

Diabetic Neuropathy among Type 2 Diabetes Mellitus Patients at Amplas Primary Health Care in Medan City

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Abstract

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BACKGROUND: Diabetic neuropathy is one of the most complicated complications of diabetes patients with Type 2 diabetes.

AIM: The purpose of this study was to determine the diagnosis of diabetic neuropathy based on Clinical Neurological Examination (CNE) and the factors that influence the occurrence of diabetic neuropathy in Type 2 DM patients at Amplas Primary Health Care (PHC) in Medan City.

METHODS: The research design was descriptive-analytic with the cross-sectional approach. The study population was all Type 2 DM patients who came to Amplas PHC with a total sample of 53 people using the consecutive sampling. The research data source is primary data, namely the assessment of diabetic neuropathy using the Clinical Neurological Examination (CNE) criteria. Data were processed using SPSS and analysis using the chi-square test.

RESULTS: The results showed the majority of Type 2 DM patients had mild neuropathy as many as 24 people (45.3%). The Chi-square test results showed there was a relationship between age and duration of diabetes with the incidence of diabetic neuropathy in Type 2 DM patients at Amplas Primary Health Care.

CONCLUSION: Education and early detection with proper management can prevent more severe complications so that the quality of life of patients can be maintained better.

Introduction

Diabetic neuropathy is one of the macrovascular complications in Type 2 DM patients; this can occur due to uncontrolled blood sugar in diabetic patients, the more uncontrolled, the faster the neuropathy complaints [1].

Diabetic neuropathy is one of the chronic diabetes complications. People with diabetes have 11 times riskier of developing neuropathy compared to those without diabetes [2]. Some study found the most cases of neuropathy above the age of 55 years. People with DM have peripheral neuropathy as much as 25% of all people with diabetes mellitus in the world [3]. In the United States, 60-70% of diabetic patients (T2DM) have complications of diabetic neuropathy [4]. In Indonesia, experienced neuropathy in 43% of 16.800 patients Types 2 DM who were

proven to be at risk of developing neuropathy [5].

Symptoms of neuropathy in patients with Type 2 DM such as numbness, burning, pricking, and other problems are often complained of but rarely noticed. Patients rarely treat neuropathy because they do not know the symptoms, and this problem can interfere with the quality of life of patients. Some study reported that out of a total of 4097 patients, 90.6% had type 2 diabetes. Among that 90.6 %, those with complications of diabetic neuropathy were 19.4%, followed by other complications of DM such as erectile dysfunction by 17. 5% and diabetic retinopathy of 16.8% [2].

Neuropathy is a serious health problem in patients with Type 2 DM because it can cause disruption of function and can even cause disability. Peripheral neuropathy can impact on muscle weakness and loss of reflex, especially at the ankles.

This situation results in changes in the way of walking and changes in the shape of the legs, such as hammertoes. As a result of suppression or injury to areas that experience numbness, often ulcers arise in the legs of patients with peripheral diabetic neuropathy, if it is not handled correctly, an infection can occur that spreads to the bone so it must be amputated [6].

Prevention of worsening of neuropathy can be done by early prevention. One form of early prevention is by examining peripheral neuropathy. Early detection of neuropathy is essential in DM patients, and preventive interventions can be applied to reduce morbidity. Clinical Neurological Examination (CNE) is used to detect and diagnose diabetic neuropathy in daily clinical practice. CNE includes a study of sensory function, leg muscle strength, ankle reflexes, and a specific score for each examination [7].

The Clinical Neurological Examination (CNE) is a scoring system that is used to assess sensory disorders and reflexes in the lower limbs. Clinical assessment is done to determine the presence or absence of neurological disorders, including sensory tests, tot strength, and ankle reflexes. Recently CNE has been used to detect and diagnose diabetic neuropathy in daily clinical practice. CNE is one modification of NDS because of the Neuropathy Disability Score (NDS), considered to be more complicated and challenging to apply in practical clinical use. Clinical Neurological Examination includes studies of sensory function, leg muscle strength, ankle reflexes, and the giving of sure scores for each examination.

