Volume-11/Issue-II/December 2023/ISSN No.-2321-3450
ORIGINAL RESEARCH ARTICLE
DOI: htttp://doi.org/10.36611/upjohns/volume11/Issue2/2
Date received: 18.10.2023 / Date Published : 30.12.2023

ASSESSMENT OF HEARING IN ADULTS WITH HYPOTHYROIDISM- A TERTIARY CARE CENTRE STUDY

Authors: Monica Manhas M (1) Samiksha Bhagat* (2) Danish Fayaz (2) Gopika Kalsotra(3) Parmod Kalsotra (2) Sahil Kalsotra (4)
Authors Affiliations: (1) Associate Professor Dept of physiology, GMC Jammu (2) Postgraduate in department of ENT and HNS, (3) Associate professor department of ENT and HNS; SMGS Jammu (4) Casualty medical officer, SDDM Hospital, Jammu

ABSTRACT

OBJECTIVE

The study was done to evaluate the hearing loss in adults (> 18 years of age) with hypothyroidism and compared it with the euthyroid patients who presented in OPD with complaints other than hearing loss. Furthermore, the type and severity of hearing loss was also assessed. We also compared the degree of hearing loss with the extent of thyroid hormone deficiency in patients with hypothyroidism.

MATERIALS AND METHODS

A case-control study was conducted in adults more than 18 years of age in which 65 hypothyroid patients and 65 healthy individuals were evaluated by audiological testing which included pure tone audiometry and impedance audiometry.

RESULTS

Approximately 70.7% of the hypothyroid patients had sensorineural hearing loss affecting bilateral ear and about 58.4% of these patients had mild hearing loss. The degree of hearing loss was affected by the serum thyroid stimulating hormone levels.

CONCLUSION

The study revealed that hypothyroidism has significant corelation with sensorineural hearing loss. Hearing evaluations should be done in patients with thyroid disease thus starting the treatment as soon as possible to halt the progression of hearing loss.

Keywords
Hypothyroidism, Hearing loss, Audiometry, Impedance

INTRODUCTION

Insufficiency of thyroid hormone is termed as hypothyroidism (1). It can cause severe cognitive dysfunction and deafness and can give rise to genetically and environmentally induced deafness. All the metabolic functions of the body and development of cells in our body are influenced by the thyroid hormones(2). It can be primary that is due to defect in thyroid gland or secondary that is due to disturbance in hypothalamic-pituitary-thyroid axis. Hashimoto's thyroiditis that occurs due to glycosamino glycans' accumulation is the most common cause of acquired hypothyroidism. Women are more commonly affected as compared to men.

Thyroid hormone synthesis takes place by transportation of iodine from cytoplasm to the colloid via pendrin which is a transmembrane transporter and is organised into thyroglobulin.

Review Process: Double blind Peer Reviewed by Reviewer Board Members

Any mutation in the pendrin can lead to progressive bilateral sensorineural hearing loss and abnormal synthesis of thyroid hormone.

Thyroid hormone plays a pivotal role in development of hearing by commencing myelinogenesis of the cochlea and vestibulocochlear nerve. Hypothyroidism resulting from the chemicals playing havoc with the thyroid hormones is the possible source of hearing loss with cochlear or auditory nerve dysfunction (3). The hypomylenation of the nerve slows down the speed of auditory brain stem response (4).

Low levels of free T4 are significantly related to the hearing loss making it a prevalent otorhinolaryngological manifestation and few studies have revealed that T4 declines the cochlear damage caused by kanamycin. The prevalence of hearing loss in hypothyroidism ranges from 25 to 50% (5). Therefore, it is essential to evaluate the hearing in hypothyroidism. The hearing loss can be sensorineural, conductive or mixed type.Many clinical evidence suggests that there is a significant permutational arrangement in hearing and vestibular system due to hypothyroidism (6).
In cases of hypothyroidism cochlea is most commonly affected. Neural hearing loss is present because of the neural involvement which can be explained by the metabolic changes in nervous system thus altering nerve conduction. Sensory deafness is present in hypothyroid patients because the components of cochlea are affected by the low levels of thyroid hormone.

