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The IPPTT *Method* for Early Detection of Nuropathic Disease in Type 2 Diabetes Mellitus Patients at the Practice of General Practitioner Dr. Rewin Dhillon, MBBS Berastagi

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Abstract: *Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease characterized by hyperglycemia resulting from insulin resistance or impaired insulin secretion. One of the most common long-term complications is diabetic neuropathy, which causes peripheral nerve damage and may lead to sensory and motor disturbances, foot ulcers, and amputations. Early detection is essential to prevent disease progression. The Ipswich Touch Test (IpTT) is a simple, non-invasive, and practical screening method suitable for primary care settings. This descriptive study involves 57 patients with T2DM who met the inclusion criteria (aged >20 years, no foot ulcers, and cooperative). Samples are selected using accidental sampling. Neuropathy screening is conducted using the IpTT at six points on both feet with an observation sheet. Data are analyzed univariately and presented as frequencies and percentages. Of the 57 respondents, 50 patients (87.7%) show no signs of neuropathy, while 7 patients (12.3%) are identified as having neuropathy based on IpTT results. Most patients without neuropathy have a duration of diabetes of less than five years (82%), whereas neuropathy was more commonly found in patients with a diabetes duration of five years or more. The prevalence of diabetic neuropathy among patients with T2DM in this practice is relatively low. The duration of diabetes is presumed to be associated with neuropathy due to prolonged exposure to chronic hyperglycemia. Routine use of the IpTT in primary care is recommended for early detection and prevention of diabetic foot complications.*

1. INTRODUCTION

Diabetes is a chronic disease associated with metabolic disorders and is characterized by increased blood glucose levels. This condition arises due to insufficient insulin production or due to a decrease in the effectiveness of insulin's work in the body. There are three main forms of diabetes, namely type 1, type 2, and gestational diabetes. Of the three, type 2 diabetes is the most common, accounting for 90% of cases worldwide. Alrashed et al. (2024) stated that type 2 DM arises due to a combination of insulin resistance in peripheral tissues with pancreatic β cell dysfunction, thus gradually decreasing the body's ability to control blood glucose levels. In addition, high blood glucose levels can also be triggered by other factors such as obesity, unhealthy diet, lack of physical activity, genetic factors, and the aging process. The impact of this condition can cause various serious health complications, including nerve damage, kidney failure, heart disease, and limb amputation (Undie et al., 2025).

The International Diabetes Federation (IDF) reports that in 2024 more than 589 million adults aged twenty to seventy-nine years will experience DM worldwide, and the number is predicted to continue to grow to 853 million by 2050. Based on the results of the 2023 Indonesian Health Survey (SKI), the prevalence of diabetes in the population of all ages was recorded at 1.7%. For the North Sumatra region, the prevalence of DM is 1.4%, although lower than the national average, this figure shows a significant burden of DM so that it is necessary to strengthen early detection, management, and follow-up prevention at the primary service and community levels.

One of the many common and dangerous long-term complications of DM is diabetic neuropathy, which is a condition that occurs due to peripheral nerve damage as a result of abnormalities in blood glucose levels over a long period of time. This neuropathy mainly affects the peripheral nervous system, both somatic and autonomic, which can cause various complaints such as tingling, burning, pain such as stabbing, loss of sensation in the legs or hands (Aktivah et al., 2022) and can cause symptoms such as loss of distal sensation, pain, as well as motor disorders such as decreased or lost ankle reflexes (Määttä *et al.*, 2025). These signs are rarely noticed in the early stages, even though they can develop into inconstipated wounds and end up in complications such as diabetic wounds, gangrene, and even amputation. Therefore, it is quite important for people with DM to get regular monitoring through early detection of neuropathy so that complications can be prevented as early as possible (Activah et al., 2022).

According to data from the IDF, about 30-50% of type 2 DM patients suffer from complications of peripheral neuropathy, while the WHO says the figure can reach 50% or more if asymptomatic cases are included. In Indonesia, clinical studies show that the prevalence of diabetic neuropathy varies significantly, with an average ranging from 22% to 60%, depending on the detection method and the population studied. This is in line with the report (Nurmalisa, Aminuddin and Siregar, 2023) which states that the prevalence of diabetic neuropathy is in the range of 28.7% to 39.5%, confirming that this complication is still a high clinical burden in DM patients in Indonesia.

