Original Article

DOI: 10.4274/haseki.galenos.2026.64936
Med Bull Haseki 2026;64(2):138-146

Predictors of Postoperative Sepsis after Percutaneous Nephrostomy for Stone-related Urinary Tract Obstruction: A Tertiary Referral Center Experience

Ramazan Ugur, Emin Taha Keskin, Ahmet Eren Sagir, Abdullah Zilan, Direnc Ozboru, Halil Lutfi Canat

University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital, Clinic of Urology, Istanbul, Türkiye

Abstract

Aim: Percutaneous nephrostomy (PN) is a well-established method for urgent decompression in stone-related urinary obstruction; however, post-procedural sepsis remains a significant concern. This study aimed to determine the incidence and risk factors for sepsis following PN in patients with stone-related urinary tract obstruction who did not have pre-existing sepsis.

Methods: This retrospective observational cohort included patients who underwent PN for stone-related urinary tract obstruction. Patients were classified as non-septic (n=290) or septic (n=18) based on postoperative (post-op) sepsis. Demographic, clinical, laboratory, microbiological, and radiological parameters were analyzed. Univariate and multivariable logistic regression analyses were performed to identify independent predictors of post-op sepsis. Receiver operating characteristic (ROC) curve analysis was performed to evaluate the discriminative performance of the prediction model.

Results: Three hundred and eight patients were included; 18 (5.9%) developed post-op sepsis. Patients with post-op sepsis had significantly higher preoperative (pre-op) body temperature, white blood cell count and neutrophil count, C-reactive protein (CRP) levels, neutrophil-to-lymphocyte ratio, and systemic immune-inflammation index. Bacterial growth in nephrostomy catheter cultures and perirenal fat stranding were more frequent in the sepsis group. Multivariable analysis identified elevated body temperature, higher pre-op neutrophil count, increased pre-op CRP, and bacterial growth in nephrostomy catheter cultures as independent predictors of post-op sepsis. ROC curve analysis showed an area under the curve (AUC) of 0.925 for the prediction model, while body temperature, pre-op CRP, and neutrophil count had AUCs of 0.777, 0.750, and 0.746, respectively.

Conclusion: Percutaneous nephrostomy relieves urinary tract obstruction but may also lead to serious complications such as sepsis. An increased body temperature, a high pre-op neutrophil count, a high pre-op CRP level, and bacterial growth in nephrostomy catheter cultures were all independent predictors, and the prediction model showed excellent discrimination.

Keywords: Percutaneous nephrostomy, sepsis, urinary tract obstruction, risk factors, urolithiasis

Introduction

Drainage of upper urinary tract obstruction caused by benign or malignant conditions is achieved by percutaneous nephrostomy (PN) or double J stent placement (1-3). Percutaneous nephrostomy is frequently performed for urinary diversion in conditions such as urolithiasis, pregnancy, ureteral strictures, obstruction-related sepsis, retroperitoneal fibrosis, pelvic malignancies, and trauma-associated urinary extravasation (4-6). Despite being a commonly performed urological intervention, PN is not free of complications and may be associated with bleeding, urinary tract perforation, urinoma formation due to extravasation, injury to adjacent organs such as the spleen, liver, bowel, or pleura, infection, and nephrocutaneous fistula formation (4,5,7,8).

Stone-related urinary tract obstruction represents a urological emergency requiring prompt decompression

Corresponding Author: Ramazan Ugur, MD, University of Health Sciences Türkiye, Basaksehir Cam and Sakura City Hospital, Clinic of Urology, Istanbul, Türkiye
E-mail: rugur23@gmail.com **ORCID:** orcid.org/0000-0002-0593-8589
Received: 31.01.2026 **Accepted:** 07.03.2026 **Publication Date:** 27.03.2026

Cite this article as: Ugur R, Keskin ET, Sagir AE, Zilan A, Ozboru D, Canat HL. Predictors of postoperative sepsis after percutaneous nephrostomy for stone-related urinary tract obstruction: a tertiary referral center experience. Med Bull Haseki. 2026;64(2):138-146

©Copyright 2026 The Author(s). Published by Galenos Publishing House on behalf of Istanbul Haseki Training and Research Hospital.
This is an open access article under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License.

of the collecting system (4,9). In this situation, PN is frequently preferred due to its rapid effectiveness and wide availability (10). However, despite its effectiveness, manipulation of an infected and obstructed urinary system may lead to bacteremia, endotoxin release, and pyelovenous reflux, potentially resulting in sepsis and even mortality (3,6,11).

We hypothesized that postoperative (post-op) sepsis following PN in patients with stone-related urinary tract obstruction could be anticipated through accessible clinical, laboratory, microbiological, and radiological indicators. Therefore, this study aimed to determine the incidence of post-op sepsis and to identify its independent predictors in patients devoid of pre-existing sepsis.

