e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(2); 129-136

Original Research Article

Outcome Comparison of Conservative versus Surgical Management in Diabetic Foot Ulcers

Narendrabhai K. Prajapati[1], Jinesh B. Rathod[2], Nirav G. Shah[3]

[1]Assistant Professor, Department of General Surgery, Dr. N. D. Desai Faculty of Medical Science and Research, Dharmsinh Desai University, Nadiad, Gujarat, India

[2]MS (Gynaecology), Tirth Hospital, Himmatnagar, Gujarat, India

[3]MD (Obstetrics & Gynaecology), Vedant Hospital, Vadodara, Gujarat, India

Received: 05-12-2025 / Revised: 18-01-2026 / Accepted: 02-02-2026

Corresponding author: Dr. Nirav G. Shah

Conflict of interest: Nil

Abstract

Background: Diabetic foot ulcers (DFUs) represent a major complication of diabetes mellitus, associated with significant morbidity, mortality, and healthcare costs. The optimal management strategy—conservative versus surgical intervention—remains debated, particularly for moderate-severity ulcers where either approach may be appropriate.

Methods: This prospective comparative study enrolled 186 patients with diabetic foot ulcers (Wagner grades 2-4). Patients were categorized into conservative management group (n=92) receiving standard wound care, offloading, and antibiotics, and surgical management group (n=94) undergoing debridement with or without reconstructive procedures. Primary outcomes included complete wound healing rate and time to healing. Secondary outcomes included amputation rate, recurrence, and quality of life.

Results: Complete wound healing was achieved in 67.4% of conservative group versus 81.9% of surgical group ($p=0.021$). Median time to healing was significantly shorter in surgical group (8.4 ± 3.2 weeks vs. 14.6 ± 5.8 weeks, $p<0.001$). Major amputation rate was lower in surgical group (5.3% vs. 13.0%, $p=0.048$). Ulcer recurrence at 12 months was comparable between groups (18.5% vs. 15.9%, $p=0.642$). Multivariate analysis identified Wagner grade ≥3 (OR: 3.42, 95% CI: 1.68-6.94, $p<0.001$), peripheral arterial disease (OR: 2.86, 95% CI: 1.42-5.76, $p=0.003$), and HbA1c >9% (OR: 2.14, 95% CI: 1.12-4.08, $p=0.021$) as independent predictors of treatment failure.

Conclusion: Surgical management demonstrates superior healing rates, shorter healing times, and reduced major amputation rates compared to conservative treatment in moderate-to-severe diabetic foot ulcers. Early surgical intervention should be considered for appropriately selected patients.

Keywords: Diabetic Foot Ulcer, Surgical Debridement, Conservative Management, Wound Healing, Amputation, Diabetes Complications.

DOI: 10.25258/ijcpr.18.2.20

Introduction

Diabetic foot ulcers (DFUs) constitute one of the most devastating complications of diabetes mellitus, affecting approximately 15-25% of diabetic patients during their lifetime [1]. The global prevalence of DFUs has risen substantially in parallel with the diabetes epidemic, with current estimates suggesting over 40 million individuals worldwide are affected annually [2]. These chronic wounds impose enormous burdens on healthcare systems, with treatment costs exceeding $9 billion annually in the United States alone [3].

The pathophysiology of diabetic foot ulceration is multifactorial, involving the interplay of peripheral neuropathy, peripheral arterial disease, structural foot deformities, and impaired wound healing mechanisms [4]. Sensory neuropathy results in loss of protective sensation, predisposing patients to repetitive trauma and unrecognized injuries. Motor neuropathy contributes to foot deformities and abnormal pressure distribution, while autonomic neuropathy causes decreased sweating and skin fissuring [5]. Concurrent peripheral arterial disease, present in approximately 50% of DFU patients, further compromises tissue perfusion and healing capacity [6].

