

Serum Albumin as a Marker of Infection Severity and Clinical Course in Patients with Diabetic Foot Infection

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ABSTRACT

Objective: This study aimed to evaluate the association between admission serum albumin levels, infection severity, and clinical outcomes in patients hospitalized and managed surgically for diabetic foot disease.

Materials and Methods: This retrospective, single-center observational cohort study included adult patients hospitalized for diabetic foot wounds who underwent surgical treatment (debridement or amputation) and received enteral nutritional support at a tertiary training hospital between January and April 2025. Clinical data, including length of hospital stay, duration of enteral nutrition, and duration of intravenous antibiotic therapy, together with laboratory parameters such as admission and discharge serum albumin levels, were obtained from medical records. Infection severity was assessed using the infection component of the PEDIS classification system. Patients were categorized into the low-to-moderate severity (PEDIS Infection Grades 1–2) and advanced severity (PEDIS Infection Grade 3) groups for comparative analyses.

Results: A total of 69 patients were included in the study. The mean age of the study population was 66.6 ± 10.6 years, and 75.4% of the patients were male. Median serum albumin levels increased significantly during hospitalization, from 3.1 g/dL (2.1–4.5) at admission to 3.3 g/dL (1.6–4.3) at discharge ($p = 0.001$). Patients with PEDIS Infection Grade 3 disease had significantly lower admission serum albumin levels than those with PEDIS Infection Grades 1–2 (2.8 g/dL [2.1–3.7] vs. 3.2 g/dL [2.5–4.5], $p = 0.001$). In addition, patients with advanced disease had significantly longer hospital stays (16 days [3–86] vs. 8 days [3–33], $p = 0.004$), longer durations of enteral nutritional support (14 vs. 7 days, $p = 0.001$), and prolonged intravenous antibiotic therapy (15 vs. 7 days, $p = 0.004$). No significant differences were observed between groups regarding HbA1c, hemoglobin, platelet count, or C-reactive protein levels (all $p > 0.05$).

Conclusion: Low admission serum albumin levels were associated with advanced infection severity in patients with diabetic foot infection. Advanced disease severity was accompanied by longer hospitalization, prolonged antibiotic therapy, and increased nutritional support requirements. Serum albumin may serve as a practical and readily available biomarker for assessing disease severity and monitoring the clinical course in patients with diabetic foot disease.

Keywords: Diabetic foot, albumin, PEDIS, nutritional status, wound infection, prognosis

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INTRODUCTION

Diabetic foot ulcers represent a complex clinical condition influenced by the combined effects of neuropathy, ischemia, infection, impaired glycemic control, and the patient's systemic reserve (1). In these patients, wound healing is closely associated not only with local wound care and surgical interventions but also with infection control, metabolic regulation, and adequate nutritional support. Particularly in infected diabetic foot wounds, the increased inflammatory response and catabolic state increase the protein and energy requirements necessary for tissue repair, thereby affecting clinical outcomes, length of hospital stay, and treatment response.

Although numerous adjunctive treatment modalities—including regenerative products, skin grafts, negative pressure wound therapy, and hyperbaric oxygen therapy—are currently used to shorten treatment duration in diabetic foot management, the success of these approaches is largely influenced by the patient's systemic condition and nutritional reserve (2–4). Nutritional status is one of the key determinants of wound healing in diabetic foot disease. Adequate protein and energy intake are essential for collagen synthesis, granulation tissue formation, angiogenesis, immune regulation, and epithelialization (5,6). Therefore, assessment of nutritional reserve in patients with diabetic foot disease is important not only for planning supportive treatment but also for providing prognostic information regarding infection severity and the clinical course. In general surgical practice, this assessment is often based on practical, readily available, and reproducible laboratory parameters.

Serum albumin is one of the most commonly used biochemical markers for evaluating nutritional reserve in clinical practice. However, albumin levels reflect not only nutritional status but also systemic inflammatory activity and are influenced by several factors, including the inflammatory response, catabolic state, fluid balance, and hepatic synthetic capacity. Consequently, low serum albumin levels should be considered not only an indicator of malnutrition but also a marker of ongoing inflammatory and catabolic processes (7,8). In this respect, albumin may provide practical information regarding both nutritional status and the systemic impact of the disease in patients with diabetic foot infection.