Materials and Methods

Compliance with Ethical Standards

Ethical approval was obtained from the University of Health Sciences Türkiye Basaksehir Cam and Sakura City Hospital Institutional Ethics Committee at our center (approval no.: E-96317027-514.10-295318989/KAEK/19.11.2025.412, date: 24.11.2025), and the study was conducted in accordance with the Declaration of Helsinki. Prior to the procedures, written informed consent was obtained from all patients.

Study Design

This retrospective observational cohort study was conducted at a tertiary care center and included patients who underwent PN placement for urinary drainage due to stone-related urinary tract obstruction. Patients were excluded if they had evidence of sepsis at the time of PN placement. Patients with malignancy-related external compression, retroperitoneal fibrosis, or bladder, prostate, or gynecological malignancies were also excluded. Additionally, patients with congenital or acquired anatomical strictures, pediatric and pregnant patients, and those with incomplete clinical data were excluded. Patients were divided into two groups based on the development of post-op sepsis: (non-sepsis) and (sepsis) (Figure 1).

Post-operative sepsis was defined according to the Sepsis-3 criteria and recorded if it occurred within 72 hours of PN placement. Sepsis was considered present in patients with suspected or documented infection accompanied by organ dysfunction, defined as an acute increase of ≥2 points in the Sequential Organ Failure Assessment score (12). The primary outcome of the study was the development of post-op sepsis within 72 hours after PN placement.

Demographic, clinical, laboratory, microbiological, and radiological data were obtained from electronic medical records and patient files. The parameters included gender, age, body mass index, diabetes mellitus, history of a solitary kidney, and previous kidney surgery. Vital signs at admission were also recorded, including body temperature, heart rate, respiratory rate, and systolic and diastolic blood pressure. Data on the need for intensive care unit (ICU) admission, bleeding requiring angiographic embolization, and survival status were also included (Table 1). Laboratory

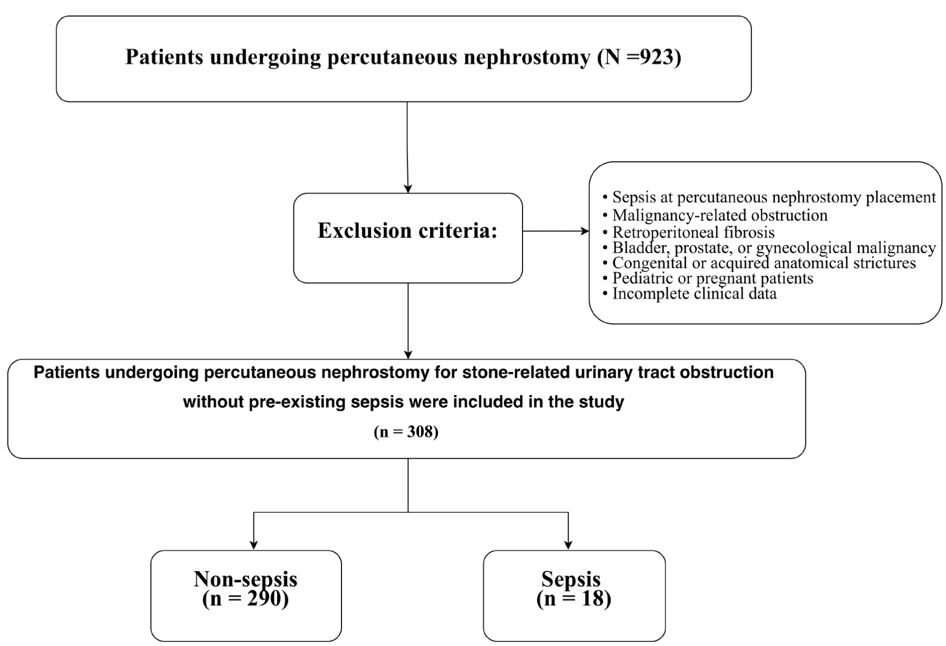

Figure 1. Study flow diagram demonstrating patient selection and group allocation

Table 1. Baseline demographic, clinical, and laboratory characteristics of all patients and stratified by postoperative sepsis status

