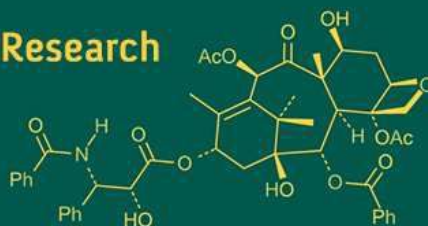
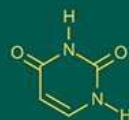


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Diabetic retinal degeneration screening for peripheral neuropathy using retinopathy and hemoglobin A1c values

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Abstract

Background and Objectives: Screening for people with diabetes mellitus who don't have any symptoms can help keep other problems from happening. The goals of this study are to find a way to detect peripheral neuropathy early on and uncover a link between this condition and diabetic retinopathy.

Material and Methods: A cross-sectional study was done on 100 patients who went to the Department of Ophthalmology, Sri Lakshmi Narayana Institute of Medical Sciences in Puducherry, India, from January 2016 to December 2016. The patients were chosen at random and the study was done using repeated sampling. People over the age of eighteen with type 2 diabetes mellitus who did not have peripheral neuropathy and had their HbA1c levels checked in the last two months were included in the study.

Results: After ruling out other possible causes of neuropathy, diabetic polyneuropathy can be identified when a person has symptoms and/or signs of peripheral nerve degeneration. Nerve conduction tests, especially those that look at nerves in the lower limbs, show problems that support this diagnosis even more. Several tools have been created to quickly and fully check for symptoms and signs of DPN. The TCNS is a valid and accurate clinical assessment tool that is often used in therapy and study. It is one of many scales that are used to describe and rate the severity of neuropathy. The current study used TCNS to divide neuropathy into three separate groups: neuropathy that wasn't present, low to moderate neuropathy, and severe neuropathy. People with DPN may have a variety of pathophysiology that cause their symptoms.

Conclusion: The study's results show that the thicknesses of the inferior and temporal parapapillary regions, as well as the overall thickness of the retinal nerve fiber layer, can help predict how neuropathy will get worse in people with type 2 diabetes.

Keywords: Diabetic, retinal, peripheral neuropathy, retinopathy, haemoglobin

Introduction

Diabetes mellitus (DM) is a common metabolic problem in which the blood sugar level stays high for a long time. Diabetes mellitus can lead to a number of problems, including peripheral neuropathy, heart disease, a brain accident, kidney failure, and vision loss. Type 2 diabetes is a long-term illness that is causing a lot of worry around the world [1-3]. The term "diabetic neuropathy" is used to describe the presence of symptoms and signs that suggest peripheral nerve dysfunction in people with diabetes after other possible causes have been ruled out. Polyneuropathy linked to diabetes is mostly caused by oxidative stress, vascular problems, and metabolic problems in people with type 2 diabetes [2-4].

Diabetic polyneuropathy can be greatly improved by finding it early, which may also help avoid serious results. Once type 2 diabetes is proven, all people with diabetes should get a neuropathy screening once a year. People with Type 2 Diabetes Mellitus (T2DM) now know that inflammation plays a big role in the development of many problems, including Diabetic Peripheral Neuropathy (DPN). Researchers have found that people with diabetes who have foot ulcers or diabetic neuropathy have higher amounts of IL-6 expression in biopsies of their sural nerves compared to people who were not diabetic [3-5].

The retina has a lot of sense neurons, just like the peripheral nerves. This means that it can be damaged by diabetic peripheral neuropathy (DPN). It is known as diabetic macular degeneration (DM) when the layer of nerve fibers in the retina thins and photoreceptors and

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ganglion cells die. It is also clear that the central retinal nerve fiber layer gets worse in people with DPN. The study of changes in the eye in people with diabetes is very important because it gives us information about possible early warning signs of problems [4-9]. The point of this project was to look at clinical, radiographic, laboratory, and neurophysiological data to find peripheral neuropathy in people with type 2 diabetes as soon as possible.

