INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

PREVALENCE OF FOOT COMPLICATIONS IN ADMITTED PATIENTS WITH TYPE 2 DIABETES MELLITUS IN A TERTIARY CARE TEACHING HOSPITAL

Original Research

Karamat Shah[1]*, Shabnam Suhrab[2], Farukh Usman[3], Rabya Munir Ahmad[4], Sadia Imdad[5], Pawan Kumar Khatri[6]
[1]Postgraduate, Pakistan.
[2]Associate Professor, Pakistan.
[3]Postgraduate, Liaquat University of Medical and Health Sciences, Pakistan.
[4]Postgraduate Trainee/House Officer, Jinnah Postgraduate Medical Centre (JPMC), Pakistan.
[5]Post graduate trainee, JPMC, Pakistan.
[6]Houseofficer, JPMC, Pakistan.
Corresponding Author: Karamat Shah, Postgraduate, Pakistan, karamat2013@hotmail.com
Acknowledgement: The authors thank the hospital staff and medical record unit for their cooperation in data retrieval.

Conflict of Interest: None
Grant Support & Financial Support: None

ABSTRACT

Background: Diabetic foot is one of the most severe and costly complications of diabetes mellitus, often leading to infections, hospitalization, and limb amputations. The growing prevalence of type 2 diabetes mellitus (T2DM) in developing countries, particularly Pakistan, has made diabetic foot a pressing public health concern. Limited access to foot care services and delayed diagnosis further compound the risk of severe complications. Understanding the epidemiological burden and clinical patterns of diabetic foot complications is crucial for developing targeted preventive strategies.

Objective: To assess the prevalence and clinical characteristics of foot complications in patients with type 2 diabetes mellitus admitted to a tertiary care hospital in Karachi, Pakistan.

Methods: This descriptive retrospective study included 183 male patients with T2DM aged between 40 and 70 years, admitted to the male general ward. The mean age was 57.87 ± 13.1 years. Data were extracted from hospital records, including foot lesion type, laterality, comorbidities, and surgical interventions. Diabetic foot complications were classified using Amit Jain's classification. Statistical analysis was performed using SPSS version 29.0.

Results: The right foot was affected in 109 patients (59.6%) and the left in 74 (40.4%). Type 1 diabetic foot complications were most prevalent, found in 131 patients (71.6%), followed by type 3 in 37 (20.2%) and type 2 in 15 (8.2%). Wet gangrene was the most frequent pathological lesion (68 cases; 37.2%), followed by abscesses (34 cases; 18.6%) and cellulitis (22 cases; 12.0%). Infected trophic ulcers were reported in 24 patients (13.1%), while 18 (9.8%) had osteomyelitis and 22 (12%) had peripheral arterial disease. Surgical amputation was performed in 147 patients (80.3%).

Conclusion: Type 1 diabetic foot complications, particularly wet gangrene, were the most common cause of hospitalization among male patients with T2DM, with a high rate of surgical intervention. These findings underscore the need for early screening, proper foot care education, and accessible multidisciplinary care.

Keywords: Amit Jain Classification, Amputation, Diabetic Foot, Diabetic Neuropathy, Diabetes Mellitus Type 2, Foot Ulcer, Risk Factors.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder of increasing global concern, with a reported prevalence ranging between 4% and 6.5% (1). It is a multifaceted disease affecting almost every major organ system, contributing significantly to morbidity, disability, and premature mortality (1). With its rapid rise across the globe, diabetes has become a formidable public health challenge of the 21st century. The International Diabetes Federation reported that, in 2011, approximately 366 million individuals were living with diabetes worldwide, a figure projected to escalate to 552 million by 2030—equating to one in every ten adults if current trends persist (2). Central to the disease burden is chronic hyperglycemia, which is responsible for an array of multisystem complications involving the eyes, kidneys, heart, blood vessels, and peripheral nerves. These complications, both microvascular and macrovascular in nature, are the leading contributors to the reduced quality of life, disability, and economic strain on healthcare systems. Evidence from the UK Perspective Diabetes Study has shown that intensive glycemic control significantly reduces the risk of both microvascular and macrovascular complications in patients with type 2 diabetes (3). However, a substantial proportion of individuals already exhibit vascular complications and metabolic disturbances by the time diabetes is clinically diagnosed (4). Factors such as long-standing hyperglycemia, hypertension, dyslipidemia, smoking, obesity, and genetic predispositions further accelerate disease progression and complication development. These cumulative effects result in major healthcare burdens, particularly in low- and middle-income countries, where access to specialized care is limited (5).

