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RISK FACTORS ASSOCIATED WITH AMPUTATION IN PATIENTS WITH DIABETIC FOOT ULCER: A PROSPECTIVE OBSERVATIONAL STUDY

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Abstract:

Background: *Diabetic foot ulcer (DFU) is one of the most serious complications of diabetes mellitus and is a leading cause of non-traumatic lower limb amputations worldwide. Several demographic, lifestyle, clinical, and metabolic factors contribute to the progression of DFU and increase the risk of amputation. Early identification of these factors is essential to improve patient outcomes and reduce the burden of limb loss.*

Methods: *A hospital-based observational study was conducted among 80 patients diagnosed with diabetic foot ulcers. Data were collected using a structured data collection form including demographic characteristics, lifestyle factors, comorbid conditions, clinical parameters, ulcer severity, treatment adherence, and laboratory values. Statistical analysis was performed using descriptive statistics, chi-square tests, and multiple regression analysis.*

Results: *Among the 80 patients, 53 (66.25%) underwent amputation. Higher amputation rates were observed among patients with peripheral arterial disease (79.1%), obesity (93.3%), long-term diabetes (73.5%), severe neuropathy (69.4%), and higher Wagner grades (87.5%). Poor medication adherence and poor foot-care practices were also associated with increased amputation risk.*

Conclusion: *The findings suggest that DFU-related amputation is influenced by multiple clinical and behavioral factors. Early diagnosis, proper glycemic control, improved foot care practices, and multidisciplinary management are essential to reduce amputation risk among diabetic patients.*

Keywords: *Diabetic Foot Ulcer (DFU), Amputation, Diabetes Mellitus, Peripheral Arterial Disease, Peripheral Neuropathy, Wagner Classification, Glycemic Control, Risk Factors, Foot Care Practices, Medication Adherence*

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INTRODUCTION:

Diabetes mellitus is a lifelong metabolic disease which causes people to experience high blood sugar levels because their bodies cannot properly produce or use insulin. The disease has become one of the most critical health problems in the world because its occurrence rate keeps rising and its related health issues continue to grow. Among the various complications of diabetes, diabetic foot ulcer (DFU) is one of the most serious and disabling conditions. The condition of DFU occurs because three medical conditions, which include peripheral neuropathy and peripheral vascular disease and infection, create an environment that leads to tissue destruction and impaired wound healing.[1,2] The treatment of these ulcers requires an extended duration of medical intervention because their inadequate care brings about major health problems that need immediate attention. Worldwide, diabetic foot ulcers affect a substantial number of diabetic patients while they create major health issues and financial burdens for the healthcare system.[3]

Diabetic foot ulcer serves as the primary reason diabetic patients require hospital admission while it accounts for most non-traumatic lower limb amputations that occur throughout the world. It is estimated that approximately 15–25% of individuals with diabetes will experience a foot ulcer at some point during their lifetime. The development of DFU occurs due to three major factors which include poor glycemic control and extended diabetes duration and peripheral neuropathy and vascular complications. The risk of ulcer formation and its progression increases because of lifestyle factors which include smoking and alcohol consumption and poor foot hygiene and insufficient patient knowledge. The early identification of risk factors together with their effective management constitutes vital actions which protect against serious complications while enhancing patient results.[4,5]

The development of diabetic foot ulcers advances through various clinical and demographic elements that include a patient's age, gender, socioeconomic background, and work profession. Patients from low socioeconomic backgrounds face restricted healthcare access which results in their health conditions remaining undiagnosed and untreated for extended periods.[6,7] The combination of hypertension and cardiovascular disease and obesity and peripheral arterial disease creates additional health problems that disrupt blood flow and slow down the process of wound recovery. Systemic complications arise from severe infections and inflammation, which also lead to higher chances of patients needing surgical procedures that might result in amputation.[8]

