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Original Research Article

An assessment of the patterns and severity of diabetic neuropathy using the modified - Toronto Clinical Neuropathy Score in recently detected diabeticsAaron Charles Lobo^{*1}, Peter George² and Kavina Marian Fernandes¹¹Resident, ²Professor; Department of Medicine, Father Muller Medical College, Mangaluru, 575002 India

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***Correspondence Info:**Dr. Aaron Charles Lobo,
Resident,
Department of Medicine,
Father Muller Medical College, Mangaluru, India***Article History:****Received:** 04/05/2017**Revised:** 16/05/2017**Accepted:** 19/05/2017**DOI:** <https://doi.org/10.7439/ijbr.v8i5.4142>**Abstract****Introduction:** Diabetic neuropathy is among the commonest vascular complication of diabetes mellitus. Even individuals with pre-diabetes are at risk of developing diabetic neuropathy (DN). Over 50% of individuals with DN are asymptomatic, keeping them at a higher risk of developing diabetic foot. The study aimed to ascertain the patterns and severity of diabetic neuropathy among patients with recently detected diabetes mellitus, using the 'modified -Toronto Clinical Neuropathy Score' (m-TCNS).**Materials & methods:** This prospective observational study was done on 50 patients with diabetes of less than 1 year duration. Patients who fulfilled the selection criteria were recruited to the study after obtaining a written informed consent. After obtaining details of their medical history, clinical examination and investigations, patients underwent m-TCNS. Laboratory tests included sugar levels, HbA1c and urine albumin. The incidence, severity and patterns of diabetic neuropathy (DN) and its correlation to the duration, diabetes control, presence of retinopathy and albuminuria were analyzed by descriptive statistics, Chi-square test and 't' test.**Results:** Among the 50 patients, there were 18 males and 32 females with a mean (\pm SD) age of 56.44 (\pm 10.82) years. Among them, 29 patients were new to treatment for diabetes. The average random blood sugar (RBS) and glycated hemoglobin (HbA1c) were 249.92 (\pm 126.63) mg/dl and 10.532 (\pm 10.64) gm% respectively. Only 46% patients had symptoms and 34% had signs of diabetic neuropathy. Pain being the commonest symptom (24%) and loss of vibration sense the most frequent sign (26%) in these patients. Features of diabetic retinopathy and albuminuria were present in 6/50 (12%) and 20/50 (40%) patients respectively. The presence or severity of neuropathic signs or symptoms had no statistically significant correlation to their glycemic control. There was a significant correlation of presence of neuropathy with albuminuria and retinopathy.**Conclusion:** The study establishes the use of m-TCNS as a simple and good screening tool to detect diabetic neuropathy. Pain and loss of vibration sense were the most common symptom and sign in DN. The severity of neuropathy was mild in this study, but had a significant correlation with other microvascular complications. We recommend all newly detected patients with diabetes to undergo screening tests for its microvascular complications.**Keywords:** Diabetic Neuropathy, clinical screening, modified Toronto Clinical Neuropathy Score, m-TCNS, recently detected Diabetes.**1. Introduction**

The prevalence of Diabetes Mellitus (DM) in India is 9.5%.[1] Diabetic Neuropathy (DN) is one among the microvascular complications of Diabetes. Amongst the various neuropathies described in diabetes, chronic

sensorimotor distal polyneuropathy (DPN) is the commonest.[2]

DPN and other microvascular complications of diabetes are recognized in newly detected diabetics.[5] Even

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individuals with pre-diabetes are at significant risk for developing diabetic neuropathy[6]. DPN is recognized as a major risk factor for diabetes related amputations.

Thus, early detection of DPN and establishing good foot care is essential in the prevention of diabetic foot.[2] Simple clinical screening tests are effective in detecting DPN.[3] The modified - Toronto Clinical Neuropathy Score (m-TCNS) is a useful screening tool to detect DPN. It has been validated as a suitable substitute to the established Toronto Clinical Neuropathy Score.[4]

We used m-TCNS to assess the patterns and severity of diabetic neuropathy in recently detected diabetics.

