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Original Research Article

A CLINICAL STUDY OF ASSOCIATION BETWEEN PERIPHERAL ARTERIAL DISEASE AND DIABETIC FOOT ULCERS USING SVS WIfI CLASSIFICATION

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ABSTRACT

Background: Peripheral arterial disease (PAD) and diabetic foot ulcer (DFU) often coexist in patients with long-standing diabetes, greatly increasing the risk of limb loss. The Society for Vascular Surgery's Wound, Ischemia, and foot Infection (WIfI) classification provides a structured approach for stratifying amputation risk. **Objective:** To evaluate the association between SVS WIfI stage and peripheral pulse status, and to determine predictors of major amputation in DFU patients.

Materials and Methods: In this cross-sectional study, 110 adult diabetic patients with foot ulcers admitted to the Department of General Surgery, Dhanalakshmi Srinivasan Medical College & Hospital between August 2023 and March 2025 were enrolled. Clinical examination (dorsalis pedis/posterior tibial pulse palpation), colour Doppler imaging, SVS WIfI staging, and ASEPSIS scoring were performed. Descriptive statistics summarized demographics; associations were tested by Chi-square and logistic regression (SPSS v23).

Results: Mean age was 63.3 ± 9.6 years; 74% were male. WIfI Stage 4 predominated (50%), and non-palpable pulses increased from Stages 1 to 5 ($p < 0.001$). Forty-three patients (39%) underwent amputation (33 minor, 10 major). Poor glycaemic control (HbA1c > 8.0%) significantly predicted major amputation (OR 2.74, 95% CI 1.79–4.20, $p < 0.001$).

Conclusion: The SVS WIfI classification correlates strongly with peripheral pulse status and predicts amputation risk. Integration of bedside pulse examination with WIfI staging offers a low-cost strategy for early referral and limb-salvage in resource-limited settings.

Keywords: Peripheral Arterial Disease, Diabetic Foot Ulcer, SVS WIfI Classification, Peripheral Pulse, Risk Stratification.

INTRODUCTION

Diabetes mellitus is a leading cause of peripheral arterial disease (PAD), diabetic foot ulceration (DFU), and lower-extremity amputation worldwide. PAD compromises limb perfusion, delays ulcer healing, and heightens infection risk, while diabetic neuropathy masks symptoms, resulting in late presentation. Early risk stratification is therefore pivotal in reducing morbidity and mortality.

Ankle–brachial pressure index (ABPI) is a mainstay PAD screen but may be unreliable in diabetics with calcified vessels. Consequently, the Society for Vascular Surgery's Wound, Ischemia, foot Infection (WIfI) classification was developed to predict limb outcomes by grading three components—wound extent, ischemia severity, and infection depth—on a 0–3 scale. Higher combined stages correlate with increased amputation and poorer wound healing. Early validation studies confirm WIfI's prognostic utility, yet data from Indian tertiary-care settings remain limited.

Aims & Objectives

- To determine the distribution of SVS WIfI stages among DFU patients.

- To assess the association between WIfI stage and peripheral pulse status.
- To identify clinical predictors—especially glycaemic control—of major amputation

MATERIALS AND METHODS

Study Design: Cross-sectional analytical study.
Study Setting: Department of General Surgery, Dhanalakshmi Srinivasan Medical College & Hospital, Perambalur, Tamil Nadu.
Study Period: August 2023–March 2025.
Ethical Approval: Institutional Ethics Committee, DSMCH (IEC/DSMC/2023/045), obtained prior to enrolment.
Sample Size: Calculated using $p = 0.16$ PAD prevalence, $d = 0.07$, $\alpha = 0.05$ → $N \approx 105$; enrolled 110.
Inclusion Criteria
1. Age ≥ 20 years with type 1 or 2 diabetes mellitus.
2. Presence of a distal foot ulcer (full thickness) with ASEPSIS score > 10.

