

## A Prospective Study on Hearing Loss in Hypothyroidism

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### ABSTRACT

Thyroid hormone regulates the metabolism of all the cells of human body. The role of thyroid hormone is very essential in bodily growth and maturation of the nervous system. If thyroid gland decreases its secretion, it can affect any system of the body. The decreased thyroxine from thyroid gland affects the auditory system. Thyroid hormone is very essential for not only the development but also functioning of cochlea. In addition to other systems, the auditory system is very sensitive to thyroid hormone. Hypothyroidism causes mild to severe degree of sensorineural hearing loss leading to auditory dysfunction. The objectives of the study was to measure the prevalence of hearing impairment among hypothyroid patients and to assess the hearing loss via audiometric tests among these patients. Thyroid disorder constitutes a spectrum of disease that occurs due to increase or decrease in thyroid hormones. Among these, the two important categories are due to thyroid over activity which is called as hyperthyroidism and thyroid lower activity which is called as hypothyroidism. Impairment with mild degree and it affects cochlea. Strict maintenance of thyroid hormone levels within normal range would help in reducing the cochlear damage, as evident from present study that longer the duration of hypothyroidism more is the proportion of hearing impairment.



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### INTRODUCTION

In this section presents introduction of this research work. The outer ear conducts the sound from outside environment to tympanic membrane. [1] The pinna portion of external ear is an appendage which extends from the side of the head (skull), made of cartilage which is covered with skin. This collects sound and transmits it to the canal, i.e ear canal. The angle of pinna is situated in such as way that it

catches the voice that is coming from the front more than those sounds which come from behind. [2] This arrangement is very useful in localizing the sound. This phenomenon is available only at higher frequencies, because of the size of head and wavelength of the sound. In case of middle frequencies, the skull acts as a casting mechanism to sound and generates a cast shadow. The lower frequency, what helps to localize a sound is the arrival of sound between two ears. The canal length is around 2.4 centimeters and it consists of an outer part and an inner part. [3] The outer part has skin which has few glands. The skin is hairy and it has lot of sweat glands and sebaceous glands. This oily sebaceous glands is responsible for production of wax. The grown hair located over the skin as well as the wax secreted from the sebaceous glands play a role in the protection of the ear canal. The wax serves as disinfectant too. Skin of the ear canal is thinner and gets attached to the bone of the deeper ear canal. This inner ear canal is a portion which is a hard cavity and absorbs few sounds. This then transmits the sound to the tympanic mem-

brane. This is also known as the ear drum or drum head. [4]

The skin of the ear canal is constantly getting shed and there is renewal of the skin regularly. The skin of the ear canal is also growing like other organs such as fingernails from base to the tip (depths to exterior). [5] This paves way for the shedding of skin into the waxy portions and then finally this falls out. This is quoted as one of the reasons to not use cotton buds for cleaning the ear canal, constant rubbing cause the skin to be pushed to deeper in the ear canal causing an accumulation and obstruction. [6] This could lead to hard of hearing. The canal of the ear is situated in such a way that it is bent slightly where the cartilaginous portion joins the bony portion making the outer part to run backwards, whereas the inner part forwards. This bend is also helpful in protecting the ear canal, by preventing the foreign objects from entering the ear and reaching out to tympanic membrane. That is why in order to inspect the tympanic membrane, the pinna of the ear is pulled upwards, backwards and laterally. Tympanic membrane is the one which separates the ear canal from the outer and middle ear cavity. This tympanic membrane constitutes the first portion of the auditory transducing pathway. The shape of the tympanic membrane is like a loud-speaker cone. [7] This shape is ideal for transmission of sound between solid as well as air media. This has a simple membrane which is covered by a layer of skin and respiratory epithelium on the inner side which is thinner. In between the two layers, the fibrous middle layer is present which contributes to the stiff nature of the tympanic membrane. The tympanic membrane is very thin as it is less than one tenth of the respiratory epithelium. The diameter measures approximately one centimeter thereby covering the round opening of middle ear cavity. [8] Figure 1

The prevalence of hypothyroidism was found to be higher at 11.4% in females compared to males with 6.2%. Hypothyroidism prevalence increases with age. Recent studies have reported the prevalence of palpable goiter to be 12%. Relationship between endemic goiter and iodine deficiency has been proven by several studies done in India including Himalayan and Sub- Himalayan regions. [9]

