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Sensorimotor Neuropathy in Type 2 Diabetes Mellitus -A Clinical and Electrophysiological Correlation

Medical Science

KEYWORDS : diabetes ,Duration , neuropathy , nerve conduction study

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ABSTRACT

Background : *Diabetic neuropathy(DN)is the most common and troublesome complication of D.M leading to great mortality and morbidity.Both micro and macro vascular predominate mainly due to delayed diagnosis . Hence this study was done for early evaluation of neuropathy with nerve conduction studies.*

Objectives : *1)To study the clinical and electrophysiological pattern of peripheral neuropathy inType 2 diabetes*
2)To determine association of diabetic neuropathy with duration of diabetes.

Methods and materials: *Cross sectional study done randomly involving 40 cases of Type 2 DM patients with or without symptoms of sensorimotor neuropathy. NCS was done using a EMG EP MARK 2 machine from RECORDER & MEDICARE SYSTEMS. Chi square test is the statistical method used in our study.*

Results: *Out of the 40 patients, 29 were male(72.5%)and 11 were females(27.5%)20 (50%)cases presented with the symptoms of diabetes.13 cases with both diabetes and neuropathy (32.5%) and 7 cases with neuropathy(17.5%).The symptoms include tingling and numbness(100%),burning sensation(25%),weakness in any limbs (15%),cramps in calves/foot, pain in any limbs(20%)and allodynia(5%).Vibration sense lost in 17.5%,ankle jerk in 12.5% .20 patients(50.0%)were found to be Symptomatic of neuropathy while 20 patients (50%) were asymptomatic.Major clinical type was distal symmetric sensory neuropathy(85%).The type of nerve damage observed was axonal degeneration(60%)found in symptomatics,while demyelinating type in(40%)More patients were seen in the duration of diabetes for 3-6 years.70% of patients with abnormal reports were on treatment with OHA's.Majority of the symptomatics (70.0%) were found to be in the OHA`s group. However 2 (10.0%) of the symptomatics were found to be first time detected diabetics who were not on any treatment.*

Conclusion : *Distal peripheral neuropathy presents before the onset of symptoms as demonstrated by NCS in asymptomatic diabetics. Patients with long standing diabetes and OHA's have higher incidenceof nerve conduction abnormalities.Axonal demyelination was the commonest nerve conduction abnormality which is a length dependent neuropathy can be diagnosed clinically by a monofilament test in resource limited settings.*

INTRODUCTION

Diabetes Mellitus (D.M.) is the third most common cause for morbidity and mortality, following cardiovascular diseases and malignancies. According to recent WHO estimates, presently India has 32 million diabetic subjects, and this is projected to increase to 100 million, i.e., a rise by 25% by the year 2035.1hence India will contribute to more than one fifth (20%) of the total diabetic population in the world.[1,2]Vascular complications both micro and macro vascular predominate the features of Indian diabetics mainly due to delayed diagnosis.Diabetic neuropathy (DN) is the most common and troublesome complication of D.M. leading to great mortality and morbidity.[3]It covers a wide range of abnormalities involving both peripheral and autonomic nerve functions.[3]

Hence this study was done for early evaluation of neuropathy with nerve conduction studies.

METHODS

Materials

Source of data : Patients of type 2 diabetes mellitus studied over a period of 1 year 2009-2010 .
Sample Size: 40 cases

Study design : One year cross section study

Inclusion Criteria: All patients of type 2 diabetes mellitus with or without symptoms of diabetic sensorimotor neuropathy.

Exclusion Criteria:

- Patients with type 1 diabetes mellitus.
- Patients below 15 years or above 70 years of age.
- Patients with established complications of neuropathy like diabetic foot etc.
- Patients with other causes of sensorimotor neuropathy

1. Drugs
2. Alcoholism
3. TB
4. HIV
5. Uremia
6. Hypothyroidism
7. Leprosy
8. Vasculitis
9. Spine abnormalities
10. Vit. B12 deficiency

Electrophysiology

A complete NCS was done for those patients, using a EMG EP MARK 2 machine from RECORDER & MEDICARE SYSTEMS, using the standard protocols and settings.

Statistical method

Chi square test is the statistical method used in our study.

