



# Risk Factors for Peripheral Neuropathy in Patients with Type 2 Diabetes Mellitus

Sukhri Herianto Ritonga<sup>(✉)</sup>, Erlina Siregar, Febrina Angraini Simamora, and Juni Andriani Rangkuti

Universitas Aufa Royhan, Padangsidempuan, Indonesia  
nerssukhri88@gmail.com

**Abstract.** Peripheral neuropathy was one of the complications type 2 DM and could make it worse the sufferer's quality of life. The aim of this study was to determine the risk factors for peripheral neuropathy. Case control design was used in this study. The population of this study were all patients with type 2 diabetes mellitus in Padangsidempuan City. Sampling used purposive sampling method with a total sample of 96 respondents, namely the case group as many as 48 respondents and the control group as many as 48 respondents. Statistically it was obtained that the duration of suffering diabetes mellitus ( $P = 0.039$ ;  $OR = 2.60$ ), hypertension ( $P = 0.002$ ;  $OR = 0.24$ ) and lifestyle ( $P = 0.000$ ;  $OR = 165$ ) had a significant relationship with the occurrence of peripheral neuropathy in patients with type 2 DM. Meanwhile, age ( $P = 0.540$ ), BMI/Obesity ( $P = 0.642$ ), regularity of treatment ( $P = 0.621$ ) did not have a significant relationship with the occurrence of peripheral neuropathy in patients with type 2 DM. Based on the results of this study, it was found that the duration of suffering type 2 DM, hypertension and lifestyle were risk factors for peripheral neuropathy.

**Keywords:** Peripheral Neuropathy · Type 2 Diabetes Mellitus

## 1 Background

Diabetes mellitus (DM) was a disease with an increasing number of sufferers from year to year. Based on estimated data from the International Diabetes Federation (IDF) in 2019, the number of DM cases reached around 463 million people in the world and is predicted to continue to increase to 700 million people by 2045. The number of DM sufferers in Indonesia is also increasing. i.e. from 8.4 million in 2000 to around 21.3 million in 2030 [1]. The increasing number of Diabetes Mellitus sufferers has an impact on the increasing number of DM sufferers who experience chronic complications. One of the most common chronic complications that can worsen quality of life is peripheral neuropathy.

Peripheral neuropathy is a microvascular disease that affects the small arteries that supply blood to the periphery [2]. According to the PERSI (Indonesian Hospital Association) data and information center, the prevalence of diabetes mellitus patients with neuropathic complications is more than 50% of DM patients. According to one study

stated that the factors that cause peripheral neuropathy include regularity of treatment, diet, activity patterns and hypertension [3]. Other factors that cause peripheral neuropathy in DM patients include obesity and high cholesterol. Other factors associated with the incidence of peripheral neuropathy include age and duration of DM [4].

The purpose of this study was to determine the risk factors that cause the incidence of peripheral neuropathy in patients with type 2 diabetes mellitus.

## 2 Research Methods

This type of research was a quantitative study with a case control study design with a retrospective approach. The target population of this study were all type 2 Diabetes Mellitus patients in the Padang Matinggi Public Health Center in Padangsidempuan City. Sampling used *purposive sampling method* with a total sample of 96 respondents, namely the case group as many as 48 respondents and the control group as many as 48 respondents. The statistical test used was the *Chi Square test*.

## 3 Research Result

Based on the Table 1, for the age variable, p value of 0.540 is obtained, meaning that it can be concluded that age is not associated with the incidence of peripheral neuropathy in patients with type 2 diabetes.

For the BMI variable, p value of 0.642 was obtained, meaning that it can be concluded that BMI is not associated with peripheral neuropathy in patients with type 2 diabetes.

For the variable duration of suffering from DM, a p value of 0.039 was obtained, meaning that it can be concluded that there is a relationship between the long duration of suffering from DM and the incidence of peripheral neuropathy in patients with type 2 diabetes.

For the hypertension variable, p value of 0.002 was obtained, meaning that it can be concluded that there is a relationship between hypertension and the incidence of peripheral neuropathy in patients with type 2 diabetes.