The clinical significance of DFUs extends beyond local wound complications. Diabetic foot infections represent the most common diabetes-related cause of hospitalization and the leading cause of non-traumatic lower extremity amputation in developed countries [7]. Patients undergoing major amputation face substantially elevated mortality rates, with five-year survival following below-knee amputation approximating only 50% [8]. Furthermore, DFUs significantly impair quality of life, functional capacity, and psychological well-being [9]. Management of diabetic foot ulcers encompasses a spectrum of approaches ranging from conservative wound care to extensive surgical reconstruction. Conservative management traditionally includes offloading, wound debridement, moisture management, infection control, and glycemic optimization [10]. Advanced wound care modalities including negative pressure wound therapy, bioengineered skin substitutes, and growth factor applications have expanded non-surgical treatment options [11].

Surgical management encompasses various interventions from sharp debridement and drainage of abscesses to revascularization procedures, reconstructive surgery, and when necessary, amputation [12]. Proponents of early surgical intervention argue that aggressive debridement of nonviable tissue, elimination of infection sources, and optimization of wound bed conditions accelerate healing and reduce amputation risk [13]. Conversely, advocates for conservative approaches emphasize the potential for spontaneous healing with appropriate wound care and the avoidance of surgical morbidity in patients with significant comorbidities [14]. The International Working Group on the Diabetic Foot (IWGDF) guidelines recommend individualized treatment approaches based on ulcer characteristics, infection severity, vascular status, and patient factors [15]. However, specific recommendations regarding the threshold for surgical intervention and comparative effectiveness of treatment strategies remain limited by insufficient high-quality evidence [16]. Recent systematic reviews have highlighted the paucity of well-designed comparative studies examining conservative versus surgical management outcomes in DFUs [17]. Most available evidence derives from retrospective analyses or studies focused on specific subpopulations, limiting generalizability and clinical applicability.

The present study aimed to prospectively compare clinical outcomes between conservative and surgical management approaches in patients presenting with moderate-to-severe diabetic foot ulcers at a tertiary care center.

Materials and Methods

Study Design and Setting: This prospective comparative study was conducted at the Department of General Surgery and Diabetic Foot Clinic of a tertiary care teaching hospital.

Study Population: Consecutive patients presenting with diabetic foot ulcers were screened for eligibility. Sample size was calculated based on anticipated healing rate difference of 15% between groups (75% surgical vs. 60% conservative), with 80% power and 5% significance level, requiring 84 patients per group. Accounting for 10% dropout, 186 patients were enrolled.

Inclusion Criteria

- Age ≥18 years
- Confirmed diagnosis of type 1 or type 2 diabetes mellitus
- Presence of foot ulcer classified as Wagner grade 2, 3, or 4
- Ulcer duration ≥2 weeks prior to presentation
- Ankle-brachial index (ABI) ≥0.5 or adequate tissue perfusion confirmed by transcutaneous oxygen measurement (TcPO2 ≥30 mmHg)

Exclusion Criteria

- Wagner grade 1 (superficial ulcers) or grade 5 (extensive gangrene requiring major amputation)
- Severe peripheral arterial disease with ABI <0.5 without revascularization potential
- Active osteomyelitis requiring primary amputation
- End-stage renal disease on dialysis
- Immunosuppressive therapy or active malignancy
- Inability to comply with follow-up requirements
- Previous major amputation on the affected limb

Treatment Group Assignment: Treatment allocation was determined by a multidisciplinary team comprising vascular surgeons, endocrinologists, and wound care specialists based on clinical assessment, patient preferences, and treatment feasibility. Patients were assigned to:

Conservative Management Group (n=92): Standard wound care protocol including:

- Sharp wound debridement at bedside (without anesthesia)
- Appropriate wound dressings based on wound characteristics
- Offloading with total contact casting, removable cast walkers, or therapeutic footwear
- Systemic antibiotics for infected ulcers based on culture sensitivity
- Optimization of glycemic control with target HbA1c <8%
- Advanced therapies (negative pressure wound therapy, bioengineered skin substitutes) as indicated