The thyroid hormone receptor alpha (THRα) and thyroid hormone receptor beta (THRβ) have role in cochlear sensory cells. The THRα is present in the spiral organ of corti while epithelial ridges of sensitive hair cells are expressed by THRβ gene. This infers that insufficient thyroid hormones in body can lead to morphological and functional abnormalities in cochlea. This shows the impact on higher frequency hearing due to hypothyroidism. Conductive hearing loss can occur in hypothyroid patients due to hypertrophy and oedema of the eustachian tube (6). It can also be due to ossicular chain dysfunction and oedema of middle ear mucosa caused due to hypothyroidism.

Defect in thyroid hormone function can also affect the cochlear circulation as it is related to hypercoagulability and venous thrombosis leading to sensorineural hearing loss (7).

In this study we will strive to ascertain the association between hearing loss and hypothyroidism.

MATERIALS AND METHODS

The present comparative study was conducted in our tertiary care centre from May 2022 to April 2023 on 140 patients. They were divided into two groups- 65 cases who were diagnosed with hypothyroidism (group A)were compared with 65 euthyroid patients who presented in OPD withENT complaints other than hearing loss (group B).

Inclusion criteria:

1. Adults > 18 years of age.
2. Patients diagnosed with hypothyroidism (T4<0.8 ng/dl and TSH>4.5μU/ml)
3. Patients undergoing medical treatment for hypothyroidism.
4. Patients giving consent for the audiological assessment.

Exclusion criteria:

1. Patients having history of ear surgery.
2. Patients having history of noise/mechanical trauma to the ear.
3. Patients with congenital cochlear malformation.

4. Patients with history of being subjected to ototoxic drugs.

Detailed clinical history was taken. Relevant general physical examination, systemic and local ENT examination including otoendoscopy was done. The patients who were diagnosed with hypothyroidism were evaluated and were subjected to audiological testing. Pure Tone Audiometry by audiolite (labat) machine was done on each ear and hearing thresholds were calculated from 250 Hz to 8000 Hz to categorize the type of hearing loss and the degree of hearing loss. The impedance audiometry was also done in each earto determine the condition of tympanic membrane and the middle ear in hypothyroid patients. The acoustic reflex was also checked.
The levels of thyroid stimulating hormone (TSH) and free T4 were taken into consideration and was compared with the degree of hearing loss.
All data was entered in MS excel spreadsheet and was analysed as per statistics advised by statistician. A p-value <0.05 was considered statistically significant.

OBSERVATIONS/RESULTS
A total of 140 patients.

Table 1: Age distribution

Age (in years)	A	B
18-25	08	11
26-40	28	29
41-55	17	16
>55	12	09
Total	65	65

The mean age of presentation in Group A was 31.7 ± 4.33 years while the mean age of presentation in Group B was 32.4±3.54, the difference being statistically insignificant.

Out of 65 patients (Table 1)with hypothyroidism (group A)8 were between 18-25 years of age, 28 were between 26-40 years of age, 17 were between 41-55 years of age and 12 were above the age of 55 years. Out of 65 patients without hypothyroidism (group B) 11 were between 18-25 years of age, 29 were between 26-40 years of age, 16 were between 41-55 years of age and 9 were above the age of 55 years.

Table 2: Gender distribution

Gender	A	B
Female	47	38
Male	18	27
Total	65	65

Out of 65 patients (Table 2) with hypothyroidism (group A) 47 were females and 18 were males and out of 65 patients without hypothyroidism (group B) 38 were females and 27 were females. The female to male ratio was 2.6:1 in Group A while it was 1.4:1 in Group B.