For the medication adherence variable, p value of 0.621 was obtained, meaning that it can be concluded that there is no relationship between medication adherence and the incidence of peripheral neuropathy in patients with type 2 diabetes.

For the lifestyle variable, the p value is 0.0000, meaning that it can be concluded that there is a relationship between lifestyle and the incidence of peripheral neuropathy in patients with type 2 diabetes.

**Table 1.** Risk Factors for Peripheral Neuropathy.

The incidence of peripheral neuropathy in patients with type 2 DM							P value
	There is a DPN		No DPN		Amount		
	n	%	n	%	n	%	
<b>Age</b>							
36–55 years old	22	45.8	26	54.2	48	100	0.540
56–70 years old	26	54.2	22	45.8	48	100	
<b>BMI</b>							
Not obese	34	47.9	37	52.1	71	100	0.642
Obesity	14	56.0	11	44.0	25	100	
<b>Long duration DM</b>							
>5 years	26	63.4	15	36.6	41	100	0.039
<5 years	22	40.0	33	60.0	55	100	
<b>Hypertension</b>							
No hypertension	13	31.0	29	69.0	42	100	0.002
Hypertension	35	64.8	19	35.2	54	100	
<b>Treatment compliance</b>							
Not obey	39	52.0	36	48.0	75	100	0.621
Obey	9	42.9	12	57.1	21	100	
<b>Lifestyle</b>							
Bad lifestyle	45	91.8	4	8.2	49	100	0.000
Good lifestyle	3	6.4	44	93.6	47	100	
<b>Total</b>	<b>48</b>	<b>50</b>	<b>48</b>	<b>50</b>	<b>96</b>	<b>100</b>	

## 4 Discussion

Based on the results of the study, it was found that age, body mass index (BMI) and medication adherence were not associated with the incidence of peripheral neuropathy in patients with type 2 diabetes.

The results of this study indicate that there is no significant relationship between age and the incidence of DPN in patients with type 2 diabetes. This is certainly contrary to several theories and existing research results. This difference can only occur if DM sufferers during their illness are able to properly control the factors that allow the risk of diabetic neuropathy to occur. Another possible cause is because at the time the research was conducted in the field there were 23 respondents with the age of respondents <50 years.

### a. **BMI/Obesity**

The results of this study showed that there was no significant relationship between BMI and the incidence of diabetic neuropathy. This of course contradicts existing theories and research results. This difference can only occur if the patient is able to properly control the factors that allow the risk of diabetic neuropathy to occur. Another possible factor is that when the researchers conducted the survey in the field, the average weight of the respondents did not include being overweight/obese.

Obesity is one of the factors that influence the onset of DM. Fat deposits due to fat or obesity will cause insulin resistance to not work properly and blood sugar levels can rise. Obese people who suffer from DM are prone to complications [5]. So that one of the efforts to control diabetes mellitus is to control body weight [6].

### b. **Long duration of suffering from DM**

Based on the results of data analysis, it was found that there was a relationship between long duration of suffering from DM and the incidence of peripheral neuropathy in patients with type 2 DM. Type 2 DM. The average OR value is 0.25, which means that the longer the duration of DM, the risk of developing DPN increases by 25%. In one study stated that the long duration of suffering from DM is a significant risk factor for the development of diabetic neuropathy [4].

### c. **Hypertension**

Based on the results of the analysis of the relationship between hypertension and the incidence of peripheral neuropathy in patients with type 2 diabetes, it was found that in the majority of the case group there were 35 people (64.8%) with hypertension, while the majority of the control group did not have hypertension as many as 29 people (69.0%). The results of the chi square test obtained  $p$  value = 0.002 ( $p < 0.05$ ) which means there is a relationship between hypertension and the incidence of peripheral neuropathy in type 2 DM patients with OR = 0.24 meaning that the higher a person's blood pressure, the risk of diabetic neuropathy increases as much as 24%.

