Section: General Medicine

Original Research Article

PREVALENCE OF NEUROPATHY IN TYPE 2 DIABETIC PATIENTS WITH AND WITHOUT METABOLIC SYNDROME

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Abstract

Background: Diabetes mellitus is a heterogenous group of metabolic disorders characterised by chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism as a result of defect in insulin secretion, action or both. The present study is being done to find out the prevalence of neuropathy in type 2 diabetic patients with and without metabolic syndrome. **Objectives:** To find out the prevalence of neuropathy in type 2 diabetic patients with and without metabolic syndrome. **Materials and Methods:** Known or previously diagnosed Type 2 Diabetes Mellitus patients and Type 2 diabetics coming under the NCEP: ATP 3 category of Metabolic syndrome attending medicine OPD or casualty or admitted in SRI MANAKULA VINAYAGAR MEDICAL COLLEGE AND HOSPITAL, MADAGADIPET, PONDICHERRY irrespective of the duration of diabetes. All the patients were evaluated with detailed history, general survey, and examination of neuropathy. **Results:** Out of sample size of 180 patients, 90 patients had metabolic syndrome and remaining 90 patients were without metabolic syndrome. The prevalence of neuropathy was higher in group with metabolic syndrome compared to group without metabolic syndrome (65.56% vs 40% respectively, p value < 0.001). The mean value of total cholesterol in patients with metabolic syndrome and patients without metabolic syndrome was 193.17± 45.29 and 176.9± 47.07 respectively, (p value < 0.001), mean value of triglycerides was 168.57± 84.94 and 138.38± 60.33 respectively, (p value < 0.001). **Conclusion:** Our study showed that the prevalence of neuropathy is higher in type 2 diabetic patients with metabolic syndrome compared to type 2 diabetic patients without metabolic syndrome and that the individual components of metabolic syndrome may contribute to the development of diabetic neuropathy in these patients.

INTRODUCTION

Type 2 Diabetes mellitus is a heterogeneous disease comprising of beta cell dysfunction and insulin resistance.[1] The chronic hyperglycaemic state in diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Neuropathies are among the most common of all the long term complications of diabetes, affecting up to 50% of patients.[2] By definition Diabetic peripheral neuropathy (DPN) is a somatic or autonomic neuropathy which is attributed solely to diabetes mellitus.[3]

Metabolic Syndrome is defined as a constellation of an interconnected physiological, biochemical, clinical, and metabolic factors that directly increases the risk of atherosclerotic cardiovascular disease (ASCVD), T2DM, and all-cause mortality.4, 5Metabolic syndrome is constituted by Insulin resistance, visceral adiposity, atherogeni cdyslipidemia, endothelial dysfunction, genetic susceptibility, high blood pressure and hypercoagulable state. Approximately 70-80% of the population with diabetes mellitus are diagnosed with Metabolic Syndrome.[6,7]

According to the NCEP.[8] ATP 3 criteria, for a person to be defined as having the metabolic syndrome they must have three or more of the following

- Central obesity (defined as waist circumference ≥ 90 cm for south Asian men and ≥ 80 cm for

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south Asian women, with ethnicity specific values for other groups)

- Raised TG level: ≥ 150 mg/dL (1.7 mmol/L), or specific treatment for this lipid abnormality.
- Reduced HDL cholesterol: < 40 mg/dL(1.03 mmol/L) in males and < 50 mg/dL (1.29 mmol/L) in females, or specific treatment for this lipid abnormality.
- Raised blood pressure: systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg, or treatment of previously diagnosed hypertension.
- Raised fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes.

Not many studies have been done comparing the prevalence of neuropathy in diabetic patients and in diabetics with metabolic syndrome.

