

NERVE CONDUCTION STUDY IN NEWLY DIAGNOSED FEMALE HYPOTHYROID PATIENTS – A CROSS SECTIONAL STUDY

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Abstract

Background: Thyroid disorders are one of the common endocrine disorders next to diabetes mellitus which has a multi factorial etiology. As the thyroid hormone controls the activities of all cells of the body, altered level of thyroid hormones leads to multi systemic disturbances. Nervous system involvement is one of the complication, which can be reversed completely if detected and treated early. The aim is to record nerve conduction study in newly diagnosed female hypothyroid individuals and age matched controls and compare the results. **Materials and Methods:** The study was conducted in Tirunelveli Medical College Hospital, The sensory and motor nerve conduction study was performed in 22 newly diagnosed hypothyroid female patients and 25 control subjects. **Result:** The parameters like latency, conduction velocity and amplitude were compared and statistical analysis done. There is a statistically significant difference between hypothyroid and control subjects. Sensory neuropathy was present in 45.4% and sensorimotor neuropathy in 9.1% and carpal tunnel syndrome in 36% of hypothyroid subjects. **Conclusion:** The importance of nerve conduction study in hypothyroid patients is explained.

INTRODUCTION

Thyroid disorders are one of the common endocrine disorders next to diabetes mellitus which has a multi factorial etiology. The prevalence of hypothyroidism in the world population ranges from 1-10% with female predominance. In Indian scenario, hypothyroidism is found to affect 1 in 10 adult. In spite of the fact that India is in post iodination phase, increasing prevalence of thyroid disorders is due to poor awareness and cost factors.

As the thyroid hormone controls the activities of almost all cells of the body, altered level of thyroid hormones leads to multi systemic disturbances. Poor appetite, weight gain, hypertension, cardiac failure and infertility are some of the common features of hypothyroidism.^[1] The Neurological changes like psychosis, poverty of movements and ataxia in hypothyroid patients are also significant and troublesome. Peripheral neuromuscular involvement in the form of proximal myopathies, entrapment neuropathies like carpal tunnel syndromes and tarsal tunnel syndromes occurs in person with thyroid disorders.^[2] The magnitude of thyroid disorders among poor people of India leads to frequent

absenteeism from duty because of the neurological manifestations. Moreover the proper treatment results in complete resolution of neuropathy and late institution of adequate treatment of hypothyroidism do not offer complete cure.^[2] Hence it is essential to study the prevalence of the same by doing neurophysiological studies in both symptomatic and asymptomatic patients of established Hypothyroidism.

Thyroid hormone plays a vital role in the maturation and development of nervous system in fetal life and in early part of the childhood. The maximal growth of brain occurs between later half of fetal life and first six months after the birth. During this period of human life, thyroid hormone is required for the initiation and facilitation of the neural cell differentiation and maturation. Axonal multiplication and branching patterns of dendrites are controlled by thyroid hormone. It also promotes the formation of synapse. Neurotransmitter synthesis is catalysed by enzymes. Thyroid hormone stimulates the enzyme productions. It also enhances the receptors formation for the attachment of neurotransmitters to perform their physiological actions.

Thyroid hormone maintains the optimum amount of the enzyme galactosyl sialyl transferase. This enzyme is very important for myelin formation around neuronal processes. Myelination is an important factor responsible for the faster conduction of impulse. Experiments in animals have proved the facilitatory role of T4 in generation of nerve growth factors. It is essential for the migration of the neuronal cells during the growth of brain. The velocity and amplitude of stretch reflex is facilitated by thyroid hormones.

Hypothyroidism very often affects peripheral nervous system and muscles. Proximal myopathy is common, and Patients presents with myalgia and muscle stiffness. Up to 30.5% of patients presents with carpal tunnel syndrome. In patients with long standing hypothyroidism it may persist even after normalization of thyroid function tests. Sensorimotor neuropathy also occurs. Neuropathy is due to the degeneration of axons and demyelination. Eliciting deep jerks detects slow relaxation of reflexes. Patients with subclinical hypothyroidism (normal thyroid hormone level with elevated TSH) usually do not exhibit abnormal nerve conduction.^[3]

MATERIALS AND METHODS

This is a cross sectional study, conducted in Tirunelveli Medical College Hospital after obtaining Institutional Ethical Committee clearance. The newly diagnosed female hypothyroid patients in the age group of 20-50 years and age matched controls were selected for the study. They were explained about the procedure and informed written consent was obtained.

