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Study On Audiologic Function In Newly Diagnosed Subclinical Hypothyroidism Patients By BERA.

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ABSTRACT

Thyroid hormone is necessary for normal development of the auditory system. The association between thyroid hormone and hearing development has long been recognized in patients with congenital hypothyroidism (CH), endemic cretinism and thyroid hormone resistance. The hearing impairment may be conductive, sensorineural or mixed and about half of the cases benefited from thyroid therapy. The aim of this study is to evaluate the audiologic function in newly diagnosed subclinical hypothyroidism patients by BERA.The study was conducted in the year between 2016-2017 in the Institute of Physiology And Experimental Medicine and Medical Endocrinology Clinic of Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai.Thirty newly diagnosed patients of subclinical Hypothyroidism of both sexes, in the age group below 60 years were included in the study. They were selected from the Medical Endocrine Clinic, Rajiv Gandhi Government general Hospital, Chennai. Thirty control subjects of both sexes, in the age group below 60 years with normal thyroid profile were selected. Cochleovestibular symptoms were more common in hypothyroid patients (48%) than control (20%) *p* value. Pure Tone Audiometric threshold was found higher in 34% of cases. Sensorineural hearing loss was most common (76.46%) compared to conductive and mixed hearing loss. BERA showed significant prolonged absolute peak latency of wave V. Early identification of thyroid hormone deficiency prevents further progression of disease and its related morbidity. Autoimmunity is the most probable factor for subclinical hypothyroidism. It is clearly shown by elevated levels of thyroid peroxidase antibody and thyroglobulin antibody. Increased levels of antibody are the cause for changes in BERA, it leads to central nervous system dysfunction and hearing defects.

Keywords: Subclinical hypothyroidism, Brainstem evoked response audiometry (BERA)

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INTRODUCTION

Subclinical hypothyroidism is defined as high serum TSH (Thyroid stimulating hormone) concentration and normal serum thyroxine and triiodothyronine concentration. Considerable controversy exists regarding the definition of a high serum TSH concentration, the biologic significance of Subclinical hypothyroidism and indication of treatment, in this study TSH level>5.1mIU/L is taken [1]. Subclinical hypothyroidism is more prevalent in patients with Down syndrome, type 1 DM (Diabetes mellitus) and other auto immune disease. About 2% of pregnant women have Subclinical hypothyroidism. Among those pregnant women 58% have positive anti-TPO (Thyroid peroxidase). Hypothyroidism shows elevated concentration of antithyroid antibodies. Interaction between genetic susceptibility and environmental factors precipitates thyroid autoimmunity. The pathophysiology mechanisms of hearing loss in hypothyroid individuals are not yet discovered. In this condition, there is reduced cell metabolism with reduced microcirculation and this affects metabolism and oxygenation of various organs. The striavascularis and organ of corti in the inner ear are found be involved. Thyroid hormones are concerned with myelin formation and lipid concentration in Central nervous system. Thyroxine is a neurotransmitter by itself so it is obvious that hearing loss in hypothyroid individuals is of central nervous system origin involving the structures of the inner ear. Synaptic transmission in auditory pathway is affected by reduced calcium absorption in hypothyroidism. ATP deficiency causes impaired function of sodium –potassium pump. It causes reduced axonal transport in nerve fibres. Increased glycogen and glycosaminoglycans in cell cause the neuropathy by compression due to myxoedematous deposits. Conductive type of hearing loss is due to oedema and hypertrophy of mucosal lining of Eustachian tube and middle ear. Tympanic membrane is also thickened in hypothyroidism, changes in ossicles in oval and round window cause obliteration of oval and round window, crystallised consistency of bone and fusion and distortion of incus [2-4]. Brain stem evoked response audiometry is used to detect the auditory pathway in brainstem. Electrodes are kept in vertex and mastoid region. Electrical stimulation is given to record the conduction of auditory pathway up to midbrain. If sound enters the cochlea, production of electrical impulse passes to the auditory cortex by the following pathway: First order neuron is bipolar cells of spiral ganglion which end in Ventral and Dorsal cochlear nuclei in brainstem. Axons of Second order neurons from cochlear nuclei pass in the dorsal part of pons. The crossing fibres of two sides form Trapezoid body. Third order neurons have their cell bodies in Superior olivary nucleus and Trapezoid body and lateral lemniscus in midbrain. The fibres of lateral lemniscus ascend to the mid brain and terminate in the inferior colliculus. Fourth order neurons have their cell bodies in inferior colliculus in midbrain and fibres arising from this region reach Medial geniculate body in Thalamus. Fifth order neurons have their cell bodies in Medial geniculate body and fibres from this region reach form acoustic radiation which ends in Auditory area in cerebral cortex [5,6]. In this study using simple non-invasive method (BERA) central nervous system dysfunction and hearing impairment are going to be detected in earlier stages in subclinical hypothyroid patients. And also, evaluation of the cause of subclinical hypothyroidism by doing anti-TPO and anti-Tg levels and finding the correlation of BERA with Thyroid antibodies [7-9]

