

Audiological Evaluation of Hypothyroid Patients by Pure Tone Audiometry at Tertiary Care Hospital in Himachal Pradesh

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Abstract

Background: Thyroid hormone is important for the normal function of the auditory system. Thus, the present study was undertaken with the objective to evaluate the audiological profile of Hypothyroid Patients at Tertiary Care Hospital in Himachal Pradesh.

Material & Methods: Between September 2020 and June 2021, a cross-sectional study was done on hypothyroid patients came in OPD at Otorhinolaryngology Department of the Pt. Jawahar Lal Nehru Government Medical College and Hospital, District Chamba, Himachal Pradesh. After confirmation of hypothyroid status based on FT3, FT4 & TSH level, their socio-demographic characteristics were assessed and audiological assessment was done by pure tone audiometry. Patients were categorized on the basis of maximum hearing threshold intensity level. Data was analysed using Epi info V7 Software.

Results: A total of 41 hypothyroid patients were participated in the study. Among them, 61% (25) were ≤ 40 years of age while 39% (16) were above 40 years. 97.6% (40) of patients were female while only 2.4% (1) was male. Mean age of study participants was 39.66 ± 9.643 years. Among the total, FT3, FT4 and TSH level were deranged in 16(39%), 14(34.1%) and 37(90.2%) patients respectively. Mean FT3, FT4 and TSH levels was 22.05 ± 44.452 ng/ml, 7.07 ± 4.192 μ g/dl and 16.46 ± 24.241 μ IU/ml respectively. Hearing impairment in right ear was found in 12(29.3%) patients in whom mild hearing loss was present in 11(26.9%) patients while Moderate Hearing loss was found in 1(2.4%) patient. Hearing impairment in left ear was found in 18(43.9%) patients and all these were having mild hearing loss. Among the total, 12 (29.3%) had hearing impairment in both ears. Mean audiometric threshold value was 23.54 ± 6.169 dB and 25.49 ± 5.075 dB in right and left ear respectively. There was no statistically significant difference in mean audiometric threshold in both ears.(P value=0.2213).

Conclusion: In our study, most of the hypothyroid patients had auditory impairment with minimal degree. Therefore we can conclude that among hypothyroid patients hearing evaluation by Pure Tone Audiometry helps in the early diagnosis of hearing impairment and its treatment.

Key words: Audiological Evaluation, Pure Tone Audiometry, Hypothyroid Patients

Introduction

Every cell in the body has its metabolic rate controlled by the thyroid hormone. Thyroid hormone plays a critical role in several developmental processes, including body growth and the maturation of the central nervous system. The auditory system can be impacted by thyroid gland dysfunction much like any other body system.^{1,2}

There have been reports of hearing loss in hypothyroid patients in the literature. According to numerous experts, the auditory function is especially susceptible to the effects of thyroid hormone, which is necessary for the intricate physiology and development of the cochlea. When hypothyroidism affects people, auditory dysfunction is frequently described, with sensorineural hearing loss ranging from mild to severe.³⁻⁵

According to Bruschini et al⁶ findings, patients with hypothyroidism experienced slower recovery times and decreased stapedial muscle amplitude. According to Musiek & Gollegly et al⁷ and Knipper & Santos et al^{8,9} between 10 to 55 percent of all hypothyroidism patients have some hearing loss, and the cochlea and central auditory pathways are the source of the damage.¹⁰ Khechinaschvili et al¹¹ looked at patients who had hypothyroidism and discovered that the auditory system was impacted secondary to hypothyroidism.

Pure tone audiometry may be applied in monitoring of auditory functions in patients with thyroid disorders. In patients with thyroid disorders, hearing evaluation by pure tone audiometry helps in the detection of hearing loss earlier and thus treatment could be started.^{5,8}

An association between hearing and thyroid function has long been reported in various studies. Still there are several unclear issues related to the true incidence and degree of hearing loss. Thus, this study was conducted with the aim of evaluating the audiological profile of Hypothyroid Patients at Tertiary Care Hospital in Himachal Pradesh

Objectives of the Study

To evaluate the Audiological profile of Hypothyroid Patients at Tertiary Care Hospital in Himachal Pradesh

