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Sensory nerve conduction parameters in patients with hypothyroidism

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Abstract: *Background:* Early determination of sensory nerve dysfunction in hypothyroidism can play a significant role in medical management of neuropathies. *Objectives:* To find out the sensory nerve conduction status of peripheral nerves to evaluate presence of sensory nerve dysfunction in hypothyroid patients. *Materials and Method:* 32 females and 8males with hypothyroidism and 40 control groups were selected. Sensory nerve conduction parameters of ulnar, median and sural nerve in the hypothyroid group were compared to that of the control group. The relationship of age, sex and BMI with alterations in sensory nerve function was also determined in the hypothyroid group. *Result:* Among the 32 female patients 15 (46.88%) had altered sensory nerve conduction parameters. Only 2 (25%) out of the 8 male patients had altered sensory nerve conduction parameters. Though females were more affected than males the difference was not statistically significant ($p>0.05$). *Conclusion:* There was significant alteration in the sensory nerve conduction parameters in hypothyroid patients. Among the altered parameters, prolonged sensory distal latency and decreased sensory nerve conduction velocity in median nerve was the most common finding.

Keywords: hypothyroid, neuropathy, Nerve conduction velocity.

Introduction

According to the Indian Thyroid Society (ITS), around 42 million people in India suffer from diseases related to thyroid gland, hypothyroidism being the most prevalent disorder affecting one in every eight women [1]. The prevalence of neurological complications have been reported to be around 79% in hypothyroidism [2].

Sensory symptoms are usually the presenting features of neuropathy. Nerve conduction studies assess the shape, amplitude, latency, and conduction velocity of an electrical signal conducted over the tested nerve. They can help determine whether the neuropathy is the result of damage to the axons (axonal neuropathy) or the myelin (demyelinating neuropathy), or both (mixed)[3]. The sensory nerve conduction studies are more sensitive in detecting early or mild disorders of peripheral nerves when compared to the motor nerve conduction studies [4].

This study has been designed to find out the sensory nerve conduction status of peripheral nerves in order to evaluate the presence of sensory nerve dysfunction in hypothyroid patients. The study also aims to find out the association between age, gender and body mass index with the presence of neurological deficits in hypothyroid patients.

This peripheral polyneuropathy, a progressive nerve disorder, can become chronic disability if undetected. Studies show that this neuropathy is reversible. Hence nerve conduction study can be used to estimate the response of peripheral nerve dysfunction to L-Thyroxine replacement therapy. There fore early electrophysiological determination of sensory nerve dysfunction in hypothyroid patients can play a significant role in the medical management of entrapment neuropathies before switching on to surgical modalities of treatment.

Material and Methods

The present study was conducted in the Endocrinology clinic of the Medicine outpatient Department and Neurophysiology lab, Department of Neurology in Government Medical College, Kozhikode. 40 patients (8 Men and 32 women) in the age group between 18 - 55yrs with hypothyroidism (TSH above 5μIU/mL) and 40 controls were included in the study after obtaining informed written consent.

Patients with documented history of Diabetes Mellitus, Alcoholism, Smoking, Hypertension, Liver disease, Renal disease, Stroke, intake of neuropathy causing drugs like amiodarone, anti cancer drugs, anti Tuberculosis drugs and serious diseases like cardiac failure were excluded.

Using electrodiagnostic equipment, following sensory nerve conduction parameters and qualitative variables were assayed.

A. Sensory distal latency, Sensory amplitude and Sensory Nerve conduction velocity of Median nerve, Ulnar nerve and Sural nerve on both sides [5].
B. Sensory nerve conduction parameters in the hypothyroid group compared to that of the control group.
C. The relationship of age, sex and BMI with alterations in sensory nerve function was determined in the hypothyroid group.

The present study was a cross sectional study and the data was analyzed using Statistical Package for Social Sciences [SPSS] version 18.

