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ORIGINAL ARTICLE

Assessment of Sensorineural Hearing Loss in Patients with Hypothyroidism and its Relationship with Thyroid Stimulating Hormones Levels: A Cross-Sectional Study

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ABSTRACT

Background: The auditory system needs thyroid hormone to develop normally. Additionally, endemic cretinism and people with thyroid hormone resistance have also been linked to hearing loss. Congenital hypothyroidism (CH) and hearing impairment (HI) have been linked in earlier studies.

Objective: This study was conducted to assess the sensorineural hearing loss in patients with hypothyroidism and its relationship with thyroid stimulating hormones levels.

Study Design: It was a cross-sectional study.

Study Duration: The study was conducted at department of ENT CMH, Multan from 01 January 2022 to 30th October 2022.

Material and Methods: Sample size of 150 patients who were diagnosed with hypothyroidism were included through convenient sampling. Patients with external or middle ear inflammation or obstruction, as well as those who were unable to complete pure tone audiometry, were not included. Once participants gave their informed consent, a standard medical history and demographics form was used to compile data, and an audiogram was then performed to round out the picture. The data was analysed using SPSS version 22.0.

Results: There were a total of 150 patients who participated in the study. The average age of patients who had hearing loss was 38.19 years old. Only 15.16% of patients were male, while 83.98% were female. Tinnitus was experienced by 11 people in their right ears and 10 in their left ears. Twenty (95.24%) patients reported having tinnitus for less than a year when they first visited our clinic. The duration of hypothyroidism in 36.7% of patients who presented to us was between 1 and 12 months, 32% between 13 and 24 months, 18.2% between 25 and 36 months, and 13.3% for more than 36 months. TSH levels ranged from 4.5 to 5.0 in 38 (62.29%) of the individuals with hearing loss, from 5.1 to 5.5 in 8 (13.11%), from 5.6 to 6.0 in 7 (11.47%), and from 6.1 to 6.5 in 8 (13.11%). Prolonged hypothyroidism has been shown to have an effect on hearing loss severity, as indicated by a significant statistical correlation (P value 0.001).

Practical implication: This study is very important since its findings may enable researchers to carry out in-depth studies in the area with objectives. Pakistan has to conduct more research on the critical issue of SSNHL.

Conclusion: According to the findings of our research, hypothyroidism has an effect on patient's hearing, which can lead to hearing impairment.

Keywords: Thyroid function test, Hypothyroidism, Sensorineural hearing loss, Hormones Levels

INTRODUCTION

Hearing loss of 30 dB or greater over at least three contiguous audiometric frequencies occurring over 72 hours is considered to be sudden sensorineural hearing loss (SSHL).[1,2] The worldwide prevalence of SSHL has been steadily rising in recent years due to the increased speed and complexity of modern living. Many different things might bring on SSHL, and its cause and abnormal physiological process are still a mystery.[3] Inner ear vasospasm, thrombosis or vascular embolization, vascular malfunction, hair cell injury and membranous labyrinth are currently accepted etiologies and probable causes.[4] The incidence and prognosis of SSHL varied according to the presence or absence of certain systemic illnesses.[5]

Bircher discovered the link between low thyroid hormone and hearing loss in 1883. The second case related to this issue was a 53 year-old female patient with hypothyroidism published by Kemp in 1907.[6]

Thyroid problems are one of the most common endocrine disorders worldwide, and they can show up in a number of different ways. There is evidence linking hyperthyroidism and hypothyroidism, two disorders that affect blood thyroid hormone levels, to sensorineural and conductive hearing impairment.[7] Only 2% of adult women and 0.2% of males have hypothyroidism. The pathophysiological mechanism of hearing loss in hypothyroidism is unknown, but it is believed that there is a decrease in cell energy production, which compromises the microcirculation as a result the oxygenation and metabolism of the affected organs, including the stria vascularis and organ of Corti. Therefore, it is thought that hearing loss in hypothyroidism may be caused by cochlea, retrocochlear area dysfunction or central auditory pathways.[8] Thyroid hormones control the synthesis of proteins, myelin, enzymes, and lipid levels in the brain and spinal cord.[9] More than that, T4 can serve as a messenger between neurons. As a result, hypothyroidism is thought to cause hearing loss at multiple sites, including the cochlea, central auditory pathways, and retrocochlear area.[10]