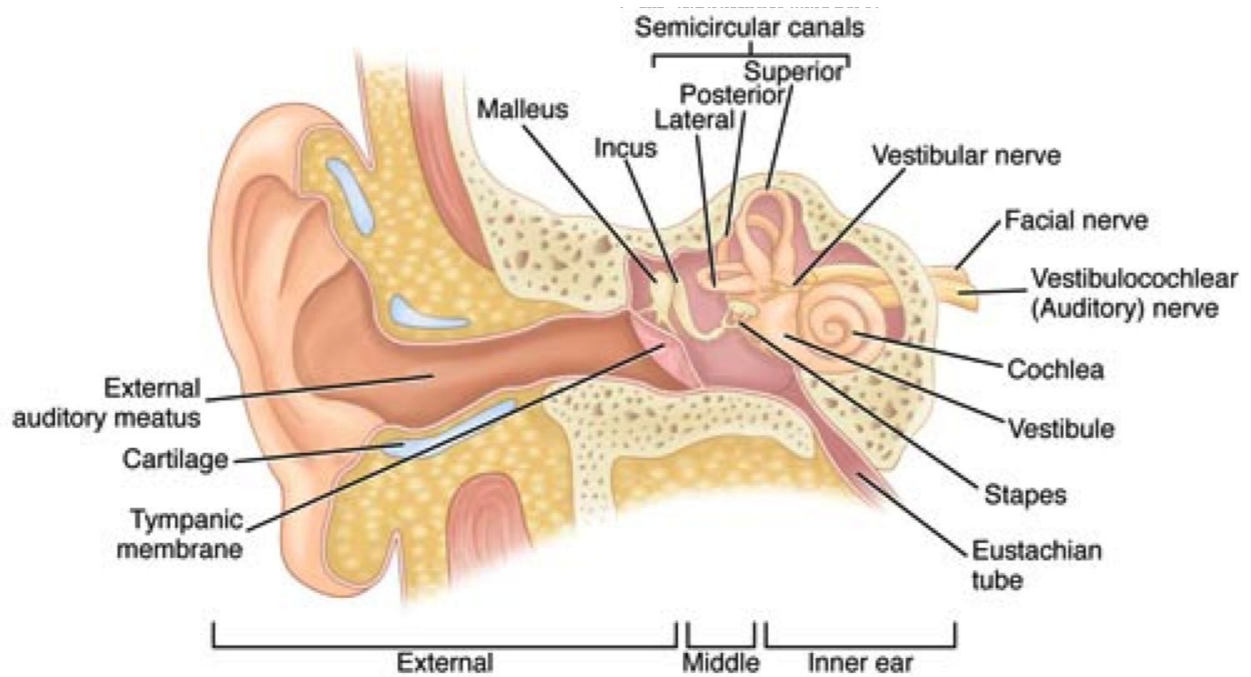
Among the several types of hypothyroidism, congenital hypothyroidism is very important as it needs to be diagnosed earlier to prevent the onset of brain damage. In previous study done in Mumbai, congenital hypothyroidism occurs in 11 out of 2640 neonates. [10] This figure is close when compared to global prevalence of 1 in 3800 neonates. In India,

there is always delay in diagnosis and lower prevalence of hypothyroidism due to ignorance about illness and lagging of health care facilities. Common mechanism of hypothyroidism in children are thyroid dysgenesis, thyroiditis and dysmorphogenesis. Congenital hypothyroidism invariably leads to auditory disturbances including hearing impairment. [11]

In this paper presents section 2 of this paper explains the detail on the related works. In section 3 presents the materials and methods adopted and section 4 presents the details of the experiments and discussions. Finally section 5 concludes the paper by sharing our inferences and future plans.