Among the most debilitating complications of diabetes is diabetic foot syndrome, which encompasses a spectrum of conditions including neuropathy, ischemia, infection, and foot deformities. Diabetic foot complications account for nearly a quarter of all diabetes-related hospital admissions (6) and are the leading cause of non-traumatic lower extremity amputations, particularly in countries like the United States, where the risk is increased up to 40-fold compared to the general population (7). The pathogenesis often begins with peripheral neuropathy and unnoticed trauma, progressing to ulceration and infection. Alarmingly, 85% of diabetes-related amputations are preceded by foot ulcers, with an estimated 15% lifetime risk of ulceration among people with diabetes (6,7). Inadequate foot care practices, poor footwear, structural foot abnormalities, and a lack of timely medical intervention further amplify this risk. Treatment failures and recurrent infections are major contributors to adverse outcomes, with one in five diabetic foot ulcers resulting in prolonged morbidity or amputation (8). Current evidence underscores the critical role of multidisciplinary care teams, standardized treatment guidelines, and patient education in preventing diabetic foot complications and reducing amputation rates (8,9). However, disparities in the prevalence and outcomes of diabetic foot disorders persist between countries, cities, and even healthcare institutions. Pakistan, like many developing countries, faces considerable challenges in diabetic foot care due to a shortage of trained professionals, limited specialized services, and an ever-increasing diabetes burden. Although several regional studies have assessed diabetic foot prevalence, a recent, large-scale assessment among patients attending tertiary outpatient clinics in the capital region remains lacking (10,11). This is particularly significant given the growing number of diabetic individuals and the evident gap in foot care services across the country (12). Recognizing these critical gaps, the present study was designed to assess the prevalence and characteristics of foot complications in individuals with type 2 diabetes attending the outpatient department of a major diabetic clinic in the capital city. The findings aim to provide updated insights into the burden of diabetic foot disease in this population, identify key risk factors, and inform future preventive and management strategies at both clinical and public health levels.

METHODS

This descriptive retrospective study was designed to determine the prevalence of foot complications among male patients with type 2 diabetes mellitus (T2DM). A sample size of 183 participants was calculated using the WHO sample size calculator version 2.2. The calculation was based on a previously reported national prevalence of diabetic foot ulcers in T2DM patients in Pakistan, which was 13.9% (13). Parameters used for the calculation included a population size of 20,000, a 95% confidence interval ($Z = 1.96$), and a 5% margin of error. The study population consisted exclusively of male patients aged between 40 and 70 years, diagnosed with type 2 diabetes, and admitted to the diabetic care unit of a tertiary care hospital. The inclusion of only male participants was intentional to minimize potential confounding due to gender-based physiological and hormonal variations that could affect the progression and clinical presentation of diabetic foot complications. Additionally, the selected facility's diabetic foot care program primarily manages male

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

patients, and logistical constraints limited the availability of sufficient female records to ensure meaningful subgroup analysis. Thus, focusing on a homogenous population enhanced the internal validity of the study. Exclusion criteria included patients with type 1 diabetes mellitus, those admitted to departments other than the diabetic unit, individuals lacking essential blood cell count data, patients who declined participation or treatment, cases with incomplete medical records, and individuals with severe hepatic or renal dysfunction that could alter disease trajectory or complicate analysis.

Data were collected retrospectively from hospital medical records after obtaining informed consent from participants or their legal representatives. The study protocol received ethical approval from the institutional review board (IRB), in compliance with the principles outlined in the Declaration of Helsinki. All ethical guidelines for human subject research were duly followed. Data analysis was performed using IBM SPSS Statistics version 29.0. Descriptive statistics summarized demographic and clinical variables. Continuous data were expressed as mean ± standard deviation (SD), along with minimum and maximum values, while categorical variables were presented as frequencies and percentages. Inferential statistical methods were applied to identify associations between variables, with statistical significance defined at a p-value of less than 0.05. Microsoft Excel and Word were used for the generation of tables and graphical data presentation.

