



CORRELATION BETWEEN PEDIS AND WAGNER SCORING SYSTEMS AND CLINICAL OUTCOMES IN PATIENTS WITH DIABETIC FOOT ULCERS

Dr. Harrison P M^{1*}, Dr. Anil kumar², Dr. Annie S Raj³

^{1,3}Postgraduate, Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, India.

²Professor, Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, India.

Corresponding Author: Dr. Harrison P M

Postgraduate, Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, India.

Email: harrisonherald25@gmail.com

ABSTRACT

Background: Diabetic foot ulcer (DFU) is one of the most difficult and severe effects of diabetes mellitus. It can lead to infection, hospitalization, and amputation. It is very important to properly examine and grade these ulcers in order to foresee how they will turn out and decide how to treat them. The Wagner and PEDIS systems are the most commonly utilized of the several classification systems.

Aims: This study aims to evaluate the severity of diabetic foot ulcers using the Wagner and PEDIS scoring systems and to clinically correlate and compare the PEDIS and Wagner scoring systems with patient outcomes in cases of diabetic foot ulcers.

Materials and Methods: A prospective observational study was conducted in the Department of General Surgery over a period of 12 months. A total of 70 patients diagnosed with DFUs were included after obtaining informed consent. Each patient underwent detailed clinical evaluation, laboratory investigations, and ulcer assessment using both the Wagner and PEDIS scoring systems. Patients were followed up throughout their hospital stay and during outpatient visits to monitor progress and final outcome. Statistical analysis was performed using SPSS software. Correlations between the two scoring systems and patient outcomes were analyzed using the Chi-square test and Pearson correlation coefficient.

Results: Out of 70 patients with DFUs, 55 (78.57%) were men and 15 (21.43%) were women, and the average age was 57.42 years. The forefoot was the most prevalent place for an ulcer (38; 54.28%). According to the Wagner classification, 14 (20.00%) had Grade I ulcers, 21 (30.00%) had Grade II ulcers, 19 (27.14%) had Grade III ulcers, 13 (18.57%) had Grade IV ulcers, and 3 (4.29%) had Grade V ulcers. The PEDIS system said that 10 (14.28%) were Grade 1, 28 (40.00%) were Grade 2, 24 (34.28%) were Grade 3, and 8 (11.42%) were Grade 4. Higher Wagner and PEDIS grades were substantially correlated with worse outcomes, extended hospitalizations, and increased amputation rates ($p < 0.001$). Both grading systems accurately reflect ulcer severity and predict prognosis, according to a substantial positive correlation between them ($r = 0.812$, $p < 0.001$).

Conclusion: The Wagner system is still a simple and quick way to use in the clinic, but the PEDIS system is better for making predictions and planning management because it includes infection and perfusion characteristics.

Keywords: Amputation, Diabetic Foot Ulcer, PEDIS Scoring System, Wagner Classification, Wound Healing.

INTRODUCTION

Diabetic foot ulcers (DFUs) are among the most dangerous and expensive side effects of diabetes mellitus, substantially increasing morbidity, mortality, and the global healthcare burden. It is a complicated mix of neuropathy, ischemia, and infection that slows down wound healing and makes tissue necrosis more likely.¹



www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 16-06-2026
Date Acceptance: 26-06-2026
Date of Publication: 13-07-2026

The lifetime chance of a person with diabetes acquiring a foot ulcer is estimated to be 15–25% worldwide, and it remains the most prevalent cause of non-traumatic lower limb amputations.² The number of DFUs in India is between 6% and 11%, which shows how diabetes is becoming more common and how little early preventive therapy is available.³

Peripheral neuropathy, peripheral arterial disease, and infection are all parts of the pathophysiology of DFU. Neuropathy causes loss of sensation and abnormalities, which create unusual pressure points on the foot.⁴ Ischemia from not enough blood flow affects how oxygen and nutrients get to tissues, and infection makes mending take longer and speeds up

tissue deterioration. These changes together cause persistent, non-healing ulcers that are hard to treat.⁵ It is important to evaluate the ulcer's severity and prognosis early on so that therapy may be guided, complications can be avoided, and results can be predicted.⁶