	Non-sepsis (n=290)	Sepsis (n=18)	p
Age, years (mean ± SD)	52.0±17.0	55.8±18.0	0.409†
	n (%)		
Gender			0.240*
Male	156 (53.8)	13 (72.2)	
Female	134 (46.2)	5 (27.8)	
Diabetes mellitus	78 (26.9)	3 (16.7)	0.144*
Solitary kidney	31 (10.7)	4 (22.2)	0.813*
Previous kidney surgery	66 (22.8)	6 (33.3)	0.803*
Urine nitrite positivity	41 (14.1)	6 (33.3)	0.509*
Pyuria	101 (34.8)	15 (83.3)	0.110*
Nephrostomy catheter culture obtained (+)	169 (58.3)	17 (94.4)	**0.011***
Nephrostomy catheter culture growth (+)	59 (20.3)	11 (61.1)	**0.003***
Pre-op urine culture obtained (+)	131 (45.2)	14 (77.8)	0.599*
Pre-op urine culture growth (+)	62 (21.4)	6 (33.3)	0.943*
Post-op ICU requirement	2 (0.7)	17 (94.4)	**<0.001***
Post-op bleeding requiring AE	8 (2.8)	6 (33.3)	0.324*
Mortality	8 (2.8)	3 (16.7)	0.601*
	Median (IQR)		
Body mass index	27.6 (8.4)	24.10 (6.8)	0.234#
Body temperature, °C	36.5 (0.3)	37.05 (1.4)	**<0.001#**
Heart rate, bpm	82 (16)	85 (30)	0.293#
Respiratory rate, /min	20 (3)	20 (4)	0.129#
Systolic blood pressure, mmHg	125 (25)	120 (28)	0.401#
Diastolic blood pressure, mmHg	74 (14)	74.5 (13)	0.721#
Pre-op creatinine, mg/dL	1.35 (1.73)	2.05 (4.69)	0.097#
Pre-op WBC count, ×10³/μL	9.53 (5.08)	15.00 (9.29)	**<0.001#**
Pre-op neutrophil count, ×10³/μL	6.9 (4.96)	11.2 (5.74)	**<0.001#**
Pre-op platelet count, ×10³/μL	272.5 (124)	259.0 (201)	0.512#
Pre-op lymphocyte count, ×10³/μL	1.90 (1.11)	1.47 (1.35)	**0.027#**
Pre-op CRP, mg/L	50 (112)	187 (181)	**<0.001#**
Pre-op procalcitonin, ng/mL	0.20 (1.54)	0.61 (5.92)	0.075#
Pre-op arterial blood gas pH	7.32 (0.17)	7.32 (0.08)	0.871#
ALT, U/L	16 (14)	17 (9)	0.522#
AST, U/L	19 (11.5)	25 (18)	**0.028#**
GGT, U/L	18.5 (26.75)	37 (21)	0.317#
Amylase, U/L	53 (50.75)	41 (52.5)	0.131#
Lipase, U/L	24.5 (26)	22.0 (22.5)	0.288#
Pre-op NLR	4.19 (5.45)	10.26 (10.10)	**<0.001#**
Pre-op PLR	175 (114)	208 (144)	0.249#
Pre-op SII	1247 (1465)	2271 (2395)	**0.010#**
Post-op NLR	3.24 (4.08)	4.08 (8.31)	0.110#
Post-op PLR	154 (117)	152 (102)	0.781#
Post-op SII	935 (1133)	1136 (1359)	0.311#
Post-op creatinine, mg/dL	1.21 (1.15)	1.45 (2.19)	0.487#
Post-op CRP, mg/L	46 (89)	104 (159)	**0.005#**
Post-op procalcitonin, ng/mL	0.14 (0.41)	0.74 (8.74)	**<0.001#**
Post-op WBC count, ×10³/μL	8.85 (3.73)	10.20 (5.61)	0.289#
Post-op platelet count, ×10³/μL	269.0 (124)	254 (183)	0.333#
Post-op neutrophil count, ×10³/μL	6.00 (3.88)	7.11 (5.46)	0.306#
Post-op lymphocyte count, ×10³/μL	1.90 (1.11)	1.47 (1.35)	0.162#
Post-op arterial blood gas pH	7.35 (0.13)	7.40 (0.08)	0.120#

†Independent Samples t-test, #Mann-Whitney U test; *Pearson chi-square or Fisher's exact test

AE: Angioembolization, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, GGT: Gamma-glutamyl transferase, CRP: C-reactive protein, ICU: Intensive care unit, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, Post-op: Postoperative, Pre-op: Preoperative, SD: Standard deviation, SII: Systemic immune-inflammation index, WBC: White blood cell count, IQR: Interquartile range parameters consisted of serum creatinine, white blood cell (WBC), neutrophil, lymphocyte, and platelet counts, C-reactive protein (CRP), and procalcitonin. Preoperative (pre-op) urine nitrite positivity and pyuria, arterial blood gas pH, alanine aminotransferase, aspartate aminotransferase (AST), gamma-glutamyl transferase, amylase, and lipase were also recorded.

Postoperative laboratory values were recorded from the initial measurements obtained after nephrostomy placement. Inflammatory indices, including the neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio, and systemic immune-inflammation index (SII), were evaluated using both pre-op and post-op laboratory values. Midstream urine cultures were obtained before PN placement, and additional urine samples were collected from the nephrostomy catheter at the time of insertion. Empirical intravenous third-generation cephalosporin therapy was initiated perioperatively in all patients and subsequently adjusted according to culture and antimicrobial susceptibility results.

