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Association of Quality of Life with Tinnitus Severity and Degree of Hearing Loss: A Comparative Cross-Sectional Study

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ABSTRACT

Objective: To assess perceptions of quality of life with and without hearing loss among patients with tinnitus.
Study Design: Comparative Cross-Sectional Study.
Place and Duration of Study: Department of ENT, Combined Military Hospital, Pakistan, from Nov 2022 to May 2023.
Methodology: Patients were divided into two groups: Group-A (n = 85) without hearing loss and Group-B (n = 85) with complaints of hearing loss. The primary variables studied were the median TFI scores between the two groups, examining the impact on quality of life. Secondary variable studied was the relationship between tinnitus and hearing loss.
Results: Median TFI scores were 36.00 (26.00) in Group-A versus 61.00 (14.00) in Group-B (p<0.001). Impact on the quality of life (QOL) as assessed through scores submitted by patients revealed no problem was faced in 02(2.4%) versus 00(0%) patients between both groups, small problem in quality of life were seen in 28(32.9%) versus 00(0%) patients between both groups, moderate quality of life deterioration was seen in 39(45.9%) versus 21(24.7%) patients, big problems in quality of life were reported by 16(18.8%) versus 56(65.9%) patients in both groups and very big problems in quality of life were reported by 00(0%) versus 08(9.4%) patients between Group-A and Group-B (p<0.001)
Conclusion: The study concluded that severity of tinnitus is associated with poor functional scores, with a strong association with the severity of hearing loss, requiring step-wise screening, work-up, and follow-up for managing complications earlier and improving the overall quality of life

Keywords: Hearing, Functional Index, Loss, Quality, Tinnitus

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INTRODUCTION

The condition characterized by the perception of sound in the absence of external acoustic stimulation is known as tinnitus.[1] Tinnitus affects approximately 400 million individuals globally, making it one of the most prevalent complaints observed in patients of impaired hearing in otorhinolaryngology centres with hearing loss.[2] It is still considered a complex and uncertain domain by most medical professionals. Tinnitus commonly presents as various auditory sensations, including beeping, whirring, whistling, yowling, roaring, or the perception of rainfall. These auditory experiences can be distressing for the affected individuals and are associated with higher levels of anxiety and depressed mood.[3] Consequently, tinnitus has a significant negative impact on the overall quality of life for most individuals, with 2% to 5% experiencing substantial impairment.[4]

Among the prominent ontological signs of hearing impairment, particularly sensorineural hearing loss, tinnitus holds a prominent position. If individuals require tones to be presented at maximum intensity beyond the normal hearing threshold to perceive them, it indicates the presence of hearing loss. Furthermore, the degree of deviation from the standard reference frequency thresholds correlates with the severity of hearing damage.[5] Therefore, conducting thorough medical and audiological assessments is crucial to evaluate middle and external ear disorders. A study revealed that conductive hearing loss was the most prevalent type, affecting 14.9% of the 11 individuals with hearing loss, while 8% reported sensorineural hearing damage, and only 2.4% had mixed hearing impairment.[6] The observed conductive hearing loss in these individuals could potentially stem from preclinical middle ear conditions such as Eustachian tube insufficiency, suggesting that treatment may lead to improvement. However, additional middle ear testing is required, which was not feasible within the scope of this study. Interestingly, this research contradicts another finding indicating that sensorineural hearing impairment is the most prevalent type of hearing loss among individuals with tinnitus. The higher average pure

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tone thresholds observed in the original study on tinnitus sufferers suggest a greater susceptibility to develop a specific type of hearing loss compared to those without tinnitus.

Tinnitus elicits varying degrees of distress among individuals, even when they share a common tinnitus pattern, making it challenging to determine the level of anxiety solely based on a description. Sleep disturbances, attention difficulties, restlessness, worrisome, and depression are commonly reported by tinnitus patients, which significantly impact their overall well-being and quality of life.[7] However, limited research exists regarding the differences in the description and impact of tinnitus among individuals, regardless of whether they have sensorineural hearing loss or not. A study suggests that the clinical manifestations of tinnitus, including its characteristics, location, and intensity, may be similar in individuals with or without associated hearing loss. However, the negative effects on daily activities, such as attention and sleep patterns, appear to be more pronounced in those with concurrent sensorineural hearing impairment.

