

Clinical and Audiological Predictors of Severe Tinnitus Handicap in Patients Presenting to a Tertiary Care Centre: A Retrospective Analysis

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Abstract:

Background: Tinnitus is the perception of sound in the absence of an external acoustic stimulus and affects a substantial proportion of patients presenting to ENT outpatient departments. While many patients tolerate tinnitus well, a subset develops severe handicap with significant impact on emotional well-being, sleep, and daily functioning. Identifying clinical and audiological factors associated with severe tinnitus handicap may help clinicians identify patients who require more intensive counselling, audiological rehabilitation, or psychological intervention.

Objectives: To determine the clinical and audiological predictors of severe tinnitus handicap, as assessed by the Tinnitus Handicap Inventory (THI), among patients presenting with subjective tinnitus to a tertiary care centre.

Methods: This retrospective analysis was conducted in the Department of Otorhinolaryngology, Patna Medical College and Hospital (PMCH), and included 100 patients presenting with subjective tinnitus over a 1-year period. Demographic data, tinnitus characteristics, comorbidities, sleep and psychological symptom history, and pure tone audiometry findings were recorded. Tinnitus handicap was graded using the THI (0-100), and severe handicap was defined as a THI score of ≥ 58 (severe or catastrophic grade). Univariate comparisons between patients with and without severe handicap were performed, followed by multivariate logistic regression to identify independent predictors.

Results: Of the 100 patients, 29 (29%) had severe or catastrophic tinnitus handicap (THI ≥ 58). On univariate analysis, severe handicap was significantly associated with older age, tinnitus duration >12 months, severe-to-profound hearing loss, sleep disturbance, and anxiety/depressive symptoms ($p < 0.05$ for all). On multivariate analysis, severe-to-profound hearing loss (adjusted OR 5.62), sleep disturbance (adjusted OR 3.18), and anxiety/depressive symptoms (adjusted OR 2.94) remained independent predictors of severe tinnitus handicap.

Conclusion: Severe tinnitus handicap was present in nearly one-third of patients in this cohort and was independently predicted by the degree of hearing loss, sleep disturbance, and psychological symptoms rather than tinnitus characteristics alone. Routine screening for hearing loss, sleep quality, and psychological distress in patients presenting with tinnitus may help identify those at risk of severe handicap who would benefit from a multidisciplinary management approach.

Keywords: Tinnitus; Tinnitus Handicap Inventory; hearing loss; sleep disturbance; anxiety; pure tone audiometry.

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Introduction

Tinnitus is the conscious awareness of a sound in the absence of an external sound and is one of the most frequent complaints that is heard in otolaryngology practice [1]. Epidemiological studies suggest that 10-15% of all adults will develop tinnitus at some stage of their lives, while a smaller, but more clinically relevant number, around 3-4% of these

adults will suffer from tinnitus that is annoying sufficiently to interfere with their activities, concentration, sleep and emotional life [1,2].

The degree of impact of tinnitus on the quality of life is different for everyone and not necessarily related to the loudness of the tinnitus itself. One of the most

widely used tools to grade the tinnitus-related handicap is the 100-point Tinnitus Handicap Inventory (THI) which has three subscales: functional, emotional, and catastrophic, with higher scores associated with greater handicap [3,4]. The THI is typically divided into five levels of severity and severity scores have been found to be related to depression, anxiety, and stress on psychiatric screening instruments [4,5].

The clinical and psychological correlates of clinically significant or severe tinnitus handicap have been the subject of a number of studies. In a multivariate algorithm developed in a cohort of elderly persons with hearing loss, severe hearing loss had the greatest odds ratio as an independent risk factor for moderate to severe tinnitus, while older age, hypertension, poor sleep quality, anxiety were other independent factors [6]. One study conducted in a similar population in South Africa identified that factors such as hearing loss severity, age and sleep disorder were the most significant predictors for clinically significant tinnitus, and that the overall risk was the combination of auditory and non-auditory factors based on the machine learning approach used in the study [7].

