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## Research Article

# A Large Study on Otological Diseases from South India: A Decade Report

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- Mixed hearing loss
- Otological diseases
- Sensorineural hearing loss

**Abstract**

**Background and objectives:** Otological diseases involving patho-physiological changes in ear sometimes leads to significant hearing disability that has an important health concern in developing countries. The aim of the study is to determine the prevalence of otological diseases and its associated hearing loss.

**Methods:** A total of 3548 cases with otological diseases referred to MAA ENT hospitals, Hyderabad, from 2004 to 2014 were considered for the study. Detailed histories, clinical examinations, disease specific otological tests and confirmatory diagnosis were all recorded in special case proformas.

**Results:** Chronic suppurative otitis media was the most common disease and occurrence of otological diseases is more in urban areas. The mean age of onset was significantly varying with male gender in chronic suppurative otitis media and presbycusis. It was observed that otosclerosis showed male preponderance while female preponderance was seen in referred otalgia. Otological diseases were significantly associated with hearing loss, chronic suppurative otitis media (OR=3.82; 95% CI=2.49-3.87) and otosclerosis (OR=3.59; 95% CI=1.40-9.23) of middle ear while Menieres disease (OR=15.75; 95% CI=2.74-90.48) in case of inner ear. Moreover, the hearing disability by otitis media decreased over the past decade while increased in presbycusis and otosclerosis.

**Interpretation & conclusions:** Chronic suppurative otitis media was the most prevalent disease and with male preponderance in all otological diseases except in referred otalgia. The prevalence of hearing loss in otitis media, otosclerosis and presbycusis over a period indicates an early detection and intervention strategies to be established for reducing or preventing the onset of hearing loss.

**INTRODUCTION**

Otological diseases caused by an abnormality or disruption in the anatomical structures and function of the ear leads to hearing impairment that may affect newborns, children, adults, and the elderly of different ethnicities present throughout the world [1,2]. The ear has a complex series of interlinked structures that are involved in maintenance of equilibrium as well as hearing. Hearing impairment is a common sensory disability to comprehend sound in one or both ears and can be caused by either genetic or environmental factors [3]. This impairment may range from mild to profound and is associated with significant adverse effects on verbal communication, difficulty in speech and language in children [4,5]. Complex relation between onset of otological disorders and diseases of other systems are reported

to exist which may act as important risk factors for the onset of hearing impairment [6,7].

WHO has reported the incidence of deafness and hearing loss affected 250-300 million people worldwide [8]. It is predicted that more than 900 million people would be suffering from hearing impairment by 2025 of which 2/3 of the affected may be from underdeveloped and developing nations [9]. The prevalence of hearing loss is around 1 in 1000 newborn infants and one in every three adults over 65 years [10]. It was reported that one out of twelve persons affected with hearing impairment belonged to India and 1 out of 500 births were likely to be affected by the congenital deafness [11]. The prevalence of adult onset hearing loss is 7.7% in Indian population and is expected to rise to 10.4% by 2020 [12].

The physical disability caused by otological diseases may not be life threatening, but it affects the patient's quality of life and increase the economic burden on the family. Unfortunately in developing countries like India there is scarcity of documented literature on the prevalence of otological diseases and its impact on hearing loss for all age groups. Hence, the present study was conceived to determine the prevalence of otological diseases and their association with hearing impairment in a South Indian population.

