



ORIGINAL RESEARCH PAPER

Physiology

A COMPARATIVE STUDY OF SENSORY AND MOTOR COMPONENTS OF MEDIAN NERVE CONDUCTION IN HYPOTHYROID SUBJECTS.

KEY WORDS: Sensory, Motor Components, Hypothyroid, Median nerve, Nerve Conduction Study.

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ABSTRACT

OBJECTIVE: To compare the latency, amplitude, conduction velocities of motor and sensory components of Median nerve in hypothyroid patients with that of normal individuals.
MATERIALS AND METHODS: With ethical committee approval, 30 hypothyroid patients and 30 age matched controls of age groups 18-40years were included in the study. After obtaining Informed written consent, detailed clinical examination, the study group was subjected to nerve conduction study. The latency difference, amplitude and conduction velocity were noted and the data was analyzed with SPSS 16.0 version.
RESULTS: There is a significant delay in latency (SDL) and decrease in amplitude in both the sensory and motor component of median nerve ($p < 0.05$). Highly significant decrease in conduction velocity with minimal latency difference in the sensory and motor component of median nerve ($p < 0.05$) has been observed. Sensory involvement is earlier than motor.
CONCLUSION: Significant prolonged latencies before appearance of neurological symptoms reveal that might be due to a mononeuropathy secondary to compression caused by mucinous deposits in the soft tissues surrounding peripheral nerves. hypothyroid patients may have preclinical asymptomatic small fiber peripheral neuropathy.

INTRODUCTION:

Hypothyroidism is a common clinical condition among women and it is associated with low levels of thyroid hormones and raised thyroid stimulating hormone. It may be due to some intrinsic disorders of thyroid or may be due to pituitary or hypothalamic disorders¹. Thyroid hormone deficiency has direct relationship with the occurrence of neuropathy².

Polyneuropathy in Overt hypothyroidism ranges from 42 to 72%. The prevalence of hypothyroidism as a cause of polyneuropathy is around 2-4%. Peripheral nervous system involvement is significantly related to the duration of hypothyroidism. Thus long-standing biochemical abnormalities lead to neurologic alterations. About 40% of the hypothyroid patients had predominantly sensory signs of a sensorimotor axonal neuropathy. Early in the course of thyroid disease motor involvement of peripheral nerves in hypothyroid patients tends to be less symptomatic than sensory nerve abnormalities and neuromuscular changes secondary to hypothyroidism are irreversible despite symptomatic improvement.

Evaluation of peripheral nerve disease by electrodiagnostic studies, primarily nerve conduction studies can document the presence of peripheral nerve disease, defines the distribution and pattern of various sensory and motor fibers, and characterize the underlying pathologic processes whether the process is axonal or demyelinating, and adds additional information⁴. The common Nerve conduction parameters done includes motor and sensory distal latencies (SDL), amplitude, motor and sensory conduction velocities (SNCV) in different peripheral nerves. The increased latency and decreased amplitude and NCV in any nerve indicate impairment of that nerve. Hypothyroid individuals present with a sensory-motor Polyneuropathy with a distal-proximal progression. Deficiency of thyroid hormones cause neuropathy by affecting different peripheral nerves but more commonly the median nerve^{3,4,5}. Median nerve is often vulnerable to compression within the carpal tunnel by the flexor retinaculum. The aim of the current study was to assess the degree of sensory and motor impairment of the median nerve function using principal electrophysiological parameters and to compare both in hypothyroid ambulatory patients.

MATERIALS AND METHODS:

The study had sample Size of 30. The study had been conducted in

the Neurophysiology laboratory, Department of Physiology, Stanley Medical College, Chennai- 1 from 2012 to 2013. 30 Hypothyroid individuals in the age group of 18-40 yrs from Endocrinology O.P Govt Stanley Medical College, Chennai and 30 age matched Controls from Master Health Checkup O.P Govt Stanley Medical College, Chennai were recruited for the study. After proper ethical committee approval and consent from subjects, Nerve conduction study was done to assess motor and sensory component of median nerve in the Neurophysiology Research Lab, Department of Physiology, Stanley medical college. **Inclusion criteria** included hypothyroid individuals with an **exclusion criteria** of Diabetes mellitus, alcoholism, liver and kidney disease, other possible causes of neuropathy or neuromuscular diseases and use of drugs known to cause neuropathy or myopathy, malignancy or serious illness and family history of neuropathy. A diagnosis of hypothyroidism was made when triiodothyronine (TT3) and/or thyroxine (TT4) were below the normal limits (0.2-0.5 ng/dl and 0.7-1.8ng/dl), and thyrotropin (TSH) was above normal (0.3-4 mIU/l). Detailed medical history was taken and general examination including height, weight were done. The study was performed at room temperature. Both the patients and the controls were explained about the procedure and were made to sit in a chair comfortably. Area to be stimulated was cleaned and dried. Motor and Sensory nerve conduction was performed in STANDARD RMS ENMG EP MARKII MACHINE after entering the patient information^{4,5,6}. Adjustments were made in parameters as sensitivity-20/division, high frequency filter-3kHz, low frequency filter-20Hz, sweep speed-1ms/division, and averaging 20 times. Gel is applied to the electrodes to reduce resistance between skin and electrode. After applying the active ring electrode in the proximal interphalangeal joint, reference electrode in distal interphalangeal joint and ground electrode which acts as a zero reference point. A submaximal stimulus was given at proximal or distal point along the course of the nerve at wrist between flexor carpi radialis and Palmaris longus. Artifact free response was captured. Distance between stimulating and recording electrode was measured and sensory nerve conduction velocity was calculated. For motor nerve conduction, active electrode was placed in the motor point & Reference electrode 3cm distal at the first metacarpophalangeal joint. Ground electrode on the dorsum of the hand. Supramaximal stimulation point one was given by placing the cathode at 3 cm proximal to the distal wrist crease at wrist and Stimulation point two, the cathode was placed at elbow near the volar crease in antecubital

