Risk Factors Of Diabetic Foot Ulcers In Patients With Type 2 Diabetes Mellitus In Bogor-Indonesia: Basis For Foot Care Education

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Abstract

Backgrounds: The rising problem of diabetes has become a major problem worldwide. Indonesia has the seventh largest number of diabetic patients (7.6 million) and is the third cause of death after stroke and hypertension. DFU are common cause of complications of DM. Diabetic foot ulcers are preventable through Diabetes Foot Care Education.

Aim: The purpose of this study was to assess risk factors of DFU in patients with Type 2 diabetes mellitus to come up with an appropriate diabetic foot care education.

Methodology: The research method used was prospective. The research was carried out at Wocare Diabetic Clinic in Bogor Indonesia. The number of participant was 48 Type 2 DM patients with total sampling technique. The instrument used was Wagner Diabetic Foot Ulcer Grade Classification System and data analysis used a hypothesis test (Wilcoxon test).

Result: There was an increase in the average diabetic foot care behavior before and after being given education with a mean value of 79.6 to 79.9. There is an effect of providing education on the behavior of diabetic foot care (Wilcoxon test showed a p value of 0.000).

Conclusion: There was a significant difference between behavioral scores before and after attending foot care education.

Keywords: *Diabetic Foot Ulcers, Diabetes Mellitus, Education.*

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Introduction

Indonesia has the seventh largest number of diabetic patients (7.6 million) and is the third cause of death after stroke and hypertension.[1,2] Prevalence of DM in Indonesia was equal to 8.5 million in 2013 and will be 14.1 million patients in 2035.[3] Non-Communicable diseases including diabetes in the Philippines account for 6 out of the top ten causes of mortality.[4]

In the 2013 prevalence estimates published by International Diabetes Federation, it is estimated that there are 3.2 million cases of Type 2 Diabetes Mellitus, with a 5.9 prevalence rate in adults between the ages of 20 and 79 years.[5]

Around 1.7 million of people with type 2 diabetes remain undiagnosed. Recent IDF findings revealed a 6.2 % prevalence rate of diabetes in adults and over 3.721.900 cases of diabetes in 2017.[6] One of the major DM complications of DM is the development of Diabetic Foot Ulcer (DFU).[7] Foot ulcers and amputation, which are consequences of diabetic neuropathy and or peripheral arterial disease (PAD), are common and represent major causes of morbidity and mortality in people with diabetes.[8]

International Working Group on Diabetic Foot has proposed neuropathy and angiopathy as the main risk factors for the development of DFUs.[9] In terms of risk factors, studies identified history of DFU or amputation, Independent variables will be demographic profile of the patients that include age and gender. The demographic variables will be collected through an interview using a checklist. Dependent variables include risk factors of DFU and this will be gathered through the review of the patient's medical record. Foot care behavior will be collected through interview using questionnaire adopted from Yusuf et al. study.[3]

To assess and classify DFU, Wagner Diabetic Foot Ulcer Grade Classification System will be utilized. The Wagner diabetic foot ulcer classification system assesses ulcer depth and the presence insulin usage, gender, distal neuropathy and foot deformity. However, limited studies in Indonesia would describe risk factors of DFUs in particular with patients with type 2 DM.[10]

Diabetic foot ulcers are preventable through Diabetes Foot Care Education.[11] Patients with diabetes mellitus, their families and health-care workers should be educated for diabetes foot care.[12] Diabetes foot care education is an effective means to improve foot care knowledge and practice in patients with diabetes[13] and reducing the burden of diabetic foot ulcer.[14] Several studies showed effectivity of foot care education to cognitive and behavioral changes as well as decrease in foot ulcer incidence.[15] Thus, this study aims to assess risk factors of DFU in patients with type 2 diabetes mellitus to develop a diabetes foot care education.

This study is aimed to to assess risk factors of DFU in patients with Type 2 diabetes mellitus to come up with an appropriate diabetic foot care education.

Methodology

The prospective research design will be used to determine risk factors of diabetic foot ulcers in patients with Type 2 diabetes mellitus to develop appropriate diabetic foot care education. The study will be conducted at Wocare Diabetic Clinic in Bogor Indonesia. Study populations will be all Type 2 DM patients with DFU and sample size will be determined using power analysis equation. Inclusion criteria will include patients with Type 2 DM diagnosed by the physician and written in the medical records, with presence of DFU and who attended diabetic clinic. All patients who attended endocrine outpatient clinic or currently admitted in the hospital will be excluded in the study. The number of participant was 48 Type 2 DM patients with total sampling technique.