OBJECTIVES

1. To study the clinical and electrophysiological pattern of peripheral neuropathy in patients with type 2 diabetes with particular reference to sensorimotor varieties.
2. To determine if an association exists between the diabetic neuropathy with duration of diabetes.

RESULTS

Total 40 patients of type 2 DM were included in the study.(Table No .1)

Table No .1: Distribution of patients according to sex

Sex	No. of Cases	Percentage (%)
Male	29	72.5
Female	11	27.5
Total	40	100

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Out of the 40 patients, 29 were male (72.5%) and 11 were females(27.5%) with the ratio of M:F ~ 3:1(Table No. 2)

Table No. 2 : Distribution of patients according to age

Age (Yrs)	No. of Cases	Percentage (%)
31-40	8	20.0
41-50	9	22.5
51-60	15	37.5
61-70	8	20.0
Total	40	100

In this study, the minimum age was 34 years and maximum age observed was 68 years and the mean age was 51.9±10.2 years. Maximum number of cases (37.5%) observed were in the age group 51-60 years.

In this study it was observed that maximum of patients were in OHA's alone 23(5 7.5%), 13 (32.5%) were both on insulin and OHA's, 3 (7.5 %) were first time detected diabetics. Only 1(2.5%) was on insulin therapy alone.

Out of the 40 patients studied, 20 (50%)cases presented with the symptoms of diabetes only ; 13 cases presented with the symptoms of both diabetes and neuropathy (32.5%) and 7 cases presented with the symptoms of neuropathy only(17.5%).

The symptoms of diabetes noticed were polyuria (54.54%), polydypsia (36.36%), fatigue (18.18%), polyphagia (12.12%) and weight loss (9.09%).

The symptoms of neuropathy noticed were tingling and numbness (100%), burning sensation (25%),weakness in any limbs (15%),cramps in calves/foot and pain in any limbs (20% each) and allodynia (5%).

Among the physical signs, vibration sense was found to be lost in 17.5% of patients, ankle jerk lost in 12.5% of patients and power was normal elicited in all (100%) patients.

Out of the 40 patients studied, 20 patients (50.0%) were found to be Symptomatic of neuropathy while 20 patients (50%) were found to be asymptomatic. Out of the symptomatic group (n=2 0), major clinical type found was distal symmetric al sensory neuropathy (85%).(Table No. 3)

Table No. 3: Clinical presentation of neuropathy in relation to NCS report

Clinical	Normal NCS	Abnormal NCS	Total
presentation	(n=1 0)	(n=3 0)	
Asymptomatics	8 (40.0%)	12(60. 0%)	20
(n= 20)			
Symptomatics	2 (10.0%)	18 (90.0%)	20
(n= 20)			
(p=0.067 9)			

Association found between the clinical presentation and NCS report was not statistically significant.

Of the 40 patients studied, the type of nerve damage observed the most common was axonal degeneration (60%) found mostly in symptomatics, while demyelinating type of damage was seen in (40%) of patients.The most common type of neuropathy observed was axonal sensorimotor type (40%).Also 2 patients (10.0%) who were symptomatic were found to have a normal NCS report.

A strong association is found between the clinical presentation of neuropathy and duration of diabetes. More number of patients were seen in the duration of 3-6 years. The minimum duration of diabetes observed was 10 days and the maximum was observed to be of 6 years with a mean 3.57 ±1.66 months.(Table No:4)

Table no 4:. NCS report in relation to duration of diabetes

Duration of diabetes	Normal NCS (n=10)	Abnormal NCS (n=30)
(years)		
< 1	2	1
1-3	7	11
3-6	1	18

(p=0.00137)

A strong association is found between the NCS report and the duration of diabetes.There is an association between the clinical presentation of neuropathy and the blood sugar levels. The majority of symptomatics were in the range of 251- 300mg/dl. Theminimum value of blood sugar observed in this study was 200 mg/dl and the maximum value observed was 400mg/dl with a mean 267 ± 56.77 mg/dl.

There is found to be a strong association between the NCS reports and the blood sugar evels.