Psychological comorbidities are especially associated with tinnitus handicap. Cross-sectional studies in adults with tinnitus have shown that increased THI scores are strongly linked to decreased psychological health and quality of life in functional, emotional and social scales [2]. Comparative studies of tinnitus severity questionnaires have also demonstrated that the THI, rather than any numerical rating scales for loudness and annoyance, has a stronger ability to predict depression, anxiety and stress on standardized psychiatric instruments, highlighting the multidimensional nature of tinnitus related disability [8,9].

Although there is some evidence from other populations, there is limited data in the Indian tertiary care settings that explains what characterizes the likelihood of severe tinnitus handicap. Local clinical and audiological predictors of severe handicap could be useful in identifying patients who are likely to experience a significant level of tinnitus-related handicap, to help guide earlier referral for audiological rehabilitation, sleep assessment or psychological support rather than the provision of reassurance alone [6,7].

The purpose of this retrospective study was then to find out the prevalence of the severe tinnitus handicap and the clinical and audiological factors independently associated to the severe handicap (THI grade) among patients with Subjective tinnitus who visited the Department of Otorhinolaryngology, PMCH, during one year.

Materials and Methods

Study Design and Setting: This retrospective analysis was conducted in the Department of Otorhinolaryngology, Patna Medical College and Hospital (PMCH), Patna. Records of patients presenting with the primary complaint of subjective tinnitus over a 1-year period were reviewed. Institutional Ethics Committee approval was obtained, and patient identifiers were anonymized prior to analysis.

Sample Size: A total of 100 patients who fulfilled the inclusion and exclusion criteria and had complete audiological and THI assessment records were included in the final analysis.

Inclusion Criteria

- Patients aged 18 years and above presenting with subjective, non-pulsatile tinnitus persisting for more than 4 weeks
- Availability of a completed Tinnitus Handicap Inventory (THI) questionnaire and pure tone audiometry (PTA) at presentation
- Complete documentation of relevant clinical history, including duration of tinnitus, laterality, comorbidities, and sleep/psychological symptom screening

Exclusion Criteria

- Pulsatile tinnitus or tinnitus attributable to an identifiable vascular, neoplastic, or middle ear pathology requiring separate management (e.g., glomus tumor, active otitis media, otosclerosis with conductive component as primary complaint)
- Patients with a pre-existing diagnosed psychiatric disorder on treatment prior to onset of tinnitus
- Incomplete audiometric or questionnaire records

Data Collection: The following variables were recorded for each patient from outpatient and audiology records:

- Demographic: age, sex
- Tinnitus characteristics: duration (≤ 12 months vs > 12 months), laterality (unilateral vs bilateral), history of noise exposure
- Comorbidities: hypertension, diabetes mellitus
- Sleep and psychological symptoms: presence of sleep disturbance and anxiety/depressive symptoms based on a brief structured screening questionnaire administered at presentation
- Audiological: pure tone average (PTA) of the better hearing ear, categorized as normal (≤ 25 dB), mild (26-40 dB), moderate (41-55 dB), severe (56-70 dB), or profound (> 70 dB) hearing loss

- Tinnitus Handicap Inventory (THI) total score and grade (slight, mild, moderate, severe, catastrophic)

Outcome Definition: Severe tinnitus handicap was defined as a THI total score of ≥ 58 , corresponding to the combined 'severe' (58-76) and 'catastrophic' (78-100) grades, consistent with categorization used in previous studies of tinnitus severity [4,16]. Patients with THI scores < 58 (slight, mild, or moderate grades) were classified as having non-severe handicap.

