https://dx.doi.org/10.22161/ijmpd.4.1.2 *ISSN: 2456-8015*

Study of Sensory Nerve Conduction Abnormalities in Hypothyroid Patients

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Abstract— *Introduction -Thyroid hormones have effects virtually on every organ system in the body including central and peripheral nervous system. Hypothyroidism is a condition associated with low levels of thyroid hormones with raised TSH. Peripheral neuropathy is one of the manifestations of the hypothyroidism.*
Aims and objectives-The present study aimed to evaluate sensory nerve conduction defects in hypothyroid patients compared to non-hypothyroid controls.
Methods-The study was conducted on 100 subjects, 50 hypothyroid patients and 50 normal Subjects between the age group of 18- 60 years, coming to JLN Hospital OPD in Neurophysiology Lab using EMG NCV EP machine by Recorders and Medicare Systems, model RMS SALUS 4C. The parameters (latency, and nerve conduction velocity) of sensory component of nerves (Median, Ulnar and Sural) compared between cases (Hypothyroidism) and controls (non hypothyroid). The patient was made to lie down on the couch and surface electrodes were fixed over the skin which was on the nerve and supplying muscle. By the stimulating electrodes, the nerve was stimulated at the distal end.
Results-56 % of median nerve was affected in hypothyroidism. 34 % of sural nerve was affected in hypothyroidism.
Conclusion- The median nerve is the most common affected sensory nerve .Estimation of the nerves conduction values can be considered as a useful parameter in the diagnosis and evaluation of the neuropathy in hypothyroid patients.
Keywords*— *Hypothyroidism, Nerve conduction study, Peripheral neuropathy.

I. INTRODUCTION

Thyroid hormones play critical roles in the normal function of nearly all tissues, with major effects on oxygen consumption and metabolic rate. [1] It helps in regulating lipid and carbohydrate metabolism, and thereby influences body mass and mentation. Thyroid hormones play crucial part in development of Central Nervous System and in myelination of neurons. Thyroid diseases can lead to signs and symptoms of neuromuscular dysfunction. Patients of hypothyroidism suffer with two major forms of peripheral nervous system dysfunction. The severity of the neuromuscular signs and symptoms are being related to the duration and degree of hormonal deficiency and clinical, electrophysiological and morphological improvement following hormone replacement therapy is typical.[2-4] Approximately one third of patients develop proximal upper and lower limbs' muscle weakness, fatigue, myalgia, and muscle cramps.[5]

II. AIMS AND OBJECTIVES

The aim of the study is to analyze the sensory nerve dysfunction in hypothyroid patients and compare it with non hypothyroid controls.

III. MATERIALS AND METHODS

After approval of the study from the ethical committee of J.L.N. Medical College; valid written and informed consent was taken from all subjects. Patients of both genders were taken. One hundred subjects were taken, out of which fifty were euthyroid control and fifty were hypothyroid.

Inclusion criterion: Patients who are within 18-60 yrs age group.

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Patients with known case of hypothyroidism newly diagnosed as well as on medication but not attaining euthyroid state were included in the study.
(Hypothyroid was defined as having raised serum TSH level and decreased free thyroxine (FT4) level.)

Exclusion criterion: Patients having other causes of neuropathy like Diabetes mellitus, Renal failure, Neuropathies associated with toxic agents e.g. metal or drugs, Neuropathies associated with malnutrition, alcoholic hepatitis or medication were excluded. Patients having skin lesion or swelling that would interfere with nerve conduction study, previous trauma to the study site were also excluded.
Subjects who had not given consent were excluded.

Nerve conduction studies (NCSs) was performed on hypothyroid patients (newly diagnosed or on treatment for hypothyroidism but not attained euthyroid state) and healthy individuals those who give consent to do so by electrophysiological method. The NCS was conducted at room temperature, with normal body temperature, on EMG NCV EP machine by Recorders and Medicare Systems, model RMS SALUS 4C. The state of hypothyroidism was detected by measuring Free T3, Free T4 and TSH by Chemiilluminisence method. Sensory nerve conductions were recorded. Median and Ulnar nerves of the upper limbs and Sural nerves of the lower limbs were tested. Latency, Amplitude, and Conduction velocity were noted and compared with age specific reference data of our electrophysiology laboratory under the Neurophysiology lab at JLN Hospital and Medical College, Ajmer.
The statistical analysis was done by Unpaired t Test.

