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Factors Associated with Foot Ulcer among Diabetic Patients

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Abstract. Diabetic foot ulcers (DFU) are among the most common complications in diabetic patients and are associated with high morbidity, mortality, and health costs. Peripheral neuropathy, peripheral arterial disease, and foot deformity are risk factors for diabetic foot ulcers. Identification of risk factors is needed to improve diabetic foot ulcer prevention strategies. This study aimed to describe the results of the monofilament 10 g test and ankle-brachial index in patients with diabetes mellitus. In this cross-sectional study, a total of 70 patients with diabetes mellitus type 1 and type 2 were included. The sampling technique used was purposive sampling. The results showed 54.3% of respondents had peripheral neuropathy with a monofilament score ≤ 8. There were 27.1% of respondents with a lower score in ABI ≤ 0.9 and indicated peripheral arterial disease. The monofilament test with a score of ≤ 8 was more common in women than in men, ages 56-65 years, and duration of diabetes mellitus for more than ten years. A lower ABI was more common in women than in men, aged 56-65 years, and duration of diabetes mellitus for more than ten years. Peripheral neuropathy and peripheral arterial disease are risk factors for diabetic foot ulcers. Therefore prevention and early screening are needed.

Keyword: Risk factors, foot ulcer, diabetes mellitus

INTRODUCTION

Diabetes mellitus (DM) is one of the world's biggest health problems and is one of the leading causes of death globally due to non-communicable diseases (1). One of the most complications that often occur in patients with diabetes mellitus is a diabetic foot ulcer. Diabetic foot ulcers are associated with the incidence of amputation in which an estimated 15% of diabetic foot ulcers cause lower limb amputations and high morbidity, mortality, and increased health costs. Globally, in 2017 the incidence of diabetes reached 425 million cases

with the prevalence of diabetic foot ulcers reaching 7-8%. Diabetic foot ulcers occur in 15-25% of patients with diabetes mellitus (2).

The main risk factors for diabetic ulcers are peripheral neuropathy, peripheral arterial disease (PAD), and leg deformities (3). Diabetic foot ulcers occur more than 2% per year in 5 - 7.5% of patients with neuropathy. Several studies have shown that peripheral neuropathy and PAD conditions can increase the risk of developing diabetic ulcers (4,5).

Neuropathic causes the presence of motor, sensory, and autonomic disorders. Motor disorders cause muscle atrophy, leg deformity, changes in the biomechanical foot, and foot pressure. Autonomic disorders cause a decrease in sweat excretion in the feet so that the skin becomes dry and easily formed fissure (5). Sensory disturbances (peripheral neuropathy) are a condition of loss of sensation or feeling numb at the distal, and more than 50% of peripheral neuropathy conditions may not show symptoms. Thus it is necessary to screen with a simple neurological examination using monofilament 10 g (6,7).

Another risk factor for diabetic foot ulcers is a peripheral arterial disease. Peripheral arterial disease is a blockage of arteries in the lower extremity due to atherosclerosis. The clinical symptom that is often found in PAD patients is intermittent claudication due to muscle ischemia (5). Screening the PAD can be done by assessing the Ankle Brachial Index (ABI). ABI is the ratio of systolic blood pressure to the ankle with systolic blood pressure in the brachial part. If the ABI value < 0.9 is an abnormal condition and indicates peripheral arterial disease (8).

Risk factors for diabetic ulcers need to be identified to improve prevention strategies. Therefore, this study focused on the detection of peripheral neuropathy using the monofilament 10 g test and assessment of the ankle-brachial index in patients with diabetes mellitus.

OBJECTIVE

This study aimed to determine the risk factors of diabetic foot ulcers in patients with diabetes mellitus through monofilament test and ankle-brachial index.

METHOD

This descriptive-analytic study used to analyze the risk factors of diabetic foot ulcers with monofilament 10 g test and ankle-brachial index, characteristic of respondents consisting of gender, age, and duration of diabetes mellitus.

This research was conducted from May to June at the Internal Medicine Clinic of Sidoarjo Public Hospital. There were 70 patients with type 1 and type 2 diabetes mellitus. The sampling technique used was purposive sampling.

The instrument used in this study was Semmes-Weinstein Monofilament Test 10 g, tensimeter, and vascular Doppler. Based on previous research, examining using monofilament-Weinstein 10 g in patients at risk of recovering diabetic ulcers has a sensitivity of 66% to 91%, the specificity of 34% to 86% with a predictive value of 18% to 39% (8). The previous study showed that an ABI value checked by doppler has 100 % sensitivity and 95 % specific to PAD. Another research showed that the sensitivity of ABI < 0,9 between 35 % and 75% (9,10). Before conducting the study, the researcher trained by the person in charge of the internal medicine clinic in the hospital on how to perform the monofilament 10 g and ABI test.