Independent variables will be demographic profile of the patients that include age and gender. The demographic variables will be collected through an interview using a checklist. Dependent var-

iables include risk factors of DFU and this will be gathered through the review of the patient's medical record. Foot care behavior will be collected through interview using questionnaire adopted from Yusuf et al. study.

To assess and classify DFU, Wagner Diabetic Foot Ulcer Grade Classification System will be utilized. The Wagner diabetic foot ulcer classification system assesses ulcer depth and the presence of osteomyelitis or gangrene by using grade 0-5.

Data were analyzed using SPSS version 23. The study were divided into univariate analysis and bivariate analysis. The data processing are presented in the form of an explanation table. Data analysis used a hypothesis test (Wilcoxon test). The p-value< 0.05.

Results

Table 1. Frequency Distribution of Respondents Characteristics Based on Age, Gender, risk factors for diabetic foot ulcers based on history of DFU, pre-ulcerative callus or corns, Foot Care Behavior and Classification of DFU Based on Wagner's Scale in Type 2 Diabetes Patients

Characteristics	Frequency	Percentage (%)
Age		
0-35 years old	2	4.2
36-51 years old	10	20.8
52-67 years old	29	60.42
68-83 years old	7	14.58
Gender		
Male	31	64.6
Female	17	35.4
History of DFU		
DFU	33	68.7
No DFU	15	31.3
Pre-ulcerative callus or corns		
Yes	45	93.75
No	3	6.25
Foot Care Behavior		
Good	34	70.83
Less	14	29.17
Classification of DFU Based on Wagner's Scale		
Level 1	3	6.25
Level 2	5	10.41
Level 3	20	41.67
Level 4	11	22.92
Level 5	9	18.75
Total	48	100

Based on the table above, out of 48 participants, the most participants were aged 52 – 67 years, as many as 29 participants (65.9%), most participants were male, namely 31 participants (64.6 %). 33 participants (68.7%) had a history of DFU, 40 participants (83.33%), 45 participants (93.75%) had callus or pre-ulcerative corns, and 20 respondents (41.67%) who had Diabetic foot uIcers at grade or grade 3 based on the wagner scale.

Risk Factors	OR	95% CI	P value
Age	2,35	4,25-7,29	0,017*
History of DFU	0,4	0,23-1,27	0,000*
Pre-ulcerative callus or corn	2,3	0,76-8,45	0,000*
Foot Care Behavior	2,76	4,76-8,93	0,014*

Table 2. Relationship Between DM Ulcer Risk Factors with DFU Classification

The table above showed that risk factors for DM ulcers which include Age, History of DFU, callus, and foot care behavior statistically affect the DFU classification, where p value < 0, 05.

Table 3. Variables For The Final Model In Multivariate Analysis With Multiple Logistic Regression Test

Variabel	B	Wald	P value	Exp (B)	95% CI
Age	2.453	13.275	0.001	19.27	1.24-189.45
History of DFU	3.274	12.156	0.000	25.19	4.25-210.14
Callus or corn Pra- ul-cerative	2.649	11.513	0.000	15.28	3.25-119.28
Foot Care Behavior	5.623	23.518	0.000	42.59	5.24-247.18

The calculation results show that participants with type 2 diabetes mellitus who are > 36 years old, have a history of DFU, have callus, and poor foot care behavior, have a probability or risk for developing diabetic foot events. Diabetic foot care behavior is the most dominant variable affecting the incidence of diabetic foot (DFU) with the largest Odds Ratio value, which is 42.59.

Table 4. Behavior of Diabetic Foot Ulcers Before and After Education

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Normality saphiro Wilk	P value
				Lower Bound	Upper Bound		
PRETEST	48	79.6	4.87	78.16	80.99	0.004	0.000
POSTTEST	48	79.9	0.77	99.63	100	0.000	

Based on Table 4 above, there was an increase in the average diabetic foot care behavior before and after being given education with a mean value of 79.6 to 79.9. The normality test of the data with the Shapiro Wilk test showed a value below 0.05, so the statistical test used was non-parametric, namely the Wilcoxon rank test. The results of the Wilcoxon test showed a p value of 0.000 which means that there is an effect of providing education on the behavior of diabetic foot care.

Discussion

A. Age

The age variable was proven to have a significant relationship with the incidence of diabetic foot (p= 0.001), meaning that people with type 2 diabetes mellitus aged 36 years had a risk of developing diabetic foot 19.27 times greater than their age < 36 years.