Surgical Management Group (n=94): Operative intervention including:

- Surgical debridement under regional or general anesthesia
- Excision of necrotic tissue, infected bone, and non-viable structures
- Incision and drainage of abscesses and deep space infections
- Minor amputations (toe or ray amputation) when necessary
- Reconstructive procedures (skin grafting, local flaps) as indicated
- Postoperative wound care following standardized protocols

Baseline Assessment: Comprehensive baseline evaluation included:

Clinical Assessment:

- Complete medical history and physical examination
- Ulcer characteristics: location, size (measured by digital planimetry), depth, presence of undermining or tunnelling
- Wagner classification and University of Texas wound classification
- Neurological assessment using 10-g monofilament and 128-Hz tuning fork
- Infection assessment using IDSA/IWGDF criteria

Laboratory Investigations:

- Fasting blood glucose and HbA1c
- Complete blood count, renal function tests, liver function tests
- Inflammatory markers (C-reactive protein, erythrocyte sedimentation rate)
- Wound culture and sensitivity

Vascular Assessment:

- Ankle-brachial index measurement
- Toe pressures where applicable
- Arterial duplex ultrasonography
- CT angiography for patients with suspected significant arterial disease

Radiological Evaluation:

- Plain radiographs of the affected foot
- MRI for suspected osteomyelitis or deep space infection

Outcome Measures

Primary Outcomes:

- Complete wound healing: defined as complete epithelialization without drainage
- Time to complete healing: measured in weeks from treatment initiation

Secondary Outcomes:

- Major amputation rate: amputation above the ankle
- Minor amputation rate: amputation at or distal to the ankle
- Ulcer recurrence: new ulcer at the same or adjacent site within 12 months
- Infection-related complications
- Hospital readmission rate
- Quality of life assessed using the Diabetic Foot Ulcer Scale (DFS) at baseline and 6 months

Follow-up Protocol: Patients were followed at weekly intervals during active wound healing, then monthly until wound closure, and subsequently at 3-month intervals for 12 months. At each visit, wound measurements, photographs, and clinical assessments were documented.

Statistical Analysis: Data were analyzed using SPSS version 26.0 (IBM Corporation, Armonk, NY). Continuous variables were expressed as mean ± standard deviation or median with interquartile range based on distribution. Categorical variables were presented as frequencies and percentages. Chi-square or Fisher's exact test was used for categorical comparisons. Independent samples t-test or Mann-Whitney U test was employed for continuous variables. Kaplan-Meier survival analysis with log-rank test was used for time-to-healing analysis. Multivariate logistic regression identified independent predictors of treatment outcomes. Statistical significance was defined as $p<0.05$.

Results

Baseline Characteristics: A total of 186 patients were enrolled, with 92 patients in the conservative management group and 94 patients in the surgical management group. Baseline demographic and clinical characteristics were comparable between groups (Table 1). Mean age was 57.4 ± 11.2 years in the conservative group versus 58.8 ± 10.6 years in the surgical group (p=0.382). Male patients predominated in both groups (67.4% vs. 69.1%, p=0.796).

Mean diabetes duration was 14.2 ± 7.8 years in the conservative group and 15.6 ± 8.4 years in the surgical group (p=0.236). Mean HbA1c was elevated in both groups (9.2 ± 1.8% vs. 9.4 ± 1.6%, p=0.418). Peripheral neuropathy was present in 84.8% and 87.2% of patients respectively. Peripheral arterial disease was documented in 38.0% of conservative group and 41.5% of surgical group patients (p=0.624).

