Assessment and comparison of electrophysiological findings in thyroid dysfunction patients of Kanchipuram district.

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ABSTRACT

Background: Thyroid dysfunction is a clinical condition associated with low levels of thyroid hormone (hypothyroidism) which produces variety of manifestations affecting peripheral nervous system. Objectives: To evaluate and compare the peripheral changes (neuromuscular dysfunction) by using electrophysiological tests in hypothyroid patients and to compare the pattern of neuromuscular involvement between hypothyroidism and control group. Materials and methods: Prospective study was conducted in patients of kanchipuram district with diagnosed thyroid dysfunction.40 hypothyroid patients, and 40 controlled subjects. All participants were subjected to electro diagnostic evaluation. Results: There was significant polyneuropathy in hypothyroid patients but none was found in control group. There was significant polyneuropathy mainly axonal in hypothyroid groups but none in the control group. In upper limb 85% had sensory neuropathy and 20% have motor neuropathy among hypothyroid group. As for the lower limbs, 70% sensory neuropathy and 60% motor neuropathy among hypothyroid group. Entrapment neuropathy in the form of carpal tunnel syndrome was found in 30%. 20% of the hypothyroid, and control group respectively. Conclusion: Thyroid dysfunction affects both central and peripheral nervous system. There is definite subclinical sensori-neurological involvement in early stages which can be assessed by nerve conduction studies and need to be intervened as early as and can be reversed by treatment.

ORIGINAL ARTICLE

Introduction

Thyroid hormone plays an important role in stimulating the development and differentiation of the neuromuscular junction and brain, they also play important role in maintaining the various metabolic functions by stimulating the O2 consumption in most of the cells of our body and are also necessary for their growth and maturation. Both hyperthyroidism and hypothyroidism cause signs and symptoms of neuromuscular dysfunction. Thyroid hormone exert multiple effects on the neuromuscular system and the brain, with the most important being their role in stimulating the development and differentiation of the neuromuscular system in foetal and neonatal life. 23 Peripheral polyneuropathy in this condition is progressive and gradually becomes chronic disability due to defect in the axons, nerve cell body or myelin sheath. It usually manifests as numbness, paraesthesia, weakness, fatigue, loss of reflexes, loss of vibration. Most of the neuropathy remains latent in early stage of the disorder. Several investigators have studied nerve conduction parameters in both hypo and hyperthyroid patients to observe the neuropathy and functional status of peripheral nerves in both conditions individually but not comparing them. In retrospective studies, published in the early1980s 1, 11 the prevalence of neuropathy in hypothyroid patients varied between 10% and 70% and that of myopathy between 20% and 80%, whereas the prevalence of myopathic features in hyperthyroidism varied between 60% and 80% of the patient. 34 The present study was planned to investigate the motor and sensory nerve conduction status in hypothyroid patients and to compare it with the euthyroids or controls.

MATERIALS AND METHODS

Selection criteria for patients:

The present study was conducted in Meenakshi medical college hospital and research institute enathur, kanchipuram, from March 2014 to January 2015. 40 euthyroid adults of both sex, age >20 to <60 years attending the medicine outpatient department were considered as control sample. All adult patients with diagnosed thyroid dysfunction (abnormal serum concentrations of thyroid stimulating hormone (TSH) and free thyroxine (FT4), (40 hypothyroid ) who were attending internal medicine outpatient department between March 2014 to January 2015 were asked to participate in our prospective follow up study.

Inclusion criteria

(1) Newly diagnosed hypothyroidism that are advised for the treatment, and (2) Age group 20-60 years

Exclusion criteria: (1) other possible causes of neuropathy or neuromuscular diseases (for example, diabetes mellitus, alcoholism, liver and kidney disease, use of drugs known to cause neuropathy or myopathy, malignancy, or other serious illness (for...
example, cardiac failure or HIV infection), a family history of neuropathy), and (2) pre-existence of myopathy. The study was approved from institutional Ethical Committee. After getting informed and written consent, history taking and examination were performed.

Methodology
LABORATORY INVESTIGATIONS

Serum concentrations of TSH, FT4, T3, was measured in the pathology lab for all the patients including 40 euthyroids (TSH = 0.3-5 MIU/L). The procedure was clearly explained to the subjects recruited for study, examination was conducted at physiology lab of Meenakshi medical college kanchipuram.