Amputation is considered one of the most severe medical results that can occur from diabetic foot ulcers because it causes major physical and mental health and social life problems for patients. The identification of amputation risk factors plays a crucial role in developing effective preventive methods and enhancing clinical treatment procedures.[9] The study of how demographic factors and lifestyle habits and existing medical conditions and disease severity and laboratory results interact provides healthcare professionals with a method to identify patients who have a high risk of developing health issues. The current study study aims to investigate the factors that lead to amputations in patients with diabetic foot ulcers while identifying the predictors which affect their treatment results and disease progression.[10]

METHODOLOGY:

Study Design : The present study was conducted as a hospital-based observational study to assess the factors associated with amputation among patients with diabetic foot ulcer (DFU).

Study Setting and Duration : The study was carried out in the selected tertiary care hospital during the defined study period. Patients attending the outpatient department or admitted to the hospital with diabetic foot ulcers were included in the study.

Study Population and Sample Size : A total of 80 patients diagnosed with diabetic foot ulcer were included in the study. All eligible patients who met the inclusion criteria during the study period were recruited.

Inclusion Criteria

1. Patients aged 18 years and older diagnosed with diabetic foot ulcers.
2. Patients with or without a history of lower limb amputation.
3. Patients willing to provide informed consent and participate in the study

Exclusion Criteria

1. Patients with amputations due to non-diabetic causes (ex: trauma or congenital conditions).
2. Patients with incomplete medical records or unwilling to participate in the study

Data Collection : Data were collected using a structured data collection form. Information regarding demographic characteristics (age, gender, occupation, and socioeconomic status), lifestyle factors (smoking and alcohol consumption), comorbid conditions (hypertension, cardiovascular disease, and peripheral arterial disease), and clinical characteristics (BMI, duration of diabetes, peripheral neuropathy score, and Wagner ulcer grade) was recorded.

Laboratory and Clinical Assessment: Relevant laboratory parameters such as HbA1c levels, white blood cell (WBC) count, and hemoglobin levels were obtained from patient medical records. The severity of diabetic foot ulcers was evaluated using the Wagner grading system.

Statistical Analysis: The collected data were compiled and analyzed using appropriate statistical methods. Descriptive statistics such as frequency and percentage were used to summarize the data. The Chi-square test was used to evaluate the association between variables and amputation outcomes. In addition, multiple regression analysis was performed to identify independent predictors of amputation among DFU patients. The results were presented in tables with relevant statistical values.

RESULTS:

Table 1: Distribution of DFU Patients According to Demographic Characteristics

Variable	DFU Patients n (%)	Amputation n (%)
Total	80 (100)	53 (66.25)
Age Group		
Young Adult (18–44)	8 (10)	5 (62.5)
Middle Aged Adult (45–59)	30 (37.5)	23 (76.6)
Older Adult (>60)	42 (52.5)	25 (59.5)
Gender		
Male	69 (86.2)	46 (66.6)
Female	11 (13.7)	7 (63.6)
Occupation		
Highly Skilled	5 (6.25)	2 (40)
Semi-Skilled	20 (25)	10 (50)
Low Skilled	55 (68.75)	41 (74.5)
Socioeconomic Status		
Middle Class	39 (48.75)	24 (61.53)
Poor	41 (51.25)	29 (70.73)

A total of 80 diabetic foot ulcer (DFU) patients were included in the study, of whom 53 patients (66.25%) underwent amputation. The majority of patients belonged to the older age group (>60 years) (42; 52.5%), while the highest amputation rate was observed in middle-aged adults (23; 76.6%). Male patients represented 69 cases (86.2%), with 46 amputations (66.6%). Most patients were low-skilled workers (55; 68.75%), showing the highest amputation rate (41; 74.5%), particularly among those from poor socioeconomic status (29; 70.73%).

