Risk factor and Outcomes of Diabetic Foot Ulcer among Diabetes Mellitus Patients Admitted to Nekemte Referral Hospital, Western Ethiopia:Prospective cohort study

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Abstract

Background:Foot problems are very common in people with diabetes affecting up to 15% of diabetic patients during their lifetime throughout the world. Foot ulcers significantly contribute to morbidity and mortality of patients with diabetes mellitus. The diabetic patients with foot ulcers require long-term hospitalization and carry the risk of limb amputation. Despite this, no study has been done on risk factor and outcomes of diabetic foot ulcer in NRH. **Methods:** A general prospective cohort study of diabetes mellitus patients who had diabetic foot ulcer was conducted among diabetes patients of Nekemte referral hospital (NRH) from March 15 to June 15, 2018. The Wagner classification of diabetic foot ulcer was used to assess the severity of foot ulcers. Multivariate logistic regression was used to analyze the associations between dependent variable and independent variables. **Results:** Over the study period, 115 diabetes foot ulcer patients were admitted to the Nekemte referral hospital; of these patients, 35(30.43%) were under gone (minor and major amputations) and 80(69.57%) were healed. Grade of diabetic foot ulcer AOR=1.7; 95% CI: 1.604, 4.789, inappropriate antibiotics AOR = 2.526; 95% CI: 1.767, 8.314, Overweight AOR = 2.767; 95% CI: 1.827, 9.252, obesity AOR = 3.020; 95% CI: 2.556, 16.397, blood glucose control AOR = 2.592; 95% CI: 1.937, 7.168, and neuropathy AOR = 1.565; 95% CI: 1.508, 4.822 were found to be a risk factor for amputation in multivariable logistic regression analysis. **Conclusion:** Blood glucose level, higher body mass index (BMI), inappropriate antibiotics given, neuropathy, and advanced grade of diabetic foot ulcer were independent predictors of amputation. Provision of special emphasis for patients having neuropathy and advanced grade of diabetic foot ulcer, decreasing excessive weight gain, managing hyperglycemia, and appropriate antibiotics prescription practice would decrease outcomes of diabetic foot ulcer. **Key words:**Diabetic Foot Ulcer, Risk Factors, Outcomes, Nekemte Referral hospital

Background

Diabetes mellitus is a non-communicable disease and one of the most common chronic diseases[1]. World health organization defined diabetes mellitus (DM) as a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both[2]. Complications of DM have become a major public health problem in all countries [3]. It is characterized by multiple long-term complications affecting almost every system in the body and often leads to blindness, heart and blood vessel disease, stroke, kidney failure, amputations, and nerve damage[4].

Diabetic patients who present with foot ulceration is associated with many risk factors. Peripheral arterial disease (PAD) is present in approximately one-half of all patients with foot ulcers and is considered an important predictor of outcome[5]. Diabetic foot ulcer patients who developed infections of the foot not only suffers from mortality it can also prolong the hospital stay which finally leads to minor and major amputations of lower limb[6]. Along with increased morbidity, foot ulcers can lead to lifelong disability and may substantially diminish the quality of life (QOL) for these patients. Specifically, patients with diabetic foot ulcer (DFU) have restrictions on mobility, poor psychosocial adjustment, and lower self-perceptions of health than patients who do not have ulcers. Survival from the time of diagnosis was significantly reduced for the foot ulcer group compared with the control group [7, 8].

DM has been established as one of the most common and important disease states associated with an increased risk of postoperative infections and poor outcomes after lumbar spinal surgery[9]. Patients with DM patients undergoing degenerative cervical spine surgery also have an increased risk for several preoperative complications, including increase in length of hospital stay, inpatient mortality, and postoperative infection[10]. Foot problems remain very common in people with diabetes throughout the world, affecting up to 15% of diabetic patients during their lifetime. Diabetic foot ulcers increases morbidity, high expenditure for therapeutic management and precede amputations in about 85% of patients. Frequency of lower limb amputations can be lowered by 49-87% by preventing the development of diabetic foot ulcers[11].

