



ASSESSMENT OF LEVEL OF COGNITION AND SENSORY NERVE CONDUCTION IN NEWLY DIAGNOSED HYPOTHYROID AND HYPERTHYROID MALES

Mr. Mahesh Angidi	M.Sc. (Medical Physiology) Final Year, Department of Physiology, JIPMER, Puducherry - 605006
Dr. Prabhu Natesan*	Associate Professor, Department of Physiology, JIPMER, Puducherry -605006 *Corresponding Author
Dr. Sadishkumar Kamalanathan	Additional professor, Department of Endocrinology, JIPMER, Puducherry - 605006

ABSTRACT Thyroid disorders are common endocrinological disorder and alteration in thyroid hormones level cause impairment in central and peripheral nervous system. We are aimed to assess the sensory nerve conduction study and level of cognition in subjects with various thyroid hormone levels. Euthyroid, hyperthyroid, hypothyroid. This study is performed in three groups and thirty two male patients in each group. The Mini-Mental State Examination (MMSE) is administered for cognitive assessment. Sensory nerve conduction study is recorded using Nihon Kohden-Neuro Pack machine. Statistical analysis is done by using t test using OpenEpi software for comparing between two groups. MMSE scoring shows that all the components of cognition are affected significantly in hypothyroid group and nonsignificant decrease in hyperthyroid group. Sensory nerve conduction study shows significant prolongation of latency and decrease in the conduction velocity and amplitude response of both the nerves in hypothyroid group compared to control group.

KEYWORDS : Cognition, Hypothyroid, Sensory nerve conduction velocity

INTRODUCTION:

Thyroid diseases are commonest endocrine disorders world wide. India too, is no exception. It has been estimated that about 42 million people in India suffer from thyroid related diseases¹. Thyroid hormones are essential for development of the nervous system. If there is an alteration in thyroid hormone level that induces demyelination, axonal degeneration leading to the impairment in central and peripheral nervous system as well². Studies have shown that altered sensory nerve latency, amplitude and velocity in hypothyroid patients and the sensory component is found to be affected than motor component of the nerve³. Apart from the impairment in nerve conduction among thyroid diseases research studies also have reported cognitive impairments in hypothyroid individuals⁴. Many studies have shown impairment of nerve conduction among hypothyroid individuals and few studies have shown impairment in nerve conduction among hyperthyroid individuals. In most of those studies participants are females. There are no studies about comparing sensory nerve conduction and cognition in existing literature among euthyroid, hyperthyroid and hypothyroid males.

Objectives of the study:

- To assess the sensory nerve conduction study and level of cognition in subjects with various thyroid hormone levels (Euthyroid, Hyperthyroidism and hypothyroidism)
- To compare the sensory nerve conduction and level of cognition among the subjects with various thyroid hormone levels (Euthyroid, Hyperthyroidism and hypothyroidism)

Materials and Methods:

A Prospective study is performed at our institute over the duration of one year. In the study 96 adult males are included. Informed consent is obtained from all participants. The approval of the institute Scientific Advisory committee and Ethics committee is obtained. Patients are recruited from Endocrinology OPD of our institute and fulfilling inclusion criteria are recruited for Group II and Group III. Apparently healthy volunteers from the institute are recruited for Group I (control group).

Inclusion Criteria:

Group I (Euthyroid): Serum Free T3 (FT3), Free T4 (FT4), Thyroid stimulating hormone (TSH) levels are normal, 20 - 50 years aged males.

Group II (Hyperthyroid): Decreased TSH, with or without increase FT3, FT4 levels, 20 - 50 years aged males, diagnosed as hyperthyroid since one year with or without treatment.

Group III (Hypothyroid): Increased TSH, with or without decrease FT3, FT4 levels, 20 - 50 years aged males, diagnosed as hypothyroid since one year with or without treatment.

Exclusion Criteria:

Chronic alcoholics, Diabetes mellitus, Neuromuscular disorders, liver diseases, renal failure, use of drugs known to cause neuropathy or myopathy and malignancy

Based on inclusion and exclusion criterias, 32 subjects in each group are included in this study. The subject is asked to come to the electrophysiology laboratory of our department at 10am. Detailed clinical history and anthropometric measurements are taken. Then the Mini-Mental State Examination (MMSE) questionnaire is administered for cognitive assessment. It is a widely used tool for assessing cognitive mental status which can be administered in 10 minutes by following simple instructions⁵. Administration of the MMSE test takes 10 minutes and examines functions including registration (repeating named prompts), attention and calculation, recall, language, ability to follow simple commands and orientation⁶.