Table 3: Type of hearing loss

Type of hearing loss	A	B	p value
Normal	7 (10.76%)	52 (80%)	0.0059
Sensorineural	46 (70.76%)	6 (9.23%)	0.0026
Conductive	5 (7.69%)	3 (4.61%)	0.566
Mixed	7 (10.76%)	4 (6.15%)	0.041
Total	65	65	

Out of 65 patients (Table 3) with hypothyroidism (group A) 7 had normal hearing and out of 65 patients without hypothyroidism (group B) 52 patients had normal hearing, the difference being statistically significant (p<0.05). Among group A patients 46 had sensorineural hearing loss and among group B patients 6 had sensorineural hearing loss, the difference being statistically significant (p<0.05). Among group A patients 5 had conductive hearing loss and among group B patients 3had conductive hearing loss, the difference being statistically insignificant. Among group A patients 7 had mixed hearing loss and among group B patients 4 had mixed hearing loss, the difference being statistically significant (p<0.05).

Table 4: Impedance audiometry

Impedance curve	A	B	p value
A	44	57	0.041
B	13	04	0.0017
C	03	02	0.088
Ad	03	01	0.0889
As	02	01	0.0811
Total	65	65	

Out of 65 patients (Table 4) with hypothyroidism (group A) 44 patients had A type of curve and out of 65 patients without hypothyroidism (group B) 57 patients had A type of curve on impedance audiometry, the difference being statistically significant ($p<0.05$). Among group A patients 13 had B type of curve and among group B patients 4 had B type of curve on impedance audiometry, the difference being statistically significant ($p<0.05$). Among group A patients 3 patients had C type of curve and among group B patients 2 had C type of curve on impedance audiometry, the difference being statistically insignificant. Among group A patients 3 had Ad type of curve and among group B patients 1 had Ad type of curve on impedance audiometry, the difference being statistically insignificant. Among group A patients 2 had As type of curve on impedance audiometry and one of the group B patients had similar findings the difference being statistically insignificant.

Table 5: Acoustic reflex

Reflex	A	B	p value
Present	41	59	0.0038
Absent	35	06	0.00027
Total	65	65	

Out of 65 patients with hypothyroidism (Table 5) acoustic reflex was present in 41 patients and out of 65 patients without hypothyroidism (group B) acoustic reflex was present in 59 patients, the difference being statistically significant ($p<0.05$). Among group A patients acoustic reflex was absent in 35 patients and among group B patients acoustic reflex was absent in 6 patients, the difference being statistically significant ($p<0.05$).

Table 6: Degree of hearing loss and type of hearing loss in Group A patients

Severity	SNHL	CHL	Mixed HL	Total
Minimal HL	31	04	03	38
Mild HL	12	01	03	16
Moderate HL	03	00	01	04
Total	46	05	07	58

Out of 58 hypothyroid patients who had hearing loss, 38 patients had minimal hearing loss, 16 had mild hearing loss and 4 had moderate hearing loss. 46 patients had sensorineural hearing loss, 5 patients had conductive hearing loss and 7 patients had mixed hearing loss.

Table 7: Correlation between the severity of hearing loss and the levels of the relevant thyroid-stimulating hormone

TSH (0.35-6.0 µIU/ml)	Mild HL	Moderate HL	Severe HL	Spearman's coefficient (r_s)	P value
Mean value	13.1±0.2	23.2±2.34	28.1±3.72	0.88	0.007

The mean value of thyroid stimulating hormone in patients with mild hearing loss was 13.1±0.2, in cases of moderate hearing loss mean value of TSH was 23.2±2.34 and in cases of severe hearing loss it was 28.1±3.72, the difference being statistically significant ($p<0.05$).

Table 8: Correlation between the severity of hearing loss and the levels of the relevant T4

Free T4 (0.7-1.48 ng/dl)	Mild HL	Moderate HL	Severe HL	Spearman's coefficient (r_s)	P value
Mean value	0.49±0.1	0.45±0.2	0.39±0.1	0.54	0.037

The mean value of free T4 in patients with mild hearing loss was 0.49±0.1, in cases of moderate hearing loss the mean value of free T4 was 0.45±0.2 and in cases of severe hearing loss it was 0.39±0.1, the difference being statistically significant ($p<0.05$).

DISCUSSION

In otorhinolaryngology hearing deficit is the most common symptom in hypothyroid patients along with cochleovestibular symptoms. The patients frequently present with sensorineural type of hearing loss(3).