Foot complications, especially foot ulcers, constitute a major public health problem for diabetes patients in sub-Saharan Africa and are important causes of prolonged hospital admission and death in patients from this part of the continent[12]. Foot wounds are now the most common diabetes-related cause of hospitalization and are a frequent precursor to amputation. An infected foot wound precedes about two-thirds of lower extremity amputations, and infection is surpassed only by gangrene as an indication for diabetic lower-extremity amputation. In addition, 28% to 51% of amputated diabetics will have a second amputation of the lower limb within five years of the first amputation [13, 14].

Generally, diabetic foot complications remain the major medical, social, and economic problem for all types of diabetes [15]. Diabetic foot ulcer is the most fatal complication of diabetes mellitus [11]. In Ethiopia, patient habits of poor foot-care practice, and the absence of good quality service of diabetic foot ulcer may have leads to foot infections which result in limb amputation. Only few pharmacists were assigned to avoid the inappropriate use of antibiotic in NRH by intervening problems at only dispensing level. Despite this, no study has been done on incidence, risk factor and outcomes of diabetic foot ulcer in NRH. This study tried to identify the risk factors associated with the outcomes of diabetic foot ulcer patients in this area.

Methods And Materials

Study setting and study period

A prospective cohort study was conducted at NRH from March 15 to June 15, 2018. The hospital is located in Nekemte town, which is located 330 km to the west of Addis Ababa, the capital city of Ethiopia. The hospital is a referral hospital and gives health service for more than 10, 000,000 people living in west Ethiopia. There were about 2420 diabetic patients who have been following diabetic clinic annually. This hospital serves as a referral hospital, a teaching hospital, and research center, and the hospital has one diabetic follow-up clinic.

Study participants and eligibility criteria

Patients ≥ 18 years who were be diagnosed as diabetes, diabetic patients who had diabetic foot ulcer, patients who were willing to participate in the study and diabetes mellitus patients who had any visible foot lesions patients were included. Patients with diabetic patients who had traumatic ulcer due to other than normal cause like car accident, burn and any injury to sharpened materials and diabetic patients who was in acute stress which were difficult to respond to the interview were excluded.

Study variables and outcome end points

Amputation was the dependent variable and the primary outcome was the incidence of amputation. The Wagner classification of diabetic foot ulcer was used to assess the severity of foot ulcers. Extent (i.e. size) was determined by multiplying the largest by the second largest diameter perpendicular to the first. The status of diabetic foot ulcer which developed infection or not were identified by using gram stains. Amputation and healing status were measured using a checklist and assessed by close follow up of the patient through telephone interview of the patient/ caregiver/ proxy on weekly basis.

Sample Size and Sampling Technique

Single population proportion formula was used to calculate the required sample size considering the following assumptions: n is required sample size, P is incidence of Amputation which was 29%, the rate found at Muhimbili National Hospital, Dares Salaam, Tanzania [12]. Z is standardized normal distribution value at the 95% CI: 1.96 and d is the margin of error of 5%.

$$n = \frac{(Z_{\alpha/2})^2 \cdot p \cdot (1-p)}{d^2}$$

$$d^2$$

$$z = 1.96$$

$$P = 29\% (0.29)$$

$$d = 0.05$$

$$n = \frac{(1.96)^2 \cdot (0.29) \cdot (0.71)}{(0.05)^2} = 316$$

$$(0.05)^2$$

The expected number of population in the study period (N), based on the average number of patients coming to the hospital was 156. The corrected sample size, using the following correction formula was 104. A 10% contingency yielded a final sample size of 115. Conveniently all patients during the study period full filling the eligibility criteria were included in the final analysis.

Data collection process and management

Data was collected using questionnaire which was developed after reviewing and adopting Study participants were selected by using convenience technique different literature. One medical doctor, one nurses and one pharmacist were selected as data collector. The data was supervised by another doctor selected. A pus swab was obtained from the ulcers prior to any ulcer cleaning and avoiding other contamination. The samples were delivered to the laboratory immediately and a thin smear was prepared on Grease or oil free slides. Appropriateness of antibiotics was identified based on standard guidelines of Infectious Diseases Society of America (IDSA) for diagnosis and treatment of diabetic foot infection [17] which is based on the most likely coverage of antibiotics for treatments of diabetic foot infection for identified gram stain results and their correct dosage regimens. Five percent of the sample was pre-tested to check acceptability and consistency of data collection tool two weeks before the actual data collection.