MATERIALS AND METHODS

The study was conducted in the year between 2016-2017 in the Institute of Physiology And Experimental Medicine and Medical Endocrinology Clinic of Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai.Thirty newly diagnosed patients of subclinical Hypothyroidism of both sexes, in the age group below 60 years were included in the study. They were selected from the Medical Endocrine Clinic, Rajiv Gandhi Government general Hospital, Chennai. Thirty control subjects of both sexes, in the age group below 60 years with normal thyroid profile were selected. **Inclusion Criteria:** Patients are both men and women in the age group below 60 years with TSH >5.1mIU/L, fT_4>0.93 to 1.7 ng/dl, fT_3- >3.1 to 6.8pmol/L. **Exclusion Criteria:** Patients with: Neurological or psychiatric illness, Altered sensorium ,Any other medical disorder that can affect hearing like diabetes mellitus, anaemia, hypertension, chronic obstructive pulmonary disease, acute or chronic liver disease, and acute or chronic renal disease, Malignancy, History of drug abuse and alcoholism, Above 60 years, Pregnancy. Both the control and study group individuals were subjected for basic ENT examination. It includes external ear examination, tuning fork tests like Rinne's test and weber's test, Otoscopic examination. **Pure tone audiometry:** Pure tone audiometry examination was done in both control and subclinical hypothyroid patients. To find out, hearing threshold of the subjects, to find out external or middle ear pathology. **Brainstem Auditory Evoked Potential:** The patients with subclinical hypothyroidism and controls were subjected to the non-invasive assessment of hearing by Brainstem Evoked Response Audiometry (BERA).

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It was done by Computerised Neurostim, Medicaid system. The recording was done in semi darkened and quiet room. The patient is advised to take head bath before recording. Electrodes placing areas are cleaned. Active, reference & ground electrodes are kept in an appropriate place. Below 5 kilo ohms levels of resistance are used. Auditory stimulus consists of clicks of 100µsec are given in one ear. It is given through electrically shielded ear phones at the rate of11.1 clicks/sec. Another ear is masked by pure white noise of 40dB.It is used to prevent false BAEP response. filter out undesirable frequencies in the surroundings we had to use band pass of 150-3000 Hz. Responses to 2000 clicks presentations were averaged. A graph is plotted to show the result. X-axis contains time (in milliseconds from the onset of stimulus). Y-axis contains amplitude (in µvolts).5-7wave or peaks are seen within 8-10 milliseconds. It is marked with Roman numerals. After obtaining informed consent, under aseptic precautions, 5-10ml of blood would be taken for estimation of TSH, fT_4, fT_3 (ElectroChemiluminescence immunoassay), Thyroglobulin antibody (Anti-Tg Elecsys e 100 kit) and Thyroid peroxidase antibody (Anti-TPO Elecsyscobas kit).

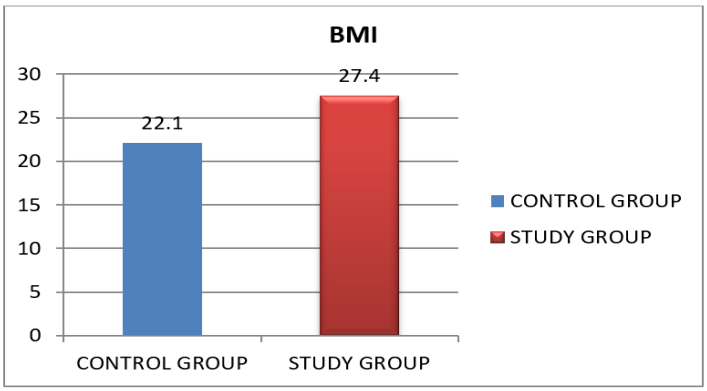
Statistical Analysis

Using unpaired t test the mean variables between the normal and subclinical hypothyroid patients are compared. SPSS version 17 was used for data analysis. Pearson's coefficient was done to find out the correlation between BERA with thyroglobulin antibody and thyroid peroxidase antibody in subclinical hypothyroid patients.