1.1 Objectives

1. To ascertain the patterns and severity of diabetic neuropathy in recently detected diabetics using m-TCNS.
2. Correlation between diabetic neuropathy and other microvascular complications in recently detected diabetics.

2. Materials and Methodology

2.1 Source of data and study design

The source of data was those patients who were recently detected (within 1 year) with Type 2 Diabetes Mellitus attending to the out-patient and in-patient services of a tertiary care teaching hospital in Mangaluru, South India. This was designed as a prospective observational cross-sectional pilot study on 50 patients. The study was done from 1st of May to 30th of September 2015 among patients with recently detected diabetes.

2.2 Methodology

Recently detected diabetes patients attending the in-patient and out-patient services were randomly identified. Those patients who fulfilled the selection criteria and had given a written informed consent were included in the study. Their clinical details including - age, sex, treatment for T2DM, glycemic control and duration were obtained. A clinical and biochemical assessment of diabetes and its microvascular complications were done. This included; an un-dilated fundoscopic examination to identify diabetic retinopathy, Random Blood Sugar (RBS), Glycated hemoglobin (HbA1c) levels to determine glycemic control

and urine albumin for diabetic nephropathy [5]. They were further screened and scored as per m-TCNS.[4]

The patterns and severity of diabetic chronic sensorimotor neuropathy were assessed using the m-TCNS. Components assessed included presence/absence as well as severity of symptoms i.e. of Foot pain, Numbness, Tingling, Weakness, Ataxia, Upper limb symptoms. Signs assessed included Pinprick, Temperature, Light touch, Vibration, Position Sense.

As the m-TCNS doesn't classify severity of neuropathy into preassigned categories based on scoring, an arbitrary scoring was done. The total severity score of 18 for symptoms were graded as 1-6 (mild), 7-12 (moderate) and 13-18 (severe). Signs had a total score of 15; which were graded as 1-5 (mild), 6-10 (moderate) and 11-15 (severe). These scores were the sum of severity scores for individual signs and symptoms for each patient. The data were captured to a preformatted sheet for further analysis.

2.3 Selection criteria

2.3.1 Inclusion criteria: (1) Patients detected with Type 2 diabetes mellitus within 1 year.

2.3.2 Exclusion criteria: (1) Pre-existing neuropathies. (2) History of spinal surgery or vertebral injury. (3) History of Stroke in past.

2.4 Statistical analysis

Statistical analysis was done using the Statistical Package for Social Sciences (SPSS version 11.5). Using descriptive statistics, Chi-square test and "t" test; the incidence, severity and patterns of diabetic polyneuropathy (DPN) and its correlation with duration, diabetes control, retinopathy and albuminuria were studied.

3. Results

Among the 50 included in the study 18 were male and 32 were female patients. The mean age was 56.44 (\pm 10.82) years. The mean duration of DM in the study population was 3.08 months. In this study, 58% of patients were not on diabetic medications.

The average random blood sugar (RBS) and glycated hemoglobin (HbA1c) levels were 249.92 (\pm 126.63) mg/dl and 10.532 (\pm 10.64) gm% respectively. The un-dilated fundus examination showed features of retinopathy in 12% patients. Albuminuria was observed in 40% of the patients.

Table 1: Occurrence of neuropathic signs and symptoms

Symptoms	No. of patients (%)	Sign	No. of patients (%)
Pain	12/50 (24%)	Vibration	13/50 (26%)
Tingling	6/50 (12%)	Fine touch	10/50 (20%)
Numbness	8/50 (16%)	Temperature	5/50 (10%)
Ataxia	3/50 (6%)	Pinprick	3/50 (6%)
Weakness	3/50 (6%)	Position	1/50 (2%)

Among the 50 patients assessed 46% had symptoms of neuropathy. Symptoms are represented in Table 1. The commonest symptom was pain (24%), followed by numbness (16%) and tingling (12%). Other symptoms were ataxia and weakness of lower limbs; noted in 6% of patients. Symptoms in upper limbs were felt only by one patient. The severity score > 3 on m-TCNS was noted only in 3 patients.

