



PROGNOSTIC VALUE OF THE DIABETIC ULCER SEVERITY SCORING SYSTEM IN DIABETIC FOOT ULCERS

General Surgery

**Dr. Kesireddy
Karthik Reddy**

Junior Resident, Sri Siddhartha Medical College And Hospital

Dr. Srinath. S

Professor, Sri Siddhartha Medical College And Hospital

Dr. Sai Kiran. K

Senior Resident, Sri Siddhartha Medical College And Hospital

ABSTRACT

Background: Diabetic foot ulcers (DFUs) are a serious and common complication of diabetes, representing a major cause of morbidity and mortality. Due to their variable clinical presentations, standardization in assessment is essential. The Diabetic Ulcer Severity Score (DUSS) is a novel tool developed for wound-based classification of DFUs. This study aimed to validate the DUSS and explore its association with clinical outcomes. **Methods:** In this prospective study, 100 patients with DFUs were evaluated from April 2023 to March 2025. DUSS was calculated based on four parameters: palpable pedal pulses, probing to bone, ulcer site, and number of ulcers. Each factor was scored as 0 or 1. Patients were followed until ulcer healing or amputation. Statistical analysis included Chi-square tests and Kaplan-Meier analysis. **Results:** Healing outcomes were significantly better in patients with lower DUSS scores. Factors like presence of palpable pedal pulses, single ulcers, toe location, and absence of bone probing were associated with higher healing rates. Patients with higher DUSS scores had increased rates of complications, infections, and amputations. **Conclusions:** DUSS provides a reliable method to predict healing potential and stratify patients based on risk. Lower scores were associated with favorable outcomes, while higher scores predicted poorer healing and higher amputation risk.

KEYWORDS

Diabetic Foot Ulcer, DUSS, Healing, Amputation.

INTRODUCTION

Diabetic foot ulcers (DFUs) are among the most challenging complications faced by individuals with diabetes mellitus. These ulcers often result from a complex interaction of peripheral neuropathy, peripheral arterial disease, and infection. DFUs contribute substantially to patient morbidity, healthcare utilization, and risk of lower extremity amputation.

The Diabetic Ulcer Severity Score (DUSS) is a scoring system that evaluates ulcer severity based on objective clinical parameters. This score includes the presence of palpable pedal pulses, ulcer site, probing to bone, and number of ulcers. Each parameter is assigned a binary score, providing a total score between 0 and 4. This study aimed to assess the relationship between DUSS and ulcer outcomes including healing, complications, and need for amputation.

MATERIALS AND METHODS

This prospective observational study was conducted at Sri Siddhartha Medical College and Hospital, Tumkur, from April 2023 to March 2025. A total of 100 patients with diabetic foot ulcers who met the inclusion criteria were enrolled after obtaining informed consent.

Ulcers were considered infected when there was purulent discharge along with at least two other local signs such as warmth, redness, lymphatic streaking, swollen lymph nodes, swelling, or pain. The depth of each wound was assessed using a sterile blunt probe. If the probe reached bone and there were accompanying signs of local or systemic infection, along with radiological evidence, a clinical diagnosis of osteomyelitis was made.

Peripheral vascular disease was identified by the absence of both pedal pulses. Patients were also classified based on whether they had a single ulcer or multiple ulcers on the same foot.

Patients with unhealed ulcers were monitored for at least six months. The study was considered complete for each participant once the ulcer had fully healed—either through natural healing, skin grafting—or if the patient underwent a lower limb amputation. The final outcome was recorded at that point.

DUSS Parameters:

Parameter	Score 0	Score 1
Palpable pedal pulses	present	absent
Probing to bone	no	yes
Ulcer site	toes	Foot
Ulcer number	single	multiple

Each participant's DUSS ranged from 0 to 4. Patients were followed

until healing, amputation, or study end. Statistical analysis used SPSS with Chi-square and Mann-Whitney U tests.

All patients received standard care, which comprised blood sugar control with oral hypoglycemic agents or insulin, patient education on diabetes management, administration of antibiotics when indicated, and consistent wound care.