**MATERIALS AND METHODS**

**Subjects**

The study subjects consisted of 3548 patients referred to MAA ENT Hospitals, Hyderabad, from the regions of Telangana State and Andhra Pradesh, from January 2004 to December 2014. The distribution of otological diseases showed that 3.4% of the subjects were affected with outer ear, 78.5% with middle and 18.1% with inner ear diseases. All patients who were considered as study subjects underwent a general medical examination and detailed history pertaining to age of onset, symptoms (otalgia, tinnitus, dizziness etc.,) and other diseases was collected. The ENT specialist uses different battery of diagnostic tests depending on the type of otological diseases. In case of outer ear diseases, video otoscopy is done to diagnose otomycosis and differentiate between cerumen impaction and otomycosis. Tympanic membrane condition was confirmed by otoscopic examination in case of otitis media while otosclerosis is by detailed history, battery of audio logical tests and surgeries. Congenital hearing loss is diagnosed by detailed history, battery of audio logical tests (Pure tone audiometry, Otoacoustic emission test, Impedence audiometry, and BERA tests), and site of lesion (cochlear, retrocochlear or central), speech development and laboratory tests. The frequencies used for estimating average hearing in pure tone audiometry is 500, 1000 and 2000 Hz. The study has been carried out with institutional ethics committee clearance.

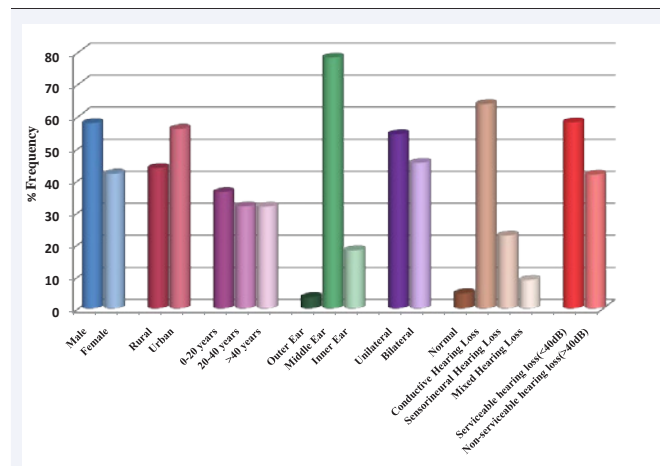
**Statistical analysis**

The data obtained was coded for statistical evaluations. Appropriate statistical analysis was performed using the Statistical Package for Social Sciences, PASW STATISTICS 18.0 software (SPSS Inc., Chicago, IL, USA). Continuous data is represented as mean and standard deviation. Binary logistic regression analysis was performed for examining the association between hearing loss and various types of otological diseases.

**RESULTS**

Among the 3548 study subjects, the males were observed to be 57.9% and females were 42.1 % with a male preponderance of 1.4. The prevalence of otological diseases was more in the study subjects located in urban areas (56.2%) compared to rural areas (43.8%). The mean ± SD of patient's age visiting the hospital with various otological diseases was 33.9 ± 19.7 years. With regard to the onset of otological diseases, the occurrence was more in the age group of <1-20 years (36.3%) followed by 20-40 years (31.9%) and >40 years (31.8%) as depicted in (Figure 1).

In the present study, otological diseases occurrence was more in middle (78.5%) followed by inner (18.1%) and outer ear



**Figure 1** Frequency distribution of demographic and otological findings among study subjects.

(3.4%). Most of the otological diseases were found to frequently affect unilaterally (54.7%) than bilaterally (45.3%). With regard to outer ear diseases, the prevalence of otomycosis (54.5%) was high followed by otitis external (25.2%) and cerumen impaction (13%). It was noticed that otitis media was the most common middle ear disorder, of which chronic suppurative otitis media (CSOM) constituted 62% followed by acute suppurative otitis media (ASOM) (16.3%) and otitis media with effusion (OME) (15.4%). In case of inner ear diseases, the highest prevalence was shown by presbycusis (44%), followed by congenital hearing loss (41.2%) and sudden sensorineural hearing loss (SSNHL) (6.5%) (Table 1).