RESULTS

A total of 183 male patients with type 2 diabetes mellitus were included in the study. The participants were aged between 40 and 70 years, with a mean age of 57.87 ± 13.1 years. Among these patients, the right foot was more commonly affected, noted in 109 cases (59.6%), while the left foot was affected in 74 cases (40.4%). According to Amit Jain's classification for diabetic foot complications, type 1 complications were the most prevalent, observed in 131 patients (71.6%). Type 3 complications accounted for 37 cases (20.2%), whereas type 2 complications were least common, recorded in 15 patients (8.2%). Analysis of the underlying pathological lesions revealed wet gangrene as the most frequently observed lesion, diagnosed in 68 cases (37.2%). This was followed by abscess formation in 34 patients (18.6%) and cellulitis in 22 patients (12.0%). Necrotizing fasciitis was present in 5 patients (2.7%). All these pathologies were associated with type 1 diabetic foot complications. Among type 2 complications, dry gangrene was identified in all 15 patients (100%). For type 3 complications, infected trophic ulcers were the primary lesion, found in 24 patients (66%), while the remaining 12 patients (33%) presented with infected ulcers complicated by gangrene. A subset of patients was initially misdiagnosed at other facilities, having undergone incision and drainage procedures under the assumption of minor infected ulcers, when in fact, these were more advanced lesions. Infected trophic ulcers accounted for approximately 20% of the total study population. Additionally, 18 patients (9.8%) were found to have underlying osteomyelitis, while peripheral arterial disease was documented in 12% of the cohort.

Surgical intervention in the form of amputation was required in a significant majority of cases, with 147 patients (80.3%) undergoing some form of amputation. Only 36 patients (19.7%) were managed without surgical removal of tissue. A stratified analysis of foot complications based on common comorbid conditions revealed significant associations across all three types of diabetic foot complications. Among patients with type 1 complications, 90% had poor glycemic control (HbA1c > 7%), 85% had a history of diabetes exceeding 10 years, 72% had concomitant hypertension, and 48% reported a history of smoking. In contrast, type 2 complications were relatively rare across all comorbidity categories, with 6% showing poor glycemic control and 5% having hypertension. Type 3 complications showed intermediate prevalence with 20% of cases having elevated HbA1c levels, 25% having diabetes for more than 10 years, 18% diagnosed with hypertension, and 12% reporting smoking history. These findings underscore the strong correlation between prolonged poor glycemic control and duration of diabetes with more severe foot complications. Smoking and hypertension also contributed to increased complication severity, though to a lesser extent.

Table 1: Demographics

Variable	Value
Total Patients	183
Age Range (years)	40-70
Mean Age ± SD	57.87 ± 13.1
Right Foot Affected	109 (59.6%)
Left Foot Affected	74 (40.4%)

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 2: Showing the side of foot affected

Side of foot	Number	Percentage %
Right	109	63
Left	74	37

Table 3: Showing the distribution of cases according to Amit Jain's classification for diabetic foot complication.

Types of diabetic foot complications	Number	Percentage
Type 1 Diabetic foot complication	131	72 %
Type 2 Diabetic foot complication	15	8.1 %
Type 3 Diabetic foot complication	37	19.9 %
total	183	100 %

Table 4: Showing the distribution of pathological lesions.

variables	Type 1 (n=131)	Type 2 (n = 15)	Type 3 (n =37)	Total (n = 183)	P Value
Diagnosis					
Abcess	34 (26 %)	0	0	34 (18.5)	
Wet gangrene	68 (52.2%)	0	0	68 (37.5 %)	
Necrotizing Facitis	5 (4.4 %)	0	0	5 (2.7 %)	
cellulitis	22 (17.4%)	0	0	22 (12 %)	
Dry gangrene	0	15 (100 %)	0	15 (8.1 %)	
Infected Ulcers(trophic)	0	0	24 (66%)	24 (13 %)	
Infected Ulcers (trophic with gangrene)	0	0	12 (33%)	60 (33 %)	

Table 5: Showing amputations done.

