The Impact Factors of Peripheral Diabetic Neuropathy Which is Along with Hyperglycemia, Hypercholesterolemia, and Hyperaggregation

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Abstract

Objective: The prevalence of T2DM case in 2018 has increased by 10.9%. The majority of T2DM patients often ignore some of the most important conditions to experience complications, which is complications of PDN. This study aims to analyze the dominant factors in PDF patients with hyperglycemia, hypercholesterolemia, and hyperaggregation**. Material and methods:** This research is a case control study conducted from April to October 2020. The sample is 85 patients who have been confirmed to have PDN by neurologists aged 40 - 65. Sampling was conducted at several hospitals in Surabaya with a purposive sampling method. Data analysis was conducted in three stages, namely univariate analysis, bivariate analysis and multivariate analysis. **Results**: 85 PDN patients who experienced hyperglycemia amounted to 81%, hypercholesterolemia 81%, and hyperaggregation 67%. The dominant factor affecting the three conditions (hyperglycemia, hypercholeterol, and hyperagregation) in this PDN patient was a history of hypertension with a value of p = {(0.012); (0.007); (0.001)} and also a long period of suffering from T2DM with p value = {(0.019); (0.025); (0.041)). Meanwhile, age, gender and regularity for treatment control were not the dominant influencing factors. **Conclusion:** Suffered for a long time from T2DM and a history of hypertension are the main determinants of peripheral diabetic neuropathy which is along by hyperglycemia, hypercholesterolemia, and hyperaggregation.

Key words: *Determinant Factors, Peripheral Diabetic Neuropathy, Hypeglycecimia, Hypercholesterolemia, Hyperaggregation*

Introductions

One of the causes of death in the world is a metabolic disease characterized by an increase in blood glucose levels due to insulin secretion disorders, this disease is known as Diabetes Mellitus [1]. Known by the data [2], there are 43% of deaths caused by hyperglycemia at the age under 70 years. This is also in line with what happened in Indonesia, based on [3] diabetes mellitus patients experienced increase of 6.9% in 2013 to 10.9% in 2018. The majority of diabetes mellitus patients are not aware of the symptoms they suffer until these patients experience complications. Diabetes and its complications are rapidly becoming the most significant causes of morbidity and mortality in the world [4].

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One of the most common complications of DM that can worsen quality of life is peripheral neuropathy. Diabetic neuropathy is diffuse nerve damage due to excessive hyperglycemia. Complications of diabetic neuropathy experienced by people with diabetes mellitus reach 50% [5].

In neuropathic diabetics, there is an endoneural vascular dysfunction that is recognized by platelet activity with an increase in platelet aggregation [6]. Platelet aggregation is the attachment between platelets that can occur through the secretion of Adenosine Diphosphate and ordering of Thromboxane A2.The increase in thromboxane production is a trigger for platelet aggregation [7]. Apart from being affected by hyperglycemia, and platelet aggregation, patients with 2TDM along with hypercholesterolemic states had a higher rate of complications than patients with hypercholesterolemia or DM. This is due to the fact that DM has an addictive effect on the development of arterial stiffness in patients with hypercholesterolemia, so that it can cause peripheral nerve disorders [8].Various conditions that occur in PDN can be exacerbated if there are external environmental factors that influence it. Environmental factors come from a bad lifestyle, such as lack of physical activity, hypertension, and irregular medical control [9].

It is hoped that the introduction of various risk factors in the various circumstances that can be experienced by PDN patients will serve as a reminder for patients not to aggravate their suffering. The purpose of this study was to analyze the dominant factors in PDN patients with hyperglycemia, hypercholesterolemia, and hyperaggregation.