Recording of sensory nerve conduction study: Sensory nerve conduction study is performed in the electrophysiology lab in department of Physiology at our institute. The room temperature was kept at 25-28°C. Sensory nerve conduction is recorded using EP-EMG machine (Nihon Kohden-Neuro Pack). Nerve conduction study is performed at Median nerve and Sural nerve respectively in right upper limb and lower limb and sensory latency (SL), sensory amplitudes (SNAPs) and sensory conduction velocities (SNCV) of are determined. The subject is asked to sit comfortably. The skin was adequately swabbed with methylated spirit before the application of the stimulating and recording electrodes, to ensure good contact between these electrodes and the skin. Sensory conduction of median nerve is determined with the stimulus 8 cm distal to active electrode on the wrist, with the distance between active and recording electrode about 3cm. For the sural nerve sensory parameters, proximal segment conduction was done with an active recording electrode placed between the lateral malleolus and the achilles tendon, with electrical stimulation applied 14cm proximal to the active electrode right below the ventral part of gastrocnemius muscle.

Results:

Table 1: Anthropometric parameters in different groups

	Group I (Euthyroid)	Group II (Hyperthyroid)	Group III (Hypothyroid)
Age (years)	34.52±6.28	36.97±5.43	35.79±3.85

Height (cm)	162.14±2.45	160.96±4.12	161.78±3.23
Weight	59.64 ± 6.21	56.51 ± 4.73	68.14 ± 5.45*

* = significant (p-value < 0.05);

** = highly significant (p-value < 0.001)

Table 2: Mini-Mental State Examination scoring in different groups

Mini-Mental State Examination (MMSE)	Group I (Euthyroid)	Group II (Hyperthyroid)	Group III (Hypothyroid)
Orientation (10)	9.38±0.74	8.92±0.54*	6.37±0.72**
Registration (3)	2.89±0.31	2.87±0.47	2.56±0.56*
Attention (5)	4.16±0.87	3.85±0.96	3.26±0.54**
Recall (3)	2.46±0.57	2.37±0.69	1.85±0.93*
Language (8)	7.69±0.82	7.54±0.63	7.18±0.46*
Copying (1)	0.94±0.35	0.92±0.61	0.76±0.48

* = significant (p-value < 0.05); ** = highly significant (p-value < 0.001)

Table 3: Sensory nerve conduction study in different groups

Sensory nerve conduction study	Group I (Euthyroid)	Group II (Hyperthyroid)	Group III (Hypothyroid)
Median nerve	1.74±0.65	2.19±0.58*	2.86±0.43**
Latency (ms)	33.14±8.43	30.59±7.62	23.04±10.11**
Amplitude (mV)	51.17±7.82	49.65±9.24	44.89±8.63*
Conduction velocity (m/s)			
Sural nerve	2.35±0.26	2.47±0.39	2.83 ± 0.41**
Latency (ms)	17.54±1.96	15.30±1.89*	11.47 ± 2.14**
Amplitude (mV)	47.54±2.87	45.38±2.69*	39.76±3.52**
Conduction velocity (m/s)			

* = significant (p-value < 0.05);

** = highly significant (p-value < 0.001)

Table 1 shows anthropometric parameters in different groups such as age, height and weight. Table 2 shows the MMSE scoring as follows; 10 for Orientation, 3 for Registration, 5 for Attention, 3 for Recall, 8 for Language and 1 for Copying. Table 3 shows the parameters (Latency, Amplitude and Conduction velocity) of sensory nerve conduction study of median nerve in right upper limb and sural nerve in right lower limb. All the data are kept confidential and stored in excel for statistical analysis.

Statistical analysis:

All the data are expressed as mean ± SD. We have compared hypothyroid (group III) and hyperthyroid patients (group II) with the control group (group I). Statistical analysis is done by using t test using OpenEpi software for comparing between two groups. Statistical significance is taken at p value of < 0.05 is significant and p value of < 0.001 is highly significant.