Khan *et al.,* proposed that extreme tinnitus discomfort negatively affects individuals' life satisfaction, with depression and anxiety being the most prevalent psychological comorbidities experienced by these patients.[8] In addition to cognitive impacts like attention difficulties, tinnitus can result in increased stress, emotional trauma, communication and listening challenges, frustration, restlessness, decreased concentration, and reduced overall effectiveness, leading to limitations in daily activities. Numerous global studies similar to Kara *et al.,* have demonstrated the detrimental impact of tinnitus on the quality of life of affected individuals.[9] However, further investigation is still needed to examine key clinical factors.

The present study aimed to assess the influence of tinnitus frequency and its impact on the quality of life of two distinct groups: those with hearing loss and those without hearing loss, concerning tinnitus.

METHODOLOGY

This cross-sectional study was carried out at the department of Ear, Nose, and Throat (ENT) department, Combined Military Hospital, Rawalpindi, Pakistan, from Nov 22 to May 23 after approval by ethical review board (ERB) from the institute vide letter no 384. Sample size was calculated keeping the confidence interval at 95%, power of test at 80%, with severe impairment of quality of life (QOL) due to tinnitus seen in 8.9% patients with no hearing loss versus 30.7% with sensineuronal hearing loss.[10] Minimum sample size calculated comparing the two population proportions using the WHO calculator came out to be 49 patients. We included 85 patients in each of the two groups under study, making the total study sample of 170 patients using non-probability consecutive sampling via lottery method.

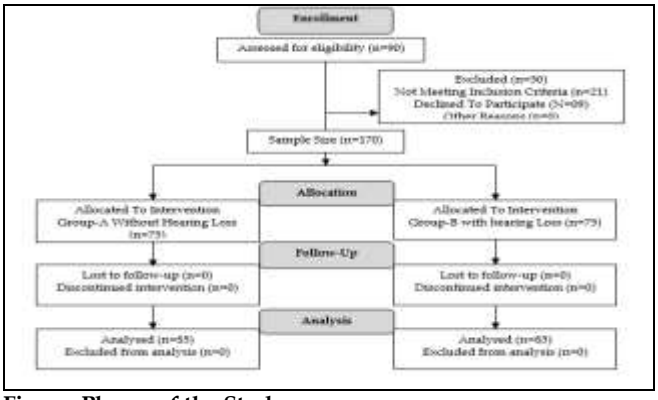

Figure: Phases of the Study

Inclusion Criteria: Patients aged >20 and <70 years, male and female, presenting to the outpatient department of the institute with complaints of tinnitus with associated complaints of presence or absence of hearing loss

Exclusion Criteria: Patients with previous surgeries to one or both ears, patients with foreign bodies in the ear, patients with hard impacted wax, patients lost to follow-up, and patients unwilling to participate were excluded.

The study method included data collection after individuals were added to the study Group-As per the inclusion criteria furnished. Patients were divided into Group-A (n=85) without hearing loss and Group-B (n=85) with complaints of hearing loss. Written informed consent was taken from all patients for inclusion in the study, considering all ethical protocols. They were counselled in detail that they would have to undergo pure tone audiometry (PTA) to assess the degree of hearing loss and would be asked to fill a questionnaire at the end of the study but were not made aware of the study outcomes to ensure blinding and prevent bias.

All the patients included in the study were first employed to detailed history taking and physical examination of the external auditory meatus by a senior ENT resident unaware of the outcomes of the

study protocol on a proforma provided by the research team. After completing the proforma, all patients underwent pure tone audiometry (PTA) to assess the degree and severity of hearing loss according to standard values for sensineuronal hearing loss. Normal hearing loss < 25 dB loss, Mild hearing loss: 26-40 dB hearing loss, Moderate hearing loss: 41-60 dB hearing loss, Severe hearing loss: 61-80 dB hearing loss and Profound hearing loss > 81 dB hearing loss. After the results of PTA, patients were then asked to complete a tinnitus functional index (TFI) proforma under supervision in case of any difficulty by a senior resident ENT. The TFI included 25 parameters assessing the quality of life and which were finally tabulated to a score between 0-100 for each patient according to the questionnaire with 0-17 signifying no problem on daily functioning, 18-31 posing a small problem, 32-53 posing a moderate problem, 54-72 posing a big problem and 73-100 posing a very big problem. These were then tabulated against frequency and severity of hearing loss and no hearing loss of the two groups for final study assessment.