Material and Methods

This research is a study with a case control study design. The sample of this research is PDN patients who control treatment at the Internal Medicine and Neurology Polyclinic in several hospitals in Surabaya. The sample calculation refers to the Lemeshow formula, in order to get 85 respondents. The inclusion criteria in this study were patients who had been confirmed by a neurologist with PDN aged 40 - 65 years, and were cooperative in being willing to participate in this study. The exclusion criteria in this study were patients with chronic kidney disease, chronic liver disease, HIV / AIDS, and cancer and were on heparin therapy and taking drugs such as aspirin, anti-retroviral, anti-platelet, chemotherapy, allupurinol, and estrogen.The sample in this study was taken by purposive sampling where all subjects met the inclusion criteria to be included in the study until the required sample size was met. Subjects were selected based on study inclusion and exclusion criteria until the minimum sample size was met. The study sample was taken when the patient left the examination room. Data were collected from April to October 2020 at the Internal Medicine Department in several hospitals in Surabaya. The dependent variable in this study was hyperglycemia, hypercholesterolemia, and hyperaggregation in PDN patients. The independent variables in this study were gender, age, regularity of treatment, length of suffering from T2DM, and history of hypertension. Data were collected through direct interviews with respondents and conducting laboratory examinations with several parameters, namely examination of BSN, cholesterol, and platelet aggregation activity. Laboratory examinations were carried out at the Kedungdoro Laboratory in Surabaya. This data that has been obtained, data analysis is carried out in three stages, namely univariate analysis, bivariate analysis and multivariate analysis. Univariate analysis to describe variables in terms of frequency. Bivariate analysis to see the relationship between variables in the study using the chi square test. Multivariate analysis to determine the dominant factor using logistic regression test.

Results

Characteristics of respondents based on age groups are divided into 2 age groups, namely age <53 years and> 53 years. Characteristics of respondents based on age mostly are> 53 years old as many as 56 people (66%). Characteristics of respondents based on gender were mostly female as many as 62 people (73%). The characteristics of respondents based on the type of work were mostly housewives as many as 27 people (32%). Characteristics of respondents based on education level are mostly high school graduates as many as 47 people (55%).Characteristics of respondents based on the domicile area of the patient's subjects mostly came from central Surabaya as many as 37 people (44%). Characteristics of respondents based on the results of most of the BSN examination, with results> 126 mg / dL or 69 respondents (81%) experienced hyperglycemia.

The characteristics of the respondents based on the results of the total cholesterol examination were mostly those with results> 200 mg / dL or 69 respondents (81%) had hypercholesterolemia. Characteristics of respondents based on the results of the examination of the Platelet Aggregation Test (TAT) were mostly hypergarge as many as 57 people (67%) (Table 1).

Table 1: Response Characteristics of Patients with Peripheral Diabetic Neuropathy complications (NDP)

Characteristics	Total	
	N	%
Age		
≤ 53 years	29	34
> 53 years	56	66
Gender		
Man	23	27
Woman	62	73
Type of Work		
Private Employees	13	15
Entrepreneur	25	29
Retired	11	13
Housewife	27	32
Does Not Work	9	11
Education		
Elementary	0	0
Junior High School	17	20
Senior High School	47	55
University	21	25
Domicile		
Central of Surabaya	37	44
East of Surabaya	19	22
North Surabaya	16	19
West of Surabaya	8	9
South of Surabaya	5	6
Blood Sugar Levels During Fasting		
< 126 mg/dL	16	19
> 126 mg/dL	69	81
Total Cholesterol Levels		
< 200 mg/dL	16	19
> 200 mg/dL	69	81
Platelet Aggregation Test		
Normoagregasi	28	33
Hiperagregasi	57	67
Total	85	100%

The Relationship of Gender Factors on Hypeglycemia, Hypercholesterolemia, and Hyperaggregation Conditions in PDN Patients

Table 2. shows that the majority of PDN patients were hyperglycemic women as many as 55 (80%). The results of the chi square analysis obtained p = 0.01 (p> 0.05), which means that there is a significant relationship between gender and hyperglycemia in patients with peripheral diabetic neuropathy with OR = 5.051, the patients are women and in a hyperglycemic state have a risk of suffering from diabetic neuropathy 5.051 times than male sufferers.Table 3 shows that most of the PDN patients were women with hypercholesterolemia as many as 51 (74%). The results of the chi square analysis showed that p = 0.757 (p> 0.05), which means that there is no significant relationship between the gender of men and women to the hypercholesterol state of PDN sufferers. Table 4 shows that the majority of PDN sufferers were women who were in a hyperaggregated state as many as 41 people (72%). The results of chi square analysis obtained p = 0.968 (p> 0.05), which means that there is no significant association between the gender of male and female genitalia on the hyperaggregation state of PDN patients.

The Relationship of Age Factors to Hyperglycemia, Hypercholesterolemia, and Hyperaggregation Conditions in PDN Patients

Table 2. shows that the majority of PDN patients were> 53 years of age who were in a hyperglycemic state as many as 49 (71%). The results of chi square analysis obtained p = 0.757 (p> 0.05), which means there is no significant association between age> 53 years and ≤ 53 years of age on the hyperglycemic state of PDN patients.Table 3 shows that most of the PDN patients were aged> 53 years with hypercholesterolemia as many as 46 people (67%). The results of the chi square analysis showed that p = 0.981 (p> 0.05), which means that there is no significant association between age> 53 years and ≤ 53 years of age on the hypercholesterolemic state of PDN patients. Table 4 shows that most of the Peripheral Diabetic Neuropathy patients were aged> 53 years who were in a hyperaggregated state as many as 37 people (65%). The results of chi square analysis showed p = 0.979 (p> 0.05) which means there is no significant association between age> 53 years and ≤ 53 years of age on the hyperaggregation state of PDN patients.