Radiological findings were assessed using pre-op computed tomography scans. Evaluated parameters included stone location, perirenal fat stranding, laterality, and hydronephrosis grade. The laterality of nephrostomy placement was also recorded.

Statistical Analysis

Statistical analysis was performed using SPSS version 27.0 software (IBM Corp., Armonk, NY, USA). Categorical variables were summarized as frequencies and percentages, while continuous variables were presented as mean ± standard deviation for normally distributed data or as median and interquartile range for non-normally distributed data. The normality of the distribution of continuous variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests, along with visual methods (histograms and Q-Q plots) and analytical methods (skewness and kurtosis values). For comparisons between two independent groups, the Independent Samples t-test was used when the data were normally distributed, while the Mann-Whitney U test was applied for non-normally distributed data. Associations between categorical variables were analyzed using the Pearson chi-square or Fisher's exact test as appropriate. To identify factors associated with post-op sepsis, univariate logistic regression analysis was first performed. Variables with statistical significance in univariate analysis were subsequently included in a multivariable logistic regression analysis to determine independent predictors of post-op sepsis. Variables with a p-value <0.05 in univariate analysis were included in the multivariable analysis. Receiver operating characteristic (ROC) curve analysis was performed to evaluate the predictive performance of the developed model and selected pre-op parameters for post-op sepsis following PN. Discriminative ability was assessed using the area under the curve (AUC). Optimal cutoff values were determined using the Youden index derived from the ROC curve. The goodness-of-fit of the model was evaluated using the Hosmer-Lemeshow test. For all statistical analyses, a p-value <0.05 was considered statistically significant.

Results

Among 923 patients assessed for eligibility, 308 met the inclusion criteria and were included in the final analysis. Of these, 290 patients (94.1%) were classified into the non-sepsis group and 18 (5.9%) into the sepsis group. The cohort consisted of 169 male (54.9%) and 139 female (45.1%) patients, and sex distribution did not differ significantly between the groups. Mean age was also similar between the non-sepsis and sepsis groups (52.0±17.0 vs. 55.8±18.0 years, p=0.409) (Table 1).

Patients in Group 2 (sepsis) presented with a significantly higher body temperature than patients in Group 1 (non-sepsis) (37.05 °C vs. 36.5 °C, p<0.001; Table 1).

Compared with the non-sepsis group, patients who developed sepsis had significantly higher pre-op WBC counts, neutrophil counts, CRP levels, NLR, and SII values and lower lymphocyte counts (all p<0.05). Postoperatively, CRP and procalcitonin levels were also significantly higher in the sepsis group. In microbiological analyses, both the rate of nephrostomy catheter culture sampling and the rate of bacterial growth in nephrostomy catheter cultures were significantly higher among patients with sepsis (all p<0.05) (Table 1).

Radiological assessments indicated that perirenal fat stranding was significantly more prevalent in Group 2 (sepsis) (94.4% vs. 39%, p=0.011). No significant differences were observed between the groups in stone location, stone laterality, grade of hydronephrosis, or laterality of nephrostomy tube placement (all p>0.05, Table 2).

The requirement for post-op ICU was significantly more frequent in sepsis group (94.4% vs. 0.7%, p<0.001). Higher rates of post-op bleeding requiring angiographic embolization and in-hospital mortality were observed in sepsis group; these differences did not reach statistical significance (Table 1).

After univariate and multivariable logistic regression analyses, elevated body temperature, bacterial growth in nephrostomy catheter cultures, higher pre-op CRP, and higher pre-op neutrophil count were identified as independent predictors of post-op sepsis (Table 3).

ROC curve analysis demonstrated that the prediction model had an AUC of 0.925. The AUC values for individual

Table 2. Radiological stone characteristics of all patients and stratified by postoperative sepsis status

	Non-sepsis (n=290)	Sepsis (n=18)	p
	n (%)		
Perirenal fat stranding	113 (39.0)	17 (94.4)	**0.011***
Stone location			0.501*
Calyceal stone	18 (6.2)	2 (11.1)	
Renal pelvis	45 (15.5)	1 (5.6)	
Ureteropelvic junction	60 (20.7)	6 (33.3)	
Proximal ureter	91 (31.4)	5 (27.8)	
Mid-ureter	30 (10.3)	2 (11.1)	
Distal ureter	46 (15.9)	2 (11.1)	
Hydronephrosis			0.803*
None	6 (2.1)	0 (0.0)	
Unilateral	224 (77.2)	13 (72.2)	
Bilateral	60 (20.7)	5 (27.8)	
Hydronephrosis, grade			0.097*
0	14 (4.8)	1 (5.6)	
1	24 (8.3)	1 (5.6)	
2	138 (47.6)	5 (27.8)	
3	81 (27.9)	10 (55.6)	
4	33 (11.4)	1 (5.6)	
Nephrostomy			0.794*
Unilateral	224 (77.2)	14 (77.8)	
Bilateral	66 (22.8)	4 (22.2)	