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Conservative Group (n=92)	Surgical Group (n=94)	p-value
Age (years), mean ± SD	57.4 ± 11.2	58.8 ± 10.6	0.382
Male sex, n (%)	62 (67.4)	65 (69.1)	0.796
BMI (kg/m²), mean ± SD	28.4 ± 4.6	27.8 ± 4.2	0.348
Diabetes type, n (%)			0.842
Type 1	8 (8.7)	9 (9.6)	
Type 2	84 (91.3)	85 (90.4)	
Diabetes duration (years), mean ± SD	14.2 ± 7.8	15.6 ± 8.4	0.236
HbA1c (%), mean ± SD	9.2 ± 1.8	9.4 ± 1.6	0.418
Hypertension, n (%)	58 (63.0)	62 (66.0)	0.682
Chronic kidney disease, n (%)	22 (23.9)	26 (27.7)	0.564
Coronary artery disease, n (%)	18 (19.6)	21 (22.3)	0.634
Peripheral neuropathy, n (%)	78 (84.8)	82 (87.2)	0.628
Peripheral arterial disease, n (%)	35 (38.0)	39 (41.5)	0.624
Current smoking, n (%)	24 (26.1)	28 (29.8)	0.572
Previous foot ulcer, n (%)	32 (34.8)	38 (40.4)	0.426
Previous amputation, n (%)	14 (15.2)	18 (19.1)	0.476

Ulcer Characteristics: Ulcer characteristics at baseline are presented in Table 2. Wagner grade distribution was similar between groups (p=0.284). Grade 2 ulcers comprised 37.0% and 31.9%, grade 3 ulcers 44.6% and 46.8%, and grade 4 ulcers 18.5% and 21.3% in conservative and surgical groups respectively. Mean ulcer size was 8.4 ± 6.2 cm² in the conservative group versus 9.2 ± 7.4 cm² in the surgical group (p=0.416). Ulcer duration prior to presentation was similar (6.8 ± 4.2 weeks vs. 7.4 ± 5.1 weeks, p=0.382).

Clinical infection was present in 72.8% and 78.7% of patients respectively (p=0.348). Osteomyelitis was diagnosed in 28.3% of conservative group and 34.0% of surgical group patients (p=0.398).

Table 2: Ulcer Characteristics at Baseline

Characteristic	Conservative Group (n=92)	Surgical Group (n=94)	p-value
Wagner grade, n (%)			0.284
Grade 2	34 (37.0)	30 (31.9)	
Grade 3	41 (44.6)	44 (46.8)	
Grade 4	17 (18.5)	20 (21.3)	
Ulcer location, n (%)			0.642
Forefoot/toes	52 (56.5)	56 (59.6)	
Midfoot	24 (26.1)	22 (23.4)	
Hindfoot/heel	16 (17.4)	16 (17.0)	
Ulcer size (cm²), mean ± SD	8.4 ± 6.2	9.2 ± 7.4	0.416
Ulcer depth, n (%)			0.526
Superficial	38 (41.3)	34 (36.2)	
Deep (muscle/tendon)	36 (39.1)	38 (40.4)	
Bone involvement	18 (19.6)	22 (23.4)	
Ulcer duration (weeks), mean ± SD	6.8 ± 4.2	7.4 ± 5.1	0.382
Clinical infection, n (%)	67 (72.8)	74 (78.7)	0.348
Infection severity (IDSA), n (%)			0.412
Mild	22 (32.8)	20 (27.0)	
Moderate	32 (47.8)	36 (48.6)	
Severe	13 (19.4)	18 (24.3)	
Osteomyelitis, n (%)	26 (28.3)	32 (34.0)	0.398
ABI, mean ± SD	0.92 ± 0.18	0.88 ± 0.21	0.166

Treatment Outcomes: Clinical outcomes are summarized in Table 3. Complete wound healing was achieved in 62 patients (67.4%) in the conservative group compared to 77 patients (81.9%) in the surgical group (p=0.021). Time to complete healing was significantly shorter in the surgical group (8.4 ± 3.2 weeks vs. 14.6 ± 5.8 weeks, p<0.001).

Major amputation was required in 12 patients (13.0%) in the conservative group versus 5 patients (5.3%) in the surgical group (p=0.048). Minor amputation rates were similar between groups (21.7% vs. 25.5%, p=0.542).

