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A Study Of Nerve Conduction Velocity In Diabetes Mellitus Type 2.

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ABSTRACT

Diabetic neuropathy (DN) is the most common and troublesome complication of D.M. leading to great mortality and morbidity. It covers a wide range of abnormalities involving both peripheral and autonomic nerve functions. Aim is to role of Nerve Conduction Velocity in Asymptomatic Diabetes Mellitus Type II. Patients, Male / Female, coming to OPD/IPD of Krishna hospital, who has been a diagnosed case of diabetes mellitus type 2 were taken for this study.The patients should be diagnosed as DM type II to for more than a year and should have no symptoms of neuropathy.Patients were included in this study after taking a informed and written consent. The patients would also be screened for glycosylated haemoglobin (HbA1C) performed in department of biochemistry on choral kit. Based on HbA1C report patients were divided into two groups. Group A: HbA1C>7.1% ; Group B: HbA1C <7.0%. Nerve conduction study would be done at department of physiology. The mean age of group A and B was 53.65 ±6.39 and 53.20±6.81 years respectively. The mean FBS in Group B and group A w?s 169.45 ±48.92 mg% and 207.55±84.25mg% respectively. The mean HbA1C in Group B and Group A was 5.66±0.63 and 10.36±2.23 respectively. The mean FBS of the patient's who were having abnormal NCS report was 222.03187.75 mg% and mean PPBS was 268.33±83.77 mg. The mean of HbA1C in patients with abnormal NCS report was 11.27%±1.78% where as it was 7.62%±0.51% in patient's with normal NCS report. The neuropathy was mainly of axonal type in both the groups 18 (45%) patients were having axonal type of neuropathy 6 (15%) patients were having demyelinating type and 6 (15%) were having mixed neuropathy. The maximum number of patients 14 (46.66%) in group A were between 3-5 years of duration of DM where as in group B 4 (44.44%) were in the same duration as seen in group A. The prevalence of diabetic neuropathy in asymptomatic diabetics is very high in patients with poor glycemic control. The patients who were on insulin or a combination of insulin + OHA'S were having better glycemic control and hence occurrence of diabetic neuropathy was less. Electrophysiological methods are more sensitive tools to detect diabetic neuropathy in asymptomatic diabetics.

Keywords: diabetes mellitus type2 , nerve conduction study , diabetic neuropathy , glycemic control

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INTRODUCTION

Diabetes mellitus has reached epidemic proportions worldwide. There is an apparent epidemic of diabetes which is strongly related to lifestyle and economic change. Diabetes mellitus is often not recorded as cause of death. It leads to complications, which subsequently become the cause of death. There are about five times as many deaths indirectly attributable to diabetes as compared to directly attributable ones.

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.[1] This means by that time 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. Therefore many complications are present at diagnosis and it is the complications of the foot that cause great functional impairment.

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]

AIM AND OBJECTIVES

Aim:

Role of Nerve Conduction Velocity in Asymptomatic Diabetes Mellitus Type II.

Objectives:

To study the prevalence of neuropathy in asymptomatic diabetics.
To study type of neuropathy in asymptomatic diabetics.
To co-relate between the duration of DM and NCS reports.
To co-relate between blood sugar levels and NCS reports.
To co-relate between HbA1C levels and NCS reports.
To co-relate treatment modality and NCS report.

MATERIAL AND METHODS

Patients, Male / Female, coming to OPD/IPD of Krishna hospital, who has been a diagnosed case of diabetes mellitus type 2 were taken for this study.

The patients should be diagnosed as DM type II to for more than a year and should have no symptoms of neuropathy.

Patients were included in this study after taking a informed and written consent.

Inclusion Criteria:

- Diagnosed case of diabetes mellitus Type II for more than 1 year.
- No symptoms suggestive of neuropathy.

Exclusion Criteria:

- Patients below age of 18 years.
- Non diabetics.
- Patients having symptoms of neuropathy.
- Patients known case of Diabetes Mellitus Type II less than 1 year.
- Patients with diabetes mellitus Type I.

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Methodology:

The patients would also be screened for glycosylated haemoglobin (HbA1C) performed in department of biochemistry on choral kit at Krishna hospital.

Based on HbA1C report patients were divided into two groups.
Group A: HbA1C>7.1%
Group B: HbA1C <7.0%
Nerve conduction study would be done at department of physiology at Krishna hospital.
NCS would be done on a machine manufactured by medicare.
In upper limb the following nerves would be tested for both motor and sensory component

- Median nerve
- Ulnar nerve

In lower limb following nerves will be tested for both sensory and motor component

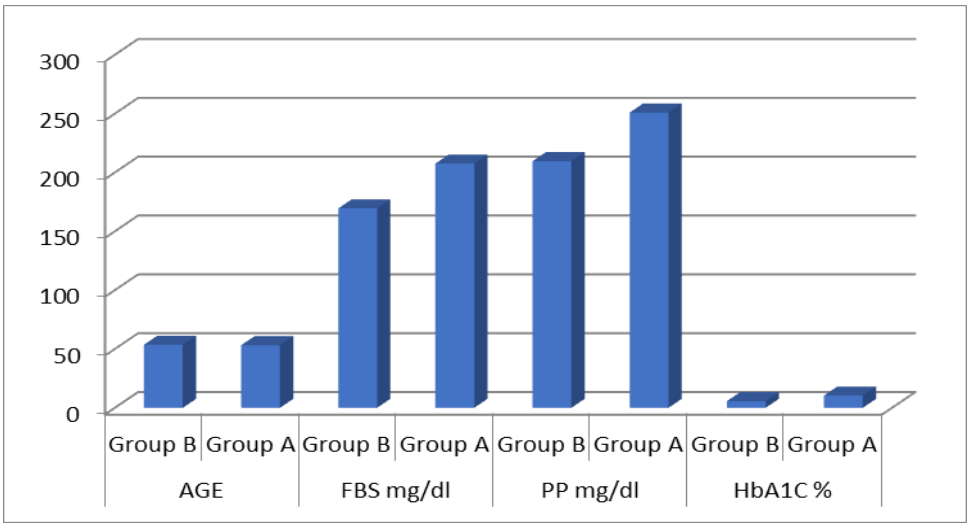
- Peroneal nerve
- Tibial nerve
- Sural nerve

Patients fasting blood sugar level, post-prandial blood sugar levels on the day of admission were also done.

