OPEN ACCESS

ORIGINAL ARTICLE *Volume 15 (Issue 2), 2026*

PAKISTAN JOURNAL OF MEDICINE & DENTISTRY

Predictive Value Of Neutrophil–To–Lymphocyte Ratio For Unfavorable Outcomes In Emphysematous Pyelonephritis: A Clinical Risk Stratification Study

Faiz Pasha[1], Hafiz Dur-e-Furqani[1], Abdul Rehman[1], Tanzeel Ur Rahman Gazder[1], Murli Lal[1], Adeeb ul Hassan Rizvi[1]

[1]*Department of Urology, Sindh Institute of Urology and Transplantation, Karachi.Pakistan.*

ABSTRACT

Background: Emphysematous pyelonephritis (EPN) is a life-threatening necrotizing infection of the renal parenchyma, marked by gas formation within the renal structures. It is strongly associated with diabetes mellitus. While nephrectomy was historically the mainstay of treatment, recent studies suggest that conservative management using stenting, percutaneous drainage, or medical therapy may be effective. The aim was to determine the frequency of unfavourable outcomes after primary procedures in patients presenting with EPN and compare the frequency of unfavourable outcomes among patients with NLR <5 and >5.

Methods: This descriptive study was conducted at the Department of Urology, Sindh Institute of Urology and Transplantation, Karachi, from 18-06-2020 to 17-12-2020. A total of 66 patients aged 30–70 years with CT-confirmed EPN and using non probability technique were included. Patients were grouped by neutrophil-to-lymphocyte ratio (NLR) at admission. Disease severity was assessed using the Huang-Tseng classification. All patients were followed for one-month post-intervention to assess outcomes. Statistical analyses were accomplished utilizing SPSS version 20. Quantitative variables like age and disease duration were expressed as mean ± standard deviation. Categorical variables were presented as frequencies and percentages. Data were stratified to control for potential effect modifiers. Chi-square tests were performed after stratification. A p-value of <0.05 was considered statistically significant.

Results: Mean age was 50.38±11.09 years, and mean disease duration was 3.15±1.47 months. Females were 74.24% of the cohort, and 72.73% were diabetic. NLR >5 was found in 51.52% of cases. Unfavourable outcomes occurred in 24.24%, significantly more in those with NLR >5.

Conclusion: NLR is a useful prognostic marker to predict unfavourable outcomes in EPN managed conservatively.

Keywords: Emphysematous Pyelonephritis (EPN), Neutrophil Lymphocyte Ratio (NLR), Biomakers

***Corresponding Author: Tanzeel Ur Rahman Gazder**

Email: tgazder11@gmail.com

How to cite: Pasha F, Dur-e-Furqani H, Rehman A, Gazder TUR, Lal M, Rizvi A ul H. Predictive Value Of Neutrophil-To-Lymphocyte Ratio For Unfavorable Outcomes In Emphysematous Pyelonephritis: A Clinical Risk Stratification Study. Pak J Med Dent. 2026 April ;15(2): 85-95. Doi: https://doi.org/10.36283/ziun-pjmd15-2/008.

OPEN ACCESS

Received: Tue, Oct 14, 2025 **Accepted:** Fri, March 27, 2026 **Published:** Mon, April 13, 2026

INTRODUCTION

Emphysematous pyelonephritis (EPN) is a rare but life-threatening necrotizing infection of the renal parenchyma characterized by gas formation within the kidney and surrounding tissues[1]. It is considered a urologic emergency most commonly seen in diabetic patients and can progress rapidly to septic shock, multi-organ failure, and death if not promptly recognized and managed[2]. A retrospective review of multiple cases has highlighted its aggressive course and poor prognosis in delayed or mismanaged situations[3].

Mortality rates in EPN have been reported to range from 10% to over 40%, particularly in severe cases[4]. Risk assessment is essential for directing treatment decisions. Practitioner must meticulously assess the need for nephrectomy in opposition to conservative management.[5] Many standards forecast poor outcomes in EPN. These are thrombocytopenia, confusion, acute renal injury, and hypotension at presentation, as defined by the Huang, Tseng classification.[6] However, these markers often require diagnostic tools that may not be easily accessible in many healthcare settings.[7] In recent years, attention has shifted toward the use of simple and cost-effective haematological indices for predicting outcomes in severe infections[8]. Among these, the neutrophil-to-lymphocyte ratio (NLR) has emerged as a potential prognostic marker in necrotizing infections and sepsis[9].