region. The anode was proximal. Statistical analysis was done . Variables compared using independent t-test.

PARAMETERS STUDIED:

Distal Latency, Latency difference. Amplitude, Motor and Sensory Nerve Conduction Velocity.

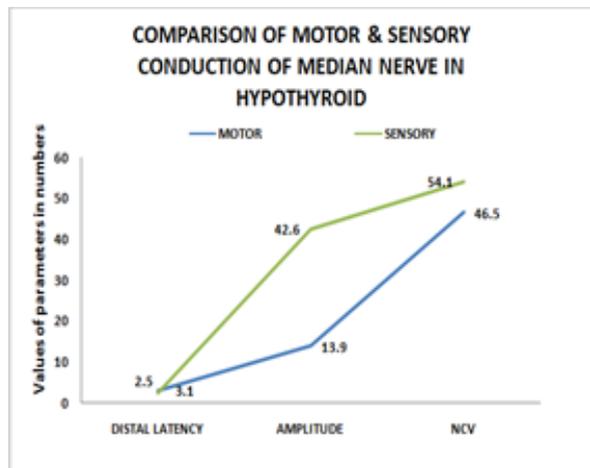
RESULTS:

The demographic data and baseline patient characteristics are given in

(Table 1).

VARIABLES	HYPOTHYROID (MEAN)	EUTHYROID (MEAN)
Age(Yrs)	30	30
Sex	F	F
Height (Cm)	159.65	162
Weight (Kg)	60	58
T3 ng/dl	0.1	0.5
T4 µg/dl	0.5	1.8
TSH mIU/L	12.84	4

In this study, the mean TT3 and TT-4 were significantly lower in hypothyroids in comparison to those of healthy group and TSH was high.



There is a significant increase in distal latency, latency difference and decrease in amplitude in both the sensory and motor component of median nerve (p<0.05). Highly significant decrease in conduction velocity in the sensory and motor component of median nerve (p<0.05) has been observed Also sensory involvement is more earlier than motor.

DISCUSSION:

All the hypothyroids had significantly (P <0.01) lower TT3 and TT4 levels compared to euthyroids. Also nerve conduction abnormalities are confirmed by electrophysiological examination. The hypothyroid groups showed slightly higher sensory distal latency (SDL) with lower motor(MNCV) and sensory nerve conduction velocity (SNCV) .Misiunas et al observed electrophysiologic changes in peripheral nerve in patients with high basal levels of serum TSH⁶. The deposition of mucopolysaccharide leads to compression over the peripheral nerves and results in swelling and degeneration of nerves. A mononeuropathy secondary to compression caused by mucinous deposits in the soft tissues surrounding peripheral nerves and a polyneuropathy due to either a demyelinating process or primary axonal degeneration may be the reason.^{7,8}

Thyroid hormones increase ATPase activity and thus increases ATP dependent Na⁺/K⁺ pump. Therefore, in hypothyroidism there is ATP deficiency and decreased ATPase activity with decreased Na⁺/K⁺ pump activity which cause alteration of pump dependent axonal transport and lead to peripheral neuropathy⁴. Decrease in glycogen degradation also lead to energy deficit in

hypothyroidism^{3,4,8}. There may be a combination of both compression and axonal degeneration, which results in the development of motor as well as the sensory neuropathy in hypothyroidism⁷.Therefore, this study revealed that sensory neuropathy is early to occur and common manifestation in patients suffering from hypothyroidism

CONCLUSION:

All the nerve conduction parameters were altered in the hypothyroid individuals which reveals the presence of subclinical neuropathy. This study also revealed the early involvement of sensory component of the Median nerve of Hypothyroid group. Observed nerve conduction abnormalities in hypothyroid individuals may be due to direct involvement of the nerves or compression caused by mucinous deposits. These findings suggest that a considerable number of untreated hypothyroid patients have subclinical small fibre peripheral neuropathy. Thus Nerve conduction study should be used as a routine screening test for hypothyroid individuals.

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