Material and Methods

100 patients with ocular diseases who sought treatment at the Srilakshmi Narayana Institute of Medical Sciences' Ophthalmology outpatient clinic in Puducherry, India, between January 2016 and December 2016 were the subjects of a cross-sectional analytical study. Participants had to be at least 18 years old, have type 2 diabetes mellitus, not exhibit peripheral neuropathy symptoms, and have had their HbA1c levels checked within the last two months to be included in the study.

Data Collection Method:

The MNSI self-administered surveys were given to the patients. For a positive answer, one point was given. For a negative response, two points were given. The final number was thirty. A score of 15 or less was thought to be an abnormal number. A full medical background was gathered, including information on the person's age, gender, the length of time they had type 2 diabetes, their HbA1c levels, and any other health problems they were having at the same time, like asthma, dyslipidemia, tuberculosis, high blood pressure, and coronary heart disease. The HbA1c results were put into three groups: good, poorly controlled, and pretty good. The patient's foot feelings were checked, and a fundus examination was done and written down on the case study form.

Diabetic Retinopathy Detection

A standard fundus examination was done on each patient using either fundus photography or indirect ophthalmoscopy with a 90D lens on a slit lamp. Diabetes retinopathy was broken down by the ETDRS into four separate groups: severe diabetic eye disease, proliferative diabetic retinopathy, diabetic macular edema, and nonproliferative diabetic retinopathy.

Results

Forty of the people who took part in the study were from PHCs and sixty were from hospitals. Forty of the people who filled out the MNSI assessment were marked as abnormal, which means they had symptoms of peripheral neuropathy. As a result, they were eliminated. A full report of the past was gathered, and interviews with the last ninety patients were conducted. Five people were taken out of the study because they had megaloblastic anemia, hypothyroidism, diabetic foot sores, or a long-term illness affecting their kidneys. Last but not least, 100 people took part in the study of diabetic peripheral neuropathy (DPN) and blindness. The people who took part had tests on their eyes to look for retinopathy and neuropathy. These tests included monofilament testing and biothesiometer screening. Each of the 100 people with type 2 DM was 54.7 years old, with an error of 11.4 years. The vast majority of them were men. People with Type 2 diabetes mellitus (DM) had it for an average of 8.9 ± 7.9 years, but it could last

anywhere from 3 months to 40 years. The length of DM and DR were linked in a way that was statistically significant.

Table 1: Diabetic retinopathy and peripheral neuropathy correlation

Biothesiometer	Normal	NPDR	Maculopathy	Total
Normal	4	0	1	5
Mild	6	0	2	8
Moderate	20	1	1	22
Severe	50	13	4	67
Total	80	12	8	100

Table 2: The relationship between HbA1c and peripheral neuropathy screening methods

Variables	Good control	Fairly good	Poor control	Total
Normal (score < 8)	5	25	60	90
Abnormal (score ≥ 8)	1	0	3	4
Normal (score 20)	5	20	50	75
Grade 1 (score 19)	1	1	1	3
Grade 2 (score 18)	0	1	1	2
Grade 3 (score 0-17)	2	2	16	20
Normal (< 9 Volts)	0	2	1	3
Mild	0	6	4	10
Moderate	5	5	10	20
Severe	5	14	51	70

Anterior retinopathy was seen in 14 of the 51 patients whose diabetes was not well controlled, 4 of the 5 patients whose diabetes was mostly well controlled, and 1 of the 9 patients whose diabetes was well controlled. Diabetes retinopathy (DR) and glycated hemoglobin (HbA1c) were not found to be significantly linked. There was, however, a statistically significant link between DR and HbA1c. This might be because the people in the study have had diabetes mellitus for a shorter amount of time.

Discussions

If a person has symptoms and/or signs of damage to their peripheral nerves, and no other possible reasons of neuropathy have been ruled out, then diabetic polyneuropathy can be diagnosed. Problems seen in nerve conduction exams, especially those that deal with nerves in the lower limbs, add to the evidence for this diagnosis. Several tools have been created to quickly and fully check for symptoms and signs of DPN. One of the scales used to define and group neuropathy is the TCNS, which is a valid and accurate clinical assessment tool that is often used in study and therapy [10, 11].