OBSERVATIONS

TABLE 1 : MEAN AGE. MEAN FBS. MEAN PPBS. MEAN HbA1C

	Group	N	Mean	SD	P-value
AGE	Group B	40	53.65	6.39	0.761
	Group A	40	53.20	6.81	
FBS mg/dl	Group B	40	169.45	48.92	0.016
	Group A	40	207.55	84.25	
PP mg/dl	Group B	40	209.63	75.78	0.022
	Group A	40	250.88	81.53	
HbA1C %	Group B	40	5.66	0.63	<0.001
	Group A	40	10.36	2.23	



There were total 40 patients each in both the groups.
Group A (HbA1C >7.1%) & Group B (HbA1C <7.0%)
The mean age in group B and group A was 53.65 ±6.39 and 53.20±6.81 years respectively.
The mean FBS in Group B and group A w?s 169.45 ±48.92 mg% and 207.55±84.25mg% respectively.

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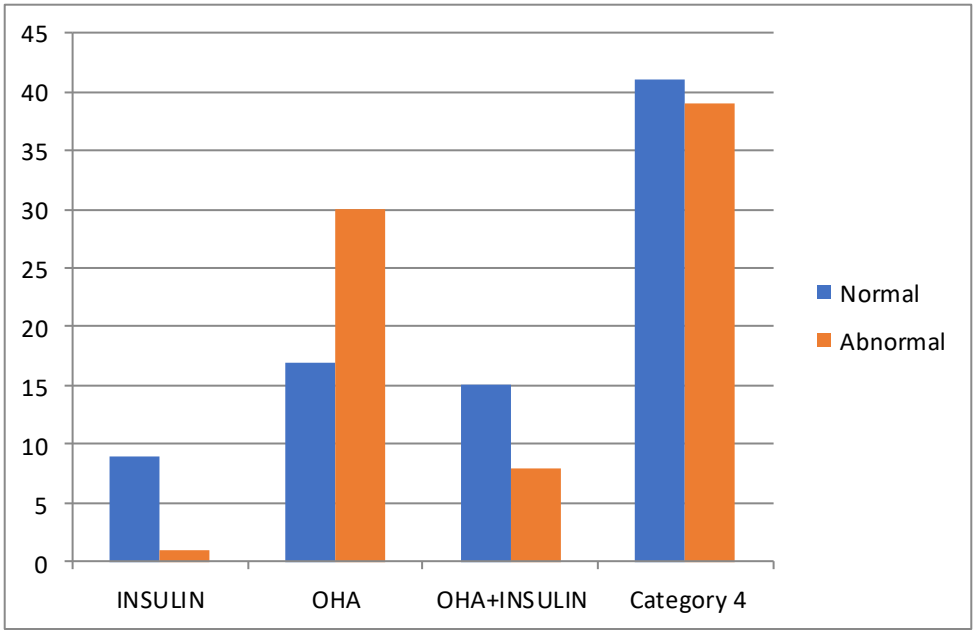
The mean PPBS in Group B and Group A was 209.63±75.78 and 250.88±81.53 respectively.
The mean HbA1C in Group B and Group A was 5.66±0.63 and 10.36±2.23 respectively.

TABLE 2: RELATION OF TREATMENT TO ABNORMAL NCS REPORT

Treatment	NCS		
	Normal	Abnormal	Total
INSULIN	9	1	10
OHA	17	30	47
OHA+INSULIN	15	8	23
Total	41	39	80



In our study total 41 patient were having normal NCS report out of which 9(21.95%) were on insulin alone 17 (41.46%) were on OHA'S and 15 (36.58%) were on OHA's+insulin (p=0.001)

There were 39 patients with abnormal NCS report out of which 1 (2.56%) was on insulin 30(76%) on OHA'S and 8 (20.51%) on OHA+lsulin

TABLE 3: DISTRIBUTION WITH RESPECT TO GENDER

Sex	Group B	Group A	Total	P-value
Male	24	19	43	0.37
Female	16	21	37	
Total	40	40	80	

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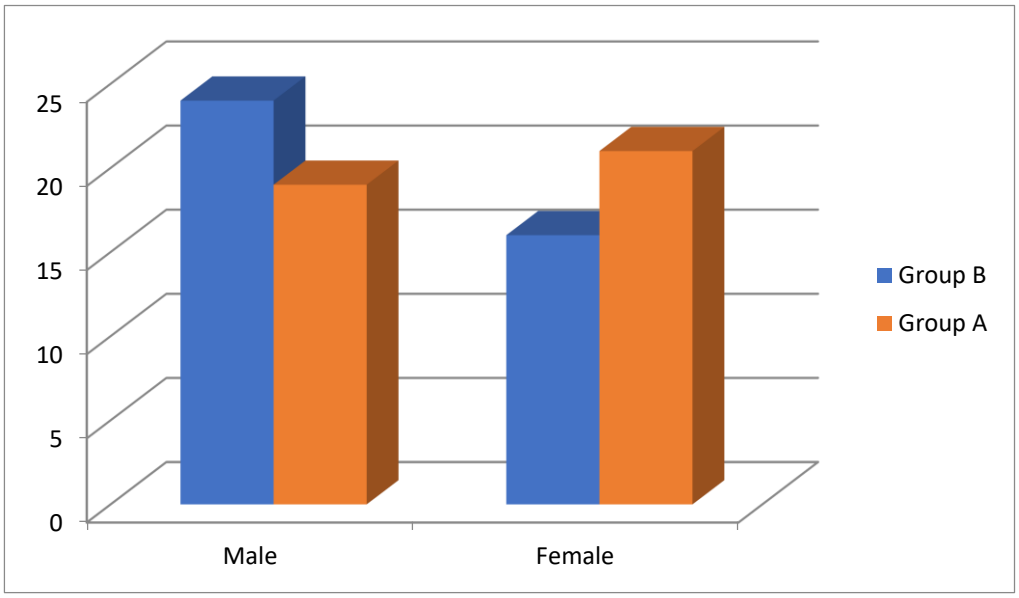
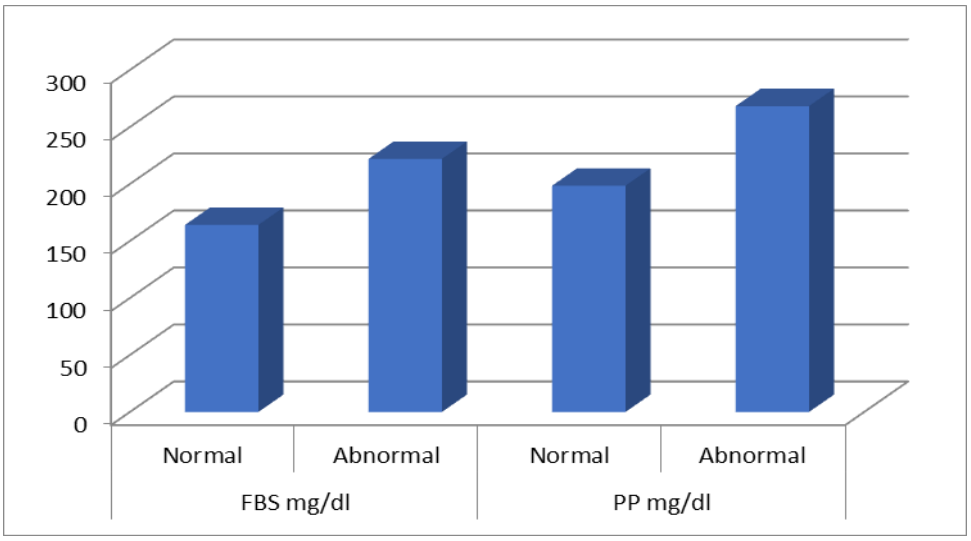