## RELATED WORKS

In this section presents focuses the related works of this research work. Hearing is a sense which is like other senses such as vision. Hearing is important in communication of language and also helpful in distant warning. It plays a role in alerting, communicating emotions. Conscious appreciation of vibration received as sound. This is achieved by an appropriate signal, which reaches the central nervous system via ear canal. [11] The role of ear is to convert the physical sound to nervous impulse. Ear is also known to be a biological microphone. Similar to the mechanism of microphone, where the vibration is converted to electrical signal, the ear is stimulated by vibration and this impulse is converted into signal which is processed by auditory pathway leading to stimulation of brain. This is a very delicate and complicated mechanism. This is a very delicate and complicated mechanism. [12] Literature have proven already that there exists a link between lower secretion of thyroid levels with sensorineural hearing loss. Various mechanisms have been postulated explaining the pathogenesis of low thyroid hormone levels causing damages to the inner ear structures. Hypothyroidism causes decrease in amplitude of a muscle which is located in ear called the stapedius muscle. The outer ear conducts the sound from outside environment to tympanic membrane. [13] The pinna portion of external ear is an appendage which extends from the side of the head (skull), made of cartilage which is covered with skin. This collects sound and transmits it to the canal, i.e ear canal. The angle of pinna is situated in such a way that it catches the voice that is coming from the front more than those sounds which come from behind. This arrangement is very useful in localizing the sound. In spite of this crucial situation, our country does not have very functional and effective policy to control the burden of disease. The prevalence



**Figure 1: Anatomy of ear**

in India for hypothyroidism is 11%. This is very high when compared to UK and US where the prevalence is 2% and 4.6% respectively. In India, higher prevalences are reported from Kolkata, Delhi, Bangalore and Hyderabad (cities situated inland) when compared to coastal cities such as Mumbai, Goa and Chennai. [14] Long standing iodine deficiency is the reason which contributes to higher mean thyroid stimulating hormone (TSH) levels in India. The highest prevalence of (13.1%)hypothyroidism is seen in people aged between 46–54 years, while people with age range of 18–35 years are being less affected (7.5%). Environmental factors are also said to be playing an important role in hypothyroidism in India. Certain substances such as goitrogens and other compounds including cyanogenic agents might have adverse effect on iodine metabolism. Pthallic acid and resorcinol which are industrial pollutants have also been suggested as causes for hypothyroidism in India. [15]

**MATERIALS AND METHODS**

In this section presents the materials and methods of this research work. The study was conducted in the Department of ENT with various departments including super specialty. The hospital has an exclusive audiometry unit for Audiological evaluation.

**STUDY DESIGN :** The study was an observational (prospective) study.

**STUDY POPULATION**

The study population constituted of patients pre-

senting in the Department of ENT. The study population includes people with hypothyroidism. The study participants who are all fulfilling the inclusion criteria are included in the study

**Inclusion criteria**

1. All individuals between 18 -50 years of age
2. The patients who are newly diagnosed with hypothyroidism
3. The patients undergoing treatment for hypothyroidism
4. Patients who underwent partial or total thyroidectomy

**Exclusion criteria**

1. Patients with middle ear disease and previous ear surgeries were excluded from the study.
2. Patients with family history of hearing impairment.
3. Patients who underwent chemotherapy, radiotherapy and tuberculosis treatment.

All the necessary information regarding the study were explained to the patients. Informed written consent was taken from the patients who were willing to participate in the study. After obtaining written informed consent in local vernacular language,

the patients who were fulfilling the inclusion criteria were included in the study. Detailed history was taken from the study group to establish proper diagnosis and to know about the presence of the risk factors of hypothyroidism.

## RESULTS AND DISCUSSION

In this section focuses the results and discussions of this research work. Among total 58 participants, 39(67.2%) were females and 19(32.8%) were males. The age of the study participants ranged from 18-50 years with mean ( $\pm$ SD) age was 38.6 ( $\pm$ 9.06) years. Majority of the study participants belong to the age group 31-45 years (58.6%), followed by 46-50 years (24.1%) and 18-30 years (16.2%). Majority of the participants had the history of hypothyroidism for 3-4 years (50%), followed by 44.8% who had hypothyroidism for a duration of 5 years and above. Mean (SD) for TSH value (in  $\mu$ IU/ml) was 6.47( $\pm$ 0.74) among the study population. Tympanic membrane examination was done with otoscopic examination. None of the study participants had any perforated tympanic membrane.

