

## Original Research Article

# Study of sensorineural hearing loss in hypothyroidism patients and its association with thyroid stimulating hormone levels

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### ABSTRACT

**Background:** The most common symptom of hypothyroidism regarding ear, nose and throat is hearing insufficiency accompanied with cochleovestibular symptoms such as tinnitus, dizziness.

**Methods:** This was a hospital based observational clinical study conducted in Rajarajeswari medical college between December 2016 to June 2018. Patients with hypothyroidism attending department of ENT-HNS that satisfied the inclusion and exclusion criteria were included in the study. Patients were subjected to pure tone audiometry, thyroid function test after detailed history and physical examination. PTA was recorded and average of 500 Hz, 1 kHz and 2 kHz were taken as the pure tone average.

**Results:** 150 patients were included in the study. Mean age of patients with hearing loss was 37.2 years. 84.3% were females. 41 patients presented to us with unilateral hearing loss and 10 patients had bilateral hearing loss. 43 (84.3%) patients had mild degree of hearing loss, 8 (15.7%) had moderate hearing loss. Patients with hearing loss had altered TSH levels. Significant correlation ( $p < 0.001$ ) was found between hearing loss and duration of hypothyroidism, mean TSH levels.

**Conclusions:** It was found that hypothyroidism affects the hearing producing hearing impairment, ranging from mild to moderate in severity and had significant correlation between duration of hypothyroidism and mean TSH levels with the severity of hearing loss.

**Keywords:** Sensorineural hearing loss, Hypothyroidism, Thyroid function test, Thyroid stimulating hormone levels

### INTRODUCTION

The relation between hypothyroidism and hearing insufficiency was first identified by Bircher in 1883. The second case was a 53 years old, the female patient with hypothyroidism published in 1907 by Kemp.<sup>1</sup> Hypothyroidism affects 2% of adult women and only 0.2% of men.<sup>2</sup> In 1974, Ritter stressed that hearing loss can be the most common otolaryngological manifestation of congenital and acquired hypothyroidism, and auditory

symptoms may happen alone or in association with vertigo and tinnitus.<sup>3</sup>

Hypothyroidism is associated with all types of deafness sensorineural, mixed and conductive.<sup>4</sup> The real incidence of hearing loss in patients with hypothyroidism is still uncertain, and it may affect 25% of the patients with acquired hypothyroidism and 35-50% of the patients with congenital hypothyroidism.<sup>5,6</sup>

It is known that in hypothyroidism there is reduction in cell energy production, compromising the micro-circulation and, consequently, oxygenation and the metabolism of the involved organs.<sup>7</sup> Thyroid hormone also controls protein synthesis, myelin production and enzymes and the level of lipids in the central nervous system. Thus, it is believed that under hypothyroidism, hearing impairment can originate in the cochlea, in the central auditory pathways and/or in the retrocochlear region.<sup>1</sup>

In current study, we have studied the prevalence of sensorineural hearing loss in hypothyroidism patients and its relation to age, sex, duration of hypothyroidism and thyroid stimulating hormone (TSH) levels.

## METHODS

Current study was a hospital based observational clinical study conducted in patients visiting Rajarajeswari medical college and hospital between December 2016 to June 2018. Patients with hypothyroidism attending the department of ENT-HNS (a total of 150 patients) were assessed. Those who satisfied the inclusion and exclusion criteria and were willing to participate in the study were included.

### Inclusion criteria

Inclusion criteria for current study were; patients who have given informed written consent for the research, patients in the age group of 20-50 years with confirmed hypothyroidism and subclinical hypothyroidism.

### Exclusion criteria

Exclusion criteria for current study were; patients with ear infections, congenital ear diseases, ear trauma causing sensorineural hearing loss, patients with noise induced sensorineural hearing loss, patients with hypertension, diabetes mellitus, patients on ototoxic drugs causing sensorineural hearing loss and patients with congenital hypothyroidism.

Informed written consent was taken from the patients following which a detailed history and physical examination was done and then patients were subjected to pure tone audiometry, thyroid function test (normal TSH-0.3-4.5  $\mu$ IU/ml).

Pure tone audiograms were recorded (using ELKON eda 3N 3 MULTI audiometer). Frequencies of 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz were tested and average of 500 Hz, 1 kHz and 2 kHz were taken as the pure tone average (PTA). Hearing loss was classified according to WHO guidelines (Table 1).<sup>8</sup>

**Table 1: Hearing loss (WHO classification).<sup>8</sup>**

Hearing in PTA (dB)	Degree of loss
0-25	Not significant
26 to 40	Mild
41 to 55	Moderate
71 to 91	Moderately severe
>91	Profound

### Statistical analysis

Data was entered in Microsoft excel and analyzed using SPSS (Ver.18.0.5) package. The results were averaged (mean $\pm$ standard deviation) for continuous data and number and percentage for dichotomous data are presented in tables and figures. A univariate analysis of the dichotomous variables encoded was performed by means of the Chi square test with Yates correction if required. The student t test was used to determine whether there was a statistical difference between groups in the parameters measured. In all the above test  $p < 0.05$  was accepted as indicator of statistical significance.