Amputations performed	Number	percentage
yes	147	80%
no	26	20%
total	183	100 %

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 6: Foot Complications Stratified by Comorbidities

Comorbidity/Risk Factor	Type 1 (%)	Type 2 (%)	Type 3 (%)
Poor Glycemic Control (HbA1c > 7%)	90	6	20
Diabetes Duration >10 yrs	85	10	25
Hypertension	72	5	18
Smoking	48	4	12

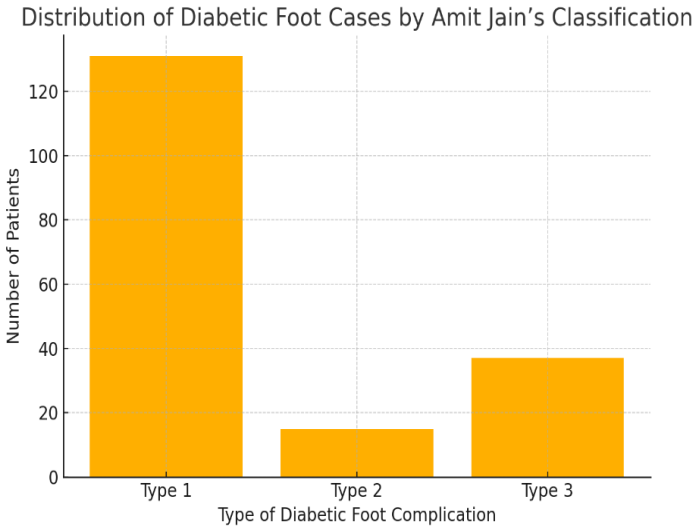

Figure 1 Distribution of Diabetic Foot Cases by Amit Jain's Classification

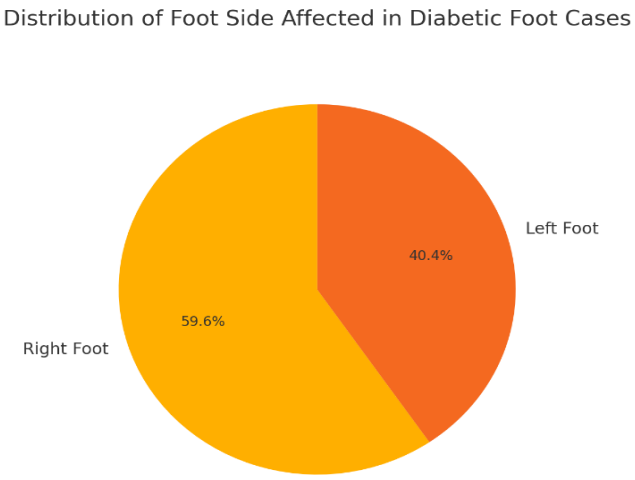

Figure 2 Distribution of Foot Side Affected in Diabetic Foot Cases

DISCUSSION

Diabetic foot remains one of the most debilitating and feared complications of diabetes mellitus due to its strong association with infection, limb amputation, and increased mortality (14). The findings of the present study reinforce this concern, demonstrating that a substantial proportion of hospitalized male patients with type 2 diabetes presented with advanced diabetic foot complications, most notably type 1 lesions. These findings align with national data reporting a 13.6% prevalence of diabetic foot ulcers among diabetic patients in Pakistan (15), with projections suggesting a continued rise as the diabetic population grows (16). The clinical significance of this trend is compounded by the limited availability of specialized foot care services across the country, which restricts timely intervention and secondary prevention strategies (17). Consistent with prior literature, ulceration, infection, peripheral neuropathy, ischemia, and foot deformities were identified as central factors contributing to diabetic foot complications and subsequent amputations (18). In the current study, type 1 diabetic foot complications, which typically present acutely and require surgical management, accounted for 72% of cases. Wet gangrene emerged as the most common pathological lesion, observed in 37.5% of the cohort, mirroring trends reported in other inpatient studies where wet gangrene was seen in over one-third of patients (19). These findings highlight the need for urgent surgical debridement and intravenous antibiotic therapy in such cases and suggest that early diagnosis and intervention remain inadequate in most clinical settings.