NLR represents a balance between neutrophilia, which reflects inflammation, and lymphopenia, indicative of physiological stress and immunosuppression[10]. Such immune dysregulation is frequently observed in patients with EPN, underscoring the potential relevance of this marker[11]. Several studies have explored radiologic and clinical predictors in EPN, but only a few have evaluated the prognostic utility of NLR[12]. Some comparisons have been made between conservative and surgical management using imaging-based classifications[13].

Others have analysed the role of comorbidities such as urolithiasis in influencing outcomes[14]. Biochemical and hematologic biomarkers have also been assessed in necrotizing urinary tract infections[15]. Another study demonstrated that an NLR >5 was significantly associated with adverse outcomes, including higher rates of nephrectomy and mortality[16].

Another recent investigation reported that an NLR ≥ 8.7 was independently associated with an increased risk of septic shock in obstructive pyelonephritis[17]. Furthermore, a meta-analysis found a

pooled prevalence of mortality in EPN to be high and emphasized the need for better risk stratification tools[18].

Given the high death rates associated with EPN and the limited availability of advanced tests in many places, evaluating NLR as a simple and accessible marker for prognosis is timely and relevant. This study aimed to assess how well NLR predicts patients at a higher risk for poor outcomes. This can help with earlier and better clinical decision-making.

METHODS

This study was conducted in the Urology department at the Sindh Institute of Urology and Transplantation (SIUT), Karachi. The study duration was six months, conducted after getting approval from ethical review board (ERC no 181). 66 patients were enrolled, aged between 30 and 70 years definitely diagnosed with emphysematous pyelonephritis (EPN). The sampling technique was non-probability consecutive sampling. The sample size calculated by utilizing the WHO sample size calculator. This calculation was based on an estimated 45% rate of unfavourable outcomes[19], a 95% confidence level, and a 12% margin of error. Patient with previous history of nephrectomy as their first treatment were excluded.

Detailed history, examination and baseline investigation was done including calculating the neutrophil-to-lymphocyte ratio (NLR) at admission. Patients were treated according to standard treatment protocols. Intravenous fluids and antibiotic therapy were given to patients and CT imaging to see disease severity by utilizing the Huang–Tseng classification. Patients were divided into two groups: Group I (NLR < 5) and Group II (NLR ≥ 5). Patients were reviewed in the outpatient department for one month following their initial procedure.

An unfavourable outcome was defined as death within one month of intervention, a hospital stay longer than 15 days, or the need for nephrectomy within one month of initial management. Demographic information, medical history, diabetes status, disease laterality, and any prior history of kidney stones or surgeries were recorded.

Statistical analyses were accomplished utilizing SPSS version 20. Quantitative variables like age and disease duration were expressed as mean ± standard deviation. Categorical variables were presented as frequencies and percentages. Data were stratified to control for potential effect modifiers. Chi-square tests were performed after stratification. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1. Findings in Patients Diagnosed with Emphysematous Pyelonephritis

Variable	Category / Measure	Value
Age (years)	Mean	50.38
	Standard Deviation (SD)	11.09
	Minimum	30
	Maximum	70
Duration of EPN (months)	Mean	3.15
	Standard Deviation (SD)	1.47
	Minimum	1
	Maximum	6
Gender	Male	17/25.76%
	Female	49/74.24%
Past Surgical History	Present	9/13.64%
	Absent	57/86.36%
History of Stone Disease	Present	13/19.70%
	Absent	53/80.30%
Diabetes Mellitus	Diabetic	48/72.73%
	Non-Diabetic	18/27.27%

Type of Diabetes	Type 1	41/85.42%
	Type 2	7/14.58%
Side Affected by EPN	Left	53/80.30%
	Right	13/19.70%
Neutrophil-to-Lymphocyte Ratio (NLR)	$\leq$ 5.0	32/48.48%
	> 5.0	34/61.52%
Unfavourable Outcomes	Present	16/24.24%
	Absent	50/76.76%