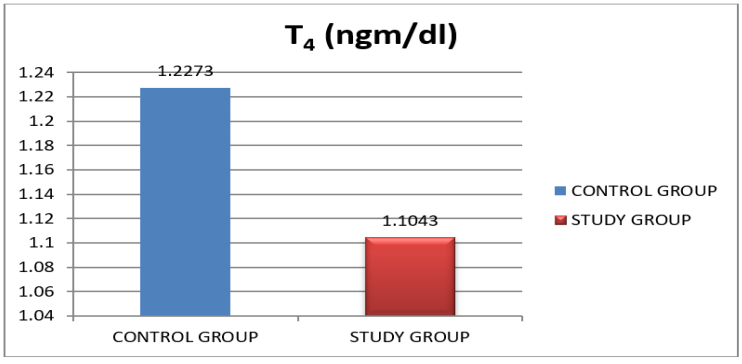
RESULTS

All the Subclinical hypothyroid patients and controls enrolled for the present study had clinically no evidence of hearing deficit. Our study population consists of 30 subclinical hypothyroid patients in the age group 20-60 years without any clinical evidence hearing impairment. The control subjects were 30 in number belonging to the age ranging from 20-60 years. BERA parameters are utilized for evaluating the integrity of auditory pathway.

Graph 1: Comparison of mean values of BMI between controls and subclinical hypothyroid patients



Graph 2: Comparison of mean values of T_4between controls and subclinical hypothyroid patients



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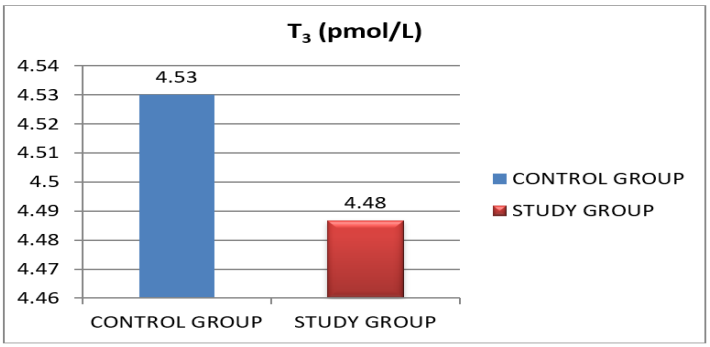
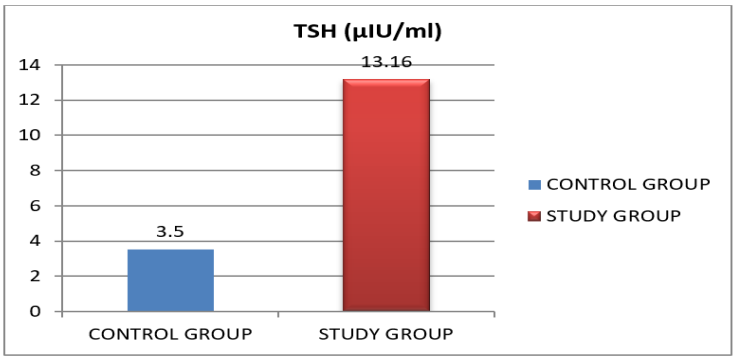
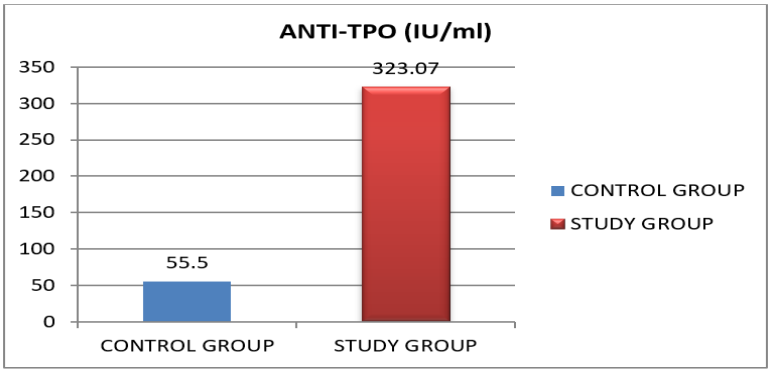
Graph 3: Comparison of mean values of T_3 between controls and subclinical hypothyroid patients