There are a number of systems that can be used to rate the severity of DFUs. The Wagner and PEDIS (Perfusion, Extent, Depth, Infection, Sensation) systems are the most common.⁷ The Wagner classification, which came out in 1976, gives ulcers a grade from 0 to 5 based on how deep they are, whether there is gangrene, and whether they affect bones or joints. It is straightforward, easy to use, and widely recognized in clinical settings. But it doesn't take into account the severity of the infection or ischemia, which are important factors that affect outcomes.⁸

The International Working Group on the Diabetic Foot (IWGDF) created the PEDIS classification, which is a better way to examine a diabetic foot since it looks at five important factors: perfusion, extent/size, depth/tissue loss, infection, and sensation. Each part gets a score from 1 to 4, which helps you realize how bad the ulcer is and how it affects the whole body.⁹ The PEDIS system is more thorough and helpful for research and making predictions, but it can take longer to utilize in everyday clinical situations than the Wagner method.¹⁰

Research on the association between these classification schemes and patient outcomes, such as healing, infection control, amputation necessity, and mortality, is still under progress. A comparative review aids in identifying the system that most accurately predicts prognosis and facilitates treatment planning. Prior research indicates that elevated grades in both systems are associated with inferior outcomes; nevertheless, discrepancies in predicting accuracy continue to be contested.

The study aims to determine whether categorization offers greater prognostic significance and practical applicability by evaluating its correlation with clinical progression, healing status, surgical intervention, and limb preservation. The findings may facilitate enhanced patient classification, optimized management regimens, and a decrease in amputation rates by the early identification of high-risk individuals.

Aims and Objectives

- To evaluate the severity of diabetic foot ulcers using the Wagner and PEDIS scoring systems
- To clinically correlate and compare the PEDIS and Wagner scoring systems with patient outcomes in cases of diabetic foot ulcers.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of General Surgery, Sree Mookambika Institute of Medical Sciences,

Kulasekharam, over a period of 12 months. The study aimed to evaluate and compare the PEDIS and Wagner scoring systems in assessing DFUs and to correlate these scores with clinical outcomes.

A total of 70 patients with DFUs who attended the surgical outpatient department or were admitted to the general surgery wards during the study period were included after obtaining written informed consent. The study was approved by the Institutional Ethics Committee prior to commencement.

Inclusion criteria included all patients aged above 18 years, diagnosed with diabetes mellitus and presenting with foot ulcers of varying grades and duration. Exclusion criteria were patients with non-diabetic ulcers, ulcers due to trauma, venous insufficiency, or malignancy, and those who refused consent for participation or follow-up.

All patients underwent a detailed history and clinical examination, including demographic data, duration of diabetes, glycemic control, ulcer characteristics (site, size, duration, depth, discharge, presence of necrosis, and surrounding tissue condition), and associated systemic comorbidities such as peripheral vascular disease, neuropathy, nephropathy, or retinopathy. Peripheral pulses were assessed clinically and confirmed by Doppler ultrasonography when necessary. Neuropathy was evaluated using the Semmes-Weinstein monofilament test and vibration perception with a tuning fork.

Each ulcer was classified according to the Wagner grading system and the PEDIS classification system at the time of presentation.

- Wagner classification grades ulcers from 0 to 5 based on depth, presence of gangrene, and bone involvement.
- PEDIS classification assesses five parameters—Perfusion, Extent, Depth, Infection, and Sensation—each graded from 1 (mild) to 4 (severe).

Routine laboratory investigations were performed for all patients, including complete blood count, fasting and postprandial blood sugar, HbA1c, renal function tests, and pus culture and sensitivity. Radiological investigations such as X-ray foot were done to rule out osteomyelitis. Additional investigations like Doppler or MRI were performed when indicated.