IV. RESULTS

Table 1: Comparison between Sensory Nerve Conduction Parameters in both the Hypothyroid (n=50) and the control subjects (n=50).

PARAMETER	NERVE	GROUP	NUMBER	MEAN±SD	P –Value
Latency (ms)	Rt median nerve	Controls	50	2.83±0.35	<0.001
		Cases	50	3.52±0.88	
	Lt median nerve	Controls	50	2.87±0.39	<0.001
		Cases	50	3.51±0.83	
	Rt ulnar nerve	Controls	50	2.15±0.4	0.483
		Cases	50	2.21±0.45	
	Lt ulnar nerve	Controls	50	2.15 ±0.42	0.137
		Cases	50	2.27±0.38	
	Rt Sural nerve	Controls	50	2.44±0.67	<0.001
		Cases	50	3.45±1.59	
	Lt Sural nerve	Controls	50	2.44±0.57	<0.001
		Cases	50	3.40±1.16	
Amplitude (mV)	Rt median nerve	Controls	50	40.54±8.45	0.031
		Cases	50	37.24±6.47	
	Lt median nerve	Controls	50	42.56±9.36	0.233
		Cases	50	40.44±8.26	
	Rt ulnar nerve	Controls	50	40.51±8.46	0.312
		Cases	50	38.91±7.24	
	Lt ulnar nerve	Controls	50	40.08±6.12	0.221
		Cases	50	38.38±7.60	
	Rt Sural nerve	Controls	50	14.28±7.48	0.399
		Cases	50	13.03±7.27	
	Lt Sural nerve	Controls	50	14.34±8.19	0.463
		Cases	50	13.24±6.67	
NCV (m/s)	Rt median nerve	Controls	50	54.68±9.62	0.006

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		Cases	50	49.88±7.43	
	Lt median nerve	Controls	50	54.64±9.46	0.002
		Cases	50	49.26±7.77	
	Rt ulnar nerve	Controls	50	58.25±5.79	0.563
		Cases	50	57.59±5.58	
	Lt ulnar nerve	Controls	50	58.13±5.15	0.152
		Cases	50	56.67±4.95	
	Rt Sural nerve	Controls	50	56.70±10.25	0.002
		Cases	50	49.97±10.92	
	Lt Sural nerve	Controls	50	56.10±13.47	0.011
		Cases	50	50.16±8.72	

Mean age of cases were 45.94±12.97, and for control group is 46.1±11.5, there were no significant difference in age between cases and control group. Sex and BMI matching was also not significant.

Mean Sensory Nerve Conduction Velocity of Median nerve on right side in Cases was **49.88±7.43** and that of Control group was **54.68±9.62**. Mean sensory Nerve Conduction Velocity of Median nerve on left side in Cases was **49.26±7.77** and that of Control group was**54.64±9.46**.

A Significant decrease in sensory NCV of the Median Nerve on both sides in hypothyroid subjects was observed as compared to the control subjects.

Sensory NCV of Ulnar nerve on both sides does not show significant decrease in hypothyroid, as compared to the control subjects.

Mean sensory NCV of Sural nerve on right side in cases is **49.97±10.92** and that of control group is **56.70±10.25.** Mean sensory NCV of Sural nerve on left side in cases is **50.16±8.72** and that of control group is **56.10±13.47.**

A Significant decrease in sensory NCV of the Sural Nerve on both sides in hypothyroid subjects is observed as compared to the control subjects.

Sensory Latency of Median Nerve on Right side in Cases is **3.52±0.88** and in control group is **2.83±0.35**. Sensory Latency of Median Nerve on left side in Cases is **3.51±0.83** and in control group is**2.87±0.39**.

There is significant increase in latency of Median nerve on both sides in hypothyroid subjects as compared to the control subjects.

Sensory Latency of Sural Nerve on Right side in Cases is **3.45±1.59** and in control group is **2.44±0.67**. Sensory Latency of Sural Nerve on left side in Cases is **3.40±1.16** and in control group is **2.44±0.57**. There is significant increase in latency of Sural nerve on both side in hypothyroid subjects as compared to the control subjects.

