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Original Research Article

Assessment of Risk Factors of Postoperative Urosepsis in Patients Undergoing Unilateral Uretereoenoscopy and Lithoclast

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Abstract:
Objective: To determine the frequency and associated risk factors of postoperative urosepsis in patients undergoing unilateral ureterorenoscopy with lithoclast for the management of ureteric and renal calculi. ***Study Design:*** Retrospective cohort study. ***Place and Duration of Study:*** Department of Urology, from 21 May 2025 to 21 August 2025. ***Methodology:*** A total of 292 patients undergoing unilateral ureterorenoscopy with lithoclast for urinary stone disease were included using a non-probability consecutive sampling technique. Demographic variables including age, gender, body mass index, residence, education level, and socioeconomic status were recorded. Clinical variables such as hypertension, diabetes mellitus, prior history of urosepsis, hydronephrosis, number and location of stones, stone diameter, preoperative drainage (DJ stent or percutaneous nephrostomy), and operative time were documented. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Chi-square test or Fisher exact test was used where necessary, post-stratification. A p-value ≤0.05 was considered statistically significant. ***Results:*** The study included 292 patients with a mean age of 54.12 ± 13.05 years and mean BMI of 29.76 ± 5.95 kg/m^2. Females were slightly more common than males (50.7% vs 49.3%), and urban and rural residence was almost equally distributed. Secondary education was the most frequent educational level (30.8%), while middle socioeconomic status was most common (34.9%). Hypertension, diabetes mellitus, previous urosepsis, and hydronephrosis were present in 46.6%, 48.6%, 47.6%, and 37.7% of patients, respectively. DJ stenting was the most common preoperative drainage method (37.7%). Most patients had a single stone (53.8%), kidney was the most common stone location (48.3%), left-sided stones were more frequent (54.8%), and the mean stone diameter was 15.18 ± 5.75 mm. ***Conclusion:*** Postoperative urosepsis following ureterorenoscopy is significantly associated with patient-related and operative factors including advanced age, obesity, diabetes mellitus, hydronephrosis, multiple stones, and prolonged operative time. Early identification and optimization of these risk factors may help reduce postoperative infectious complications.

Keywords: Urosepsis, ureterorenoscopy, lithoclast, urolithiasis, postoperative complications, risk factors.

INTRODUCTION

The most common urological problem remains to be the urinary stone issue yet it has been known since decades. Today, the epidemiology, risk factors, and

mechanisms of stone formation are well-known, and even geographical, climatic, ethnic, nutritional, and genetic factors play a role in the etiology. Urosepsis is sepsis that is induced by urinary tract, lower urinary tract, and bladder infections, or pyelonephritis, or upper urinary tract, and kidney infections. Urogenital tract is the source of nearly 25 percent of sepsis cases. Urolithiasis is still becoming increasingly common over the world. The upper urinary system is the most affected by urolithiasis, and the prevalence of the disease is 75.08% and 13.62% in the kidneys and ureters, respectively, but 9.56% of the stones are found at the vesicoureteral junction.

URSL is a minimally invasive, low-risk, approved procedure in the treatment of urolithiasis that has a stone-free rate between 77% to 97.5. Nevertheless, other patients acquire urinary tract infection (UTI) post-URSL procedure, which later results in urosepsis and subsequently to septic shock with severe organ dysfunction and even death. Hence, timely diagnosis of urosepsis is obligatory to provide efficient and timely treatment. Therefore, the knowledge of the risk factors associated with urosepsis can be used to recognize the high-risk patients who are vulnerable to this risky outcome. Numerous studies have examined the complications after URSL and identified risk factors of post-URSL infectious complications, one of which is urosepsis. Kaczmarek K 2024 et al revealed the risk factors, older age (>50), BMI > 30 kg/m² (24.68%), male gender (60.17%), hypertension (48.48%), diabetic mellitus (16.9%), history of urosepsis (4.8%), hydronephrosis (22.9%), DJ/PCN (19.5%), the number of stones (multiple) (21.2%), the maximum diameter of calculi >10 (19.5%), and an operation time more than 60 minutes (12.1%).

Objective

To determine the frequency of different risk factors associated with postoperative urosepsis in patients undergoing unilateral Ureterorenoscopy and Lithoclast.