Exclusion criteria

The patients with diabetes, hypertension, any prior history of neurological illness, intake of any drug causing peripheral neuropathy, liver or kidney disease family H/o neuropathy and those who are pregnant were excluded.

The required personal details and general clinical examination was done and recorded in a proforma. The sensory nerve conduction study was performed in left median and left ulnar nerves of upper limb and left sural nerve of lower limb. The nerves examined for the motor nerve conduction study were median and ulnar nerves and posterior tibial nerve of the left side. The nerve conduction study was performed by using RMS EMG EP MARK II at Neurophysiology unit of the neurology department. Surface electrodes

were used. This equipment used filter frequency of 2 to 10 Hz in motor conduction and 2 to 3 Hz in sensory conduction studies. Initially nerves were stimulated with low voltage strength of current and gradually increased till we obtained a maximal response curve.

RESULTS

After performing the conduction study, the latency, conduction velocity and amplitude of the action potential of both motor and sensory conduction were entered in master chart and tabulated. The statistical analysis was done using unpaired student 't' test and the statistical significance between the groups was obtained.

[Table 1] shows the amplitude, conduction velocity and amplitude (SNAP) in left ulnar, median and sural nerve and it is compared with controls.

- The sensory conduction of the ulnar nerve indicated a non significant increase in the latency and decrease in the amplitude and a significant decrease in the conduction velocity in hypothyroid group.
- The statistical analysis of sensory conduction parameter of median nerve showed a significant increase in the latency and decrease in the conduction velocity and amplitude in hypothyroid group.
- The sensory conduction study of the sural nerve showed that there was a significant increase in the latency and decrease in the conduction velocity and amplitude of sensory action potential in hypothyroid group.

[Table 2] shows the amplitude, conduction velocity and amplitude (CMAP) in left ulnar, median and posterior tibial nerve and it is compared with controls

- All the parameters in the median nerve motor conduction study were significantly altered in the hypothyroid group. The distal latency was increased and the conduction velocity and action potential was decreased.
- The ulnar nerve motor conduction study of the hypothyroid on comparison with control showed no statistically significant alteration of the nerve conduction parameters.
- The motor conduction parameters of the tibial nerve showed a significant decrease in the conduction velocity in hypothyroid group. The distal latency and compound motor action potential did not indicate a significant change.

Table 1: Sensory Nerve conduction

	Nerve	Control	Hypothyroid	P value
Latency (ms)	Ulnar	3.41 ± 0.19	3.6 ± 0.41	0.055
	Median	2.99 ± 0.19	3.45 ± 0.41	0.000*
	Sural	3.97 ± 0.26	4.51 ± 0.61	.001
Conduction Velocity (m/s)	Ulnar	51.09 ± 1.81	48.81 ± 3.07	0.004*
	Median	51.42 ± 1.56	45.01 ± 8.04	0.001*
	Sural	42.20 ± 1.86	38.84 ± 5.01	.006*
SNAP (microvolt)	Ulnar	17.84 ± 0.67	17.26 ± 2.06	0.220
	Median	21.35 ± 1.39	17.80 ± 3.28	0.000*
	Sural	6.20 ± 0.41	5.75 ± 0.51	.002*

*P value < 0.05 significant

Table 2: Motor Nerve conduction

Variable	Nerve	Control	Hypothyroid	P value
Latency (ms)	Median	4.03 ± 0.35	4.74 ± 0.82	0.001
	Ulnar	2.99 ± 0.26	2.93 ± 0.29	0.45
	Tibial	5.82 ± 0.23	6.05 ± 0.56	0.93
Conduction Velocity (m/s)	Median	51.01 ± 1.87	48.83 ± 1.60	0.000*
	Ulnar	51.14 ± 1.64	49.83 ± 2.85	0.67
	Tibial	43.46 ± 2.02	40.55 ± 2.59	0.000*
CMAP (milli volt)	Median	4.39 ± 0.26	3.99 ± 0.66	0.014*
	Ulnar	6.23 ± 0.23	5.99 ± 0.91	0.24
	Tibial	3.45 ± 0.32	3.19 ± 0.75	0.13

*P value < 0.05 significant

Table 3: F wave Latency

Nerve	Control	Hypothyroid	P value
Tibial	47.26 ± 0.69	47.49 ± 0.60	0.23
Median	24.1 ± 0.75	23.90 ± 0.9	0.43
Ulnar	25.46 ± 0.64	25.38 ± 0.72	0.69

P value > 0.05 not significant

Table 4: Neuropathy in Hypothyroidism

Neuropathy	No of Hypothyroid	Percentage
Sensory	10	45.4
Sensorimotor neuropathy	2	9
Carpal tunnel syndrome	8	36.3

[Table 3] shows F wave latency compared with hypothyroid and control subjects.