Data processing and analysis

The data was entered in to computer using EPI-manager 4.0.2 software. The collected data was cleared by principal investigator before data analysis. Analysis was done using statistical software for social sciences (SPSS) 24. Descriptive data was explained by frequency and percentage. The obtained Results were explained by means and Standard Deviations (SD). Multivariate logistic regression was used to analyze the variable and each variable was evaluated independently in a bivariate analysis and association was determined using cross tabulation and COR with 95% CI. All variables associated with the amputation at a probability level of less than or equal to 0.25 on the bivariate analysis were entered into a multivariate logistic regression analysis to control for confounders. The variables with A p-value of less than 0.05 had statistically significant association with the amputation.

Operational definitions

Diabetic Foot ulcer: the foot of a diabetic patient that has the potential risk of pathologic consequences, including infection, ulceration, and/or destruction of deep tissues

Healing: The complete closure of the ulcer with skin intact (complete epithelialization) and without, drainage or sinus formation

Amputation: The complete or partial removal of a limb or body appendage by surgical or traumatic means.

Minor amputation: Amputation involving below ankle

Major amputation: Amputation of legs which involves above the ankle

Grades of diabetics foot ulcer: For purpose of this study we used Wagner system for classification of diabetic foot ulcer which uses 6 wound grades (scored 0 to 5) to assess ulcer depth[16].

- **Grade 0 diabetic foot ulcer:** No ulcer, but the foot is at risk for ulceration
- **Grade 1 diabetic foot ulcer:** Superficial ulceration
- **Grade 2 diabetic foot ulcer:** Ulcer with deep infection, but without involvement of the bone
- **Grade 3 diabetic foot ulcer:** Ulcer with osteomyelitis.
- **Grade 4 diabetic foot ulcer:** Presence of localized gangrene on the foot.
- **Grade 5 diabetic foot ulcer:** Presence of gangrene of the whole foot.

Neuropathy: It was diagnosed if the patient had at least one manifestation from the following list of manifestations: burning pain, vibration from the skin, gradual numbness, freezing, extreme sensitive to touch, muscle weakness, and lack of coordination.

Peripheral Vascular Disease: It is an arterial and vein disease at the peripheral region, which often occurs in diabetic patient.

Glycemic control: for purpose of this study we categorized patients based on American Diabetic

Association (ADA) recommendation in to two groups:

- **Good glycemic control:** Fasting blood glucose of 70-130 mg/dl.
- **Poor glycemic control:** Fasting blood glucose of <70 mg/dl and >130mg/dl

Appropriate drug: Antibiotics prescribed in accordance with infectious diseases society of America (IDSA) guideline for treatment of diabetic foot infection recommendation based on gram stains and dosage regimens.

In appropriate drug: Antibiotics prescribed inconsistent with infectious diseases society of America (IDSA) guideline for treatment of diabetic foot infection recommendation based on gram stains and dosage regimens.

Result

Socio-demographic characteristics.

Over the study period, 115 diabetes foot ulcer patients were admitted to the NRH medical ward; of these patients, 64(55.65%) were males. About 26(22.61%) of them were in the age range of 58-67, while mean age of participants was 44.4 ± 14.7 . About 34(29.57%) of the diabetic foot ulcer were overweight and 16(13.91%) were obese while the mean body mass index (BMI) was $24.94 \pm 3.69 \text{ kg/m}^2$. Eighty (69.57%) were married (table 1).