Research conducted by Aimei Zhong, MD et al. found that aged 60-70 years (30.99%) had DFU. The incidence of diabetic foot in patients with type 2 diabetes mellitus increases with age. The prevalence of diabetes mellitus reaches its peak at the age of 70-89 years and 60-69 years, then decreases at the age of more than 70 years. The decrease in the prevalence of diabetes mellitus in the very old age shows that those in the very old age group have a lower survival power than the previous age group. This is associated with chronic complications.[16]

The aging process differs between individuals, this difference is influenced by endogenous factors (genetic and biological) as well as exogenous factors (lifestyle and disease).[17] The aging process that takes place will result in anatomical, physiological and biochemical changes as well as a decrease in quality of life by 1%.[18]

B. History of DFU

The variable of history of DFU proved to have a significant relationship with the incidence of diabetic foot (p= 0.000) and is a risk factor for the occurrence of diabetic foot in patients with type 2 diabetes mellitus (OR=25.19; 95%CI=4.25-210,14), meaning that patients with type 2 diabetes mellitus who have a history of DFU have 25 times more diabetes mellitus than patients with type 2 diabetes mellitus who do not have a history of DFU.

Previous studies have shown that the risk of developing DFU in diabetes with a previous history of DFU is 9.507 times higher when compared with diabetes without a history of DFU.[19] This may also be related to other factors such as duration of diabetes, blood glucose control, and foot self-care performed by the patient, each diabetic.[20]

C. Pre-Ulcerative Callus/Maize

The variable having a history of ulceration on the feet was shown to have a significant relationship with the incidence of diabetic feet (p=0.000) and is a risk factor for diabetic foot in patients with type 2 diabetes mellitus (OR = 15.28; 95%CI = 3.25-119.28), meaning that patients with type 2 diabetes mellitus who have a history of foot ulceration may develop diabetic foot. 15.28 times greater than patients with type 2 diabetes mellitus who did not have a history of foot ulceration.

Several studies have the same result that a history of previous foot ulceration is a risk factor for diabetic foot. This is supported by the results of the study where each with an RR of 1.6 and p = 0.003. This is in line with a study conducted in India which stated that a history of previous foot ulceration (p=0.0001) was a risk for diabetic foot occurrence.[21]

Loss of sensation in the foot will lead to repetitive pressure, injury and fracture, structural abnormalities of the foot, eg hammer toes, callus, metatarsal deformity, or Charcot's foot; continuous pressure and eventually soft tissue damage occurs. Not feeling hot or cold, wrong shoe pressure, damage from blunt or sharp objects can cause blistering and ulceration. These factors plus poor blood flow increase the risk of limb loss in people with diabetes.[22]

D. Foot Care Behavior

Variable foot care behavior proved to have a significant relationship with the incidence of diabetic foot (p = 0.000) and is a risk factor for diabetic foot in patients with type 2 diabetes mellitus (OR = 42.59; 95%CI = 5.24-247.18), meaning that people with type 2 diabetes mellitus with poor foot care behavior have 42.59 times greater risk of developing diabetic feet than patients with type 2 diabetes mellitus who take good care of their feet.

This is in line with Amelia's research (2018) which showed that there was a relationship between foot care behavior and the occurrence of complications of diabetic foot ulcers in type 2 DM patients at the Tuntungan Health Center in Medan with a p value of 0.049. The results of this study also imply the importance of knowledge as

a variable that determines foot care behavior and the need for education to increase knowledge of foot care which ultimately improves foot care behavior.[23]

Better foot care behavior will reduce the risk of foot ulcer complications and lead to the patient's quality of life.[24] Prevention of foot ulcers is more important because the treatment of foot ulcers takes more time and resources.[25]

E. Education on diabetic foot care in patients with type 2 diabetes mellitus

Based on the Wilcoxon test results showed a p value of 0.000 which means that there is an effect of providing education on the behavior of diabetic foot care in patients with type 2 diabetes mellitus. Hosam Almetahr et al (2020) conducted that the effectiveness of the foot care education program on the level of foot care knowledge (p = 0.001).[26]

Diabetic Foot Ulcer (DFU) can be prevented through Diabetes Foot Care Education.[27] Patients with diabetes mellitus, the patient's family and health workers should be educated in the care of diabetic feet. Diabetic foot care education is an effective way to increase knowledge and practice of foot care in patients with diabetes[28] and reduce the occurrence of diabetic foot ulcers.[29] Several studies have demonstrated the effectiveness of foot care education for cognitive and behavioral changes and a reduction in the incidence of foot ulcers.

Conclusion

Based on the results of the study, it can be concluded that the risk factors for the incidence of diabetic foot in patients with type 2 diabetes mellitus are respondents who are > 36 years old, have foot deformities, have a history of DFU, have callus, have a history of high BP, and foot care behavior. There is a significant difference between behavioral scores before and after attending foot care education.

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