In group A there were total 19 (47.5%) males and 21 (52.5%) females In group B there were 24 (60%) males and 16 (40%) females.

TABLE 4: DISTRIBUTION OF ABNORMAL NCS REPORT IN RELATION TO FBS PPBS AND HbA1C

GROUP A:

	NCSFinal	N	Mean	SD	P-value
FBS mg/dl	Normal	10	164.10	56.12	0.023
	Abnormal	30	222.03	87.75	
PP mg/dl	Normal	10	198.50	46.12	0.003
	Abnormal	30	268.33	83.77	



The mean FBS of the patient's who were having abnormal NCS report was 222.03187.75 mg% and mean PPBS was 268.33±83.77 mg%

	NCSFinal	N	Mean	SD	P-value
HbA1C %	Normal	10	7.62	0.51	< 0.001
	Abnormal	30	11.27	1.78	

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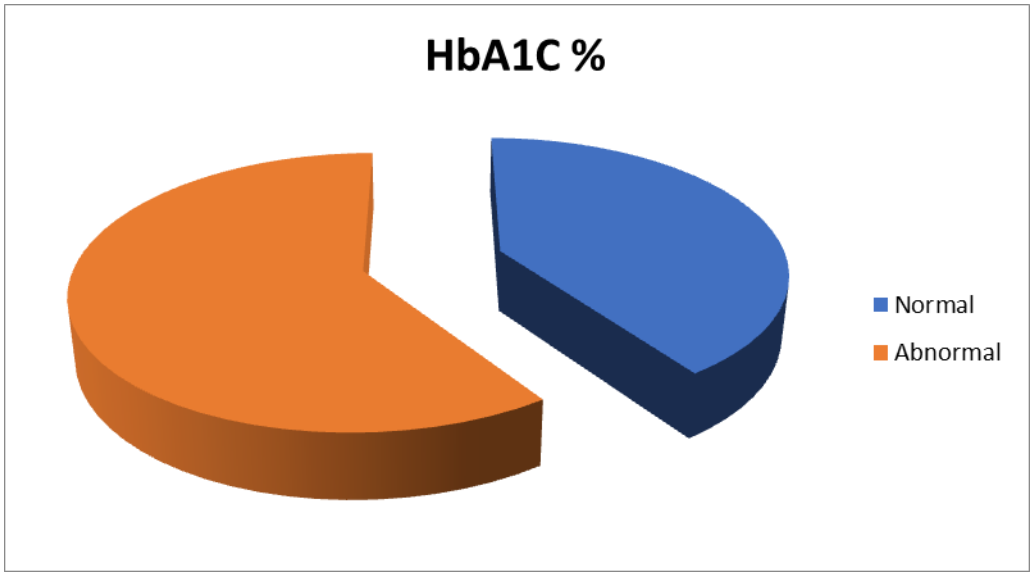
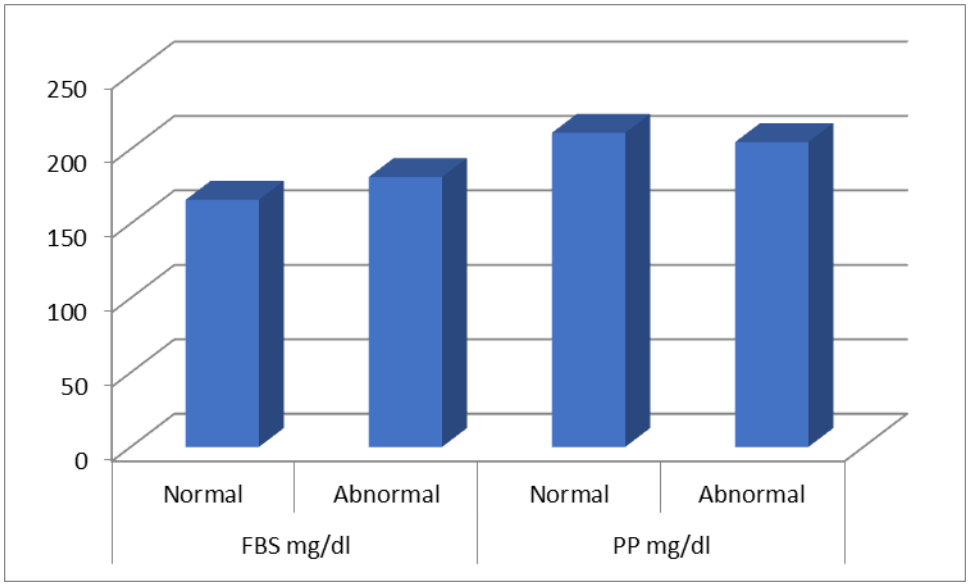


The mean of HbA1C in patients with abnormal NCS report was 11.27%±1.78% where as it was 7.62%±0.51% in patient's with normal NCS report.

GROUP B

	NCSFinal	N	Mean	SD	P-value
FBS mg/dl	Normal	31	166.00	50.13	0.396
	Abnormal	9	181.33	45.12	
PP mg/dl	Normal	31	211.03	85.32	0.724
	Abnormal	9	204.78	25.80	



The mean FBS of patients with abnormal NICS report was 181.33mg%±45.12mg% and the mean PPBS report of patient's with abnormal NCS was 204.78mg%±25.80mg%.