Since thyroid hormones are crucial for the cochlea's physiological development, thyroid gland failure has an impact on the auditory system's structural integrity. Pure tone audiometry has revealed that between 11.5 and 95% of the subjects examined had hearing loss. [11] There are conflicting accounts on the link between hypothyroidism and hearing loss. According to a research by Means et al.[12], it occurs in 66.7% of instances. Contrarily, according to Post's analysis, no cases had complaints of hearing impairment. Consequently, the connection among hypothyroidism and hearing loss has been debatable.[13]

In light of the above mentioned literature, we can see that there is a need to do further studies in this area because the findings from the audiometric evaluation of individuals with hypothyroidism are inconsistent. The objective of study was to determine the prevalence of sensorineural hearing loss in hypothyroidism patients and to observe the relationship between sensorineural hearing loss and thyroid stimulating hormone levels.

MATERIALS AND METHODS

Study Setting: This study was carried out in the Department of Otorhinolaryngology and Head & Neck Surgery, CMH, Multan.
Study Duration: Over 10 month from 01 January 2022 to 30th October 2022,
Study Design: Cross Sectional Study.
Sample Size: 150 patients who were diagnosed with hypothyroidism
Sampling Technique: Non-Probability consecutive sampling technique will be used.
Methodology: After the approval of Ethical Committee of the CMH, Multan under (ERC/47/2022) this study was carried out in the Department of Otorhinolaryngology and Head & Neck Surgery CMH, Multan. Patients in the age range of 20-50 years old with confirmed hypothyroidism or subclinical hypothyroidisms who have given written informed consent for the research. Patients were not included if they were above the age of 60, had undergone ear surgery in the past, worked in a noisy setting, had a conductive or type B or C tympanometric curve, had a family history of hearing loss, or had taken ototoxic medicine in the past. Participants who had undergone treatment for a brain tumour, a disease of the auditory nerve, or a benign neoplasm of the cranial nerves were also disqualified.

Patients underwent a thorough history and physical examination, including pure tone audiometry and a thyroid function test (normal TSH0.3-4.5 IU/ml). Audiograms with just pure tones were captured (using ELKON eda 3N 3 MULTI audiometer). Two hundred and fifty hertz (Hz), five hundred hertz (Hz), one kilohertz (Hz), two kilohertz (Hz), four kilohertz (Hz), and eight kilohertz (kHz) were evaluated, with the mean of 500 Hz, 1 kHz, and 2 kHz.

All hypothyroid individuals were substantiated by estimating low levels of FT3 (normal value: 1.4-4.2 pg/dl), FT4 (normal value: 0.71-1.85 ng/dl), and TSH (normal value: 0.4-5.4 IU/ml). The study's participants took thyroxin hormone for a period of 6 months while also being followed closely. At these appointments, patients had their hearing tested both before and after therapy.
Data Analysis: SPSS Version 22 was used to analyse the collected data. For statistical analysis, we employed the Student t test (both unpaired and paired) and the Chi square test when appropriate. The level of statistical significance for all tests was set at P 0.05.

RESULTS

Among the total 150 enrolled patients in our study, 61 (40.66%) reported hearing problems. Participants with hearing loss were found to have a mean age of 37.2 years, while those without hearing loss averaged 35.9 years old. It was found that patients with hearing loss ranged in age from 28 to 45. The study population of people with hearing loss consisted of 15.7% men and 84.3% women. Only 15(24.5%) of the individuals who came in complained of having hearing problems on both sides of their bodies, while 46(75.40%) complained of only one either right or left. Patients who had reported hearing impairment for 1-12 months (49%) were more numerous than those who had reported it for 13-24 months (45.1%), 25-36 months (5.9%), or longer (36+ months, 1%). The link across tinnitus and loss of hearing was statistically significant (P .0001), with 18 patients reporting both conditions. Three more patients also experienced tinnitus but denied any hearing loss as shown in Table 1.

