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"AN ANALYSIS OF SUBCLINICAL PERIPHERAL NERVE CHANGES WITH NERVE CONDUCTION VELOCITY AND 60- SECOND DIABETIC FOOT SCREEN SCALE IN TYPE-II DIABETICS MELLITUS AND NORMAL HEALTHY SUBJECT -- AN OBSERVATIONAL STUDY."

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ABSTRACT

INTRODUCTION: Diabetics mellitus is characterised by chronic hyperglycaemia with disturbance of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action or both. Type 2 diabetics is a heterogeneous group of disorders characterised by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production.

AIM OF THE STUDY: To assess subclinical peripheral nerve changes in Type-II diabetic mellitus and Normal healthy subjects.

METHOD: This study was carried out in and around clinics in Rajkot city. Total 120 Type-II diabetic mellitus and Normal healthy subjects were selected in each group. Subjects were selected according to inclusion & exclusion criteria and written consents were taken. Subjects having age between 30-65 years were selected. Subjects were divided in two groups i.e. Type-II diabetic mellitus and normal healthy, it was assessed for nerve conduction study for bilateral motor median, ulnar, common peroneal nerve and tibial along with that sensory median, ulnar, sural and superficial peroneal nerve analyzed. For assessing a sensation 60-second diabetic foot screen scale used.

Data were analysed using SPSS 20 software for Microsoft windows by unpaired t –test.

RESULT: Data were analysed using SPSS 20 software for Microsoft windows by unpaired t – test. It shows there were significantly reduced velocity of sural as well as superficial peroneal nerve as compared to other nerves in Type-II diabetic mellitus subjects. There were no changes in amplitude and velocity of motor median, tibial and sensory median nerve of diabetics subject compared to normal healthy subjects. Significance level was kept at 0.05 level.

OUTCOME MEASURES:

1. Amplitude, Latency and Conduction Velocity of motor median, ulnar, tibial and common peroneal nerve.

2. Amplitude, Latency and Conduction Velocity of sensory median, ulnar, sural and superficial peroneal nerve.
3. 60-second Diabetic Foot Screen Scale.

CONCLUSION: It was concluded that there was significant changes in superficial peroneal nerve and sural nerve, subclinical in Type-II diabetic mellitus compared to normal healthy subjects.

Keywords: Diabetes, Nerve conduction study, Peripheral nerve, Sensory examination, Vibration, Temperature analysis and Normal Healthy Subjects, 60-second diabetic foot screen scale.

INTRODUCTION

The human system is continually inundated with sensory information from a variety of environmental inputs as well as from movement, touch, awareness of the body in space, sight, sound, and smell. "In all higher order motor behaviours, the brain must correlate sensory inputs with motor outputs to accurately assess and control the body's interaction with the environment.(O'Sullivan & Schmitz, 2022)

The main function of sensory receptors is to transform physical stimuli into trains of nerve impulses in the afferent nerve fibres that innervate the receptors. Receptors only respond to physical stimuli of certain types. The properties of the receptors and the media that transmit the physical stimuli to the receptors determine the range of stimuli that are coded in the discharge pattern of the afferent nerve fibers.

Sensory organs that respond to innocuous stimulation perform two important kinds of tasks for the organism:

- Detect a physical stimulus that reaches one of its sensory organs
- Communicate that information to the sensory nervous system where extraction of useful information occurs.

Sensory receptors that respond to noxious stimulation warn and protect the animal from trauma and other dangers to their existence. The sensitivity of sensory systems depends on the sensitivity of sensory cells and the efficiency with which the physical stimulus is conducted to the sensory

Diabetes is a global public health problem whose burden is most affected in developing countries such as India. It is a major health issue that has reached alarming levels today, nearly half of the population worldwide is affected with diabetes. According to the World Health Organization (WHO), 422 million adults had diabetes in 2014. The global prevalence of diabetes is estimated to be 366 million by 2030; the overall global prevalence decreasing, with India having the largest number of diagnosed individuals.(Mitra, S. 2019) Prevalence is defined as the total number of individuals in a population who have a disease or health condition at a specific period of time, usually expressed as a percentage of the population. More than 62 million people in India are currently affected by the disease. The rapid rise of the Indian middle class, coupled with sedentary lifestyles and a shift in dietary patterns, fuels the existing burden of this disease. (Mitra, S. 2019)

Diabetes mellitus is a common chronic disease. It will include microvascular changes between neuronal and immunological system along with gilal cell activation. Vascular and neural disease closely related to each other, vasoconstriction is the first pathological changes seen in microvascular as the disease progress, it will lead to neuronal dysfunction, thickening of capillary basement membrane which contribute diminished oxygen tension, hypoxia and neuronal ischemic changes seen in diabetes.(Mitra, S. 2019)