	NCSFinal	N	Mean	SD	P-value
HbA1C %	Normal	31	5.39	0.42	<0.001
	Abnormal	9	6.57	0.21	

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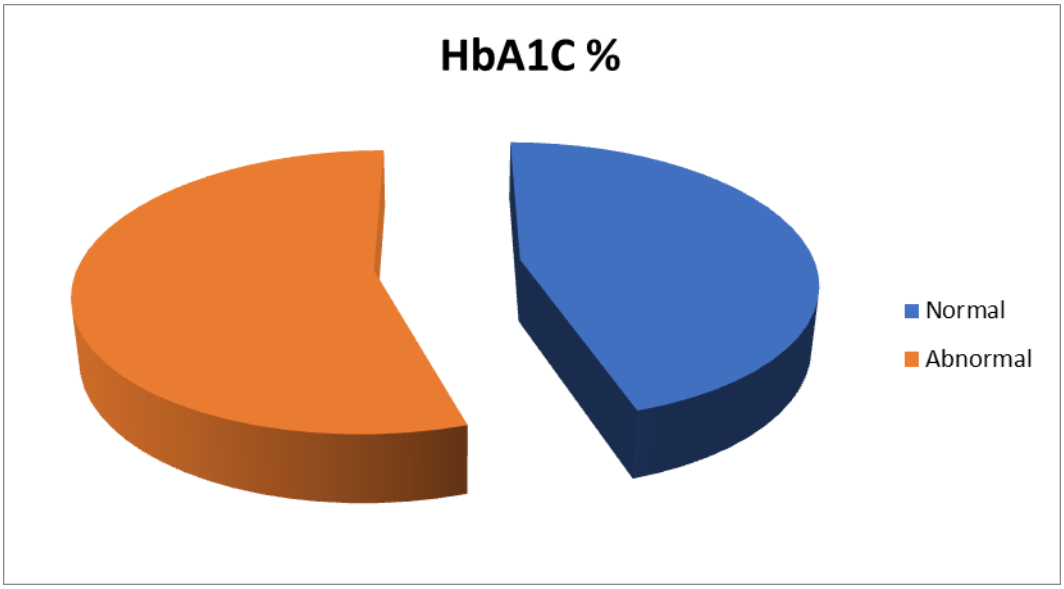
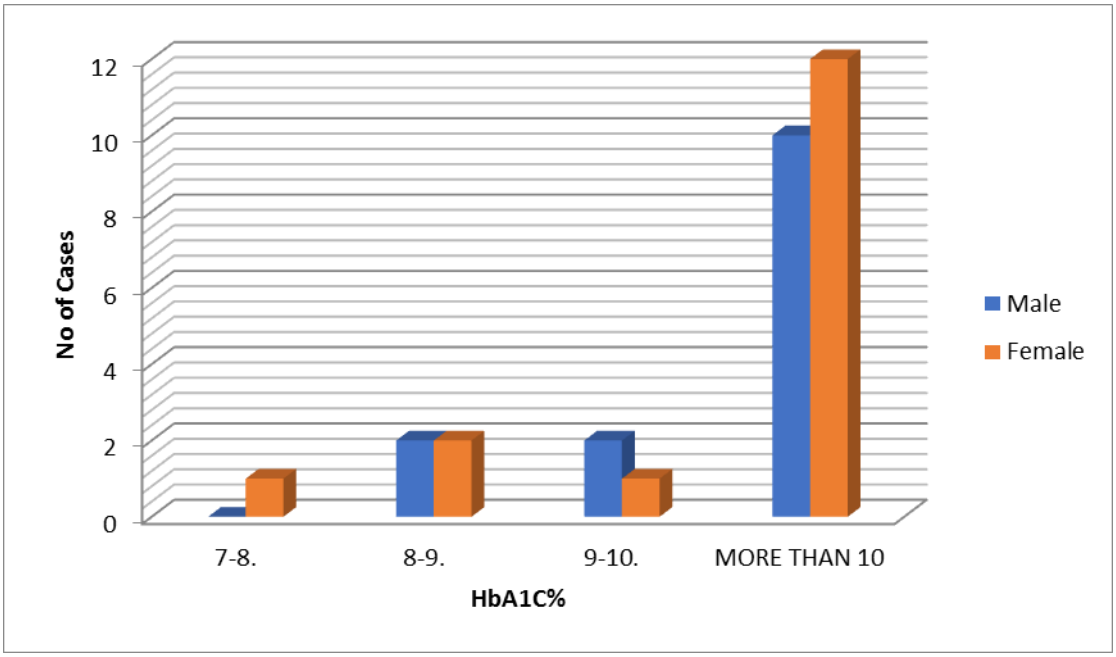


The mean HbA1C report of abnormal patient was 6.57%±0.21%

TABLE 5: HbA1C AND ABNORMAL NCS REPORT

Group A		
HbA1C %	**Male**	**Female**
7-8	0	1
8-9	2	2
9-10	2	1
MORE THAN 10	10	12



Group B		
HbA1C %	***Male***	***Female***
7-6	*6*	*3*
6-5	*0*	*0*
LESS THAN 5	*0*	*0*

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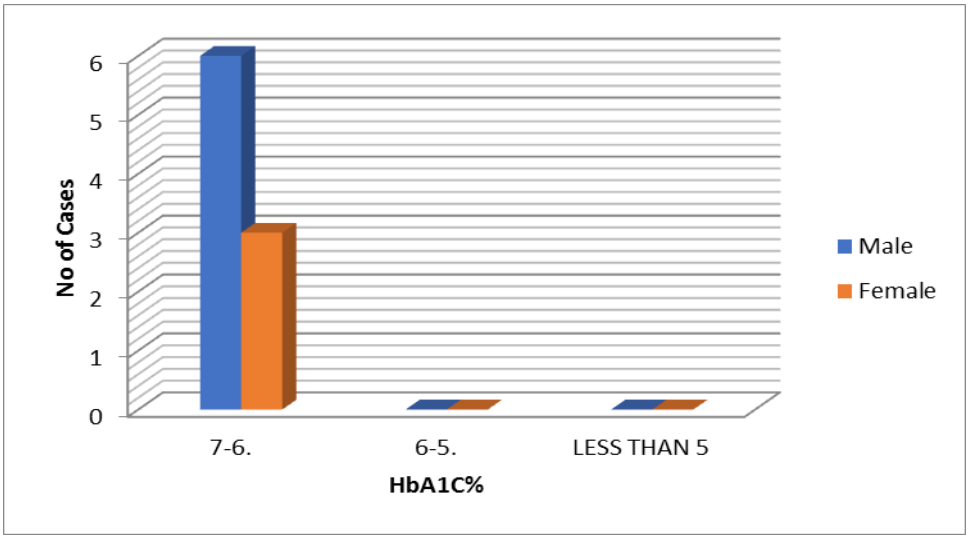