Table 2 : Association of Lifestyle Factors with Amputation in DFU Patients

Lifestyle Factor	DFU n (%)	Amputation n (%)	χ^2	p value
Alcohol Consumption				
Alcoholic	44 (55)	31 (70.4)	13.30	0.005
Non-Alcoholic	36 (45)	22 (61.1)		
Smoking Status				
Smoker	43 (53.75)	29 (67.4)	13.71	0.01
Non-Smoker	37 (46.25)	24 (64.8)		

Lifestyle factors showed a notable association with amputation among DFU patients. Alcohol consumption was reported in 44 patients (55%), among whom 31 patients (70.4%) underwent amputation, compared to 22 amputations (61.1%) among 36 non-alcohol users. This association was statistically significant ($\chi^2 = 13.30$, $p = 0.005$). Similarly, 43 patients (53.75%) were smokers, of whom 29 (67.4%) underwent amputation, while 24 amputations (64.8%) occurred among non-smokers, indicating a slightly higher risk among smokers ($\chi^2 = 13.71$, $p = 0.01$).

Table 3 : Impact of Comorbid Conditions on Amputation

Comorbidity	DFU n (%)	Amputation n (%)	χ^2	p value
Hypertension				
Hypertensive	38 (47.5)	27 (71)	41.36	0.001
Non-Hypertensive	42 (52.5)	26 (61.9)		
Cardiovascular Disease				
Yes	21 (26.25)	13 (61.9)	—	—
No	59 (73.75)	40 (67.7)		
Peripheral Arterial Disease (PAD)				
Yes	48 (60)	38 (79.1)	15.51	0.003
No	32 (40)	13 (40.6)		

Comorbid conditions played a significant role in DFU-related amputations. Among 38 hypertensive patients (47.5%), 27 patients (71%) underwent amputation, compared with 26 amputations (61.9%) among 42 non-hypertensive patients, showing a statistically significant association ($\chi^2 = 41.36$, $p = 0.001$). Peripheral arterial disease (PAD) was present in 48 patients (60%), of whom 38 (79.1%) underwent amputation, while only 13 amputations (40.6%) occurred among 32 patients without PAD, indicating a strong relationship ($\chi^2 = 15.51$, $p = 0.003$).

Table 4 : Clinical Characteristics Associated with Amputation

Clinical Factor	DFU n (%)	Amputation n (%)
BMI Category		
Underweight	13 (16.25)	6 (46.1)
Normal	20 (25)	10 (50)
Overweight	17 (21.25)	9 (52.9)
Obese	30 (37.5)	28 (93.3)
Duration of Diabetes		
Newly Diagnosed	1 (1.25)	0
6 months–5 years	23 (28.75)	14 (60.8)
>5 years	53 (66.25)	39 (73.5)
Peripheral Neuropathy Score		
0–3	8 (10)	3 (37.5)
≥4	72 (90)	50 (69.4)

Clinical characteristics significantly influenced the risk of amputation. Among the BMI categories, obese patients (>30 BMI) accounted for 30 cases (37.5%), with the highest amputation rate (28; 93.3%). In contrast, underweight patients showed a lower amputation rate (6; 46.1%). Regarding diabetes duration, 53 patients (66.25%) had diabetes for more than 5 years, with 39 amputations (73.5%). Severe peripheral neuropathy (score ≥4) was present in 72 patients (90%), among whom 50 patients (69.4%) underwent amputation.

Table 5 : Ulcer Severity and Treatment Factors Associated with Amputation

Variable	DFU	Amputation
Wagner Grade		
Grade 1	4	1 (25%)
Grade 2	18	9 (50%)
Grade 3	21	14 (66.6%)
Grade 4	21	15 (71.4%)
Grade 5	16	14 (87.5%)
Medication Adherence		
Low	43	35 (81.3%)
Medium	27	15 (55%)
High	10	3 (30%)
Foot Care Practices		
Poor	46	39 (~85%)
Good	34	14 (~41%)

Ulcer severity and patient behavior were strongly associated with amputation outcomes. The risk of amputation increased with higher Wagner grades, rising from 25% in Grade 1 (1/4 patients) to 87.5% in Grade 5 (14/16 patients). Medication adherence also influenced outcomes; 35 of 43 patients (81.3%) with low adherence underwent amputation, compared with 15 of 27 patients (55%) with moderate adherence and 3 of 10 patients (30%) with high adherence. Poor foot-care practices were also linked to higher amputation rates.