The total symptom severity score was the sum of the severity score of each symptom in a patient. All the symptomatic patients had only mild neurological symptoms (total symptom severity score: 1-6). None of the symptoms when assessed individually correlated significantly with the random blood sugar or HbA1c levels (p value > 0.5) as depicted in Table 2. The total symptom severity score did not show statistically significant correlation with RBS (p

value = 0.705) and HbA1c (p = 0.785) either. The duration of treatment did not correlate with the total symptom severity score (p <0.5). However, there was a significant correlation between presence of neurological symptoms with diabetic retinopathy (p = 0.005) and albuminuria (p = 0.052).

Among our patients, 17/50 (34 %) had signs of neuropathy. Impaired sensation of vibration was the common sign in 26% (13/50) of patients. Other signs were impaired fine touch observed in 10/50 (20%), temperature in 5/50 (10%), pin prick in 3/50 (6%) and position sense in 1/50 (2%) as represented in Table 1. When signs were analyzed individually for severity, impaired vibration was found to be severe in 7 of the 13 patients; a score of 2-3 by m-TCNS. The severity of signs was mild in 14 patients; and moderate in 3 patients.

Table 2: Correlation of Neuropathic Symptoms and Signs with glycemic control and microvascular complications (values denoted are 'p' values)

Neuropathic symptoms (p value) (n=50)						
	Pain	Tingling	Numbness	Ataxia	Weakness	Upper limb symptoms
HbA1c	0.998	0.922	0.894	0.929	0.921	0.799
Random sugar	0.757	0.312	0.938	0.715	0.000	0.705
Presence of retinopathy	0.002	0.653	0.177	0.020	0.814	0.716
Albuminuria	.000	0.458	0.063	0.457	0.253	0.224
Neuropathic signs (p value)						
	Pin prick	Temperature	Fine touch	Vibration	Position	
HbA1c	0.952	0.941	0.998	0.975	0.806	
Random sugar	0.975	0.944	0.830	0.802	0.694	
Presence of retinopathy	0.250	0.000	0.007	0.078	0.716	
Albuminuria	0.029	0.014	0.065	0.002	0.224	

The correlation between individual signs and degree of glycemic control was poor. A few signs correlated well with retinopathy and albuminuria, but no specific pattern was noted (Table 2). The total severity score for signs did not show a significant correlation with random blood sugar or HbA1c levels (p >0.5). The duration of treatment showed no significant correlation with the total sign severity score (p <0.5). But there was significant correlation between total sign severity score with retinopathy (p =0.008) and albuminuria (p =0.004).

4. Discussion

Early screening for detection of diabetic neuropathy and peripheral occlusive vascular disease among diabetics might significantly reduce diabetes related limb amputations.[2] Regular screening for neuropathy among diabetics in India is not as per the standards of care across the world. The lack of disease awareness and its complications among caregivers, patients and other stakeholders in diabetic care is the possible reason.[7] The ADA guidelines [8] recommend screening for DPN at the

time of diagnosis of Type 2-DM. In the present study, m-TCNS was used as a screening tool for its simplicity and efficacy. Zillox *et al* found comparable results with m-TCNS and nerve conduction studies (NCS) among patients with impaired glucose tolerance in identifying DPN. [9]

In this study done among recently detected diabetes patients; 46% had symptoms and 34% had signs of DPN. The incidence of DN in similar studies across India varied from 28.8 -31 %. [10-12]. Contrary to these studies, Sosale A *et al* found its incidence to be much lower at 13.5 %. [13] The high incidence of DN among recently detected DM is worrisome. This raises suspicion on the public awareness on early screening for diabetes or early manifestation of complication in the Indian population. Such high numbers warrant mandatory screening for DPN in every newly detected diabetes patient.

