ORIGINAL RESEARCH PAPER

Clinical Research

CLINICAL PROFILE AND ELECTRODIAGNOSTIC (NERVE CONDUCTION) STUDY OF PERIPHERAL NEUROPATHY IN PATIENT WITH HYPOTHYROIDISM.

KEY WORDS:

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ABSTRACT

In hypothyroidism, thyroid hormone is not produced in enough amounts; it leads to neuropathies due to long-term and untreated hypothyroidism. The prevalence of neuromuscular dysfunctions in thyroid disorders was found to be 20%–80% Patients develop the usual manifestations of peripheral neuropathy as loss of reflexes, proximal muscle weakness, numbness, paraesthesia, and decreased sensations, for example, vibration; joint position and touch pressure, muscle contraction, and relaxation are reduced with prolonged duration. The peripheral neuropathy was detected by electrophysiological testing or by quantitative assessment of vibratory and thermal sensitivity. **Objectives-** To study clinical profile and electrodiagnostic (nerve conduction) study of peripheral neuropathy in patient with hypothyroidism. **Materials And Methods-** This study was done in Pacific Institute of Medical Science and Hospital, Udaipur, Rajasthan. Adult patients with primary hypothyroidism were included. Patients with other possible causes of neuropathy were excluded. Detailed medical history was obtained, and clinical examination and nerve conduction study by electrodiagnostic method were done in all patients. **Results-** A total of 100 patients who met the diagnostic criteria of primary hypothyroidism were included in this study. The sample comprised 36 females (36%) and 64 males (64%) with age group ranging from 20 years to 75 years. Presence of either signs or symptoms suggestive of presence of neuropathy was seen in 50 patients (50%). Motor demyelinating neuropathy was found in 15 patient and polyneuropathy in 15 patients, with others having mixed (axonal and demyelinating), pure sensory and pure motor neuropathy. **Conclusion-** Advanced age and male gender are important risk factors for development of neuropathy in patients with hypothyroidism. A through clinical examination and nerve conduction study is very important and are sensitive predictors for the presence of neuropathy.

INTRODUCTION

The thyroid gland secretes triiodothyronine (T3) and thyroxin (T4) hormones .These hormones maintain the level of metabolism in the tissues that is optimal for their normal function.

In hypothyroidism, thyroid hormone is not produced in enough amounts; it leads to neuropathies due to long-term and untreated hypothyroidism. The prevalence of neuromuscular dysfunctions in thyroid disorders was found to be 20%–80% [2].

In hypothyroidism, central and peripheral nerve is involved. Some of the usual signs of hypothyroidism are muscle weakness, fatigue, muscular and mental sluggishness, weight gain, constipation, and intolerance to cold.

Patients develop the usual manifestations of peripheral neuropathy as loss of reflexes, proximal muscle weakness, numbness, paraesthesia, and decreased sensations, for example, vibration; joint position and touch pressure, muscle contraction, and relaxation are reduced with prolonged duration. The peripheral neuropathy was detected by electrophysiological testing or by quantitative assessment of vibratory and thermal sensitivity[1].

In many studies conducted in the past, polyneuropathy was observed to be associated with hypothyroidism. The peripheral polyneuropathy may be due to the defect in nerve cell body, axons, or myelin sheath, and it results in decreased nerve conduction velocities and amplitudes in peripheral nerves. Sural and median nerves are affected earlier, and distal and sensory nerves are affected later.

Metabolic alterations induced by hypothyroidism are responsible for peripheral neuropathy[3]. Adenosine triphosphate (ATP) deficiency and reduced ATPase activity with decreased Na/K pump activity cause alteration in axonal transport leading to peripheral neuropathy. These changes initially damage function in the nerve, and later induce structural alterations[6].

These are studies which reported primary axonal degeneration while some reported demyelination as the predominant feature of neuropathy in hypothyroidism[4] In hypothyroid patients, the polyneuropathy can be reversed with the appropriate and timely hormonal treatment.