Previous studies have suggested that low serum albumin levels in patients with diabetic foot disease may be associated with delayed wound healing, increased infectious burden, prolonged hospitalization, and unfavorable clinical outcomes (9). However, this relationship may not be uniform across all patient populations and should be interpreted in conjunction with disease severity. Unlike C-reactive protein (CRP) and

white blood cell (WBC) count, serum albumin may provide additional clinical information by reflecting both nutritional reserve and inflammation-related systemic burden in patients with diabetic foot infection. The PEDIS classification is widely used to assess diabetic foot ulcers based on key clinical components, including perfusion, extent, depth, infection, and sensory loss (10). Therefore, evaluating serum albumin levels together with PEDIS Infection Grade, length of hospital stay, duration of intravenous antibiotic therapy, and duration of enteral nutritional support may contribute to the clinical management of patients with diabetic foot infection.

Nevertheless, studies investigating the relationship between serum albumin levels and PEDIS Infection Grade, as well as treatment-related clinical parameters in patients with diabetic foot infection, remain limited. The present study aimed to evaluate the association between admission serum albumin levels, infection severity, and clinical outcomes in patients hospitalized for diabetic foot infection.

MATERIALS AND METHODS

Study Design and Patient Selection

This single-center observational cohort study was designed as a retrospective analysis of patients hospitalized for diabetic foot wounds and treated surgically (debridement or amputation) in the Department of General Surgery at Gülhane Training and Research Hospital between January and April 2025.

Among patients hospitalized for diabetic foot wounds and managed surgically in our clinic, those with inadequate oral intake requiring enteral nutritional support were included in the study.

HIGHLIGHTS

- Lower serum albumin levels were associated with advanced PEDIS Infection Grades.
- Patients with PEDIS Infection Grade 3 disease required longer hospitalization and intravenous antibiotic therapy.
- Advanced infection severity was associated with longer durations of enteral nutritional support.
- Serum albumin levels increased significantly during hospitalization.
- Serum albumin may be a practical biomarker for assessing infection severity in patients with diabetic foot disease.

Adult patients hospitalized and treated for diabetic foot disease were eligible for inclusion. Patients with incomplete clinical or laboratory data were excluded. Patients who did not undergo surgical debridement in the operating room or did not require operative intervention were not included. Patients with inadequate oral intake requiring intensive care unit follow-up and parenteral nutritional support were excluded. Patients undergoing day-case surgical procedures, those receiving corticosteroid therapy, immunosuppressed individuals, and patients with concomitant immunosuppressive conditions (such as malignancy or rheumatologic diseases) were also excluded. Patients with known chronic renal failure, end-stage renal disease, severe chronic liver disease, or hepatic failure were also excluded from the study.

Ethical approval was obtained from the University of Health Sciences Gülhane Training and Research Hospital Non-Interventional Scientific Research Ethics Committee on April 2, 2026, with decision number 2026/95.

Data Collection and Variables

Demographic characteristics (age and sex), clinical variables (length of hospital stay, duration of enteral nutrition, and duration of intravenous antibiotic therapy), and laboratory parameters including glycated hemoglobin (HbA1c), serum albumin, C-reactive protein (CRP), white blood cell (WBC) count, hemoglobin, and platelet count, were retrospectively collected from the medical records. Serum albumin levels were recorded at both admission and discharge, and changes in albumin levels during hospitalization were evaluated.

Assessment of Infection Severity

The infection component of the internationally recognized PEDIS classification categorizes diabetic foot infections into four grades based on clinical severity, ranging from Grade 1 (no clinical signs of infection) to Grade 4 (infection associated with systemic inflammatory response syndrome [SIRS]). In the present study, disease severity was assessed using this infection component. For analysis, patients were categorized into two groups based on clinical severity: PEDIS Infection Grades 1–2, representing low-to-moderate infection severity, and PEDIS Infection Grade 3, representing advanced infection severity. Clinical and laboratory parameters were compared between these groups.

Patients classified as PEDIS Infection Grade 4, characterized by SIRS or severe sepsis, were excluded because serum albumin levels in these patients are substantially influenced by systemic inflammation, capillary leakage, aggressive fluid

resuscitation, and critical illness in addition to the severity of the local diabetic foot infection. To specifically evaluate the association between serum albumin levels and localized diabetic foot infection severity while minimizing the confounding effects of systemic critical illness, only patients with PEDIS Infection Grades 1–3 were included.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 27.0 for Windows (IBM Corp., Armonk, NY, USA). The distribution of continuous variables was assessed using visual methods and the Kolmogorov-Smirnov test. Normally distributed variables were expressed as mean $\pm$ standard deviation, whereas non-normally distributed variables were presented as median (minimum–maximum). Categorical variables were expressed as frequencies and percentages.