A major strategy in controlling diabetes is in maintaining effective glucose levels. The most recent criteria to be followed for diagnosing diabetes mellitus are as follows (American Diabetes Association, 2018):(Rabeeha Mankhi Alzuhairi ,2017)

- Fasting plasma glucose ≥ 126 mg/dl
- 2-hour post-load glucose ≥ 200 mg/dl
- HbA1c ≥ 6.5%
- Random plasma glucose concentration ≥ 200 mg/dl

An effective strategy involve in primary prevention through healthy lifestyle management and reducing risk through proper drug therapy. These form the cornerstone for managing diabetes in India.(Rabeeha Mankhi Alzuhairi ,2017)

There are several types of diabetes, most commonly type I and type-II.(Rabeeha Mankhi Alzuhairi ,2017) Major causes of insulin resistance and intolerance would be attributed to overweight and obesity as well as impaired glucose tolerance. If the amount of insulin secreted by the β-cells is not enough to counter insulin resistance, the glucose tolerance impairment progresses to Type-2 diabetes. Hormonal abnormalities, for instance, lower incretin glucagon secretions such as peptide 1(GLP), hyperglucagonemia and increased concentrations of counter regulatory hormones leads to insulin resistance as well as hyper glycemia in T2DM.(Mitra, S. 2019)(Paul L Drury,2005)(Katherine Salter, 2013)

Inlow's 60 second diabetic foot ulcer screening tool is gaining immense attention over the years which is associated with its simplicity to use, rapid detection of high risk diabetic feet, and provides referral for patients necessitating treatment. A systematic review is conducted to assess the reliability and credibility of using Inlow's 60 second diabetic foot screening tool for diabetic foot risk stratification and to examine its feasibility in the Indian context.

Technology is moving ahead day by day, leaving us all confined and comfort with a lot of unknown harmful side effects on health. Clinician can initiate early intervention by educating subjects on the do's and don'ts for wound prevention and modification. Provide foot education for subjects with DM which emphasis on daily inspection of the feet, implementation of the appropriate level of wt bearing activity and selection of proper foot wear. Cheap, quick easy to assess & simple to administer for evaluation of Type-II diabetic mellitus subjects.

AIM OF THE STUDY:

To find out subclinical peripheral nerve changes occur in Type-II diabetic mellitus and normal healthy subjects with nerve conduction study and 60- Second diabetic foot screening scale.

OBJECTIVE OF THE STUDY:

1. Analysis of latency, amplitude and conduction velocity of MNCV in Median, Ulnar, Tibial and Common Peroneal Nerve in Type-II diabetic mellitus and Normal Healthy Subjects.
2. Analysis of latency, amplitude and conduction velocity of SNCV in Median, Ulnar, Sural and Superficial Peroneal Nerve in Type-II diabetic mellitus and Normal Healthy Subjects.
3. Analysis of 60- second diabetic foot screen scale in Type-II diabetic mellitus subjects.

METHODOLOGY

After the approval of the study from the ethical committee, 120 subjects from Out Patient Department (OPD) centres were taken, who fulfilled the inclusion and exclusion criteria taken for the study purpose. After proper explanation about the purpose and procedure of the study, subjects who were willing to participate in the study were requested to sign a written consent form. The selection of subjects was done purposive sampling. A pre-participation evaluation form consisting of basic assessment chart was filled.

Inclusion criteria: Age between 30-50 years. (Alanta,2020), Person with normal cognitive function.(MMSE >23) (Katherine Salter, 2013), Duration of diabetes (2-5 years), on using oral hypoglycaemic agents or those who are in injection of insulin. (Alanta,2020), Gender Both Male and Female.

Exclusion criteria: Person having open ulcer, any type of foot injury or infection, Person having any neurological disorders, history of any musculoskeletal injury in the last 6 months. Neurological disorder persons, chronic alcoholism, renal failure, type I diabetic patients are excluded. No previous history of any systemic condition related to peripheral neuropathy. Person with any Musculoskeletal Disorder like any fracture of lower limb, Lumbar Radiculopathy etc.

All measurements have been taken in morning hours between 9:00 to 12:00. Before testing commencement, all subjects have been asked to rest on the bed with shoes, removed for 5 minutes and remain comfortable and relaxed. All the subjects were asked to empty their bladder prior to testing. To provide a quiet testing environment, all tests have been performed in a close quiet room, with natural light from windows.

Motor Nerve Conduction Velocity(MNCV) and Sensory Nerve Conduction Velocity(SNCV) of Median, Ulnar, Tibial, Common Peroneal Nerve, Sural and Superficial Peroneal Nerve analysis method given in Mishra and Kalita. Instrumentation Parameters for motor nerve conduction study: Sweep speed : 5 ms/div, Sensitivity : 200-500 and Filter setting : 5hz- 3 KHz.