The association between the clinical presentation of neuropathy and the treatment history was not statistically significant. Majority of the symptomatics (70.0%) were found to be in the OHA`s group. However 2 (10.0%) of the symptomatics were found to be first time detected diabetics who were not on any treatment.

There is a strong association between the NCS reports and the treatment history. All the first time detected diabetics had an abnormal NCS report.

DISCUSSION

This study was conducted to know the electrophysiological and clinical profile of diabetic peripheral neuropathy. Another aim was to determine whether any association existed between the duration and severity of neuropathy to the electrophysiological profile.

Out of the 40 patients studied maximum number of cases (37.5%) observed were in the age group 51- 60 yrs. the minimum age was 34 yrs and the maximum age observed was 68 yrs and the mean 51.9±10.2 yrs. Out of the 40 patients, 29 were male (72.5%) and 11 were females (27.5%) with the ratio of M:F ~ 3:1

First time detected diabetics or DN as the presentation of diabetes

In our study, 2(5%) patients were found to be first time detected diabetics and they presented with symptoms of neuropathy as their presentation of diabetes.Marchal de calvi et al and Leyden E et al had observed incidence of neuropathic symptoms in 7.5% and 8.5% respectively in their study.

Clinical profile

In our study, 20 patients had symptoms of diabetes only (50%), 7 patients had symptoms of neuropathy only (17.5%) and 13 patients had symptoms of both diabetes and neu-

ropathy (32.5%).It is comparable to one study in which 12% of patients had symptoms of neuropathy only and 34.5% had both symptoms simultaneously.6

The most common diabetic symptoms observed in our study were polyuria (54.54%) and polydipsia (36.36%) with the most common neuropathy symptoms being sensory type in which tingling and numbness is the most common (100%) followed by others like burning sensations (25%), cramps and pain in any limbs (20% each). Motor symptoms were found to be very less in our patients (15%). The most common sign was loss of vibration sense (17.5%) , loss of ankle jerk (12.5%).These findings are consistent with one study which observed that sensory symptoms are the most common neuropathy symptoms with loss of vibration sense as the most common sign.6Another study also commented that most patients presents with predominantly sensory symptoms and that too positive symptoms like pain and paraesthesia.7.

Clinical presentation of neuropathy
In our study, 20 patients were found to be asymptomatic (50%) while equal number was asymptomatic. This observation is comparable to a study in which 45% of patients with type 2 DM were found to have symptoms of neuropathy.9

Among the symptomatics, the most common presentation observed was distal symmetrical sensory neuropathy (85%), sensorimotor neuropathy (10%), while mononeuritis multiplex in 1 (5%) case. It is comparable to a study who also noted that distal symmetrical sensory neuropathy was the most common clinical type (50%) noted.8

NCS report
Out of the 40 patients studied, reports of NCS revealed 30 abnormal studies (75%) while 10(25%) showed normal studies.

This alarming high figure and disparity is probably due to the small sample size, presence of subclinical neuropathy detected by electrophysiological methods, inadequate control of diabetes over a period of time or using NCS as a major criteria for diagnosis of neuropathy by which the prevalence increases.

These findings are consistent with one study which showed that electrophysiological abnormalities are seen more in the nerves of lower limb and the decrease in sensory and motor amplitudes are more pronounced findings that the slowing of the NCVs.11

Clinical presentation of neuropathy in relation to NCS report
In our study, among the asymptomatics 8(40%) showed normal NCS report while 12(60%) showed abnormal NCS reports. Among the symptomatics, 18(90%) showed abnormal NCS while 2(10%) showed normal NCS report.

The findings are consistent with a study which found that more than 80% of the asymptomatic recently diagnosed diabetics of one year duration had abnormal NCS reports.

Among the abnormal reports, axonal degeneration was observed as the most common type of nerve damage (60%) both in asymptomatics (50%) and symptomatics (50%). Only demyelination was observed in 6 patients(20%) The presence of both axonal degeneration and demyelination observed in 6 patient (20%). The reports were seen more commonly in symptomatic groups.

These findings are consistent with a study which showed, the most common electrophysiological abnormality was axonal degeneration in DN.[11]

Among the abnormal reports, axonal sensorimotor type was observed as the commonest type electrophysiologically (40%) present in both asymptomatics (23.33%) and symptomatics (16.66%). The next common types observed were axonal sensory type, Demyelinating sensorymotor neuropathy, and mixed axonal+demyelinatingsensorymotor neuropathies occurring in 20% patients each.