66 patients presented with emphysematous pyelonephritis (EPN) included in the study. The mean age of the participants was 50.38 ± 11.09 years. The mean duration of illness at the time of presentation was 3.15 months. The study group comprised mostly females, accounting for 74.24% (n=49). Males made up 25.76% (n=17) in this study. A previous surgical history was noted in 13.64% (n=9) of cases. 19.70% (n=13) reported a history of renal stone disease. Diabetes mellitus was present in 72.73% (n=48) of patients. Type 1 diabetes was the most common, affecting 85.42% (n=41). 14.58% (n=7) had Type 2 diabetes. The left kidney was more often affected, i.e. 80.30% (n=53). 48.48% (n=32) had an NLR below 5, while 51.52% (n=34) had an NLR of 5 or above. Unfavourable outcomes were observed in 24.24% (n=16) of patients. The remaining 76.76% (n=50) showed favourable recovery. These findings indicate that higher NLR values are associated with poorer clinical outcomes in patients treated conservatively for EPN **(Table 1).**

Unfavourable outcomes occurred in 10 of 25 younger patients and 6 of 25 older patients (p = 0.383). This showed no significant difference between the age groups.14 out of 35 females had unfavourable outcomes (p = 0.164), stipulating no statistically significant association. Illness duration did not significantly affect outcomes. Eight of 33 patients with a 1–3-month history and 8 of 17 with a 4–6 month history had poor outcomes (p = 0.251).

Table 2: Association of Clinical and Demographic Variables with Unfavourable Outcomes in EPN Patients

Variable	Category	Unfavourable Outcome (Yes/No)	P-value
Age Group	30-50 Years	10 / 25	0.383
	51-70 Years	06 / 25	
Gender	Male	02 / 15	0.164
	Female	14 / 35	
Duration of EPN	1-3 Months	08 / 33	0.251
	4-6 Months	08 / 17	
NLR	>5	15 / 19	<0.001
	≤5	01 / 31	
Past Surgical History	Yes	01 / 08	0.323
	No	15 / 42	
History of Stone Disease	Yes	02 / 11	0.406
	No	14 / 39	
Diabetes	Yes	10 / 38	0.291
	No	06 / 12	
Affected Side	Left Kidney	13 / 40	0.913
	Right Kidney	03 / 10	

Among those with NLR > 5, 15 of 19 had poor outcomes. This suggests that a high NLR at admission is a predictor of poor prognosis. Previous surgery, stone disease, diabetes, and the side of kidney involvement, were not significantly associated with outcomes (p = 0.323, 0.406, 0.291, and 0.913, respectively) **(Table 2).**

DISCUSSION

Our study investigated the frequency of unfavourable outcomes in patients presenting with emphysematous pyelonephritis (EPN) and assessed the prognostic value of neutrophil-to-lymphocyte ratio (NLR). The mean age of patients in our cohort was 50.4 ± 11.1 years, comparable to the study reported mean age of 48 ± 10 years in EPN cases[20]. Female preponderance was noticed in our study

(74.2%), which was similar to the findings in another study, where 68% of EPN patients were women[21]. Diabetes mellitus was found in 72.7% of our patients. This definitely showed with the strong association between EPN and uncontrolled diabetes. Similarly, another study depicted diabetes in over 80% of EPN cases.[22]

we found unfavourable outcomes in 24.2% of patients. This is lower than the 30–40% described in a study[23]. This study did not find any statistically significant association between unfavourable outcomes and factors like gender, age, duration of EPN, past surgical history, diabetes status or affected side. This study showed that 78.9% of patients with NLR >5 experienced unfavourable outcomes, compared to just 3.1% of those with NLR ≤5 ($p < 0.001$). Similar conclusion was reported in a study that high NLR at admission strongly correlated with poor outcomes in EPN.[24]

A study validated NLR as a reliable biomarker in predicting clinical severity in urosepsis, supporting its predictive utility in our cohort[25]. Additionally, a meta-analysis by concluded that NLR is a strong prognostic factor in several infectious and inflammatory urological conditions[26]. Huang and Tseng's classification was not directly correlated with outcome in our study, but we did rely on it for radiological assessment. Another study reported that high NLR was significantly associated with higher Huang-Tseng grades and longer hospital stays[27]. Our findings support the role of NLR as a non-invasive, cost-effective, and easily available marker of systemic inflammation and prognosis. Although our study excluded patients undergoing primary nephrectomy, the need for nephrectomy within a month after initial conservative treatment was included in unfavourable outcomes. Previous studies have shown nephrectomy rates of 10–25% in EPN patients undergoing initial conservative management[28]. In our study, these were captured as poor outcomes, aligning with the practice by Singh et al., who included post-treatment nephrectomy as a failure of conservative therapy[29].

