

## THE ASSOCIATION OF DURATION OF TYPE 2 DIABETES MELLITUS WITH THE PREVALENCE OF PERIPHERAL DIABETIC NEUROPATHY

Nixie Sabari<sup>1)</sup>, Prettysun A Mellow<sup>2)</sup>, Franklin V Malonda<sup>3)</sup>

Correspondent Email: [anixiesabari@gmail.com](mailto:anixiesabari@gmail.com)

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### ABSTRACT

**Introduction:** Chronic complications of diabetes mellitus have a significant role in increased morbidity, mortality, disability, and health cost as the population increases every year. Promotive and preventive actions are needed to decrease the prevalence of peripheral diabetic neuropathy. The screening tool for peripheral diabetic neuropathy is Michigan Neuropathy Screening Instrument (MNSI), which consists questionnaire and physical examination.

**Purpose:** The purpose of this study was to understand the association of the duration of type 2 diabetes mellitus with the prevalence of peripheral diabetic neuropathy in the Outpatient Unit of Gotong Royong Hospital Surabaya.

**Method:** A cross-sectional study was done using 50 patients in the Outpatient Unit of Gotong Royong Hospital Surabaya. The sampling technique used consecutive sampling with filling out the Michigan Neuropathy Screening Instrument (MNSI) questionnaire. The score of the MNSI questionnaire is analyzed using Chi-Square Test.

**Results:** Among 50 subjects who participated in the study, most were women (78%). The prevalence of patients with peripheral diabetic neuropathy was 28% from all subjects. This chronic complication is divided into two groups based on the duration of diabetes mellitus type 2 with the prevalence of peripheral diabetic neuropathy with a duration of diabetes <5 years (18,2%) and peripheral diabetic neuropathy with the duration of diabetes more than equal to five years old (35,7%). From the analysis with Chi-Square, we did not find a significant association between the duration of type 2 diabetes mellitus and peripheral diabetic neuropathy ( $p = 0.004$ ).

**Conclusion:** There was no statistically significant association between the duration of type 2 diabetes mellitus and the prevalence of peripheral diabetic neuropathy.

**Keywords:** Type 2 Diabetes Mellitus, Peripheral Diabetic Neuropathy, Michigan Neuropathy Screening Instrument (MNSI).

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<sup>1)</sup> Faculty of Medicine, Widya Mandala Surabaya Catholic University  
Email: [anixiesabari@gmail.com](mailto:anixiesabari@gmail.com)

<sup>2)</sup> Department of Internal Medicine, Faculty of Medicine, Widya Mandala Surabaya Catholic University

<sup>3)</sup> Department of Surgery, Faculty of Medicine, Widya Mandala Surabaya Catholic University

## INTRODUCTION

Diabetes mellitus is a metabolic disease caused by activated hyperglycemia because of functional error in the pancreas that allows a defect in insulin secretion, functional error in insulin itself, or both. According to *International Diabetes Federation (IDF)*, an increase in people who have caught this disease can be seen. In 2010, research showed that in 2025, around 438 million people would be infected by this disease. Nevertheless, in 2019, the numbers have already hit 463 million people, which was beyond the analysis.

Indonesia, one of the developing countries, is the 4<sup>th</sup> out of 10 countries, with the most diabetes mellitus diseases between 2000 and 2030, with an estimation of 8,4 to 21,3 million. Riskedas (2018) stated that diabetes mellitus mostly affects people around 55 to 64 years old. Since 2013, diabetes Mellitus commonness has been experiencing an increase of 2%, with an estimation of 22,7 million.

Diabetic neuropathy, a chronic complication due to DM, is the most common complication among DM type 2's patients. Nerve damage usually happens along with the complication. It affects specifically the lower leg and feet or can be referred to as the body's lower extremity (limb). Patients of this chronic complication often experience symptoms around the distal and symmetrical parts of their hands and legs (glove and stocking). These symptoms include pain, which usually gets worse at nighttime, numbness, tingling, or electric sensation. Peripheral diabetic neuropathy is one of the causes that can negatively impact a patient's quality of life and psychosocial. It particularly affects patients with ulceration, amputation, unable to walk, and injuries.

Chronic hyperglycemia and metabolism defects in DM can cause blood vessels, peripheral nervous system, eyes, and kidney damage. The pathogenesis of diabetic neuropathy consists of three main metabolic pathways. One of the following is the

production of advanced glycation end products, which is increased by hyperglycemia. Protein Kinase C and Polyol Pathway disorders can cause macroangiopathy and microangiopathy. Blood flow damages in nerves and nerve transduction disorders occur, resulting in peripheral diabetic neuropathy.

## METHOD

This study is an observational analytic study with a cross-sectional design study, used to analyze the association between variables. The population of this study was all type 2 diabetes mellitus patients in the outpatient unit of the Gotong Royong Hospital who met the inclusion criteria during September 2019. The sampling technique in this study was carried out using a non-probability sampling technique named consecutive sampling.

## RESULTS

Based on the research that has been done, the following shows the characteristics of respondents in the form of age, gender, and duration of type 2 diabetes mellitus with the incidence of diabetic peripheral neuropathy.