Medical condition and Behavioral characteristics

About Fifty-eight (50.43%) of the participants had chronic health problems or co-morbidity with other diseases, and among these, 56(48.69%) participants were hypertensive. About 56(48.69%) of the diabetic foot ulcer had diabetic complication, among these, 55 (47.83%) study participants had retinopathy. Thirty (26.09%) of the study participants were current smokers and 38 (33.04%) study participants were current alcohol drinkers during the study period (table 2). Among the total 115 study participants, 61 (53.04%) of them had type 2 diabetes mellitus. The mean fasting blood glucose level among diabetic patients with foot ulcer was $147.93 \text{ mg/dl} \pm 45.03$. Twenty six participants (22.61%) were diabetic for more than 10 years. Fifty three (46.09%) participants had poorly controlled blood glucose levels. Forty two (54.55%) of microorganism isolated was gram positive. Ulcer size was greater than 5 cm^2 in the 23(20.00%) of the patients (table 3). From total number of the patients, about 9(7.83%) of the patients who had diabetic foot ulcer on dorsal/inter digital toes were amputated and about 4(3.48%) of the patients who had ulcer on heel were amputated (table 4).

Antibiotics prescribed to treat Diabetic Foot Ulcer

Cloxacillin was the most commonly prescribed antibiotics for treating diabetic foot ulcer followed by Metronidazole and ceftriaxone (table 5). From the total patients given antibiotics about 38(49.35%) of them prescribed appropriately and 39(50.65%) were prescribed inappropriately.

Risk factors and Outcomes of Diabetic Foot Ulcer

From the patients who developed diabetic foot ulcers, 80(69.57%) were healed and 35(30.43%) of them were amputated. From amputated diabetic foot ulcer patients, 20(57.14%) and 15(42.86%) were undergone minor and major amputation, respectively. From the patients who undergone major amputation, 9(60%) of them were amputated below knee and 6(40%) of them were amputated above knee. Grade of diabetic foot ulcer [AOR = 1.7; 95% CI: 1.604, 4.789], inappropriate antibiotics [AOR = 2.526; 95% CI: 1.767, 8.314], overweight [AOR = 2.767; 95% CI: 1.827, 9.252], obesity [AOR = 3.020; 95% CI: 2.556, 16.397], blood glucose control [AOR = 2.592; 95% CI: 1.937, 7.168], and neuropathy [AOR = 1.565; 95% CI: 1.508, 4.822] were found to be predictors of amputation in multivariable logistic regression analysis.

Those diabetic patients who had Grade ≥ 4 diabetic foot ulcer were 1.7 times more likely to be amputated than those Grade < 4 diabetic foot ulcer [AOR = 1.7; 95% CI: 1.604, 4.789]. Patients with diabetic foot ulcer who had taken inappropriate antibiotics prescription were 2.5 times more likely to be amputated than those taken appropriate antibiotics [AOR = 2.526; 95% CI: 1.767, 8.314].

Overweight diabetic patients were 2.8 times more likely to undergo amputations compared to diabetic patients with normal weight [AOR = 2.767; 95% CI: 1.827, 9.252]. Obese diabetic patients were 3.02 times more likely to undergo amputation as compared to diabetic patients with normal body mass index [AOR = 3.02; 95% CI: 2.556, 16.397]. Those with diabetic foot ulcer who had poor blood glucose control were 2.6 more likely to undergo amputation as compared to diabetic foot ulcer patients who had good controlled blood glucose level [AOR = 2.592; 95% CI: 1.937, 7.168]. Furthermore, those diabetic foot ulcer patients who had neuropathy were 1.6 times more likely to undergo amputation as compared to those diabetic foot ulcer patients without neuropathy [AOR = 1.565; 95% CI: 1.508, 4.822] (table 6).

Discussion

This study found that almost half of patients had poor glycemic control and it showed that poor blood glucose control patients were 2.6 times more likely to be amputated as compared with those who had a good blood glucose control. This was consistent with the studies conducted in USA, Germany, India, and Sudan [9, 13, 18, 19]. This indicates that importance of good glycemic control should be implied and emphasized by these findings as a key aspect of primary intervention in diabetic foot ulcer management and also to prevent unnecessary limb wastage.

The result of this study showed that overweight and obese diabetic foot ulcer patients were 2.8 and 3 times more likely to undergo amputation as compared with those who had a normal body mass index respectively. This is consistent with the studies conducted in Gondar [20]. But the study done in Kenya showed that higher body mass index (BMI) was not associated with diabetic foot ulcer [6]. The possible reason could be due to the decreased blood flow circulations to the lower limb as a result of fat accumulations in those higher body mass index patients.