About 95.1% of the study subjects were found to suffer from hearing loss. Among them, conductive hearing loss (CHL) was the most common form (63.7%) followed by sensorineural hearing loss (SNHL) (22.7%) and mixed (8.9%) hearing loss as depicted in Table 2. 54.3% of ontological diseases exhibited hearing loss at higher frequency (>40 dB) which is observed to be 54.3%. Conductive hearing loss (CHL) was mainly due to CSOM (61.1%) followed by ASOM (15.8%), OME (15.3%), otosclerosis (5.4%) and otomycosis (1.5%). Prevalence of SNHL was mainly due to presbycusis (35.1%), congenital hearing loss (32.9%), CSOM (12.0%), SSNHL (5.2%) and otosclerosis (2.6%). In case of mixed hearing loss, the occurrence is due to CSOM (69.1%), OME (11%), otosclerosis (9.8%) and ASOM (8.2%) (Figure 2). Bilateralism was found in majority of the cases affected with middle ear (62%), followed by inner ear (36.4%) and outer ear (1.6%). Binary logistics revealed significant association of hearing loss in middle ear diseases such as CSOM (OR=3.82; 95% CI=2.49-3.87), OME (OR=4.38; 95 % CI= 2.17-8.84), otosclerosis (OR=3.59; 95% CI= 1.40-9.23) when ASOM is considered as reference category (Table 2).

**DISCUSSION**

Otological diseases have shown male preponderance in different population which was attributed to occupational and environmental exposures, endocrinological factors and life style habits in relation to geographical variation [14,15]. The present study on otomycosis, otitis media, prebycusis and

**Table 1:** Distribution of sex, age of onset and laterality among ontological diseases.

Diseases	Sex n(%) / Age (Mean ± SD)		
	Males	Females	Total
<b>Outer Ear(n=123)</b>			
Otomycosis	39(58.2) 29.1 ± 19.88	28(41.8) 28.5 ± 20.28	67(54.5) 29.3 ± 19.76
Otitis externa	18(58.1) 32.9 ± 24.09	13(41.9) 36.2 ± 16.04	31(25.2) 34.3 ± 20.60
Cerumen impaction	9(56.3) 32.9 ± 26.45	7(43.8) 43.4 ± 20.06	16(13.0) 37.4 ± 23.73
Referred Otalgia	2(22.2) 42.0 ± 8.49	7(77.8) 27.9 ± 13.44	9(7.3) 31.1 ± 13.52
<b>Middle Ear(n=2780)</b>			
Chronic suppurative otitis media (CSOM)	994(58.0) 26.9 ± 19.09	719(42.0) 29.6 ± 17.56	1713(61.6) 28.3 ± 18.68
Acute suppurative otitis media (ASOM)	264(57.8) 29.5 ± 19.16	193(42.2) 30.7 ± 18.08	457(16.4) 30.2 ± 18.91
Otitis media with effusion (OME)	267(61.8) 28.5 ± 22.13	165(38.2) 30.0 ± 22.29	432(15.5) 29.44 ± 22.22
Otosclerosis	95(53.4) 33.9 ± 16.45	83(46.6) 33.0 ± 12.26	178(6.4) 33.7 ± 14.71
<b>Inner Ear(n=645)</b>			
Presbycusis	172(60.6) 60.7 ± 12.15	112(39.4) 58.0 ± 10.63	284(44.0) 59.7 ± 11.64
Congenital hearing loss	137(51.5) at birth	129(48.5) at birth	266(41.2) at birth
Meniere's disease	32(60.3) 44.8 ± 13.98	21(39.6) 36.1 ± 10.78	53(8.2) 41.6 ± 13.42
Sudden sensorineural hearing loss (SSNHL)	24(57.1) 39.8 ± 19.66	18(42.9) 35.2 ± 16.82	42(6.5) 37.8 ± 18.43

