



# Analysis of Risk Factors for Perioperative Sepsis in Urinary Calculi

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**Abstract :** The risk factors for perioperative sepsis were investigated in patients with urinary calculi in order to propose targeted interventions. Patients discharged from a 3A hospital with a diagnosis of urinary calculi co-infection in 2020 were retrospectively analyzed and grouped according to whether sepsis occurred in the perioperative period, and the clinical data of the two groups were compared. A total of 435 patients discharged with a diagnosis of urinary calculi co-infection were collected, and urogenic sepsis occurred in 23 cases, with an overall incidence of 5.3%. Univariate analysis showed that gender, abnormal blood leukocyte count on admission, positive urine culture results, carbon dioxide binding capacity and blood creatinine values were risk factors for the development of urogenital sepsis in patients with urinary calculi after surgery ( $P<0.05$ ), while preoperative prophylaxis was a protective factor ( $P<0.05$ ). Multifactorial logistic regression analysis showed that preoperative blood leukocyte values, urine culture results, and blood creatinine values were independent risk factors for the development of urogenic sepsis in patients with urinary calculi after surgery.

**Keywords:** Urinary Calculi; Influencing Factors; Logistic Regression Analysis

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## Introduction

Urinary calculi are a common disease in urology, and patients are often combined with urinary infections. With the continuous improvement of lithotripsy technology, from the original incisional lithotripsy with more invasive, to percutaneous nephrolithotomy and ureteroscopic lithotripsy, which are minimally invasive lithotripsy procedures, the change of the procedure has reduced the trauma and pain of patients and improved the quality of life and long-term prognosis of patients. However, due to the large lumpectomy water perfusion pressure required to obtain a clear view during minimally invasive lumpectomy, it is easy to cause urogenital bacteria into the blood during lithotripsy, and the incidence of urogenital sepsis (US) in the perioperative period still has an incidence of 4.2-32.5% in recent years<sup>[1]</sup>. The purpose of this paper is to retrospectively analyze the basic information and case data of patients discharged from a tertiary care hospital with a diagnosis of urinary tract stone co-infection in 2020, discuss the risk factors for the occurrence of perioperative US.

## 1. Materials and Methods

Patients discharged from a 3A hospital with a diagnosis of urinary calculi and urinary tract infection in 2020 were selected.

### 1.1 Diagnostic criteria for urogenic sepsis

The basis for the occurrence of sepsis in this thesis included patients who were clearly diagnosed with sepsis by

physicians in the discharge diagnosis or whose case data met the diagnostic criteria for urogenic sepsis. According to the 2014 edition of the Chinese Diagnostic and Treatment Guidelines for Urological Diseases, the diagnostic criteria for urogenic sepsis are two or more of the following conditions: body temperature  $>38^{\circ}\text{C}$  or  $<36^{\circ}\text{C}$ ; heart rate  $>90/\text{min}$  and respiration  $>20/\text{min}$ ; peripheral blood leukocytes  $>12\times 10^9/\text{L}$  or  $<4\times 10^9/\text{L}$ ; systolic blood pressure  $<90\text{ mmHg}$  or a decrease in basal blood pressure  $40\text{mmHg}$ .

## 1.2 Study methods

A retrospective survey of patients hospitalized for urological stone surgery, divided into US and control groups according to whether sepsis occurred in the perioperative period, based on whether the patients had combined diabetes mellitus, whether they had a history of urological surgery, whether they had a recent history of antimicrobial exposure, whether the length of hospitalization was greater than 2 weeks, whether the blood leukocyte values were normal ( $3.69\text{-}9.16 \times 10^9/\text{L}$ ) or not, whether the urine leukocytes were normal ( $0\text{-}10.4/\mu\text{L}$ ) or not, whether the preoperative urine culture was positive or not, whether the carbon dioxide binding capacity in preoperative renal function was normal ( $23\text{-}32\ \mu\text{mmol/L}$ ) or not, whether the blood creatinine value was normal or not, whether the duration of surgery was greater than 120 min or not, whether there was intraoperative pus or flocculent material or not, whether there was preoperative hydronephrosis or not, and whether antibacterial drugs were used prophylactically before surgery were stratified and compared. The differences in the incidence of US between the groups after stratification of the above factors were compared.

## 1.3 Statistical analysis

The SPSS 22.0 software was applied to the single-factor analysis of each variable separately, and the *chi-square* test was used for categorical variables. Continuous variables were first tested for normality, and if they obeyed the normal distribution, the independent sample *t*-test was selected, and if they did not obey the normal distribution, the nonparametric test of two independent samples was selected. Risk factors with statistically significant single-factor analysis were included in the multifactor logistic regression analysis, and differences were considered statistically significant at  $P<0.05$ .

## 2. Results

### 2.1 Incidence of perioperative US

A total of 435 patients were counted, of which 23 cases of urogenital sepsis occurred, with an overall incidence of 5.3%.

### 2.2 Univariate analysis

The results of univariate analysis showed that eight factors were not associated with postoperative sepsis after urinary calculi ( $P>0.05$ ). While female patients, abnormal blood leukocytes, positive urine culture, abnormal carbon dioxide binding, and abnormal blood creatinine were risk factors for sepsis after urinary calculi surgery ( $P<0.05$ ), and preoperative prophylaxis was a protective factor ( $P<0.05$ ), as shown in Table 1.