Tinnitus was experienced by 11 people in their right ears and 10 in their left ears. Twenty (95.24%) patients reported having tinnitus for less than a year when they first visited our clinic. The duration of hypothyroidism in 36.7% of patients who presented to us was between 1 and 12 months, 32% between 13 and 24 months, 18.2% between 25 and 36 months, and 13.3% for more than 36 months. Forty-six patients (75.40%) had only mild hearing loss, whereas 15 (24.59%) had moderate hearing loss. There was a highly significant relationship (P 0.001) between the length of time someone had hypothyroidism and their degree of hearing loss as shown in Table 2.

TSH levels ranged from 4.5 to 5.0 in 38 (62.29%) of the individuals with hearing loss, from 5.1 to 5.5 in 8 (13.11%), from 5.6 to 6.0 in 7 (11.47%), and from 6.1 to 6.5 in 8 (13.11%). Prolonged hypothyroidism has been shown to have an effect on hearing loss severity, as indicated by a significant statistical correlation (P value 0.001). Untreated hypothyroidism has been linked to a worsening of hearing loss, as measured by a significant connection (P 0.001) between the two variables.

Table 1: Distribution of hearing loss among study population

Variables	Characterstics	Hearing Loss	No Hearing Loss
Hearing Loss	Present	61	40.66%
	Absent	89	59.33%
Mean Age	Hearing Loss	28 to 45	37.2±3.833
	No Hearing Loss	22 to 45	35.9±4.572
Gender	Male	15.7%	21.2%
	Female	84.3%	78.8%
Hearing Loss Laterality	Left	21	34.42%
	Right	25	40.98%
	Bilateral	15	24.5%
Duration of Hearing Loss (Months)	1-12	29	47.51%
	13-24	26	42.62%
	25-36	6	9.83%
Tinnitus	Present	35.3%	3.0%
	Absent	64.7%	97.0%

Tables 2: Characterstics of studied patients

Variables	Characterstics	Number	Percentage
Tinnitus Side	Left	10	47.6%
	Right	11	52.4%
duration of tinnitus Months	1-12	20	95.24%
	13-24	1	4.76%
Duration of Hypothyroidism (Months	1-12	55	36.7%
	13-24	48	32.0%
	25-36	27	18.0%
	37-48	10	6.7%
	49-60	8	5.3%
	>60	2	1.3%
Grade Of Hearing loss	Normal	89	59.33%
	Mild (26-40 dB)	46	75.40%
	Moderate (41-55dB)	15	24.59%

Table 3: Hypothyroidism and hearing loss correlation

	Duration of Hypothyroidism (Months)						Total	2 value*	P-Value
	1-12	13-24	25-36	37-48	49-60	>60			
HearingLoss	0	6	26	9	14	6	61	118.302	<0.001
	.0%	11.8%	51.0%	17.6%	15.7%	3.9%	100.0%		
No HearingLoss	49	38	1	1	0	0	89		
	55.05%	42.69%	1.12%	1.12%	.0%	.0%	100.0%		

Table 4: Variation in TSH Concentrations Across a Study Population

	TSH					Total
	<4.5	4.5-5.0	5.1-5.5	5.6-6.0	6.1-6.5	
Hearing Loss	0	38	8	7	8	61
	.0%	62.29%	13.11%	11.47%	13.11%	100.0%
No Hearing Loss	89	0	0	0	0	89
	100.0%	.0%	.0%	.0%	.0%	100.0%
Total	89	38	8	7	8	150
	59.33%	25.3%	5.3%	4.66%	5.33%	100.0%