The condition of chronic hyperglycemia experienced by people with type 2 diabetes triggers changes in glucose metabolism in peripheral nerve tissue. One of the main pathways that is disrupted is the polyol pathway, which results in the buildup of sorbitol and fructose in nerve cells leading to osmotic stress and cell damage. In addition, hyperglycemia also increases the formation of glycation end products (AGEs) and triggers oxidative stress, both of which play a major role in the breakdown of myelin as well as nerve axons. The accumulation of this

disorder leads to a slow deterioration of nerve function, so that neuropathy is often unnoticed in the early stages by sufferers (Nurmalisa et al., 2023).

Over time, these degenerative processes are further exacerbated by increased free radical production and systemic inflammation. Oxidative stress causes damage to cell structure through lipid peroxidation and impaired mitochondrial function, while the body's immune response produces pro-inflammatory cytokines such as TNF-α and IL-6 that accelerate nerve damage. This has an impact on gradual loss of sensation, the appearance of neuropathic pain, and motor disorders that affect the patient's daily activities (Hauwanga et al., 2024).

Diabetic neuropathy then progresses to a more advanced stage when the nerve damage is severe enough and clinically identifiable. Neuropathy can be classified as probable and confirmed based on the Toronto criteria. In the early stages, patients show decreased reflexes and sensations, while in the advanced stages, neural structural damage is found through supporting examinations. If not detected early, this neuropathy can develop into serious complications such as diabetic foot ulcers and amputations (Määttä *et al*., 2025).

From the initial data collection that has been carried out on July 21, 2025 at the General Practitioner Practice of dr. Rewin Dhillon, Berastagi, it was found that 1 in 5 type 2 DM patients (20%) showed positive results for neuropathy, characterized by no response at two points out of six points through IpTT examination. These findings reflect the potential for undiagnosed occurrence of neuropathy, especially in areas with limited diagnostic tools. Regular application of IpTT can help identify at-risk patients early and prevent further complications such as foot ulcers and amputations.

From the background that has been described, this study is focused on the topic of the IpTT method for early detection of neuropathy in type 2 diabetes mellitus patients in the practice of dr. Rewin Dhillon Berastagi.

2. LITERATURE REVIEWS

Other research suggests that the progression of diabetic neuropathy is also related to vascular dysfunction and the immune system. Li *et al.* (2025), reported that an increase in the ratio of monocytes to lymphocytes is one of the indicators of systemic disorders that accompany peripheral nerve damage. Therefore, early detection through simple but effective methods such as *the Ipswich Touch Test* (IpTT) is essential to prevent further complications. This method can be used practically by health workers in primary care as an efficient and non-invasive preventive effort.

The application of IpTT is a practical answer to the challenge of early detection of diabetic neuropathy in primary facilities. This method can be done by general practitioners, nurses, and even caregivers who have received training. Its effectiveness has been proven in various studies, and it has great potential in reducing the incidence of ulcers and amputations by starting interventions early (Nurmalisa, Aminuddin and Siregar, 2023). Other researchers began to adopt IpTT as an early screening tool for neuropathy. In several health centers and general practitioner practices, IpTT has been successfully implemented and has given positive results in detecting mild to moderate neuropathy. With this method, the detection of neuropathy can be done without tools and in less than two minutes (Utami et al., 2024).

3. METHODS

In this study, a descriptive design was used with the aim of providing an overview and explanation of ongoing events (Nursalam, 2020). The type of design used is *cross sectional*, which is an approach by making observations once in a certain time.

In this study, the population used was type 2 DM patients at dr. Rewin Dhillon Berastagi's practice, with a total of 398 people in the period from January to June 2025, or an average of around 66 patients per month. This study applies the *accidental sampling* method in the sample determination process, which is a non-probability technique in which respondents are selected based on who the respondents happen to come to the research location and meet the inclusion criteria during the data collection time. This technique was chosen because it adapts to situations where type 2 DM patients come in turns and irregularly, as well as because of the limited research time (Nursalam, 2020). The inclusion criteria chosen as the basis for selecting respondents in this study were: No leg ulcers, Age > 20 years, and Cooperative patients.

Visits of type 2 DM patients in a period of one month at dr. Rewin Dhillon Berastagi's practice showed an average of 66 people. Because the researcher uses *the accidental sampling method*, the determination of the number of samples is still carried out as the basis for quantitative research needs. The number of samples was calculated using the Slovin formula, Thus, the minimum number of targeted samples is 57 respondents, which will be met through the selection of patients who come by chance and are willing to be respondents during the time of the study.