The purpose of this study was to determine the diagnosis of diabetic neuropathy based on Clinical Neurological Examination (CNE) and the factors that influence the occurrence of neuropathy in Type 2 DM patients at Amplas Primary Health Care in Medan City.

Material and Methods

The study was descriptive-analytic (cross-sectional approach). The population of the study was all Type 2 DM patients who came to the Amplas Primary Health Care from January to March 2019. The participation of patients was voluntary by signing informed consent. Sampling was carried out by consecutive sampling with inclusion and exclusion criteria. Inclusion criterion is Diabetes patients residing in the Amplas PHC area, patients who come independently to the PHC, while the inclusion criteria are patients with a history of previous neuropathy (e.g., heavy smokers, known blood vessel blockage diseases from anamneses), patients who have

experienced heart attack, patients who have had heart surgery.

The source of study data is Primary data. Neuropathy assessment is based on CNE criteria, where sensory tests, muscle strength, and ankle reflexes are assessed on both right and left limbs. The results of the examination are determined by scoring if the measurement is in normal condition the score is 0, decreases are 1, and a negative score is 2. The overall score for CNE examination ranges from 0 to 37 points. The total score is then categorised. Score 0 = no neuropathy, score 1-9 = mild degree, score 10 - 18 = moderate degree, while score 19-33 = severe degree. The data is processed using computer SPSS to assess the factors that influence the occurrence of diabetic neuropathy by doing the chi-square test.

Results

Baseline Characteristics of Type 2 Diabetic Patients

The result of Table 1 shows that the majority of patients aged 51-60 years as many as 25 people (47.2%), DM patients at most are female as many as 36 people (67.9%), based on the duration of diabetes it is known that most DM patients have 3-5 years and more than 5 years 19 people (35.8%).

Table 1: Basic Characteristics of T2DM patients

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
40-50	19	35.8
51-60	25	47.2
61-70	8	15.1
> 70	1	1.9
Gender		
Male	17	32.1
Female	36	67.9
Duration Suffering DM		
< 3 years	15	28.4
3-5 years	19	35.8
> 5 years	19	35.8
Family History		
Father	10	18.9
Mother	15	28.3
Father and Mother	2	3.8
No one	26	49.0
Neuropathy (based on CNE Score)		
Normal (score 0)	18	34
MildNeuropathy (score1-9)	24	45.3
Moderate Neuropathy (Score10-18)	8	15.0
Severe Neuropathy (Score 19-32)	3	5.7

The majority of patients did not have a family history of diabetes as many as 26 people (49.0%). Based on the assessment, it is known that most patients have mild neuropathy of 24 people (45.3%).

Factors influence the Prevalence of Diabetic Neuropathy

Based on Table 2 shows that severe neuropathy is found in the age group of 40-50 as many as 2 people (10.6%) while moderate neuropathy

is located in the age group 51-60 years as many as 12 people (48.0%), based on chi-square test result that age and duration of diabetes have relationship with peripheral neuropathy experienced by Type 2 DM patients ($p < 0.05$).