Table 5: Correlation between the duration of hypothyroidism with hypothyroidism and the level of hearing loss

	Duration of Hypothyroidism (Months)						Total	2 value*	P-Value
	1-12	13-24	25-36	37-48	49-60	>60			
Normal	49	38	1	1	0	0	89		
	55.0%	42.69 %	1.0%	1.0%	.0%	.0%	100.0 %		
Mild	0	5	23	10	6	2	46	198.87	<0.0001
	0.0%	11.6 %	53.5 %	21.73 %	14.0 %	4.7 %	100.0 %		
Moderate	0	3	8	3	1	0	15		
	0.0%	20.0 %	53.33%	20.0 %	6.6 %	0.0%	100.0 %	122.66	<0.001

Table 6: Correlation in level of hearing loss and mean thyroid stimulating hormones TSH levels

	N	Mean TSH	SD	Min.	Max.	't' value*	'p' value
Normal	89	2.667	0.733	0.20	4.20		
Mild	46	4.764	0.182	4.40	5.10	197.651	<0.001
Moderate	15	5.727	0.352	5.30	6.20		

DISCUSSION

Sixty-one (40.66%) of the hypothyroidism patients in our study reported some form of hearing loss. Thirty percent of hypothyroid patients reported subjective hearing loss in a 2015 study by Anil HT et al. Patients' perceptions of hearing loss may reflect either conductive or sensorineural impairments.[14]

Our study's mean age of patients with hearing loss was 37.2 years old, which is equivalent to the mean age of 34.8 years found in the 1989 study by Anand VT et al. [15] Anil HT et al. found that 86% of the women with hypothyroidism in their 2015 study. The 30-39 age range was significantly more numerous than the other age groups in both sets of participants (p0.05).[14]

In line with previous research, the vast majority of patients in our study participants with hearing loss were female (84.3 percent).[1617,18] In our clinic, we observed 46 patients with unilateral hearing loss (or 75.40%) and 15 patients with bilateral hearing loss (or 24.5%). When studying 30 hypothyroid patients, Santos et al. found substantial sensorineural hearing loss in 22 of 60 ears, with the majority of these cases being bilateral.[19]

Patients who had reported hearing loss for 1-12 months (49%) were more numerous than those who had reported it for 13-24 months (45.1%), 25-36 months (5.9%), or longer (36+ months, 1%). Our investigation found a statistically significant link among tinnitus and hearing loss, with 18 (12%) patients reporting both conditions, and 3 (2%) patients reporting only tinnitus. Researchers Anil HT et al. found that 16.66% of hypothyroid patients experience tinnitus.[14] Seven patients (15.55%) reported tinnitus symptoms in a 2002 research by Vikasmalik et al.[16]

Sensorineural hearing loss was found to be present in 61 patients (40.66%) across our sample size. Patients with acquired hypothyroidism are reported to experience a 25% decrease in hearing, whereas those born with congenital hypothyroidism experience a 35%-50% decrease. [20,21] Also, medical literature indicates that myxedema is associated with a 30% - 40% prevalence of sensorineural hearing loss. A total of 46 individuals (75.40%) were found to have mild hearing loss, while 15 (24.59%) had significant hearing loss.

Anil HT et al.[14] found that hypothyroid patients had a higher prevalence of mild hearing loss (33.33%), moderate hearing loss (10%), and severe hearing loss (1.66%) than patients in the control group. In our study, 38 (62.29%) of the patients with hearing loss had TSH levels between 4.5 and 5.0, 8 (13.11%) had levels between 5.1 and 5.5, 7 (11.47%) had levels between 5.6 and 6.0, and 8 (13.11%) had levels between 6.1 and 6.5. The degree of hearing loss was shown to be significantly correlated with mean TSH levels (P 0.001).

CONCLUSION

According to the findings of our research, hypothyroidism has an effect on patient's hearing, which can lead to hearing impairment.

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