The current study used TCNS to divide neuropathy into three separate groups: neuropathy that wasn't present, low to moderate neuropathy, and severe neuropathy. People with DPN may have a variety of pathophysiologies that cause their symptoms. Some risk factors are linked to peripheral neuropathy in people with type 2 diabetes mellitus [12]. This study looked at a lot of different factors, including how long someone had been diagnosed with diabetes mellitus, their body mass index, their systolic and diastolic blood pressure, and their total cholesterol. The length of time since being diagnosed with DM was very different between the groups that were looked at in this study. The shortest amount of time in years was in group 1, which did not have neuropathy. On the other hand, the largest amount of time was in group 2, which had severe neuropathy. No matter

how old the patient is, the length of time has been shown to be a reliable sign of neuropathy in people with diabetes ^[13]. The exact ways that having diabetes for a long time affects the start and seriousness of DPN are not fully understood yet. Chronic sugar and/or metabolic disturbance are thought to be the cause of nerve damage, not the length of time. Glycated hemoglobin is a way to find out what a person's normal blood sugar levels have been over the last two to three months. It is thought to be a useful way to keep an eye on a diabetic's long-term control of their blood sugar. Keeping your HbA1c numbers at the right level is important to stop or slow the development of diabetes complications like neuropathy ^[14].

According to this study, there was a strong link between HbA1c values and the progression and severity of DPN. Levels of cholesterol, systolic and diastolic blood pressure, and body mass index (BMI) all had a big effect on how often and how bad DPN was. Previous research had found a link between being overweight, not being active, and diabetic peripheral neuropathy (DPN) in people with type 2 diabetes. This study confirmed that link. High amounts of total cholesterol, which is known as dyslipidemia, have been shown to have a big effect on diabetic peripheral neuropathy (DPN). This effect might have something to do with endothelial dysfunction and oxidative stress on sense neurons in the dorsal root ganglion ^[15].

What the study found was that the conduction speeds and amplitudes of the motor and sensory nerves were very different between the groups. Neuropathy that was worse in some groups had slower conduction speeds and smaller SNAP and CMAP amplitudes. The peroneal nerve was the most damaged motor nerve. It was followed by the tibial nerve, the ulnar nerve, and finally the median nerve. It was more severe on sensory nerves than on motor nerves, especially the sural nerve, which was the most severely affected. In group 3, people with more serious neuropathy did not have any response from the sural nerve at all. These results are in line with those of a past study that was made public. In fact, people thought that damage to the sural nerve was needed to diagnose DPN ^[16].

Sensory nerves are more likely to get hurt than motor nerves because they cover longer distances in the body. This is why they are usually hurt before motor nerves. When levels of pro-inflammatory cytokines like IL-6 and tumor necrosis factor α rise, it is thought to have a big effect on the neuroinflammatory process that causes neuropathic pain and may be linked to how bad diabetic peripheral neuropathy (DPN) is. There was more interleukin-6 (IL-6) in the blood serum of patients with more serious diabetic peripheral neuropathy (DPN), according to the study. In general, these results were similar to those of earlier studies, such as one done in Germany that found people with diabetic peripheral neuropathy (DPN) had much higher amounts of interleukin-6 (IL-6) than people who did not have DPN ^[17].

The results of this study were different from those of another study that looked at the Emirati people. The last study showed that the average amounts of IL-6 in the blood of the two groups of patients did not change significantly. It was also found that the average readings of patients with DPN were lower than those of patients without DPN. IL-6 amounts in the blood are different for people of different races. Asians have lower levels than other races ^[18]. It was clear that the amounts of IL-6 in the blood were inversely related to the amplitude and conduction velocity of the sural

nerve. More than that, there was a link between the levels of HbA1c and the length of the illness. A greater chance of sural nerve axonal injury was linked to higher amounts of IL-6. The results were mostly the same as those of a previous study that found a strong negative relationship between the intensity of the compound muscle action potential (CMAP) and the sensory nerve action potential (SNAP) ^[19].