The Relationship of Regular Control of Treatment to Hyperglycemia, Hypercholesterolemia, and Hyperaggregation Conditions in PDN Patients

Table 2 shows that the majority of PDN patients who were hyperglycemic did not control for regular treatment as many as 52 (75%). The results of the chi square analysis showed p = 0.002 (p> 0.05), which means that there is a significant relationship between not having regular treatment and the hyperglycemic state of PDN patients with OR = 6.729, meaning that patients who are not regularly control treatment and in a hyperglycemic state have a risk of suffering from PDN 6,729 times than patients who regularly seek treatment.

Table 3 shows that the majority of PDN patients who were hypercholesterolemic did not receive regular treatment as many as 51 people (74%). The results of the chi square analysis showed that p = 0.008 (p> 0.05), which means that there is a significant correlation between not having control over regular treatment and hypercholesterolemia in PDN patients with OR = 4.722, which means that patients who do not control regularly seek treatment and are in hypercholesterolemic conditions at risk of suffering from neuropathydiabetic 4,722 times than patients who regularly seek treatment. Table 4 shows that the majority of PDN sufferers who are in a hyperaggregated state are not controlled for regular treatment as many as 45 people (79%). The results of the chi square analysis showed that p = 0.008 (p> 0.05), which means that there is a significant relationship between not having regular treatment and the hypercholesterolemia of PDN patients with OR = 4.722, which means that patients who do not have regular control over treatment and in a hyperaggregated state have a risk of suffering from PDN 4.722. times than patients who regularly control treatment.

The Relationship of the Old Factors of Suffering from T2DM to the State of Hyperglycemia, Hypercholesterolemia, and Hyperaggregation in PDN Patients.

Table 2 shows that the majority of PDN patients suffer from T2DM for> 5 years who are in a hyperglycemic state as many as 60 people (87%). The results of the chi square analysis showed p = 0.003 (p> 0.05), which means that there is a significant relationship between the length of suffering from T2DM and the hyperglycemic state of PDN patients with OR = 6.667 meaning that patients with T2DM for> 5 years and in a hyperglycemia

state have a risk. Suffer from diabetic neuropathy 6.667 times than patients who had T2DM for ≤ 5 years. Table 3 shows that the majority of PDN patients suffer from T2DM for> 5 years who are in a hypercholesterol state as many as 60 people (87%). The results of the chi square analysis obtained p = 0.003 (p> 0.05), which means that there is a significant relationship between the length of suffering from T2DM and the hypecholesterol state of PDN patients with OR = 6,667 meaning that the patient has had diabetes mellitus 2 for> 5 years and is in a hypecholesterol state have a risk of suffering from diabetic neuropathy 6.667 times than patients who have had T2DM for ≤ 5 years. Table 4 shows that the majority of PDN patients suffer from T2DM for> 5 years who are in a hyperaggregated state as many as 51 people (90%). The results of the chi square analysis showed that p = 0.002 (p> 0.05), which means that there is a significant relationship between the length of suffering from T2DM and the hyperaggregation state of PDN patients with OR = 5,500 meaning that patients with T2DM for a long time of> 5 years and in a hyperaggregated state have a risk. suffer from PDN 5.5 times than patients who have had T2DM for ≤ 5 years for a long time.

The Relationship of Hypertension History to Hyperglycemia, Hypercholesterol, and Hyperaggregation Conditions in PDN Patients