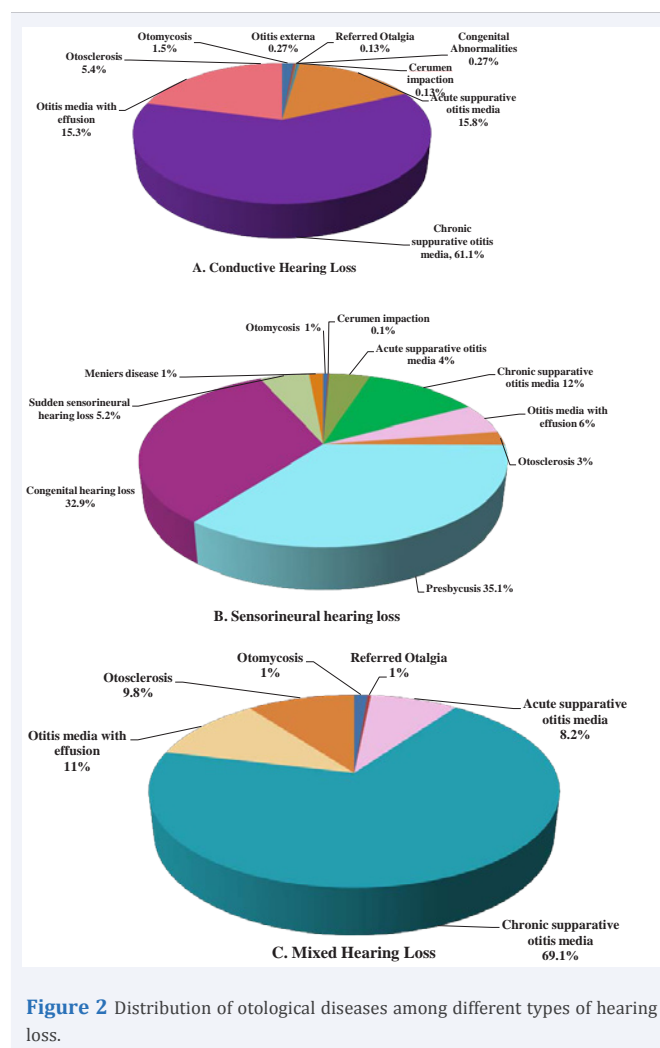
a. n-Frequency; Values in parenthesis are percent frequency  
 b. Level of significance: \*p-value<0.05, \*\*p-value<0.01, \*\*\*p-value<0.001

congenital hearing loss have also shown male preponderance. Female preponderance in otosclerosis was reported in earlier studies but in the present study it was found to be more in males [16,17]. Female preponderance was also observed in referred otalgia which was in accordance with earlier reports [18,19]. The prevalence of otological diseases was 56.2% and more in the study subjects located in urban areas. Change in life style due to economic improvement and urbanisation might have possibly enhanced the risk of otological diseases.

The prevalence of otological diseases also varied with respect to age. About 36.3% of the patients suffering from ear diseases were found to be mostly in the age group of <1-20 years. This occurrence at younger age was mostly attributed by pathological changes occurring in the middle ear of the study population. The occurrence of middle ear diseases especially otitis media was noticed in younger age group while the prevalence of inner ear diseases was noticed to be more in elderly age group (≥40 years). It was also noticed that there was a significant difference in mean age of onset with gender in cases of otitis media and presbycusis. Pathological changes that occur in the middle ear of young are reported to increase the risk for otological diseases in the study

population.

Middle ear diseases accounted for 78.5% among the study subjects. CSOM was the most common otological disease which was found to be 48.6% and was similar to the other studies [13,20]. However, the prevalence was high compared to the results reported from South India which was 6% and 12.4% from a study in population from Bangladesh [21,22]. This can be attributed to an influence of infections (tonsil opharyngitis and sinusitis), genetic predisposition and environmental factors in the present population. In CSOM subtypes, the squamous type was seen in 71.9% of the cases which is lower to the findings in Enugu is 99 % and 96% in Kano [13,20]. ASOM was ranked as 2<sup>nd</sup> common otological condition in the study population with prevalence of 12.8% which was similar to other studies [20,23]. The prevalence of otosclerosis (5%) was found to be higher than other studies which were due to smaller size of ear canal in the study population that facilitates poor visualisation, thereby less chance of success with surgical treatment in the study population [24]. It was observed that presbycusis occurring at an elderly age was found to be 7.9% in the present study which could be mainly due to effect of environmental stress and the pathological changes occurring in the inner ear during the life span. Frequent superficial infection of outer ear otomycosis was 1.9% in study