Advanced Wagner stage ulcers were a significant risk factor for amputation. Diabetic foot ulcer patients who had Wagner Grade ≥ 4 were 1.7 times more likely to be amputated as compared to diabetic foot ulcer patients who had Wagner Grade < 4 . This result is consistent with the studies conducted in USA and Tanzania [12, 21]. The possible reason was most of the patients in advanced Wagner stage were developed gangrene.

Peripheral neuropathy was another variable which predicts of amputation in diabetic foot ulcer patients. Diabetic patients who had neuropathy were 1.6 times more likely to be amputated as compared to diabetic patients without neuropathy. This result is consistent with the studies conducted in Germany and Gondar [18, 20]. This is due to higher blood glucose level can result in damage of peripheral nerves which resulted in peripheral neuropathy.

The most commonly prescribed individual antibiotics in NRH during study period for patients was cloxacillin 56 (34.15%) followed by Metronidazole 43 (26.22%) and Ceftriaxone 33 (20.12%). Study in UK by Wong ML and Coppini DV showed that the most commonly prescribed antibiotics was cefradine, clindamycin, and ciprofloxacin [22]. However, the study done in Sweden showed that metronidazole (56%) and ciprofloxacin (54%) were the most commonly used, followed by flucloxacillin (40%) and cefadroxil (31%) [23]. The study done in Switzerland by Pittet D showed that the antibiotics most commonly used included semi synthetic penicillins (flucloxacillin or amoxicillin-clavulanic acid), second and third generation cephalosporins and fluoroquinolones [24]. The variety of individual antibiotic use in variety of setting was mostly due to availability and preference of the physicians.

The outcome of diabetic foot ulcer is strongly associated with inappropriate antibiotics given to treat diabetic foot infection. Diabetic foot ulcers who had taken inappropriate antibiotics were 2.5 more times to be amputated than diabetic foot ulcer which had been treated with appropriate antibiotics. This is similar with the study conducted in UK in which the amputation rate dropped from about 70% to about 30% with appropriate antibiotics therapy [25]. In our study area, about half of the antibiotics were prescribed inappropriately. Therefore, because of excessive and inappropriate use of antibiotics for treating diabetic foot infections, resistance to the usually employed bacteria will possibly increase to alarming levels in the study area unless tackled.

The duration of diabetes prior to presentation had no effect on the outcome of diabetic foot ulcers. Previous studies done in Germany, Pakistan, Jamaica, Khartoum and Arbaminch have demonstrated the inhibitory effects of diabetes on wound healing but the duration of diabetes independently may not be as important as overall blood glucose control (which was not looked at in this study) [13, 18, 26-28].

Diabetic patients who lived in the rural area often walk with bare feet. This may expose their feet to be injured and in those patients the foot ulcer may result in infections. Despite, these most of the patients in our study area were from urban and the place of the residence had no significant associations with the outcomes of diabetic foot ulcer. Previous studies done in Pakistan, Arbaminch and Gondar have demonstrated that diabetic foot ulcer significantly associated with the rural residence of the patients [20, 26, 27].

From the total diabetic foot ulcer patients, 35(30.43%) of them were amputated and from amputated diabetic foot ulcer patients, 20(57.14%) and 15(42.86%) were undergone minor and major amputation, respectively. This figure was higher than the study done in university of Malta and lower than the study done in Singapore and comparable with the study done in Pakistan and Tanzania [12, 27,29,30]. This is due to the differences in quality of diabetic foot care and may be related to the difficulty of obtaining consent for major or even minor surgery that required amputation of an affected limb. The reason for this reluctance lies in part in cultural factors where loss of limb may be considered worse than loss of life.

Strength and limitation of the study

As strength, the study was conducted among DFU patients as the foot complication of Diabetes mellitus patient is increasing in developing world and this study was general prospective cohort and may be used as baseline information for other researchers. As limitations, fasting plasma glucose was used to assess adequacy of glycemic control instead of glycosylated hemoglobin (HbA1c) and culture and sensitivity tests was not done to identify specific strain of the pathogen. Further the follow-up period was short, thus failing to take into account any non-healing ulcers resulting in amputation after this time and Patients were followed by telephone not by face to face interview.