Table 2: Factors that influence the occurrence of Diabetic Neuropathy

Risk Factors	Normal	Mild	Moderate	Severe	P
Age (years)					
40-50	7 (36.8)	7 (36.8)	3 (15.8)	2 (10.6)	0.03
51-60	8 (32.0)	12 (48.0)	4 (16.0)	1 (4)	
61-70	2 (25.0)	5 (62.5)	1 (12.5)	0 (0)	
> 70	1 (100)	0 (0)	0 (0)	0 (0)	
Gender					
Male	4 (23.5)	9 (52.9)	2 (11.8)	2 (11.8)	0.90
Female	14 (38.9)	15 (41.7)	6 (16.7)	1 (2.7)	
Duration DM					
< 3 Years	8 (53.3)	7 (46.7)	0 (0)	0 (0)	0.04
3-5 Years	8 (42.1)	11 (57.9)	0 (0)	0 (0)	
> 5 Years	2 (10.6)	6 (31.6)	8 (42.0)	3 (15.8)	
Family History					
Father	3 (30)	3 (30)	3 (30)	1 (10)	0.15
Mother	6 (40)	5 (33.3)	3 (20)	1 (6.7)	
Both	1 (50)	0 (0)	0 (0)	1 (50)	
No One	8 (30.8)	16 (61.5)	2 (7.7)	0 (0)	

Discussion

The study showed that there was a significant relationship between age and the prevalence of diabetic neuropathy. The results of this study are in line with other studies who get the most age in patients with diabetic neuropathy ranging from 51-60 years [8], while another study states that diabetic neuropathy patients are more than 50 years old [9].

In theory, it can be explained that increasing age stimulates the degeneration process and causes nerve cell damage. Changes in both large nerve fibres and small nerve fibres give rise to vulnerability in the elderly to neuropathy [4]. The number of patients with diabetic neuropathy in the age range of 45-65 years is due to the age of tissue damage caused by free radicals such as increased levels of lipid peroxide and changes in enzyme activity. Diabetes is degenerative, a disease that appears slowly along with the increasing age of the patient for years so that patients experience complications of diabetic neuropathy [10]. So that rising age will increase the risk of complications of diabetic neuropathy in diabetic patients [11].

Neuropathy based on gender is known to be more severe in male neuropathy (11.8%), while mild neuropathy is more common in female DM patients 15 people (41.7%). The Chi-square statistical test showed that there was no correlation between the incidence of neuropathy and the gender of Type 2 DM patients ($p < 0.05$).

The results of the study found that the prevalence of diabetic neuropathy was more prevalent in women ranging from 50.8% [4], [12]. Hormone

differences in men and women affect the onset of neuropathy. High levels of oestrogen in women can interfere with the absorption of iodine, which plays a role in the process of nerve myelin formation while testosterone levels in men protect the body from type 2 DM, but not in women [4].

In general, in this study it can be seen that more women experience diabetic neuropathy than men, more women participating in this study can cause this no difference in the prevalence of diabetic neuropathy based on age in Type 2 DM patients at Amplas PHC.

Majority duration of illness of diabetic patients > 5 years, the results of the Chi-square statistical test revealed that there was a relationship between the duration suffering of diabetes with neuropathy ($p < 0.05$).

This study is in line with by Tabatabaei-Malazy where diabetic neuropathy sufferers are more common in people who have suffered DM for > 5 years [13], while according to [4] the average age of diabetic neuropathy patients has experienced DM for 10 year

Diabetic neuropathy generally occurs after 5 years of suffering from type 2 diabetes mellitus. Low glycemic control and dyslipidemia will increase the occurrence of diabetic neuropathy [14]. The more extended Type 2 DM, the higher the incidence of complications experienced. The duration of type 2 diabetes mellitus with high blood sugar levels will affect changes in blood vessel walls [15]. Chronic high blood sugar levels cause a decrease in insulin secretion. Glucose will turn into sorbitol, which causes nerve cell damage. The longer a person suffers from DM, the process will last longer and worsen the occurrence of nerve cell damage [16].

The duration of suffering from diabetes causes chronic hyperglycemia in patients whose blood sugar levels are uncontrolled. Chronic hyperglycemia causes microangiopathy that underlies the onset of neuropathy. In patients newly diagnosed with DM, it was found that less than 10% had symptoms of clinical neuropathy [4].

It was found that there were 16 people (61.5%) who had neuropathy without having a family history of DM, the Chi-square statistical tests stated that $p = 0.15$ ($p > 0.05$) means that there was no association between family history with neuropathy in Type 2 DM patients.