Primary variables studied were median TFI scores between both groups for impact on the quality of life between both groups. Secondary variable studied was the relationship between tinnitus and hearing loss. Demographic data were statistically described in terms of mean and SD, frequencies, and percentages when appropriate. Independent samples t-test was used to compare demographic means and frequency variables compared using the Chi-square test/Fisher exact test. Median values were compared using the Mann-Whitney U test. A p value of ≤0.05 was considered statistically significant. All statistical calculations were performed using Statistical Package for Social Sciences 26.0.

RESULTS

A total of 170 patients were analyzed in the final study protocol, divided into Group-A (n=85) with no hearing loss and Group-B (n=85) with hearing loss, either unilateral or bilateral. Mean age of patients in Group-A was 46.80±17.56 years versus 48.44±18.08 years in Group-B (p=0.551). Mean weight was 72.13±5.26 kg versus 71.47±5.23 kg between both groups (p=0.414). Gender distribution revealed 33 (38.8%) males and 52(61.2%) females in Group-A versus 30(35.3%) males and 55(64.7%) females in Group-B. Presenting complaints showed that tinnitus was reported to be unilateral in 53 (62.4%) patients and bilateral in 32(37.6%) patients in Group-A versus unilateral in 42(49.4%) and bilateral in 43(50.6%) patients in Group-B. In Group-B, hearing loss was unilateral in 37(43.5%) patients versus bilateral in 48(56.5%) patients between both groups (Table-I).

Table-I: Demographic and Clinical Characteristics of Both Groups (n=170)

Variable	Group-A (n=85)	Group-B (n=85)	*p*-value
Mean Age (Years)	46.80±17.56	48.44±18.08	0.551
Mean Weight (Kg)	72.13±5.26	71.47±5.23	0.414
Gender			
Male	33(38.8%)	30(35.3%)	-
Female	52(61.2%)	55(64.7%)	-
Tinnitus Localization			
Unilateral	53(62.4%)	42(49.4%)	-
Bilateral	32(37.6%)	43(50.6%)	-
Hearing Loss Confirmed On PTA			
Unilateral	00(0%)	37(43.5%)	-
Bilateral	00(0%)	48(56.5%)	-

**PTA - Pure-Tone Audiometry*

Median TFI scores were 36.00 (26.00) in Group-A versus 61.00(14.00) in Group-B (p<0.001). Impact on the quality of life (QOL) as assessed through scores submitted by patients revealed no problem was faced in 02(2.4%) versus 00 (0%) patients between both groups, small problem in quality of life were seen in 28(32.9%) versus 00 (0%) patients between both groups, moderate quality of life deterioration was seen in 39 45.9%) versus 21(24.7%) patients, big problems in quality of life were reported by 16(18.8%) versus 56(65.9%) patients in both groups and very big problems in quality of life were reported by 00(0%) versus 08(9.4%) patients between Group-A and Group-B (p<0.001) (Table-II).

Table-II: Comparison Of Median Tinnitus Functional Index (TFI) Scores of Both Groups (n=170)

Variable	Group-A (N=85)	Group-B (N=85)	*P* Value
Median TFI Scores (0-100)	36.00(26.00)	61.00(14.00)	<0.001
Impact on Quality of Life as Per TFI Scores			
No Problem	02(2.4%)	00(0%)	<0.001
Small Problem	28(32.9%)	00(0%)	
Moderate Problem	39(45.9%)	21(24.7%)	
Big Problem	16(18.8%)	56(65.9%)	
Very Big Problem	00(0%)	08(9.4%)	

Finally, relationship between tinnitus and hearing loss showed that unilateral tinnitus was seen in 53(62.4%) patients and bilateral tinnitus in 32(37.6%)

patients in Group-A. In Group-B, unilateral hearing loss with unilateral tinnitus was seen in 25(29.4%) patients, unilateral hearing loss with bilateral tinnitus was seen in 12(14.1%) patients, unilateral hearing loss with bilateral tinnitus was seen in 17(20.0%) patients and bilateral hearing loss with bilateral tinnitus was seen in 31(36.4%) patients in Group-B. The proportion of unilateral tinnitus and bilateral tinnitus was significantly more in Group-B versus Group-A (p=0.003) (Table-III).