Hypertension is a common complication of diabetes mellitus which affects about 75% of people with diabetes mellitus and is a major risk factor for cardiovascular disease and macrovascular complications such as peripheral neuropathy.

### d. **Medication regularity**

Based on the results of the analysis of the relationship between medication adherence and the incidence of peripheral neuropathy in patients with type 2 DM, it was found that the majority of the case group did not comply with the regularity of treatment as many as 39 people (52.0%) while the majority of the control group did not comply with the regularity of treatment as many as 36 people. (48.0%). The results of the chi square test obtained  $p$  value = 0.621 ( $p > 0.05$ ), which means that there is no relationship between the regularity of treatment and the incidence of peripheral neuropathy in patients with type 2 diabetes.

The results of this study showed that there was no significant relationship between the regularity of treatment and the incidence of diabetic neuropathy. This of course contradicts existing theories and research results. This difference can only occur if the patient is able to properly control the factors that allow the risk of diabetic neuropathy to occur.

Regular treatment can result in more control of the patient's glucose levels. This controlled blood sugar level will result in the prevention of diabetes mellitus sufferers from experiencing complications, one of which is peripheral neuropathy. According to [7].

#### e. Lifestyle

Based on the results of the analysis of the relationship between lifestyle and the incidence of peripheral neuropathy in patients with type 2 diabetes, it was found that in the majority of the case group with a bad lifestyle as many as 45 people (91.8%) while most of the control group with a healthy lifestyle were 44 people (93 people), 6%. The results of the chi square test obtained p value = 0.000 ( $p < 0.05$ ) which means that there is a relationship between a bad lifestyle and the incidence of peripheral neuropathy in patients with type 2 diabetes mellitus with OR = 165. This study is in line with research conducted by [3] which shows there is a significant relationship between the pattern of physical activity on diabetic neuropathy with OR = 3.57 meaning that patients with low physical activity patterns are at risk of suffering from diabetic neuropathy 3.37 times than patients with adequate activity patterns.

The better the lifestyle of a person with diabetic neuropathy also has a further impact, namely the better the quality of his life. So that an increasingly healthy lifestyle in patients with diabetic neuropathy needs to be emphasized to the sufferer. This is in line with research [8] which states that the better the lifestyle, the better the quality of life.

## 5 Conclusion

The conclusion of this study is to produce information that long duration of suffering from DM, hypertension, and lifestyle are associated with the incidence of peripheral neuropathy in patients with type 2 DM.

## References

1. Perkeni. CONSENSUS MANAGEMENT AND PREVENTION OF TYPE 2 DIABETES MELLITUS IN INDONESIA 2015. 2015.
2. Bilous R, Donnelly R. Handbook of diabetes. Printing 1. Bumi Medika, editor. Jakarta: Bumi Medika; 2014.
3. Rahmawati A, Hargono A. Dominant Factor of Diabetic Neuropathy on Diabetes Mellitus Type 2 Patients. *J Berk Epidemiol*. 2018;6(1):60.
4. Nath Rai O, Mishra V, Chandra R, SKS, BD M. Study of Prevalence and Risk Factors of Peripheral Diabetic Neuropathy in a Tertiary Hospital. *J Evol Med Dent Sci*. 2016;5(13):557–9.
5. Tandra H. Everything you need to know about diabetes. EGC, editor. Surabaya: EGC; 2017.

6. Chong S, Ding D, Byun R, Comino E, Bauman A, Jalaludin B. Lifestyle changes after a diagnosis of type 2 diabetes. *Diabetes Spectr.* 2017;30(1):43–50.
7. Iqbal Z, Azmi S, Yadav R, Ferdousi M, Kumar M, Cuthbertson DJ, et al. Diabetic Peripheral Neuropathy: Epidemiology, Diagnosis, and Pharmacotherapy. *Clin Ther* [Internet]. 2018; 40(6): 828–49. Available from: <https://doi.org/10.1016/j.clinthera.2018.04.001>
8. Ritonga SH, Julianda DP, Antoni A. Patients with Diabetic Foot Problems. *J Priority Nursing.* 2021; 4(1): 1–8.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

