LEVEL OF PERIPHERAL NEUROPATHY IN TYPE 2 DIABETES MELLITUS PATIENTS IN JEMBER DISTRICT

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ABSTRACT

Diabetic neuropathy is a heterogeneous entity, consisting of peripheral sensorimotor and autonomic nerve dysfunction conditions. Diabetic peripheral neuropathy has a broad impact on patients, including recurrent infections, ulcers that do not heal and amputations of fingers and toes. This study aims to be able to overcome these risks, screening for neuropathy can be carried out including autonomic, sensory, and motor examinations.The research method uses a cross-sectional exploratory quantitative descriptive. The sample is 100 people using probability sampling method, namely multistage random sampling. The research locations are in 5 working areas of the Jember District Health Center (Bangsalsari, Umbulsari, Kalisat, Arjasa, and Patrang). Inclusion criteria for Type 2 Diabetes Mellitus (T2DM) patients aged 18 - 65 years, diagnosed with T2DM, did not have diabetic ulcers, did not have amputation of both legs, and suffered > 1 year. The exclusion criteria were no hospitalization and no communication disorders. The research instrument used the Michigan Diabetic Neuropathy Score (MDNS), Michigan Neuropthy Screening Instrument (MNSI), screening with the Ipswich Touch Test (IpTT), screening with the Monofilament Test.T2DM respondents experienced multiple autonomic damage to the right leg (52%; 53%). Sensory damage in T2DM patients on the right and left legs showed normal results (63%). Motor damage is dominated by normal conditions on the right and left legs as much as (49%; 52%) and there is a decrease in muscle strength on the right and left (50%; 47%).Based on the results, there is still a moderate risk of T2DM patients experiencing peripheral neuropathy. The provision of nursing care in screening early conditions is an action to reduce risk and improve the patient's quality of life.

Keywords: Type 2 Diabetes Mellitus; Peripheral Neuropathy

Preliminary

Diabetes Mellitus (D.M.) is a chronic disease in the form of metabolic disorders characterized by blood sugar levels that exceed normal limits (Kemenkes RI, 2020). Based on data International Diabetes Federation (IDF), in 2019, there were 382 million people in the world suffering from diabetes, one of the main causes of neuropathy. Diabetic neuropathy is a heterogeneous entity consisting of peripheral sensorimotor and autonomic nerve dysfunction conditions. Although diabetic neuropathy may be asymptomatic, D.M. patients are accompanied by pain [3].

Diabetes Mellitus (D.M.) in Indonesia in 2021 is ranked 5th with 19.5 million sufferers, which is predicted to increase to 28.6 million in 2045[3]. East Java is a region in Indonesia with a high prevalence of D.M., as much as 2.6% (Kementrian Kesehatan Republik, indonesia, 2020)[4]. The Jember District Health Office (Dinkes) in 2020 stated that the incidence of Type 2 Diabetes Mellitus as 35,951 cases.

Complications of Type 2 Diabetes Mellitus (T2DM) that often occur are caused by peripheral neuropathy caused by microangopathic disorders [4]. The prevalence of Diabetic peripheral neuropathy (DPN) ranges from 30-50%. Diabetic peripheral neuropathy has a broad impact on patients, including recurrent infections, ulcers that do not heal, and amputations of fingers and toes. The most common complication of NPD is the occurrence of diabetic foot ulcers (DFU), which is twice that of patients without diabetes [6].

The mechanism of painful DPN suggests that aberrant neurons in the ventral posterolateral thalamus of diabetic patients can become hyper-excitable and amplify pain sensation. This central process may be related to increased or abnormal thalamic perfusion supraspinal modulation of sensory processing arise potentially as a result of prolonged damage hyperglycemia, resulting in allodynia and hyperalgesia [7]. Diabetic peripheral neuropathy (DPN) is diagnosed when a diabetic patient complains of symptoms with signs of peripheral nerve dysfunction. Damage that occurs in the peripheral nerves will cause changes in autonomic, motor, and sensory functions [8]. Diabetic peripheral neuropathy (DPN) in the feet occurs due to complications of diabetes in the microvascular, which ultimately results in damage to the nerves in the feet [6].

