MMDJ
MEANDROS MEDICAL AND DENTAL JOURNAL

September 2025 26(3):350-355

Meandros Medical and Dental Journal
doi: 10.69601/meandrosmdj.1738164

Research Article

MULTIFACTORIAL INSIGHTS INTO CHRONIC LEG ULCERS: EXPERIENCE FROM A TERTIARY WOUND CARE CENTER

Mustafa AKYUREK[*1], Berkay KAYA[1], Anil BOLCA[1]

[1] Department of Aesthetic, Plastic and Reconstructive Surgery, Faculty of Medicine, Canakkale Onsekiz Mart University, Canakkale, TURKIYE

[*]Correspondence: drmustafaakyurek@gmail.com

Received: *09 July 2025*
Revised: *03 August 2025*
Accepted: *06 August 2025*
Published: *22 September 2025*

ABSTRACT

Objective: To analyze the demographic features, etiological factors, clinical profiles, and treatment outcomes of patients with chronic lower extremity wounds managed at a tertiary wound care center.

Materials and Methods: A retrospective review was conducted on 783 patients treated for chronic lower extremity wounds between May 2014 and January 2022. Patient demographics, comorbidities, wound etiology, microbiological data, histopathological findings, and treatment modalities were evaluated. Patients with trauma-related wounds or incomplete follow-up were excluded.

Results: The mean age was 62.1 years, with females comprising 32% of the cohort. Diabetes was the leading cause of chronic lower extremity wounds (68.6%), followed by PAD in non-diabetic patients (21%), venous insufficiency (5.6%), and stasis dermatitis (3%). Pyoderma gangrenosum and drug reactions represented less common etiologies. Among diabetic foot ulcer patients, 55% were Wagner Grade 1–2, while 45% were Grade 3 or higher. Smoking prevalence was 74%, and associated with longer healing times. Wound closure was achieved via skin grafting in 58% of cases, secondary intention in 21%, and amputation in 12%. Negative pressure wound therapy was employed in 15% of cases. Staphylococcus aureus, Enterococcus spp., and Pseudomonas spp. were the most commonly isolated pathogens. Pyoderma gangrenosum was histologically confirmed in 6 patients.

Conclusions: Diabetes and PAD remain the predominant etiologies of chronic lower extremity wounds. High smoking prevalence, delayed referrals, and advanced Wagner grades at presentation underscore the importance of early multidisciplinary intervention and standardized treatment protocols. The judicious use of negative pressure wound therapy, tailored antibiotic stewardship, and consideration of non-infectious etiologies in non-healing wounds are vital. Nationwide multicenter prospective studies are needed to develop uniform strategies for reducing the clinical and economic burden of chronic lower extremity wounds. a multidisciplinary approach are essential to improving outcomes and reducing the risk of limb loss.

Keywords: Foot injuries, Wound healing, Diabetic Foot, Foot Ulcer

MMDJ
MEANDROS MEDICAL AND DENTAL JOURNAL
September 2025 26(3):350-355

Meandros Medical and Dental Journal
doi: 10.69601/meandrosmdj.1738164

INTRODUCTION

The lower extremity, which bears the body's weight and contains dense muscular tissue for this purpose, is the most common site of chronic wounds (1). Unlike the well-vascularized thigh, the ankle region has relatively poor perfusion. Consequently, wounds located below the knee have a higher likelihood of becoming chronic. Ligaments that stabilize the ankle, tendons that transfer muscular force, and joints that enable movement make the distal lower extremity a region rich in connective tissue. When skin injury extends into deeper structures, permanent damage to these tissues may occur.

The sensory function of the plantar skin, which resists friction forces during ambulation, is particularly critical. As the most distal part of the body, the lower leg is highly vulnerable to ischemia caused by atherosclerosis. Additionally, due to gravity, it is the region where venous return is most problematic. Unfortunately, common comorbidities such as diabetes, obesity, and smoking further impair lower extremity perfusion and make chronic wounds a growing public health concern (2).