Objectives-

- Study of Clinical profile of Peripheral Neuropathy in patient with Hypothyroidism.
- Study of Electrodiagnostic (Nerve Conduction) findings of Peripheral Neuropathy in patient with Hypothyroidism.

MATERIALS AND METHODS

This is a cross sectional analytical study and was conducted on all hypothyroidism patients coming to medicine opd and admitted in medicine ward in Pacific Institute of Medical Sciences and Hospital, Udaipur.

The study objectives were explained to each patient, and written informed consent was obtained. Detailed medical history regarding duration of disease and medical treatment was taken.

Duration of disease is defined as the period from the diagnosis to the date of enrollment in the study. The common features of nerve dysfunctions such as pain, cramps,

paresthesia, and weakness were asked and documented in the data sheet.

The complete medical examination was carried out for every patient. Body mass index (BMI) was calculated for each patient. Patient with BMI more than or equal to 25 kg/m^2 and more than or equal to 30 kg/m^2 were considered as overweight and obese, respectively.

The biochemical profile was evaluated to confirm the diagnosis of primary hypothyroidism. Thyroid function tests including serum T3, T4 or free T3, free T4, and thyroid stimulating hormone (TSH) were measured.

Moreover, nerve conduction studies (NCSs) were done by electrophysiological method. The NCS was performed at room temperature, with normal body temperature, on two channel electromyography (EMG) machine. Motor and sensory nerve conductions including F responses were recorded. Median and ulnar nerves of the upper limb and peroneal, tibial and sural nerves of the lower limb were tested.

Inclusion Criteria:

- All adult patients (age > 18 years),
- Patients who will consent to participate in the study,
- Patients with diagnosis of primary hypothyroidism, irrespective of the etiology, attending outdoor patient department, or admitted in medicine wards.

Exclusion criteria:

- Patients with secondary hypothyroidism.
- Subclinical hypothyroidism.
- Patients with other possible causes of neuropathy (e.g., diabetes mellitus, alcoholism, liver or kidney diseases, use of drugs known to cause neuropathy, vasculitis, HIV, Leprosy, malignancy.
- Known case of AIDP, CIDP and its variants.
- Known case of Hereditary neuropathy.
- Critical Illness neuropathy.

Statistical Analysis

The data was presented as number and percentages for the qualitative data, mean, standard deviations and ranges for the quantitative data with parametric distribution and median with inter quartile range (IQR) for the quantitative data with non parametric distribution. Chi-square test was used in the comparison of qualitative data and Fisher exact test was used. The comparison between two groups with quantitative data and parametric distribution was done by using student's 't' test. A p-value < 0.05 was considered statistically significant.

RESULT

Table A: Summary Of Patients' Baseline Characteristics

Characteristics	n=100	Percentage %
Age (years)		
18-30	25	25
31-45	43	43
46-60	22	22
>60	10	10
Gender		
Male	64	64
Female	36	36
BMI (kg/m2)		
Normal	35	35
Overweight	40	40
Obese 25 25		
Signs and/symptoms of neuropathy		
Negative	50	50
Positive	50	50
Serum TSH		
Normal	25	25
Abnormal	75	75
Electrophysiological study		
Abnormal	26	26
Normal	74	74

BMI: Body mass index, TSH: Thyroid stimulating hormone.

Table 1: Latency, Amplitude And NCV Of Right and Left Median Nerve – 'Motor Component' in Hypothyroid Patients

Right Median Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.36± 1.14
Distal latency (ms)	7.21±1.43
Amplitude (mV)	10.12±2.41
NCV (m/s)	46.14±8.34

Left Median Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.51±1.13
Distal latency (ms)	7.62±0.46
Amplitude (mV)	12.09±3.94
NCV (m/s)	58.66±5.02

Table 2: Latency, Amplitude And NCV Of Right And Left Ulnar Nerve – 'Motor Component' In Hypothyroid Patients