### Assumptions

Following assumptions were made, dependent variables should be normally distributed, samples drawn from the population should be random, and cases of the samples should be independent.

## RESULTS

According to our study, 51 patients (34%) had symptoms of hearing loss among the study population. Mean age of patients with hearing loss was 37.2 years and among patients without hearing loss was 35.9 years. Patient with minimum age among hearing loss patients was 28 years and maximum age was 45 years. 15.7 % of patients were male and 84.3% were females among the study population with hearing loss. 41 patients presented to us with unilateral hearing loss while only 10 patients had bilateral hearing loss. A majority (49%) of the patients had complaints of hearing loss for 1-12 months while 45.1% had for 13-24 months and 5.9% for 25-36 months. 36.7% patients presented to us with hypothyroidism duration of 1-12 months, 32% for 13-24 months, 18% for 25-36 months, and 13.3% for more than 36 months. Significant correlation ( $p < 0.001$ ) was present between hearing loss and duration of hypothyroidism (Table 2). 43 (84.3%) patients had mild degree of hearing loss, 8 (15.7%) had moderate hearing loss. Among the patients with hearing loss, 38 (74.5%) had TSH levels of 4.5-5.0, 8 (15.7%) had levels of 5.1-5.5, 2 (3.9%) had levels of 5.6-6.0, 3 (5.9%) had levels of 6.1-6.5. Significant correlation ( $p < 0.001$ ) was found between duration of hypothyroidism and degree of hearing loss (Table 3). Significant correlation ( $p < 0.001$ ) was found between degree of hearing loss and mean TSH levels (Table 4).

**Table 2: Correlation between hearing loss and duration of hypothyroidism.**

	Duration of hypothyroidism (months)						Total N (%)	$\chi^2$ value*	P value
	1-12 N (%)	13-24 N (%)	25-36 N (%)	37-48 N (%)	49-60 N (%)	>60 N (%)			
<b>Hearing loss</b>	0 (0)	6 (11.8)	26 (51)	9 (17.6)	8 (15.7)	2 (3.9)	51 (100)	118.302	<0.001
<b>No hearing loss</b>	55 (55.6)	42 (42.4)	1 (1)	1 (1)	0 (0)	0 (0)	99 (100)		

\*Chi square test

**Table 3: Correlation between duration of hypothyroidism and degree of hearing loss.**

	Duration of hypothyroidism (months)						Total N (%)	$\chi^2$ value*	P value
	1-12 N (%)	13-24 N (%)	25-36 N (%)	37-48 N (%)	49-60 N (%)	>60 N (%)			
<b>Normal</b>	55 (55.6)	42 (42.4)	1 (1)	1 (1)	0 (0)	0 (0)	99 (100)	122.669	<0.001
<b>Mild</b>	0 (0)	5 (11.6)	23 (53.5)	7 (16.3)	6 (14.0)	2 (4.7)	43 (100)		
<b>Moderate</b>	0 (0)	1 (12.5)	3 (37.5)	2 (25)	2 (25)	0 (0)	8 (100)		

\*Chi square test

**Table 4: Correlation between degree of hearing loss and mean TSH levels.**

	N	Mean TSH	SD	Minimum	Maximum	t value*	P value
<b>Normal</b>	99	2.558	0.843	0.30	4.10	198.787	<0.001
<b>Mild</b>	43	4.774	0.192	4.50	5.20		
<b>Moderate</b>	8	5.738	0.362	5.20	6.10		

\*Student t test

## DISCUSSION

Most of the patients among the study population with hearing loss (84.3%) were females, which was similar to other studies.<sup>9,10</sup> According to study conducted by Anand et al mean age of patients with hypothyroidism was 34.8 years (range; 15-50 years), comparable with mean age of patients with hearing loss in our study i.e. 37.2 years.<sup>9,10</sup> According to current study, 51 (34%) hypothyroidism patients had symptoms of hearing loss among the study population. In a study conducted by Anil et al in 30% hypothyroid patients had subjective hearing loss.<sup>11</sup> The medical literature quotes a hearing loss of 25% for patients with acquired hypothyroidism and 35%-50% for congenital hypothyroidism.<sup>7</sup> Moreover, an incidence of 30%-40% for sensorineural hearing loss has been reported for myxedema in medical text.<sup>12</sup> 36.7% patients presented to us with hypothyroidism duration of 1-12 months, 32% for 13-24 months, 18% for 25-36 months, and 13.3% for more than 36 months. In a study conducted by Anil et al most of the patients with hypothyroidism (63.33%) had known of the diagnosis for <3 year and also when compared to patients in the control group, hypothyroid patients had mild hearing loss in 20 ears (33.33%), 6 (10%) had moderate hearing loss and only 1 (1.66%) had moderately severe and severe hearing loss each comparable to our study.<sup>11</sup>