According to the World Health Organization, health is defined not merely as the absence of disease or infirmity, but as a state of complete physical, mental, and social well-being (3). Chronic wounds in the lower extremity can significantly restrict mobility, leading to social withdrawal. This in turn contributes to financial and psychological distress, adversely affecting individuals' quality of life. With a prevalence of 2.21 per 1,000 people, chronic wounds affect millions of individuals worldwide (1). Beyond the direct expenses associated with wound care materials and healthcare personnel, the loss of patient productivity further exacerbates the overall economic burden. In the United States alone, the annual expenditure on the management of chronic wounds is estimated to be approximately $25 billion (4). Therefore, the underlying causes of chronic wounds should be thoroughly analyzed and addressed promptly to prevent additional healthcare costs and minimize long-term socioeconomic impact.

The aim of this study is to share the demographic characteristics, underlying causes, and treatment processes of patients with chronic lower extremity wounds who presented to our tertiary care center.

MATERIALS AND METHODS

The records of patients who presented to our clinic with chronic lower extremity wounds between May 2014 and January 2022 were retrospectively reviewed. Data on treatment and follow-up processes, requested consultations, wound culture results, histopathological diagnoses (if available), and imaging studies related to the wound pathophysiology were analyzed. Wounds that remained open for more than four weeks and had a Bates–Jensen Wound Assessment Tool score above 20 at the time of admission were classified as chronic wounds (5). Patients with wounds resulting from trauma following orthopedic procedures or those lost to follow-up before wound healing were excluded.

The etiology of chronic wounds was classified based on patient history and review of prior medical records. Ankle-brachial index (ABI) was measured in patients with diabetes, a history of smoking, or ischemic heart disease. Those with an ABI value below 0.9 were referred for vascular surgery consultation. Patients without diabetes but with a low ABI were classified as having peripheral arterial disease–related ulcers. In cases of suspected stasis dermatitis, venous Doppler ultrasonography was performed to evaluate for venous insufficiency as part of the differential diagnosis.

The wounds of patients treated in our clinic were monitored using the Bates–Jensen scoring system. Patients whose scores decreased below 15 or whose wounds were closed through amputation were considered to have achieved wound healing.

This study was approved by the local ethics committee on January 5, 2022, with decision number 2022-01. Informed consent forms were obtained from all patients for the use of their clinical photographs.

RESULTS

A total of 783 patients meeting the inclusion criteria were analyzed. The mean age was 62.1 years (range: 24–82), with 32% being female (mean age: 66.2). Approximately 61% of patients first presented through the outpatient clinic, while 19.6% were admitted via the emergency department. The remaining patients were referred from other departments. The average follow-up duration was 64 days, with the shortest healing time being 10 days. The most common causes of chronic wounds were diabetes (68.6%), peripheral arterial disease in non-diabetic patients (21%), venous insufficiency (5.6%), and stasis dermatitis (3%) (Table 1).

Other causes included immunological conditions such as pyoderma gangrenosum (Figure 1), topical drug reactions,

MMDJ
MEANDROS MEDICAL AND DENTAL JOURNAL
September 2025 26(3):350-355
Meandros Medical and Dental Journal
doi: 10.69601/meandrosmdj.1738164

and non-diabetic neurological diseases such as spina bifida. Among the patients presenting with diabetic foot, 55% were classified as Grade 1 or 2 according to the Wagner classification (Figure 2).

Table 1. The distribution of chronic lower extremity wound etiologies presenting to our clinic based on underlying diseases and gender.