This finding is consistent with the report given by a study which stated that the mixed type (sensorimotor variety) as the predominant neuropathy, in diabetics determined electrophysiologically.14

However it was also observed that 2 patients (10%) who were symptomatic were found to have a normal NCS report.

Relation with duration of diabetes
In our study it was found that there is significant association between duration of diabetes and clinical presentation of neuropathy (p=0.0062). Symptom prevalence increased with increased duration of diabetes. In this study 10% of symptomatic patients had diabetes for less than an year, 20% had diabetes of 1-3 year duration, while 70% had diabetes of 3-6 years duration.

Other studies have also found significant association between duration of diabetes and symptoms of neuropathy.4,15,16,17,18

In our study it was found that there is a significant association between duration of diabetes and the NCS reports (p=0.00137). Diabetic duration of < 1 year had 3.33%, 1-3 years had 36.66% and 3-6 years had 60% of patients with abnormal NCS reports.

Other studies have also confirmed significant associations between duration of diabetes and the abnormal NCS reports.15,16,17

Relation with blood sugar levels
In our study it was found that there is significant association between the blood sugar levels and clinical presentation of neuropathy (p=0.0374). Blood sugar levels (RBS) of < 200 mg/dl had 0%, 201-250 mg/dl had 25%, 251-300 mg/dl had 50% and > 301 mg/dl had 25% of patients with symptoms of neuropathy.

Other studies have also found significant association between blood sugar levels and symptoms of neuropathy. [4,15,16,17,18]

In our study it was found that there is significant association between the blood sugar levels and the NCS reports (p=0.0003). Blood sugar levels (RBS) of < 200 mg/dl had 3.33%, 201-250 mg / dl had (23.33%); 251-300 mg/dl had (46.66%) and > 301 mg/dl had 26.66% of patients with abnormal reports of NCS.

Other studies have also found significant association between blood sugar levels and abnormal NCS.[15,16,17]

Relation to treatment modality.
In our study, it was found that there was no significant association between the treatment modality and clinical presentation of neuropathy (p=0.1027). 70.% of symptomatics

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were on OHA's group and 10% of symptomatics were first time detected. Whereas 5% of symptomatics were on insulin only along with 50% of asymptomatics were on both OHA's and insulin.

Reports of previous studied conducted are in conformity with our findings.[17,12]

In our study, it was found that there is a strong association between the treatment modality and the abnormal NCS reports ($p<0.0031$). 70.% of patients who had abnormal reports were on treatment with OHA's while 20% and 80% of patients who had normal reports were on treatment with OHA only and both drugs respectively. It is in conformity with the reports of previous studies.[12,17]

Inference: Diabetic patients who are on OHA's are found to have more clinical symptoms of neuropathy and their electrophysiological studies done are highly abnormal. Those patients on insulin are found to be asymptomatic and have normal electrophysiological study. Hence insulin could be protective against diabetic neuropathy probably because of good glycemic control.

In relation to motor conduction studies

In our study, it was found that there is a strong association between the amplitude of CMAP of common peroneal nerve to that of the abnormal NCS report ($p=0.0001$) and also the F wave latency ($p=0.0142$).

It is confirmatory with the reports of previous studies.[11,19,20]

The association between the F wave latency of common peroneal nerve to the NCS report was statistically significant.

In relation to sensory conduction studies

In our study, it was found that there is a strong association between the amplitude of SNAP of sural nerve to that of the abnormal NCS report ($p<0.0001$) and also to the clinical presentation of neuropathy ($p=0.0679$).

It is in conformity with the reports of the previous studies.[11,19,20]

Diabetic sensorimotor neuropathy is therefore a significant complication of diabetes, and the condition may exist even at the time of diagnosis of diabetes. Large scale studies are required to determine the prevalence in this part of the country. Further studies may have to be done in order to determine the association and overall the Indian population may have to be evaluated extensively to determine the magnitude of the problem as it may help in cautioning us to exercise a better control of blood glucose to avoid or even curb the progression of this complication.