*Pearson chi-square or Fisher's exact test

Table 3. Univariate and multivariable logistic regression analysis to determine prognostic factors for post-op sepsis after nephrostomy tube placement

	Univariate analysis				Multivariable analysis			
	OR	95% CI Lower	95% CI Upper	p-value	OR	95% CI Lower	95% CI Upper	p-value
Perirenal fat stranding	3.528	1.270	9.800	**0.016**	0.889	0.143	5.534	0.900
Body temperature	7.275	3.020	17.524	**<0.001**	15.174	3.119	73.836	**<0.001**
Nephrostomy catheter culture (+)	5.766	1.289	25.784	**0.022**	5.879	0.182	189.631	0.318
Nephrostomy catheter culture growth	4.384	1.555	12.354	**0.005**	13.648	2.205	84.454	**0.005**
Pre-op WBC count	1.168	1.070	1.274	**<0.001**	1.115	0.936	1.329	0.224
Pre-op neutrophil count	1.124	1.040	1.214	**0.003**	1.362	1.075	1.724	**0.010**
Pre-op lymphocyte count	0.546	0.265	1.125	0.101	-	-	-	-
AST	1.006	0.988	1.025	0.509	-	-	-	**-**
Pre-op NLR	1.125	1.043	1.214	**0.002**	0.676	0.277	1.649	0.390
Pre-op CRP	1.009	1.004	1.014	**<0.001**	1.014	1.004	1.023	**0.004**
Pre-op SII	1.002	0.995	1.012	**0.003**	1.000	0.997	1.003	0.719
Post-op CRP	1.003	0.996	1.009	0.728	-	-	-	**-**
Post-op procalcitonin	1.001	0.998	1.002	**0.027**	1.000	0.998	1.004	0.515

CI: Confidence interval, AST: Aspartate aminotransferase, CRP: C-reactive protein, NLR: Neutrophil-to-lymphocyte ratio, OR: Odds ratio, PLR: Platelet-to-lymphocyte ratio, Post-op: Postoperative, Pre-op: Preoperative, SII: Systemic immune-inflammation index, WBC: White blood cell count parameters were 0.777 for body temperature, 0.750 for pre-op CRP, and 0.746 for pre-op neutrophil count (Figure 2). Based on the Youden index, the optimal cut-off values were 37.05 °C for body temperature (sensitivity 50.0%, specificity 94.7%), 98.5 mg/L for pre-op CRP (sensitivity 77.8%, specificity 67.1%), and 9.41×10³/μL for pre-op neutrophil count (sensitivity 77.8%, specificity 72.5%). The Hosmer-Lemeshow goodness-of-fit test indicated an adequate model fit (p=0.443).

Discussion

In cases of upper urinary tract obstruction, emergency drainage is recommended (2,13). It has been reported that there is no definitive superiority between double J stenting and PN (14). The choice of drainage method has a decisive influence not only on providing mechanical decompression but also on systemic inflammatory response, sepsis, and procedure-related complications (4,10). While PN is an effective and rapid drainage method, it can lead to systemic and local complications, particularly in infected systems, due to the direct involvement of the renal parenchyma and pelvicalyceal system (3,4,15). From a pathophysiological perspective, this intervention, by resembling a high-grade (grade IV) renal injury, may facilitate the translocation of infected urine into the systemic circulation via pyelovenous and pyelolymphatic pathways (16,17). Considering that the kidneys receive approximately 20-25% of the cardiac output, have a blood flow of about 1.0-1.2 L per minute, and have a daily glomerular filtration volume of approximately 180 L, infected content may rapidly enter the systemic circulation via pyelovenous and pyelolymphatic pathways, potentially contributing to the development of a systemic inflammatory response (18-20). In our study, the identification of growth in nephrostomy catheter cultures as an independent predictor of post-op sepsis is consistent with the concept that PN may facilitate systemic dissemination of infected urinary contents through pyelovenous and pyelolymphatic pathways. Conversely, the absence of a significant association between post-op sepsis and pre-op urinalysis findings (pyuria and nitrite positivity), as well as a positive urine culture, suggests that sepsis risk may be more closely related to infected material in the upper urinary tract. Accordingly, the selection of the drainage method should be individualized based on the patient's clinical condition, anatomical characteristics, hemodynamic stability, and the technical feasibility of the procedure.