Wound Etiology	Total (n)	Male (n)	Female (n)	Percentage (%)
Diabetic	537	365	172	68.6%
Peripheral Arterial Disease	164	112	52	21.0%
Venous Insufficiency	44	30	14	5.6%
Stasis Dermatitis	24	16	8	3.0%
Others	14	9	5	0.8%
Total	783	532	251	

Figure 1. 73-year-old male patient with pyoderma gangrenosum

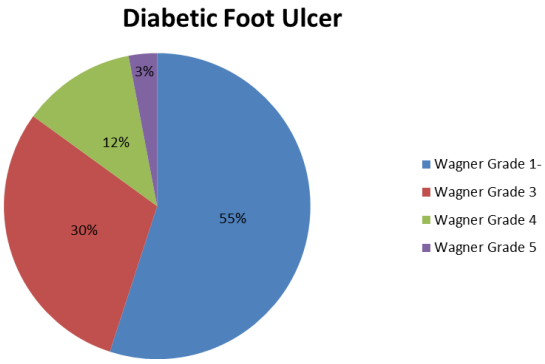

Figure 2. In our clinical practice, 55% of diabetic foot ulcer patients presented with early-stage wounds (Wagner Grade 1-2). Advanced stages were observed at lower rates: 30% for Grade 3, 12% for Grade 4, and only 3% for Grade 5 cases. These findings highlight the importance of early diagnosis and intervention.

Diabetic foot the leading cause of amputations. Among all patients, 74% were active smokers, and those who smoked had the longest treatment durations. Wounds not requiring amputation were treated mostly with partial- or full-thickness skin grafting (58%) (Figure 3).

Figure 3. 40-year-old male patient, pre-operative and post-operative 6th months results after graft application.

Amputation was performed in 12% of patients, and 21% achieved wound closure via secondary intention (Table 2).

Table 2. Average follow up was 70.6 days for diabetic patients and 50.9 days for those with peripheral arterial disease across all age groups. The highest amputation rate was observed in the diabetic patients.

Total Number of Amputee Patients	Diabetic Patients (n)	PAD Patients (n)	Diabetic Ratio (%)	PAD Ratio (%)	Average Diabetic Follow-up Duration	Average PAD Follow-up Duration
94	69	25	73%	27%	70.6 Days	50.9 Days

The remaining patients underwent flap surgery. During follow-up, wound care was most frequently performed using conventional moist dressings. Additional agents included boric acid (eau de borique), hydrogen peroxide, mupirocin, silver sulfadiazine, and Bactigras. In patients with high exudate levels, oscillating negative pressure wound therapy was used (15%). The most frequently isolated pathogens in wound cultures were Staphylococcus aureus (28%), Enterococcus spp. (20%), and Pseudomonas spp. (16%). Differential diagnosis was pursued in wounds with clinical suspicion based on patient history, and biopsy was performed in selected cases. Among these, pyoderma gangrenosum was the most frequently identified specific pathology (6 patients), with the diagnosis confirmed histopathologically in patients whose anamnesis was consistent with this entity.

MMDJ
MEANDROS MEDICAL AND DENTAL JOURNAL
September 2025 26(3):350-355
Meandros Medical and Dental Journal
doi: 10.69601/meandrosmdj.1738164

DISCUSSION

Chronic wounds of the lower extremity represent a significant burden for both patients and healthcare systems, particularly in populations with increasing rates of diabetes, peripheral arterial disease, and smoking. In our study, diabetes emerged as the most common etiology, consistent with existing literature, where diabetic foot ulcers are reported to account for up to 70% of chronic lower extremity wounds (6). The primary cause of chronic lower extremity wounds associated with diabetes is neuropathy (7). While factors such as the duration of diabetes, the degree of glycemic control, and patient height have been investigated in the development of neuropathic ulcers, it is widely acknowledged among researchers that chronic wounds occur more frequently in male patients (8) . In our cohort as well, the proportion of male patients was higher than the rates commonly reported in the literature (9). This may be attributed to sociocultural factors, such as lower smoking prevalence among women and their comparatively greater involvement in agricultural work.