CONCLUSION

The study concludes distal peripheral neuropathy presents even before the onset of symptoms as demonstrated by NCS in asymptomatic diabetics. Patients with long standing diabetes and OHA's have higher incidenceof nerve conduction abnormalities. We noticed diabetic neuropathy is not a common feature presenting during the diagnosis of diabetes.Axonal demyelination was the commonest nerve conduction abnormality which is a length dependent neuropathy can be diagnosed clinically by a monofilament test in resource limited settings. The strict glycemic control and other general measures can prevent further progression of DPN and help a patient to lead a comfortable and symptom free life.

BIBLIOGRAPHY

1. Wild S, Roglic G., Green A. Global prevalence of diabetes. Estimates for the year 2000 and projections for 2030. Diabetes care 2004 ; 24(5) : 1047-53.
2. Diabetes Atlas, Second edition, IDF, 2003.
3. Dyck PJ, Thomas PK. Diabetic Neuropathy ,Second Edition, Philadelphia, W.B. Saunders, 1999.
4. Marchal de Calvi. J: (1884) Recherches sur les Accidents Diabetiques. Paris Cited by Jordon 1936.
5. Leyden E. (1893) BeitragZurKlinik des Diabetes mellitus Wien. Med. Wochenschr. 43.926.
6. Pryce T.D. (1893) On Diabetes neuritis with a Clinical and Pathological description of three cases of diabetic pseudo tabes Brain 16: 416.
7. Pirart J Diabetes mellitus and its degenerative complications : A prospective study of 4,400 patietns observed between 1947 and 1973 (3rd and last part) (Authors Transl) [French]. DiabeteMetab1997 ; 3 : 245-256.
8. Apelquist J, Balcker K, Van Houtum WQH, NabuursFransen MH. SchaperNC:International consensus on the diabetic foot. In the International Working groups on the Diabetic foot. Amsterdam, Netherlands, John Wiley and Sons, 1999, :p 67.
9. Joslin`s Diabetes Mellitus, 14th Edition, new Delhi, Lippincott Williams and Wilkins, 2005, Kahn, Weir, King, Jacobson, Moses, Smith.
10. Gavin JR III, Alberti KGMM, Davidson MB. Report of expert committee on the diagnosis and classification of diabetes mellitus. Diabetes Care 1997 ; 20 : 1183-1197.
11. WHO Classification Consultation Group. Definition, diagnosis and classification of DM and its complications, 2nd edition WHO NCD / NCS / 99 Geneva WHO, 1999;1-55.
12. WHO study group. Diabetes Mellitus Technical report Series 727 ; Geneva WHO, 1985.
13. Harrisons Principles of Internal Medicine, 17th Edition, New Delhi, McGraw- Hill,2008, Kasper, Braunwald, Fauci, Hauser, Longo, Jameson.
14. Shah Bela, Kumar Narender, Khuranasarabjeet, Assessment of Burden of Non-communicable disease, Burden of diabetes, ICMR, 2004.
15. RajendraPradeepa, Raj Deepa, Viswanathan Mohan, Epidemiology of diabetes inIndia – current perspective and future projections, Journal of Indian Medical Association 2002 ; 100(3).
16. Dyck PJ and Thomas PK. Peripheral neuropathy 4th Edition Vol I, Elsevier Saunders 1996.
17. Boulton AJM, Gries FA, Jervell JA. Guidelines for the diagnosis and outpatient management of diabetic peripheral neuropathy. Diabet Med 1998 ; 15 : 508-514.
18. Dyck PJ, Katz KM, Karnes JL, Litchy WJ. The prevalence by staged severity of varioustypes of diabetic neuropathy, retinopathy and nephropathy in a population based cohort : The Rochester Diabetic neuropathy study. Neurology 1993 ; 43 : 817-824.
19. American Diabetes Association, American Academy of Neurology : Report and recommendations of the San Antonio Conference on Diabetic Neuropathy (Conbsensus statement). Diabetes Care 1988 ; 11 : 592-597.
20. Thomas PK.: Classification, differential diagnosis and staging of diabetic peripheral neuropathy. Diabetes 46(Sulppl 2) 1997 : S54-S57.