In our study, the mean age of presentation of hypothyroid patients was 31.7±4.33 years with female preponderance. This was consistent with the studies done by Vinitha V et al in 2020 (1) and Hussein M. et al in 2017 (5).

In our study, out of 65 patients with hypothyroidism (Group A) 7 (10.76%) had normal hearing and out of 65 patients without hypothyroidism (group B) 52 (80%) patients had normal hearing. Among group A patients 46 (70.76%) had sensorineural hearing loss and among group B patients 6 (9.23%) had sensorineural hearing loss. Among group A patients 5 (7.69%) had conductive hearing loss and among group B patients 3 (4.61%) had conductive hearing loss, the difference was statistically insignificant. Among group A patients 7 (10.76%) had mixed hearing loss and among group B patients 4 (6.15%) had mixed hearing loss. The difference being statistically significant. The findings are consistent with the study done by karakus CF et in 2015 (2) and Santos et al in 2010 (8). These results can be due to the fact that appropriate thyroid hormone is required for the development of auditory system(7). Thyroid hormone has an impact over the development of cochlear development. Thyroid autoantibodies act as an intermediary for peripheral or central hearing organ dysfunction. The study done by Cordas et al (9) revealed that Thra and Thrb encode thyroid hormone receptors α1 and β in the tympanic membrane, immature ossicles, and middle ear mesenchyme of mice thus implying that changes in thyroid hormone levels may target middle and inner ear leading to impaired hearing ability. Conductive hearing loss may occur due to oedema in middle ear and eustachian tube.

In our study, out of 65 patients with hypothyroidism (Group A) 44 patients had A type of curve and out of 65 patients without hypothyroidism (group B) 57 patients had A type of curve on impedance audiometry. Among group A patients 13 had B type of curve and among group B patients 4 had B type of curve on impedance audiometry, the difference being statistically significant ($p<0.05$). Among group A patients 3 patients had C type of curve and among group B patients 2 had C type of curve on impedance audiometry. Among group A patients 3 had Ad type of curve and among group B patients 1 had Ad type of curve on impedance audiometry. Among group A patients 2 had As type of curve on impedance audiometry and one of the group B patients had similar findings the difference being statistically insignificant. Similar findings were seen in the study done by Vinitha V et in 2020 (1) in which 66.3 % of hypothyroid patients had type A tympanogram, 17.5 % had type Ad tympanogram and 15% had type B tympanogram. Majority of patients had type A tympanogram which suggests normal ossicular chain pathology and normal middle ear pressure.

In this study, in patients with hypothyroidism acoustic reflex was present in 63.07% of the patients and in patients without hypothyroidism (group B) acoustic reflex was present in 90.07% of the patients. Among group A patients acoustic reflex was absent in 56.4% of the patients and among group B patients acoustic reflex was absent in 9.23% of the patients, the difference being statistically significant. The findings are consistent with the study done by Vinitha V et al (1) which suggests that absence of acoustic reflex can occur because hypothyroidism leads to the accumulation of glycosaminoglycans which can infiltrate the middle ear mucosa and eustachian

tube.It can alsobe due to an increased hearing threshold.

In our study, out of 58 hypothyroid patients who had hearing loss, 38 patients presented with minimal hearing loss, 16 withmildand 4 with moderate hearing loss. Out of these, 46 patients had sensorineural hearing loss, 5 patients had conductive hearing loss and 7 patients had mixed hearing loss. Minimal to mild hearing loss was present in majority of the hypothyroid patients. Similar findings were present in the study done byKarakus CF et al (2) which shows mild hearing loss in hypothyroid patients and the study done by Hussein et al (5) suggests that the deafness in hypothyroid patients occurred symmetrically in bilateral ears and was insidious in onset with mild to moderate deafness.