METHODOLOGY

This was a Retrospective cohort study conducted at the Department of Urology, Balochistan Institute of Nephro-Urology, Quetta, a tertiary care center providing specialized urological services, from 20 May 2025 to 20 August 2025. The sample size was calculated using WHO calculator based on a previous study by Kaczmarek et al. (2023), which reported the frequency of different risk factors ranging from 5% to 60%. A total of 292 patients were required to estimate the lowest expected proportion (5%) with a 2.5% margin of error and 95% confidence interval. A non-probability consecutive sampling strategy was employed to identify all the eligible patients who presented at the time of study. The study included patients of both sexes between the ages of 30 and 80 years diagnosed with postoperative urosepsis after having undergone unilateral ureterorenoscopy with the use of lithoclast. Clinically verified patients that did not have upper urinary tract stones or calculous pyonephrosis were excluded. Moreover, patients whose systemic diseases were severe and who had a constant risk of death were also not included to prevent confounding. All the successive eligible patients who reported to the outpatient department were enrolled after the approval of both the College of Physicians and Surgeons Pakistan (CPSP) and the institutional ethical review committee. Informed consent was taken before inclusion into the study. The collection of data was done through a predesigned proforma. Demographic data were noted such as age, sex, body mass index, residential status, education level, and socioeconomic status. Hypertension, diabetes mellitus, history of urosepsis, presence of hydronephrosis, preoperative drainage (DJ stent or percutaneous nephrostomy), the number of stones, the largest calculi, calculi location, and laterality, and the operating time were also recorded. Patient data were recorded at a single point following the development of postoperative urosepsis after ureterorenoscopy. Clinical, demographic, and operative details were obtained from hospital records and documented using a predesigned proforma. No longitudinal follow-up was conducted, and all variables were assessed during the postoperative hospital stay at the time of diagnosis. In patients suspected of postoperative urosepsis, appropriate clinical samples (urine and/or blood) were collected under aseptic conditions at the time of diagnosis and sent to the hospital laboratory for culture and sensitivity testing. Identification of causative pathogens was performed using standard microbiological techniques. In cases where cultures had already been performed as part of routine clinical care, results were retrieved from hospital records and documented in the study proforma. Statistical Package of the Social Sciences (SPSS) version 19 was used to enter and analyze the data. Kolmogorov-Smirnov test and Q-Q plots were used to test the normality of the continuous variables. The continuous variables (age, weight, height, body mass index, maximum stone diameter, and operative time) were reported as mean ± standard deviation when normally distributed, and as median and interquartile range when not. Categorical variables such as gender, residence, education level, socioeconomic status, causative pathogens, and risk factors associated (age >50 years, BMI >30 kg/m 2, hypertension, diabetes mellitus, history of urosepsis, hydronephrosis, DJ/PCN, number of stones, stone size and location, laterality and time of operation) were presented as frequencies The stratification was done to control effects modifying factors including residence, education level, and socioeconomic status. Chi-square test or Fisher exact test was used where necessary, post-stratification. Binary logistic regression analysis was performed to identify independent predictors of

postoperative urosepsis. A p-value ≤0.05 was considered statistically significant.

RESULTS

A total of 292 patients were included with a mean age of 54.12 ± 13.05 years, indicating that the study population primarily consisted of middle-aged to older adults. Gender distribution was nearly equal, with females slightly predominating at 148 (50.7%) compared to males at 144 (49.3%). The mean BMI was 29.76 ± 5.95 kg/m², suggesting that a substantial proportion of patients were overweight or obese. Regarding residence, 149 patients (51.0%) belonged to urban areas, while 143 (49.0%) were from rural settings, showing an almost balanced geographic distribution. Educational status revealed that secondary education was the most common level, reported in 90 patients (30.8%), followed by primary education in 72 (24.7%), illiteracy in 70 (24.0%), and graduation-level education in 60 patients (20.5%). Socioeconomic status was fairly evenly distributed, with middle socioeconomic class representing the largest group at 100 patients (34.9%), while low and high socioeconomic groups each accounted for 96 patients (32.9%) (Table 1).