Research Methodology

- Research Approach -Descriptive
- Research Design- Cross Sectional study design
- Setting of the study- Otorhinolaryngology Department of the Pt. Jawahar Lal Nehru Government Medical College and Hospital, Chamba, Himachal Pradesh
- Study duration- between September 2020 and June 2021
- Study population- Hypothyroid patients came to the OPD of Otorhinolaryngology Department of the Pt. Jawahar Lal Nehru Government Medical College and Hospital, Himachal Pradesh during study period.
- Sample size- All hypothyroid patients at ENT OPD during the study period and who gave consent to participate.
- Sampling Technique- convenience Sampling Technique
- Diagnostic criteria- Hypothyroid patients were confirmed by estimating reduced FT3 (normal value; 0.7–2.04 ng/ml), FT4 (normal value; 5.0–14.10 µg/dl) below normal range and TSH level (normal value; 0.30–5.50 µIU/ml) above normal range
- Ethical considerations: Informed consent/assent was taken from them and confidentiality of the selected participants was also maintained
- Inclusive Criteria- Hypothyroid patients selected who were willing to participate in the study.
- Exclusion Criteria:
 - a. Patients who were not willing to participate in the study
 - b. Patients older than 60 years, history of prior ear surgery, working in noisy environment, conductive or type B or C type tympanometric curve, history of hereditary hearing loss or genetic syndrome, history of ototoxic medication were excluded from our study.
- Description of Tool
 - a. Section A-Socio-demographic characteristics of the patients (Age, Gender etc.).
 - b. Sections B- Data regarding FT3, FT4, TSH levels and Pure Tone Audiometry
- Validity of tool - by the experts in this field
- Permission- obtained from the concerned head of the Pt. Jawahar Lal Nehru Government Medical College and Hospital, Chamba, Himachal Pradesh
- Data collection Method: All hypothyroid patients came to the O.P.D were confirmed by estimating FT3 & FT4 and TSH level. After confirmation their socio-demographic characteristics were assessed. Audiological assessment was done by pure tone audiometry. Patients were categorized on the basis of maximum hearing threshold intensity level found either in left or right ear, i.e. if the patient is having different hearing threshold intensity in both ears, patient is grouped in higher threshold intensity group.

- Data analysis with appropriate statistical test in terms of frequencies & percentage and mean & standard deviation for qualitative and quantitative variables respectively using Epi info V7 Software.

Results

The present study was descriptive cross sectional study carried out to evaluate the Audiological profile of Hypothyroid Patients at Tertiary Care Hospital in Himachal Pradesh

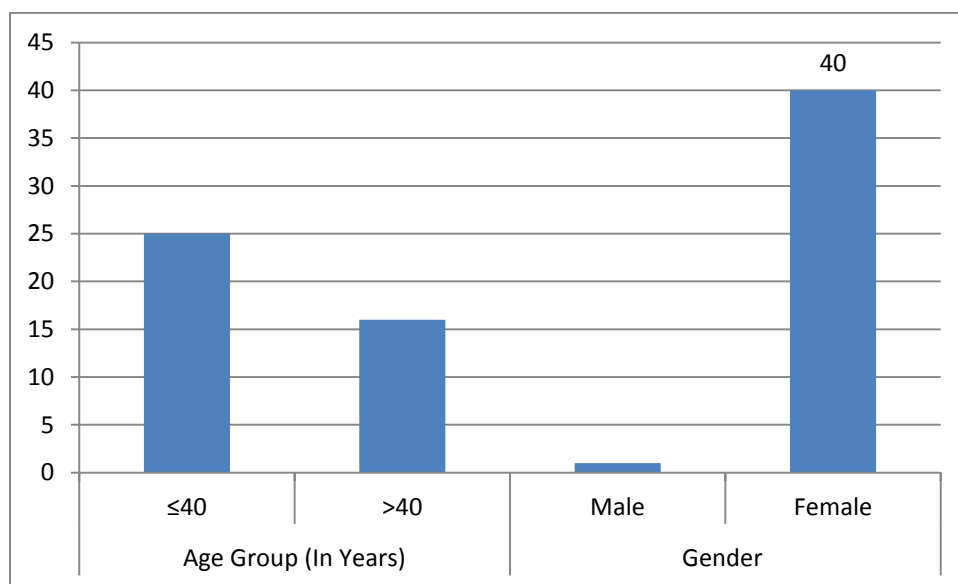


Figure-1: Age and gender distribution of Study Participants

A total of 41 hypothyroid patients were participated in the study. Among them, 61% (25) of the hypothyroid Patients were ≤40 years of age while 39% (16) were above 40 years. In the study, 97.6% (40) of patients were female while only 2.4% (1) was male. Mean age of study participants was 39.66 ± 9.643 years. (Figure-1)

		Frequency	Percent
FT3 Level	Within Normal Limits (0.7–2.04 ng/ml)	25	61.0
	Deranged	16	39.0
	Mean level	22.05±44.452	
FT4 Level	Within Normal Limits (5.0–14.10 µg/dl)	27	65.9
	Deranged	14	34.1
	Mean level	7.07±4.192	
TSH Level	Within Normal Limits (0.30–5.50 µIU/ml)	4	9.8
	Deranged	37	90.2

	Mean level	16.46±24.241	
	Total	41	100.0

Table-1: Thyroid profile among study participants

Among the total 41 hypothyroid patients, FT3, FT4 and TSH level were deranged in 16(39%), 14(34.1%) and 37(90.2%) patients respectively. Mean FT3, FT4 and TSH levels among hypothyroid patients was 22.05±44.452 ng/ml, 7.07±4.192 µg/dl and 16.46±24.241 µIU/ml respectively.