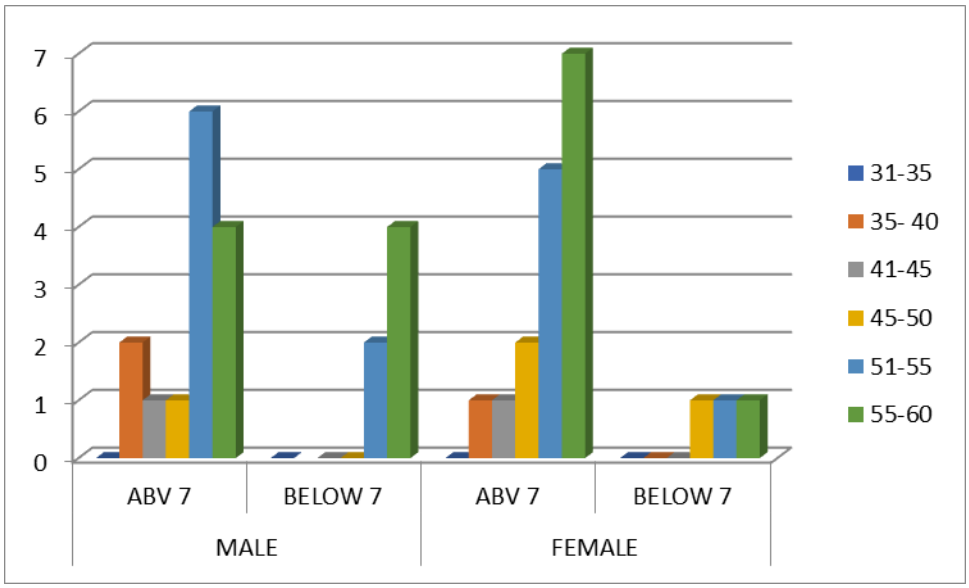
Group A: The patients 22 (73.33%) who were having abnormal NCS reports were having HbA1C more than 10%.

3 (10%) patients were having HbA1C in the range of 9-10%

Group B: All the 9 (100%) patients who were having abnormal NCS report were in the range of 6-7%

TABLE 6: Abnormal NCS report in relation to age

AGE IN YEARS	MALE		FEMALE	
	ABV 7	BELOW 7	ABV 7	BELOW 7
31-35	0	0	0	0
35- 40	2		1	0
41-45	1	0	1	0
45-50	1	0	2	1
51-55	6	2	5	1
55-60	4	4	7	1



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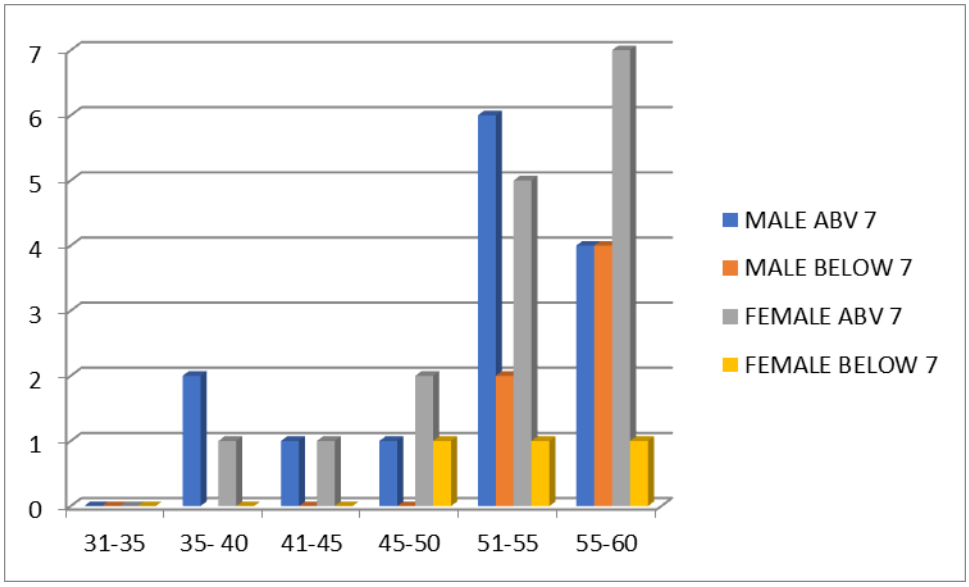
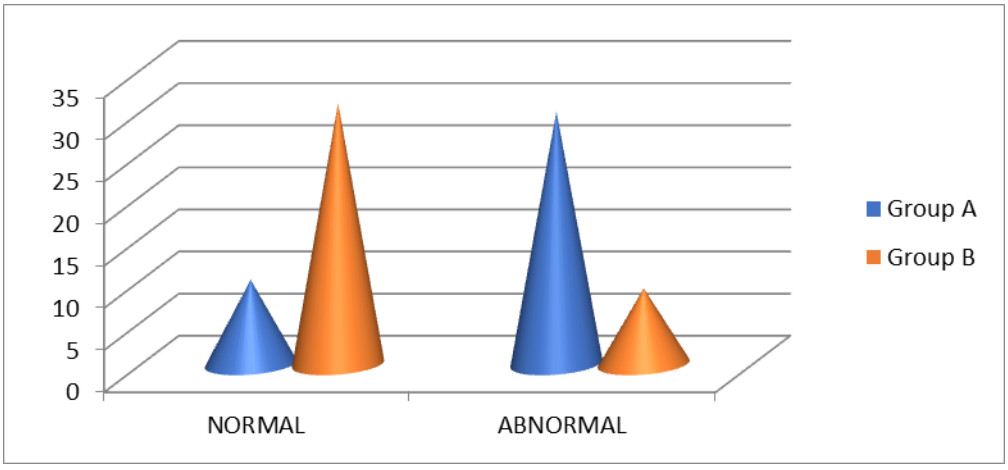


It was observed that maximum number of patients were in age group of 55-60 years in both the groups.

9(22.5%) patients in group A and 8(20%) in group B.

TABLE 7 : ABNORMAL NCS REPORT IN BOTH THE GROUPS

NCS REPORT	Group A	Group B
NORMAL	10	31
ABNORMAL	30	9
TOTAL	40	40



There were total 30 (75%) patients having abnormal NCS report in group A where as only 9 (22.5%) patients were having abnormal NCS report in group B.