Right Ulnar Nerve

Parameter	Mean±SD
Proximal latency (ms)	2.21±0.23
Distal latency(ms)	7.69 ±0.92
Amplitude (mV)	11.84±2.43
NCV (m/s)	52.67±5.04

Left Ulnar Nerve

Parameter	Mean±SD
Proximal latency (ms)	2.32±0.43
Distal latency(ms)	7.03±0.63
Amplitude (mV)	12.03±2.37
NCV (m/s)	55.15±5.24

Table 3: Latency, Amplitude And NCV Of Right and Left Common Peroneal Nerve – 'Motor Component' in Hypothyroid Patients

Right Common Peroneal Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.11±0.80
Distal latency(ms)	10.24 ±0.80
Amplitude (mV)	6.08±2.32
NCV (m/s)	48.59±5.59

Left Common Peroneal Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.11±0.80
Distal latency(ms)	10.24 ±0.80
Amplitude (mV)	6.08±2.32
NCV (m/s)	48.59±5.59

Table 4: Latency, Amplitude And NCV Of Right and Left Median Nerve – 'Sensory Component' in Hypothyroid Patients

Right Median Nerve

Parameter	Mean±SD
Proximal latency (ms)	2.92±1.16
Amplitude (mV)	6.80±0.83
NCV (m/s)	55.23±4.88

Left Median Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.65±1.32
Amplitude (mV)	6.23±0.51
NCV (m/s)	58.26±16.17

Table 5: Latency, Amplitude And NCV Of Right and Left Ulnar Nerve – 'Sensory Component' in Hypothyroid Patients

Right Ulnar Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.71±0.79
Amplitude (mV)	5.53±1.33
NCV (m/s)	61.32±9.93

Left Ulnar Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.71±0.74
Amplitude (mV)	5.00±2.33
NCV (m/s)	60.76±4.54

Table 6: Latency, Amplitude And NCV Of Right and Left Sural Nerve – 'Sensory Component' in Hypothyroid Patients

Right Sural Nerve

Parameter	Mean±SD
Proximal latency (ms)	3.53±0.73
Amplitude (mV)	3.30±1.39
NCV (m/s)	50.64±10.93

Left Sural Nerve

Parameter	Mean±SD
Proximal latency (ms)	4.44 ±1.39
Amplitude (mV)	4.28±1.52
NCV (m/s)	45.23± 9.97

Summary Of Patients' Baseline Characteristics Is Described In Table -A.

A total of 100 patients who met the diagnostic criteria of primary hypothyroidism and inclusion criteria were included in this study.

The sample comprised 36 females (36%) and 64 males (64%) with age group ranging from 20 years to 75 years.

In 23 (23%) patients, thyroid peroxidase antibodies were positive, 10 (10%) patients were post iodine therapy, and 67 (67%) were idiopathic.

35 patients (35%) had normal BMI, 40 (40%) were overweight, and 25 (25%) were obese.

Presence of either signs or symptoms suggestive of presence of neuropathy was seen in 50 patients (50%).

TSH bioassay was done in all cases. With reference to standard limits, TSH was normal in 25 cases (25%), and abnormal in 75 (75%).

By electrophysiological study, occurrence of neuropathy was found in 26 patients (26%).

The mean of amplitude, conduction velocity, and latency of individual motor and sensory nerves, that is, median, ulnar, common peroneal and sural nerve in hypothyroid patients are shown in Table 1 to 6.

26 Patients Showed Peripheral Neuropathy.

5 patients had right sural neuropathy.

8 patients had pure sensory neuropathy affecting right median and ulnar nerves.

7 patients had pure motor mononeuropathy affecting left median nerve.

6 patients had sensory motor neuropathy affecting lower limb with right peroneal and sural neuropathy.

CONCLUSION

Peripheral neuropathy, a disorder marked by damage to the nerves, particularly in the arms and legs, can be exacerbated by hypothyroidism, or an underactive thyroid. Nerve compression brought on by fluid retention is frequently the cause of this.