In this study, the instrument used is in the form of an observation sheet with the following procedure:

a. Lightly touch the tip of the finger on the patient's toes on the first, third and fifth fingers of the first, third and fifth fingers for 1-2 seconds.

b. Before the examination begins, the patient is asked to close his eyes.
c. If the patient is unable to feel touch at least 2 of the 6 examination points, the patient is categorized as having neuropathy.

In its implementation, the examination should not be carried out by pressing or tapping too hard, as it can give rise to other sensations besides light touch (Pamungkas, 2021). This instrument was chosen because it is simple, fast, practical, and does not require additional tools. In addition, the instrument has good validity and reliability in detecting diabetic neuropathy. Based on research by Nurmalisa, Aminuddin, and Siregar (2023), the sensitivity value of the IpTT method reached 83% and the specificity was 97%, making it suitable for use in primary service facilities such as general practitioner practices.

This research was conducted at the practice of general practitioner dr. Rewin Dhillon, MBBS, which is located at Jalan Trimurti No. 73, Tambak Lau Mulgap I Village, Berastagi District, Karo Regency, North Sumatra Province. The research was conducted from November to December 2025. The data was obtained from sensory examination using *the Ipswich Touch Test* (IpTT) method. The examination was carried out by touching the researcher's fingertips to six points on the soles of the patient's feet (thumb, middle palm, and heel of each foot) to assess the presence of sensory disturbances. The results of the examination are then written into the observation sheet that has been prepared.

In this study, univariate analysis was used which aimed to describe the characteristics of each variable in a single way. Univariate analysis was used to display the frequency distribution and percentage of early detection results. Because this study is descriptive and does not examine the relationship between variables, inferential statistical tests were not performed. The purpose of this analysis is to explain the characteristics of the detection results, which are then presented in the form of frequency distribution tables and percentages.

This research has also been ethically feasible from the health research commission of STIKes Santa Elisabeth Medan with letter number No: No.149/KEPK-SE/PE-DT/X/2025

4. RESULT AND DISCUSSIONS

Characteristics of respondents based on age, gender, KGD, and length of time suffering from DM in the practice of dr. Rewin Dhillon Berastagi

Table 1. The distribution of respondent frequencies is based on demographic data on age, gender, KGD, and length of time suffering from DM in the practice of dr. Rewin Dhillon Berastagi as many as 57 people.

Characteristic	Frequency(f)	Percentage
Age		
36-45	8	14%
46-55	9	15,8%
56-65	24	42,1%
>65	16	28,1%
Total	**57**	**100%**
Gender		
Male	25	43,9%
Female	32	56,1%
Total	**57**	**100%**
KGD		
Normal	11	19,3%
Abnormal	46	80,7%
Total	**57**	**100%**
Long Suffering		
<5 Year	46	80,7%
≥5 Year	11	19,3%
Total	**57**	**100%**

Based on Table 1, it shows that of the 57 respondents, the most age group is in the range of 56-65 years as many as 24 respondents (42.1%) and the least is in the age group of 36-45 years as many as 8 respondents (14%). There were more female respondents, namely 32 respondents (56.1%) compared to 25 male respondents (43.9%). Based on the examination of blood sugar levels, most of the respondents were in the abnormal category, namely 46 respondents (80.7%), while the normal category was only 11 respondents (19.3%). Judging from the length of suffering from DM, the majority of respondents had DM for less than 5 years as many as 46 respondents (80.7%) and the rest had DM for ≥5 years as many as 11 respondents (19.3%).

Table 2. Distribution of the frequency of neuropathy events in type 2 DM patients in the practice of dr. Rewin Dhillon Berastagi .

Incidence of neuropathy	Frequency (f)	Percentage
Neuropaths	7	12,3%
No Neuropathy	50	87,7%
Total	**57**	**100%**

Based on Table 2 above, it can be seen that out of 57 respondents, as many as 7 respondents (12.3%) experienced neuropathy and as many as 50 respondents (87.7%) did not experience neuropathy.