TABLE 8: TYPE OF NEUROPATHY IN BOTH THE GROUPS:

TYPE OF NEUROPATHY	Group A	Group B
AXONAL	18(45%)	9 (22.5%)
DEMYELINATING	6(15%)	0
MIXED	6(15%)	0

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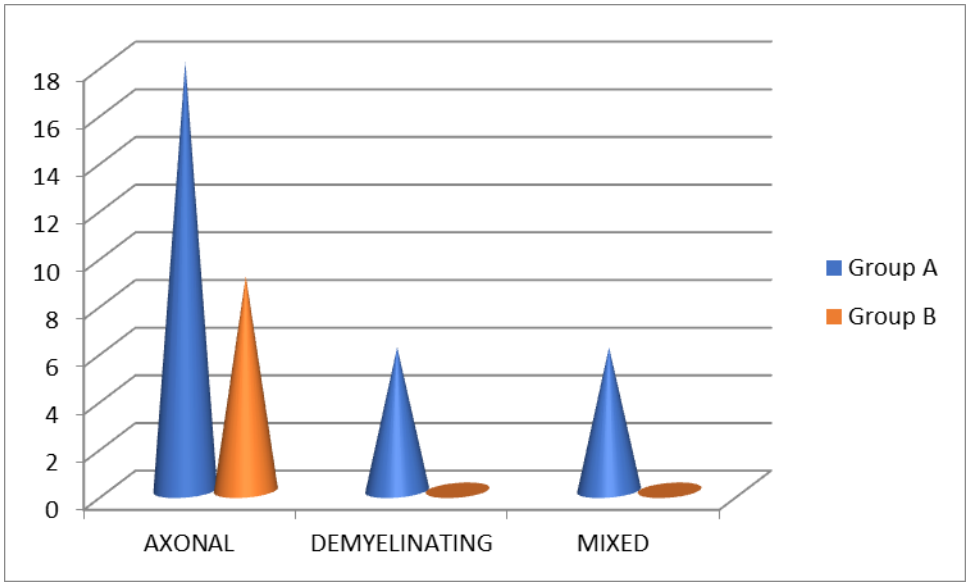
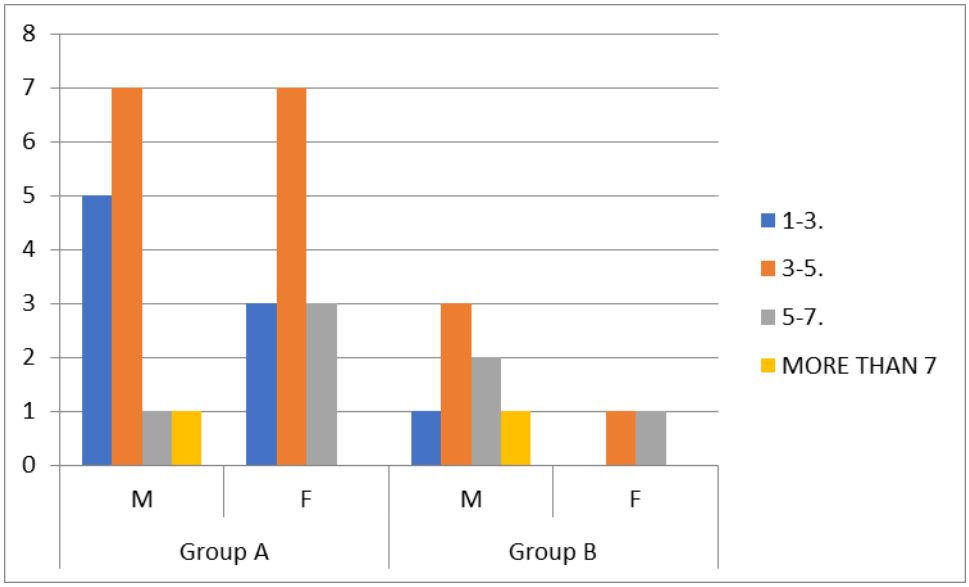


The neuropathy was mainly of axonal type in both the groups 18 (45%) patients were having axonal type of neuropathy 6 (15%) patients were having demyelinating type and 6 (15%) were having mixed neuropathy

In group B 9 (22.5%) patients were having axonal type of neuropathy.

TABLE 9: RELATION BETWEEN DURATION OF DIABETES AND

	ABNORMAL NCS REPORT			
DURATION OF DM IN YRS	Group A		Group B	
	M	F	M	F
1-3	5	3	1	
3-5	7	7	3	1
5-7	1	3	2	1
MORE THAN 7	1	0	1	0



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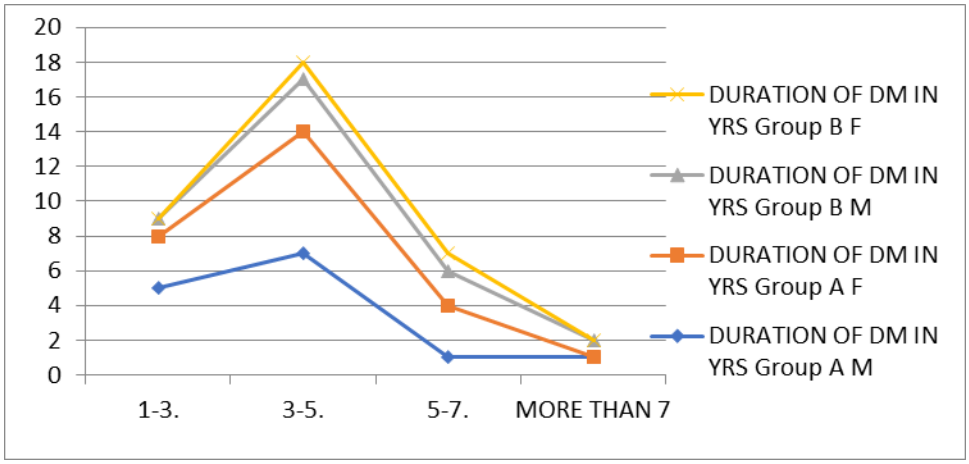

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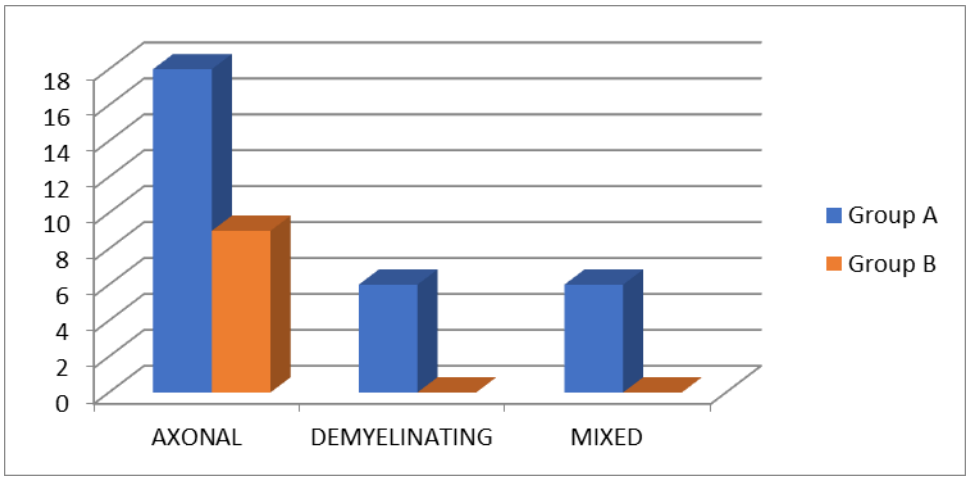
The maximum number of patients 14 (46.66%) in group A were between 3-5 years of duration of DM where as in group B 4 (44.44%) were in the same duration as seen in group A.