Statistical Analysis: Data were analyzed using SPSS software (version 25.0 or equivalent). Continuous variables were expressed as mean $\pm$ standard deviation (SD) and compared between groups using the Student's t-test or Mann-Whitney U

test as appropriate. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test or Fisher's exact test. Variables significant on univariate analysis ($p < 0.05$) were entered into a multivariate logistic regression model to identify independent predictors of severe tinnitus handicap, with results expressed as adjusted odds ratios (aOR) and 95% confidence intervals (CI). A p-value of less than 0.05 was considered statistically significant.

Results

A total of 100 patients presenting with subjective tinnitus and completing THI assessment over the 1-year study period were included. Baseline demographic, clinical, and audiological characteristics are summarized in Table 1.

Table 1: Baseline characteristics of the study population (N = 100)

Variable	Value
Mean age (years), mean $\pm$ SD	46.8 $\pm$ 13.2
Male sex, n (%)	58 (58.0%)
Duration of tinnitus > 12 months, n (%)	61 (61.0%)
Bilateral tinnitus, n (%)	67 (67.0%)
History of noise exposure, n (%)	39 (39.0%)
Hypertension, n (%)	34 (34.0%)
Diabetes mellitus, n (%)	22 (22.0%)
Sleep disturbance, n (%)	48 (48.0%)
Anxiety/depressive symptoms (self-reported), n (%)	41 (41.0%)
Normal hearing (PTA ≤ 25 dB, better ear), n (%)	13 (13.0%)
Mild hearing loss (26-40 dB), n (%)	21 (21.0%)
Moderate hearing loss (41-55 dB), n (%)	20 (20.0%)
Severe hearing loss (56-70 dB), n (%)	17 (17.0%)
Profound hearing loss (> 70 dB), n (%)	10 (10.0%)
Mean THI score, mean $\pm$ SD	44.6 $\pm$ 22.3

Distribution of Tinnitus Handicap: The mean THI score in the study population was 44.6 ± 22.3 . Based on THI grading, 18% of patients had slight handicap, 27% mild, 26% moderate, 19% severe, and 10% catastrophic handicap. Overall, 29 of 100 patients

(29%) had severe or catastrophic handicap (THI ≥ 58) and were classified as having severe tinnitus handicap for the purposes of comparative analysis. The distribution of THI grades is summarized in Table 2 and illustrated in Figure 1.

Table 2: Distribution of THI grades among study participants

THI Grade	Score Range	n (%)
Slight	0-16	18 (18.0%)
Mild	18-36	27 (27.0%)
Moderate	38-56	26 (26.0%)
Severe	58-76	19 (19.0%)
Catastrophic	78-100	10 (10.0%)
Severe + Catastrophic (severe handicap)	58-100	29 (29.0%)

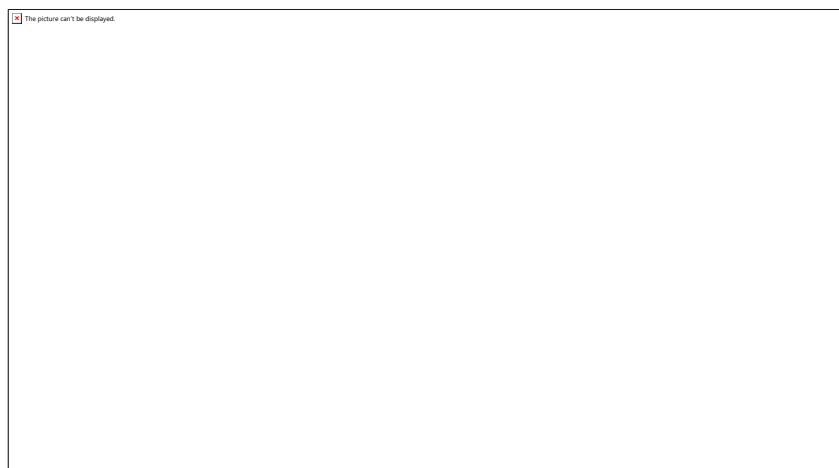


Figure 1: Distribution of Tinnitus Handicap Inventory (THI) grades among the study population (N = 100) (illustrative data).