Discussion

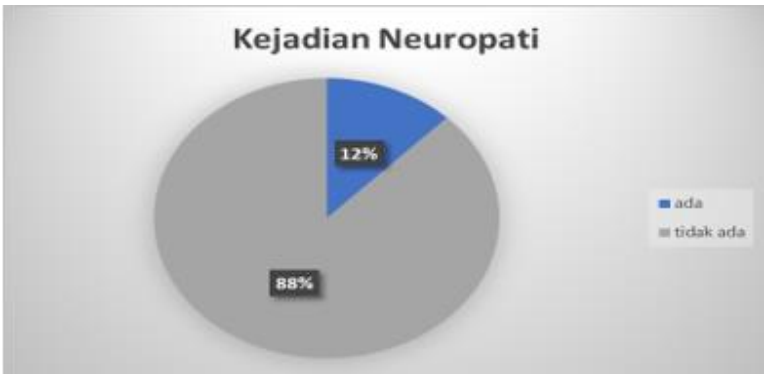

Diagram 1. Distribution of respondents based on the incidence of neuropathy in the practice of dr. Rewin Dhillon Berastagi.

Based on the results of the study, it can be seen that the majority of Type 2 DM patients in dr. Rewin Dhillon's practice did not experience neuropathy as many as 50 respondents (88%) and those who experienced neuropathy 7 respondents (12%).

From the data, it was found that out of 50 respondents who were not affected by neuropathy, there were 41 respondents (82%) suffering from diabetes mellitus < 5 years and as many as 9 respondents (18%) ≥ 5 years. Based on the results of this study, researchers assume that the low prevalence of neuropathy is related to long-term factors of suffering. From the theory, it is found that the length of suffering from diabetes mellitus is a common risk factor related to the incidence of neuropathy. Patients who have had diabetes for ≥5 years have a much higher chance of developing nerve damage compared to those newly diagnosed.

Research by Dita Hanna Febriani (2025), shows that the length of suffering from type 2 diabetes mellitus has a significant relationship with the occurrence of complications, especially neuropathy. The longer a person lives with diabetes, the greater the risk of developing nerve damage due to exposure to chronic hyperglycemia. This condition can cause impaired peripheral nerve function which has an impact on the patient's quality of life. These findings confirm that the duration of the disease is an important factor in the development of diabetes complications. Therefore, regular monitoring and long-term care interventions are indispensable to prevent and control neuropathy complications in patients with diabetes mellitus.

Research conducted by Ilmi et al (2020), at the Loa Janan Health Center also confirmed that there is a significant link between the duration of suffering from type 2 diabetes mellitus and the onset of sensory neuropathy. Of the 43 respondents, most had had diabetes for 1–5 years, and almost all (93%) showed symptoms of decreased to loss of sensation in the legs. The results of the statistical test showed a value of p = 0.003, which means that the longer the patient

lives with diabetes, the higher the likelihood of sensory nerve damage due to prolonged hyperglycemia exposure. This condition causes impaired sensitivity in the distal extremities, so the patient is no longer able to feel pain or light touch that serves as the body's natural protective mechanism. Thus, the length of the duration of the disease is an important risk factor that accelerates the appearance of sensory neuropathy in patients with type 2 diabetes mellitus.

Rany *et al* (2024), in their research also support this. Patients who have had DM for more than 5 years have almost 80 times the risk of complications compared to newly diagnosed patients. Long suffering from Type 2 DM closely develops over time. Chronic hyperglycemia, or uncontrolled high blood sugar, causes progressive damage to both large (macrovascular) and small (microvascular) blood vessels, contributing to coronary heart disease, stroke, peripheral vascular disease, diabetic retinopathy, diabetic neuropathy, and diabetic nephropathy. In addition, the process of protein glycation due to hyperglycemia causes sugar to stick to proteins in the blood and body tissues, interfering with the normal function of proteins and damaging tissues.

In this study, there were also 5 respondents who suffered from diabetes mellitus for less than 5 years but had experienced neuropathy. Researchers assume that other factors such as poor blood glucose control, old age, and uncontrolled KGD play a significant role in accelerating peripheral nerve damage. These findings are in line with the research of Selano (2021), who concluded that there was no significant relationship between the length of suffering from diabetes and the incidence of diabetic neuropathy, but metabolic and vascular factors such as chronic hyperglycemia, age, and lipid levels were more dominant in influencing the progression of neuropathy.