Table 6 : Laboratory Parameters Associated with Amputation

Parameter	DFU	Amputation
HbA1c Levels		
Controlled	3(3.75%)	1 (33.3%)
Moderate	36(45%)	22 (61.1%)
Poor Control	41(51.25%)	30 (73.1%)
White Blood Cell Count		
Leukopenia	2(2.5%)	1 (50%)
Normal	43(53.75%)	26 (60.3%)
Mild Elevation	19(23.75%)	13 (68.4%)
Moderate Elevation	13(16.25%)	10 (76.9%)
Severe Elevation	3(3.75%)	3 (100%)
Hemoglobin Levels		
Normal	3	1
Mild Anemia	16	9
Moderate Anemia	43	28
Severe Anemia	18	15

Laboratory parameters indicated a strong relationship between metabolic control, infection, and amputation risk. Among 41 patients (51.25%) with poor glycemic control, 30 patients (73.1%) underwent amputation, compared with 22 amputations (61.1%) among patients with moderate HbA1c levels. Increasing white blood cell (WBC) counts were associated with higher amputation rates, reaching 100% among patients with severe elevation (3/3). Additionally, severe anemia showed high amputation prevalence, with 15 amputations among 18 patients.

Table 7 : Multiple Regression Analysis Showing Predictors of Amputation in Diabetic Foot Ulcer Patients

Predictor	B	Std Error	Beta	t	p
Constant	8.431	6.616	—	1.274	0.206
Duration of Hypertension	-0.255	0.180	-0.164	-1.410	0.163
HbA1c	-0.581	0.982	-0.068	-0.592	0.555
Duration of Diabetes	0.147	0.148	0.115	0.989	0.326

The regression analysis was done to see whether duration of hypertension, HbA1c levels, and duration of diabetes could predict the risk of amputation in diabetic foot ulcer patients. The results showed that none of these factors alone had a strong or statistically significant effect on amputation. Duration of hypertension showed a small negative effect ($p = 0.163$), HbA1c levels also showed a weak relationship ($p = 0.555$), and duration of diabetes showed a slight positive trend ($p = 0.326$). However, these results were not significant. This suggests that amputation risk in diabetic foot patients depends on many combined factors, such as infection severity, blood circulation problems, nerve damage, and ulcer stage.

DISCUSSION:

The present study included 80 diabetic foot ulcer (DFU) patients, among whom 53 patients (66.25%) underwent amputation, indicating a high burden of severe diabetic foot complications. The majority of patients belonged to the older age group (>60 years) (42; 52.5%), while the highest amputation rate occurred in middle-aged adults (23; 76.6%). Male patients accounted for 69 cases (86.2%), with 46 amputations (66.6%), suggesting higher susceptibility among men. Similar findings were reported in a large meta-analysis involving 6505 DFU patients, which showed that male sex significantly increased amputation risk (OR 1.30). Another population-based study of 918 DFU patients also reported that most DFU cases occur in middle-aged and elderly patients, highlighting the influence of age and demographic factors on DFU outcomes.[11,12]