Nerve conduction study:

Nerve Conduction Study was performed by using the Standard RMS EPMARK II machine. The nerve conduction studies consisted of the determination of the motor nerve conduction velocity (MNCV), amplitude, and duration of the compound muscle action potentials (CMAPs) after distal and proximal stimulation, and distal motor latencies (DMLs) of the median and peroneal nerves. The latency of the fastest F wave was recorded for the median and peroneal nerves. In addition, the sensory nerve conduction velocity (SNCV), amplitude, and duration of the sensory nerve action potential [SNAP] after distal stimulation of the median nerve, and sural nerve were studied. MNCV evaluated by Belly Tendon montage. SNCV were measured by anti-dromic stimulation. The parameters were analysed by statistical tests – "t" test and Pearson Correlation using SPSS software version 17.

Results

Out of 80 subjects group A consists of euthyroid or control (n=40); group B Hypothyroid (n=40). In this study the serum concentrations of T3 and FT4 levels were significantly lower in hypothyroids as compared to controls;the levels of TSH were significantly higher in hypothyroids. The levels were within normal range in euthyroid group (table I). The mean age of all participating patients was 39.5 years (range: 20-60 years; hypothyroid patients (30.05± 10.77), Controls 37.8 (± 10.83) (table 2). The mean subjective duration of disease (at study entry) was significantly longer for patients with hypothyroidism: 18.6 months (range: 2–84). As expected, the mean BMI of hypothyroid patients was higher than that of (p<0.005)euthyroid subjects.The motor axonal neuropathy, was present in upper limbs in 30% (n=12) of the hypothyroid patients and 80% (n=32). Sensory neuropathy in the upper limbs was present in 85% (n=34) of the hypothyroid group (p=0.000). As for the lower limb, 70% (n=28) of the hypothyroid group (p=0.036) were having sensory neuropathy. There was no statistical significant difference between the control group and either the hypothyroid. Carpal tunnel syndrome was found in, 20% (n=8), 30% (n=12) among the controls,and hypothyroid group respectively.

Table II: Comparison of baseline characteristics

<table>
<thead>
<tr>
<th></th>
<th>Hypothyroids (n=40)</th>
<th>Controls (n=40)</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>30.05 ±10.8</td>
<td>47.8 ±10.83</td>
<td>NS</td>
</tr>
<tr>
<td>Height in cm</td>
<td>151.9 ±5.8</td>
<td>153.9 ±5.84</td>
<td>NS</td>
</tr>
<tr>
<td>Weight in kg</td>
<td>67.4± 11.3</td>
<td>57.4±11.3</td>
<td>P&lt;0.01**</td>
</tr>
<tr>
<td>BMI in kg/m2</td>
<td>28.1 ±3.7</td>
<td>24.7±4.94</td>
<td>P&lt;0.005***</td>
</tr>
</tbody>
</table>

P < 0.05 : significant

Table III: Motor conduction study findings for hypothyroids and controls

<table>
<thead>
<tr>
<th>Nerves</th>
<th>Hypothyroids (n=40)</th>
<th>Controls (n=40)</th>
<th>P values for CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Nerve (MNCV)</td>
<td>3.88</td>
<td>5.92</td>
<td>50.54</td>
</tr>
<tr>
<td>Peroneal nerve (MNCV)</td>
<td>6.24</td>
<td>1.01</td>
<td>38.0</td>
</tr>
</tbody>
</table>

P < 0.05 : significant, DL = Distal Latency (m sec), CV = Conduction Velocity (m/sec), Amp = Amplitude (m v)

Table IV: Comparison of F wave response in all three groups

<table>
<thead>
<tr>
<th>F response</th>
<th>Control (n=40)</th>
<th>Hypothyroid (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median nerve</td>
<td>24.9±2.04</td>
<td>26.4 ±1.9</td>
</tr>
<tr>
<td>Peroneal nerve</td>
<td>42.5±3.36</td>
<td>47.2±4.2</td>
</tr>
</tbody>
</table>

