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A Case Control Study of Sensory Nerve Conduction in Hypothyroidism

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Abstract:-
Background: Thyroid hormones (TH) are having significant effects on the nervous system. They are important for the development of Central Nervous System and myelination of neurons. Thyroid diseases can lead to neuromuscular dysfunction.

Materials and Methods:The study was conducted in the department of Physiology and department of Medicine in J N Medical College, Aligarh. 50 patients with hypothyroidism were included in the study. The diagnosis of hypothyroidism was confirmed by serum TSH levels. They were then sent for nerve conduction study of Ulnar, Median and Sural nerve.

Results: There were significant changes in the latency, amplitude and conduction velocity in the sensory nerve conduction study of Ulnar, Median and Sural nerve on both sides.

Conclusion: Hypothyroidism manifests as polyneuropathy which is mixed type. There is the involvement of nerves in both upper and lower limbs which can be diagnosed even before the occurrence of other clinical symptoms in hypothyroidism. There is a need to include sensory nerve conduction in the initial workup of hypothyroid patients.

Keywords: *Sensory, Nerve conduction, Hypothyroidism, Polyneuropathy.*

I. INTRODUCTION

Thyroid hormones (TH) are having significant effects on the nervous system. They are important for the development of Central Nervous System and myelination of neurons. Thyroid diseases can lead to neuromuscular dysfunction.

Hypothyroidism is the condition of deficient hormone production by the thyroid gland. This low level of hormone affects the functioning of brain and peripheral tissues. Hypothyroidism can result in neurological complications like neuropathy, myopathy, carpal tunnel syndrome, dementia, psychosis, cerebellar syndrome and coma. [1].

The development of peripheral neuropathy in hypothyroidism is gradual, taking a long time for development of clinical manifestation. In the nerves, there will be metabolic alterations which affects the Schwann cells and induces segmental degeneration. [2] Mononeuropathy and polyneuropathy are reported in hypothyroidism by various studies.Sensory nerve conduction deficit can manifest as pain, cramps, paraesthesia of fingers and limbs. [3].

Neurological symptoms are reported in 79% of hypothyroidism [4]. As a result, abnormal nerve conduction studies are expected in hypothyroidism. These nerve conduction studies can be used to differentiate between demyelination or axonal loss. Studies done in hypothyroidism had shown abnormalities in both motor and sensory nerve conduction studies[5].

II. MATERIALS AND METHODS:

The study was done in the department of Physiology, J N Medical college, AMU, Aligarh. Patients attending the Medicine outpatient department of the same hospital was selected for the study. This study was done as a prospective study from August 2017 to August 2019 after obtaining clearance from the ethical committee in J N Medical college, AMU, Aligarh.

III. INCLUSION CRITERIA:

Patients who are newly diagnosed as having hypothyroidism by laboratory confirmation was included in the study irrespective of their age and gender.

IV. EXCLUSION CRITERIA

- Pregnant patients with Hypothyroidism.
- Known patients of Malabsorption syndrome.
- Known cases of Chronic Renal Failure.
- Known cases of COPD.
- Known case of Diabetes Mellitus.
- Patients on Oral Anti-coagulants or Anti-epileptic or Anti-cancer Medications
- Patients with history of Gastric/Ileal resection.
- Patients with history of Pancreatic Insufficiency.
- Known cases of Chronic Alcoholism.
- Exclusive Vegetarians.
- Patients with any type of malignancy

Proper consent was taken from the patients prior to the study. TSH was estimated by chemiluminescence method and values more than 4.0 µIU/mlwere considered in the diagnosis of hypothyroidism.

Nerve conduction study was done by Neuro-Stim EMG/NCV/EP SYSTEM(Medicaid systems, Chandigarh, 160002, India). In the present study, antidromic conduction is recorded. Here the sensory nerve is stimulated at a proximal point and the recording is done at a distal point. The parameters measured in the study includes the onset

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latency, amplitude, duration of action potential and the nerve conduction velocity.

Statistical analysis was done using IBM® SPSS® Statistic 23.0. The cases and control was compared using Mann-Whitney U test after normality testing by Shapiro–Wilk test. p-value less than 0.05 is taken as statistically significant.

V. RESULTS

In the present study, 50 patients of hypothyroidism were included after considering the inclusion and exclusion criterion. They were compared with healthy controls of same age group. Out of the 50 patients with hypothyroidism, 12 are males and 38 are females. This is in agreement with the higher prevalence of hypothyroidism in females than males worldwide. Out of the 50 controls, 30 are males and 20 are females. In the patient group, the mean age is 48.74 ± 12.09 years. In the control group, the mean age is 37.52 ± 21.21 years.

The patients selected for the study are proven cases of hypothyroidism. They have elevated levels of serum TSH levels. Out of the 50 proven hypothyroid cases, 43 patients are having symptoms suggestive of hypothyroidism and 7 were not having the symptoms.

The Body Mass Index (BMI) of the patients with hypothyroidism are BMI are 22.66 ± 1.08Kg/m2 and control were 25.75 ± 3.50Kg/m2 (p value of < 0.05).

The nerves selected for sensory conduction are Median, Ulnar and Sural nerves. Three main parameters, namely, latency, amplitude and nerve conduction velocities are compared between both the groups.