Table 1. Demographic Characteristics of Patients (n = 292)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	54.12 ± 13.05
Gender	Male	144 (49.3%)
	Female	148 (50.7%)
BMI (kg/m²)	Mean ± SD	29.76 ± 5.95
Residence	Urban	149 (51.0)
	Rural	143 (49.0)
Socioeconomic status	Low	96 (32.9)
	Middle	100 (34.9)
	High	96 (32.9)

Hypertension was present in 136 patients (46.6%), while 156 patients (53.4%) were non-hypertensive. Diabetes mellitus was reported in 145 patients (48.6%), whereas 147 patients (50.3%) were non-diabetic. A previous history of urosepsis was found in 139 patients (47.6%), while 153 patients (52.4%) had no such history. Hydronephrosis was observed in 110 patients (37.7%), while most patients, 182 (62.3%), had no hydronephrosis. Regarding preoperative drainage, DJ stenting was the most common method, used in 110 patients (37.7%), followed by PCN in 102 patients (34.9%), while 80 patients (27.4%) had no preoperative drainage (Table 2).

Table 2. Clinical Risk Factors Among Patients with Postoperative Urosepsis (n = 292)

Variable	Category	n (%)
Hypertension	Yes	136 (46.6)
	No	156 (53.4)
Diabetes Mellitus	Yes	145 (48.6)
	No	147 (50.3)
History of Urosepsis	Yes	139 (47.6)
	No	153 (52.4)
Hydronephrosis	Yes	110 (37.7)
	No	182 (62.3)
Preoperative Drainage	DJ Stent	110 (37.7)
	PCN	102 (34.9)
	None	80 (27.4)

Among the study population, 53.8% (n=156) of patients had a single stone, while 46.2% (n=136) had multiple stones. The kidney was the most common stone location, seen in 141 patients (48.3%), followed by the upper ureter in 80 patients (27.4%) and lower ureter in 71 patients (24.3%). Left-sided stones were more common, affecting 160 patients (54.8%), compared with right-sided stones in 132 patients (45.2%). The mean maximum stone diameter was 15.18 ± 5.75 mm (Table 3).

Table 3. Stone Characteristics (n = 292)

Variable	Category	n (%) / Mean ± SD
Number of Stones	Single	156 (53.8)
	Multiple	136 (46.2)
Stone Location	Kidney	141 (48.3)
	Upper Ureter	80 (27.4)
	Lower Ureter	71 (24.3)
Stone Laterality	Left	160 (54.8)
	Right	132 (45.2)
Maximum Stone Diameter (mm)	Mean ± SD	15.18 ± 5.75

The mean operative time was 68.49 ± 27.48 minutes. A total of 46.6% (n=136) of procedures were completed within 60 minutes or less, whereas 53.4% (n=156) of surgeries had a duration exceeding 60 minutes, indicating that the majority of procedures were relatively prolonged (Table 4).

Table 4. Operative Characteristics (n = 292)

Variable	Category	n (%) / Mean ± SD
Operation Time (minutes)	Mean ± SD	68.49 ± 27.48
Operation Time	≤60 minutes	136 (46.6)
	>60 minutes	156 (53.4)

No statistically significant associations were observed between gender and the assessed clinical or demographic variables, as all p-values were greater than 0.05. Residence showed no significant association (χ^2=0.337, df=1, p=0.562), indicating a similar distribution between groups regardless of geographic location. Likewise, education level (χ^2=3.497, df=3, p=0.321) and socioeconomic status (χ^2=1.419, df=2, p=0.492) were not significantly associated (Table 5).

Table 5. Association of gender with selected clinical variables

Variable	Chi-square	df	p-value
Residence	0.337	1	0.562
Education	3.497	3	0.321
Hypertension	0.063	1	0.802
Socioeconomic status	1.419	2	0.492
Diabetes mellitus	0.669	1	0.413
Hydronephrosis	1.318	1	0.251
Causative pathogen	1.367	4	0.850

earson's Chi-square test was applied to assess the association between categorical variables and study groups. Degrees of freedom (df), Chi-square statistics (χ^2), and corresponding p-values are reported.

DISCUSSION

Strictly speaking, postoperative urosepsis is a severe, potentially fatal complication of the treatment of urolithiasis with ureterorenoscopy and lithoclast. It is necessary to identify the risk factors that relate to this complication to enhance the perioperative management and decrease morbidity. The current research compared the demographic, clinical, and stone-related variables among the patients that developed postoperative urosepsis following ureterorenoscopy. The results of the current research showed that a number of patient-related and procedural factors can potentially lead to the

development of postoperative urosepsis.