Table V: Sensory nerve conduction study findings in hypothyroids

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Distal latencies</th>
<th>Hypothyroids</th>
<th>controls</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>median</td>
<td>4.25</td>
<td>2.53</td>
<td>P=0.003</td>
<td></td>
</tr>
<tr>
<td>Sural</td>
<td>6.90</td>
<td>5.10</td>
<td>P=0.000</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The present study showed that there is subclinical peripheral nerve involvement in hypothyroid patients. There were no significant changes in motor nerve conduction velocity in our study unlike Schutte et al. who had shown a decreased motor nerve conduction velocity. Parallel to the study by O Malley et al. found that the sensory threshold were elevated and suggested that it seem to be reliable reflectors of hypothyroid nature. F wave responses done in median and peroneal nerve were within normal limits contrary to Udayakumari et al.10. In the literature1 3 4 6 7 24 the prevalence of neuromuscular disorders in thyroid dysfunctioning varies between 20% and 80%. Most of these studies were retrospective and were carried out before modern sensitive FT4 and TSH assays were available. Our data invalidate the presumption that a high prevalence of neuromuscular symptoms in thyroid dysfunction is due to a late diagnosis. Sensory nerve Conduction showed an overall decrease in conduction in...
hypothyroids as compared to control. This decrease is well appreciated and significant in conduction velocity of sural nerve and area of both sural and median nerve. Li et al.17 reported that thyroid hormones are essential for the maturation and repair of the peripheral nervous system which has its own system responsible for local production of 3,5,3 triiodothyronine, which play a role in the regeneration process. As for the peripheral nervous system, this study showed that many patients with thyroid problems have neuromuscular findings, as manifested by nerve conduction studies. The motor axonal neuropathy, was present in upper limbs in 30% (n=12) of the hypothyroid patients and 80% (n=32) in the lower limb (p=0.036, p=0.00 respectively). Sensory neuropathy, in the upper limbs was present in 85% (n=34) of the hypothyroid group (p=0.000). As for the lower limb, 70% (n=28) of the hypothyroid group (p=0.006) were having sensory neuropathy. These percentages of sensory neuropathy were higher than what was found by Khedr et al. 21, which reached 9% only of cases. But in other studies published in the early 1980s, the prevalence of sensory neuropathy in hypothyroid patients varied between 18% and 70%,3,11A. In our patients with hypothyroidism the prevalence of clinical and electro diagnostically confirmed carpal tunnel syndrome was 30%, whereas percentages varying from 2 to 20% are reported.11B. In spite of our findings, other studies showed the myopathic pattern of affection to be detected as found by Rao et al.1 and Khaledi et al.11B, between 20% and 80% in hypothyroid group of patients. Also, Duffy et al.22 found the myopathic pattern of affection in 33% of hypothyroid patients. In hyperthyroidism Puvanendran et al.4 detected myopathy in 80% of patients while Duffy et al.22 found it to be 10%. Duffy et al. 22 found that hypothyroidism group of patients show axonal neuropathy in 60% (p = 0.01), while the carpal tunnel entrapment neuropathy in 20% with significance 0.03. Also entrapment neuropathy of the median nerve has been observed in 30 % of hypothyroid patients though such a finding was statistically insignificant when compared to controls. This finding differs from what had been observed by DeKorn et al.24, who found the incidence of entrapment neuropathy in those patients to be as low as 5%. Other studies done by Khedr et al. 21. found 35% of hypothyroid patients to have entrapment neuropathy while Duffy et al. 22. found 25% of hypothyroid patients hadentrapment neuropathy. Regarding demyelinating neuropathy in the upper limb, there has been no report in such category of thyroid dysfunction contrary to what has been found in lower limb where the incidence was 40% -50% in the hypothyroid group which is statistically significant and is proved by presence of significant delay latency, and decrease in CV in the PT nerve in the hypo, and hyper thyroid group in the study of Duffy et al. 22. found that hypothyroidism group of patients show demyelinating neuropathy in 40% with a significant value 0.02. The results of our study revealed presence of significant decrease in CV of the median nerve in the hypothyroid group which could be explained by the presence of early demyelinating neuropathy as the finding don’t meet the criteria of demyelinating neuropathy.25 where there should be both delay in latency, and decrease in CV in two or more of the studied nerves. The current study also revealed presence of significant decrease CV in the peroneal nerve in the hypothyroid group, interpreted by in the presence of severe affection of large diameter axon, the motor CV can fall markedly, while early in the disease the CV in surviving axons will be normal or marginally reduced.26 A major shortcoming of this study is the lack of an age and sex matched control group. Unfortunately healthy control volunteers refused the burden of electrodiagnostic investigations. A selection bias may have occurred, because patients with muscle and/or sensory complaints could have given consent to the study more readily. Yet all studies cited in reviews for estimating prevalence data, have this shortcoming 24.

**Conclusion**

So we conclude from the electrophysiological nerve conduction study that there is mixed axonal degeneration and demyelinating form of neuropathy but the study fulfilling the criteria of axonal degeneration with early mild demyelination process in hypothyroid subjects. We conclude from the current study that electrophysiological studies can be useful in the diagnosis of subclinical polyneuropathy in hypothyroid patients, and when early detected in both upper and lower limbs could be resolved on thyroid hormone replacement therapy.

**REFERENCES**


16. Weins SC; Trudeau VL. Thyroid hormone and gamma-aminobutyric acid (GABA) interactions in neuroendocrine systems. CompBiochemPhysiol.2006;144(3): 332-44.