All patients received standard treatment according to ulcer grade and infection status. Management included glycemic control, local wound care, appropriate antibiotic therapy based on culture sensitivity, debridement of necrotic tissue, and surgical interventions such as skin grafting or amputation when required. Patients were followed up during their hospital stay and at regular intervals after discharge until ulcer healing or definitive outcome was achieved.

The outcomes were recorded as:

1. **Complete healing** – full epithelialization without discharge.
2. **Partial healing** – reduction in ulcer size or depth.
3. **Non-healing/persistent ulcer** – no significant improvement.
4. **Major amputation** – above or below-knee amputation.
5. **Death** – due to sepsis or systemic complications.

All data were entered into Microsoft Excel and analyzed using SPSS software (version 26.0). Descriptive statistics were expressed as mean $\pm$ standard deviation for continuous variables and as

frequency and percentage for categorical variables. The correlation between Wagner and PEDIS scores and patient outcomes was analyzed using the Chi-square test and Pearson correlation coefficient. A p-value < 0.05 was considered statistically significant.

OBSERVATION AND RESULTS

Most patients (37.14%) were in the 51–60 years age group, with a male predominance (78.57%). Nearly half (45.71%) had diabetes for more than 10 years, indicating chronic disease as a major risk factor for ulcer development. (Table 1)

Table 1: Demographic Profile of Patients (n = 70)

Parameter	No. Of Patients (N)	Percentage (%)
Age (Years)		
30–40	6	8.57
41–50	14	20.00
51–60	26	37.14
61–70	18	25.71
>70	6	8.57
Mean Age (Years)	57.42 $\pm$ 8.63	—
Gender		
Male	55	78.57
Female	15	21.43
Duration Of Diabetes (Years)		
<5	10	14.28
5–10	28	40.00
>10	32	45.71

Peripheral neuropathy (68.57%) was the most common predisposing factor, followed by

hypertension (45.71%) and peripheral arterial disease (37.14%). (Table 2)

Table 2: Risk Factors and Comorbidities

Risk Factor / Comorbidity	No. Of Patients (N)	Percentage (%)
Peripheral Neuropathy	48	68.57
Peripheral Arterial Disease	26	37.14
Hypertension	32	45.71
Nephropathy	12	17.14
Retinopathy	15	21.42
Smoking	30	42.85
Alcohol Use	26	37.14
Obesity (Bmi > 25)	20	28.57

The forefoot (54.28%) was the most common site for ulcer formation, likely due to pressure points and repeated trauma in neuropathic feet.

Table 3: Site of ulcer

Site	No. Of Patients (N)	Percentage (%)
Forefoot	38	54.28
Midfoot	18	25.71
Heel	14	20.00

Based on Wagner classification, most patients presented with Grade II (30.00%) and Grade III (27.14%) ulcers, reflecting moderate to severe infection and tissue involvement. Based on PEDIS

classification most ulcers were PEDIS Grade 2 (40.00%), followed by Grade 3 (34.28%), representing moderate infection and perfusion impairment. Nearly half (48.57%) of patients

achieved complete healing, while 14.28% required major amputations and 1.42% died due to systemic complications. (Table 4)

Table 4: Treatment Outcomes in Study Population

Outcome	No. Of Patients (N)	Percentage (%)
Complete Healing	34	48.57
Partial Healing	16	22.85
Non-Healing	9	12.85
Major Amputation	10	14.28
Death	1	1.42

A significant correlation was observed between higher Wagner grades and poor outcomes ($p <$

0.001). Grades III–V were strongly associated with major amputations. (Table 5)