**Figure 2** Distribution of otological diseases among different types of hearing loss.

**Table 2:** Frequency distribution of hearing loss among otological diseases.

Otological Diseases	Hearing Loss n(%) Mean ± SD(dB)	Normal n (%)	p-value†	OR(95 % CI) ††
<b>Outer Ear(n=123)</b>				
Otomycosis	41(61.2) 41.3 ± 22.25	26(38.8)	<0.001	4.73(1.38-16.24)*
Otitis externa	12(38.7) 42.6 ± 19.94	19(61.3)		1.90(0.50-7.26)
Cerumen impaction	4(25.0) 43.2 ± 38.41	12(75.0)		2.40(0.42-13.60)
Referred Otalgia	4(44.4) 32.1 ± 12.99	5(55.6)		1.00(Reference)
<b>Middle Ear(n=2780)</b>				
Acute suppurative otitis media (ASOM)	414(90.6) 39.6 ± 12.92	43(9.4)	<0.001	1.00(Reference)
Chronic suppurative otitis media (CSOM)	1675(97.8) 43.7 ± 15.70	38(2.2)		4.58(2.92-7.18)***
Otitis media with effusion (OME)	422(97.7) 45.7 ± 16.73	10(2.3)		4.38(2.17-8.84)***
Otosclerosis	173(97.2) 51.5 ± 18.11	5(2.8)		3.59(1.40-9.23)**
<b>Inner ear(n=645)</b>				
Presbycusis	284(100.0) 52.4 ± 17.48	0(0.0)	<0.001	NA
Congenital hearing loss	266(100) 91.9 ± 2.55	0(0.0)		NA
Sudden sensor neural hearing loss (SSNHL)	42(100.0) 54.5 ± 21.38	0(0.0)		NA
Meniere's disease	44(83.0) 43.8 ± 19.45	9(17.0)		NA

a. n-Frequency; Values in parenthesis are percent frequency.  
 b. †- Chi- square test; †† -Binary logistic regression analysis; NA-Not applicable.  
 c. Level of significance of odds ratio: \*p-value<0.05, \*\*p-value<0.01, \*\*\*p-value<0.001.

population which was less compared to other studies [25,26]. Cerumen impaction, OME and otosclerosis were the common otological diseases that showed increased bilateralism.

The frequency of hearing loss observed among otological diseases was 95.1%, of which 25.5% were of severe type and 46.4% were affected bilaterally. In the present study, significant occurrence of CHL was mostly contributed by CSOM (61%) and OME (15%) while SNHL was due to presbycusis (34%), congenital hearing loss (32%), CSOM (12%) and otosclerosis (3%). Mixed form of hearing loss was significantly constituted by CSOM (69.1%), OME (11%) and otosclerosis (9.8%). It was observed that hearing disability increased with longer duration of disease in case of otitis media which could be due to diagnosis at the later stage. The study has also observed increased disability

in presbycusis which could be attributed to environmental and occupational exposures, increased life expectancy and associated co-morbidities such as diabetes and hypertension. In case of otosclerosis, genetic and environmental factors might have probably increased the occurrence of hearing disability by continuous abnormal bone remodelling which needs to be further elucidated.

Hence, the study emphasizes the need for early detection of CSOM for better management and therapeutic intervention to prevent the onset of hearing loss. Preventive measures for audio logical rehabilitation are to be taken for management of presbycusis that would improve the quality of life. Studies on genetic aspects and research on bone remodelling in otosclerosis will provide potentially new therapeutic treatments for restoring the hearing. Therefore, further support are warranted to understand the otological diseases associated with appreciable number of different forms of hearing loss and other related determinants in aetio-pathogenesis for the identification of potential interventions strategies.

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