Overall limb salvage rate was 87.0% in the conservative group versus 94.7% in the surgical group (p=0.048).Hospital readmission within 12 months occurred in 28 patients (30.4%) in the conservative group compared to 18 patients (19.1%) in the surgical group (p=0.074). Ulcer recurrence at 12 months was similar between groups (18.5% vs. 15.9%, p=0.642). Mean hospital stay was 12.4 ± 8.6 days in the conservative group versus 16.8 ± 7.2 days in the surgical group (p<0.001). Total treatment cost was higher in the surgical group ($8,420 ± 4,280 vs. $6,840 ± 3,960, p=0.008).

Quality of life improved significantly in both groups at 6 months, with greater improvement observed in the surgical group (DFS score change: +18.4 ± 12.6 vs. +12.8 ± 10.4, p=0.001).

Table 3: Clinical Outcomes Comparison

Outcome	Conservative Group (n=92)	Surgical Group (n=94)	p-value
Complete wound healing, n (%)	62 (67.4)	77 (81.9)	0.021
Time to healing (weeks), mean ± SD	14.6 ± 5.8	8.4 ± 3.2	<0.001
Healing at 12 weeks, n (%)	38 (41.3)	64 (68.1)	<0.001
Healing at 24 weeks, n (%)	58 (63.0)	74 (78.7)	0.018
Major amputation, n (%)	12 (13.0)	5 (5.3)	0.048
Minor amputation, n (%)	20 (21.7)	24 (25.5)	0.542
Limb salvage rate, n (%)	80 (87.0)	89 (94.7)	0.048
Mortality, n (%)	4 (4.3)	3 (3.2)	0.718
Ulcer recurrence at 12 months, n (%)	17 (18.5)	15 (15.9)	0.642
Hospital readmission, n (%)	28 (30.4)	18 (19.1)	0.074
Hospital stay (days), mean ± SD	12.4 ± 8.6	16.8 ± 7.2	<0.001
Treatment cost ($), mean ± SD	6,840 ± 3,960	8,420 ± 4,280	0.008
DFS score change at 6 months, mean ± SD	+12.8 ± 10.4	+18.4 ± 12.6	0.001
Complication rate, n (%)	34 (37.0)	32 (34.0)	0.678

Predictors of Treatment Failure: Multivariate logistic regression analysis identified independent predictors of treatment failure (non-healing or major amputation). Wagner grade ≥3 (OR: 3.42, 95% CI: 1.68-6.94, p<0.001), peripheral arterial disease (OR: 2.86, 95% CI: 1.42-5.76, p=0.003), HbA1c >9% (OR: 2.14, 95% CI: 1.12-4.08, p=0.021), ulcer size >10 cm² (OR: 1.92, 95% CI: 1.04-3.54, p=0.038), and osteomyelitis (OR: 2.68, 95% CI: 1.34-5.36, p=0.005) were significantly associated with treatment failure.

Kaplan-Meier survival analysis demonstrated significantly faster time to healing in the surgical group (log-rank p<0.001), with median healing time of 7.8 weeks (95% CI: 6.8-8.8) versus 13.2 weeks (95% CI: 11.4-15.0) in the conservative group.

Discussion

This prospective comparative study demonstrates that surgical management of diabetic foot ulcers is associated with superior healing outcomes, shorter time to wound closure, and reduced major amputation rates compared to conservative treatment. These findings have important implications for clinical decision-making and resource allocation in diabetic foot care.

The complete healing rate of 81.9% observed in our surgical group compares favorably with published literature. A meta-analysis by Liu and colleagues examining outcomes of surgical debridement in DFUs reported pooled healing rates of 75-85% across included studies [18]. The improved healing rate in surgically managed patients likely reflects several mechanisms including removal of necrotic tissue burden, elimination of bacterial biofilms, exposure of viable wound bed tissue, and promotion of granulation tissue formation [19]. The substantially shorter time to healing (8.4 weeks vs. 14.6 weeks) in the surgical group represents a clinically meaningful difference with implications for patient quality of life, functional status, and healthcare resource utilization. Prompers et al., in their EURODIALE study analysis, identified prolonged healing time as a significant predictor of subsequent complications and amputation [20]. Accelerated healing reduces the window of vulnerability for wound deterioration and secondary infection.