Comparisons between groups were performed using the chi-square test for categorical variables, the independent-samples Student's t-test for normally distributed continuous variables, and the Mann-Whitney U test for non-normally distributed continuous variables. Admission and discharge serum albumin levels were compared using the Wilcoxon signed-rank test. A p-value of < 0.05 was considered statistically significant.

Univariable logistic regression analyses were first performed to evaluate factors associated with advanced infection severity, defined as PEDIS Infection Grade 3 versus PEDIS Infection Grades 1–2. Variables with a p-value < 0.05 in the univariable logistic regression analysis were subsequently entered into the multivariable logistic regression model to identify independent predictors of advanced infection severity. Results were presented as odds ratios (ORs) with 95% confidence intervals (CIs).

RESULTS

A total of 69 patients with diabetic foot infection were included in the study. The mean age of the patients was 66.6 ± 10.6 years, and 75.4% of the cohort were male. The median length of hospital stay was 10 days (3–86), the median duration of enteral nutrition was 8 days (2–57), and the median duration of intravenous antibiotic therapy was 9 days (2–86). The median HbA1c level was 8.2% (5–16).

The median serum albumin level at admission was 3.1 g/dL (2.1–4.5), which increased to 3.3 g/dL (1.6–4.3) at discharge. The median C-reactive protein (CRP) level at admission was 129 mg/L (1–410). According to the infection component of the PEDIS classification, 20.3% of patients

were classified as Grade 1, 47.8% as Grade 2, and 31.9% as Grade 3 (Table 1). These categories included 14, 33, and 22 patients, respectively.

When patients were compared according to PEDIS Infection Grade, those in the PEDIS Infection Grade 3 group, representing advanced disease severity, had significantly longer hospital stays, longer durations of enteral nutritional support, and longer durations of intravenous antibiotic therapy than those in the PEDIS Infection Grades 1–2 group ($p = 0.004$, $p = 0.001$, and $p = 0.004$, respectively). In addition, admission serum albumin levels were significantly lower (2.8 vs. 3.2 g/dL; $p = 0.001$), whereas white blood cell counts were significantly higher in the PEDIS Infection Grade 3 group ($p = 0.048$). CRP levels did not differ significantly between the groups, although median values were numerically higher in patients with PEDIS Infection Grade 3 (147 vs. 103 mg/L; $p = 0.059$). No significant differences were observed between

the groups regarding HbA1c, hemoglobin, or platelet counts (Table 2).

Across the entire cohort, the median serum albumin level increased from 3.1 g/dL at admission to 3.3 g/dL at discharge, and this increase was statistically significant ($p = 0.001$).

Univariable logistic regression analysis was performed to identify factors associated with advanced infection severity, defined as PEDIS Infection Grade 3 versus PEDIS Infection Grades 1–2. Length of hospital stay (OR = 1.070, 95% CI: 1.019–1.123; $p = 0.007$), duration of enteral nutrition (OR = 1.099, 95% CI: 1.030–1.174; $p = 0.005$), duration of intravenous antibiotic therapy (OR = 1.071, 95% CI: 1.019–1.125; $p = 0.007$), and admission serum albumin level (OR = 0.050, 95% CI: 0.009–0.291; $p = 0.001$) were significantly associated with advanced infection severity (Table 3). Variables with a

Table 1. Demographic, clinical, and laboratory characteristics of patients with diabetic foot disease.