Conclusion

Blood glucose level, Higher BMI (overweight and obesity), inappropriate antibiotics given, neuropathy, and advanced grade of diabetic foot ulcer were factors that predict outcomes of diabetic foot ulcer. The rate of amputation of the diabetic foot ulcer was found to be high in which most of the patients were amputated below ankle. From the patients amputated above ankle most of them amputated below knee. The most commonly prescribed antibiotics for treating diabetic foot ulcer was cloxacillin. About half of antibiotics were prescribed inappropriately. In order to reduce the associated unwelcomed effects of diabetic foot ulcer, especial emphasis should be given by treating health care provider for patients having neuropathy and advanced grade of diabetic foot ulcer and To minimize the risk of developing diabetic foot ulcer, Health educators should emphasize on the benefit of weight reduction. Additionally laboratory services should be strengthened like culture and sensitivity tests to identify specific strain of the pathogen for definitive treatment. Through this prescribers have to minimize empiric antibiotics prescribing to the possible level.

Abbreviations

AOR: Adjusted Odds Ratio; BMI: Body mass index; CI: Confidence Interval; COR: Crude Odds Ratio; DFU: Diabetic Foot Ulcer; DM: Diabetes Mellitus; IDSA: Infectious Diseases Society of America; NGO: Nongovernmental organization; NRH: Nekemte Referral Hospital; PAD: Peripheral Arterial Disease; QOL: Quality of life; SD: Standard Deviation; SPSS: Statistical Package for Social Sciences; SSTI: Skin and Soft Tissue Infections; USA: United States of America.

Declarations

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Authors' Contributions

FB contributes in the proposal preparation, study design, analysis and writes up the manuscript. LC contributed to the design of the study and GF contributed to analysis and edition of the manuscripts. KB made a substantial contribution to the local implementation of the study. All authors read and approved the final version of the manuscript.

Ethics Approval and Consent-to-Participate

Ethical clearance was obtained from the Institutional Review Board (IRB) of Jimma University, Institute of health with reference number of [IHRPGC/104/208](#). Ethics waiver was not applicable since the study was not randomized clinical trial so that the study subjects never have been divided to experimental and control group. Permission was obtained from medical director of the NRH to access diabetes patients and conducts the study. The benefit and risks of the study was explained to each participant included in the study and written consent were obtained from each patient involved in the study. To ensure confidentiality, name and other identifiers of patients and health care professionals were not recorded on the data collection tools.

Consent for publication: Not applicable. No individual person's personal details, images or videos are being used in this study.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: No competing interests exist.

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Tables

Table 1:Socio-demographic characteristics of respondents in Nekemte referral hospital, west Ethiopia, 2018.

Variables		Frequency	Percent
Sex	Male	64	55.65
	Female	51	44.35
Age	18-27	16	13.91
	28-37	14	12.17
	38-47	15	13.04
	48-57	24	20.87
	58-67	26	22.61
	68-77	20	17.39
Marital Status	Married	80	69.57
	Single	21	18.26
	Window	8	6.96
	Divorced	6	5.22
Residence	Urban	58	50.43
	Rural	57	49.57
Occupation	Farmer	31	26.96
	Government employee	19	16.52
	Private employee	17	14.78
	Merchant/trade	17	14.78
	House wife	13	11.30
	Daily labor	8	7.00
	NGO	6	5.22
	Student	4	3.48
Educational level	Illiterate	24	20.87
	Primary school	29	25.22
	Secondary school	22	19.13
	Above Secondary school	40	34.78
BMI	<24.5	65	56.52
	24.5-29.5	34	29.57
	>29.5	16	13.91

BMI: Body mass index

NGO: Nongovernmental organization

Table 2: life style approaches, presence of co-morbidities and complications among diabetic foot ulcer patients attending the Nekemte referral hospital,west Ethiopia, 2018.