One of the key strengths of this study is the use of a broader classification system—Amit Jain's classification—which considers a wider spectrum of diabetic foot pathology beyond ulcerations. Traditional classifications, such as Wagner and the University of Texas systems, focus predominantly on ulcers and fail to encapsulate the full clinical burden of diabetic foot, including soft tissue infections and gangrene, particularly in patients without visible ulcerations (20). By employing a more inclusive and descriptive classification, the current study provides a more realistic picture of the diabetic foot disease burden in a tertiary care hospital setting. The association between foot complications and comorbid risk factors, such as poor glycemic control, prolonged diabetes duration, hypertension, and

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

smoking, was evident in this study. Type 1 complications were particularly prominent among patients with long-standing uncontrolled diabetes and coexisting cardiovascular risk factors. This reinforces the established pathophysiological understanding that chronic hyperglycemia and vascular compromise synergistically predispose diabetic individuals to foot complications.

Despite the strengths, several limitations must be acknowledged. The study population consisted exclusively of male patients, which limits generalizability, especially considering that diabetic foot affects both genders. This exclusion was primarily due to logistical constraints and the gender-specific admission patterns in the hospital setting. Additionally, while the overall response rate exceeded 78%, non-responses among men may have introduced some degree of selection bias. The study also overrepresented the urban population, potentially underestimating the true burden in rural settings where healthcare access is limited, and foot complications often go unreported or mismanaged. Future research should aim to include a more diverse population sample, including female and rural patients, and evaluate the influence of socioeconomic factors, educational background, and foot care awareness. Moreover, prospective designs incorporating follow-up data on wound healing, re-ulceration, and long-term limb salvage outcomes would provide deeper insight into the effectiveness of current management strategies. Integrating emerging diagnostic and therapeutic technologies, including thermal imaging, wearable sensors, and minimally invasive surgical techniques, may further enhance outcomes for high-risk diabetic foot patients (18–20). Additionally, structured foot care education programs, delivered through multidisciplinary teams, could serve as a cornerstone for both prevention and early detection in the community setting. In conclusion, this study provides valuable insight into the clinical spectrum and comorbid associations of diabetic foot complications among hospitalized male patients in Pakistan. The predominance of acute, limb-threatening type 1 complications underscores the urgent need for strengthened preventive care, early risk stratification, and timely intervention to reduce the burden of disability and healthcare costs.

CONCLUSION

This study highlights the significant burden of diabetic foot complications among patients in Karachi, Pakistan, emphasizing the predominance of type 1 lesions and the urgent clinical concern posed by wet gangrene. The findings reinforce the critical need for early identification, improved glycemic control, and multidisciplinary preventive strategies to reduce hospitalization and amputation risks. Addressing the often-underestimated impact of diabetic foot through structured awareness programs, timely screening, and proactive foot care education can play a pivotal role in minimizing disease progression. By shedding light on the patterns and risk factors associated with diabetic foot complications, this study contributes valuable insight for strengthening patient care and guiding future interventions in similar high-risk populations.

AUTHOR CONTRIBUTION

Author	Contribution
Karamat Shah*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Shabnam Suhrab	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Farukh Usman	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Rabya Munir Ahmad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sadia Imdad	Contributed to Data Collection and Analysis