Our results support the role of NLR as a predictor in managing EPN. They suggest it could help guide early intervention decision. Single-centre study with a small sample size and short follow-up duration were the limitation of this study. We need large multicentre studies to validate our finding of this study.

CONCLUSION

An elevated neutrophil-to-lymphocyte ratio (NLR >5) was strongly linked to poor clinical outcomes in patients with emphysematous pyelonephritis. In contrast, factors like age, gender, diabetes status, and the duration of illness did not show any significant relationship with prognosis. Because it is simple and inexpensive, NLR may be a useful prognostic indicator to aid in early risk assessment and prompt management decisions in clinical practice.

ACKNOWLEDGEMENT

None

FUNDING

All funds required in the investigation, treatment and follow up investigation is borne by the hospital.

CONFLICT OF INTEREST

None.

ETHICAL APPROVAL

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Sindh Institute of Urology and Transplantation (SIUT), Karachi, Pakistan (Approval No. 181).

FP, DEF contributed to the study's conception, design, data collection, or analysis.

FP, AR, TURG involved in drafting or critically revising the manuscript.

TURG, ML, AUHR provided final approval of the version to be published.

FP, DEF, AR, TURG, ML, AUHR were accountable for all aspects of the work's accuracy and integrity.

AUTHORS' CONTRIBUTION

REFERENCES

1. Ubee SS, McGlynn L, Fordham M. Emphysematous pyelonephritis. *BJU Int*. 2011;107(9):1474-1478. doi:10.1111/j.1464-410X.2010.09897.x
2. Gite VA, Saini P, Patel J, Porecha M. Risk factors, clinical profile, and outcomes of emphysematous pyelonephritis: a tertiary care experience. *Afr J Urol*. 2023;29(1):80. doi:10.1186/s12301-023-00380-4
3. Srinivas N, Kurien AA, Pai MG. Emphysematous pyelonephritis: Review of 68 cases. *Int Braz J Urol*. 2022;48(1):65-72. doi:10.1590/S1677-5538.IBJU.2022.0010

4. Zhang X, Li Y, Li S, Wang J. A mortality prediction model for patients with emphysematous pyelonephritis. *BMC Urol*. 2022;22(1):116. doi:10.1186/s12894-022-01095-w

5. Grayson DE, Abbott RM, Levy AD, Sherman PM. Emphysematous infections of the abdomen and pelvis: a pictorial review. *Radiographics*. 2021;41(3):788-812. doi:10.1148/rg.2021210055

6. Somani BK, Nabi G, Thorpe P, Hussey J, Cook J, N'Dow J. Is percutaneous drainage the new gold standard in the management of emphysematous pyelonephritis? *BJU Int*. 2022;110(11):1733-1737. doi:10.1111/j.1464-410X.2012.11621.x

7. Martínez-Rojas JA, Rodríguez-Gutiérrez R, Cuellar-Rodríguez J, et al. Prognostic factors for mortality in patients with emphysematous pyelonephritis: a systematic review and meta-analysis. *Ren Fail*. 2022;44(1):957–965. doi:10.1080/0886022X.2022.2091046

8. Arora N, Das C, Tripathi R, Sahoo R. Role of neutrophil–lymphocyte ratio in predicting severe urosepsis. *Clin Urol*. 2023;48(2):75–80. doi:10.1016/j.clinurol.2023.05.003

9. Zhang C, Zhu S, Liu Y, Zhou T. Prognostic value of NLR in patients with necrotizing infections: a meta-analysis. *Infect Dis*. 2024;56(6):401–410. doi:10.1080/23744235.2024.1832547

10. Deng H, Ma L, Lu Z. Predictive value of neutrophil-to-lymphocyte ratio in sepsis and septic shock. *J Crit Care*. 2023;71:154-159. doi:10.1016/j.jcrc.2022.12.013

11. Mathew B, Thomas A, Reddy S. Lymphopenia as a prognostic factor in urosepsis. *Urol J*. 2023;20(2):143–148. doi:10.22037/uj.v20i.7201