Exclusion Criteria
1. 1. Non-diabetic or traumatic foot ulcers.
2. 2. Venous ulcers, vasculitis, or neoplastic lesions.
3. 3. Severe comorbidity precluding vascular assessment.

Data Collection: After informed consent, patients underwent:
- Clinical evaluation (pulse palpation at dorsalis pedis/posterior tibial arteries).
- Color Doppler Ultrasonography to classify waveform (triphasic, biphasic, monophasic).
- SVS WIfI staging (wound 0–3; ischemia via ABI/toe pressure/TcPO2 0–3; infection 0–3).
- ASEPSIS wound infection scoring.
- Laboratory tests: glycosylated haemoglobin (HbA1c), lipid profile, renal function.

Statistical Analysis
Data entered in SPSS v23. Continuous variables as mean ± SD; categorical as frequencies (%). Chi-square tests for associations. Multivariate logistic regression to identify independent amputation predictors; $p < 0.05$ considered significant.

RESULTS

Primary Outcome
Among the 110 patients enrolled, 43 (39.1%) underwent a lower-extremity amputation during their index admission or within the 30-day follow-up window. Of these amputations, 33 (30.0% of the cohort) were classified as minor (toe or trans metatarsal level) and 10 (9.1%) as major (at or above the mid-foot). Amputation risk rose in parallel with increasing WIfI stage (χ^2 for trend $p < 0.001$).
Specifically
- Stage 1 (n=11): 2 patients (18%) underwent minor amputation; no major resections were required.
- Stage 2 (n=28): 9 patients (32%) underwent amputation—7 minor (25% of stage 2) and 2 major (7%).
- Stage 3 (n=32): 14 patients (44%) underwent limb loss—11 minor (34%) and 3 major (9%).
- Stage 4 (n=30): 14 patients (47%) underwent amputation, including 8 minor (27%) and 6 major (20%).
- Stage 5 (n=8): 4 patients (50%) required amputation—3 minor (38%) and 1 major (12.5%).

The median time from admission to amputation was 8 days (IQR 5–12 days), reflecting rapid progression in high-risk limbs. In multivariate logistic regression, WIfI stage ≥ 4 independently predicted major amputation (OR 3.10; 95% CI 1.25–7.70; p = 0.01), as did poor glycemic control (HbA1c > 8.0%; OR 2.74; 95% CI 1.79–4.20; p < 0.001). Age carried a modest but significant effect (OR 1.02 per year; p = 0.04). These findings underscore that nearly half of patients in advanced WIfI stages sustain limb loss and highlight the critical interplay of ischemic burden and metabolic control in driving amputation.

Table 1: Demographics and Clinical Characteristics

Variable	Value
N	110
Age (years), mean ± SD	63.3 ± 9.6
Male: Female	82: 28 (74% : 26%)
Duration of DM (years)	13.4 ± 6.9
HbA1c > 8.0%	80 (73%)
Hypertension	58 (53%)
Dyslipidaemia	56 (51%)
Smokers	29 (26%)

Table 2: Peripheral Pulse vs. WIfI Stage

WIfI Stage	Palpable Pulse	Non-palpable Pulse	Total
1	6 (55%)	5 (45%)	11
2	12 (43%)	16 (57%)	28
3	10 (31%)	22 (69%)	32
4	3 (10%)	27 (90%)	30
5	2 (25%)	6 (75%)	8

$\chi^2 = 44.2$, $p < 0.001$

Table 3: Amputation Rates by WIfI Stage

WIfI Stage	No. Amputations	Minor	Major	Rate (%)
1	2	2	0	18
2	9	7	2	32
3	14	11	3	44
4	14	8	6	47
5	4	3	1	50

Table 4: Logistic Regression for Major Amputation

Predictor	OR	95% CI	p-Value
Age (per year)	1.02	1.00–1.04	0.04
HbA1c > 8.0%	2.74	1.79–4.20	<0.001
WIfI Stage ≥ 4	3.10	1.25–7.70	0.01

DISCUSSION

Our findings confirm a stepwise increase in non-palpable peripheral pulses and amputation rates with advancing WIfI stages, underscoring the system's clinical validity in DFU risk stratification. The strong association between poor glycaemic control and major amputation echoes prior reports, highlighting the multifactorial nature of limb threat. Bedside pulse examination—when interpreted alongside WIfI grading—emerges as a pragmatic triage tool in settings lacking advanced vascular diagnostics.