Results

Table-1: Sensory nerve conduction parameters of Median nerve, Ulnar nerve and Sural nerve

Nerve	Parameter	Right side			Left side		
		Study group	Control group	P value	Study group	Control group	P value
Median nerve	Sensory distal latency (in milliseconds)	3.23 ± 0.6077	2.55 ± 0.201	0.00	3.097 ± 0.5026	2.615 ± 0.1673	0.00
	Sensory amplitude (in milivolts)	50.75 ± 12.82	70.4 ± 5.063	0.00	56.08± 10.093	72.05 ± 4.992	0.00
	Sensory Nerve conduction velocity (meters /second)	57.05 ± 10.718	70.45 ± 3.58	0.000	58.85 ± 10.327	69.53 ± 3.412	0.000
Ulnar nerve	Sensory distal latency (in milliseconds)	2.31 ± 0.247	2.41 ± 0.256	0.105	2.36 ± 0.324	2.35 ± 0.273	0.882
	Sensory amplitude (in milivolts)	54.85 ± 7.553	58.23 ± 6.15	0.031	55.18 ± 0.409	59.43 ± 7.228	0.037
	Sensory Nerve conduction velocity (meters /second)	62.63 ± 4.325	64.33 ± 5.69	0.137	62.3 ± 4.692	63.08 ± 4.87	0.471
Sural nerve	Sensory distal latency (in milliseconds)	2.292 ± 0.543	2.143 ± 0.291	0.123	2.265 ± 0.401	2.29 ± 0.259	0.741
	Sensory amplitude (in milivolts)	31.25 ± 6.02	51.03 ± 8.08	0.00	30.4 ± 4.088	47.55 ±9.928	0.00
	Sensory Nerve conduction velocity (meters /second)	59.58 ± 7.66	61.85 ± 4.092	0.102	58.35 ± 6.058	60.2 ± 3.458	0.097

Table-2: Nerve involvement and altered nerve conduction parameters in hypothyroid patients				
Nerve	**Sensory Distal Latency SDL↑ n (%)**	**Sensory Amplitude SA ↓ n (%)**	**Sensory distal latency SDL↑ Sensory Nerve conduction velocity NCV↓ n (%)**	**Total* n (%)**
Median nerve	3 (7.5)	1 (2.5)	10 (25)	14 (40)
Sural nerve	3 (7.5)	-	2 (5)	5 (12.5)
Median +sural nerve	-	-	2 (5)	2 (5)
Ulnar nerve	-	-	-	-
*multiple nerve involvement present, - absent, ↑ increased, ↓ decreased, n number, % percentage.				

Table-3: Association of age and gender with altered parameters in hypothyroid group			
	Altered sensory nerve conduction parameters		**Total n (%)**
	Present n (%)	**Absent n (%)**	
Age ≥ 25	15 (46.9%)	17 (53.1%)	32 (100%)
Age <25	2 (25%)	6 (75%)	8 (100%)
Total	17 (42.5%)	23 (57.5%)	40 (100%)
Female	15(46.9%)	17(53.1%)	32(100%)
Male	2(25%)	6(75%)	8(100%)
Total	17(42.5%)	23(57.5%)	40(100%)

Table-4: Association of BMI with presence of altered parameters in hypothyroid group			
BMI category	**Altered sensory parameters**		**Total n (%)**
	Present n (%)	**Absent n (%)**	
BMI ≥23 kg/m^2	15 (57.6%)	11 (42.4%)	26 (100%)
BMI <23 kg/m^2	2 (14.3%)	12 (85.7%)	14 (100%)
Total	17 (42.5%)	23 (57.5%)	40 (100%)
n –number, %-percentage			

Discussion

The mean sensory distal latencies of median nerves on both sides were prolonged in the hypothyroid patients when compared to the controls and the differences were significant on both sides with p value 0.000 (Table 1). Similar findings were observed by Somay et al [6] and Fariba Eslamian et al [7] in median nerve.

The mean distal sensory amplitudes of right and left median nerves were decreased in the hypothyroid group and differences were statistically significant on both sides with p=0.000 (Table 1). Nemni and Bottachi [8] and Cruz et al [9] also reported similar reduction of sensory amplitude in median nerve. Decrease in amplitude is due to primary axonal degeneration. This is seen as shrinkage of axons, disintegration of neurotubules and neurofilaments and active axonal breakdown in hypothyroidism.

Sensory conduction velocities of right and left median nerves were decreased in the hypothyroid patients compared to the control group and differences were statistically significant on both sides with p=0.000 (Table 1). Ajeena et al [10] and Garg et al [11] reported decreased median nerve conduction velocity in hypothyroid patients. In the present study the nerve conduction parameters were less affected in the ulnar nerve. There was no significant difference in the latency between the two groups (Table 1).