Duration of more than 5 years shows less number of patients with abnormal NCS report as such patients becomes symptomatic and hece they were excluded from the study.

TABLE 10: TYPE OF NEUROPATHY IN BOTH THE GROUPS:

TYPE OF NEUROPATHY	Group A	Group B
AXONAL	18	9
DEMYELINATING	6	0
MIXED	6	0



DISCUSSION

The present study was conducted to determine the occurence of neuropathy in asymptomatic diabetics and also to determine whether any association is existing between the duration and glycemic index to the electrophysiological study done.

The study was divided into two groups

Group A: HbA1C more than 7.1% and

Group B: HBAIC less than 7.0%

No similar studies keeping this margin of duration has been so far determined from the extensive search of literature, although Pirart says that the prevalence is about 7.5% at the time of diagnosis of diabetes [4]

Lehtinen et al from Finland have studied the prevalence of DN in newly diagnosed diabetes where it was diagnosed as within 4 weeks of diagnosis date.[5]

- Out of 40 patient's studied in each group maximum number of cases was observed in age group of 51 years to 55 years in both the group with mean age of 53.20±6.81years in group A and mean age in group B was 53.65±6.39years.(p= 0.7)
- All the patients were of type 2 DM.
- The mean FBS of group A was 207±84.25mg% with and the mean FBS in group B was 169.45±48.92mg% (p=0.016)
- The mean PPBS in group A was 250.88±81.53mg% and in group B was 209.63±75.78mg% (p=0.02)
- Group A: The patients 22 (73.33%) who were having abnormal NCS reports were having HbA1C more than 10%.
- 3 (10%) patients were having HbA1C in the range of 9-10% Group B: All the 9 (100%) patients who were having abnormal NCS report were in the range of 6-7%
- The mean HbA1C in group A was 10.37±2.23% and in group B was 5.66+0.63% with a (p=0.001)4,21,22,23,33

NCS REPORT:

Out of 40 patients studied in group A 30 (70%) were having abnormal NCS reports and 10 (30%) were having normal NCS reports.

Out of 40 patients in group B 9 (22.5%) were having abnormal NCS reports whereas 31(77.5%) were having normal NCS reports[5]

This is supported by one study of prevalence of neuropathy in asymptomatic patients
***(Lehtinen, Uusitya, Siitonen and Pyorala** : Prevalence of neuropathy in newly diagnosed NIDDM and Non diabetic control. Diabetes 1989 ; 38 : 1307- 1313.)*

Inference : In diabetics, the prevalence of neuropathy is still higher if electrophysiological methods are used and are considered as a major tool for diagnosis of neuropathy.

- Among the abnormal reports, axonal degeneration was observed as the most common type of nerve damage in both the groups.

These findings are consistent with a study which showed, the most common electrophysiological abnormality was axonal degeneration in DN.[6]

***(Partanen J, Niskanen L, Lehtinen J.** Natural history of peripheral neuropathy in patients with NIDDM. N Eng J Med. 1995; 333 : 89-94.)*

Inference: In newly diagnosed diabetes, the electrophysiological abnormalities are prevalent in the lower limbs than upper limbs and the most common abnormality detected is a decrease in sensory and motor amplitude indicating axonal destruction as the primary pathology in diabetic neuropathy.

- The maximum number of patients 14 (46.66%) in group A were between 3-5 years of duration of DM where as in group B 4 (44.44%) were in the same duration as seen in group A.
- Duration of more than 5 years shows less number of patients with abnormal NCS report as such patients becomes symptomatic and hence they were excluded from the study

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.[7]
***(Chopra and Hurwitz.** Comparative study of peripheral nerve conduction in diabetes and non diabetic chronic occlusive peripheral vascular disease. Brain 1969; 92 : 83-96.)*

Inference : Even though the diabetic patients are clinically asymptomatic of the symptoms of neuropathy, electrophysiological abnormalities of neuropathy are present in them without any symptoms of neuropathy.

- The neuropathy was mainly of axonal type in both the groups
- 18 (45%) patients were having axonal type of neuropathy 6 (15%) patients were having demyelinating type and 6 (15%) were having mixed neuropathy
- In group B 9 (100%) patients were having axonal type of neuropathy.

These findings are consistent with a study which showed, the most common electrophysiological abnormality was axonal degeneration in DN.[6]

(Partanen J, Niskanen L, Lehtinen J. *Natural history of peripheral neuropathy in patients with NIDDM. N Eng J Med. 1995; 333 ; 89-94.)*

Inference : In diabetics, the type of nerve damage that occurs in DN is axonal degeneration and it is also the first change that occurs in DN as evident from both the group.

- In our study it was found that there is significant association between duration of diabetes and clinical presentation of neuropathy.

Maximum number of patients 15 (50%) having abnormal NCS report were in duration of 3 to 5 years.

Other studies have also confirmed significant associations between duration of diabetes and the abnormal NCS reports. [8,9]>[10]

(Tesfaye S, Stevens LK, Stephenson JM. *Prevalence of diabetic peripheral neuropathy and its relation to glycemic control and potential risk factors : The EURODIAB IDDM Complications study. Diabetologia 1996; 39: 1377-1384.*

Maser RE, Steenkiste AR. Dorman JS. *Epidemiological correlates of diabetic neuropathy. Report from Pittsburg Epidemiology of Diabetes complications study. Diabetes 1989; 38: 1456-1461.*

Franklin GM, Shtterly SM, Cohen J A, Baxter J, Hamman RF *: Risk factor for distal symmetric neuropathy in NIDDM. Diabetes Care 1994 ; 17 : 1172-1177.*

DCCT Research group *The effect of intensive diabetes therapy on the development and progression of neuropathy. Ann Int Med 1995 ; 122 : 561- 568.)*

Inference : As the duration of diabetes increases the abnormalities detected electrophysiologically of DPN increases and thereby the prevalence- of DPN also increases.

- In our study it was found that there is significant .association between the blood sugar levels and clinical presentation of neuropathy.