MATERIALS AND METHODS

This study is a cross-sectional, analytical, single centre study conducted at SRI MANAKULA VINAYAGAR MEDICAL COLLEGE AND HOSPITAL, MADAGADIPET, PONDICHERRY from September 2012 to June 2014irrespective of the duration of diabetes. All patients who fit the inclusion criteria were included in the study. A total of 180 cases were included in this study after applying inclusion criteria. Simple random sampling of known/ previously diagnosed type 2 diabetes patients and type 2 diabetics coming under the NCEP: ATP 3 criteria of metabolic syndrome attending medicine OPD or casualty or admitted in Sri Manakula Vinayagar Medical College and Hospital, Madagadipet, Pondicherry from September 2012 to June 2014 irrespective of the duration of diabetes.

Inclusion Criteria

- Known / previously diagnosed Type 2 Diabetes Mellitus patients irrespective of the duration of diabetes.
- Type 2 Diabetic patients coming under the NCEP: ATP3 criteria of metabolic syndrome.

Exclusion Criteria

- Patients with maturity onset diabetes of young
- Patients on Thiazide diuretics, Beta blockers, Oral contraceptives, Hormone replacement therapy, Steroids, Anti retro viral drugs.

Institute Ethical Committee approved the study

Method of Collection of Data

For the purpose of the study venous blood was drawn from each of the patient for estimation of FBS, PPBS, HbA1c, FLP. Nerve conduction study was done of both lower limbs.

Serum total cholesterol (TC) was measured by cholesterol oxidase – peroxidase method, triacylglycerol (TG) levels by cholesterol oxidase – peroxidase method and high density lipoproteins (HDL) by divalent cation precipitation method. Low density lipoproteins (LDL) and very low density lipoproteins (VLDL) were calculated by Friedwald's formula9 where VLDL was calculated as Triglyceride/5, and LDL was taken as total cholesterol-(HDL + VLDL).

Statistical Analysis

The statistical analysis was performed using SPSS for windows version 22.0 software. The findings were present in number and percentage analyzed by frequency, percent. Chi‐ square test was used to find the association among variables. The critical value of P indicating the probability of significant difference was taken as <0.05 for comparison.

RESULTS

Table 1: Age and Gender wise distribution of cases

Age group (in years)	Number of cases
20-29	1
30-39	8
40-49	42
50-59	64
60-69	42
70-79	23

As per table 1 the total population of this study was constituted by 180 patients. The age range of diabetic patients with and without metabolic syndrome studied was 28-78 years. Maximum number of cases was in the age group of 50-59 years and least number of cases in the age group of 20-29 years. Of the total sample size of 180 patients 92 patients (51.11%) were males and 88 patients (48.99%) were females. The number of male patients in group A was 47 (52.22%) and female patients were 43 (47.78%). Group B constituted of 45 male patients (50%) and 45 female patients (50%). Patients in group A (diabetics without metabolic syndrome) and group B (diabetics with metabolic syndrome).

Table 2: Clinically measured parameters in Group A and Group B

	A	B
BMI (kg/m^2)	24 ± 1.54	31.42 ± 1.73
WAIST CIRCUMFERENCE (cm)	71.64 ± 5.95	95.29 ± 6.21
SBP (mmHg)	119.44 ± 9.15	158.87 ± 6.21
DBP (mmHg)	74.9 ± 6.38	99.22 ± 7.66

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As per table 2 the mean Body Mass Index in group A was 24± 1.54 and that in group B was 31.42± 1.73. The mean waist circumference in group A was 71.64± 5.95 and in group B was 95.29± 6.21. The mean systolic and diastolic blood pressures in Group A was 119.44± 9.15 and 74.9± 6.38 respectively and that in group B was 158.87± 6.21 and 99.22± 7.66 respectively.
The mean BMI, WC, SBP, DBP were higher in group B compared to group A ($p<0.001$).