Type-II diabetic mellitus subjects were examined by different component 60-second diabetic foot screen scale .

Different component of scale are :

1. Look
(skin , nails , deformity , foot wear)
2. Touch
(temperature hot & cold)
3. Assess
Sensation – Monofilament Testing
Sensation – Ask 4 Questions:

i. Are your feet ever numb?
ii. Do they ever tingle?
iii. Do they ever burn?
iv. Do they ever feel like insects are crawling on them?

4.Pedal Pulses
5.Dependent Rubor
6.Erythema

Use the highest score from left or right foot.
Score = 0 to 6 recommend screening yearly
7 to 12 recommend screening every 6 months
13 to 19 recommend screening every 3 months
20 to 25 recommend screening every 1 to 3 months
Highest score to detect any changes is 25. Access right and left side both.

RESULT

STASTICAL ANALYSIS

SPSS version 22.0 for windows software. Microsoft excel was used to generate graphs and tables. Mean and Standard Deviation (SD) were calculated as measure of central tendency and measure of dispersion respectively.

Data was analysis between Diabetes and Non- Diabetes subjects by using of electrophysiological study in that velocity and amplitude of median and ulnar motor , median and ulnar sensory, tibial, common peroneal motor, Sural and superficial peroneal nerve sensory analysis by **Unpaired T-Test**.

TABLE 4.1 Shows Mean And SD of Diabetes and Normal Healthy Individual subjets of Age, Latency and Amplitude of MNCV, Latency and Amplitude of SNCV and 60-Second Diabetic Foot Screening Scale of 120 subjects.

	Number of Subjects	Mean		Standard Deviation	
		Normal Healthy subjects	Diabetes	Normal Healthy subjects	Diabetes
Diabetes subjects (Age)	120	----	40.98	------	3.74
Normal Healthy subjects (Age)		43.97	----	2.45	-------
60- Second Diabetic Foot Screening Scale		1	18	0.45	3.89
NERVE CONDUCTION VELOCITY STUDY VALUE FOR NORMAL HEALTHY SUBJECTS & DIABETICS					
Latency of Median Motor	120	2.55	2.75	9.20	10.56

Amplitude of Median Motor		2.76	2.90	10.79	12.98
Latency of Ulnar Motor		2.89	4.34	12.98	14.76
Amplitude of Ulnar Motor		2.44	3.45	10.09	12.32
Latency of Median Sensory		2.86	2.98	1.8	1.9
Amplitude of Median Sensory		2.56	2.78	1.6	1.09
Latency of Ulnar Sensory		2.08	2.09	1.78	1.98
Amplitude of Ulnar Sensory		2.98	2.87	1.09	1.78
Latency of Tibial Motor		2.16	2.90	7.90	8.76
Amplitude of Tibial Motor		2.45	3.00	9.08	10.09
Latency of Common Peroneal Motor		2.34	2.89	8.09	9.09
Amplitude of Common Peroneal Motor		2.39	2.97	6.98	9.78
Latency of Sural Sensory		2.40	2.96	9.67	12.09
Amplitude of Sural Sensory		3.67	2.90	5.67	9.80
Latency of Superficial Peroneal Sensory		2.10	2.80	7.68	9
Amplitude of Superficial Peroneal Sensory		2.08	3.89	7.89	7.90

TABLE 4.2 Shows Test Result Diabetes and Normal Healthy Individual subjets of Latency and Amplitude of MNCV, Latency and Amplitude of SNCV of 120 subjects.

NERVE	**NUMBER OF SUBJECTS**	**T-VALUE**	**P-VALUE**	**INTERPRETATION**
RIGHT MEDIAN DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY	120 IN EACH GROUP	-1.289	.210	NON-SIGNIFICANT

LEFT MEDIAN DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		-1.289	.210	NON-SIGNIFICANT
RIGHT MEDIAN DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		.104	.918	NON-SIGNIFICANT
LEFT MEDIAN DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.547	.135	NON-SIGNIFICANT
RIGHT MEDIAN SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.818	.421	NON-SIGNIFICANT
LEFT MEDIAN SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.220	.827	NON-SIGNIFICANT
RIGHT MEDIAN SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.406	.172	NON-SIGNIFICANT
LEFT MEDIAN SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.435	.203	NON-SIGNIFICANT
RIGHT ULNAR DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.987	.231	NON-SIGNIFICANT
LEFT ULNAR DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.765	.112	NON-SIGNIFICANT
RIGHT ULNAR DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.90	.256	NON-SIGNIFICANT
LEFT ULNAR DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.798	. 441	NON-SIGNIFICANT
RIGHT TIBIAL DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.818	.421	NON-SIGNIFICANT
LEFT TIBIAL DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.430	.675	NON-SIGNIFICANT