Table 2 shows that the majority of PDN patients have a history of hypertension who are in a hyperglycemic state as many as 49 people (71%). The results of chi square analysis obtained p = 0.007 (p> 0.05), which means that there is a significant relationship between the history of hypertension and the hyperglycemia state of patients with peripheral diabetic neuropathy with OR = 5,390, meaning that patients with a history of hypertension and a hyperglycemic state have a risk of suffering from PDN 5, 39 times than patients without a history of hypertension. Table 3 shows that most of the PDN patients have a history of hypertension who are in a hypecholesterol state as many as 50 people (70%). The results of the chi square analysis showed p = 0.001 (p> 0.05), which means that there is a significant relationship between the history of hypertension and the hyperglycemia state of PDN patients with OR = 7.895, meaning that patients with a history of hypertension and in a hypercholesterolemic state have a risk of suffering from diabetic neuropathy 7.895 times than patients who do not have a history of hypertension. Table 4 shows that the majority of PDN patients have a history of hypertension who are in a hyperglycemic state as many as 49 people (71%). The results of the chi square analysis showed that p = 0.000 (p> 0.05), which means that there is a significant relationship between the history of hypertension and the hyperglycemic state of PDN patients with OR = 7,917 meaning that patients with a history of hypertension and in a hyperaggregated state have a risk of suffering from PDN 7,917 times than the patient. who do not have a history of hypertension.

Table 2. Cross tabulation the effect of gender, age, regularity of treatment, duration of diabetes, and history of hypertension on hyperglycemia in PDN patients (p <0.05)

Variable	Hyperglycemia State				Total		P	Score of OR (95% CI)
	Yes		No					
	N	%	N	%	N	%		
Gender								
Male	14	20	9	56	23	27	0,010	5,051 (1,601 < OR < 15,934)
Female	55	80	7	44	62	73		
Age								
≤ 53 years	20	29	9	56	29	34	0,075	3,150 (1,032 < OR < 9,618)
> 53 years	49	71	7	44	56	66		
Regular Treatment Control								
Irregular	52	75	5	31	57	67	0,002	6,729 (2,046 < OR < 22,132)
Regular	17	25	11	69	29	33		

Cont... **Table 2. Cross tabulation the effect of gender, age, regularity of treatment, duration of diabetes, and history of hypertension on hyperglycemia in PDN patients (p <0.05)**

Long Suffering From T2DM								
≤ 5 years	9	13	8	50	17	20	0,003	6,667 (1,999 < OR < 22,238)
> 5 years	60	87	8	50	68	80		
History of Hypertension								
Yes	49	71	5	31	54	64	0,007	5,390 (1,659 < OR < 17,508)
No	20	29	11	69	31	36		

Table 3. Cross tabulation of the effect of gender, age, regularity of treatment, duration of diabetes, and history of hypertension on hypercholesterolemia in patients with peripheral PDN (p <0.05).

Variable	Hypercholesterol State				Total		P	Nilai OR (95% CI)
	Yes		No					
	N	%	N	%	N	%		
Gender								
Male	18	26	5	31	23	27	0,757	1,288 (0,393 < OR < 4,216)
Female	51	74	11	69	66	73		
Age								
≤ 53 years	23	33	6	37	29	34	0,981	1,200 (0,388 < OR < 3,712)
> 53 years	46	67	10	63	56	66		
Regular Treatment Control								
Irregular	51	74	6	37	57	67	0,008	4,722 (1,501 < OR 14,853)
Regular	18	26	10	63	28	33		
Long Suffering From T2DM								
≤ 5 years	9	13	8	50	17	20	0,003	6,6670 (1,999 < OR < 22,238)
> 5 years	60	87	8	50	68	80		
History of Hypertension								
Yes	50	72	4	25	54	64	0,001	7,895 (2,265 < OR < 27,522)
No	19	28	12	75	31	36		

Table 4. Cross tabulation the effect of gender, age, regularity of treatment, duration of diabetes, and history of hypertension on platelet aggregation activity in patients with complications of peripheral diabetic neuropathy complications (p <0.05).

Variable	Hyperaggregation State				Total		P	Nilai OR (95% CI)
	Yes		No					
	N	%	N	%	N	%		
Gender								
Male	16	28	7	25	23	27	0,968	0,854 0,304 < OR < 2,398
Female	41	72	21	75	62	73		
Age								
≤ 53 years	20	35	9	32	29	34	0,979	0,976 0,335 < OR <,293
> 53 years	37	65	19	68	56	66		
Regular Treatment Control								
Irregular	45	79	12	43	57	67	0,008	4,722 (1,501 < OR 14,853)
Regular	12	21	16	57	28	33		
Long Suffering From T2DM								
≤ 5 years	6	10	11	39	17	20	0,002	5,500 1,766 < OR 17,131
> 5 years	51	90	17	61	68	80		
History of Hypertension								
Yes	45	79	9	32	54	64	0,000	7,917 2,863 < OR < 21,891
No	12	21	19	68	31	36		