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Author	Contribution
	Has given Final Approval of the version to be published
Pawan Kumar Khatri	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. Rastogi A, Ravindranath V, Dubey A, Gude D, Agarwal M, Prajapati H, et al. A real-world multicenter cross-sectional observational study to assess the clinical profile of peripheral neuropathy in patients with diabetes. PLoS One. 2025;20(4):e0312085.
2. de Jesus Nascimento de Aquino M, de Souza ACC, Borges JWP, da Silva Negreiros FD, de Sousa Gonçalves M, Martins PMO, et al. Prevalence, Incidence and Factors Associated with Diabetic Foot in People with Type 2 Diabetes: Systematic Review with Meta-Analysis. Curr Diabetes Rev. 2024;20(1):e070423215527.
3. Yovera-Aldana M, Pérez-Cavero S, Pinedo-Torres I, Zubiate-López C. Prevalence of Foot At-Risk and its Associated Characteristics among Outpatients with Diabetes Mellitus in a Peruvian Public Hospital. Rev Diabet Stud. 2022;18(1):1-9.
4. Bundó M, Vlacho B, Llussà J, Puig-Treserra R, Mata-Cases M, Cos X, et al. Prevalence and risk factors of diabetic foot disease among the people with type 2 diabetes using real-world practice data from Catalonia during 2018. Front Endocrinol (Lausanne). 2022;13:1024904.
5. Ponirakis G, Elhadd T, Al Ozairi E, Brema I, Chinnaiyan S, Taghadom E, et al. Prevalence and risk factors for diabetic peripheral neuropathy, neuropathic pain and foot ulceration in the Arabian Gulf region. J Diabetes Investig. 2022;13(9):1551-9.
6. Zhang M, Yan J, Huang J, Ye K, Zhou P, Liu X. Prevalence and related factors of peripheral arterial disease in diabetes mellitus inpatients: a cross-sectional study in China. Endocr J. 2022;69(2):155-63.
7. Tuglo LS, Nyande FK, Agordoh PD, Nartey EB, Pan Z, Logosu L, et al. Knowledge and practice of diabetic foot care and the prevalence of diabetic foot ulcers among diabetic patients of selected hospitals in the Volta Region, Ghana. Int Wound J. 2022;19(3):601-14.
8. Lovell L, Dunkley A, Webb D, Jarvis J, Gillies C. Incidence, prevalence, and potential risk factors for diabetic foot ulceration: A retrospective review at a multidisciplinary centre in Barbados. Int Wound J. 2023;20(4):935-41.
9. Vergès B, Brands R, Fourmont C, Petit JM, Simoneau I, Rouland A, et al. Fewer Type A personality traits in type 2 diabetes patients with diabetic foot ulcer. Diabetes Metab. 2021;47(6):101245.
10. Zhang H, Huang C, Bai J, Wang J. Effect of diabetic foot ulcers and other risk factors on the prevalence of lower extremity amputation: A meta-analysis. Int Wound J. 2023;20(8):3035-47.
11. Viswanathan V, Gupta A, Devarajan A, Kumpatla S, Shukla S, Agarwal S, et al. Early screening for foot problems in people with diabetes is the need of the hour: 'Save the Feet and Keep Walking Campaign' in India. BMJ Open Diabetes Res Care. 2024;12(4).
12. Naserrudin NA, Jeffree MS, Kaur N, Syed Abdul Rahim SS, Ibrahim MY. Diabetic retinopathy among type 2 diabetes mellitus patients in Sabah primary health clinics-Addressing the underlying factors. PLoS One. 2022;17(1):e0261249.
13. Wang J, Jiang T, Hu S, Zhou L, Zheng Y, Wang W. Correlation between serum adenosine deaminase levels and risk of diabetic foot ulcers in patients with type 2 diabetes mellitus. Zhong Nan Da Xue Xue Bao Yi Xue Ban. 2024;49(7):1015-22.
14. Uivaraseanu B, Bungau S, Tit DM, Fratila O, Rus M, Maghiar TA, et al. Clinical, Pathological and Microbiological Evaluation of Diabetic Foot Syndrome. Medicina (Kaunas). 2020;56(8).
15. Jiang F, Liu Q, Wang Q. Association between hemoglobin levels and diabetic foot ulcer in patients with type 2 diabetes: a cross-sectional study. Wounds. 2024;36(3):73-9.
16. Blaya Fernández C, Gracia-Sánchez A, Zúnica-García S, Chicharro-Luna E. Assessment of healthcare utilization in diabetes patients according to foot risk level. Prim Care Diabetes. 2025;19(1):53-60.
17. Yao Y, Chen L, Qian Y. Age Characteristics of Patients With Type 2 Diabetic Foot Ulcers and Predictive Risk Factors for Lower Limb Amputation: A Population-Based Retrospective Study. J Diabetes Res. 2024;2024:2380337.
18. Balasubramanian GV, Chockalingam N, Naemi R. The role of cutaneous microcirculatory responses in tissue injury, inflammation and repair at the foot in diabetes. Front Bioeng Biotechnol. (2021) 9:732753.

19. Lung C-W, Wu F-L, Liao F, Pu F, Fan Y, Jan Y-K. Emerging technologies for the prevention and management of diabetic foot ulcers. J Tissue Viability. (2020) 29:61–8.
20. Biz C, Belluzzi E, Crimì A, Bragazzi NL, Nicoletti P, Mori F, et al. Minimally Invasive Metatarsal Osteotomies (MIMOs) for the Treatment of Plantar Diabetic Forefoot Ulcers (PDFUs): a systematic review and meta-analysis with meta-regressions. Appl Sci. (2021) 11:9628.