Table 5: Correlation between Wagner Grade and Outcome

Wagner Grade	Healed N(%)	Partial N(%)	Non-Healing N(%)	Amputation N(%)	Death N(%)
I (N=14)	11 (78.57)	3 (21.42)	0 (0.00)	0 (0.00)	0 (0.00)
Ii (N=21)	13 (61.90)	5 (23.80)	3 (14.28)	0 (0.00)	0 (0.00)
Iii (N=19)	6 (31.57)	4 (21.05)	3 (15.78)	6 (31.57)	0 (0.00)
Iv (N=13)	3 (23.07)	2 (15.38)	2 (15.38)	6 (46.15)	0 (0.00)
V (N=3)	1 (33.33)	0 (0.00)	0 (0.00)	2 (66.66)	0 (0.00)

Higher PEDIS grades (3 and 4) were significantly correlated with infection, prolonged hospitalization,

and amputation ($p < 0.001$). Grades 1 and 2 showed excellent healing outcomes.

Table 6: Correlation between PEDIS Grade and Outcome

Pedis Grade	Healed N(%)	Partial N(%)	Non-Healing N(%)	Amputation N(%)	Death N(%)
1 (N=10)	8 (80.00)	2 (20.00)	0 (0.00)	0 (0.00)	0 (0.00)
2 (N=28)	18 (64.28)	8 (28.57)	2 (7.14)	0 (0.00)	0 (0.00)
3 (N=24)	7 (29.16)	4 (16.66)	3 (12.50)	9 (37.50)	1 (4.16)
4 (N=8)	1 (12.50)	2 (25.00)	1 (12.50)	4 (50.00)	0 (0.00)

There was a strong positive correlation ($r = 0.812$, $p < 0.001$) between the Wagner and PEDIS grading systems, confirming that both reflect ulcer severity and progression reliably.

DISCUSSION

The current study, which included 70 patients with DFUs, showed that middle-aged men were more likely to be in the 51–60 age range (37.14%), with men making up 78.57% of the population. Almost half of the people who took part (45.71%) had diabetes for more than 10 years. This shows how long diabetes can last and how it can lead to ulcers. These results correspond with the study of Naganandini R et al.¹¹, which indicated a mean participant age of 56.4 years, mostly male (63.3%), and an average diabetes duration of 12.5 years. Similarly, Patra DS et al.¹² observed that DFUs were more common in males (89.99%) and predominantly observed in the 51–60-year age bracket (41.07%), with a slightly elevated frequency in rural areas (52.68%). These data confirm the documented epidemiological trend of DFUs predominantly affecting older males with an extended history of diabetes, possibly attributable to

a confluence of neuropathy, vascular disease, and lifestyle variables.

The present study found that comorbidities were common, with peripheral neuropathy (68.57%), hypertension (45.71%), and peripheral arterial disease (37.14%) being the most common. These disorders are well-known causes of ulcers and slow healing of wounds. Gong HP et al.¹³ also found that the number of people with several conditions, like high blood pressure, coronary artery disease, chronic kidney disease, and peripheral artery disease, went up a lot with age ($P < 0.001$). They also said that younger people (48.3%) were more likely to have neuropathic ulcers, whereas middle-aged (42.1%) and older (56.9%) people were more likely to have neuro-ischemic ulcers. This age-related change in ulcer histology shows that as diabetes lasts longer, the blood vessels get worse and the nerve damage gets worse.

The anatomical distribution in this study indicated that the forefoot (54.28%) was the predominant ulcer site, aligning with regions of maximal pressure and recurrent damage in neuropathic feet. The results of Patra DS et al.¹² who found that the plantar aspect was the most frequently occurring site

(46.43%), followed by the dorsum (38.39%), were similar to this observation. This focus emphasizes the need of preventive offloading and suitable footwear in the therapy of diabetic foot.

The Wagner classification showed that Grade II (30.00%) and Grade III (27.14%) ulcers were the most common. The PEDIS Grade 2 (40.00%) and Grade 3 (34.28%) ulcers were the most common, which means that most patients had moderate to severe illness. Arhire LI et al.¹⁴ showed comparable distributions, finding 32.4% of patients with Grade 1 ulcers and 29.2% with Grade 2 ulcers using the Wagner–Meggett classification. This suggests that hospital-based studies also show a trend toward mid-grade lesions.