Variable	Value
Age (years), mean $\pm$ SD	66.62 $\pm$ 10.59
Sex, n (%)	
Female	17 (24.6)
Male	52 (75.4)
Duration of enteral nutrition (days), median (min–max)	8 (2–57)
Duration of IV antibiotic therapy (days), median (min–max)	9 (2–86)
Length of hospital stay (days), median (min–max)	10 (3–86)
HbA1c (%)	8.2 (5–16)
Admission albumin (g/dL), median (min–max)	3.1 (2.1–4.5)
Discharge albumin (g/dL), median (min–max)	3.3 (1.6–4.3)
WBC ($\times 10^9$ /L), median (min–max)	11 (4–28)
Hemoglobin (g/dL), median (min–max)	10.8 (8.8–14.0)
Platelet count ($\times 10^9$ /L), median (min–max)	346 (134–782)
CRP (mg/L), median (min–max)	129 (1–410)
The infection component of the PEDIS Infection Grade, n (%)	
PEDIS Infection Grade 1	14 (20.3)
PEDIS Infection Grade 2	33 (47.8)
PEDIS Infection Grade 3	22 (31.9)

IV: Intravenous, HbA1c: Glycated hemoglobin, WBC: White blood cell, CRP: C-reactive protein; PEDIS: Perfusion, Extent, Depth, Infection, and Sensation.

Table 2. Comparison of clinical and laboratory parameters between PEDIS Infection Grades 1–2 and PEDIS Infection Grade 3.

Variable	PEDIS Infection Grade 1–2 (n=47)	PEDIS Infection Grade 3 (n=22)	p-value
Sex, n (%)			
Female	11 (64.7)	6 (35.3)	*0.769
Male	36 (69.2)	16 (30.8)	
Age (years), mean $\pm$ SD	67.55 $\pm$ 9.89	64.64 $\pm$ 11.94	**0.290
Length of hospital stay (days), median (min–max)	8 (3–33)	16 (3–86)	***0.004
Duration of enteral nutrition (days), median (min–max)	7 (2–32)	14 (3–57)	***0.001
Duration of IV antibiotic therapy (days), median (min–max)	7 (2–32)	15 (3–86)	***0.004
HbA1c (%), median (min–max)	7.9 (5–16)	9.1 (5–13)	***0.119
Admission albumin (g/dL), median (min–max)	3.2 (2.5–4.5)	2.8 (2.1–3.7)	***0.001
WBC ($\times 10^9$ /L), median (min–max)	10.7 (4–28)	11.5 (8–28)	***0.048
Hemoglobin (g/dL), median (min–max)	11.0 (8.8–14.0)	10.7 (8.8–12.0)	***0.344
Platelet count ($\times 10^9$ /L), median (min–max)	333 (134–782)	373 (134–782)	***0.647
CRP (mg/L), median (min–max)	103 (1–410)	147 (12–410)	***0.059

IV: Intravenous, **HbA1c**: Glycated hemoglobin, **WBC**: White blood cell, **CRP**: C-reactive protein; **PEDIS**: Perfusion, Extent, Depth, Infection, and Sensation.

Note: Percentages for sex are calculated within each sex category (row percentages).

*Chi-square test (used for categorical variables).

**Student's t-test (used for normally distributed continuous variables).

***Mann–Whitney U test (used for non-normally distributed continuous variables).

A p-value < 0.05 was considered statistically significant.

p-value < 0.05 in the univariable analysis were included in the multivariable logistic regression model.

In the multivariable logistic regression analysis, only admission serum albumin remained independently associated with advanced infection severity (OR = 0.101, 95% CI: 0.015–0.665; $p = 0.017$). In contrast, length of hospital stay, duration of enteral nutrition, and duration of intravenous antibiotic therapy were no longer significantly associated with advanced infection severity after adjustment (Table 4).

DISCUSSION

Diabetic foot ulcers represent a complex clinical condition that should be evaluated not only according to local wound characteristics but also in relation to infection severity, vascular status, metabolic control, tissue repair capacity, and the patient's systemic reserve. Current guidelines recommend the assessment of diabetic foot infections based on clinical findings and

the severity of infection (1,10). In the present study, disease severity was evaluated using the infection component of the PEDIS classification, and several parameters reflecting the clinical course differed significantly between patients with low-to-moderate and advanced infection severity.

In our study, the length of hospital stay, duration of enteral nutritional support, and duration of intravenous antibiotic therapy were significantly longer in the PEDIS Infection Grade 3 group than in the PEDIS Infection Grades 1–2 group. This finding suggests that advanced PEDIS stages reflect not only more severe local wounds or infections but also a greater need for intensive treatment and prolonged hospitalization. PEDIS Infection Grade 3 is associated with more complex infectious features, including deep tissue involvement, extensive cellulitis, abscess formation, gangrene, and involvement of muscle, tendon, joint, or bone structures. Therefore, prolonged antibiotic therapy, increased nutritional support requirements, and longer hospitalization in patients with advanced-stage

Table 3. Univariable logistic regression analysis of factors associated with PEDIS Infection Grade 3.