In group A where there were 30 abnormal NCS report the mean FBS was observed to be 207.55184.25 mg% and mean PPBS was observed to be 250.88±81.53mg% (p= 0.016)

In group B where 9 patients were having abnormal NCS report the mean FBS and PPBS were 169.45±48.92mg% and 209.63±75.78mg% respectively (p=0.02)

Other studies have also found significant association between blood sugar levels and symptoms of neuropathy. [4-8,9,10,11]

(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]. Diabete Metab 1997; 3: 245-256.*

Tesfaye S, Stevens LK, Stephenson JM. *Prevalence of diabetic peripheral neuropathy and its relation to glycemic control and potential risk factors : The EURODIAB ID DM Complications study. Diabetologia 1996 ; 39 : 1377-1384.*

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DCCT Research group *The effect of intensive diabetes therapy on the development and progression of neuropathy. Ann Int Med 1995 ; 122 : 561- 568.)*

Inference : As the blood sugar levels increase, the electrophysiological abnormalities increases and thereby the prevalence of DPN also increases.

- In our study, it was found that there is a strong association between the HbA1C levels and the NCS reports.

In group A 1(3.33%) patient was having abnormal NCS reportwith HbA1C between 7-8%4(13.33%) patients were in the group of HbA1C between 8-9% and 3(10%) patients were in group of HbA1C between 9-10% 22(73.33%) patients with abnormal NCS report were having HbA1C more than 10%.

In group B 9(100%) patient with abnormal NCS report were in the range of HbA1C between 6-7%.
There were no abnormal NCS report in patients whose HbA1C was less than 6%
It is in conformity with the reports of other previous studies.[8,9,10,11]

(Tesfaye S, Stevens LK, Stephenson JM. *Prevalence of diabetic peripheral neuropathy and its relation to glycemic control and potential risk factors : The EURODIAB IDDM Complications study Diabetologia 1996; 39 : 1377-1384.*

Maser RE, Steenkiste AR. Dorman JS. *Epidemiological correlates of diabetic neuropathy. Report from Pittsburg Epidertiiology of Diabetes complications study. Diabetes 1989; 38 :1456-1461.*

Franklin GM, Shtterly SM, Cohen JA, Baxter J, Hamman RF *: Risk factor for distal symmetric neuropathy in NIDDM. Diabetes Care 1994 ; 17 : 1172-1177.*

DCCT Research group *The effect of intensive diabetes therapy on the development and progression of neuropathy. Ann Int Med 1995 ; 122 : 561- 568.)*

Inference : As the HbA1C levels increases, the electrophysiological abnormalities of DN detected also increases and thereby the prevalence of DPN also increases.

- In our study, it was found that there is a strong association between the treatment modality and the abnormal NCS reports.
- In our study total 41 patient were having normal NCS report out of which 9(21.95%) were on insulin alone 17 (41.46%) were on OHA'S and 15 (36.58%)were on OHA's+insulin (p=0.001)
- There were 39 patients with abnormal NCS report out of which 1 (2.56%) was on insulin 30(76%) on OHA'S and 8 (20.51%) on OHA+lsulin.

It is in conformity with the reports of previous studies.[10,12]

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.

(Franklin GM, Shtterly SM, Cohen JA, Baxter J, Hamman RF : Risk factor for distal symmetric neuropathy in NIDDM. Diabetes Care 1994 ; 17 : 1172-1177.

Fraser, Campbell, Ewing, Murray, Neilson and Clarke. *Peripheral and autonomic nerve function in newly diagnosed diabetics. Diabetes 1997 ; 25: 546-550.)*

SUMMARY AND CONCLUSION

The present study was done to determine the occurrence of sensorimotor neuropathy in patients having diabetes mellitus type 2 with no symptoms of neuropathy, to determine whether any co relation exits between duration, blood sugar levels and HbA1C to NCS.

The study included total 80 asymptomatic diabetics who were divided into two groups
Group A: HbA1C> 7.1%
Group B: HbA1C<7.0%

- These patients were diagnosed cases of DM type 2 and were not having any symptoms of neuropathy.
- All patients were subjected to NCS and their FBS PPBS and HbA1C were done at the time of admission.
- Statistical analysis was done by calculating mean ± SD and p value was calculated by using 2 independent sample t-test
- The results showed that there were significant relation between gycemic index and neuropathy.
- Mean of Age FBS, PPBS and HbA1C was compared in both the groups with a significant p value of 0.05, 0.16, 0.022 and 0.001 respectively.
- Mean of FBS PPBS and HbA1C was compared between the patients having normal NCS and abnormal NCS in both the groups
- 30 (75%) patients out of 40 in group A and 9 (22.5%) out of 40 in group B were having abnormal NCS report
- Hence, the prevalence of diabetic neuropathy in asymptomatic diabetics is very high in patients with poor glycemic control.
- Nearly 80% of the patients who were having abnormal NCS in both the group were in the age group of 51-60 years.
- Maximun number of patients having abnormal NCS were having DM type 2 in the duration of 3-5 years.
- This is because the patients who were in the duration of 5-7 years were mostly symptomatic and were excluded from this study.
- Significant difference was observed in the mean FBS of the patients in both the groups who were having normal and abnormal NCS report with a significant p value of 0.023 in group A and 0.003 in group B.
- Similarly significant difference was observed in mean PPBS and HbA1C of the patients in both the group having normal and abnormal NCS with a significant p value of less than 0.05
- Hence the prevalence of diabetic neuropathy is less in patients who are having good glycemic control.
- In our study total 41 patient were having normal NCS report out of which 9(21.95%) were on insulin alone, 17 (41.46%) were on OHA'S and 15 (36.58%)were on OHA's+insulin (p=0.001)
- There were 39 patients with abnormal NCS report out of which 1 (2.56%) was on insulin 30(76%) on OHA'S and 8 (20.51%) on OHA+lsulin
- Hence the patients who were on insulin or a combination of insulin + OHA'S were having better glycemic control and hence occurrence of diabetic neuropathy was less.
- All the 39 (48.75%) patients having abnormal NCS were asymptomatic diabetics.
- Hence electrophysiological methods are more sensitive tools to detect diabetic neuropathy in asymptomatic diabetics.
- The neuropathy was mainly of axonal type in both the groups
- 18 (60%) patients were having axonal type of neuropathy 6 (20%) patients were having demyelinating type and 6 (20%) were having mixed neuropathy
- In group B 9 (100%) patients were having axonal type of neuropathy.

- Hence the most common type of neuropathy seen in diabetes mellitus type 2 is axonal type of neuropathy.

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