).

Fifteen patients had pre-op urine culture positive, who developed fever post-op with significant association (Table 9).

Table 7: Post op FUTI with respect to diabetes mellitus.

Diabetes	Post op fever				Total		X^2	Df	P value
	Present		Absent						
	N	%	N	%	N	%			
Absent	8	4.7	161	95.3	169	100	27.65	2	<0.001
Controlled	6	16.2	31	83.8	37	100			
Uncontrolled	6	46.2	7	53.8	13	100			
Total	20	9.1	199	90.9	219	100			

Table 8: Post op FUTI with respect to pre-stenting.

DJ stent	Post op fever				Total		X^2	Df	P value
	Present		Absent						
	N	%	N	%	N	%			
Present	20	44.4	25	55.6	45	100	85.11	1	<0.001
Absent	0	0	174	100	147	100			
Total	20	9.1	199	90.9	219	100			

Table 9: Post op FUTI with respect to pre-op culture.

Pre-op UTI	Post op fever				Total		X^2	Df	P value
	Present		Absent						
	N	%	N	%	N	%			
No	15	62.5	9	37.5	24	100	92.51	1	<0.001
Yes	5	2.6	190	97.4	195	100			
Total	20	9.1	199	90.9	219	100			

Table 10: Post op FUTI with respect to duration of surgery.

Duration (min)	Post op fever				Total		X^2	Df	P value
	Present		Absent						
	N	%	N	%	N	%			
<90	11	5.8	178	94.2	189	100	19.24	1	<0.001
>90	9	30	21	70	30	100			
Total	20	9.1	199	90.9	219	100			

Nine patients' surgery prolonged beyond 90 mins, who developed post op fever. There was a significant association with p<0.001.

DISCUSSION

A febrile UTI and urine sepsis are the result of a complex process, involving several precondition factors. Identification of these, promotes sepsis treatment that are both timely and effective. As a result, urinary sepsis after ureterorenoscopy is a potentially significant consequence that might endanger the patient life, as it did in the three instances in our study who were admitted to the critical care unit fallowing procedure. A total of 219 patients were enrolled in our study after assessment for inclusion criteria and exclusion criteria after taking an informed consent.

In 210 (95.9%) patients, presentation was pain abdomen and only 9 (4.1%) were asymptomatic at presentation. our patients, age distribution ranged from 17 to 70 years, the maximum cases were in the age group of 41 to 50 years (74 cases, 33.8%) followed by more than 50 years (57 cases, 26%), and 170 patients were male contributing 70% and 65 (30%) were females. Patients who had post-operative fever were in the age group of 41-60 years, contributing 24%. In our study, UTI of 65 females, 10 (15%) patients had post op FUTI compared to 10 (6%) out of 154 males. This was in favour to literature and other studies. As they show increased incidence in female patients, due multiple factors of which, short urethra favoring colonization of bacteria is most important.

In our study, 50 (23%) patients were diabetic of which 50% of these diabetic patients had uncontrolled sugars. We noted that 16 patients who had post-operative fever were diabetics, of which 6 had uncontrolled glycemic status (HbA1c >8). There was significant association between diabetes and post-operative fever (p<0.001). Which substantiates that, decreased immunity in diabetics and uncontrolled glycemic status is a risk factor for febrile UTI post instrumentation. Tian et al in his study also stress the presence of diabetes is a risk factor for development of post-operative UTI.[2]

For all patient's preoperative urine culture was performed of which 20 (9.1%) had urine culture positive. And all culture positive patients were treated with culture sensitive antibiotics., 18 patients presented with post-operative fever in spite of proper perioperative antibiotics after procedure. Our study showed a significant association between pre-operative culture positive and post-operative outcome (p<0.001). Two patients who were culture positive, progressed to sepsis requiring Intensive care monitoring, although these 2 patients had double J stent in situ and one among them was a diabetic with HbA1c>8. All these factors might have caused them to progress to sepsis. Because antibiotic therapy provided during the clinical onset of lithiasis is insufficient to prevent the development of sepsis after elective surgery, the role of a preoperative urine culture in treating patients with a positive urine culture is critical.

Preoperative urine culture positive is a well-known risk factor for urinary sepsis. As a result, all candidates for ureterorenoscopy should have preoperative urine cultures conducted, and the precise criteria for antibiotic prophylaxis in patients with bacteremia prior to surgery must be followed.

Mitsuzuka et al studied 153 patients and concluded that pyuria is a high risk for developing FUTI and sepsis.[1] Diaz et al studied 246 patients who underwent ureterorenoscopy.[4] After the surgery, 18 patients (7.3%) had urinary sepsis, with 10 (55.5%) occurring within the first 24 hours. Conclude, the clinical debut of urolithiasis as urinary sepsis, receiving antibiotics or requiring urinary diversion by a double J during debut, positive pre surgical culture were all found to be significantly associated with the development of urinary sepsis after ureterorenoscopy.

Of all 219 patients, 45 (20%) patients were stented preoperatively before the admission. We noted that 20

(45%) patients on stents preoperatively developed FUTI post procedure. Statistical analysis shows significant association with p>0.001. Ureterorenoscopy with a double J stent for urgent urine diversion is associated with the development of a FUTI and sepsis.

Kim et al in their study, 43 patients had a postoperative FUTI (14.1%).[3] The operation time was found to be an independent risk factor for FUTI following URS in multivariate analysis. The operation time cut-off value for an elevated risk of FUTI was 70 minutes. Tian li et al also conclude increased operative time is a risk for post-operative infection.[2] In our study 9 patients' surgery prolonged beyond 90 mins, who developed post op fever. There was a significant association with p<0.001

Mitsuzuka et al warn that, patients with ureteral stents have high risk for developing FUTI and sepsis in their study.[1] It was also noted that in 30 patients surgery prolonged beyond 60 mins, among them 9 patients developed post-operative fever. There was a significant association (p>0.001) and also in patients in whom intra operative dilation either with balloon dilation or path finder also had significant association in developing post-operative fever. Stating increased operative time in way it reflects large stone burden have high risk for post of infection.

This study had several limitations. DJ stent and antibiotics were used preoperatively at physician's discretions, clear indications were not defined. Stone culture which is important in predicting post op outcome was not taken into consideration in present study.

CONCLUSION

Infectious complications after ureteroscopy can cause significant morbidity and even death. Despite the fact that the majority of these are modest, efforts must be made to reduce them, particularly in high-risk individuals. Prophylactic antibiotics, reducing Double J duration and operative duration, early detection and treatment of UTI and urosepsis and careful planning in patients with substantial stone burdens and other co morbidities are all examples of this. Although not all causative pathogens were identified, *Enterobactericia* spp. and *P. aeruginosa* was the most frequently reported pathogen, which was isolated in more than half of the patients with a FUTI. Moreover, to prevent postoperative UTI, it will be necessary to optimize sugar levels in diabetics, avoid or reduce pre procedural stent placements, treat positive urine culture with appropriate antibiotics and try to reduce the operation time.

In conclusion, female sex, a prolonged pre procedural stent dwelling time, high stone burden, long surgical time, positive preoperative urine culture, and the presence of diabetes mellitus were found to increase the risk of FUTI and urinary sepsis after ureterorenoscopy. Despite adequate prophylactic antibiotics, postoperative FUTI after URS developed in 11% and urinary sepsis in 1.3% of patients at our institution.

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