Approximately half of the patients presenting to our clinic with diabetic foot ulcers were classified as Wagner Grade 1 or 2. As is well known, such cases generally respond well to basic wound care, proper glycemic control, and offloading of the affected foot (10) . However, a major concern is that 45% of the patients had wounds classified as Grade 3 or higher, which represents a significantly high proportion. Notably, the majority of these patients were referred from other healthcare centers. In contrast, studies from other countries report that only around 20% of patients presenting with diabetic foot ulcers fall into Grade 3 or higher categories (11). This discrepancy highlights the need for comparative assessments across tertiary centers in different regions of our country, and suggests that current diabetic foot care algorithms should be reevaluated and revised through comprehensive meta-analyses.

The predominance of wounds located distal to the knee aligns with anatomical and vascular considerations. The distal lower limb, especially the ankle and foot regions, has relatively poor perfusion compared to the proximal limb. Furthermore, gravitational effects and compromised venous return contribute to stasis, edema, and tissue hypoxia, all of which hinder wound healing (12). Smoking negatively affects both the healing rate and overall healing outcomes of diabetic foot ulcers (13). In our cohort, the high incidence of smoking (74%) is a striking finding, supporting its known vasoconstrictive effects and detrimental impact on both microcirculation and immune response. Our findings also highlight the prolonged treatment durations in smokers, in line with studies reporting delayed epithelialization and higher rates of infection and dehiscence in this group.

Additionally, diabetic wounds were the leading cause of lower limb amputations, underlining the need for early detection, glycemic control, and timely referral to multidisciplinary wound care teams (14). In our study, 8.3% of the patients who presented with diabetic foot ulcers underwent either major or minor amputation. A review of the literature reveals variability in amputation rates across different geographic regions. For example, a study conducted in Iran reported a relatively high amputation rate of 18.8%, whereas a study from China reported a significantly lower rate of 7.3% (15,16). These differences may be attributed to sociocultural factors and dietary habits. Among patients presenting with peripheral arterial disease, the rate of major or minor amputation was notably high at 29.8%. In the literature, major amputation rates are generally reported to be around 10% (17,18). This discrepancy may be explained by the exclusion of minor amputations in some of the published studies.

Regarding wound management, traditional moist dressings were the mainstay of treatment, supplemented by topical antimicrobial agents. The use of negative pressure wound therapy (NPWT) in 15% of cases was associated with highly exudative wounds, consistent with its established role in reducing edema, promoting granulation tissue formation, and enhancing perfusion (19). The application of negative pressure wound therapy (NPWT) in ischemic extremities should be approached with particular caution. In patients with an ankle-brachial index (ABI) below 0.6, its use may lead to progression of tissue necrosis. It must be emphasized that NPWT cannot serve as an alternative to appropriate revascularization procedures (20).

Our culture data demonstrated a predominance of Staphylococcus aureus, Enterococcus spp., and Pseudomonas spp., which are among the most common organisms reported in chronic wounds (21). Prior to the initiation of antibiotic therapy in patients with diabetic foot ulcers, the presence of systemic infection should be substantiated not only by microbiological culture results but also through comprehensive clinical assessment and relevant biochemical markers. Pathogens isolated from diabetic foot wounds are frequently characterized by a high degree of antimicrobial resistance (22). Given the susceptibility of diabetic patients to renal impairment,

MMDJ
MEANDROS MEDICAL AND DENTAL JOURNAL
September 2025 26(3):350-355
Meandros Medical and Dental Journal
doi: 10.69601/meandrosmdj.1738164

renal function must be carefully evaluated when selecting antibiotic regimens, and unnecessary or empiric antimicrobial use should be avoided whenever possible.
The identification of pyoderma gangrenosum in biopsy samples highlights the importance of considering non-infectious etiologies in non-healing wounds, particularly in the presence of atypical clinical features or poor response to conventional therapy. Delayed or missed diagnoses of inflammatory dermatoses can lead to inappropriate treatments and worsened outcomes (23).