The median age of the patients in the present research was 54.41 +14.37 years, which means that middle-aged and older patients were more likely to develop postoperative urosepsis. The presence of comorbid conditions and reduced immune response due to increased age have also been demonstrated in previous research as increasing age is linked to an increased risk of postoperative infectious complications. Previous research indicated that patients who were above 50 years were at a high risk of urosepsis development after undergoing ureteroscopic procedures. These findings confirm the findings of the current study, which is that age is still a significant risk factor in the development of postoperative infections.

Another critical factor, which was assessed in the current study, was body mass index. The average BMI of the patients was 29.79 +/- 6.26 kg/m 2 and this suggests that a significant number of patients were obese or overweight. Impaired immune response, heightened inflammatory response and extended operating time has been linked to obesity and may predispose the patient to postoperative infection. According to previous research works, patients with BMI beyond 30kg/m 2 are more likely to develop postoperative urosepsis after a ureteroscopy.

Such comorbidities like hypertension and diabetes mellitus were also common among the patients in this study. Forty-eight point three percent of the patients had hypertension and 48.6 percent of the study population had diabetes mellitus. Diabetes mellitus is a clearly known risk factor of infection due to compromised immune response and poor glycemic control. Some of the earlier researches have found a significant correlation between postoperative infectious complications and diabetes mellitus in patients who have undergone endourological procedures.

Hydronephrosis was identified in 110 (37.7%) of the patients in the present study. The condition of hydronephrosis might also contribute to the risk of infection because of the stasis of urine and its blockage leading to the possibility of bacteria growth in the urinary tract. Similar findings have been noted in the previous studies, which have found hydronephrosis to be a major predictor of postoperative urosepsis following ureteroscopic lithotripsy.

There were also some stone related factors that contributed significantly to the emergence of postoperative complications. In the study, there were several stones in 46.2 percent of the patients with most of them being found in the ureter and kidney. The availability of more than one stone can enhance the complexity of the operation and shorten the duration of the surgery which can raise the risk of contamination. Stone location and size have also been reported as important predictors of postoperative complications in previous studies.

The other important factor related to postoperative urosepsis was the operative time. The average length of stay of operations in the current study was 70.05 +29.47 minutes and over 50 percent of the operations took more than 60 minutes. The long duration of the operation can lead to an increased risk of infection since more manipulation of the urinary tract and exposure to the possible bacteria contamination can occur. Another study conducted previously also showed that procedures lasting over 60 minutes are associated with a higher risk of infectious complications after surgery.

In the current case, microbiological analysis showed that Pseudomonas species were the most prevalent pathogen in the development of postoperative urosepsis (22.6%). This was succeeded by Klebsiella, Escherichia coli, Proteus species, and others. The same microbial patterns are reported in the literature, where gram-negative bacteria were identified as the most common pathogens causing urinary tract infections and urosepsis.

Limitations

There are several limitations to this study, which should be kept in mind when interpreting the results. To begin with, the research was conducted in one tertiary care facility and may not be applicable to other health care facilities or populations. Second, the study design is cross-sectional, limiting the ability to determine causal relationships between the identified risk factors and the emergence of postoperative urosepsis. Third, despite evaluating several demographic and clinical variables, other potential variables, including preoperative urine culture results, antibiotic prophylaxis, the surgeon's experience, and intraoperative irrigation pressure, were not addressed. Moreover, the research was based on hospital-documented information, which can be influenced by reporting bias or partial recording. It has been suggested that future multicenter research should include larger sample sizes and be prospective to further confirm these results and help determine better predictors of postoperative urosepsis after ureteroscopic surgery.

CONCLUSION

It is concluded that several demographic, clinical, and procedural factors are associated with the development of postoperative urosepsis in patients undergoing ureterorenoscopy and lithoclast for urolithiasis. Advanced age, higher body mass index, presence of comorbid conditions such as hypertension and diabetes mellitus, hydronephrosis, multiple stones, and prolonged operative time were identified as important risk factors. Gram-negative organisms, particularly Pseudomonas and Klebsiella species, were the most common pathogens causing postoperative urosepsis.

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