Variables		Frequency	Percent	
Co-morbidities and complications	Retinopathy	Yes	55	47.83
		No	60	52.17
	Neuropathy	Yes	52	45.22
		No	63	54.78
	Coronary heart disease	Yes	27	23.48
		No	88	76.52
	Nephropathy	Yes	46	40.00
		No	69	60.00
	Peripheral vascular disease	Yes	42	36.52
		No	73	63.48
	Hypertension	Yes	56	48.69
		No	59	51.30
Ischemic heart disease	Yes	41	35.65	
	No	74	64.35	
Dyslipidemia	Yes	40	34.78	
	No	75	65.22	
Behavioral characteristics	Previous alcohol drinker	No	76	66.09
		Yes	39	33.91
	Current alcohol drinker	No	77	66.96
		Yes	38	33.04
	Previous smoker	No	85	73.91
		Yes	30	26.09
	Current smoker	No	85	73.91
		Yes	30	26.09

Among the total 115 study participants, 61 (53.04%) of them had type 2 diabetes mellitus. The mean fasting blood glucose level among diabetic patients with foot ulcer was 147.93mg/dl $\pm$ 45.03. Twenty six participants (22.61%) were diabetic for more than 10 years. Fifty three (46.09%) participants had poorly controlled blood glucose levels. Forty two (54.55%) of microorganism isolated was gram positive. Ulcer size was greater than 5cm² in the 23(20.00%) of the patients (table 3).

Table 3: Clinical characteristic of diabetic foot ulcer patients among diabetes mellitus patients admitted to Nekemte Referral Hospital, west Ethiopia, 2018.

Variables		Frequency	Percent
Types of DM	Type 2 DM	61	53.04
	Type 1 DM	54	46.96
Duration of Diabetic Mellitus	<5years	42	36.52
	5-10years	47	40.87
	>10 years	26	22.61
Glycemic Control	Good control	62	53.91
	Poor control	53	46.09
Size of Ulcer	<1cm ²	66	57.39
	1-5cm ²	26	22.61
	>5cm ²	23	20.00

From total number of the patients, about 9(7.83%) of the patients who had diabetic foot ulcer on dorsal/inter digital toes were amputated and about 4(3.48%) of the patients who had ulcer on heel were amputated (table 4).

Table 4: The location of diabetic foot ulcer patients admitted to Nekemte referral hospital, west Ethiopia, 2018.

Location of ulcer	Amputation		
	Yes (%)	No (%)	Total (%)
Dorsal/inter digital toes	9(7.83)	22(19.13)	31(26.96)
Plantar forefoot/mid foot	8(6.96)	17(14.78)	25(21.74)
Plantar toes	6(5.22)	24(20.87)	30(26.09)
Dorsal foot	5(4.35)	4(3.48)	9(7.83)
Heel	4(3.48)	4(3.48)	8(6.96)
Plantar hind foot	3(2.61)	9(7.83)	12(10.44)

Table 5: Commonly prescribed individual antibiotics for treating diabetic foot ulcer in Nekemte referral hospital, west Ethiopia, 2018.

Antibiotics	Frequency	Percentage
Cloxacillin	56	34.15
Metronidazole	43	26.22
Ceftriaxone	33	20.12
Ampicillin	9	5.49
Chrompenicol	8	4.88
Gentamycin	5	3.05
Ceftazidime	4	2.44
Ciprofloxacin	3	1.83
Vancomycin	2	1.22
Amoxacillin	1	0.61
Total	164	100

Table 6: Multivariate logistic regression analysis result of factors associated with amputation among diabetic foot ulcer patients admitted to NRH, west Ethiopia, 2018.