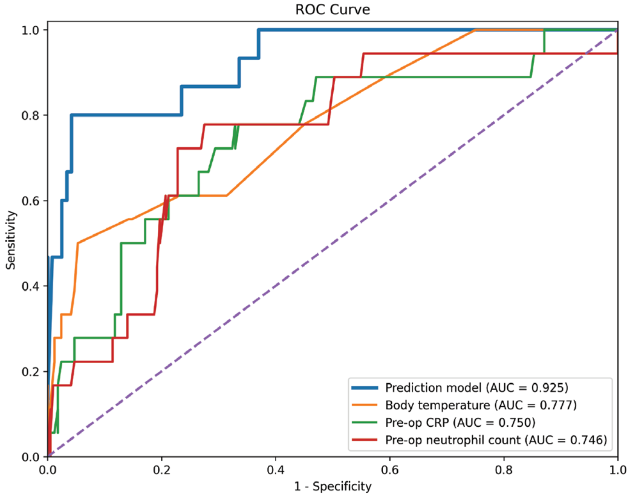

Figure 2. ROC curve analysis for the prediction of postoperative sepsis following percutaneous nephrostomy

ROC: Receiver operating characteristic, AUC: Area under the curve, Pre-op: Preoperative, CRP: C-reactive protein

Elevated body temperature, increased WBC count—particularly the neutrophil count—and high CRP levels are early, readily available indicators of active systemic inflammation, and their association with sepsis risk has been reported previously (21-23). Fever is a systemic response that occurs as a result of the effects of pyrogenic cytokines (interleukin-1, tumor necrosis factor-α, interleukin-6, and interferons) on the hypothalamic thermoregulatory center and represents an early indicator of systemic inflammatory activation (24). In the presence of an obstructed upper urinary system, elevated body temperature, which was identified as an independent predictor in our study, should be regarded as a clinical warning sign indicating potential development of sepsis. C-reactive protein, an acute-phase reactant, is stimulated in the liver via the interleukin-6 pathway and is a sensitive biomarker reflecting the severity of infection and the magnitude of the inflammatory response (25). In the literature, high CRP levels have been reported to be associated with bacteremia and sepsis (9). Similarly, neutrophils are key effector cells of the immune response in sepsis, with increased neutrophil counts reflecting an early and intense inflammatory response to infection. However, it has been shown that excessive neutrophil activation and associated cytotoxic mediator release can contribute to sepsis pathogenesis through tissue damage and microvascular dysfunction (26). The development of post-op sepsis is associated with increased pre-op CRP levels and pre-op neutrophil counts, which can be considered a pathophysiological reflection of the systemic inflammatory response in obstructed and infected systems.

In obstructed upper urinary tracts, the need for ICU after PN is a crucial indicator reflecting the clinical severity of sepsis and is associated with increased morbidity, prolonged hospital stay, and increased healthcare costs (3,10,27). Sepsis developed in 89% (17/19) of patients who required the ICU after PN in our study, supporting the clinical significance of this relationship.

Radiologically, the presence of perirenal fat stranding on computed tomography represents a marker of local inflammation and, in our study, was found to be significantly associated with post-op sepsis (28). However, the lack of independent predictive value of this variable in the multivariable logistic regression analysis suggests that local inflammation may increase the risk of sepsis in the presence of a concomitant systemic inflammatory response. Similarly, pre-op lymphocyte count, AST, pre-op NLR, pre-op SII, post-op CRP, and post-op procalcitonin were associated with sepsis in univariate analyses but were not independent predictors in the multivariable analysis. This finding indicates that these parameters may reflect indirect manifestations of systemic inflammation and overall disease severity rather than serving as stand-alone determinants of post-op sepsis risk, underscoring the need to interpret them within a comprehensive clinical context. From a clinical perspective, all these variables may help identify patients who require closer monitoring, earlier escalation of antimicrobial therapy, and heightened post-procedural surveillance.

Percutaneous nephrostomy is an invasive procedure that may be associated with a broad spectrum of complications, including bleeding and various local adverse events. In particular, the close anatomical proximity of structures such as the colon, liver, spleen, pleura, and lungs may increase the risk of injury to these organs, which, in turn, may adversely affect the clinical course. In addition, urinary extravasation and catheter-related problems can lead to limitations in daily activities and reduced quality of life, particularly for patients who may experience chronic pain or recurrent infections as a result of these complications (7,29-31). In our study, bleeding requiring angioembolization was identified in 14 patients (4.5%). This complication is typically attributable to procedure-related segmental arterial injury, arteriovenous fistula formation, or pseudoaneurysm development (29,32). Notably, in patients with coagulopathy and radiological evidence of perirenal fat stranding, increased tissue fragility is likely to increase the potential risks associated with PN (33). Therefore, procedure-related complications should be carefully considered when selecting a drainage strategy. In patients in whom retrograde access is feasible, retrograde double J stent placement may represent a less invasive option without direct trauma to the renal parenchyma; conversely, PN may be preferred when retrograde access is not feasible or has failed.