Sensory Latency of Ulnar nerve on both sides does not show significant increase in hypothyroid, as compared to the control subjects.

MEDIAN NERVE-SENSORY COMPONENT: 28 patients had abnormal nerve conduction values. 56 % of median nerve was affected in hypothyroidism.

SURAL NERVE: 17 patients had abnormal nerve conduction values. 34 % of sural nerve was affected in hypothyroidism.

V. DISCUSSION

Myelin synthesis disturbances during acute hypothyroidism may be the cause for demyelinating peripheral neuropathy in hypothyroid patients. Hormonal and metabolic changes associated with hypothyroidism are responsible for the electrophysiological changes in the form of abnormal peripheral nerve conduction study which occurs early in the disease course.

In our study, the SNCV of median nerve was found to be significantly decreased on right as well as left side in hypothyroid subjects as compared on the SNCV of median nerves in control subjects. Also sensory latency of median nerve was increased in hypothyroid subjects as compared to sensory latency of control subjects and reduced CMAP amplitudes. SNCV were significantly reduced in cases as compared to controls in bilateral Sural and Median nerves ($p<0.05$).

Our Findings are supported by previous studies by Ettore Beghi et al (1989) [6]. They assessed the prevalence and characteristic of polyneuropathy using standard clinical and electrophysiological tests in patients with primary hypothyroidism. They too have observed mild degree of sensory polyneuropathy in the patients.

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Marcia W.Cruz et al (1996) [7] reported sensory axonal polyneuropathy in 68.7% of patients with primary hypothyroidism. This observation is similar with our findings. Gülbün Yuksel et al (2007)[4] noted the similar findings of sensory polyneuropathy in subclinical hypothyroid patients.

Somay G et al (2007) [22] and Yeasmin S et al (2007) [9] electro physiologically evaluated the patients of hypothyroidism and observed occurrence of sensory polyneuropathy in them especially affecting median and sural nerves. These reports coincide with our findings.

In our study 72% of hypothyroid patients had at least one type of electrophysiological abnormality, most commonly in median and sural sensory nerves.

Conduction velocity was abnormal in 69% cases, and in median nerve in 13% cases by Ettore B. This could be due to a distoproximal progression of polyneuropathy as reported in earlier studies. [10]

Rao et al[11] found reduction of amplitude for median sensory nerves whereas Fincham[12] found it for median and ulnar sensory nerves .

Our data comprising of outpatients with thyroid dysfunction confirms the assumption that demyelinating polyneuropathy in hypothyroidism is commonly encountered. The nerve conduction study findings correlate well with those in literature. Axonal degeneration has been reported both electro physiologically and pathologically. [9].

Previous studies have shown a reduction in amplitude and mild slowing of sensory and motor conduction velocity consistent with presence of axonal polyneuropathy. [14]. Morphological evidence of primary axonal degeneration with secondary demyelination has also been cited in studies. [15].

In our study hypothyroid patients had at least one type of electrophysiological abnormality, most commonly in median nerve. Our data comprising of outpatients with thyroid dysfunction confirms the assumption that demyelinating polyneuropathy in hypothyroidism is commonly encountered. The nerve conduction study findings correlate well with those in literature. The neurological abnormalities associated with hypothyroid patients may be a result of hormonal imbalance or may be related to the immune mechanisms related with thyroid diseases. [16] Some investigators suggested that the weight gain in the hypothyroid patients may be a contributory factor for neuropathy. Entrapment of median nerve at the wrist caused by the deposition of mucinous material in the tissues surrounding the nerve is one of the most frequent causes of peripheral nerve damage in hypothyroidism. [16,17] The sensory neural dysfunction seen in the present study may be linked to the various functional and structural changes in peripheral nerves associated with deficiency of thyroid hormones.

VI. CONCLUSION

The median nerve is the most common affected sensory nerve .Estimation of the nerves conduction values can be considered as a useful parameter in the diagnosis and evaluation of the neuropathy in hypothyroid patients.

We conclude that hypothyroidism causes significant decrease in NCV as well as increase in latency, and this decrease in NCV is more prominent in median nerve. It is proposed that as soon as a patient is diagnosed with hypothyroidism they should be evaluated for decrease in NCV.