The observed major amputation rate of 5.3% in the surgical group versus 13.0% in the conservative group aligns with accumulating evidence supporting early surgical intervention. Lipsky and colleagues demonstrated that aggressive surgical debridement combined with appropriate antimicrobial therapy significantly reduced amputation rates in patients with moderate-to-severe diabetic foot infections [21]. The preservation of limb function carries profound implications for patient mobility, independence, and survival [22].

Our finding that peripheral arterial disease independently predicted treatment failure underscores the critical importance of vascular assessment in DFU management. The presence of ischemia compromises wound healing regardless of treatment approach and may indicate need for revascularization procedures prior to or concurrent with wound management [23]. The IWGDF guidelines emphasize the necessity of comprehensive vascular evaluation and consideration of revascularization in patients with evidence of peripheral arterial disease [24].

The association between elevated HbA1c and treatment failure highlights the fundamental role of glycemic control in wound healing. Hyperglycemia impairs multiple phases of wound repair including inflammatory cell function, angiogenesis, collagen synthesis, and epithelialization [25]. Intensive glycemic management should be considered an integral component of any DFU treatment strategy, regardless of whether conservative or surgical approaches are employed.

Wagner grade emerged as a powerful predictor of outcomes in our analysis, consistent with its established role as a prognostic classification system. Higher Wagner grades indicate greater tissue loss and deeper infection, which logically predict worse outcomes [26]. However, our data suggest that early surgical intervention may partially mitigate the adverse prognostic impact of higher-grade ulcers by preventing progression and facilitating healing.

The higher initial hospital stay and treatment costs in the surgical group require contextualization. While surgical patients incurred greater upfront costs, the improved healing rates and reduced major amputation rates translate to substantial downstream cost savings.

Bus and colleagues demonstrated that costs associated with major amputation, including prosthetic fitting, rehabilitation, and long-term disability, far exceed those of limb-preserving treatments [27]. Economic analyses incorporating long-term outcomes consistently favor aggressive intervention strategies [28].

Ulcer recurrence rates were comparable between groups at 12-month follow-up, suggesting that treatment modality does not substantially influence recurrence risk. This observation emphasizes that recurrence prevention requires ongoing attention to predisposing factors including neuropathy, deformity, and pressure distribution regardless of initial treatment success [29]. Our study has several limitations. The non-randomized design introduces potential selection bias, as treatment allocation was influenced by clinical judgment and patient preferences. Although baseline characteristics were statistically similar, unmeasured confounders may have influenced outcomes. Additionally, the single-center design may limit generalizability to settings with different resources or patient populations. Future randomized controlled trials would provide stronger evidence for treatment recommendations.

Conclusion

This comparative study demonstrates that surgical management of moderate-to-severe diabetic foot ulcers achieves superior outcomes compared to conservative treatment, including higher complete healing rates, significantly shorter healing times, and reduced major amputation rates. These benefits must be weighed against increased initial hospitalization and treatment costs, which are likely offset by improved long-term outcomes and preserved functional status.

Clinical decision-making should incorporate comprehensive assessment of ulcer severity, vascular status, glycemic control, and patient factors. Early surgical intervention should be strongly considered for patients with Wagner grade 3 or 4 ulcers, significant necrotic tissue burden, or inadequate response to initial conservative management. Multidisciplinary diabetic foot teams integrating surgical, medical, and wound care expertise are essential for optimizing patient outcomes.

Glycemic control and management of peripheral arterial disease remain fundamental regardless of treatment approach. Future research should focus on identifying patient subgroups most likely to benefit from surgical intervention and developing evidence-based algorithms for treatment selection in diabetic foot ulcers.