In the right side, the results obtained are as follows (Table 1):

NERVE	PARAMETER	CONTROL(n= 50)	CASE(n= 50)	p VALUE
MEDIAN	Latency	2.71 ± 0.12	2.96 ± 0.13	<0.05*
	Amplitude	43.81 ± 3.00	27.59 ± 4.89	< 0.05*
	Velocity	57.03 ± 2.70	50.32 ± 1.89	< 0.05*
ULNAR	Latency	2.57 ± 0.11	2.52 ± 0.18	>0.05
	Amplitude	37.43 ± 1.57	35.32 ± 2.57	< 0.05*
	Velocity	56.59 ± 1.41	53.79± 1.03	< 0.05*
SURAL	Latency	2.67 ± 0.69	3.14 ± 0.21	<0.05*
	Amplitude	17.59 ± 1.27	14.86 ± 1.77	< 0.05*
	Velocity	51.32 ± 0.89	43.28 ± 1.26	< 0.05*

Table 1: Comparison of nerve conduction parameters between control and cases on right side Median, Ulnar and Sural Nerves

*P value <.05: Statistically Significant

In the left side, the results obtained are as follows (Table 2):

NERVE	**PARAMETER**	**CONTROL(n= 50)**	**CASE(n= 50)**	**p VALUE**
MEDIAN	Latency	2.69 ± 0.11	2.92 ± 0.14	**<0.05***
	Amplitude	43.76 ± 2.92	27.84 ± 4.89	**< 0.05***
	Velocity	57.05 ± 2.71	50.09 ± 1.31	**< 0.05***
ULNAR	Latency	2.52 ± 0.10	2.57 ± 0.18	>0.05
	Amplitude	37.44 ± 1.56	35.32 ± 2.57	**< 0.05***
	Velocity	56.58 ± 1.43	53.79± 1.03	**< 0.05***
SURAL	Latency	2.66 ± 0.66	3.12± 0.22	**<0.05***
	Amplitude	17.57 ± 1.25	14.91 ± 1.70	**< 0.05***
	Velocity	51.31 ± 0.86	43.40 ± 1.19	**< 0.05***

Table 2: Comparison of nerve conduction parameters between control and cases on left side Median, Ulnar and Sural Nerves

*P value <.05: Statistically Significant

VI. DISCUSSION

The onset latency in nerve conduction study is a measure of the fastest conducting nerve fibres. The amplitude measures the number of nerve fibres. Velocity represents the conduction speed in the fastest nerve fibres in a big motor or sensory nerve. All these parameters will be deviated from normal in a peripheral neuropathy due to loss of fibres in the nerve. The latency will be prolonged as compared to normal in neuropathy. There will be reduction in amplitude and velocity due to the loss of nerve fibres in neuropathy. The peripheral neuropathy occurring in hypothyroidism is expected to exhibit these derangements in the parameters of nerve conduction study.

In the present study, there is significant prolongation of latency in Median and Sural nerve on both sides. Amplitude is significantly reduced in Median, Ulnar and Sural nerve on both sides. There is significant reduction in conduction velocities of Median, Ulnar and Sural nerve on both sides. Bafna et al (2020) [6]showed increased latency and decreased conduction velocity in Median and Sural nerve of

Hypothyroid cases which is in agreement with the findings of our study. The study of sensory conduction in median nerve by Murugiah et al (2018)[7] showed significant variation in amplitude and velocity. Similar result in Sural nerve was shown by Gupta et al (2021)[8]. The changes observed in Sural nerve is similar to that reported by Garg et al (2015)[9].

The changes observed in neurophysiological parameters of sensory conduction in upper and lower limb suggests a mixed type of neuropathy in patients of hypothyroidism. This can be substantiated by the variations in latency, amplitude and conduction velocity that are a result of both axonal damage and demyelination. Studies done by Mahadule et al (2015) [10]and Shettyet al (2017)[11] came to such a conclusion. The metabolic changes associated withhypothyroidism may be responsible for the decreased conduction velocities. hypothyroidism induced ATP deficiency with reduced activity of ATP ase enzyme may result in reduced amplitudes. The entrapment of nerves in narrow passages in the body, like that of Median nerve in Carpal tunnel syndrome is a common feature of hypothyroidism. This contributes to the axonal damage which already begins in hypothyroidism. The increased BMI in the cases of our study may worsen such a situation.

VII. CONCLUSION

Hypothyroidism is associated with polyneuropathy which is largely mixed type. Sensory nerves like Median, Ulnar and Sural nerve are affected in neuropathy of this type. This study showed involvement of nerves in both upper and lower limbs. The nerve involvement can go unnoticed for a long time and can appear even before the manifestation of clinical symptoms. There is a need to include nerve conduction study in the initial work up of hypothyroidism cases. Equal importance should be given to sensory study like that of motor study. This helps in finding the neurological involvement in purely sensory nerves like Sural nerve. Initial diagnosis, treatment and follow up can prevent debilitating neuropathy to progress in cases of hypothyroidism.

VIII. LIMITATIONS

- Small sample size
- The exact aetiology of neuropathy is not found out
- Follow up and response to treatment is not done.
- **CONFLICT OF INTEREST**: Nil

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