Healing was considered achieved when complete epithelialization of the ulcer occurred. The amputation rate referred to the proportion of patients who underwent either minor or major amputations during the study period. Minor amputations included removal of the toe or forefoot, while major amputations involved procedures below or above the knee.^[3]

Follow-Up

Patients were monitored in the surgical outpatient department every two weeks during the first month, and then monthly thereafter, until the ulcer healed or for a minimum duration of six months. Ulcer healing progress was regularly evaluated during these visits.

Inclusion Criteria

Participants included were aged between 20 and 90 years and diagnosed with diabetes mellitus as per World Health Organization guidelines. Diagnostic criteria included:

- 1) Random blood glucose levels >200 mg/dL
- 2) Fasting blood glucose >126 mg/dL
- 3) Two-hour postprandial plasma glucose >200 mg/dL

Exclusion Criteria

The following individuals were excluded from the study:

- 1) Patients with venous stasis ulcers in the context of diabetes
- 2) Those who had fewer than two follow-up visits during the study period
- 3) Patients with non-diabetic neuropathic ulcers
- 4) Individuals with ulcers located above the ankle
- 5) Non-diabetic individuals with foot ulcers

RESULTS

In this study involving 100 patients, 81 were male and 19 were female. The age group most frequently affected by diabetic foot ulcers was 51–60 years, followed by those aged 41–50 years. The average age of the participants was 57 ± 12 years. Among the study population, a DUSS score of 1 was most common (seen in 44 patients), followed by a score of 2 (in 21 patients). Peripheral pulses were absent in 24 patients, and 43 tested positive on the probe-to-bone examination. Gangrene was identified in 28 cases.

Out of the 100 patients, 55 experienced complete primary healing, while 45 required amputations. Among those who underwent amputations, 37 were male and 8 were female. A total of 17 patients had major amputations, comprising 13 males and 4 females. Minor amputations were performed in 29 patients, of whom 25 were male and 4 were female.

DUSS SCORE	Clinical outcome healing	Clinical outcome amputation	Total
0	14	0	14
1	37	7	44
2	4	17	21
3	0	14	14
4	0	7	7
Total	55	45	100

Kaplan-Meier analysis revealed that patients with a DUSS score of 0 had a 100% likelihood of healing. Those with a score of 1 had a 16% chance of requiring amputation, while patients with a score of 2 faced an 81% risk of amputation. All patients with DUSS scores of 3 and 4 underwent amputation, indicating a 100% probability in these groups.

DISCUSSION

Diabetic foot is a serious complication of diabetes, carrying both medical and socioeconomic burdens. It affects more than 15% of diabetic individuals over the course of their lifetime. Some studies, such as that by Prompers et al., report that the lifetime risk may be as high as 25%. In India, diabetic foot infections are a major reason for hospitalization among diabetic patients, with prevalence rates between 26% and 34%, largely influenced by various sociocultural factors^[1].

In this study, the most affected age group was between 51 and 60 years, followed by 41 to 50 years, with an average age of 57 ± 12 years (ranging from 27 to 90 years). These findings are consistent with other studies—for example, Viswanathan et al. reported a mean age of 60.6 years, Prompers et al. found a mean age of 64.7 years, and Deribe B et al. reported a mean of 50.7 years^[6]. Similarly, Paul et al., in a multicenter international study, observed an average age of 66.7 years, while Graham Lee et al. in Scotland found it to be 67.4 years^[5]. According to a U.S. national hospital discharge survey, older diabetic patients are at significantly increased risk—twice as likely to develop foot ulcers, three times more likely to develop abscesses, and four times more likely to develop osteomyelitis.

This study clinically validated the DUSS (Diabetic Ulcer Severity Score) by comparing scores with actual wound outcomes. Consistent with Beckert et al.'s findings, lower DUSS scores correlated strongly with healing. Based on Kaplan-Meier analysis, patients with a score of 0 had a 100% healing rate, those with a score of 1 had an 84% chance of healing, and those with a score of 2 only had a 19% healing probability. None of the patients with scores of 3 or 4 experienced healing^[4].