The treatment outcomes in this study showed that 48.57% of patients healed completely, 14.28% had significant amputations, and 1.42% died. Lower Wagner and PEDIS grades were significantly associated with greater healing rates, while higher grades correlated strongly with amputation and poor prognosis ($p < 0.001$). In particular, 78.57% of Wagner Grade I and 80.00% of PEDIS Grade 1 ulcers healed completely. On the other hand, 66.66% of Wagner Grade V and 50.00% of PEDIS Grade 4 ulcers led to severe amputations.

Onofriescu A et al.¹⁵ also noted that patients who had their limbs amputated and those who were treated conservatively had very different ulcer depths and sizes ($p < 0.001$) when using the PEDIS system. Sezikli İ et al.¹⁶ also indicated that a Wagner grade ≥ 4 strongly correlated with an elevated amputation risk (AUC = 0.728; $P < 0.001$), indicating that whereas PEDIS more effectively distinguished between healing and amputation, the Wagner system more precisely predicted amputation risk.

Further validating these findings, Gandhi C et al.¹⁷ revealed that elevated PEDIS scores correlated with peripheral neuropathy, inadequate healing, and heightened amputation rates. In the study by Agarwal NK et al.¹⁸, 85% of healed patients had PEDIS scores below eight, in contrast to 63.6% of non-healing patients and 80% of amputated patients, who presented with elevated PEDIS scores; all died patients were likewise classified into the high-score category. These results concur with the current study, which identified a robust positive correlation ($r = 0.812$, $p < 0.001$) between Wagner and PEDIS grades, suggesting that both systems accurately represent ulcer severity and clinical consequences.

While both grading systems exhibit predictive significance, their use varies in clinical contexts. The Wagner classification is still a basic and useful tool for doctors to use at the bedside that focuses on ulcer depth and gangrene. The PEDIS system, on the other hand, gives a more complete picture by including perfusion, infection, depth, and sensory status. Therefore, PEDIS may offer better categorization of ulcer severity and prognosis,

especially in research settings, whereas Wagner's ease of use makes it appropriate for everyday clinical use.

CONCLUSION

The current study shows that the Wagner and PEDIS scoring systems are both useful instruments for determining the degree of DFUs and forecasting their course. Higher grades in both systems were strongly linked to slower recovery, a higher chance of amputation, and longer hospital stays. The Wagner classification is a quick and easy way to examine someone at the bedside, whereas the PEDIS system is a more thorough way to do so, taking into account perfusion, infection, and feeling, which makes it more accurate for predicting outcomes.

Using these approaches to identify and grade ulcers early on can help minimize morbidity and amputation rates, optimize treatment plans, and guide proper management. Combining both rating systems may be the best way to make clinical decisions about patients with DFUs.

Financial Support and Sponsorship:

Nil.

Conflicts of Interest:

There are no conflicts of interest

REFERENCES

1. Yang L, Rong GC, Wu QN. Diabetic foot ulcer: challenges and future. *World journal of diabetes*. 2022 Dec 15;13(12):1014.
2. Armstrong DG, Tan TW, Boulton AJ, Bus SA. Diabetic foot ulcers: a review. *Jama*. 2023 Jul 3;330(1):62-75.
3. Sahu SS, Chaudhary V, Sharma N, Kumari S, Pal B, Khurana N. Prevalence and risk factors associated with diabetic foot ulcer in India: a systematic review and meta-analysis. *International Journal of Diabetes in Developing Countries*. 2025 Sep;45(3):516-27.
4. Syafril S. Pathophysiology diabetic foot ulcer. In *IOP Conference series: earth and environmental science* 2018 Mar 1 (Vol. 125, No. 1, p. 012161). IOP Publishing.
5. Simon F, Oberhuber A, Floros N, Busch A, Wagenhäuser MU, Schelzig H et al. Acute limb ischemia—Much more than just a lack of oxygen. *International journal of molecular sciences*. 2018 Jan 26;19(2):374.
6. Hinchliffe RJ, Forsythe RO, Apelqvist J, Boyko EJ, Fitridge R, Hong JP et al. Guidelines on diagnosis, prognosis, and management of peripheral artery disease in patients with foot ulcers and diabetes (IWGDF 2019 update). *Diabetes/metabolism research and reviews*. 2020 Mar;36:e3276.
7. Monteiro-Soares M, Hamilton EJ, Russell DA, Srisawasdi G, Boyko EJ, Mills JL et al.

