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Use of Neuropathy System Score (NSS) in Measuring Peripheral Neuropathy in Diabetes Mellitus

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ABSTRACT

Keywords:
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Peripheral neuropathy is one of the microvascular complications of Diabetes Mellitus (DM) that occurs in the periphery and causes damage to nerve function. Damage to nerve function can affect sensory, motor and autonomic nerves. The purpose of this study was to determine peripheral neuropathy in patients with diabetes mellitus. This study uses descriptive research with a population of 62 respondents with sampling by the inclusion criteria. The instrument uses a peripheral neuropathy examination sheet from the NSS (Neuropathy system score) consisting of 10 questions. The data analysis used in this study is univariate analysis. More than half of diabetics are in the early elderly (55%), female (66%), have diabetes >5 years (69%), and have GDS levels 200 mg/dL (74%). A small proportion of people with diabetes have a history of comorbidities and a history of DFU (Diabetic Foot Ulcer) (24%, 8%). More people with diabetes had mild neuropathy (52%) than people with moderate or severe neuropathy (34%; 8%). The results of this study showed that more than half of the respondents had mild peripheral neuropathy. The results of this study showed that more than half of the respondents had mild peripheral neuropathy. Therefore, an early examination is needed to prevent more severe neuropathy. It takes promotive and preventive efforts from primary health services to people with diabetes.

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I. INTRODUCTION

Diabetes mellitus (DM) is a common public health problem where there is a continuous increase in both the world, developed countries, and developing countries. Diabetes mellitus is a group of metabolic diseases characterized by high blood sugar levels (hyperglycemia) caused by abnormal insulin secretion, insulin function, or both. The state of persistent hyperglycemia is associated with long-term damage or malfunctioning of body organs such as the eyes, heart, kidneys, blood vessels, and nerves [1]. Diabetic neuropathy is the most common chronic complication of DM, both in type 1 and type 2 diabetes. Of all the complications of DM, neuropathy causes the greatest morbidity and reduces the quality of life of patients if not managed properly. Diabetic neuropathy can develop asymptotically and go undetected, it can also show symptoms and signs that run slowly and even serious complications occur [2]. Diabetic neuropathy (ND) is one of the long-term complications of DM and more than 50% of DM patients experience this condition [3].

According [4], diabetes increased 4-fold from 108 million in 1980 to about 422 million adults with diabetes in 2014. This is supported [5] the number of adults who have diabetes as many as 424.9 million people who are thought to have increased by 628.6 million people in 2045. According [6], Indonesia has experienced an increase in the number of people with diabetes from 7.6 million people in 2013 to 9.1 million people in 2015 and is ranked as the 5th most diseased in the world which ranks fifth The 4 most diseases in Indonesia and East Java

Province rank 6 have the highest prevalence of suffering from diabetes mellitus from 33 provinces throughout Indonesia. Based on (21) a from the Ministry of Health of East Java Province (2014) there are 605,974 people suffering from Diabetes mellitus. And from the results of data from the Jombang district health office, diabetes mellitus itself is in the position of the 10 most cases of the disease with a total of 6,917.

Complications of DM occur due to blood glucose concentrations that are not well controlled, can be divided into macrovascular and microvascular complications. Neuropathy is the most common chronic complication of DM [7]. Peripheral neuropathy is a microvascular disease that affects the small arteries that supply blood to the periphery [8]. The prevalence of diabetic peripheral neuropathy in African countries is 46% with the highest prevalence in West Africa and the lowest in Central Africa . A higher prevalence of peripheral neuropathy can be found in Southeast Asian countries, namely Malaysia (54.3%), the Philippines (58.0%), and Indonesia (58.0%) [9].

Symptoms of peripheral neuropathy also vary from no complaints to very severe pain [10]. Symptoms depend on the size and function of the damaged nerve fibers. Nerve damage can occur in the sensory, motor, and autonomic nervous systems [11]. Autonomic nerve damage causes changes in skin texture and turgor that cause the skin to become dry, cracked, and calloused. Symptoms due to motor nerve damage include muscle weakness, atrophy, and eventually deformity. Symptoms of sensory nerve damage are divided into two, namely severe pain and painless. Numbness is the most common symptom and usually appears earlier [12].