bles		Amputation		COR(95%CI)	P value	AOR(95%CI)	P value
		Amputated N (%)	Not Amputated N (%)				
ence	Rural	17(29.82)	40(70.18)	1.720[0.392,7.554]	0.247*	1.547[0.364,6.579]	0.416
	Urban	18(31.03)	40(68.97)	1		1	
	Male	19(29.69)	45(70.31)	1.639[0.169,2.410]	0.158*	1.660[0.178,2.451]	0.221
	Female	16(31.37)	35(68.63)	1		1	
ing ol ntly	Yes	12(31.58)	26(68.42)	1.516[0.107,2.485]	0.240*	1.594[0.128,2.761]	0.693
	No	23(29.87)	54(70.13)	1		1	
ing ette ntly	Yes	12(40)	18(60)	1.426[0.362,5.622]	0.188*	1.359[0.346,5.345]	0.222
	No	23(27.06)	62(72.94)	1		1	
ous history er	Yes	16(32.65)	33(67.35)	1.656[0.175,2.462]	0.235*	1.674[0.182,2.499]	0.317
	No	19(28.79)	47(71.21)	1		1	
of DM	Type 2 DM	23(37.70)	38(62.30)	1.483[0.117,2.001]	0.074*	1.431[0.108,1.715]	0.057
	Type 1 DM	12(22.22)	42(77.78)	1		1	
rtension	Yes	16(28.57)	40(71.43)	2.951[0.216,4.186]	0.167*	1.109[0.267,4.604]	0.509
	No	19(32.20)	40(67.80)	1		1	
mic Heart se	Yes	14(34.15)	27(65.85)	1.184[0.298,4.708]	0.152*	1.133[0.345,5.156]	0.361
	No	21(28.38)	53(71.62)	1		1	
demia	Yes	13(32.50)	27(67.50)	2.645[0.141,2.937]	0.157*	1.766[0.185,3.170]	0.629
	No	22(29.33)	53(70.67)	1		1	
opathy	Yes	17(30.90)	38(69.10)	1.345[0.092,1.386]	0.113*	1.358[0.097,1.319]	0.052
	No	18(30)	42(70)	1		1	
opathy	Yes	20(38.46)	32(61.54)	2.658[1.561,12.602]	0.029*	1.565[1.508,4.822]	0.004**
	No	15(23.81)	48(76.19)	1		1	
ary Heart se	Yes	9(33.33)	18(66.67)	1.176[0.035,2.891]	0.078*	1.179[0.135,1.915]	0.179
	No	26(29.55)	62(70.45)	1		1	
ropathy	Yes	18(39.13)	28(60.87)	1.645[0.148,2.814]	0.100*	1.227[0.173,3.013]	0.604
	No	17(24.64)	52(75.36)	1		1	
heral lar se	Yes	13(30.95)	29(69.05)	1.243[0.283,5.452]	0.177*	1.440[0.343,6.048]	0.864
	No	22(30.14)	51(69.86)	1		1	
mass	<24.5	15(23.08)	50(76.92)	1	0.073*	1	0.122
	24.5-29.5	12(35.29)	22(64.71)	7.054[1.410,35.296]	0.032*	2.767[1.827,9.252]	0.021**
	>29.5	8(50)	8(50)	7.729[2.828,72.134]	0.017*	3.020[2.556,16.397]	0.019**
	Poor Control	21(39.62)	32(60.38)	2.779[1.755,10.231]	0.048*		0.023**
mic ol ion of ctic us						2.592[1.937,7.168]	
	Good Control	14(22.58)	48(77.42)	1		1	
	<5years	14(33.33)	28(66.67)	1	0.184*	1	0.174
	5-10years	14(29.79)	33(70.21)	2.273[0.299,5.418]	0.071*	1.171[0.279,4.910]	0.061
of Ulcer	>10years	7(26.92)	19(73.08)	1.672[0.112,4.011]	0.157*	1.596[0.103,3.439]	0.558
	<1cm ²	16(24.24)	50(75.76)	1	0.215*	1	0.109
	1-5cm ²	11(42.31)	15(57.69)	1.515[0.109,2.431]	0.190*	1.608[0.139,2.665]	0.253
	>5cm ²	8(34.78)	15(65.22)	1.881[0.154,5.027]	0.132*	1.894[0.158,5.054]	0.130
opriateness tiotics	Inappropriate	21(53.85)	18(46.15)	6.192[1.108,34.614]	0.012*		0.017**
	Appropriate	14(36.84)	24(63.16)	1		1	
e of Ulcer	Grade < 4	19(21.84)	68(78.16)	1	0.001*	1	0.005**
	Grade ≥ 4	16(57.14)	12(42.86)	3.209[1.790,13.033]		1.70[1.604,4.789]	

Note *Shows statistically significant p value <0.25 at 95% CI

*Shows statistically significant p value <0.05 at 95% CI