Socioeconomic and occupational factors were also associated with DFU outcomes in the present study. Most patients were low-skilled workers (55; 68.75%), and 41 of them (74.5%) underwent amputation, while patients from poor socioeconomic status showed a higher amputation rate (29; 70.73%). Limited access to healthcare, delayed treatment, and poor awareness may contribute to the progression of diabetic foot ulcers in these populations. Previous research conducted in India involving 162 DFU patients reported that social and clinical factors such as hypertension, neuropathy, and poor healthcare access significantly increased the likelihood of amputation. Another clinical study examining risk factors in diabetic foot wounds also emphasized that underlying health conditions and delayed clinical management contribute to higher amputation rates in vulnerable patient groups.[13,14]
Lifestyle factors such as smoking and alcohol consumption were also associated with amputation in this study. Among 44 alcohol users (55%), 31 patients (70.4%) underwent amputation, which was significantly higher compared to 22 amputations (61.1%) among non-alcohol users ($\chi^2 = 13.30$, $p = 0.005$). Similarly, 43 patients (53.75%) were smokers, and 29 of them (67.4%) underwent amputation, slightly higher than non-smokers (24; 64.8%) ($\chi^2 = 13.71$, $p = 0.01$). Smoking can worsen blood circulation and delay wound healing, which increases ulcer severity. Previous studies have reported similar findings, showing that smoking significantly increases the risk of amputation in DFU patients. Another study on diabetic foot complications also identified vascular impairment and infection severity as major contributors to limb loss.[15,16]

Comorbid conditions were also strongly associated with amputation outcomes. In the present study, 38 patients (47.5%) had hypertension, among whom 27 patients (71%) underwent amputation, which was significantly higher compared with non-hypertensive patients (26; 61.9%) ($\chi^2 = 41.36$, $p = 0.001$). Additionally, peripheral arterial disease (PAD) was present in 48 patients (60%), and 38 of them (79.1%) underwent amputation, whereas only 13 patients (40.6%) without PAD underwent amputation ($\chi^2 = 15.51$, $p = 0.003$). PAD significantly reduces blood flow to the lower extremities, delaying wound healing and increasing infection risk. Previous research involving 654 diabetic foot patients found that peripheral arterial disease and anemia were major predictors of amputation. Another study also identified PAD as the most critical risk factor influencing major amputation in DFU patients.[17,18]

Clinical characteristics such as obesity, long duration of diabetes, and neuropathy also influenced amputation risk in this study. Obese patients accounted for 30 cases (37.5%), and 28 of them (93.3%) underwent amputation, representing the highest amputation prevalence among BMI categories. Additionally, 53 patients (66.25%) had diabetes for more than 5 years, with 39 amputations (73.5%). Severe peripheral neuropathy (score ≥4) was present in 72 patients (90%), among whom 50 patients (69.4%) underwent amputation. Neuropathy leads to loss of protective sensation in the foot, which increases the risk of unnoticed injuries and infections. Previous studies have confirmed that neuropathy and long duration of diabetes significantly increase DFU severity and amputation risk. Research has also shown that ischemia and neuropathy together significantly worsen DFU outcomes.[19,20]

Ulcer severity and treatment adherence were strongly associated with amputation outcomes in the present study. The results showed that the risk of amputation increased progressively with Wagner ulcer grade, rising from 25% in Grade 1 (1/4 patients) to 50% in Grade 2 (9/18 patients), 66.6% in Grade 3 (14/21 patients), 71.4% in Grade 4 (15/21 patients), and reaching 87.5% in Grade 5 (14/16 patients). This clearly indicates that advanced ulcer severity significantly increases the likelihood of limb loss. In addition, medication adherence played an important role in treatment outcomes. Among patients with low medication adherence, 35 out of 43 patients (81.3%) underwent amputation, compared with 15 of 27 patients (55%) with moderate adherence and only 3 of 10 patients (30%) with high adherence. These findings highlight the importance of early ulcer management and consistent treatment compliance in preventing severe DFU complications.[21]

Laboratory parameters and infection indicators were also associated with increased amputation risk in the present study. Patients with poor glycemic control (HbA1c) accounted for 41 cases (51.25%), among whom 30 patients (73.1%) underwent amputation, while patients with moderate control showed 22 amputations (61.1%). Elevated infection markers were also linked with poor outcomes. The amputation rate increased with rising white blood cell (WBC) counts, reaching 100% among patients with severe WBC elevation (3/3 patients). Additionally, anemia was commonly observed among DFU patients, with 15 amputations among 18 patients with severe anemia, suggesting that reduced oxygen-carrying capacity may impair wound healing. Previous studies have also reported that Wagner grade, elevated WBC levels, and poor metabolic control significantly increase the risk of amputation in diabetic foot ulcer patients.[22]