This research has received ethical approval from the health research ethics Committee of Sidoarjo Public Hospital (Number 893.3 / 1875 / 438.6.7 / 2019). In this study, data were analyzed using descriptive analysis

RESULTS

Characteristic of respondents

Table 1 showed the characteristics of respondents based on gender, age, and duration of diabetes. The gender characteristics showed that the majority of respondents were female (60%). Age characteristics showed that most respondents were in the age range of 56-65 years (61.4%). The duration of DM that most respondents suffered from DM for 1-5 years (47.1%)

Table 1. Characteristic of respondents

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	28	40
	Female	42	60
Age	36-45 year	3	4.3
	46-55 year	24	34.3
	56-65 year	43	61.4
Duration of Diabetes	1-5 year	33	47.1
Mellitus	6-10 year	15	21.4
	>10 year	22	31.4

Frequencies and Percentages of Monofilament 10 g test

Table 2 shows that the majority of respondents had a score of ≤ 8 on monofilament 10 g examination, indicating the presence of peripheral neuropathy (54.3%). In contrast, those who had a score of> 8 were no peripheral neuropathy (45.7%).

Table 2. Characteristic of respondents based on age and nutritional status among the experimental group and the control group

Monofilament 10 g test	Frequency	Percentage (%)
Score ≤ 8	38	54.3
Score >8	32	45.7
Total		

Frequencies and Percentages of the Ankle Brachial Index (N=70)

Table 3 shows that most patients had normal ankle-brachial index values (72.9%) and those with abnormal ABI values (27.1%).

Table 3 The effect of implementation-intention-based audiovisual psychoeducation program on the behavior of adherence for preventing tuberculosis transmission (n=72)

Ankle Brachial Index	**Frequency**	**Percentage (%)**
Abnormal	19	27.1
Normal	51	72.9

Frequencies and Percentages of Characteristic of Monofilament 10 g test

Table 4 showed the characteristics of respondents based on the results of the monofilament 10 g test. The gender characteristics indicated that some of the respondents

who were female had a score of ≤ 8 (32.9%), and a score> 8 was also in the female sex category (27.1%). Age characteristics indicate that the majority of respondents in the 56-65 year age range had a score of ≤ 8 (35.7%), and a score> 8 was also in the same age range category (25.7%). The duration of DM showed that majority respondents suffered from DM for> 10 years have a score of (8 (20%) and most respondents suffered from DM for 1-5 years have a score of> 8 (28.6%)

Characteristic	Category	Monofilament 10 g test			
		Score ≤ 8		Score >8	
		Frequency	Percentage (%)	Frequency	Percentage (%)
Gender	Male	15	21.4	13	18.6
	Female	23	32.9	19	27.1
Age	36-45 year	0	0	3	4.3
	46-55 year	13	18.6	11	15.7
	56-65 year	25	35.7	18	25.7
Duration of DM	1-5 year	13	18.6	20	28.6
	6-10 year	11	15.7	4	5.7
	>10 year	14	20	8	11.4

Frequencies and Percentages of Characteristic of the Ankle Brachial Index (N=70)

Table 5 showed the characteristics of respondents based on the ankle-brachial index. Gender characteristics showed that the majority of respondents with abnormal ABI were female (17.1%), while the majority of respondents with normal ABI were also in female gender (42.9). Age characteristics showed that most respondents who had abnormal ABI were in the age range of 56-65 years (12.9%). The long-standing characteristics of DM showed that most respondents who had abnormal ABI had DM for more than ten years (11.4%).

DISCUSSION

The results of this study indicate that peripheral neuropathy and abnormal ABI scores are more common in women than men. This is supported by research conducted by Katulanda et al. 2012, which showed that more women had peripheral neuropathy than men (11). Diabetes mellitus causes a decrease in the protective effect of estrogen, which increases the risk of blood flow disorders in women. Besides, women tend to have higher BMI and obesity than men (12).

Besides gender, the factors that influence the incidence of peripheral neuropathy and PAD are age. The higher the age of a person, the greater the risk of developing neuropathy. Several studies have shown that increased age is associated with peripheral neuropathy and peripheral arterial disease (13,14). Along with increasing age, there are disorders of the arteries and disorders of lipid and glucose metabolism that cause peripheral neuropathy (15). Research conducted by Unmar et al. 2017 found that age is a risk factor for neuropathy, with increasing age associated with disorders of the nervous system, which then causes neuropathy (16).

The duration of DM is also associated with peripheral neuropathy and PAD. This study is in line with several research results that show that the longer a person experiences DM, the higher the incidence of complications such as peripheral neuropathy and PAD are experienced (13,17,18). Vibha et al. 2018 also found that DM duration was one of the factors contributing to the incidence of neuropathy and PAD (19-20). Neuropathic conditions tend to

occur around ≥ five years of experiencing DM. This is caused by the more extended suffering from DM, the higher the possibility of chronic hyperglycemic (5). Long-suffering from DM with hyperglycemia causing interference with blood vessels and blood pressure (21-22)

CONCLUSION

Most of the respondents experienced peripheral neuropathy, which had a monofilament examination score of ≤ 8, and most respondents had normal ABI values so that they did not experience peripheral arterial disease. Early detection of diabetic foot ulcer needs to be done in every DM patient, and this study can be used as a source of information for healthcare workers in increasing efforts to prevent diabetic ulcers

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