RIGHT TIBIALDIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-2.098	.234	NON-SIGNIFICANT
LEFT TIBIAL DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.99	0.610	NON-SIGNIFICANT
RIGHT COMMON PERONEAL DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.897	.876	NON-SIGNIFICANT
LEFT COMMON PERONEAL DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.310	.752	NON-SIGNIFICANT
RIGHT COMMON PERONEAL DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-.679	.172	NON-SIGNIFICANT
LEFT COMMON PERONEAL DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.589	.961	NON-SIGNIFICANT
RIGHT SUPERFICIAL PERONEAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.993	.00	SIGNIFICANT
LEFT SUPERFICIAL PERONEAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		-.372	.00	SIGNIFICANT
RIGHT SUPERFICIAL PERONEAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		.783	.03	SIGNIFICANT
LEFT SUPERFICIAL PERONEAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.562	0.04	SIGNIFICANT
RIGHT SURAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		.893	.00	SIGNIFICANT
LEFT SURAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS VELOCITY		-1.372	.00	SIGNIFICANT
RIGHT SURAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		.893	.03	SIGNIFICANT

LEFT SURAL SENSORY DIABETICS AND NORMAL HEALTHY SUBJECTS AMPLITUDE		-1.372	0.04	SIGNIFICANT

Co reelation test was used for analysis of 60- second diabetic foot screening scale with normal healthy individual and diabetics. Result shows diabetics subjects having higher value as compared to normal healthy individual.

DISCUSSION

At present study evaluate sub-clinically peripheral nerve changes in Type-II Diabetes Mellitus and compared with the normal healthy subjects , in that nerve conduction velocity study and 60-second diabetic foot screening scale used. Some of the review focuses on the types of diabetes and the effective diagnostic methods and criteria to be used for diagnosis of diabetes and prediabetes. Evidently, diabetes is a complex disease with a large pool of genes that are involved in its development.

Individuals with prediabetes do not meet the criteria of having diabetes but are at high risk to develop type 2 diabetes in the future. According to the ADA Expert Committee, individuals are defined to have prediabetes if they have either impaired fasting plasma glucose (IFG) levels between 100-125 mg/dL (5.6-6.9 mmol/L) or impaired glucose tolerance test (IGT) with 2-h plasma glucose levels in the oral glucose tolerance test (OGTT) of 140-199 mg/dL (7.8-11.0 mmol/L). The World Health Organization (WHO) still adopts the range for IFG from 110-125 mg/dL (6.1-6.9 mmol/ L). Prediabetes has been shown to correlate with increased cardiovascular mortality and cancer.

Nerve conduction studies are sensitive, specific, reproducible, and easily standardized measures of the presence of nerve function impairment. In the initial half of the study, SNCV was evaluated in diabetic and compared it with Normal Healthy Individual. A significant bilateral decrease in the SNCV of lower limb, sural nerve and superficial peroneal nerve was observed in diabetic. However, bilateral decrease in the SNCV of upper limb (Median and Ulnar nerves) was seen in diabetic when compared with normal healthy subjects but this decrease in SNCV was statistically non-significant.

In the current study more deterioration of nerve conduction velocity are found in nerves of lower limb as compared to upper limb. Kulkarni et al., also observed that nerves of lower limbs are more commonly affected as compared to upper limb suggesting that long nerves are more susceptible to diabetes assault.

The pathological mechanisms implicated in diabetic neuropathy, include microvascular damage, metabolic disorders, and changes in the interactions between neuronal and immunological systems along with glial cell activation.

Kanavi Roopa shekharappa is an author and she has done research on **A Study on the utility of nerve conduction studies in type 2 diabetes mellitus.** This study shows that nerve conduction velocity progressively decrease with diabetes mellitus.

The factor leading to diabetic neuropathy is not completely understood. Developmental symptoms depend on many factors such as total hyperglycemic exposure, elevated lipids etc.
Diabetic neuropathy severely decrease patient's quality of life.beacause it will also lead a amputation of limb and any other serious condition. so it is very important to understand and early intervention is needed.
LIMITATION OF THE STUDY: Medication effects can not be consider here. Small sample size.
FURTHER RECOMMENDATION OF THE STUDY: Study can be done with large sample size. It can be compared with the other outcome measure.

CONCLUSION: The results of present study suggest that through NCV Sensory nerve changes mostly occur in sural and superficial nerve as compared to upper limb. Also 60- second diabetic foot screening scale shows decrease value and it's suggest chances\of neuropathy in later stages of life.

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