In the present study, probing to bone was a strong predictor of poor outcome, with a hazard ratio of 0.024 (suggesting a 97.6% risk of amputation when bone was probed). This finding aligns with Karthikesalingam's conclusion that ulcer depth influences healing potential. Graham Lee and Maria Candida Persis also identified ulcer depth as a critical factor in predicting wound healing^[7].

In the current study, 45 out of 100 patients (45%) underwent amputations—substantially higher than previous reports. Of these, 11% had major amputations (below or above the knee), and 34% had minor amputations (toe or forefoot). This higher rate could be attributed to the lower socioeconomic background of the patient population. The theory proposed by Kington and Smith suggests economic hardship influences complication rates, and Wachtel MS also found that poverty, poor diet, lack of proper footwear, and delayed medical care significantly contribute to increased lower limb amputation risk^[8].

Most ulcers in the study had a DUSS score of 1, followed by score 2, with a mean score of 1.56 ± 1.113 . Among patients with a DUSS score of 1, 7 (9.4%) underwent amputations. For score 2, 17 of 21 patients (80%) required amputation. Amputation was almost universal among those with score 3 (90.6%) and score 4 (100%).

When comparing DUSS scores to major amputation rates: 14.28% (3 of 21) of patients with score 2, 28.57% (4 of 14) of patients with score 3, 57.14% (4 of 7) of patients with score 4 underwent major

amputations. None of the patients with scores 0 or 1 had major amputations. In contrast, Beckert et al. reported major amputation risks as follows: 0% for score 0, 2.4% for score 1, 7.7% for score 2, 11.2% for score 3, 3.8% for score 4^[6].

In our study, major amputations were seen in 30.2% of patients with score 3 and in 55.9% of those with score 4, indicating a more severe outcome pattern, potentially reflecting differences in patient demographics or healthcare access.

CONCLUSION

The Diabetic Ulcer Severity Score (DUSS) offers a practical and easy-to-use clinical tool for predicting the likelihood of wound healing or amputation. By combining four straightforward, clinically assessable wound features, it allows healthcare providers to categorize patients based on ulcer severity and streamline decision-making, even in resource-limited settings. Although it does not alter the core principles of wound management, DUSS can guide early intervention strategies.

The study confirmed that lower DUSS scores are significantly associated with higher healing rates, while higher scores correlate strongly with increased risk of amputation. However, successful treatment also depends heavily on patient engagement. Regular foot examinations are vital for identifying and addressing early signs of complications. Ultimately, surgical expertise, multidisciplinary teamwork, and comprehensive patient care remain crucial for achieving optimal outcomes.

REFERENCES

- Hess CT. Diabetic Foot Ulcer Assessment and Management: Use of Classification Systems for Healing Progress. *Advances in Skin & Wound Care*. 2020.
- Haycocks S, Cameron R, Edge M, Chadwick P. Implementation of a novel mHealth application (INTELLIN®) for the management of people with diabetes and recently healed foot ulceration: A feasibility study (Preprint). 2021.
- Everett EM, Mathioudakis N. Update on management of diabetic foot ulcers. *Ann N Y Acad Sci*. 2018;1411.
- Boulton AJM, Armstrong DG, Hardman MJ, Malone M, Embil JM, Attinger CE, et al. Diagnosis and Management of Diabetic Foot Infections. 2020.
- Hua Q, Zhao J. Effect of tibial cortex transverse transport in patients with recalcitrant diabetic foot ulcers: A prospective multicenter cohort study. *Foot & Ankle Orthopaedics*. 2023;8.
- Derakhshan R, Ahmadi H, Bayat M, Mehboodi L, Pourhashemi E, Amini A, et al. The combined effects of a methacrylate powder dressing (Altrazeal Powder) and photobiomodulation therapy on the healing of a severe diabetic foot ulcer in a diabetic patient: A case report. *J Lasers Med Sci*. 2022;13:e38.
- Snyder R, Hanft J. Diabetic foot ulcers—effects on QOL, costs, and mortality and the role of standard wound care and advanced-care therapies. *Ostomy Wound Manage*. 2009;55(11):28-38.
- Harries R, Harding K. Management of diabetic foot ulcers. *Curr Geriatr Rep*. 2015;4: 265-76.