Variable	B	OR (95% CI)	p-value
Sex	-0.205	0.815 (0.256–2.589)	0.728
Age (years)	-0.027	0.974 (0.927–1.023)	0.287
Length of hospital stay (days)	0.067	1.070 (1.019–1.123)	0.007
Duration of enteral nutrition (days)	0.095	1.099 (1.030–1.174)	0.005
Duration of IV antibiotic therapy (days)	0.068	1.071 (1.019–1.125)	0.007
HbA1c (%)	0.118	1.125 (0.907–1.395)	0.284
Admission albumin (g/dL)	-2.998	0.050 (0.009–0.291)	0.001
WBC ($\times 10^9/L$)	0.074	1.077 (0.992–1.168)	0.076
Hemoglobin (g/dL)	-0.220	0.803 (0.528–1.220)	0.304
Platelet count ($\times 10^9/L$)	0.001	1.001 (0.997–1.004)	0.705
CRP (mg/L)	0.005	1.005 (1.000–1.010)	0.071

Reference category for sex: Female, OR: Odds ratio, CI: Confidence interval, IV: Intravenous; HbA1c: Glycated hemoglobin, WBC: White blood cell, CRP: C-reactive protein.

disease are clinically expected findings (1,10). From a general surgical perspective, this observation suggests that the infection component of the PEDIS classification may serve not only as a descriptive grading system but also as a practical tool for estimating treatment intensity and healthcare resource utilization. Similarly, a previous study from our institution demonstrated that elevated HbA1c levels were associated with more advanced PEDIS infection stages and an increased need for surgical intervention. These findings support the concept that systemic biomarkers may be closely associated with disease severity in diabetic foot disease (11).

In the present study, admission serum albumin levels were significantly lower in patients with PEDIS Infection Grades. Although albumin is commonly used in clinical practice as a marker of nutritional reserve, it is also a negative acute-phase reactant whose concentration decreases in the presence of infection and inflammation (7,8). During the acute-phase response, positive acute-phase reactants such as CRP increase, whereas negative acute-phase reactants, including albumin, prealbumin, and transferrin, decrease. Consequently,

Table 4. Multivariable logistic regression analysis of factors associated with PEDIS Infection Grade 3.

Variable	B	OR (95% CI)	p-value
Length of hospital stay (days)	-0.896	0.408 (0.039–4.283)	0.455
Duration of enteral nutrition (days)	0.080	1.083 (0.957–1.225)	0.205
Duration of IV antibiotic therapy (days)	0.885	2.423 (0.235–24.965)	0.457
Admission albumin (g/dL)	-2.294	0.101 (0.015–0.665)	0.017

OR: Odds ratio, CI: Confidence interval, IV: Intravenous.

low serum albumin levels in patients with infected diabetic foot ulcers may reflect not only malnutrition but also inflammatory burden, catabolic response, and reduced systemic reserve. Increased cytokine release, protein catabolism, and hepatic acute-phase responses observed in more severe diabetic foot infections may contribute to lower serum albumin levels. Therefore, low serum albumin levels may indicate not only inadequate protein intake but also the systemic inflammatory burden associated with the disease process.

For this reason, patients with PEDIS Infection Grade 4 were intentionally excluded from the present study. In these patients, serum albumin concentrations are affected by systemic inflammatory response syndrome, severe sepsis, capillary leakage, fluid resuscitation, and critical illness, making it difficult to distinguish the effects of localized diabetic foot infection from those of generalized systemic inflammation. Restricting the study population to PEDIS Infection Grades 1–3 allowed a more homogeneous evaluation of the relationship between serum albumin and infection severity. Consequently, our findings should not be extrapolated to patients with PEDIS Infection Grade 4.