Multiple regression analysis was performed to determine whether duration of hypertension, HbA1c levels, and duration of diabetes independently predicted the risk of amputation among diabetic foot ulcer patients. The results indicated that none of these variables were statistically significant predictors of amputation. Duration of hypertension showed a negative association ($B = -0.255$, $p = 0.163$), while HbA1c showed a weak negative relationship ($B = -0.581$, $p = 0.555$). In contrast, duration of diabetes showed a slight positive association ($B = 0.147$, $p = 0.326$). However, all p-values were greater than 0.05, indicating no statistically significant independent effect. These findings suggest that amputation risk in DFU patients is influenced by multiple factors such as infection severity, peripheral arterial disease, neuropathy, and ulcer grade rather than single metabolic indicators alone.[23]

CONCLUSION:

The present study evaluated the factors associated with amputation among diabetic foot ulcer (DFU) patients. Among 80 patients included in the study, 53 patients (66.25%) underwent amputation, indicating a significant burden of severe DFU complications. The findings showed that several factors were associated with higher amputation risk, including older age, male gender, low socioeconomic status, smoking, alcohol consumption, hypertension, peripheral arterial disease, obesity, long duration of diabetes, severe neuropathy, and higher Wagner ulcer grades. In addition, poor medication adherence, inadequate foot-care practices, poor glycemic control, elevated white blood cell counts, and anemia were also linked with increased amputation rates. However, regression analysis showed that duration of hypertension, HbA1c levels, and duration of diabetes were not independent predictors of amputation, suggesting that DFU outcomes are influenced by multiple interacting clinical and behavioral factors.

REFERENCES:

1. Hossain MJ, Al-Mamun M, Islam MR. Diabetes mellitus, the fastest growing global public health concern: Early detection should be focused. Health Sci Rep. 2024 Mar 22;7(3):e2004
2. Akkus G, Sert M. Diabetic foot ulcers: A devastating complication of diabetes mellitus continues non-stop in spite of new medical treatment modalities. World J Diabetes. 2022 Dec 15;13(12):1106-1121
3. Wang X, Yuan CX, Xu B, Yu Z. Diabetic foot ulcers: Classification, risk factors and management. World J Diabetes. 2022 Dec 15;13(12):1049-1065