Study Limitations

This study has several limitations. The retrospective design and the absence of a comparative control group evaluating PN limit the ability to draw method-specific inferences from the observed findings. In addition, ICU requirement, which represents a clinical outcome resulting from sepsis, was not included in the logistic regression analysis to minimize potential bias and allow a more appropriate assessment of causal relationships. Another limitation is the relatively low number of sepsis events (n=18). Since only 18 instances of sepsis were recorded, the multivariable model may be susceptible to overfitting; consequently, the identified predictors should be regarded as preliminary until externally validated. Finally, the single-center nature of the study represents an additional limitation that may restrict the generalizability of the findings. Furthermore, the predictive model lacked internal bootstrapping and external validation; consequently, its discriminative efficacy may be overly optimistic and requires validation in independent cohorts.

Despite these limitations, this study includes a relatively large, well-characterized cohort of patients undergoing PN for stone-related urinary tract obstruction without pre-existing sepsis. Furthermore, it identifies independent predictors of post-op sepsis, allowing identification of higher-risk patients in this population.

Conclusion

This study underscores the potential prognostic significance of clinical and laboratory parameters in forecasting sepsis subsequent to PN in patients with obstructed upper urinary tracts. An elevated body temperature, higher pre-op neutrophil counts and pre-op CRP levels, and bacterial growth in nephrostomy catheter cultures were identified as independent predictors of post-op sepsis. These findings may help clinicians identify patients at increased risk of post-op sepsis and support more individualized peri-procedural monitoring and management. In high-risk patients, it may be clinically appropriate to consider less invasive drainage strategies before proceeding to more invasive approaches. Further prospective randomized controlled studies are needed to clarify the effects of different drainage strategies on sepsis development and clinical outcomes.

Ethics

Ethics Committee Approval: The study was approved by the University of Health Sciences Türkiye Basaksehir Cam and Sakura City Hospital institutional Ethics Committee at our center (approval no.: E-96317027-514.10-295318989/KAEK/19.11.2025.412, date: 24.11.2025).

Informed Consent: Informed consent was obtained from all patients involved in this study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: R.U., E.T.K., A.E.S., A.Z., D.O., H.L.C., Concept: R.U., E.T.K., A.E.S.,A.Z., D.O.,