We found no correlation between nerve conduction values and the physiological parameters (age and length of disease). In the upper limb, the median nerve is most frequently affected, while in the lower limb, the sural nerve is most frequently affected. One useful parameter for diagnosing and assessing neuropathy in hypothyroid patients is the estimation of nerve conduction values.

DISCUSSION

Hypothyroidism is an endocrine disorder of deficient thyroid hormone levels in the circulation. It can affect multiple system in our body including nervous system, musculoskeletal system, cardiovascular system, respiratory system, gastrointestinal system, reproductive system and genitourinary system. Thyroid hormones are essential for the normal functioning of the brain and nervous system.

Endocrine manifestations depend on the cause of the disease, duration and severity of hypothyroidism. Nerve conduction study (NCS) provides the greatest help in assessing the peripheral nerve disorder. Prolonged nerve conduction time, decreased amplitude and longer latencies are the well documented features of neurological findings in hypothyroidism and that can be reversed with treatment. More common presenting feature is the carpal tunnel syndrome with 29% incidence. The connective tissues of the tendon get thickened and entrap the median nerve, which is the reason for the carpal tunnel syndrome.

In our present study we find that the nerve conduction velocity is reduced in right median, right and left ulnar and left common peroneal nerves.

In our study out of 100 patients, 51% were in the age group of 31-45 yrs, followed by 20% in the age group of 46-60 yrs, 16% in 18-30 yrs. 13% were above 60 yrs of age. In 51 patients with age 31-45 years, 41 had abnormal neuropathy, in 20 patients of 46-60 yrs 16 had abnormal neuropathy and in 13 patients of >60 yrs 11 had abnormal neuropathy. Male : Female ratio was 1:1.04 i.e. there is almost equal distribution between male and females. Of 51 female patients, 40 had abnormal neuropathy and of 49 male patients, 40 had normal neuropathy.

In our study maximum patients 65% were either overweight or obese, only 35% were normal in BMI. Of 35 normal BMI, 30 had abnormal neuropathy, of 65 overweight and obese 50 had abnormal neuropathy.

In our study 67% had idiopathic etiology whereas 23% had TPO positive and 10% had postiodine therapy.

In our study 80% had signs and symptoms of neuropathy. 77% had abnormal serum TSH values. 75% had abnormal electrophysiological parameters.

Three parameters (latency, amplitude and nerve conduction velocity) of motor component of three nerves (Median nerve, Ulnar nerve and Peroneal nerve) and sensory component of three nerves (Median nerve, Ulnar nerve and Sural nerve) were studied between Hypothyroidism cases.

The sensory nerve conduction velocity of the sural nerve is reduced in our present study.

In our study, out of 100 patients, medial nerve carpal tunnel syndrome was found in 25 patients. Peroneal nerve motor, sensory were found in 30 patients. Peroneal nerve tibial nerve foot drop in 5 patients, sural nerve in 5 patients and ulnar nerve in 10 patients.

In present study, out of 100 patients, motor demyelinating neuropathy (Gillian Bare Syndrome) was found in 15 patients. Mixed (Axonal + Demylinating) in 15 patients. Axonal neuropathy ad pure motor neuropathy in 10 patients each,

pure sensory neuropathy and both sensory+motor in 5 patients each.

In this present study we could not find any correlation between the nerve conduction abnormalities and the age and duration of the disease in hypothyroid patients.

Amplitude measures are important in sensory nerve conduction evaluations. The nerve conduction velocity in turn is depend mainly on the faster conducting nerve fibre, even if maximum number of nerve fibres get affected, the presence of few faster conducting fibre carry the conduction and the result will be disproportionate to the affected fibres.

It is important to evaluate every patient with hypothyroidism or with the suspicion of the disease for any neurological abnormalities. Thyroid conditions are prevalent and frequently present with neurological symptoms. However, when neurological symptoms are manifesting, a high index of suspicion is required. Thyroid function and antibody testing must be done proactively in these situations because treatment may result in full recovery.

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