DISCUSSION:

In Table 1, there is a significant increase in weight in hypothyroid patients (n=32) (p<0.05) compared to control (n=32). There is no significance observed in age and height between three groups which shows that subjects in three groups are matched with age and height. MMSE scoring is shown in table 2 which tells that all the components of cognition are affected significantly in hypothyroid groups and nonsignificant decrease in hyperthyroid groups. So we observed that abnormalities in thyroid hormones affect the level of cognition especially significant variation in orientation, attention and recall of hypothyroid groups when compare with the control group. There is mild decrease in the level of cognition in hyperthyroid group when compare with the control group but it is not statistically significant. Studies report decrements in general intelligence, attention/concentration, memory, perceptual function, language, psychomotor function, and executive function. Memory is the most consistently affected domain⁷. Imaging studies provide objective evidence that brain structure and function are altered in hypothyroid patients, with decreased hippocampal volume, cerebral blood flow and function globally and in regions that mediate attention, visuospatial processing, working memory, and motor speed⁸. Table 3 showed significant prolongation of latency and decrease in the conduction velocity and amplitude response of both the nerves in hypothyroid groups compared to control group. It is well established that thyroid

hormones have profound effects on mitochondrial oxidative activity, synthesis and degradation of proteins, sensitivity to catecholamines, differentiation of muscle fibres, capillary growth and level of antioxidant enzymes⁹. Demyelination due to oxidative damage to myelin membrane or oligodendroglial cells may result in decrease in nerve conduction velocity¹⁰.

CONCLUSION:

From this study we conclude that abnormalities in thyroid hormones affect the level of cognition especially significant variation in orientation, attention and recall of hypothyroid patients. Sensory nerve conduction study shows significant prolongation of latency and decrease in the conduction velocity and amplitude response in hypothyroid patients. There is mild decrease in the level of cognition and sensory conduction velocity in hyperthyroid group but it is not statistically significant.

REFERENCES:

- Ambika Gopala krishnan Unni krishnan, Usha V Menon. (2011) Thyroid disorders in India: An epidemiological perspective. Indian journal of endocrinology and metabolism. (Haryana) 15 (6); 78-81.
- Yuksel G, Karlikaya G, Tanridag T et al. (2007) Nerve conduction studies, SEP and blink reflex studies in recently diagnosed, untreated thyroid disease patients. Journal of Neurological Sciences (Turkish) 2007;24:7-15
- Ihsan M Ajeena. (2013) Prevalence of neuromuscular abnormalities in newly diagnosed patients with thyroid dysfunction. American journal of research communication. (Texas) 1 (3):79-88.
- Gulseren S, Gulseren L, Hekimsoy Z, et al. (2006) Depression, anxiety health related quality of life and disability in patients with overt and subclinical thyroid dysfunction. ARCH MED RES. (Mexico) 37;133-39
- Folstein MF, Folstein SE, McHugh PR: Mini-Mental State: (1975) A practical method for grading the state of patients for the clinician. J Psychiatric Res. (Stanford) Elsevier 12: 189-198. 10.1016/0022-3956(75)90026-6.
- Tuijl, JP; Scholte, EM; de Craen, AJM; van der Mast, RC (2012). "Screening for cognitive impairment in older general hospital patients: comparison of the six-item cognitive test with the Mini-Mental Status Examination". International Journal of Geriatric Psychiatry. (London) 27 (7): 755-762. doi:10.1002/gps.2776. PMID 21919059
- Miller KJ, Parsons TD, Whybrow PC, et al. (2007) Verbal memory retrieval deficits associated with untreated hypothyroidism. J Neuropsychiatry ClinNeurosci. USA 19:132-136.
- Cooke GE, Mullaly S, Correia N, et al. (2014) Hippocampal volume is decreased in adults with hypothyroidism. Thyroid. (Virginia) 24: 1-8.
- Ruurd F. Duyff, Joan Van den Bosch, et al., (2000). Neuromuscular findings in thyroid dysfunction study. Department of Neurology and clinical Neurophysiology. J. NeuroNeurosurg Psychiatry. (Netherlands) 68: 750-755.
- Abbott, R.J., B.P. O'Malley, D.B. Barnett, et al. (1988). Central and peripheral nerve conduction in thyroid dysfunction: the influence of L-thyroxine therapy compare with warming upon the conduction abnormality of primary hypothyroidism. ClinSci (London), 64(6): 617-22.