Table 3: Biochemical parameters in Group A and Group B

	A	B
FBS (mg/dl)	177.11± 79.25	186.43± 67.33
PPBS (mg/dl)	272.38± 97.55	292.69± 95.67
HbA1c (%)	7.98± 0.98	8.27± 1.06
TC (mg/dl)	176.9± 47.07	193.17± 45.29
TG (mg/dl)	138.38± 60.33	168.57± 84.94
HDL (mg/dl)	39.73± 8.47	39.01± 6.88
LDL (mg/dl)	106.19± 37.80	118.5± 36.05
VLDL (mg/dl)	28.03± 11.89	30.8± 12.93

The mean value of FBS in Group A was 177.11± 79.25 while that in group B was 186.43± 67.33. Group A showed a mean PPBS value of 272.38± 97.55 compared to 292.69± 95.67 in group B. The mean HbA1c level in group A was 7.98± 0.98 while that in group B was 8.27± 1.06.

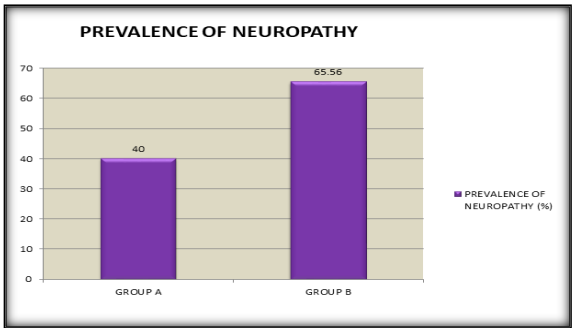

Figure 1: The percentage of prevalence of neuropathy in Group A and Group B

Figure 1 depicts the percentage of prevalence of neuropathy in both the groups. Out of the 90 patients in group A 36 had neuropathy and hence the prevalence of neuropathy in group A was 40%. In group B out of 90 patients 59 of them had neuropathy and so the prevalence of neuropathy in this group was 65.56%. The prevalence of neuropathy was higher in group A compared to Group B.

Table 4: The mean measured values of BMI and Waist circumference in Groups A1, A2, B1, B2

	A1 (Diabetics without metabolic syndrome not having neuropathy)	A2 (Diabetics without metabolic syndrome having neuropathy)	B1 (Diabetics with metabolic syndrome not having neuropathy)	B2 (Diabetics with metabolic syndrome having neuropathy)
BMI (Kg/m2)	22.48 ± 1.3	23.89 ± 1.15	31.01 ± 1.84	31.65 ± 1.65
Waist circumference (cm)	69.8 ± 5.05	75.30 ± 4.22	93.39 ± 5.60	96.29 ± 6.33

Group A1 had a mean BMI of 22.48± 1.3 and a mean waist circumference of 69.8± 5.05. Group A2 had a mean BMI of 23.89± 1.15 and waist circumference of 75.30± 4.22. The mean BMI in group B1 was 31.01± 1.84 and waist circumference was 93.39± 5.60. Group B2 had a mean BMI of 31.65± 1.65 and waist circumference of 96.29± 6.33.

Table 5: Biochemical parameters in Groups A1, A2, B1, B2

	A1	A2	B1	B2
FBS (mg/dl)	168.09 ± 82.33	190.64 ± 73.42	161.06 ± 59	199.76 ± 67.63
PPBS (mg/dl)	248 ± 90.88	308.94 ± 96.95	241.64 ± 76.47	319.51 ± 94.32
HbA1c (%)	7.56 ± 0.74	8.6 ± 0.96	7.40 ± 0.58	8.72 ± 0.96
TC (mg/dl)	171.63 ± 39.37	184.80 ± 56.40	172.52 ± 39.06	204.02 ± 44.83
TG (mg/dl)	132.83 ± 52.92	146.70 ± 69.99	115.03 ± 38.98	196.69 ± 89.16
HDL (mg/dl)	39.71 ± 8.08	40.58 ± 9.08	37.71 ± 5.19	39.69 ± 7.58
LDL (mg/dl)	103.02 ± 33.87	110.94 ± 43.10	111.87 ± 33.94	121.9 ± 36.91
VLDL (mg/dl)	27.52 ± 11.050	28.80 ± 13.17	23.16 ± 7.85	34.81 ± 13.3

The mean value of FBS in Group A1 was 168.09± 82.33, group A2 was 190.64± 73.42, group B1 was 161.06± 59 and group B2 was 199.76± 67.63. The mean value of PPBS in group A1 was 248± 90.88, group A2 was

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308.94± 96.95, group B1 was 241.64± 76.47 and group B2 was 319.51± 94.32. The mean value of HbA1c in group A1 was 7.56± 0.74, group A2 was 8.6± 0.96, group B1 was 7.40± 0.58 and group B2 was 8.72± 0.96.