Research method

The research design used exploratory quantitative descriptive with a cross-sectional method. The sample amounted to 100 people and was selected using the probability sampling method, namely multistage random sampling. The research location is in 5 working areas of the Public Health Center in Jember Regency, including the Bangsalsari, Umbulsari, Kalisat, Arjasa, and Patrang Health Centers. Inclusion criteria were T2DM patients aged 18 - 65 years, diagnosed with T2DM, did not have diabetic ulcers, did not have amputation in both legs, and suffered for more than one year. The exclusion criteria in this study were that people with diabetes were not hospitalized and had no difficulty communicating. This study uses the univariate method in the form of a frequency distribution table.

The data collection instruments in this study used the Michigan Diabetic Neuropathy Score (MDNS), Michigan Neuropathy Screening Instrument (MNSI), screening with the Ipswich Touch Test (ITT), screening with the Monofilament Test [9]. The data collection tool was in the form of a checklist that was adjusted with diabetic foot screening, an aneroid phygmomanometer, and a stethoscope.

Result

The data collection process was carried out in September 2022. This study describes the demographic characteristics of the respondents, including age, gender, long-suffering from DM, smoker, GDS check results, history of comorbidities, and history of DFU. This study also describes the features of autonomic damage, sensory impairment, motor impairment, and risk classification of diabetic foot ulcers. Data analysis used univariate analysis presented in the form of a frequency distribution.

Table 1. Demographic Characteristics of Type 2 Diabetes Mellitus Patients

Respondent Category	Frequency	Percentage (%)
Age		
Early adulthood (26-35 years)	5	5
Late adult (36-45 years)	14	14
Early seniors (46-55 years)	30	30
Late seniors (56-65 years)	51	51
Gender		
Man	21	21
Woman	79	79
Long Suffering D.M.		
1-5 years	78	78
>5 years	22	22
Check Result GDS		
90-199 mg/dL	34	34
≥200 mg/dL	66	66
Smoking History		
Yes	9	9
Not	91	91
History of comorbidities		
Yes	52	52
Not	48	48
Types of Comorbidities		
There isn't any	48	48
Hypertension	26	26
Stroke	2	2
Coronary heart disease	6	6
Glaucoma	14	14
Etc	4	4
DFU history		
Yes	22	22
Not	78	78
Pathological Nail Conditions		
There aren't any	41	41
Fungi	45	45
Beaus line	6	6
Terry's Nails	8	8
Total	**100**	**100**

The results (Table 1) show that 51% of patients with type 2 diabetes are in the late elderly category (56-65 years). The majority were female 79 (79%) with more than 5 years of suffering 22 (22%), and the results of GDS examination 200 mg/dL as many as 66 people (66%). A total of 22 people (22%) had a foot ulcer. The majority of patients with type 2 DM also experienced pathological nail conditions in the form of fungi as many as 45 people (45%). The most common type of comorbidities was having a history of hypertension by 26%.

Table 2. Results of Autonomic Damage Assessment for T2DM Patients

Rating result	n	%
Right foot		
Normal	12	12
Single autonomic damage	36	36
Multiple autonomic damages	52	52
Left foot		
Normal	11	11
Single autonomic damage	36	36
Multiple autonomic damages	53	53
Total	**100**	**100**

Based on table 2 above shows that the majority of T2DM. patients experienced multiple autonomic damages to the left leg, as many as 52 people (52%). While on the left leg, as many as 53 people (53%).

Table 3. Sensory Damage Assessment Results for T2DM Patients

Rating result	n	%
Right Foot		
Normal	63	63
Decreased sensation	37	37
No sensation	0	0
Left Foot		
Normal	63	63
Decreased sensation	36	36
No sensation	1	1
Total	**100**	**100**

Based on table 3 above, it can be seen that the majority of people with DMT2 on the right and left legs showed the expected results, namely 63 people (63%), in Decreased sensation as many as 36 people (36%) and on the left foot there was a sign of no sensation as much as 1 person (1%).