The mean value of thyroid stimulating hormone in patients with mild hearing loss was 13.1±0.2, in cases of moderate hearing loss mean value of TSH was 23.2±2.34 and in cases of severe hearing loss it was 28.1±3.72.The mean value of free T4 in patients with mild hearing loss was 0.49±0.1, in cases of moderate hearing loss the mean value of free T4 was 0.45±0.2 and in cases of severe hearing loss it was 0.39±0.1. These findings suggests that as the severity of hypothyroidism increases in the patient the degree of hearing loss also increases, thus showing a significant corelation. A study by Hussein et al (5) also reported that as the severity of hearing deficit increases with increase in TSH value and decrease in free T4 value.

CONCLUSION

The study reveals a significant relationship between hypothyroidism and hearing loss thus making it one of the important investigations to be done in these patients for early detection of the hearing loss and timely intervention for better outcomes.

Majority of the patients were females with sensorineural hearing loss in 70.76% of hypothyroid patients with hearing loss. Higher frequencies were comparatively more affected. As the levels of thyroid hormones deteriorate the hearing deficit also increases. It proves that there is a significant corelation between thyroid hormones and degree of hearing loss.

This depicts that early interference with the worsening of the hypothyroidism will reduce the chances of degrading hearing loss.

DECLARATION

Ethics approval and consent to participate: The study was approved by Institutional Ethics committee.

Conflict of Interests- The authors declares that there are no conflicts of interest.

Funding: The study was self funded

Acknowledgement: None

REFERENCES:

1. Vinitha V, Jowhara PV, Geetha P, Abdul Salam RT, et al. audiological assessment in adults with hypothyroidism. National journal of physiology, pharmacy and pharmacology 2020, Vol 10 issue 03, 242-246.
2. Karakus CF, Altuntas EE, Kilicli F, Durmus K, Hasbek Z, et al. is sensorineural hearing loss related with thyroid metabolism disorders. Indian journal of otology, 2015, Vol 21, Issue 2, 138-143.
3. Berker D, Karabulut H, Isik S, Tutuncu Y, Ozuguz U, Erden G, Aydin Y, Dagli M, Guler S, et al. evaluation of hearing loss in patients with grave's disease, Endocrine, 2012, 41:116-121.
4. Singh R, Aftab M, Jain S, Kumar D, et al. audiological evaluation in hypothyroid patients and effect of thyroxine replacement therapy. Indian J Otolaryngol Head Neck Surg, 2019 71(Suppl 1):S548–S552.

5. Hussein MM, Asal SI, Salem TM, Mohammed AM, et al. the effect of L-thyroxine hormone therapy on hearing loss in hypothyroid patients. Egyptian Journal of Otolaryngology, 2017, 33:637–644.
6. Malik V, Shukla GK, Bhatia N, et al. hearing profile in hypothyroidism. Indian journal of otolaryngology and head and neck surgery, Vol 54 No. 4, October-december 2002, 285-290.
7. Tsai YT, Chang IJ, Hsu CM, et al. Association between sudden sensorineural hearing loss and preexisting thyroid diseases: a nationwide case-control study in Taiwan. International Journal of Environmental Research and Public Health 2020, 17, 834.
8. Santos KT, Dias NH, Mazeto GM, Carvalho LR, Lapate RL, Martins RH. Audiologic evaluation in patients with acquired hypothyroidism. Braz J Otorhinolaryngol 2010; 76:478□84.
9. Cordas, E.A.; Ng, L.; Hernandez, A.; Kaneshige, M.; Cheng, S.-Y.; Forrest, U. Thyroid hormone receptorscontrol developmental maturation of the middle ear and the size of the ossicular bones. Endocrinol. 2012, 153, 1548–1560.

Dr. Samiksha Bhagat
Department of ENT and Head and Neck Surgery, SMGS Hospital,
Government Medical College, Jammu, Jammu and Kashmir, 180001,
India
E-mail: samiksha94bhagat@gmail.com

How to cite this article

Manhas M etal- Assessment Of Hearing In Adults With Hypothyroidisma Tertiary Care Centre Study - UPJOHNS; December 23; 11(2); page: 8-14
DOI: htttp://doi.org/10.36611/upjohns/volume11/Issue2/2
Orchid Id: https://orcid.org/0000-0001-9316-8678