- Guidelines on the classification of foot ulcers in people with diabetes (IWGDF 2023 update). Diabetes/Metabolism Research and Reviews. 2024 Mar;40(3):e3648.
8. Mehraj M, Shah I. A review of Wagner classification and current concepts in management of diabetic foot. Int J Orthop Sci. 2018 Jan 1;4(1):933-5.
 9. Noorsyawala R, Yusufa FJ, Dahlan K, Dewib RM. PEDIS classification in diabetic foot ulcers patients. Journal of Indonesian Society for Vascular and Endovascular Surgery. 2020 Jun;1(2):2715-1239.
 10. Wang X, Yuan CX, Xu B, Yu Z. Diabetic foot ulcers: Classification, risk factors and management. World journal of diabetes. 2022 Dec 15;13(12):1049.
 11. Naganandini R. Demographic factors and autonomic dysfunction in middle-aged patients with Type 2 Diabetes and Diabetic Foot Ulcers. Bharati Vidyapeeth Medical Journal. 2024 Oct 1;4(4):20-7.
 12. Patra DS, Shetty DR, Quadras DP, Shetty DK. Clinical and Demographic Profile of Diabetic Foot Ulcers: Insights from a Hospital-Based Observational Study. Res. J. Med. Sci. 2024 Dec 31;18:673-6.
 13. Gong HP, Ren Y, Swe TH, Li ZY, Zha PP, Chen DW et al. Age-related variations in clinical characteristics of patients with diabetic foot ulcers. Journal of Diabetes Investigation. 2025.
 14. Arhire LI, Mihalache L, Popa AD, Nita G, Gherasim, A, Graur, M. Evaluating Classification Systems of Diabetic Foot Ulcer Severity: A 12-Year Retrospective Study on Factors Impacting Survival. Healthcare 2023, 11, 2077 [Internet]. 2023
 15. Onofriescu A, Popescu RM, Gheorghe L. Comparison of Different CLASSIFICATION Systems in Predicting the outcome of diabetic foot ulcers—results of an observational study. The Medical-Surgical Journal. 2019 Jun 28;123(2):242-7.
 16. Sezikli İ, Topcu R, Demir E, Kendirci M. Prospective Comparative Evaluation of Wagner, Pedis, and Texas Classification Systems in Predicting Outcomes of Diabetic Foot Ulcers. Hitit Medical Journal. 2025 Oct 10;7(3):358-68.
 17. Gandhi C, Kadam P, Kamepalli V, Kadam Y. PEDIS grading and its role in diabetic foot ulcer management. Int Surg J. 2019 Jul;6(7):2548-52.
 18. Agarwal NK, Choudhury DN, Das B, Kalita TK. Role of Perfusion, Extent, Depth, Infection and Sensation Scores in Determining the Outcome of Patients with Diabetic Foot Ulcers: A Prospective Cohort Study. International Journal of Anatomy,

Radiology and Surgery. 2024 May, 13(3): 5-8.

How to cite this article: Dr. Harrison P M, Dr. Anil kumar, Dr. Annie S Raj, CORRELATION BETWEEN PEDIS AND WAGNER SCORING SYSTEMS AND CLINICAL OUTCOMES IN PATIENTS WITH DIABETIC FOOT ULCERS, Asian J. Med. Res. Health Sci., 2026; 4 (2):2033-2038.

Source of Support: Nil, Conflicts of Interest: None