Our study has several limitations. As a retrospective analysis conducted in a single tertiary care center, it is inherently subject to selection, referral, and reporting biases. Patients referred to tertiary centers often represent more severe or complex clinical presentations, which may limit the generalizability of the findings to the broader population with chronic lower extremity wounds. Moreover, the retrospective nature of the study introduces variability in clinical documentation, data completeness, and follow-up duration, potentially affecting the consistency and reliability of collected information. These factors should be taken into account when interpreting the results. Nevertheless, despite these limitations, our study offers valuable insight into the clinical characteristics, management approaches, and microbiological profiles associated with chronic lower extremity wounds in a tertiary care setting, contributing to the understanding of this challenging patient population.

CONCLUSION

Chronic lower extremity wounds constitute a complex clinical challenge with multifactorial etiologies and significant individual and societal impact. Our findings underscore the predominance of diabetes and peripheral arterial disease as leading causes, along with the substantial role of smoking in delayed wound healing and increased treatment burden. The high rate of advanced Wagner grades and amputations among referred patients highlights the need for earlier intervention, improved referral systems, and standardized treatment algorithms across centers. The utility of negative pressure wound therapy and microbiological surveillance in guiding personalized treatment was evident; however, caution must be exercised in ischemic cases, especially those with severely reduced perfusion. Strengthening multidisciplinary wound care teams, promoting patient education, and addressing modifiable risk factors such as smoking and glycemic control remain essential. Future multicenter and prospective studies are warranted to develop evidence-based national strategies aimed at reducing the incidence, complications, and economic burden of chronic lower extremity wounds.

Acknowledgments
The authors would like to thank the medical staff of the tertiary wound care center for their invaluable support in patient management and data collection.

Authorship contributions
Surgical and medical practices: Dr.Mustafa Akyurek
Concept: Dr.Mustafa Akyurek
Design: Dr. Berkay Kaya
Data collection or Processing: Dr. Anıl Bolca
Analysis or interpretation: Dr. Berkay Kaya
Literature Search: Dr. Anıl Bolca
Writing: Dr.Mustafa Akyurek
All authors read and approved the final version of the manuscript.

Data availibity statement
The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest
The authors declare that they have no competing interests related to this work.

Ethics
This study was approved by the Çanakkale Onsekiz Mart University Ethics Committee on January 5, 2022 (decision number 2022-01, application number 2011-KAEK-27/2021-2100214566). Written informed consent was obtained from all patients for the use of their clinical data and photographs.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES
1. Martinengo L, Olsson M, Bajpai R, et al. Prevalence of chronic wounds in the general population: Systematic review and meta-analysis of observational studies. Ann Epidemiol 2019;29:8–15
2. Sen CK, Gordillo GM, Roy S, et al. Human skin wounds: A major and snowballing threat to public health and the economy. Wound Repair Regen 2009;17(6):763–771
3. World Health Organization. Constitution of the World Health Organization. Geneva: World Health Organization; 1948.

MMDJ
MEANDROS MEDICAL AND DENTAL JOURNAL
September 2025 26(3):350-355
Meandros Medical and Dental Journal
doi: 10.69601/meandrosmdj.1738164