The finding of lower albumin levels in the PEDIS Infection Grade 3 group supports the association between advanced disease severity and both reduced nutritional reserve and a greater systemic inflammatory response. Likewise, the higher white blood cell counts observed in the PEDIS Infection Grade 3 group further support the presence of a more pronounced systemic inflammatory response in advanced infections. CRP levels did not differ significantly between the groups, although median values were numerically higher in patients with advanced infection severity. Therefore, no conclusion was

drawn based on CRP, and this finding should be interpreted cautiously in light of the relatively limited sample size. Accordingly, serum albumin should be interpreted not as a substitute for CRP or WBC, but as a complementary and readily available marker that reflects both nutritional reserve and inflammatory burden in patients with diabetic foot infection. This information may help general surgeons and wound care specialists during early clinical assessment and decision-making, particularly by identifying patients who may require closer monitoring, early nutritional assessment, and more intensive inpatient management.

Our findings partially align with those reported by Cheng et al. (12), who demonstrated an association between serum albumin levels and postoperative wound healing outcomes in patients with diabetic foot ulcers. However, unlike that study, the present study did not evaluate direct wound healing endpoints. Therefore, our results should be interpreted as supporting the association between lower serum albumin levels and greater infection severity and treatment intensity during hospitalization, rather than as evidence of impaired wound healing.

In the present study, all patients received enteral nutritional support during hospitalization, and serum albumin levels increased significantly from admission to discharge. Importantly, this does not indicate that enteral nutritional support was applied universally to all patients with diabetic foot infection as standard care; rather, the study cohort was limited to patients who were clinically identified as having inadequate oral intake and requiring enteral feeding. This selected cohort and structured nutritional support may partly explain the significant improvement in discharge albumin levels, together with surgical source control, antibiotic therapy, and resolution of the inflammatory response. This finding supports the importance of early nutritional assessment in diabetic foot patients and the provision of appropriate nutritional support in individuals with inadequate oral intake or at risk of malnutrition. Previous studies have shown that diabetes health literacy is often inadequate among diabetic foot patients and is associated with educational status, which may influence disease management, treatment adherence, and implementation of nutritional recommendations (13).

Furthermore, malnutrition has been reported to be highly prevalent among hospitalized diabetic foot ulcer patients and associated with prolonged hospitalization. In the study by Ran et al. (14), the prevalence of malnutrition was reported as 38.36%, and malnutrition was associated with an

approximately threefold increase in the likelihood of prolonged hospital stay. Additionally, the current literature on nutritional support in diabetic foot ulcers emphasizes that malnutrition is a common and frequently overlooked problem in patients with chronic wounds and that protein, amino acid, and micro-nutrient supplementation may play important biological roles in wound healing processes (15).

Because albumin is a negative acute-phase reactant, the increase in albumin levels observed in our study should not be attributed solely to enteral nutritional support. Improvements in albumin levels may also reflect infection control, resolution of inflammation, antibiotic therapy, and overall clinical recovery following surgical treatment. Therefore, serum albumin may be considered a practical parameter for assessing nutritional and inflammatory status and monitoring the clinical course in patients with diabetic foot disease.

The main limitations of this study include its retrospective design, single-center setting, relatively small sample size, and the inability to assess nutritional status using more detailed clinical nutritional assessment tools. Although patients with known chronic renal failure, end-stage renal disease, severe chronic liver disease, or hepatic failure were excluded, overt proteinuria was not systematically evaluated as a separate variable because of the retrospective design. Therefore, unrecognized or undocumented proteinuria may have acted as a potential residual confounder affecting serum albumin levels. In addition, postoperative wound healing outcomes were not evaluated. Therefore, our findings should be interpreted as reflecting the association between serum albumin levels, infection severity, and short-term clinical course during hospitalization rather than long-term wound healing outcomes or prognosis.

CONCLUSION

Low serum albumin levels were associated with advanced PEDIS Infection Grades in patients with diabetic foot disease. Patients with advanced PEDIS Infection Grades had longer hospital stays, prolonged intravenous antibiotic therapy, and extended durations of enteral nutritional support. The significant increase in serum albumin levels observed during hospitalization may reflect the combined effects of nutritional support, infection control, and clinical recovery, supporting the importance of early nutritional assessment and appropriate nutritional intervention in this patient population. Serum albumin may serve as a practical biochemical parameter for evaluating infection severity and monitoring clinical progress in patients with diabetic foot disease.

Ethical Approval: Ethical approval was obtained from the University of Health Sciences Gülhane Training and Research Hospital Non-Interventional Scientific Research Ethics Committee (Decision No: 2026/95, Date: April 2, 2026).

Informed Consent: Owing to the retrospective design of the study, informed consent was waived by the Ethics Committee.

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