Dominant Variables that Affect the Incidence of Diabetic Neuropathy

The results of the logistic regression analysis showed that there was a significant influence between history of hypertension ((0.012 <0.05); (0.007 <0.05); (0.001 <0.05)} and a long period of suffering from T2DM {(0.019 <0.05); (0.025 <0.05); (0.041 <0.05)) against hyperglycemia, hypercholestetol, and hyperaggregation of patients with peripheral diabetic neuropathy. The dominant factor affecting the three conditions (hyperglycemia, hypercholeterol, and hyperagregation) in patients with complications of peripheral diabetic neuropathy is a history of hypertension, because the probability is lowest, 0.012; 0.007; 0.001 with OR = 6.880; 5,913; 6,437 means that patients with a history of hypertension are at risk of suffering from peripheral diabetic neuropathy which is in a hyperglycemic state

6,880 times, a hypercholesterol state 5,913 times, and a hyperaggregated state 6,437 times greater than patients without a history of hypertension (Table 5).

Table 5. Logistic Regression table of determinants in some of the main conditions often experienced by patients with complications of peripheral diabetic neropathy.

Main Parameters	Variable	P	OR	95% CI
Hyperglycemia State	Historyof Hypertension	0,012	6,880	1,515 – 31,234
	Long Suffering From T2DM	0,019	5,664	1,327 – 24,182
Hypercholesterol State	History of Hypertension	0,007	5,913	1,611 – 21,706
	Long Suffering From T2DM	0,025	4,420	1,207 – 16,185
Hyperaggregation State	History of Hypertension	0,001	6,437	2,249 – 18,430
	Long Suffering From T2DM	0,041	3,684	1,054 – 12,880

Discussion

The state of hyperglycemia in PDN patients was found in this study with a percentage of 81%. The hyperglycemic state in T2DM causes glucose levels to increase 4-fold in peripheral nerves [10], creating an oxidative environment and high carbon dioxide accumulation, which result in an inflammatory process that causes oxidative stress and neuronal cell injury [11]. This phenomenon is referred as glucose neurotoxicity with clinical manifestations in the form of peripheral diabetic neuropathy [10].

The subjects with PDN in this study who experienced hypercholesterolemia were also high with a percentage of 81%. This isaccordance with the study [12], where patients with T2DM and hypercholesterolemia had a higher rate of complications than patients with hypercholesterolemia or diabetes alone. This is because DM has an additive effect on the development of arterial stiffness in patients with hypercholesterolemia, so that it can cause peripheral nerve disorders [8]. The lipid profile potential to activity in platelet by apolipoprotein E and its interaction with platelet low density lipoprotein receptors [13]. In patients with DM, administration of dissolved high density lipoprotein has been shown to suppress aggregation by increasing the removal of cholesterol from the platelet membrane [14]. A further contribution to platelet hyperactivity, however,mediated by lipid and glucose interactions with low density lipoprotein formation, leading to impaired nitric oxide production and increased intraplatelet calcium concentration [15]. It is well known that hyperglycemia, hypercholesterolemia, and hyperaggregation can cause peripheral endothelial dysfunction which is commonly known as PDN [16].

Diabetes mellitus improves health with an increased risk of vascular disease. T2DM shows increased reactivity and activation of the platelet base,result in increased events such as thrombosis then platelet activation that initiates the coagulation cascade and thrombus ordering [17]. Platelets in patients with T2DM exhibit an irregular signaling pathway with platelet hyperactivation and by chronic and acute hyperglycemia via elevated levels of protein kinase C [18]. Increased hyperglycemia-induced interactions will make the surface membrane of platelets in patients with DM decrease membrane fluidity and increase platelet sensitivity to agonists [19]. Platelet surface agonist receptors (P2Y12) and targets of the antiplatelet agent thienopyridine have also been shown to increase in platelets in patients with DM due to changes in membrane fluidity dynamics, thus complicating DM patients with peripheral diabetic neuropathy [20]. In this study, 67% of PDN patients experienced hypergaregation. This is consistent with a study [20] where patients with DM PDN

complications have been shown to have a higher P2Y12 signaling rate compared to non-diabetic complications [16].

The majority of subjects with diabetic neuropathy complications were > 53 years old with a percentage of 66%. Accordance with the results of this study in line with research [21], namely the highest incidence of diabetic neuropathy at the age of 45-65 years. The number of neuropathy patients in the age range 45-65 years is due to tissue damage caused by free radicals, such as increased levels of lipid peroxide and changes in enzyme activity [1]. Diabetes mellitus is a degenerative disease, a disease that appears slowly as the patient's age increases over the years so that the patient experiences complications of diabetic neuropathy [22]. Age is not a major determinant of complications of peripheral diabetic neuropathy because age is only related to patients with hyperglycemia, but hypercholesterolemia and hyperaggregation are not related.