Dry and cracked skin coupled with deformity conditions that put pressure on the feet, especially when wearing shoes that don't fit, can cause ulcers on the feet of DM patients. Because of the decreased perception of pain in sensory neuropathy, DM patients may develop ulcers without realizing it [13]. Foot ulcers in diabetic patients who have neuropathy are at high risk of infection and developing diabetic gangrene. This situation can lead to amputation which will increase the cost of treatment and the mortality rate in DM patients [14].

Although some patients with peripheral neuropathy experience a decrease in pain sensation, around 15-25% of DM patients experience neuropathic pain [15]. Pain that is felt in the form of burning and vibrating feet on its own (Indonesian Endocrinology Association (PERKENI, 2015), so it is often disturbing and can limit physical activity, reduce the quality of life, and work productivity [16]. Stated that there is a relationship between peripheral neuropathy and quality of life in DM patients. The majority of DM patients with neuropathy experience burning in the feet and legs, tingling, weakness, and instability when standing or walking, which adversely affects the patient's quality of life and can lead to depression [17].

Diabetic experts in 1988 tried to compile and establish a diagnostic tool for diabetic neuropathy known as the San Antonio consensus, where at that time several scoring systems had been introduced including, Neuropathy Symptom Score (NSS), Diabetic Neuropathy Symptom (DNS), Diabetic Neuropathy Examination (DNE), Michigan Score, Neuropathy Deficit Score (DNS) and so on. He concluded that the NSS score is a tool that includes the symptoms and signs of DM neuropathy that has been validated, is fast and easy to do in clinical practice and has a high predictive value for screening DM neuropathy [18].

Examination to see the presence of peripheral neuropathy has never been done in primary health services. This phenomenon is also not found in the elderly Integrated Healthcare Center, where nurses have never carried out foot examinations from simple (examination of the callus and foot shape) to foot examinations that require special tools and skills. Nurses need to pay special attention to people with diabetes to prevent the worsening of neuropathy. These prevention efforts are urgently needed to prevent the development of neuropathy which will have an even worse impact on amputation and death. Prevention of the worsening of neuropathy can be done by doing early prevention. One form of early prevention efforts is by examining peripheral neuropathy. Examination of peripheral neuropathy is important considering that there are still many people with diabetes who ignore the symptoms of neuropathy. Based on this phenomenon, the researchers are interested in researching the use of the Neuropathy System Score (NSS) in the Measurement of Peripheral Neuropathy in Diabetes Mellitus.

II. METHOD

This research uses descriptive research. With the population obtained a sample of 62 respondents with sampling by the inclusion criteria 1) patients with glucose metabolism disorders, 2) do not have DFU. The selected sample was then assessed for the NSS score (Neuropathy system score) consisting of 10 standard questions. The data analysis used in this study is univariate analysis.

III. RESULTS AND DISCUSSION

1. Results

Table 1. Frequency Distribution of Diabetic Demographic Characteristics

Respondents Category	Frequency	Percentages (%)
Ages		
Early adulthood	1	2
Late adulthood	12	19
Early elderly	34	55
Late elderly	15	24
Genders		
Male	21	34
Female	41	66
Long Suffering from DM		
> 5 years	19	31
≥ 5 years	43	69
Blood Sugar Check Results		
< 200 mg/dL	46	74
≥ 200 mg/dL	16	26
Patient's Disease History		
Comorbidities	15	24
None	47	76
DFU History		
Ulcer history	5	8
None	57	92
Total	62	100

Based on the table above, more than half of the respondents are in the early elderly (55%), and less than half of them are female (66%). More than half of the respondents had diabetes >5 years (69%) and had GDS levels 200 mg/dL (74%). A small proportion of people with diabetes have a history of comorbidities (24%) and history of DFU (Diabetic Foot Ulcer) (8%).

Table 2. Frequency distribution of neuropathy assessment with NSS

Category	Frequency	Percentages (%)
Mild neuropathy	36	58
Moderate neuropathy	21	34
Severe Neuropathy	5	8

Based on table 2. More than half of respondents have mild neuropathy (58%) and a small proportion of respondents have severe neuropathy (8%).