**Table 1.** Univariate analysis of urinary sepsis after surgery

		Control group	US Group	Incidence	$\chi^2$	P-value
Gender	Male	263	9	3.31%	5.674	0.017*
	Female	149	14	8.59%		
Urine leukocytes	Anomalies	65	3	4.41%	0.127	0.722
	Normal	346	20	5.46%		
Blood leukocytes	Anomalies	72	14	16.28%	25.762	0.001*
	Normal	339	9	2.59%		
Positive urine culture	Yes	132	18	12.00%	20.600	0.001*
	No	280	5	1.75%		
CO <sub>2</sub> binding force	Anomalies	129	15	10.42%	11.244	0.001*
	Normal	282	8	2.76%		
Blood creatinine	Anomalies	74	13	14.94%	20.244	0.001*
	Normal	338	10	2.87%		
Whether to use antibacterial drugs for prophylaxis	No	134	15	10.07%	10.339	0.001*
	Yes	278	8	2.80%		
Length of hospitalization	<2 weeks	331	18	5.16%	0.059	0.808
	>2 weeks	81	5	5.81%		
History of antimicrobial drug exposure within three months	None	390	20	4.88%	2.387	0.122
	There are	22	3	12.00%		
History of previous lithotripsy	None	191	13	6.37%	0.903	0.342
	There are	221	10	4.33%		
Diabetes	None	373	22	5.57%	0.683	0.408
	There are	39	1	2.50%		
Surgery time	<120min	302	19	5.92%	0.976	0.323
	>120min	110	4	3.51%		
Intraoperative pus or flocculent material	None	317	18	5.37%	0.021	0.884
	There are	95	5	5.00%		
Hydronephrosis	None	260	16	5.80%	0.392a	0.531
	There are	152	7	4.40%		
Age #		51 (36~61)	52 (45~62)		-0.697	0.486

Note: \*  $P < 0.05$ , # indicates that the non-normal distribution is obtained by the SK normality test.

### 2.3 Multi-factor logistic regression analysis

The six variables with statistically significant univariate analysis were included in the logistic regression model for risk

factor analysis, and the results showed that all three factors were independent risk factors for the development of sepsis after urinary calculi surgery ( $P < 0.05$ ), as shown in Table 2.

**Table 2.** Multivariate logistic regression analysis on urinary sepsis after surgery

Entry Variables	b	Sb	Wald $\chi^2$	P	OR	95% CI	
						Lower limit	Upper limit
Gender (Male)	-0.280	0.506	0.306	0.580	0.756	.280	2.038
Abnormal blood leukocytes	1.559	0.521	8.948	0.003*	4.754	1.712	13.205
Abnormal urine culture	1.755	0.559	9.865	0.002*	5.786	1.935	17.303
Abnormal CO <sub>2</sub> binding	0.856	0.506	2.858	0.091	2.353	0.873	6.343
Abnormal blood creatinine value	1.395	0.497	7.872	0.005*	4.034	1.523	10.688
No antibacterial drugs for prophylaxis	0.678	0.530	1.637	0.201	1.970	0.697	5.568
Constants	-5.515	0.754	53.466	0.000	0.004		

Note: \*  $P < 0.05$ .

## Discussion

With the development of lumpectomy urology in recent years, the incidence of perioperative urogenital sepsis and related deaths are increasing. Urogenic sepsis progresses rapidly and is prone to septic shock, which endangers patients' lives and is indeed one of the most risky and worst prognostic perioperative complications in urology. Therefore, early identification of risk factors for urogenital sepsis and correct and timely diagnosis and treatment are important to reduce the related morbidity and mortality rate and improve the prognosis.

The multifactorial analysis of this study found that abnormal blood leukocytes on admission, renal insufficiency and positive urine culture results were independent risk factors for the development of US in patients. Positive urine culture was a high-risk factor for the development of US, which is consistent with the findings of Shoshany et al [2,3]. Preoperative blood leukocyte abnormalities and positive urine cultures are considered to be prone to US due to bacterial translocation into the blood under puncture and high water perfusion pressure when surgery is performed without adequate anti-infective treatment, so it is recommended that appropriate antibacterial drugs should be given for different urine culture results in future clinical practice before elective surgery. In addition, patients with abnormal creatinine values in renal function were also found to be susceptible to US in this study. This may be due to the fact that most of these patients have combined chronic diseases and low immune function on the one hand; on the other hand, because of renal insufficiency, the perioperative urinary tract antimicrobial drug concentration is relatively insufficient.

It is noteworthy that although univariate analysis of preoperative prophylactic use of antimicrobials significantly reduced the incidence of US in this study, multifactorial analysis did not support this result. The incidence of US in patients with antimicrobial drug exposure in the three months before surgery was greater than that in patients without antimicrobial drug exposure, which may be related to the fact that most of the colonized bacteria were resistant after antimicrobial drug screening. Therefore, it is suggested that clinical prevention of US in the future does not rely on antimicrobial drugs alone, but should focus on other factors and aspects such as adequate preoperative preparation and standardized intraoperative aseptic practice [4].

In summary, patients with urinary calculi combined with infection should be stratified according to risk factors, with emphasis on adequate preoperative anti-infective treatment, routine preoperative blood and renal function tests, and post-admission urine routine, urine culture and drug sensitivity results, in order to use appropriate antibacterial drugs in a reasonable manner and thus reduce the incidence of US.

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