This study is the same with another study where the higher prevalence of diabetic neuropathy was found in groups without a family history [12]. In theory, stated that family history relates to diabetes mellitus where if one parent suffers from DM, a person's risk of developing DM is 15% if both parents have diabetes, the risk of developing DM increases to 75% [17]. Still, this research is not in line with the theory, possibly caused by the more significant role of

lifestyle in creating respondents in this study to be affected by DM.

The genetic risk will increase two to six times if parents or siblings experience type 2 diabetes mellitus [18]. Someone who has a history of hereditary type 2 diabetes mellitus will increase the risk of type 2 diabetes mellitus by 2-fold compared to someone who does not have a history of genetic type 2 diabetes mellitus. The result another study said the majority of female type 2 diabetes mellitus has a history of type 2 diabetes mellitus [19], [20] In this study indicate that lifestyle is a significant risk of diabetes compared to genetic patients, because of all people with diabetes, it is known that 49% do not have a family history.

In conclusions, diabetes neuropathy is one of the most common complications of microangiopathy experienced by Type 2 DM patients, from various factors known as age and family history, affecting the occurrence of diabetic neuropathy. Education and early detection with proper management can prevent more severe complications so that the quality of life of patients can be maintained better.

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References

- Amelia R, Burhan BB, Lelo A. The relationship between anthropometry and ankle-brachial index with blood glucose level in patients with type 2 diabetes mellitus at the Community Health Center in Medan, Indonesia. *Family Medicine & Primary Care Review*. 2018; (4):307-12. <https://doi.org/10.5114/fmpcr.2018.79339>
- Pop-Busui R, Boulton AJ, Feldman EL, Bril V, Freeman R, Malik RA, Sosenko JM, Ziegler D. Diabetic neuropathy: a position statement by the American Diabetes Association. *Diabetes care*. 2017; 40(1):136-54. <https://doi.org/10.2337/dc16-2042> PMID:27999003
- Rosyida K, Safitri DK. Gambaran Neuropati Perifer pada Diabetisi di Wilayah Kerja Puskesmas Kedungmundu Semarang (Doctoral dissertation, Faculty of Medicine).
- Suri MH, Haddani H, Sinulingga S. Hubungan Karakteristik, Hiperqlikemi, dan Kerusakan Saraf Pasien Neuropati Diabetik di RSMH Palembang Periode 1 Januari 2013 Sampai Dengan 30 November 2014. *Jurnal Kedokteran Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya*. 2015; 2(3):305-10.
- Indonesia PE. Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 di Indonesia. PB. PERKENI. 2015.
- Deli G, Bosnyak E, Pusch G, Komoly S, Feher G. Diabetic neuropathies: diagnosis and management. *Neuroendocrinology*. 2013; 98(4):267-80. <https://doi.org/10.1159/000358728> PMID:24458095
- Meijer JW, van Sonderen E, Blaauwweikel EE, Smit AJ, Groothoff JW, Eisma WH, Links TP. Diabetic neuropathy examination: a hierarchical scoring system to diagnose distal polyneuropathy in diabetes. *Diabetes Care*. 2000; 23(6):750-3. <https://doi.org/10.2337/diacare.23.6.750> PMID:10840990
