

An observation into the conduction of nerve fibers and goniometry in women with hypothyroidism



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ABSTRACT

Background: The thyroid hormone is so essential that it is involved in the functioning of all the body systems, especially in the development of the brain in fetal life. The World Health Organization has estimated that around 2 billion individuals are suffering from thyroid disorders. Hence, it is essential to identify and diagnose hypothyroid patients so that the treatment strategy can be started at the earliest. **Aims and Objectives:** The present study aimed to find out the peripheral nerve conduction velocity, range, and degree of movement of joints in newly diagnosed hypothyroid women and compare them with those of normal euthyroid women. **Materials and Methods:** The present study was a case-control study conducted from July 2015 to March 2016. A total of 50 cases of newly diagnosed hypothyroid women and 50 age-matched euthyroid women were part of the study after obtaining written and informed consent. Thyroid estimation was performed in the Clinical Biochemistry Department by the ELISA method, and nerve conduction studies were performed in the Neurology Department. **Results:** The age and height of the participants were not statistically significant. Weight and body mass index were significantly higher in the cases when compared to the control group. Sensory and motor conduction velocities of the right median nerve are significantly less in these cases when compared to control group participants. Sensory and motor conduction velocities of the right ulnar nerve are significantly less in these cases when compared to control group participants. Sensory and motor conduction velocities of the left median nerve are significantly less in these cases when compared to control group participants. Sensory and motor conduction velocities of the left ulnar nerve are significantly less in these cases when compared to control group participants. The goniometric parameters (right and left sides) of the cases and control group participants were not significantly different. **Conclusion:** Hypothyroid women have a delay in peripheral nerve conduction velocities, including sensory and motor components, and the degree and range of movements of limb joints were not affected. A nerve conduction study may be utilized as a routine screening test for hypothyroid individuals so that hormone replacement therapy can be instituted at the earliest.

Key words: Hypothyroidism; Nerve conduction; Goniometry; Endocrine disorders

INTRODUCTION

The Indian Thyroid Society has declared that hypothyroidism is one of the most common pathological hormonal deficiencies in India. Further, it was explained that women are more susceptible than men.¹ Thyroid hormone is so essential that it is involved in the functioning of all the

body systems, especially in the development of the brain in fetal life. It also influences reproductive functions. Hence, deficiency in the thyroid hormone also affects the functioning of these systems and deteriorates the quality of life. Hypothyroidism causes effects such as weight gain, lethargy, excess sleep, decreased metabolism, bradycardia, a decrease in the excitability of the nerve

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fibers, and a lack of libido. As per the statistics of the World Health Organization, around 2 billion individuals are suffering from thyroid disorders. Hence, it is essential to identify and diagnose hypothyroid patients so that the treatment strategy can be started at the earliest. One of the diagnostic methods for diagnosing thyroid disorders is nerve conduction studies. These studies also help in the observation of the prognosis of the treatment given. The peripheral nerve is the one that is involved in the early stages of hypothyroidism. Hence, the nerve conduction study, which is an electrodiagnostic procedure, helps in the early diagnosis of hypothyroidism.²⁻⁷ Another important system that is involved in hypothyroidism is the skeletal muscles. Hence, the range of the motion is affected. Hence, the measurement of the range of motion is also one of the important diagnostic tools for hypothyroidism. This measurement is called goniometry. Assessment of nerve conduction and range of motion are essential tools in the diagnosis of hypothyroidism.

Aims and objectives

The present study aimed to find out peripheral nerve conduction velocity, range, and degree of movement of joints in newly diagnosed hypothyroid women and compare them with normal euthyroid women.