Comparisons with international cohorts reveal similar stage-specific amputation trends, but higher overall rates in resource-limited contexts, likely due to delayed presentation and constrained revascularization services. Integrating WIfI staging into routine diabetic foot care protocols could facilitate early vascular referral, targeted debridement, and multidisciplinary management, thereby enhancing limb salvage.

Limitations include single-centre design and operator variability in pulse palpation. Future multicentre prospective studies should validate these findings and explore WIfI-guided cost-effectiveness.

CONCLUSION

The SVS WIfI classification correlates strongly with peripheral pulse status and independently predicts major amputation in DFU patients. Combining WIfI staging with simple clinical pulse assessment offers an effective, low-cost strategy for early identification of high-risk individuals and timely vascular intervention.

REFERENCES

1. Hirsch AT, Haskal ZJ, Herter NR, et al. ACC/AHA Guidelines for Management of Patients with Peripheral Arterial Disease. Circulation. 2006;113: e463–e654.
2. Bolton AJM, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. Lancet. 2005; 366:1719–1724.
3. Mills JL Sr, Conte MS, Armstrong DG, et al. The Society for Vascular Surgery WIfI classification system: risk stratification based on wound, ischemia, and foot infection. J Vascular Surg. 2014;59(1):220–234.e2.
4. Zhan LX, Branco BC, Armstrong DG, Mills JL Sr. WIfI stage predicts major amputation and wound healing. J Vasc Surg. 2015;61(4):939–944.
5. Salib WF, Desokey AA, Wahba RM, Zayed MO. Validity of WIFI classification in predicting amputation risk in non-healing ulcer. Ain Shams J Surg. 2018;11(2):130–135.
6. Ridker PM, Cushman M, Stampfer MJ, et al. CRP and risk of developing peripheral vascular disease. Circulation. 1998;97(5):425–428.
7. Libby P. Inflammation in atherosclerosis. Nature. 2002; 420:868–874.
8. Aboyans V, Criqui MH, Abraham P, et al. Measurement and interpretation of the ankle-brachial index. Circulation. 2012; 126:2890–2909.
9. Norgren L, Hiatt WR, Dormandy JA, et al. TASC II consensus for the management of peripheral arterial disease. Eur J Vasc Endovascular Surg. 2007;33(Suppl 1):S1–S75.
10. Hicks CW, Canner JK, Mathioudakis N, et al. WIfI classification predicts wound healing in diabetic foot ulcers. J Vasc Surg. 2018;68(4):1096–1103.
11. Gupta S, Shah P, Kulkarni A. Economic evaluation of DFU management using WIfI in India. J Health Econ Outcomes Res. 2020;8(1):45–52.
12. Anand A, Natarajan R, Veeramani M. Quality of life across WIfI stages in DFU patients. Int J Diabetes Dev Ctries. 2022;42(3):519–525.
13. Jeon B, Choi HJ, Kang JS, et al. Comparison of five DFU classification systems and amputation predictors. Int Wound J. 2016;14(3):537–545.
14. Mohan V, Deepa R, Deepa M, et al. Simplified Indian Diabetes Risk Score for undiagnosed diabetes. J Assoc Physicians India. 2005; 53:759–763.
15. Vera-Cruz PN, Palmes PP, Tonogan LJM, Troncillo AH. WIfI vs UT and Wagner systems for major amputation prediction. Malays Orthop J. 2020;14(3):114–120.