- Caro XJ, Galbraith RG, Winter EF. Evidence of peripheral large nerve involvement in fibromyalgia: a retrospective review of EMG and nerve conduction findings in 55 FM subjects. *European journal of rheumatology*. 2018; 5(2):104. <https://doi.org/10.5152/eurjrheum.2018.17109> PMID:30185358 PMID:PMC6072686
- Tantular R. Hubungan Usia dan Jenis Kelamin terhadap Derajat Kerusakan Saraf. Skripsi. Fakultas Kedokteran Universitas Sriwijaya, Palembang (tidak dipublikasikan), hal. 2013:1-2.
- Amelia R, Wahyuni AS, Felicia RA. Relationship between family support with quality of life among type 2 diabetes mellitus patients at Amplas primary health care in Medan, Indonesia. In *Journal of Physics: Conference Series* 2018 Dec (Vol. 1116, No. 5, p. 052004). IOP Publishing, 2018. <https://doi.org/10.1088/1742-6596/1116/5/052004>
- Safitri VA, Rosdiana D, Astari RV. Gambaran Hasil Pemeriksaan Monofilamen pada Pasien Diabetes Melitus (DM) yang Berkunjung ke Poliklinik Penyakit Dalam RSUD Arifin Achmad Provinsi Riau. *Jurnal Ilmu Kedokteran*. 2018; 11(2):34-9. <https://doi.org/10.26891/JIK.v11i2.2017.34-39>
- Rahmawati A, Hargono A. Dominant Factor of Diabetic Neuropathy on Diabetes Mellitus Type 2 Patients. *Jurnal Berkala Epidemiologi*. 2018; 6(1):60-8. <https://doi.org/10.20473/jbe.v6i12018.60-68>
- Tabatabaei-Malazy O, Mohajeri-Tehrani MR, Madani SP, Heshmat R, Larijani B. The prevalence of diabetic peripheral neuropathy and related factors. *Iranian journal of public health*. 2011; 40(3):55.
- Jaiswal M, Divers J, Dabelea D, Isom S, Bell RA, Martin CL, Pettitt DJ, Saydah S, Pihoker C, Standiford DA, Dolan LM. Prevalence of and risk factors for diabetic peripheral neuropathy in youth with type 1 and type 2 diabetes: SEARCH for Diabetes in Youth Study. *Diabetes care*. 2017; 40(9):1226-32. <https://doi.org/10.2337/dc17-0179> PMID:28674076 PMID:PMC5566278
- Hébert HL, Veluchamy A, Torrance N, Smith BH. Risk factors for neuropathic pain in diabetes mellitus. *Pain*. 2017; 158(4):560. <https://doi.org/10.1097/j.pain.0000000000000785> PMID:27941499 PMID:PMC5359789
- Tanhardjo J, Pinzon RT, Sari LK. Perbandingan rerata kadar HbA1c pada pasien diabetes melitus dengan neuropati dan tanpa neuropati sensori motor. *Berkala Ilmiah Kedokteran Duta Wacana*. 2016; 1(2):127-36. <https://doi.org/10.21460/bikdw.v1i2.13>
- Diabetes UK. State of the nation 2016: time to take control of diabetes. London: Diabetes UK. <https://www.diabetes.org.uk/Professionals/Position-statements-reports/Statistics/State-of-the-Nation-2016-Time-to-take-control-of-diabetes>, 2016.
- Amelia R. The Model of Self Care Behaviour and the Relationship with Quality Of Life, Metabolic Control and Lipid Control of Type 2 Diabetes Mellitus Patients in Binjai City, Indonesia. *Open access Macedonian journal of medical sciences*. 2018; 6(9):1762. <https://doi.org/10.3889/oamjms.2018.363> PMID:30338004 PMID:PMC6182544
- Fadilah NA, Saraswati LD, Adi MS. Gambaran karakteristik dan faktor-faktor yang berhubungan dengan kejadian diabetes melitus tipe 2 pada wanita (Studi di RSUD Kardinah Kota Tegal). *Jurnal Kesehatan Masyarakat (e-Journal)*. 2016; 4(1):176-83.
- Piccolo RS, Subramanian SV, Pearce N, Florez JC, McKinlay JB. Relative contributions of socioeconomic, local environmental, psychosocial, lifestyle/behavioral, biophysiological, and ancestral factors to racial/ethnic disparities in type 2 diabetes. *Diabetes care*. 2016; 39(7):1208-17. <https://doi.org/10.2337/dc15-2255> PMID:27330127 PMID:PMC4915558