Univariate Analysis of Predictors of Severe Handicap: Table 3 compares clinical and audiological characteristics between patients with severe handicap (THI ≥ 58 , n = 29) and those with non-severe handicap (THI < 58 , n = 71). Patients with severe handicap were significantly older (52.4 ± 11.6 vs 44.4 ± 13.3 years, $p = 0.004$), more likely to have tinnitus duration >12 months (79.3% vs 53.5%, $p = 0.014$), more likely to have severe-to-

profound hearing loss (65.5% vs 11.3%, $p < 0.001$), more likely to report sleep disturbance (72.4% vs 38.0%, $p = 0.001$), and more likely to report anxiety/depressive symptoms (65.5% vs 31.0%, $p = 0.001$). The relationship between degree of hearing loss and tinnitus handicap severity is illustrated in Figure 2, which shows a progressively higher proportion of severe/catastrophic handicap with increasing hearing loss severity.

Table 3: Comparison of clinical and audiological variables between patients with severe and non-severe tinnitus handicap

Variable	Severe Handicap (n=29)	Non-severe Handicap (n=71)	p-value	Significance
Mean age (years), mean $\pm$ SD	52.4 ± 11.6	44.4 ± 13.3	0.004	*
Male sex, n (%)	16 (55.2%)	42 (59.2%)	0.708	
Duration of tinnitus >12 months, n (%)	23 (79.3%)	38 (53.5%)	0.014	*
Bilateral tinnitus, n (%)	23 (79.3%)	44 (62.0%)	0.097	
Severe-to-profound hearing loss, n (%)	19 (65.5%)	8 (11.3%)	<0.001	*
Sleep disturbance, n (%)	21 (72.4%)	27 (38.0%)	0.001	*
Anxiety/depressive symptoms, n (%)	19 (65.5%)	22 (31.0%)	0.001	*
Hypertension, n (%)	13 (44.8%)	21 (29.6%)	0.140	
History of noise exposure, n (%)	13 (44.8%)	26 (36.6%)	0.435	

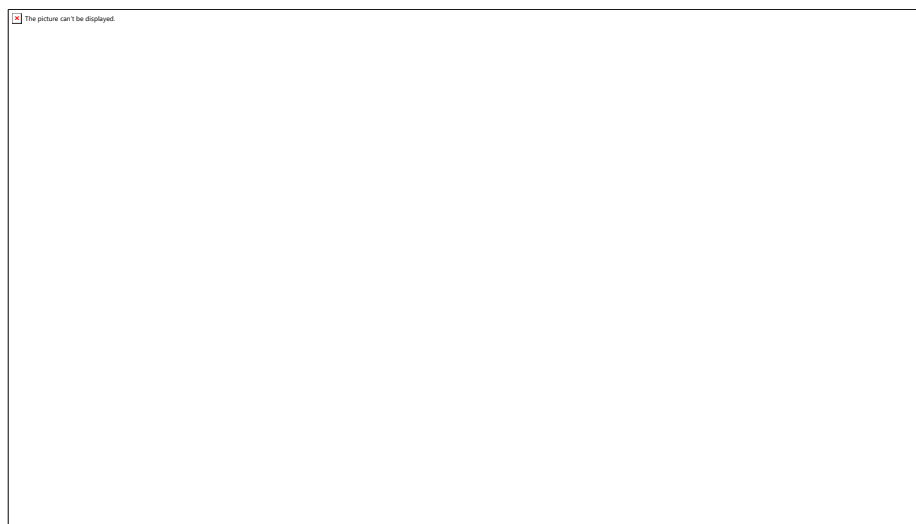


Figure 2: Tinnitus handicap severity (slight-moderate vs severe-catastrophic THI) according to degree of hearing loss (illustrative data).