**Table 1. Characteristics of Respondents**

Gender	Frequency (n)	Percentage (%)
Men	15	30 %
Women	35	70%
Total	50	100 %

  

Age (years old)	Frequency (n)	Percentage (%)
25-40	4	8 %
41-50	18	36 %
51-60	13	26 %
>60	15	30 %
Total	50	100%

The total sample size is 50 people with the frequency of gender, consisting of 15 men and 35 women. Then from the age group, it is obtained the age group 25-40 years with 14 respondents, the age group 41-50 years with 18 respondents, the age

group 51-60 years with 13 respondents, the age group > 60 years with 15 respondents.

**Table 2. Association of Duration of Type 2 Diabetes Mellitus With The Prevalence of Peripheral Diabetic Neuropathy**

	Value	Asymptomatic (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.878	.171		
Continuity Correction <sup>s</sup>	1.109	.292		
Likelihood Ratio	1.935	.164		
Fisher's Exact Test			.215	.146
Linear-by-Linear Association	1.841	.175		
N of Valid Cases	50			

From the results of the analysis test using Chi-Square shows a significant value /  $p = 0.292$  ( $p < 0.05$ ) and  $r = 0.190$ . This shows no significant relationship between the duration of suffering from type 2 diabetes mellitus with the incidence of diabetic peripheral neuropathy, so the

**DISCUSSION**

According to the research, there were 50 respondents, 15 males, and 35 females. The numbers show that 70% of the respondents are female, while the rest are males. Fourteen patients with diabetic neuropathy, three males and 11 females in particular. The three male patients cover 20% of the total male respondents affected by the

chronic complication, while the female patients are at around 31.4%. This analysis proved Mona Ali Abosrea's research that gender does not affect peripheral diabetic neuropathy. The research showed that six respondents were affected with NPD, all of them were between 51 to 60 years old. Simona Popescu, et al. stated that PDN was mainly affected by aging. Getting older can truly decrease the body's functionality and affect blood vessels and nerve transduction. This research shows that most cases of PDN are from the range of 51 to 60 years old. Hence, it shows no correlation between age and PDN, as stated in Simona Popescu, et al. No correlation between age and PDN can also occur due to narrow sample sizes.

Correlation between the duration of the patient with type 2 diabetes mellitus and PDN in the Outpatient Unit of Gotong Royong Hospital Surabaya was analyzed using *Chi-Square* implementation. It showed a significant result at 0.292, which proved no significant correlation. According to this study, the amount of sample and changes in a variable can be the factors that there is no sign of the correlation between those two things. The ordinal variable that is switched into a nominal variable can also be one of the factors due to insufficient data with the ordinal variable, which cannot be analyzed. However, this research shows that there are more patients with a period experiencing PDN in the range of more than or equal to five years than the number of patients experiencing PDN in less than five years. According to the data analysis, there were 14 respondents affected with PDN, ten respondents affected with DM, with a period of more than or equal to 5 years, which was 35.7% of the respondents. At the same time, four respondents affected with DM, with less than five years covered up as much as 18.2%. The data analysis also showed that PDN affected more DM type 2 patients with a period of more than or equal to 5 years of experiencing the disease. Although, statistical analysis did not show any significant connection or correlation.

According to Muhammad Umer Nisar, there is a correlation between a patient's period affected with DM and PDN. Nevertheless, this analysis shows that there is no significant correlation.

PDN can be caused by chronic hyperglycemia in several ways. The followings are; polyol pathway, hexosamine pathway, AGE, and Protein Kinase C. In the polyol pathway, glucose is converted into sorbitol with the help of aldose reductase, which allows the production of *nicotinamide adenine dinucleotide phosphate* to decrease, decreasing glutathione (antioxidant) occurs. Secondly, *nicotinamide adenine dinucleotide* is experiencing a decrease, which causes *glyceraldehyde-3-phosphate dehydrogenases* also to decrease. Thus, the hexosamine pathway is activated, and continuous inflammation often occurs. A significant increase of *reactive oxygen species* occurs in the AGE pathway, and NFkB is activated. Neuroinflammation, blood vessel permeability dysfunction, procoagulant activities, and monosit entry are all expected. In Protein Kinase C, diasilgliserol is activated, resulting in inflammation. Thus, vasoconstriction and thickening of small peripheral arteries occur. These several ways, causing ischemia and continuous incline in oxidative stress due to an increase in reactive oxygen species are expected. As a result, hypoxia and regeneration mechanism disorders occur, which leads to dysfunctional neurons and damages. MNSI screening is commonly used for chronic DM patients for checking purposes. It is used to see if there is any diabetic neuropathy. Routine MNSI screening is needed to prevent further chronic complications or PDN since PDN can be asymptomatic. In several cases, patients with PDN show severe pain throughout their body, periods of immobility, depression, even social dysfunction. Therefore, routine physical checkups, particularly the lower extremity (limb) of the body, or leg, are required. Narrow

sample sizes and Covid-19 pandemic cause this research not to include patients' physical checkups. Physical distancing is needed during this time of the pandemic. Hence, the type of PDN can not be determined.

## CONCLUSION

Based on the research results that have been done, it is concluded that there is no significant relationship between suffering from type 2 diabetes mellitus with the incidence of diabetic peripheral neuropathy.

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