Table-III: Relationship between Tinnitus and Hearing Loss (n=170)

Variable	Group-A (n=85)	Group-B (n=85)		*p*-Value
		Unilateral Hearing Loss	Bilateral Hearing Loss	
Unilateral Tinnitus	53(62.4%)	25(29.4%)	17(20.0%)	0.003
Bilateral Tinnitus	32(37.6%)	12(14.1%)	31(36.4%)	

DISCUSSION

The study enabled the researcher to conclude the study comprehensively. Since adult patients with a wide age range were included, it was found that the mean age of patients presenting with tinnitus was between 45 and 55 years. While various demographic studies have reported the complaint to be diagnosed in the late fifties and sixties, Bhatt *et al.,* have also outlined that the diagnosis is now being made in younger age groups as well. The main reasons reported are increased levels of noise pollution, especially traffic and factory noise, to which younger age groups are increasingly exposed, and the quality of healthcare services in the early diagnosis of the problem and its cause, as compared to a decade ago, when it was considered an issue restricted to older age.[11] Hall et al., also reported loud music as one of the implicated causes in younger patients, especially those using ear devices for recreational music.[12] Gender distribution in our study concluded that females were more prone to develop both tinnitus and hearing loss than men. The male-to-female ratio determined by Pienkowski *et al.,* was 1:1.4, which is in line with the results of our study as well.[13] While no organic cause for this association has been established, it has been reported by Ayodele *et al.,* that females usually suffer more from tinnitus, and those with increasing hearing loss also report higher TFI scores and poorer outcomes. come.[14]

When observing the primary variables, we found that patients with bilateral hearing loss presented with a higher severity of bilateral localization of tinnitus when compared to those without any hearing loss after PTA assessment. This was in line with a study by Kalsotra *et al.,* which highlighted that factors affecting hearing can adversely impact the severity of tinnitus as well.[15] A strong statistically significant association was also found between the severity of tinnitus and the severity of hearing loss in a study conducted by Stegeman *et al.*[16] Correlating the same results to the impact on quality of life using the tinnitus functional index (TFI) also concluded parallel results in our study. The scoring system uses diverse aspects of these patients, including cognitive, sensory, sleep, auditory, emotional, and other aspects, to mark scores which are reported by Henry et al., to provide excellent follow-up tools for treatment of these patients.[17]

Our TFI scores were statistically better in those with no hearing loss and vice versa. The scores were also significantly better in those with unilateral hearing loss compared to those with bilateral hearing loss. While majority of the patients with no hearing loss reported a maximum hindrance in quality of life in the moderately affected range, those with profound hearing loss and bilateral tinnitus reported higher and poorer results, showing a linear association between the scoring system and patients. Studies like those conducted by Wang *et al.,* have also shown that due to this strong linear reporting association, the TFI is better at predicting improvement after treatment in these patients as well.[18]

The study recommends using TFI as a good tool for assessment of disability associated with tinnitus, and all patients with tinnitus should undergo pure tone audiometry to assess for the level of hearing loss, since a strong association is found with the degree of hearing loss and severity of tinnitus.

LIMITATION OF STUDY

Apart from results being from a single center, our study has certain limitations. Although a thorough history was used to identify risk factors, many environmental factors could not be catered for long-term follow-up and need further studies to see a causal link between cause of tinnitus. While unilateral and bilateral hearing loss and its severity for causing tinnitus were studied, the specific type of hearing disorder (sensory, neuronal, mixed) needs further studies to establish a causal link, and was not the study criterion in our protocol.

CONCLUSION

It was concluded that severity of tinnitus is associated with poor functional scores, with a strong association with the severity of hearing loss, requiring step-wise screening, work-up, and follow-up for managing complications earlier and improving the overall quality of life.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FM & SA: Data acquisition, data analysis, critical review, approval of the final version to be published.

MSH & MK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SA & SAA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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