Table 4 Frequency Distribution of Motor Damage Assessment Results (n=102)

Rating result	n	%
Right foot		
Normal	49	49
Decreased muscle	50	50
strength	1	1
No muscle strength		
Left foot		
Normal	52	52
Decreased muscle	47	47
strength	1	1
No muscle strength		
Total	**100**	**100**

Based on table 4 above shows that the results of the assessment of motor damage are dominated by normal conditions on the right and left legs, much as (49%; 52%), and there is a decrease in muscle strength on the right in as many as 50 people with diabetes (50%) and 47 people with diabetes on the left leg (47%).

Table 5. Frequency distribution of peripheral neuropathy levels (n=100)

Rating result	n	%
No neuropathy	9	9
neuropathy Moderate	67	67
neuropathy Severe	20	20
neuropathy	4	4
Total	**100**	**100**

Based on table 5 above shows that all people with diabetes who were respondents experienced mild peripheral neuropathy, namely 67 people with diabetes (67%). The category of severe neuropathy has the least score, namely four people with diabetes (4%).

DISCUSSION

The results of the research showed that the majority of respondents had mild peripheral neuropathy, namely 67 people with diabetes (67%), moderate category 20 people with diabetes (20%), severe category four people with diabetes (4%)and 9 people with no diabetes. have neuropathy. The results of this study are in line with previous research by Wahyuni (2021), which showed that the majority of respondents (61.6%) had mild neuropathy.

1. Characteristics of Respondents

Characteristics of respondents include age, gender, duration of diabetes mellitus, GDS, smoking history, history of comorbidities, history of DFU, and pathological nail conditions. The analysis showed that most of the incidence of peripheral neuropathy occurred in the late elderly category respondents (51%). This finding is in line with the results of research that the average age of T2DM respondents who experience peripheral neuropathy is 45-63 years old [10]. This condition is marked by a decrease in physical, psychological, and intellectual conditions

when they are more than 30 years old [8].

The results of the analysis showed that most of the respondents were female compared to men who had peripheral neuropathy. These results are in line with previous studies that women have significantly more peripheral neuropathy than men [11]. According to Francon (2012) in, Wahyuni (2021) states that differences in hormones, namely the hormone estrogen, cause women to be at greater risk of developing peripheral neuropathy.

The results of the analysis show that most of the respondents have suffered from T2DM for 1-5 years. These results align with research on the average patient suffering from D.M., which is 4.6 years at that time, according to that experienced by T2DM patients that peripheral neuropathy occurs 3-5 years after being diagnosed with DM[10].

The results of the analysis showed that most of the incidence of peripheral neuropathy occurred in respondents with GDS levels at 200 mg/dL. The results of this study are in line with research by Wahyuni (2021). was found in T2DM patients with GDS levels of 200-300 mg/dL. D.M. patients with GDS 200 mg/Dl have a higher risk of experiencing complications, one of which is peripheral neuropathy; this is due to a slowdown in the development of neuropathy, resulting in a lot of nerve loss [13].

The results of the analysis showed that most of the incidences of peripheral neuropathy occurred in respondents who did not have a history of smoking. This is because the majority of patients with T2DM were women, while smoking history was only (9%). Other independent risk factors for the development of diabetic neuropathy include smoking and alcohol abuse (Callaghan et al., 2015: Rachmantoko et al., 2021). In previous studies, it was found that men are more likely to experience peripheral neuropathy when influenced by smoking habits [11].

The most common history of comorbidities was found with a history of hypertension. This is in line with previous studies where hypertension is a comorbid history in D.M. patients with peripheral neuropathy [8]. The relationship between T2DM and hypertension is explained by the emergence of conditions of microvascular damage, insulin resistance/hyperinsulinemia, metabolic disorders, and increased sympathetic nerve activity. The presence of a history of hypertension can lead to the severity of neuropathic pain in T2DM patients [15].