Significant correlation ( $p < 0.001$ ) was found between degree of hearing loss and mean TSH levels in our study.

Bakshi et al found out that the relationship between severity of hearing impairment and thyroid profile was found to be statistically insignificant ( $p > 0.05$ ).<sup>13</sup> In the study conducted by Malik et al they found out that hearing impairment gradually increased with increase in severity of hypothyroidism.<sup>10</sup> This is also in agreement with the findings of Bhatia et al who observed occurrence of hearing impairment gradually increasing with the increase in severity of hypothyroidism.<sup>14</sup>

## CONCLUSION

From current study, it was found that hypothyroidism affects the hearing producing hearing impairment, ranging from mild to moderate in severity and had significant correlation between duration of hypothyroidism and mean TSH levels with the severity of hearing loss. The literature review showed that the hearing loss in hypothyroid patients may improve with medical therapy, and so prompt screening, treatment and follow-up of the hearing level should be done in these patients. Both medical professionals and the patients must be educated about the condition and the need for prompt treatment.

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## REFERENCES

1. Di Lorenzo L, Foggia L, Panza N, Calabrese MR, Motta G, Tranchino G, et al. Auditory brainstem responses in thyroid diseases before and after therapy. *Horm Res.* 1995;43(5):200-5.
2. Santos KT, Dias NH, Mazeto GM, Carvalho LR, Lapate RL, Martins RH. Audiologic evaluation in patients with acquired hypothyroidism. *Braz J Otorhinolaryngol.* 2010;76(4):478-84.
3. Ritter FN. The effects of hypothyroidism upon the ear, nose and throat. A clinical and experimental study. *Laryngoscope.* 1967;77:1427-79.
4. Balaji PV, Thirumaran M, Sharathbabu V. Assessment of audiologic evaluation in patients with acquired hypothyroidism. *Sch J App Med Sci.* 2016;4(7A):2328-32.
5. Ben-Tovim R, Zohar Y, Zohiar S, Laurian N, Laurian L. Auditory brain stem response in experimentally induced hypothyroidism in albino rats. *Laryngoscope.* 1985;95(8):982-6.
6. Vanasse M, Fischer C, Berthezène F, Roux Y, Volman G, Mornex R. Normal brainstem auditory evoked potentials in adult hypothyroidism. *Laryngoscope.* 1989;99(3):302-6.
7. Oliveira JAA. Fisiologia da Audição - Cócleaativa In: Figueiredo MS. *Emissões Otoacústicas e BERA.* São José dos Campos: Pulso Editorial; 2003:1-34.
8. Dhingra PL, Dhingra S, Dhingra D. *Diseases of ear, nose and throat & head and neck surgery.* 6<sup>th</sup> ed. Netherlands: Elsevier; 2014:3-4.
9. Anand VT, Mann SB, Dash RJ, Mehra YN. Auditory investigations in hypothyroidism. *Acta Otolaryngol.* 1989;108(1-2):83-7.
10. Malik V, Shukla GK, Bhatia N. Hearing profile in hypothyroidism. *Indian J Otolaryngol Head Neck Surg.* 2002;54(4):285-90.
11. Anil HT, Kamath GJ, Gauri M. A study on hearing profile in acquired hypothyroidism. *Int J Sci Res.* 2015;4(12):85-90.
12. Morgan JM, McCaffrey T. Head and neck manifestations of endocrine disease. In: Gleeson M, eds. *Scott-Brown's otorhinolaryngology, head and neck surgery.* London: Hodder Arnold; 2008:400.
13. Bakshi HK, Sahni D, Goyal JP, Kumar R, Sohal BS, Kumar A. A study on hearing profile in hypothyroidism and comparative evaluation of hearing in hypothyroid subjects before and after treatment with thyroxine-a study of 100 cases. *J Med Sci Clin Res.* 2016;04(9):12606-12.
14. Bhatia PL, Gupta OP, Agrawal MK, Mishr SK. Audiological and vestibular function tests in hypothyroidism. *Laryngoscope.* 1977;87(12):2082-9.

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