It's possible that these results are the first proof of IL-6's role in peripheral axonal nerve damage in diabetics. IL-6 is a pleiotropic cytokine that is made when tissue is damaged or infected. It makes the immune system do two things: innate and adapted. Pattern recognition receptors can affect neurons and glial cells by activating stromal and leukocyte cells ^[20]. These cells release IL-6 and bring in B and T lymphocytes. When things are just right, like when you're working out, IL-6 can be released. This can cause the body to adapt to intense exercise by releasing chemicals that reduce inflammation and speed up metabolism ^[21]. Different results have been found about the effects of serum IL-6 in people with DPN. This is because people who are physically active may gain more from higher levels of the protein. It is still not clear what role blood IL-6 plays in DPN. Higher amounts of IL-6 in the blood were linked to damage in the big nerve fibers that control movement and sensation. But it was not possible to find a direct cause-and-effect link. Damage to both big and small nerve fibers is caused by IL-6 in diabetic peripheral neuropathy (DPN) ^[22, 23].

Previous research has also found a strong link between the changes that happen to the retinal nerve fiber layer (RNFL) and the changes that happen to the peripheral nerves of people with diabetic peripheral neuropathy (DPN). They also looked at the difference in thickness between the retinal nerve fiber layer (RNFL) and the whole retinal layer and saw that DPN was significantly less thick ^[24].

Conclusions

The study's results show that the thicknesses of the inferior and temporal parapapillary regions, as well as the general thickness of the retinal nerve fiber layer (RNFL), can help predict how neuropathy will get worse and progress in people with type 2 diabetes. It was also discovered that these patients' blood IL-6 levels may be able to identify whether they have neuropathy and how bad it is. This means that IL-6 could be a reliable and accurate way to diagnose DPN in people with T2DM.

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None

Conflict of Interest

None

References

1. As R, Sinha B, Ghosh C, Chowdhury SG, Sengupta P. Association between duration of diabetes mellitus and presence as well as severity of diabetic retinopathy among type 2 diabetic patients: A tertiary care hospital based cross-sectional study. *Biomedicine*. 1928;43(1):303-309.
2. Bansal D, Gudala K, Muthyala H, Esam HP, Nayakallu R, Bhansali A. Prevalence and risk factors of development of peripheral diabetic neuropathy in type 2