There are more NDP patients than men with a percentage of 73%. The results of this study are in line with research [21] which states that women more than men patients from diabetic neuropathy. The reason women dominate suffering from NDP is that women are housewives. Housewives who tend to have low activity so that they are at risk of developing diabetes mellitus [23]. Hormonal differences in men and women affect the onset of neuropathy. High estrogen levels in women can interfere with the absorption of iodine, which plays a role in the formation of myelin nerves, while testosterone levels in men protect the body from T2DM, but not in women [24]. Gender is not the main determinant factor for complications of peripheral diabetic neuropathy because gender is only related to patients with hyperglycemia, but for hypercholesterolemia and hyperaggregation, there is no association.

This study shows that there is a relationship between regular control over treatment and diabetic neuropathy. The results are in line with research [25] showing that there is a relationship between routine treatment controls and diabetic neuropathy. Especially blood sugar, is important to prevent complications, like diabetic neuropathy. Control can be seen from instantaneous blood glucose and long-term blood glucose.

This study shows that there is a link between the length of suffering from T2DM and diabetic neuropathy. The results showed that the complications of diabetic neuropathy experienced by patients occurred in a relatively longer period of time after being diagnosed with diabetes mellitus, so that there is a relationship or influence between the duration of suffering from type 2 diabetes mellitus, patients after > 5 years experiencing T2DM will gradually experience complications, one of which is peripheral neuropathy [26]. A patient with peripheral diabetic neuropathy who has suffered from T2DM for > 5 years will be at risk 3.5 - 5.5 times than those who suffer <5 years, especially triggered by a state of hyperglycemia, hypercholesterolemia, and hyperagregation. This is consistent with research [27], diabetic neuropathy generally occurs after 5 years of exposure to T2DM which is then triggered by low glycemic control and dyslipidemia, which will increase the occurrence of diabetic neuropathy. The longer experiencing T2DM, the higher the incidence of complications experienced. The duration of T2DM with high blood sugar levels will affect changes in blood vessel walls [28]. Chronic high blood sugar levels lead to decreased insulin secretion. The glucose will turn into sorbitol which causes nerve cell damage. The longer a person has diabetes, this process will last longer and aggravate the damage to nerve cells [29]. The duration of suffering from T2DM is one of the main determinants of complications of peripheral diabetic neuropathy with p value ((0.019 <0.05); (0.025 <0.05); (0.041 <0.05)), so that the duration of suffering from T2DM associate with patients has hyperglycemia, hypercholesterolemia, and hyperaggregation.

This study explains that there is a link between a history of hypertension and diabetic neuropathy. The results of this study are in line with research [30] which states that there is a relationship between hypertension and the incidence of complications of T2DM. Hypertension can cause thickening of the arteries so that the diameter of the blood vessels is narrowed. Narrowing of blood vessels will affect the transport of metabolism in the blood, so that glucose levels in the blood will be disturbed. When blood glucose levels are disturbed (hyperglycemia) and accompanied by elevated cholesterol levels (hypercholesterolemia) are risk factors for the development of systemic arterial hypertension [31]. The incidence of metabolic syndrome is 2/3 higher

in patients with hypertension so that hypertension is also a contributing factor for complications of diabetic neuropathy [32]. Hypertension history was one of the main determinants of complications of peripheral diabetic neuropathy with p value ((0.012 <0.05); (0.007 <0.05); (0.001 <0.05)), so that the history of hypertension is associated with hyperglycemia, hypercholesterolemia, and hyperaggregation.

Conclusion

The determinant factors in patients with peripheral diabetic neuropathy who are along by hyperglycemia, hypercholesterolemia, and hyperaggregation are long suffering from T2DM and had hypertension. The dominant factor that has the most influence is a history of hypertension, so PDN patients who are along by hyperglycemia, hypercholesterolemia, and hyperaggregation are expected to be able to control by knowing the factors that influence it, especially in maintaining a psychological state or food that can trigger an increase in blood pressure so that later it doesn't get worse.

Abbreviations: DM (Diabetes Mellitus); PDN (Peripheral Diabetic Neuropathy); T2DM (Type 2 Diabetes Mellitus); BSN (Blood Sugar Nechtar)

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