Similar findings were reported by Rao S N et al. [12]. The mean distal sensory amplitudes of right and left ulnar nerves decreased in the hypothyroid group than in the control group and differences obtained were statistically significant on both sides p=0.031 on right and p=0.037 on left side (Table 1). Similar findings were reported by Beghi et al. [13]

The mean sensory conduction velocities of right and left ulnar nerves were less in the hypothyroid group compared to the control group but differences obtained were not statistically significant (Table 1). This was similar to previous studies by Yerdelen et al and Garg et al [14]. Thus ulnar nerve conduction was less affected in patients with hypothyroidism.In the present study the sensory nerve conduction parameters were less affected in the sural nerve. There was no significant difference in the mean sensory distal latencies between the two groups (Table 1). This was similar to the findings by Fariba Eslamian AB et al [7].

The mean distal sensory amplitudes of right and left sural nerves were low in the hypothyroid group than in the control group and differences obtained were significant on both right side p=0.000 and left side p=0.000 (Table 1). Misiunas et al noted mean amplitude of sural nerves were low in the hypothyroid group. The mean sensory conduction velocities of right and left sural nerves were decreased in the hypothyroid group compared to the control group the differences were statistically not significant on both sides [15].

In the present study 17(42.5%) patients belonging to the hypothyroid group had altered sensory nerve conduction parameters in at least one nerve whereas those in the control group had all parameters within normal range (Table 2). The difference was found to be statistically significant (p=0.000) .This suggests sensory nerve involvement in patients with hypothyroidism. The most commonly affected nerve was the median nerve as all the parameters were altered significantly in comparison with the control group. Prolonged distal latency of median nerve with normal conduction velocity was seen in 7.5% of patients. 25% patients had decreased nerve conduction velocity along with prolonged latency for median nerve. 5% of patients had the same finding in sural nerve. Sural nerve latency was prolonged in 7.5 % patients whereas both sural nerve and median nerve were affected in 5% patients (Table 2). Median nerve amplitude was reduced in 2.5%patients. Changes in median nerve conduction parameters were suggestive of entrapment mononeuropathy at wrist. The incidence of median nerve mononeuropathy in hypothyroid patients varies from 5-92% in the previous studies 16-17].

The increased pressure as a result of the mucinosis infiltration is transferred to the median nerve and causes focal demyelination [18]. Due to the reduction of the carbohydrate metabolism, glycosaminoglycans cannot be broken down and instead accumulate in the entrapment regions leading to entrapment neuropathies [19]. In the present study no association was obtained between age and presence of nerve conduction defects in hypothyroid patients (Table 3). This may be because in the study population the age group included was from 17-55 years. More number of younger people were included in the study. It is established that though alterations in nerve conduction parameters begins by 40 years of age but more severe changes are noticed by the sixth decade [20].

Among the 32 female patients 15 (46.88%) had altered sensory nerve conduction parameters. Only 2 (25%) out of the 8 male patients had altered sensory nerve conduction parameters. Though females were more affected than males the difference was not statistically significant (p>0.05). In the present study, the mean BMI value in hypothyroid patients was significantly high when compared to that in the control group. Similar observations were reported in earlier studies [7]. In the present study 57.6 % cases who belonged to the higher BMI group had altered sensory nerve conduction parameters when compared to 14.3% patients in the lower BMI group (Table 4)

Conclusion

Therefore from the present study it can be concluded that there is significant sensory nerve involvement in hypothyroid patients which would have been missed in the

absence of nerve conduction study. This study will help to create awareness among the hypothyroid patients so that they can take early and regular treatment and thereby minimize the occurrence of peripheral neuropathy. The study also stresses the importance of life style modifications like weight reduction in preventing nerve damage.

Limitations of the study: Assessment of peripheral nerve involvement could have been better, if motor nerve conduction studies were also done in the study population. Another drawback is the small sample size. Further studies on a larger population would give a better knowledge of the peripheral nerve dysfunction in hypothyroidism. Division of the hypothyroid patients into subclinical hypothyroidism, newly detected and those patients on treatment would have provided better information on the incidence of nerve conduction abnormalities in these patients.

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