References

1. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. JAMA. 2005;293(2):217-228. doi:10.1001/jama.293.2.217. PMID: 15644549
2. Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: A systematic review and meta-analysis. Ann Med. 2017;49(2):106-116. doi:10.1080/07853890.2016.1231932. PMID: 27585063
3. Rice JB, Desai U, Cummings AK, Birnbaum HG, Skornicki M, Parsons NB. Burden of diabetic foot ulcers for Medicare and private insurers. Diabetes Care. 2014;37(3):651-658. doi:10.2337/dc13-2176. PMID: 24186882
4. Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. Lancet. 2005;366(9498):1719-

1724. doi:10.1016/S0140-6736(05)67698-2. PMID: 16291066

5. Tesfaye S, Boulton AJ, Dyck PJ, Freeman R, Horowitz M, Kempler P, et al. Diabetic neuropathies: Update on definitions, diagnostic criteria, estimation of severity, and treatments. Diabetes Care. 2010;33(10):2285-2293. doi:10.2337/dc10-1303. PMID: 20876709
6. Marso SP, Hiatt WR. Peripheral arterial disease in patients with diabetes. J Am Coll Cardiol. 2006;47(5):921-929. doi:10.1016/ j.jacc.2005.09.065. PMID: 16516072
7. Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJ, Armstrong DG, et al. 2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. Clin Infect Dis. 2012;54(12):e132-173. doi:10.1093 /cid/cis346. PMID: 22619242
8. Thorud JC, Plemmons B, Buckley CJ, Shibuya N, Jupiter DC. Mortality after nontraumatic major amputation among patients with diabetes and peripheral vascular disease: A systematic review. J Foot Ankle Surg. 2016;55(3):591-599. doi:10.1053/j.jfas.2016.01.012. PMID: 26898398
9. Ribu L, Hanestad BR, Moum T, Birkeland K, Rustoen T. A comparison of the health-related quality of life in patients with diabetic foot ulcers, with a diabetes group and a nondiabetes group from the general population. Qual Life Res. 2007;16(2):179-189. doi:10.1007/s11136-006-0031-y. PMID: 17091370
10. Everett E, Mathioudakis N. Update on management of diabetic foot ulcers. Ann N Y Acad Sci. 2018;1411(1):153-165. doi:10.1111/ nyas.13569. PMID: 29377202
11. Frykberg RG, Banks J. Challenges in the treatment of chronic wounds. Adv Wound Care (New Rochelle). 2015;4(9):560-582. doi:10.1089/wound.2015.0635. PMID: 26339534
12. Armstrong DG, Frykberg RG. Classifying diabetic foot surgery: Toward a rational definition. Diabet Med. 2003;20(4):329-331. doi:10.1046/j.1464-5491.2003.00933.x. PMID: 12675650
13. Atway S, Nerone VS, Springer KD, Woodruff DM. Rate of residual osteomyelitis after partial foot amputation in diabetic patients: A standardized method for evaluating bone margins with intraoperative culture. J Foot Ankle Surg. 2012;51(6):749-752. doi:10.1053/ j.jfas.2012.06.017. PMID: 22858308
14. Steed DL, Attinger C, Colaizzi T, Crossland M, Franz M, Harkless L, et al. Guidelines for the treatment of diabetic ulcers. Wound Repair Regen. 2006;14(6):680-692. doi:10.1111/j.152 4-475X.2006.00176.x. PMID: 17199833
15. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Hinchliffe RJ, Lipsky BA, et al. Practical Guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update). Diabetes Metab Res Rev. 2020;36 Suppl 1:e3266. doi:10.1002/dmrr.3266. PMID: 32176447
16. Game FL, Attinger C, Hartemann A, Hinchliffe RJ, Löndahl M, Price PE, et al. IWGDF guidance on use of interventions to enhance the healing of chronic ulcers of the foot in diabetes. Diabetes Metab Res Rev. 2016;32 Suppl 1:75-83. doi:10.1002/dmrr.2 700. PMID: 26340818
17. Defined Health. Systematic review of advanced wound care therapies for diabetic foot ulcers. Health Technol Assess. 2021;25 (1):1-294. doi:10.3310/hta25010. PMID: 33506718
18. Liu S, He CZ, Cai YT, Xing QP, Guo YZ, Chen ZL, et al. Evaluation of negative-pressure wound therapy for patients with diabetic foot ulcers: Systematic review and meta-analysis. Ther Clin Risk Manag. 2017;13:533-544. doi:10.2147/TCRM.S131193. PMID: 284585 56
19. Wilcox JR, Carter MJ, Covington S. Frequency of debridements and time to heal: A retrospective cohort study of 312 744 wounds. JAMA Dermatol. 2013;149(9):1050-1058. doi:10.1001/jamadermatol.2013.4960. PMID: 23884301
20. Prompers L, Schaper N, Apelqvist J, Edmonds M, Jude E, Mauricio D, et al. Prediction of outcome in individuals with diabetic foot ulcers: Focus on the differences between individuals with and without peripheral arterial disease. The EURODIALE Study. Diabetologia. 2008;51(5):747-755. doi:10.100 7/s00125-008-0940-0. PMID: 18297261
21. Lipsky BA, Senneville É, Abbas ZG, Aragón-Sánchez J, Diggle M, Embil JM, et al. Guidelines on the diagnosis and treatment of foot infection in persons with diabetes (IWGDF 2019 update). Diabetes Metab Res Rev. 2020;36 Suppl 1:e3280. doi:10.10 02/dmrr.3280. PMID: 32176449
22. Reiber GE, Vileikyte L, Boyko EJ, del Aguila M, Smith DG, Lavery LA, et al. Causal pathways for incident lower-extremity ulcers in patients with diabetes from two settings. Diabetes Care. 1999;22(1):157-162. doi:10.23 37/diacare.22.1.157. PMID: 10333919
23. Hingorani A, LaMuraglia GM, Henke P, Meissner MH, Lorber L, Zinszer KM, et al. The management of diabetic foot: A clinical practice guideline by the Society for Vascular Surgery in collaboration with the American Podiatric Medical Association and the Society for Vascular Medicine. J Vasc Surg. 2016;63(2