H.L.C., Design: R.U., E.T.K., A.E.S.,A.Z., D.O., H.L.C., Data Collection or Processing: R.U., E.T.K., A.E.S., A.Z., D.O., H.L.C., Analysis or Interpretation: R.U., E.T.K., A.E.S., A.Z., D.O., H.L.C., Literature Search: R.U., E.T.K., A.E.S., A.Z., D.O., H.L.C., Writing: R.U., E.T.K., A.E.S., A.Z., D.O., H.L.C.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Wong R, Ziegler J, Bal DS, Lother SA, Patel P, Rush B. Nephrostomy tube versus ureteral stent for obstructing septic calculi: a nationwide propensity score-matched analysis. J Assoc Med Microbiol Infect Dis Can. 2024;9:73-81.
2. Moon YJ, Jun DY, Jeong JY, Cho S, Lee JY, Jung HD. percutaneous nephrostomy versus ureteral stent for severe urinary tract infection with obstructive urolithiasis: a systematic review and meta-analysis. Medicina (Kaunas). 2024;60:861.
3. Elmansy H, Berjaoui MB, Savage DW, et al. Comparing outcomes of ureteric stent versus nephrostomy tube in urosepsis: a population-based study in Ontario, Canada. World J Urol. 2025;43:692.
4. Yoo MJ, Bridwell RE, Inman BL, Henderson JD, Long B. Approach to nephrostomy tubes in the emergency department. Am J Emerg Med. 2021;50:592-6.
5. Parmar K, Htun HZ, John A, et al. Outcome analysis of percutaneous nephrostomy insertion to relieve urinary obstruction in advanced malignancy. Urol Ann. 2025;17:239-44.
6. Zhang Z, Wang X, Chen D, et al. Minimally invasive management of acute ureteral obstruction and severe infection caused by upper urinary tract calculi. J Xray Sci Technol. 2020;28:125-35.
7. Said DF, Ferreira DB, Hayek KKRE, et al. Factors associated with complications after percutaneous nephrolithotomy: an analysis of 1,066 cases. Rev Assoc Med Bras (1992). 2023;69:e20221089.
8. Paredes-Bhushan V, Raffin EP, Denstedt JD, et al. Outcomes of conservative management of splenic injury incurred during percutaneous nephrolithotomy. J Endourol. 2020;34:811-5.
9. Anıl H, Şener NC, Karamık K, et al. Comparison of percutaneous nephrostomy and ureteral dj stent in patients with obstructive pyelonephritis: a retrospective cohort study. J Invest Surg. 2022;35:1445-50.
10. Lu X, Zhou B, Hu D, Ding Y. Emergency decompression for patients with ureteral stones and SIRS: a prospective randomized clinical study. Ann Med. 2023;55:965-72.
11. Wu H, Fu Y, He Q, Bao J. Risk factors for urosepsis after percutaneous nephrolithotomy: a meta-analysis. Asian J Surg. 2023;46:2408-9.
12. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA. 2016;315:801-10.
13. Ibrahim RM, Lotfy AM, Mahmoud O, Elrady MA, Abdallah M. Effect of initial drainage method on retrograde intrarenal surgery outcomes in acute calcular pyelonephritis: a prospective comparative study. Urolithiasis. 2026;54:40.
14. Skolarikos A, Jung H, Neisius A, et al. EAU Guidelines on Urolithiasis. 2025. Available from: https://d56bochluxqnz.cloudfront.net/documents/full-guideline/EAU-Guidelines-on-Urolithiasis-2025.pdf Accessed January 20, 2026.
15. Rizzo M, Ongaro L, Claps F, et al. An observational cohort study investigating the incidence rate of infectious complications after routine office nephrostomy tube replacement without using antimicrobial prophylaxis. Urology. 2021;147:27-32.
16. Farag M, Timm B, Davis N, Wong LM, Bolton DM, Jack GS. Pressurized-bag irrigation versus hand-operated irrigation pumps during ureteroscopic laser lithotripsy: comparison of infectious complications. J Endourol. 2020;34:914-8.
17. Hong A, du Plessis J, Browne C, Jack G, Bolton D. Mechanism of urosepsis: relationship between intrarenal pressures and pyelovenous backflow. BJU Int. 2023;132:512-9.
18. Maiti K, Maity S, Santra A, Sarkar D. A prospective study on the outcome of pyonephrosis and infected hydronephrosis drained by percutaneous nephrostomy - a tertiary care centre experience. Turk J Surg. 2025;41:411-7.
19. Kaufman DP, Basit H, Knohl SJ. Physiology, glomerular filtration rate. 2023 Jul 17. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-.
20. Hanessian K, Albaghli A, Crew R, et al. The effect of negative, single and multi-organism positive cultures on outcomes following PCNL. BJUI Compass. 2026;7:e70150.
21. Liu L, Xiao Y, Yue X, Wang Q. Safety and efficacy of enhanced recovery after surgery among patients undergoing percutaneous nephrolithotomy: a systematic review and meta-analysis. Int J Surg. 2024;110:3768-77.
22. Akdeniz E, Ozturk K, Ulu MB, Gur M, Caliskan ST, Sehmen E. Risk factors for systemic inflammatory response syndrome in patients with negative preoperative urine culture after percutaneous nephrolithotomy. J Coll Physicians Surg Pak. 2021;31:410-6.
23. Barros PL, Oliveira B, Pereira R, Dores M, Coutinho A, Peyroteo I. A possible novel approach to small iatrogenic colonic perforation during nephrostomy placement. Urol Case Rep. 2023;50:102495.
24. Luheshi GN. Cytokines and fever. Mechanisms and sites of action. Ann N Y Acad Sci. 1998;856:83-9.
25. Plebani M. Why C-reactive protein is one of the most requested tests in clinical laboratories? Clin Chem Lab Med. 2023;61:1540-5.
26. Kolaczkowska E, Kubes P. Neutrophil recruitment and function in health and inflammation. Nat Rev Immunol. 2013;13:159-75.
27. Pietropaolo A, Hendry J, Kyriakides R, et al. Outcomes of elective ureteroscopy for ureteric stones in patients with prior urosepsis and emergency drainage: prospective study over 5 yr from a tertiary endourology centre. Eur Urol Focus. 2020;6:151-6.
28. Lai C, Hu Z, Zhu J, et al. Development and validation of a deep learning-based automated computed tomography

image segmentation and diagnostic model for infectious hydronephrosis: a retrospective multicentre cohort study. EClinicalMedicine. 2025;82:103146.

29. Alabat Roca A, Torrecilla Ortíz C, Cuadrado Campaña JM, et al. Hemorrhagic complicationes after percutaneous nephrolithotomy: the importance of an early endovascular management. Actas Urol Esp (Engl Ed). 2021;45:635-41.

30. Degirmenci T, Gunlusoy B, Kozacioglu Z, et al. Utilization of a modified Clavien Classification System in reporting complications after ultrasound-guided percutaneous nephrostomy tube placement: comparison to standard Society of Interventional Radiology practice guidelines. Urology. 2013;81:1161-7.

31. Gauhar V, Pirola GM, Scarcella S, et al. Nephrostomy tube versus double J ureteral stent in patients with malignant ureteric obstruction. A systematic review and meta-analysis of comparative studies. Int Braz J Urol. 2022;48:903-14.

32. Zeng T, Wu W, Zhang L, et al. Superselective renal arterial embolization for severe postpercutaneous nephrolithotomy haemorrhage: clinical characteristics and risk factors for initial failure. World J Urol. 202;41:1647-52.

33. Kumar S, Dutt UK, Singh S, et al. Prospective audit of complications after ultrasonography-guided percutaneous nephrostomy for upper urinary tract obstruction using modified Clavien classification system. Urol Ann. 2020;12:31-6.