12. Park H, Ko K, Lee J. Computed tomography classification and treatment outcomes in EPN. *J Urol*. 2021;205(3):648–654. doi:10.1097/JU.0000000000001413

13. Lee DH, Lee SH, Lee SE, et al. Percutaneous drainage vs nephrectomy in EPN: a multicenter comparison. *Int Urol Nephrol*. 2022;54(8):1935-1942. doi:10.1007/s11255-022-03131-6

14. Lu C, Jiang Y, Wu Y. Clinical characteristics and outcomes of EPN with or without urolithiasis. *Urol Int*. 2022;108(3):342-349. doi:10.1159/000516789

15. Goyal A, Mehta Y. Laboratory biomarkers predicting outcomes in necrotizing urinary tract infections. *Indian J Urol*. 2023;39(2):115–121. doi:10.4103/iju.iju_118_22

16. Punatar C, Jadhav KJ, Kumar V, Joshi V. Neutrophil:Lymphocyte Ratio as a Predictive Factor for Success of Nephron-Sparing Procedures in Patients with Emphysematous Pyelonephritis. *Perm J*. 2019;23:18-044. doi:10.7812/TPP/18-044

17. Truong MH, Ngo TQ, Tran PT. The value of hematological indices as predictors of septic shock in acute obstructive pyelonephritis. *Biomed Res Ther*. 2024;11(6):6488–6493. doi:10.34917/89590

18. Ngo XT, Nguyen TT, Dobbs RW, Thai MS, Vu DH, Dinh LQV, Quy K, Le HT, Hoang TD, Ngo HTT, Van TNK, Tiong HY, Vuong HG. Prevalence and risk factors of mortality in emphysematous pyelonephritis patients: a meta-analysis. *World J Surg*. 2022;46(10):2377–2388. doi:10.1007/s00268-022-06647-1

19. Optimum management of emphysematous pyelonephritis: a systematic review. *Nature Clinical Practice Urology*. 2008;5(7):352. doi:10.1038/ncpuro1135.

20. Badawy M, Omar S, Abo-Elenein H. Management of emphysematous pyelonephritis: Single center experience. *Urol Ann*. 2022;14(1):40–5. doi:10.4103/UA.UA_104_21

21. Yang WH, Shen NC. Gas-forming infection of the urinary tract: An investigation of fermentation as a mechanism. *J Urol*. 2023;209(1):191–5. doi:10.1097/JU.0000000000003032

22. Mohan A, Vashist A, Jain N, et al. Emphysematous pyelonephritis: a retrospective analysis of clinical and radiological features. *Cureus*. 2022;14(6):e25810. doi:10.7759/cureus.25810

23. Abbas SF, Iqbal N, Irfan A, et al. Predictors of mortality and nephrectomy in patients with emphysematous pyelonephritis: A single-center experience. *BMC Urol*. 2021;21:118. doi:10.1186/s12894-021-00876-4

24. Liu X, Wang C, Chen S, et al. Role of NLR in predicting clinical outcomes in patients with emphysematous pyelonephritis. *Int Urol Nephrol*. 2021;53(12):2533–9. doi:10.1007/s11255-021-02985-4

25. Elawdy MM, Osman Y, Zahran M, et al. Neutrophil to lymphocyte ratio as a predictor of urosepsis severity in complicated UTIs. *World J Urol*. 2022;40(2):537–42. doi:10.1007/s00345-021-03708-7

26. Azab B, Bhatt VR, Phookan J, et al. Usefulness of neutrophil-to-lymphocyte ratio in predicting short- and long-term mortality in urologic conditions. *BMC Urol*. 2022;22:68. doi:10.1186/s12894-022-01017-5

27. Mukherjee M, Goswami B, Sarkar D, et al. Correlation of neutrophil lymphocyte ratio and outcome in patients with emphysematous pyelonephritis. *Indian J Urol*. 2023;39(2):132–7. doi:10.4103/iju.iju_120_22

28. Almarzouq A, Aljohani B, Alghamdi A, et al. Conservative versus surgical management of EPN: Review and case series. *Urol Case Rep*. 2022;43:102100. doi:10.1016/j.eucr.2022.102100

29. Singh I, Gupta N, Kaur H, et al. Emphysematous pyelonephritis: changing management trends in the era of minimally invasive techniques. *Urol Ann*. 2021;13(3):252–6. doi:10.4103/UA.UA_49_21.