Research by Nurjanah et al (2022), also found that the majority of respondents who suffered from diabetes mellitus for 1-5 years (58.7%) had experienced peripheral neuropathy, even 5 respondents (10.9%) with a long period of suffering <1 year also experienced neuropathy, which means that it is possible that neuropathy can occur in a span of < 5 years. These findings suggest that neuropathy complications can appear early, not only in patients with a long duration of the disease.

From the results of this study, 7 patients who experienced neuropathy (12.3%) were obtained. Researchers assume that this is closely related to the pathophysiological mechanisms of chronic hyperglycemia that are the main hallmarks of this disease. In type 2 DM, insulin resistance leads to decreased glucose uptake by peripheral tissues and increased liver glucose production, leading to prolonged hyperglycemia. According to Eid et al. (2023), hyperglycemia is a major factor that plays a role in the pathogenesis of diabetic neuropathy through the

mechanism of metabolic disorders and bioenergetic failure of the peripheral nervous system. Chronically high blood glucose levels cause oxidative stress and mitochondrial damage to neurons as well as Schwann cells, which play an important role in supporting nerve function and regeneration. As a result, there is progressive nerve degeneration that starts from the lower extremities and spreads to other parts of the body. The study also emphasizes that although other factors such as obesity and dyslipidemia also contribute, hyperglycemia remains the main trigger for peripheral nerve damage in people with diabetes mellitus.

Research by Rozak et al. (2025) shows that prolonged diabetes mellitus increases the risk of neuropathy due to chronic hyperglycemia. This condition disrupts the biochemistry of small nerve cells, then damages nerve structure and decreases conduction. Persistent hyperglycemia triggers the polyol pathway, the accumulation of sorbitol, the decrease in myoinositol, as well as the formation of AGEs that interfere with nerve signals and blood flow. In line with that, Zhu et al. (2024) affirm that chronic hyperglycemia activates the pathways of polyols, PKCs, and AGEs, which trigger oxidative stress, myelin damage, as well as impaired mitochondrial function. High glucose also decreases the metabolic support of Schwann cells, thereby accelerating the degenerative processes underlying diabetic neuropathy.

Research by Elliott et al. (2024) shows that long-term hyperglycemia is closely related to an increased risk of diabetic peripheral neuropathy. This prospective study proves that the length of the duration of diabetes and poor glycemic control contribute significantly to the onset of neuropathy, both painful and non-painful. These results confirm that uncontrolled blood glucose levels over a long period of time cause structural and functional changes in peripheral nerves. Therefore, optimal management of blood glucose levels is the most effective preventive step in reducing the incidence and progression of diabetic neuropathy.

On the other hand, in this study, it was found that from 7 respondents who experienced neuropathy, 5 of them were men. Researchers assume this can be attributed to several factors that are generally more common in men, such as smoking habits, alcohol consumption, and lower levels of adherence to glycemic control.

Based on a literature review conducted by Putri and Waluyo (2020), it was stated that gender also plays a role as a risk factor for diabetic peripheral neuropathy. Some of the studies they summarized show that men experience neuropathy more often than women. This is associated with women's habits that tend to be more diligent in self-care, especially foot care, so that the risk of neuropathy and foot ulcers can be suppressed.

However, these findings are not entirely in line with the results of research conducted by Lu et all (2020), through the INTERPRET-DD study, which is a study on people with type 2

diabetes from 14 countries. The study reported that the prevalence of diabetic peripheral neuropathy was actually higher in women than in men (29.49% vs. 23.37%). This difference is consistent across different age groups and indicates the presence of biological and hormonal factors that can increase women's susceptibility to nerve damage due to chronic hyperglycemia. These findings confirm that the relationship between sex and diabetic neuropathy still varies between populations and may be influenced by demographic, lifestyle, and differences in sample characteristics.

5. CONCLUSION AND SUGGESTION

From the results of this study with a sample of 57 respondents about the IpTT method for early detection of neuropathy in type 2 DM patients in the practice of dr. Rewin Dhillon Berastagi, it can be concluded that the majority of type 2 DM patients as many as 50 respondents (87.7%) do not experience neuropathy. The incidence of neuropathy in type 2 DM patients in dr. Rewin Dhillon Berastagi's practice is in the minority, namely 7 people (12.7%).

Further research can focus on the relationship between age, sex, KGD, and length of suffering factors to the incidence of diabetic neuropathy to assess the association of each factor with the incidence of neuropathy.

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