Threshold intensity (dB)	Degree of Hearing Impairment	Right Ear		Left Ear	
		< 25	Normal / Not Significant	29	70.7
26–40	Mild	11	26.9	18	43.9
41–60	Moderate	1	2.4	0	0.0
> 60	Severe	0	0.0	0	0.0
Total		41	100.0	41	100.0

Table-2: Audiometric threshold of control and hypothyroid patients

Among the total 41 hypothyroidism patients, hearing impairment in right ear was found in 12(29.3%) patients in whom mild hearing loss was present in 11(26.9%) patients while Moderate Hearing loss was found in 1(2.4%) patient. Hearing impairment in left ear was found in 18(43.9%) patients and all these were having mild hearing loss. Among the total, 12 (29.3%) had hearing impairment in both ears.

Side of ear	Audiometric threshold (dB)	p value
Right ear	23.54 ± 6.169 dB	0.2213
Left ear	25.49 ± 5.075 dB	

Table-3: Comparison of mean audiometric threshold in both ears

Among the total 41 hypothyroid patients, mean audiometric threshold value in right ear was 23.54 ± 6.169 dB, while in left ear mean audiometric threshold value in hypothyroid patients was 25.49 ± 5.075 dB. There was no statistically significant difference in mean audiometric threshold in both ears.(P value=0.2213)

Discussion

Thyroid hormones play important role in normal development of the auditory system. A decrease in speed of auditory brain stem responses may be because by hypomyelination of the auditory nerve. There are several reports that underline the possibility that parts of the myelination process, including myelin gene expression, may be under the control of thyroid hormone.^{5,8} In the present study, the detailed audiological assessment in patients having hypothyroidism was conducted to investigate the degree of hearing loss by pure tone audimetry and Patients were categorized on the basis of maximum hearing threshold intensity level

In our study, among the total 41 hypothyroid patients, 61% (25) were ≤ 40 years of age while 39% (16) were above 40 years. 97.6% (40) of patients were female while only 2.4% (1) was male. Mean age of study participants was 39.66 ± 9.643 years. Similarly in the study done by Singh R et al¹², the mean age of 50 participated hypothyroid patients was 26.5 ± 10.41 years & Out of them 70% were females while 30% males and maximum of them were in 12–25 year age group. According to Unnikrishan et al¹³ significantly higher ($p < 0.05$) proportion of females versus males (15.86 vs. 5.02%) and older versus younger (13.11 vs. 7.53%), adults were diagnosed with hypothyroidism.

In the present study, among the total, FT3, FT4 and TSH level were deranged in 16(39%), 14(34.1%) and 37(90.2%) patients respectively. Mean FT3, FT4 and TSH levels was 22.05 ± 44.452 ng/ml, 7.07 ± 4.192 μ g/dl and 16.46 ± 24.241 μ IU/ml respectively. Similarly in the study done by Singh R et al¹², among most of hypothyroid patients FT4, FT3 was within normal range TSH level was increased.

In the current study, hearing impairment in right ear was found in 12(29.3%) patients in whom mild hearing loss was present in 11(26.9%) patients while Moderate Hearing loss was found in 1(2.4%) patient. Hearing impairment in left ear was found in 18(43.9%) patients and all these were having mild hearing loss. Among the total, 12 (29.3%) had hearing impairment in both ears. Mean audiometric threshold value was 23.54 ± 6.169 dB and 25.49 ± 5.075 dB in right and left ear respectively. There was no statistically significant difference in mean audiometric threshold in both ears. (P value=0.2213). Consistent to our study findings, in the study done by Singh R et al¹², hearing impairment was found in 34% hypothyroid patients, in which mild hearing loss in 32% of hypothyroid patients while Moderate Hearing loss was found in 2% patients and mean audiometric threshold value in right ear was 24.016 ± 4.979 dB, While in left ear it was 23.42 ± 4.036 dB. Another study by Vinitha V et al¹⁴ reported the prevalence of hearing loss of 66.3% among hypothyroid patients and this Hearing loss was mild, bilateral, and commonly affected the high frequency.

Strength and limitations

The strength of our study was that pure tone audiometry is a simple and commonly done audiological investigation essential to diagnose the type of hearing loss. It can easily be done among hypothyroid adults. However, tympanometry, otoacoustic emission tests, Brainstem evoked response audiometry, etc. would be needed for confirmation of retrocochlear pathology which was not done in this study hence being a limitation

Conclusion

In our study, most of the hypothyroid patients had auditory impairment with minimal degree. A clinical approach to monitor hearing by Pure Tone Audiometry in hypothyroid patients is very important. Therefore we can conclude that among hypothyroid patients hearing evaluation by Pure Tone Audiometry helps in the early diagnosis of hearing impairment and its treatment.

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