Table 6: Neuropathy symptom score (%) among patients with neuropathy

NEUROPATHY SYMPTOM SCORE	A2 (Diabetics without metabolic syndrome having neuropathy)	B2 (Diabetics with metabolic syndrome having neuropathy)
1	11.11	15.25
2	22.22	28.81
3	38.88	30.51
4	27.77	25.42

Table 6 shows the Neuropathy symptom score in both the groups. In group A2 11.11% of patients had a neuropathy symptom score of 1, 22.22% 0f patients had a score of 2, 38.88% of patients had a score of 3, 27.77% of patients had a score of 4. In group B2 15.25% of patients had a score of 1, 28.81% of had score of 2, 30.51% of patients had score of 3 and 25.42% of patients had a score of 4.

DISCUSSION

Neuropathy is one of the most common microvascular complications affecting about 50% of diabetic patients and the most common form of which is distal symmetrical neuropathy. The increased prevalence of neuropathy in type 2 diabetics has been described in great and extensive detail, over the last years in various studies.[10,11]

The prevalence of MS in our study was equal for both males and females compared to other Indian studies. Prevalence of MS was more in males compared to females.[12] The prevalence of diabetic peripheral neuropathy increased with age, from 2.1% in 30-39 age groups to 31.57% in 70-79 years age group.[13] This pattern was also seen in the study done where they had a 5% prevalence of neuropathy in 20-29 years age group and increased to 44.2% in the 70-79 years age group.[14]

Apart from age the prevalence of neuropathy in diabetic patients in our study increased with the duration of diabetes and other similar studies.[17,18]

On evaluating the influence of the duration of diabetes on the prevalence of neuropathy in patients with MS in our study, we found that the prevalence of neuropathy increased with the duration of diabetes. This was similar to the findings by Premlatha et al in their study.[15] But it differed from the where they found that the prevalence of neuropathy was higher in the group with lesser duration of diabetes and decreases with increase in the duration of diabetes.[16]

The results of the present study concur with beck who studied the influence of metabolic syndrome on chronic complications in patients with Type 2 diabetes and showed that patients with metabolic syndrome had higher prevalence of distal neuropathy (16 vs 6%, p= 0.048) than patients without metabolic syndrome.[1]

Similarly few authors in their study identified that apart from glucose intolerance hypertriglyceridemia is a significant risk factor for the development of axonal polyneuropathy.[16] The study had however observed gender wise differences with respect to the prevalence of MS and development of neuropathy. In their study there was a positive correlation between the number of components of MS and neuropathy in women which was significant when compared to men.[17]

Sensory neuropathy is the most common form of neuropathy in diabetics. In our study all neuropathic patients had sensory neuropathy. Autonomic neuropathy was found in 82.69% of the patients and it was more in patients with metabolic syndrome. This is supported by the study done by similar study showed that cardiac autonomic dysfunction was much more common in type 2 diabetics with metabolic syndrome when compared to type 2 diabetics without metabolic syndrome.[18]

CONCLUSION

There is an increasing trend of patients with diabetes to develop metabolic syndrome. This study therefore, helps in further understanding this unique association. It follows then, that this would help in refining current treatment guidelines for diabetic patients with metabolic syndrome. Hence it would imply that these patients identified early and aggressive treatment and management be started to prevent further microvascular complications. However, further studies are definitely indicated to bring this association to light.

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