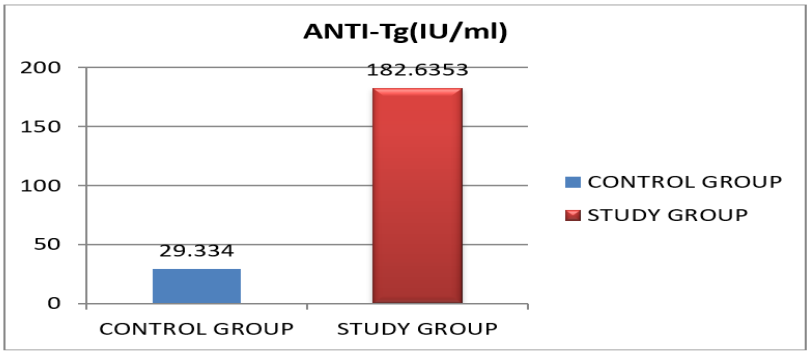
Graph 4: Comparison of mean values of TSH between controls, subclinical hypothyroid patients



Graph 5: Comparison of mean values of Anti-TPO between controls and subclinical hypothyroid patients



Graph.6 Comparison of mean values of Anti-Tg between controls and subclinical hypothyroid patients



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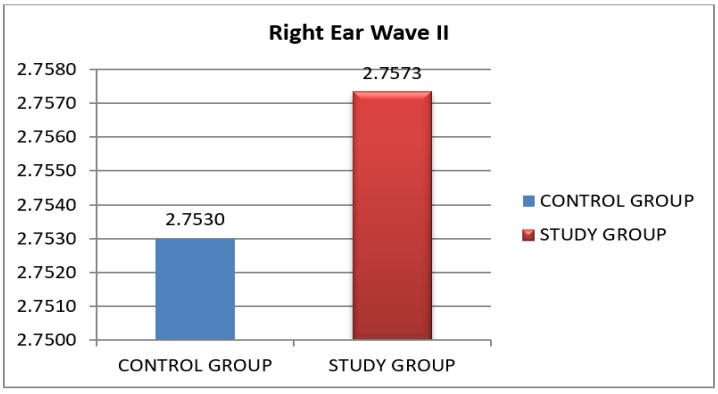
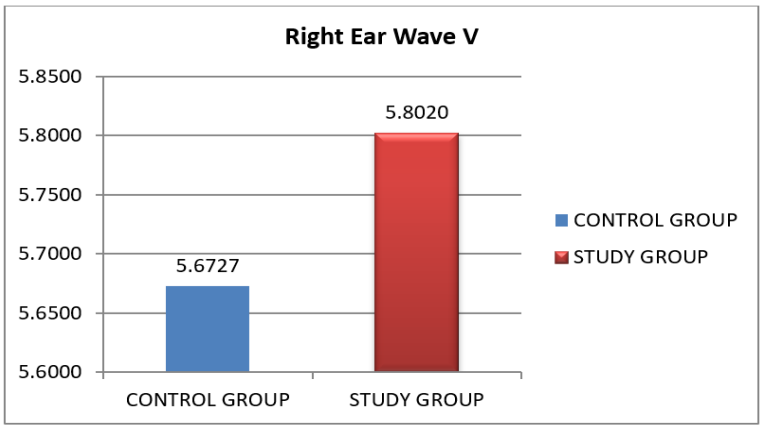
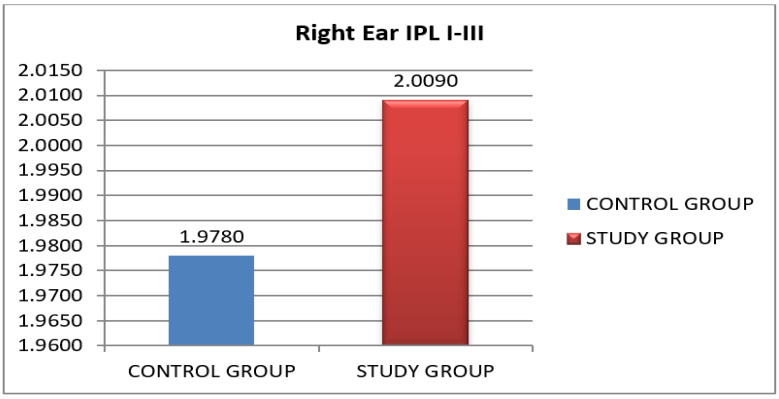
Graph 7: Comparison of mean values of absolute latencies of wave II between controls and subclinical hypothyroid patients in the right ear



Graph 8: Comparison of mean values of absolute latencies of wave V between controls and subclinical hypothyroid patients in the right ear



Graph 9: Comparison of mean values I-III IPL between controls and subclinical hypothyroid patients in the right ear.