There was no significant change in F wave latency in hypothyroid group as compared to control.

[Table 4] shows 45.4 % of patient had sensory neuropathy and 9 % and 36.3% of patients were affected by sensorimotor neuropathy and entrapment neuropathy in the form of carpal tunnel syndrome respectively

DISCUSSION

In the present study, the nerve conduction was performed in 22 hypothyroid, and 25 normal individuals. The person was diagnosed to have peripheral neuropathy if two or more nerves are involved. Prolonged latency in sensory conduction study indicates sensory neuropathy. In motor conduction study, decrease in amplitude denotes axonal degeneration and prolonged distal latency and conduction velocity indicate demyelination. Carpal tunnel syndrome is indicated by the significant prolongation of distal latency.

Hypothyroidism is most commonly due to autoimmune pathology and it has got a slow progressive course. In the present study, sensory conduction parameters of median and sural nerve showed statistically significant values. These findings are supported by studies by many researchers including Khedr et al and Ihsan M. Ajeena et al.^[4,5] The study by Adikesavan et al,^[6] has similar finding with the sural nerve and conduction velocity of median nerve but not with the latency and amplitude changes. The ulnar nerve conduction study did not show any significant change in the parameters

except conduction velocity. This finding is consistent with the Ihsan M. Ajeena et al and Yeasmin et al.^[7] Gulbun Yuskel et al,^[8] has found a significant change in ulnar nerve action potential, a finding not consistent with the present and most of the studies.

Motor conduction parameters showed the significant change in the median nerve. The finding of my study is similar with study by Sabina Yeasmin et al,^[9] and Ihsan M. Ajeena et al. There is no significant change in the parameter is the observation by Hala S Sweed et al,^[10] in median nerve. The tibial nerve (except conduction velocity) and ulnar nerve parameters did not indicate a significant change. This finding correlates with many of the studies performed. No significant change in F wave latency in any of the nerve was noted in our study. Many of the above mentioned studies agree with this finding. Involvement of motor component of the median nerve might be due to the long duration of symptoms in most of the patients in hypothyroid group.

Combining all parameters, the present study had shown the presence of sensory neuropathy in 45.4 % of and sensorimotor neuropathy in 9.1% of the hypothyroid group studied. These finding are in consistent with the observation reported by the Ihsan M. Ajeena et al and Gulbun Yuskel et al. Carpal tunnel syndrome is present in 36 % of the hypothyroid group. The incidence of carpal tunnel syndrome in hypothyroidism by various investigators ranges from 5 to 92 %. Marcia W Cruz et al have reported 43.7% as the incidence of CTS. The result of my study is comparable with this finding.^[11]

Thyroid hormone plays a key role in the regulation of basal metabolism. The thyroid hormone has effects on mitochondrial oxidase activity.^[12] By its influence on metabolism, it enhances the nerve

conduction by its various effects on nervous system. Axonal transport requires the optimum functioning of this pump. This reduction in axonal transport causes a significant change in the nerve conduction. For unknown reason, hypothyroidism affects the sensory nerves earlier than the motor nerves. The distal nerves like median and sural nerves show changes earlier than the proximal nerves. Demyelination and axonal degeneration happens due to the oxidative injury of myelinated fibers. Axonal degeneration is the common cause of neuropathy in the present study. In addition, low temperature and low sodium level in hypothyroidism decreases membrane excitability by decreasing sodium entry in depolarisation phase of nerve action potential.^[6] The weight gain in hypothyroidism may contribute to neuropathy. In hypothyroidism, there occurs reduction in the degradation of the mucopolysaccharide and carpal tunnel syndrome is a consequence of the deposition of mucopolysaccharide.

CONCLUSION

This study has enlightened the importance of the nerve conduction study in patients with thyroid disorders. The hypothyroid patients are prone to develop polyneuropathy. Hence it is essential to include nerve conduction study in all the patients diagnosed with hypothyroidism, since neuropathy is reversible if treated earlier.

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