Pure tone audiometry revealed that average threshold at frequencies 500, 1000 and 2000Hz were calculated. Mean (SD) values of pure tone audiometry in dB were 24.9(4.3) and 25.9(4.5) in left and right ear respectively. Pure tone audiometry showed, abnormal findings in 30(51.8%) and 24 (41.4%) of right and left ear respectively. Bilateral hearing loss was observed in 18 (31%) of study participants. The prevalence of hearing impairment among hypothyroidism patients as per pure tone audiometry is 51.8%. Chi square test was applied to find any difference in baseline characteristics of study population with hearing impairment. Females found to have higher hearing impairment when compared to males.( $p=0.306$ ) Among the age groups, those with age group 31-45 years of age were found to have higher hearing impairment when compared to other age groups. ( $p=0.887$ ) More the duration of hypothyroidism more the hearing impairment. ( $p$  value =0.772)

## CONCLUSION

Finally this work concludes, The prevalence of hearing impairment among hypothyroidism was moderate. Longer the duration of hypothyroidism, more the prevalence of hearing impairment was found.

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## Conflict of Interest

Authors declared no conflict of interest.

## REFERENCES

- [1] Bernal J. Thyroid hormones and brain development. *VitMorm*. 2005;71:95-122.
- [2] Ushamenon V, Sundaram KR, Unnikrishnan AG, Jayakumar RV, Nair V, Kumar H. High prevalence of undetected thyroid disorders in an iodine sufficient adult south Indian population. *J Indian Med Assoc*. 2009;107:72-79.
- [3] Karmarkar MG, Deo MG, Kochupillai N, Ramalingaswami V. Pathophysiology of Himalayan endemic goiter. *The American Journal of Clinical Nutrition*. 1974;27(1):96-103. Available from: [10.1093/ajcn/27.1.96](https://doi.org/10.1093/ajcn/27.1.96).
- [4] Sooch SS, Deo MG, Karmarkar MG, Kochupillai N, Ramachandran K, Ramalingaswami V. Prevention of endemic goitre with iodized salt. *Natl Med J India*. 2001;14:185-193.
- [5] Pandav CS, Karmarkar MG, Kochupillai N. Recommended levels of salt iodation in India. *The Indian Journal of Pediatrics*. 1984;51(1):53-54. Available from: [10.1007/bf02753527](https://doi.org/10.1007/bf02753527).
- [6] Desai MP. Disorders of thyroid gland in India. *The Indian Journal of Pediatrics*. 1997;64(1):11-20. Available from: [10.1007/bf02795771](https://doi.org/10.1007/bf02795771).
- [7] Sanjeetbagchi. Hypothyroidism in India: more to be done. *The lancet endocrinology*; 2014.
- [8] Deol MS. Congenital deafness and hypothyroidism. *Lancet*. 1973;2(7820):105-106.
- [9] Uziel A. Periods of Sensitivity to Thyroid Hormone during the Development of the Organ of Corti. *Acta Oto-Laryngologica*. 1986;101(sup429):23-27. Available from: [10.3109/00016488609122726](https://doi.org/10.3109/00016488609122726).
- [10] Sohmer H, Freeman S. The Importance of Thyroid Hormone for Auditory Development in the Fetus and Neonate. *Audiology and Neurotology*. 1996;1(3):137-147. Available from: [10.1159/000259194](https://doi.org/10.1159/000259194).
- [11] Bruschini P, Sellari-Franceschini S, Bartalena L, Aghini-Lombardi F, Mazzeo S, Martino E. Acoustic Reflex Characteristics in Hypo- and

Hyperthyroid Patients. *International Journal of Audiology*. 1984;23(1):38-45. Available from: [10.3109/00206098409072819](https://doi.org/10.3109/00206098409072819).

- [12] Musiek FE, Gollegely MK. ABR in eighth nerve and low brainstem lesions. Sand Diego, USA: The College-Hill Press; 1985.
- [13] Knipper M, Zinn C, Maier H, Praetorius M, Rohbock K, Köpschall I, et al. Thyroid Hormone Deficiency Before the Onset of Hearing Causes Irreversible Damage to Peripheral and Central Auditory Systems. *Journal of Neurophysiology*. 2000;83(5):3101-3112. Available from: [10.1152/jn.2000.83.5.3101](https://doi.org/10.1152/jn.2000.83.5.3101).
- [14] Santos KT, Dias NH, Mazeto GM, Carvalho R, Lapate RL. Audiologic evaluation in patients with acquired hypothyroidism. *Braz J Otorhinolaryngol*. 2010;76(4):478-484.
- [15] Khechinashvili S, Metreveli D, Svanidze N, Knothe J, Kevanishvili Z. The hearing system under thyroid hypofunction. *Georgia Med News*. 2007;144:30-33.

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