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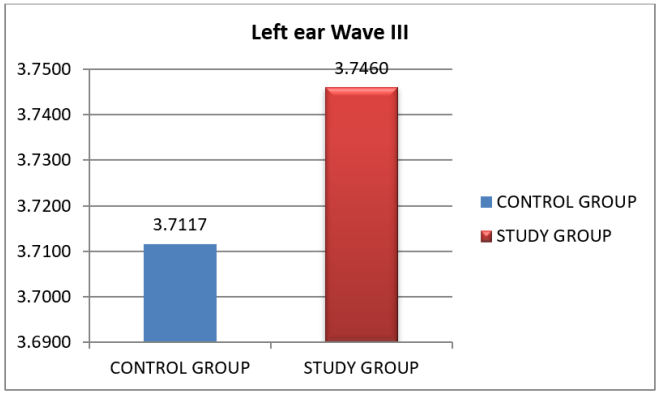
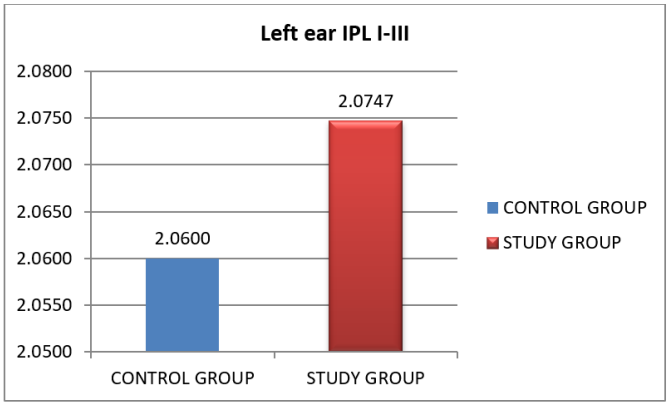
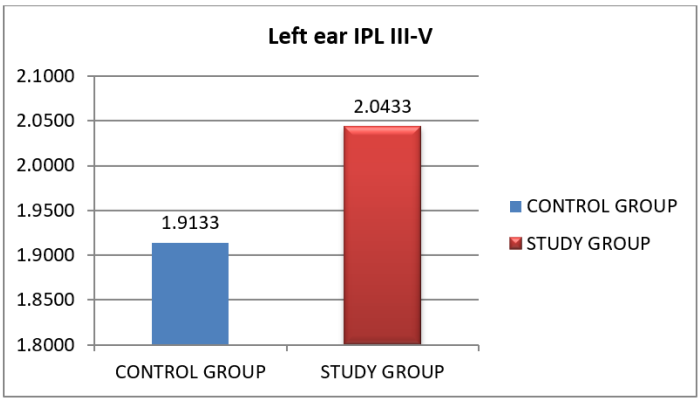
Graph 10: Comparison of mean values of absolute latencies of wave III between controls and subclinical hypothyroid patients in the left ear



Graph 11: Comparison of mean values I-III IPL between controls and subclinical hypothyroid patients in the left ear.



Graph 12: Comparison of mean values III-V IPL between controls and subclinical hypothyroid patients in the left ear.



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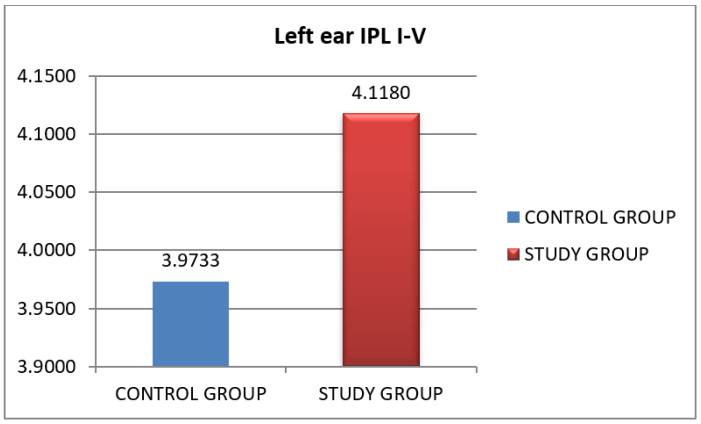
Graph 13: Comparison of the mean values of I-V IPL between controls and subclinical hypothyroid patients in the left ear.