- diabetes mellitus in a tertiary care setting. *J Diabetes Investig.* 2014;5(6).
3. Viswanath K, McGavin DD. Diabetic retinopathy: clinical findings and management. *Community Eye Health.* 2003;16(46):21-24.
4. Ahmad MF, Ahmad SM, Keservani RK, Pradhan A. Anti-ulcer activity of tuber extracts of *Solanum tuberosum* (Solanaceae) in rats. *Acta Facultatis Pharmaceuticae Universitatis Comenianae.* 2015;LXII(2):32-7..
5. Jarouliya U, Zacharia A, Keservani RK, Prasad GBKS. Protective effect of *Spirulina maxima* against fructose-induced oxidative stress in Wistar rats with histopathological observations. *Acta Facultatis Pharmaceuticae Universitatis Comenianae.* 2015;LXII(2):13-9.
6. Ahmad MF, Keservani RK, Babu DJM. Interaction study between *Ocimum sanctum* and glimepiride (sulfonylurea derivative) in diabetic rats. *Journal of Chinese Pharmaceutical Sciences.* 2015;24(3):156-163.
7. Feldman EL, Stevens MJ, Thomas PK, Brown MB, Canal N, Greene DA. A practical two-step quantitative clinical and electrophysiological assessment for diagnosing and staging diabetic neuropathy. *Diabetes Care.* 1994;17(11):1281-1289.
8. Olafsdottir E, Andersson DK, Dedorsson I, Svärdsudd K, Jansson SP, Stefánsson E. Early detection of type 2 diabetes mellitus and screening for retinopathy are associated with reduced prevalence and severity of retinopathy. *Acta Ophthalmologica.* 2016 May;94(3):232-239.
9. Sharma VK, Joshi MV, Vishnoi AA. Interrelation of retinopathy with peripheral neuropathy in diabetes mellitus. *Journal of Clinical Ophthalmology and Research.* 2016 May 1;4(2):83-87.
10. Hoque S, Muttalib MA, Islam MI, Happy TA. Evaluation of different HbA1c levels to assess the risk of peripheral neuropathy among type 2 diabetic patients along with other conventional risk factors. *Bangladesh Medical Research Council Bulletin.* 2016;42(2):95-103.
11. Nisar MU, Asad A, Waqas A, Ali N, Nisar A, Qayyum MA, Maryam H, Javaid M, Jamil M. Association of diabetic neuropathy with duration of type 2 diabetes and glycemic control. *Cureus.* 2015 Aug;7(8).
12. Lee WJ, Jang S, Lee SH, Lee HS. Correlation between the severity of diabetic peripheral polyneuropathy and glycosylated hemoglobin levels: a quantitative study. *Annals of rehabilitation medicine.* 2016 Apr 25;40(2):263-270.
13. Xu F, Zhao LH, Su JB, Chen T, Wang XQ, Chen JF, Wu G, Jin Y, Wang XH. The relationship between glycemic variability and diabetic peripheral neuropathy in type 2 diabetes with well-controlled HbA1c. *Diabetology & metabolic syndrome.* 2014 Dec;6:1-7.
14. Nisar MU, Asad A, Waqas A, Ali N, Nisar A, Qayyum MA, *et al.* Association of diabetic neuropathy with duration of type 2 diabetes and glycemic control. *Cureus.* 2015 Aug;7(8).
15. Salvotelli L, Stoico V, Perrone F, Cacciatori V, Negri C, Brangani C, *et al.* Prevalence of neuropathy in type 2 diabetic patients and its association with other diabetes complications: The Verona Diabetic Foot Screening Program. *Journal of diabetes and its complications.* 2015 Nov 1;29(8):1066-70.
16. Lee WJ, Jang S, Lee SH, Lee HS. Correlation between the severity of diabetic peripheral polyneuropathy and glycosylated hemoglobin levels: a quantitative study. *Annals of rehabilitation medicine.* 2016 Apr 25;40(2):263-270.
17. Bansal D, Gudala K, Muthyala H, Esam HP, Nayakallu R, Bhansali A. Prevalence and risk factors of development of peripheral diabetic neuropathy in type 2 diabetes mellitus in a tertiary care setting. *Journal of diabetes investigation.* 2014 Nov;5(6):714-721.
18. Salvotelli L, Stoico V, Perrone F, Cacciatori V, Negri C, Brangani C, *et al.* Prevalence of neuropathy in type 2 diabetic patients and its association with other diabetes complications: The Verona Diabetic Foot Screening Program. *Journal of diabetes and its complications.* 2015 Nov 1;29(8):1066-1070.
19. Azura MS, Adibah HI, Juwita S. Risk factor of peripheral neuropathy among newly diagnosed type 2 diabetic patients in primary care clinic. *International Journal of Collaborative Research on Internal Medicine & Public Health.* 2012 Nov 1;4(11):1858.
20. He BB, Wei L, Gu YJ, Han JF, Li M, Liu YX, *et al.* Factors associated with diabetic retinopathy in chinese patients with type 2 diabetes mellitus. *International journal of endocrinology.* 2012;2012(1):157940.
21. Hassan KM, Balaji R, Gnaneswaran S, Kumar JS. To Study the association of HbA1C with retinopathy, neuropathy and high risk foot among diabetic patients attending rural tertiary care Hospital of Tamil Nadu, India. *Int J Ophthalmol Eye Res.* 2016 May 31;4(4):206-211.
22. Mohmad AH, Hassan A. Correlation between retinopathy, nephropathy and peripheral neuropathy among adult Sudanese diabetic patients. *Sudan Journal of Medical Sciences.* 2011;6(1).
23. Ali MH, Draman N, Mohamed WM, Yaakub A, Embong Z. Predictors of proliferative diabetic retinopathy among patients with type 2 diabetes mellitus in Malaysia as detected by fundus photography. *Journal of Taibah University Medical Sciences.* 2016 Aug 1;11(4):353-358.
24. de Souza LR, Debiasi D, Ceretta LB, Simões PW, Tuon L. Meta-analysis and meta-regression of the prevalence of diabetic peripheral neuropathy among patients with type 2 diabetes mellitus. *International Archives of Medicine.* 2016 May 17;9.