In this study, pain was the most common symptom (24%), followed by numbness (16%), tingling of the feet (12%) and weakness/ataxia (6%). Similar findings were made by Katulanda *et al*[13], where the most common symptoms were burning/pain or tenderness (15.7%),

followed by numbness (12.6%), pins and needles sensation in lower limbs (11.5%) and ataxia (10.5%). Dutta A *et al*[12] found tingling and numbness (21.87 %), tingling and burning sensation of feet (12.5%) and weakness of the limbs (6.2%) in patients with newly detected diabetes. Signs of neuropathy were seen in 34% of patients in the present study. Impairment of vibration sensation was the commonest sign (26%) followed by impairment in fine touch (20%), temperature (10%), pin prick and position sense (6%) in these patients. Dutta A *et al*[12] found 30% of their patients with DM to have neuropathic signs. The observed pattern and prevalence of symptoms and signs of DN in the present study were in concurrence to similar studies.

Small and large fibre neuropathies occur early in DPN. The small fibre neuropathies primarily manifests as pain, burning and paresthesia in lower limbs during the early phase of diabetes. Large fibre neuropathy in diabetes occurs with signs of neuropathy; manifesting as impaired vibration or joint sense. The numbness and weakness of lower limbs occur much later in the illness. In this study, the predominant neuropathic symptom was pain and the sign being impaired vibration sense. [9,14]

Our study assessed and evaluated patterns of presentation of symptoms and signs of distal chronic sensorimotor polyneuropathy. Most patients had symptoms of pain and impaired vibration sense. Brill V *et al* who compared m-TCNS with TCNS found pain to be a dominant symptom as compared to tingling and numbness in diabetic neuropathy.[4] In the present study participants had mild symptoms while signs ranged from mild and moderate severity. Katlunda *et al* assessed the severity of neuropathy by utilizing the Toronto Clinical Scoring System (TCSS). They found neuropathy to be mild in 16.6%, moderate in 7.1% and severe in only 1 patient.

Attaining glycemic control is the key to prevent or delay the complications in diabetes; including neuropathy.[6,15] The current study, could not demonstrate a significant correlation between indicators of glycemic control (RBS and HbA1c) and presence of DPN. Similar observations were noted by Azura MS *et al*.[16] A study conducted in Chandigarh [17], found that poor glycemic control, elevated triglycerides, serum creatinine and male gender to be important risk factors for developing microvascular complications of diabetes.

Diabetic retinopathy and its association with diabetic neuropathy is well established. In this study, 12% of patients had features of retinopathy. In a study from UK, 35% of the newly detected diabetes had diabetic retinopathy. This indicate to inter-ethnic and regional factors affecting its incidence.[18] The presence of retinopathy had significant positive correlation with DPN in

the present study and studies by Katlunda *et al* ($p < 0.01$) and CURES *et al* ($p < 0.01$)[15].

Though, 40% patients in the present study had evidence of albumin in urine, it was not quantified. Albuminuria showed a statistically significant relationship between presence of retinopathy and DN. In a study done at Lucknow, 7.9% of newly diagnosed T2DM patients had albuminuria; but did not show any significant association with DPN.[19] The prevalence of albuminuria was 17.2% in a study from Netherlands; with significant association with DN.[5]

The predominance of milder forms of neuropathy in the present study maybe from selection of patients with shorter duration of diabetes. As patients had recently detected diabetes and most had milder forms of diabetic neuropathy, m-TCNS could not identify the patterns and severity. Screening for impaired vibration sensation using a 128 Hz tuning fork is a time tested, reliable bedside method in assessing DN.

This being a pilot study had the following limitations; (1) small study group, (2) selection only based on known duration of illness (3) failure to exclude other causes of neuropathy; and (4) failure to quantify retinopathy or nephropathy.

The significantly high incidence of diabetic neuropathy in newly detected cases of neuropathy warrant close screening of all DM patients. As observed in this study, most of the microvascular complication occurs as a cluster. A patient having neuropathic pain in his/ her extremities might be manifesting retinopathy or nephropathy; mandating routine evaluation.

5. Conclusion

The study establishes the use of m-TCNS as a simple and good screening tool to detect diabetic neuropathy. The occurrence of DN in patients with recently detected diabetes is high. Pain and loss of vibration sense were the most common symptom and sign respectively. Though the severity of neuropathy were mild in this study, it had a significant correlation with other microvascular complications of diabetes. We recommend all newly detected diabetes to undergo screening tests for detection of microvascular complications of diabetes.

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Conflicts of Interest: None declared.

Other disclosures: None declared.

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