MATERIALS AND METHODS

The present study was conducted at the Department of Physiology, Coimbatore Medical College Hospital, Coimbatore. The present study was a case-control study conducted from July 2015 to March 2016. A total of 50 cases of newly diagnosed hypothyroid women and 50 age-matched euthyroid women were part of the study after obtaining written informed consent. The participants were selected from the female outpatient department of Coimbatore Medical College Hospital, Coimbatore. Newly diagnosed cases of hypothyroid women who have not yet started the treatment, aged more than 20 years, and are willing to participate in the study were included in the study. Unwilling participants, those who are under treatment, or those with any other complications like hypertension, diabetes, etc. were excluded from the study. Thyroid function tests were performed at the Clinical Biochemistry Laboratory, Coimbatore Medical College Hospital, Coimbatore, using the Microwell ELISA technique with ERBA Thyrokit from ERBA Diagnostics. A complete nerve conduction study (NCS) was done in all the subjects with RMS-EMG-EP Mark II using standard protocols and settings. 1-cm disc surface electrodes were used with surface stimulators. Three types of electrodes were used, i.e., active, reference, and ground. The ground electrode served as a zero-voltage reference point. The nerve

conduction velocities to the electrical stimulation of the nerves of normal euthyroid women were compared with hypothyroid women. A goniometry instrument was used to find out the degree and range of movement of joints at the Neurology Laboratory, Department of Neurology, Coimbatore Medical College Hospital, Coimbatore.

Statistical analysis

Data were analyzed by the SPSS 27.0 version. Data were checked for quality control in a spreadsheet and then expressed as mean and standard deviation. Student t-test was applied to observe the significance of the difference between the groups. A probability value of <0.05 was considered significant.

RESULTS

Table 1 compares the demographic parameters of the participants. The age and height of the participants were not statistically significant. Weight and body mass index were significantly higher in the cases when compared to the control group. Sensory and motor conduction velocities of the right median nerve are significantly less in these cases when compared to control group participants (Table 2). Sensory and motor conduction velocities of the right ulnar nerve are significantly less in these cases when compared to control group participants (Table 3). Sensory and motor conduction velocities of the left median nerve are significantly less in these cases when compared to control group participants (Table 4). Sensory and motor conduction velocities of the left ulnar nerve are significantly less in these cases when compared to control group participants (Table 5). The goniometric parameters (right and left sides) of the cases and control group participants were not significantly different (Table 6 and 7).

DISCUSSION

Hypothyroidism is a common endocrinal disorder affecting women that produces a variety of manifestations of peripheral neuropathy, which affects the peripheral nervous system, namely motor, sensory, and mixed nerves, producing chronic disability. The present study aimed to find out the peripheral nerve conduction velocity, range, and degree

Table 1: Demographic parameters of the cases and control group participants

Parameter	Cases (n=50)	Controls (n=50)	P-value
Age (years)	34.6±6.3	37.5±9.2	0.0689
Height (meters)	1.5±0.05	1.5±0.05	1.000
Weight (kg)	68.7±6.5	62±7.5	<0.0001
Body mass index	28.6±2.4	25.3±2.4	<0.0001

Data were expressed as mean and standard deviation. P<0.05 was significant.

Table 2: Sensory and motor nerve conduction parameters of the cases and control group participants in the right median nerve

Parameter	Cases (n=50)	Controls (n=50)	P-value
Motor conduction velocity	48.7±3.6	54.3±3.6	<0.0001
Sensory conduction velocity	48.4±3.7	52.9±8.5	0.0009
F wave	30±1.9	32.4±2.4	<0.0001

Data were expressed as mean and standard deviation. P<0.05 was significant.

Table 3: Sensory and motor nerve conduction parameters of the cases and control group participants in the right ulnar nerve

Parameter	Cases (n=50)	Controls (n=50)	P-value
Motor conduction velocity	49.2±4.8	56.6±5.3	<0.0001
Sensory conduction velocity	48.4±5.06	53.7±5.4	<0.0001
F wave	30.1±2.9	34.7±2.7	<0.0001

Data were expressed as mean and standard deviation. P<0.05 was significant.