4. Shamsudeen MA, Gopinath SCB, Zulkiple MZH. A cross-sectional clinical analysis on diabetic foot ulcer and associated risk management. Indian J Pharmacol. 2026 Mar 1;58(2):131-136.
5. Abdissa D, Adugna T, Gerema U, Dereje D. Prevalence of Diabetic Foot Ulcer and Associated Factors among Adult Diabetic Patients on Follow-Up Clinic at Jimma Medical Center, Southwest Ethiopia, 2019: An Institutional-Based Cross-Sectional Study. J Diabetes Res. 2020 Mar 15;2020:4106383.
6. Banik PC, Barua L, Moniruzzaman M, Mondal R, Zaman F, Ali L. Risk of diabetic foot ulcer and its associated factors among Bangladeshi subjects: a multicentric cross-sectional study. BMJ Open. 2020 Feb 28;10(2):e034058
7. Kuguyo O, Mukona DM, Chikwasha V, Gwanzura L, Chirenda J, Matimba A. Prevalence and risk factors for diabetic foot complications among people living with diabetes in Harare, Zimbabwe: a cross-sectional study. BMC Public Health. 2024 Mar 4;24(1):677
8. Nongmaithem M, Bawa AP, Pithwa AK, Bhatia SK, Singh G, Gooptu S. A study of risk factors and foot care behavior among diabetics. J Family Med Prim Care. 2016 Apr-Jun;5(2):399-403.
9. Yang B, Zha X, Ding Y. Risk Factors Associated with Amputation for Patients with Diabetic Foot Ulcers: A Retrospective Study. Diabetes Metab Syndr Obes. 2024 Nov 7;17:4201-4209.
10. Zhang X, Li Q, Zhou X, Xu Y, Shu Z, Deng H. Risk factors for amputation in diabetic foot ulcers: A retrospective analysis. Int Wound J. 2024 Apr;21(4):e14832.
11. Lin C, Liu J, Sun H. Risk factors for lower extremity amputation in patients with diabetic foot ulcers: A meta-analysis. PLoS One. 2020 Sep 16;15(9):e0239236.
12. 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 Dec 19;2024:2380337
13. Zubair M, Malik A, Ahmad J. Incidence, risk factors for amputation among patients with diabetic foot ulcer in a North Indian tertiary care hospital. Foot (Edinb). 2012 Mar;22(1):24-30.
14. Kim SY, Kim TH, Choi JY, Kwon YJ, Choi DH, Kim KC, Kim MJ, Hwang HK, Lee KB. Predictors for Amputation in Patients with Diabetic Foot Wound. Vasc Specialist Int. 2018 Dec;34(4):109-116.
15. Lee YJ, Han KD, Kim JH. Association among Current Smoking, Alcohol Consumption, Regular Exercise, and Lower Extremity Amputation in Patients with Diabetic Foot: Nationwide Population-Based Study. Endocrinol Metab (Seoul). 2022 Oct;37(5):770-780
16. Pal B, Raveender N, Sudipta P. A study on the impact of smoking and alcoholism as determinant factors in the prognosis and outcome of diabetic foot ulcer disease. Int J Res Med. 2016;4(5):1720-4.
17. Costa RHR, Cardoso NA, Procópio RJ, Navarro TP, Dardik A, de Loiola Cisneros L. Diabetic foot ulcer carries high amputation and mortality rates, particularly in the presence of advanced age, peripheral artery disease and anemia. Diabetes Metab Syndr. 2017 Dec;11 Suppl 2:S583-S587
18. Kang H, Choi S, Park YG, Choi J, Lim C. Risk Factors for Major Lower Limb Amputation and Effect of Endovascular Revascularization in Patients with Diabetic Foot Wound. Indian J Orthop. 2024 Feb 16;58(4):379-386.
19. Li X, Xiao T, Wang Y, Gu H, Liu Z, Jiang Y, Liu Y, Lu Z, Yang X, Lan Y, Xu Z. Incidence, risk factors for amputation among patients with diabetic foot ulcer in a Chinese tertiary hospital. Diabetes Res Clin Pract. 2011 Jul;93(1):26-30.
20. Lu Q, Wang J, Wei X, Wang G, Xu Y. Risk Factors for Major Amputation in Diabetic Foot Ulcer Patients. Diabetes Metab Syndr Obes. 2021 May 4;14:2019-2027.
21. Iwase M, Fujii H, Nakamura U, et al. Incidence of diabetic foot ulcer in Japanese patients with type 2 diabetes mellitus: the Fukuoka diabetes registry. Diabetes Res Clin Pract. 2018;137:183–189.
22. Hurley L, Kelly L, Garrow AP, et al. A prospective study of risk factors for foot ulceration: the West of Ireland diabetes foot study. QJM. 2013;106(12):1103–1110.
23. Pickwell K, Siersma V, Kars M, Apelqvist J, Bakker K, Edmonds M, Holstein P, Jirkovská A, Jude E, Mauricio D, Piaggesi A, Ragnarson Tennvall G, Reike H, Spraul M, Uccioli L, Urbancic V, van Acker K, van Baal J, Schaper N. Predictors of lower-extremity amputation in patients with an infected diabetic foot ulcer. Diabetes Care. 2015 May;38(5):852-7