In the history of DFU, it was found that many respondents did not have a history. In a previous study, it was stated that a history of DFU with the incidence of peripheral neuropathy influenced each other; it was found in respondents who had suffered from D.M.> 10 years. Based on this statement is not in line with the results of the study because the all respondent has suffered from T2DM for < 10 years [16].

The most common history of pathological nails found in the respondents was nailed with fungi. Nails are body parts that grow at the tips of the fingers. Diabetes mellitus (D.M.) can be seen from the color of the nails, and the shape of the fingers and toes can get information about the symptoms of systemic diseases in the body. The color of the fingernails has four colors, namely red, whitish (pink), white, yellow, and bluish [17]. In patients with T2DM, there is a decrease in tissue circulation, which is characterized by loss or reduction in the pulse of the dorsalis pedis artery, tibial artery, and popliteal artery; causes the feet to become atrophic, cold, and thickened nails. Furthermore, tissue necrosis occurs, resulting in ulcers that usually start from the tips of the feet or legs [18].

2. Characteristics of leg autonomic damage examination

Based on the results of the foot damage examination that has been carried out in the work area of the Jember District Health Center, it can be seen that most of the respondents with Type 2 DM experienced multiple autonomic damages to the left foot, as many as 52 people (52%). While on the left leg, as many as 53 people (53%). The results of the examination found symptoms that appeared to include dry skin, cracks, and calluses or callus.

Diabetics are said to have single autonomic damage if only one disorder is found, and they are said to have multiple defects if more than one disorder is present. The results of the assessment of autonomic damage to the feet were found to have more multiple autonomic damages. Damage to autonomic nerve function in patients with T2DM can result in increased stress [19]. This condition can stimulate endothelial tissue damage, so that blood flow in the distal arteries increases so that it causes pressure on the sympathetic nerves affecting the decrease in sweat gland production and symptoms such as cracked skin, dry skin, and callus formation [20].

3. Sensory Examination Characteristics

Based on the results of this study, it can be seen that the majority of patients with type 2 D.M. experienced sensory damage to the right and left feet, showing normal results in as many as 63 people (63%). The results of the foot sensitivity examination were carried out at 10 location points (plantar fingers 1, 3, 5, metatarsal head fingers 1, 3, 5, medial arches, lateral arches, heel, and dorsum of the foot). Damage to sensory nerve function will result in the patient not feeling light touch or other sensations given to the soles of the feet. This is in accordance with the theory, which explains that an increase in oxidative stress will interfere with impulse delivery so that people with diabetes will lose foot protection [19].

Symptoms that arise will make some parts of the foot not feel any touch or pressure on the soles of the feet. Another study using 10 g monofilament showed that 29 people with diabetes (85.3%) had impaired foot sensitivity [21]. People with diabetes will experience impaired sensitivity due to damage to large nerve fibers, This can happen because the distal part does not get enough nutrition due to damage to large nerve fibers in the leg area [19].

Characteristics of motor examination

Based on the results of the examination of motor damage in T2DM patients, it was found that normal conditions were dominated on the right and left legs as much as (49% and 52%). Decreased muscle strength in the right side of 50 people with diabetes (50%) and 47 people with diabetes on the left leg (47%). The examination results found symptoms of decreased muscle strength in people with diabetes.

Patients with T2DM are said to have motor damage if there are symptoms of weakness and distal muscle atrophy, whereas, in long-term neuropathy, there will be many symptoms with deformities [8]. Motor damage is absent physiological reflexes in the quadriceps femoris and Achilles of the right or left leg [22]. Nerves damaged by motor neuropathy can cause an imbalance between flexion, extension, and deformity of the foot.

CONCLUSIONS AND SUGGESTIONS

The conclusion based on the presentation in this article is that most of the respondents experienced mild neuropathy, as many as 67 people (67%). Peripheral neuropathy examination is expected to be applied as a form of screening for the severity of complications in patients with type 2 diabetes mellitus so as to prevent early complications. This study has several limitations, so further researchers are expected to be able to find correlations from other variables such as HbA1c, stress level, level of knowledge of the risk of diabetes complications, family support, and self-efficacy on the level of peripheral neuropathy.

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