4. Schneider C, Stratman S, Kirsner RS. Lower Extremity Ulcers. Med Clin North Am. 2021 Jul;105(4):663-679.
5. Bates-Jensen, B. M. (2001). The Bates-Jensen Wound Assessment Tool: Development and validation for comprehensive wound evaluation. Advances in Skin & Wound Care, 14(5), 246-259.
6. Armstrong DG, Tan TW, Boulton AJM, Bus SA. Diabetic Foot Ulcers: A Review. JAMA. 2023;330(1):62-75. doi:10.1001/jama.2023.10578
7. Morbach S, Lutale JK, Viswanathan V, Möllenberg J, Ochs HR, Rajashekar S, Ramachandran A, Abbas ZG. Regional differences in risk factors and clinical presentation of diabetic foot lesions. Diabet Med. 2004 Jan;21(1):91-5.
8. Sorensen L, Molyneaux L, Yue DK. Insensate versus painful diabetic neuropathy: the effects of height, gender, ethnicity and glycaemic control. Diabetes Res Clin Pract. 2002 Jul;57(1):45-51.
9. Kiziltan ME, Gunduz A, Kiziltan G, Akalin MA, Uzun N. Peripheral neuropathy in patients with diabetic foot ulcers: clinical and nerve conduction study. J Neurol Sci. 2007 Jul 15;258(1-2):75-9.
10. Armstrong DG, Lavery LA, Wu S, Boulton AJ. Evaluation of removable and irremovable cast walkers in the healing of diabetic foot wounds: a randomized controlled trial. Diabetes Care. 2005 Mar;28(3):551-4.
11. Oyibo SO, Jude EB, Tarawneh I, Nguyen HC, Harkless LB, Boulton AJ. A comparison of two diabetic foot ulcer classification systems: the Wagner and the University of Texas wound classification systems. Diabetes Care. 2001 Jan;24(1):84-8.
12. Edmonds M, Manu C, Vas P. The current burden of diabetic foot disease. J Clin Orthop Trauma. 2021;17:88-93. Published 2021 Feb 8.
13. Álvaro-Afonso FJ, Lázaro-Martínez JL, Papanas N. To Smoke or Not To Smoke: Cigarettes Have a Negative Effect on Wound Healing of Diabetic Foot Ulcers. Int J Low Extrem Wounds. 2018 Dec;17(4):258-260.
14. Paisey RB, Abbott A, Levenson R, Harrington A, Browne D, Moore J, Bamford M, Roe M; South-West Cardiovascular Strategic Clinical Network peer diabetic foot service review team. Diabetes-related major lower limb amputation incidence is strongly related to diabetic foot service provision and improves with enhancement of services: peer review of the South-West of England. Diabet Med. 2018 Jan;35(1):53-62.
15. Aalaa M, Vahdani AM, Mohajeri Tehrani M, et al. Epidemiological Insights into Diabetic Foot Amputation and its Correlates: A Provincial Study. Clin Med Insights Endocrinol Diabetes. 2024;17:11795514241227618. Published 2024 Jan 30.
16. Gong H, Ren Y, Li Z, et al. Clinical characteristics and risk factors of lower extremity amputation in the diabetic inpatients with foot ulcers. Front Endocrinol (Lausanne). 2023;14:1144806. Published 2023 Mar 31.
17. Prasertcharoensuk S, Prateepphuangrat K, Angkasith P, et al. Risk factors of major lower limb amputation in symptomatic peripheral artery disease: a retrospective cohort study. Future Sci OA. 2025;11(1):2476881.
18. Søgaard M, Behrendt CA, Eldrup N, Skjøth F. Lifetime risk of lower extremity peripheral arterial disease: a Danish nationwide longitudinal study. Eur Heart J. 2025;46(13):1206-1215.
19. Seidel, D., Lefering, R. & DiaFu study group. NPWT resource use compared with standard moist wound care in diabetic foot wounds: DiaFu randomized clinical trial results. J Foot Ankle Res 15, 72 (2022).
20. Vig S, Dowsett C, Berg L, et al. Evidence-based recommendations for the use of negative pressure wound therapy in chronic wounds: steps towards an international consensus. J Tissue Viability. 2011;20 Suppl 1:S1-S18.
21. Maity S, Leton N, Nayak N, et al. A systematic review of diabetic foot infections: pathogenesis, diagnosis, and management strategies. Front Clin Diabetes Healthc. 2024;5:1393309. Published 2024 Aug 6.
22. Hung SY, Chiu CH, Huang CH, et al. Impact of wound microbiology on limb preservation in patients with diabetic foot infection. J Diabetes Investig. 2022;13(2):336-343.
23. George C, Deroide F, Rustin M. Pyoderma gangrenosum - a guide to diagnosis and management . Clin Med (Lond). 2019;19(3):224-228.