DISCUSSION

Central nervous system dysfunction and hearing loss are seen in subclinical hypothyroidism patients. Sensorineural deafness is the most common manifestation due to dysfunction of thyroid gland. Few studies reveal that brainstem evoked response audiometry shows changes in subclinical hypothyroidism [10]. In this study shows that there is no specific difference in age group between subclinical hypothyroidism patients and controls, on comparing the weight between subclinical hypothyroidism patients and controls, it shows that weight gain (p=0.000) is present in subclinical hypothyroid patients. p Value is statistically significant. This study findings are supported by Mario Rotondi findings, he reported that lipid deposition occurs along with increase in TSH levels. Free thyroid hormone controls TSH secretion from pituitary by negative feedback mechanism. This feedback mechanism fails in obesity [11,12]. On analysing this study data, it is obvious that subclinical hypothyroid patients have significant increase in body mass index (p value=0.000). p Value is statistically significant. GauravGupta study reported that increased weight gain is seen in subclinical hypothyroid patients and changes in basal metabolic rate and environmental factors leads to obesity by unknown biological mechanism [13]. Thyroid stimulating hormone levels are elevated in subclinical hypothyroidism patients (p Value =0.000). p Value is statistically significant. In this study shows that 22 persons have TSH value of >10mIU/L. About 8persons have TSH value between5.1mIU/L and 10mIU/L [14]. In BERA wave I abnormality shows involvement of peripheral nervous system. Other waves reports that abnormal involvement of central nervous system. a. Wave-I Right ear p Value =0.968. p Value is statistically not significant. Left ear p Value =0. 693. P Value is statistically not significant. This study reveals that no significant change in absolute latency of wave-I between subclinical hypothyroidism patients and control group in both ears. b. Wave II- This study shows that no change in absolute latency of wave II between control and study group in both ears, Right ear p Value =0. 788. P Value is statistically not significant. Left ear p Value =0. 379. P Value is statistically not significant. c. Wave III: Absolute latency of wave III means onset of stimulus to peak of wave III. It is measured in milliseconds. It is normal in both ears. Right ear p Value =0. 463. P Value is statistically not significant. Left ear p Value =0. 532.pValue is statistically not significant. d. Wave IV: Right ear p Value =0. 815. P Value is statistically not significant. Left ear p Value =0. 425. P Value is statistically not significant. In this study shows no significant changes in absolute latency of wave IV between control and study group in both ears. e. Wave V Right ear p Value =0. 040. P Value is statistically significant. Left ear p Value =. 008. P Value is statistically significant. The present study shows that prolongation of absolute latency of Wave V in subclinical hypothyroid patients in both ears which means onset of stimulus to peak of wave V [1, 15]. IPLI-III Right ear p Value =0. 483. P Value is statistically not significant. Left ear p Value =0. 810.pValue is statistically not significant. Inter peak latencies I-III in this study, reflects that there are no significant changes in both ears and conduction time between cochlea and caudal pons is normal. Inter Peak Latency III-V: Right ear p Value =0. 155. P Value is statistically not significant. Left ear p Value =0. 104. P Value is statistically not significant. Inter peak latencies III -V in the present study is found to be normal in both ears. Inter Peak Latency I-V: Right ear p Value =0. 052. pValue is statistically not significant. Left ear p Value =0. 060. P Value is statistically not significant. Inter peak latencies I -V in the present study is found to be normal in both ears. There was positive correlation between Anti-Tg and Anti-TPO in both ears [16,17].

CONCLUSION

Functional integrity of the central nervous system and hearing status is evaluated in newly diagnosed subclinical hypothyroid patients by brainstem evoked response audiometry. The central nervous system is affected in subclinical hypothyroidism. It is expressed by an increase in the latency of BERA wave V in both ears. Subclinical hypothyroidism leads to overt hypothyroidism. Early identification of thyroid hormone deficiency prevents further progression of disease and its related morbidity. Autoimmunity is the most probable factor for subclinical hypothyroidism. It is clearly shown by elevated levels of thyroid peroxidase antibody and thyroglobulin antibody. Increased levels of antibody are the cause for changes in BERA, it leads to central nervous system dysfunction and hearing defects. It is clearly shown by positive correlation that exists between thyroid antibodies and BERA changes. Thyroxine treatment may be given to prevent disease progression and hence central nervous system dysfunction and audiological dysfunction in earlier stages itself.

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