Suppl):3S-21S. doi:10.1016/j.jvs.2015.10.003. PMID: 26804367

24. Hinchliffe RJ, Brownrigg JR, Andros G, Apelqvist J, Boyko EJ, Fitridge R, et al. Effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral artery disease: A systematic review. Diabetes Metab Res Rev. 2016;32 Suppl 1:136-144. doi:10.1002/dmrr.2705. PMID: 26342204
25. Baltzis D, Eleftheriadou I, Veves A. Pathogenesis and treatment of impaired wound healing in diabetes mellitus: New insights. Adv Ther. 2014;31(8):817-836. doi:10.1007/s12325-014-0140-x. PMID: 25069580
26. Wagner FW Jr. The dysvascular foot: A system for diagnosis and treatment. Foot Ankle. 1981;2(2):64-122. doi:10.1177/107110078100200202. PMID: 7319435
27. Bus SA, van Netten JJ, Lavery LA, Monteiro-Soares M, Rasmussen A, Jubiz Y, et al. IWGDF guidance on the prevention of foot ulcers in at-risk patients with diabetes. Diabetes Metab Res Rev. 2016;32 Suppl 1:16-24. doi:10.1002/dmrr.2696. PMID: 26334001
28. Driver VR, Fabbi M, Lavery LA, Gibbons G. The costs of diabetic foot: The economic case for the limb salvage team. J Vasc Surg. 2010;52(3 Suppl):17S-22S. doi:10.1016/j.jvs.2010.06.003. PMID: 20804928
29. Armstrong DG, Boulton AJM, Bus SA. Diabetic foot ulcers and their recurrence. N Engl J Med. 2017;376(24):2367-2375. doi:10.1056/NEJMra1615439. PMID: 28614678.