2. Discussion

The results of this study indicate that the majority of the incidence of peripheral neuropathy is found in respondents aged early (46-55 years). Increasing age will stimulate the degeneration process and cause nerve cell damage, both large nerves and small nerve fibers, and cause neuropathy [19]. The number of people with diabetes who experience mild and moderate neuropathy in the age range of 45-55 years is caused by changes in the walls of blood vessels where there is a thickening of the intima layer. These changes cause the stiffness of blood vessels so that oxygen and nutrients transport to the tissues decreases resulting in ischemia and in a long time will occur neuropathy [20].

Meanwhile, a small proportion of severe neuropathy was found in people with diabetes in the late elderly (56-65 years). The occurrence of neuropathy in the elderly is associated with the accumulation of free radical damage such as increased levels of lipid peroxide and changes in enzyme activity resulting in tissue damage in the elderly. The majority of respondents in this study were women. This is in line with the results of research conducted by [21], where there are more female respondents than male respondents. This is following the theory which states that neuropathy in female respondents is associated with the presence of the hormone estrogen. Hormonally, estrogen will cause women to have more neuropathy due to impaired absorption of iodine in the intestine so that the process of forming nerve myelin fibers does not occur.

The incidence of mild peripheral neuropathy is mostly found in respondents who suffer from DM in a span of > 5 years. This is following research conducted by [22], which said that neuropathy was most common in respondents who suffered from DM in the range of 1-5 years. While the incidence of moderate neuropathy and severe neuropathy is more often found in respondents who have suffered from DM > 5 years. Found that the incidence of neuropathy can be found in DM patients with an average length of suffering from DM for 8 years [23].

The theory put forward by [24], says that the severity of neuropathy can increase in line with the duration of suffering from DM. This can occur because a prolonged state of hyperglycemia can increase oxidative stress and stimulate other pathways that cause nerve and vascular endothelial damage. Several existing studies can conclude that the longer you suffer from DM, the greater the severity of neuropathy that can be experienced [25].

The incidence of mild neuropathy was more common in respondents who had GDS in the range <200 mg/dL. while the incidence of moderate and severe neuropathy is more common in people with diabetes who have a GDS above 200 mg/dL. The results of research conducted by [26], said the same thing that the higher the GDS level, the risk for neuropathy was 4,497 times greater. Which states that in a state of hyperglycemia with a GDS above 200 mg/dL, the respondent is at risk of experiencing greater fiber damage, especially the nerves in the distal part [27].

Peripheral neuropathy can also occur because of a history of comorbidities. The majority of respondents in this study had a history of comorbidities such as hypertension. Based on research conducted by [28], shows that a history of hypertension will result in 4 times the occurrence of diabetic neuropathy. Hypertension in people with diabetes causes high blood viscosity, which reduces blood flow, resulting in vascular deficiency and lesions in endothelial blood vessels. Endothelial damage will affect tissue death.

In addition, some respondents can be found a history of stroke. In a state of hyperglycemia, the formation of reactive oxygen species (ROS) can occur which will inhibit the formation of nitric oxide. Decreased nitric oxide formation will affect the permeability between endothelial cells, including the endothelium lining blood vessels. As a result, blood vessels can be penetrated by low-density lipoprotein (LDL) known as bad cholesterol. LDL easily sticks to blood vessels and triggers atherosclerosis which if it occurs in the carotid arteries will cause a stroke [29].

Some respondents also have a history of other diseases such as CHD (coronary heart disease). The condition of a person with a history of DM can significantly increase the risk of CHD. This can occur through several mechanisms including increased oxidative stress,

activation of protein kinases that cause inflammation and thrombosis in blood vessels so that it can cause blood to accumulate and become blockages in the heart blood vessels and eventually myocardial infarction [30].

The incidence of peripheral neuropathy experienced by people with diabetes can lead to DFU. The results showed that some respondents had experienced DFU. This [22] supported by research conducted by [31], which found 85.7% of respondents experienced a high risk of DFU and 2.7% had an active foot disease. Several respondents said that before experiencing DFU, respondents complained of numbness and feeling thick. These complaints can occur because people with diabetes have impaired sensory and autonomic nerve function so that the respondent cannot feel anything or sensation in his feet. This is following the theory that people with diabetes often experience loss of sensitivity in the feet and will eventually increase the process of injury [32].

IV. CONCLUSION

The results of this study showed that more than half of the respondents had mild peripheral neuropathy. Therefore, an early examination is needed to prevent more severe neuropathy. It takes promotive and preventive efforts from primary health services to people with diabetes.

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