Table 4: Sensory and motor nerve conduction parameters of the cases and control group participants in the left median nerve

Parameter	Cases (n=50)	Controls (n=50)	P-value
Motor conduction velocity	48.8±5.1	55.2±4.9	<0.0001
Sensory conduction velocity	47.3±8.7	52.1±5.2	0.0012
F wave	30.3±2	32.4±2.1	<0.0001

Data were expressed as mean and standard deviation. P<0.05 was significant.

Table 5: Sensory and motor nerve conduction parameters of the cases and control group participants in the left ulnar nerve

Parameter	Cases (n=50)	Controls (n=50)	P-value
Motor conduction velocity	48.8±5.5	54.6±4.6	<0.0001
Sensory conduction velocity	49.2±4.2	53.8±3.7	0.0012
F wave	29.9±1.9	32.8±2.4	<0.0001

Data were expressed as mean and standard deviation. P<0.05 was significant

Table 6: Goniometric parameters (right side) of the cases and control group participants

Parameter	Cases (n=50)	Controls (n=50)	P-value
Right shoulder	62.9±10	63.3±10.1	0.8427
Right elbow	67.3±12.2	68.4±9.1	0.6105
Right wrist	61.7±12.1	60.3±14.7	0.6043
Right metacarpophalangeal joint	63.4±11.2	64.6±10.7	0.5851

Data was expressed as mean and standard deviation. P<0.05 was significant.

of movement of joints in newly diagnosed hypothyroid women and compare them with those of normal euthyroid women. Sensory and motor conduction velocities of the right median and ulnar nerve were significantly less in

Table 7: Goniometric parameters (left side) of the cases and control group participants

Parameter	Cases (n=50)	Controls (n=50)	P-value
Left shoulder	63.2±9.5	63.6±10.2	0.8396
Left elbow	68±12	67.9±9.5	0.9632
Left wrist	61.6±12.3	60.8±14.4	0.7658
Left metacarpophalangeal joint	63.8±11.3	64.6±11.9	0.7310

Data were expressed as mean and standard deviation. P<0.05 was significant.

these cases when compared to control group participants. Sensory and motor conduction velocities of the left median and ulnar nerves were significantly less in these cases when compared to control group participants. The cases and control group participants goniometric parameters (right and left sides) were not significantly different.

In this study, the weight of cases was significantly higher. This may be because of the edema caused by the accumulation of substances like hyaluronic acid.⁸ Nerve conduction latencies were significantly increased in patients with hypothyroidism, as stated by earlier studies.⁹ The neuropathy induced by hypothyroidism is not fully understood. Hormonal imbalance was expressed as an underlying reason for the damage to the nerve fibers.¹⁰ Another study reported that weight gain is a contributor to neuropathy.¹¹ Lack of thyroid hormone secretion causes a deficit of energy due to decreased metabolism. This will cause an accumulation of glycogen deposits around the nerve fibers. This causes structural alterations in the nerve fibers and causes nerve damage.^{12,13} Furthermore, a lack of thyroid hormone causes a lack of availability of ATP for sodium-potassium pump activity. This will interfere with axonal transport and cause nerve damage.^{14,15} Another interesting fact reported by a study explains that in hypothyroidism, body temperature decreases, which contributes to a decrease in nerve conduction.¹⁶ Hypothyroid women have a delay in peripheral nerve conduction velocities, including sensory and motor components, and the degree and range of movements of limb joints were not affected. A nerve conduction study may be utilized as a routine screening test for hypothyroid individuals so that hormone replacement therapy can be instituted at the earliest.

Limitations of the study

The sample size of the study is small. Hence, the results cannot be generalized.

CONCLUSION

Hypothyroid women have a delay in peripheral nerve conduction velocities, including sensory and motor components, and the degree and range of movements of

limb joints were not affected. A nerve conduction study may be utilized as a routine screening test for hypothyroid individuals so that hormone replacement therapy can be instituted at the earliest. Further, detailed studies are required in this area to understand the mechanisms involved.

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SMSK- Design of the study, review of literature, analysis and preparing the manuscript; **KP, SS**- Data collection, preparing the manuscript; **JS**- Analysis and preparing the manuscript.

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