REFERENCES

[1] Arthur C. Guyton John E. Hall,In : insulin glucagon and DM, Text book of Medical Physiology, 11 th edition, 2006 Saunders, Philadelphia:972

[2] Lewis E. Braverman, In: The heritage of the thyroid; A brief history, Werner & I ingbar's the thyroid a fundamental and clinical text, Tenth edition, 2013, Wolters Kluwer/ Lippincott Williams & Wilkins. Pg- 1.

[3] John A.H.Wass, Stephen M. Shalet and Jayne A.Franklyn In: Subclinical hypothyroidism; Oxford Textbook of Endocrinology and Diabetes. 2002. Oxford University Press. Pg 286.

[4] GulbunYuksel, Geysu Karlikaya, Tulin Tanridag, Onder US, GulserenAkyuz. Nerve Conduction Studies, SEP and Blink Reflex in 103 recently diagnosed, Untreated Thyroid Disease Patients, Journal of Neurological Sciences 2007, volume 24, Number 1, Page 007-015.

[5] Golding NN. Hypothyroidism presenting with musculoskeletal symptoms. Ann. rheum. Dis., 1970: 10-14.

[6] RaffaelloNemni , Edo Bottacchi, Rarraella Fazio, Angelo Mamoli, Massimo Corbo, Massimo Camerlingo, Giuseppe Galardi , Luciano Erenbourg, Nicholas Canal. Polyneuropathy in hypothyroidism: clinical, electrophysiological and morphological findings in four cases. Journal of Neurology, Neurosurgery and Psychiatry 1987; 50: 1454-1460.

[7] Marcia W .Cruz; Mauro Tendrich, Mario Vaisman, Sergio A.P. Novis. Electroneuromyography and neuromuscular findings in 16 primary hypothyroid patients; Arq Neuropsiquiatr 1996, 54(1): 12-18.

[8] Somay G, Oflaxoglu B, Us O, Surardamar A. Neuromuscular status of thyroid diseases: a prospective clinical and electrodiagnostic study. Electromyogr Clin Neurophysiol.2007 Mar-Apr; 47(2):67-78.

[9] Yeasmin S , Begum N, Befum S, Rahman SMH. Sensory Neuropathy in Hypothyroidism: Electrophysiological and

https://dx.doi.org/10.22161/ijmpd.4.1.2 *ISSN: 2456-8015*

Clinical Findings. Journal of Bangaladesh Society of Physiology.2007 Dec ;(2):1-6.

[10] EttoreBeghi, Maria Lelodovici, Graziella Bogliun, Vottorio Crespi, Felice Paleari, PIERLUIGI Gamba, Maurizio Capra, Michele Zarrelli. Hypothyroidism and polyneuropathy. Journal of Neurology, Neurosurgery and Psychiatry 1989; 52:1420 – 1423.

[11] Rao S N, Katiyar B C, Nair K R P, Misra S Neuromuscular status in hypothyroidism. Acta Neuro Scand 1980; 61:167-77.

[12] Fincham R W ,Cape CA Neuropathy in myxedema. Arch Neurol 1969;19(464-466)

[13] Yeasmin S , Begum N, Befum S, Rahman SMH. Sensory Neuropathy in Hypothyroidism: Electrophysiological and Clinical Findings. Journal of Bangaladesh Society of Physiology.2007 Dec ;(2):1-6.

[14] Ruurd F Duyff, Joan Van den Bosch, D Martin Laman, Bert-Jan Potter van Loon. Neuromuscular findings in thyroid dysfunction: a prospective clinical and electrodiagnostic study. Journal of Neurology, Neurosurgery, Psychiatry 2000;68:750-755.

[15] Pollard JD, McLeod JG, Honnibal TGA, Verheijden MA. Hypothyroid polyneuropathy. JNeurolSci 1982;53:461-71

[16] Colin D. Binnie, Ray Cooper, C.J.Fowler and B. M. Tedman In: Clinical neurophysiology, volume I . Second edition 2004.EMG, Nerve conduction and Evoked potentials. page 1

[17] Giroud M, Tenenbaum D, D'Athis P, Dumas R, Nivelon JL. neurophysiological study of peripheral nerves in newborn infants with congenital hypothyroidism. Value in the surveillance of replacement therapy. Arch FrPediatr. 1988 Mar;45(3):175-9