Multivariate Analysis: On multivariate logistic regression analysis (Table 4), three variables remained independent predictors of severe tinnitus handicap after adjustment: severe-to-profound hearing loss (adjusted OR 5.62, 95% CI 1.94-16.28, $p = 0.001$), sleep disturbance (adjusted OR 3.18,

95% CI 1.18-8.58, $p = 0.022$), and anxiety/depressive symptoms (adjusted OR 2.94, 95% CI 1.07-8.06, $p = 0.036$). Tinnitus duration >12 months and age showed trends toward association but did not reach statistical significance after adjustment.

Table 4: Multivariate logistic regression analysis of independent predictors of severe tinnitus handicap

Predictor	Adjusted OR	95% CI	p-value
Severe-to-profound hearing loss	5.62	1.94 - 16.28	0.001
Sleep disturbance	3.18	1.18 - 8.58	0.022
Anxiety/depressive symptoms	2.94	1.07 - 8.06	0.036
Tinnitus duration >12 months	2.41	0.84 - 6.91	0.101
Age (per year increase)	1.04	0.99 - 1.08	0.087

Discussion

A retrospective study of 100 consecutive patients with subjective tinnitus seen at PMCH during 1 year showed that severe (THI ≥ 58) or catastrophic tinnitus handicap occurred in 29%. The most important predictors of severe handicap were severe-to-profound hearing loss, sleep disturbance, and anxiety/depressive symptoms, which appeared as independent predictors on multivariate analysis; univariate analysis indicated associations of tinnitus duration and age, but these did not remain significant after multivariate analysis.

The incidence of severe tinnitus handicap (THI ≥ 38) in our cohort is similar to other tertiary care populations in which moderate to severe tinnitus was found in a significant minority of patients with hearing loss, with severe hearing loss the most important independent predictor of clinically significant tinnitus in a multivariable prediction model constructed from 301 patients (adjusted OR 3.45 for severe hearing loss) [6]. The results for severe-to-profound hearing loss (aOR 5.62) are consistent with the body of evidence mentioned

above, and further supports the notion that the severity of peripheral hearing loss is a significant determinant for tinnitus-related handicap, beyond characteristics of tinnitus itself (duration or laterality) [6,7].

Another machine learning study employing random forest, XGBoost, support vector machine and logistic regression models to predict clinically significant tinnitus in patients with hearing loss also found that hearing loss severity, age and sleep disorder were the most influential factors using SHAP analysis, with tinnitus being influenced by audiological as well as non-auditory factors [7]. The second highest independent risk factor for severe handicap in our cohort was sleep disturbance (aOR 3.18), closely paralleling the role played by poor sleep quality which was the strongest independent risk factor for moderate to severe tinnitus in the above-described multivariable model (aOR 2.82 for poor sleep) [6].

The independent correlation of anxiety/depressive symptoms with severe tinnitus handicap found in our study mirrors the extensive documentation of a

bidirectional correlation between tinnitus severity and psychological distress. Cross-sectional analyses of quality of life in adults with tinnitus have shown that adults with higher THI scores tend to have significantly worse psychological functioning in emotional and social areas [2]. Additionally, comparisons of tinnitus severity questionnaires have indicated that the THI, rather than just a numerical rating of loudness or annoyance, is a powerful predictor of the depression, anxiety, and stress scores entered into validated psychiatric questionnaires [8,9].

In our study, tinnitus duration of more than 12 months was significantly associated with severe handicap, but did not predict handicap when adjusted for hearing loss, sleep disturbance, and psychological symptoms. This could be attributed to the strong clinical association between the chronicity of tinnitus and the gradual onset of sleep disturbance and psychological stress over the years, so that duration may be more of a marker of, rather than an independent predictor of, these downstream effects [2,6].

This study's results suggest the potential to apply these results to initial patient evaluations in an outpatient clinic for ENT. Patients with moderate to profound hearing loss (in the severe to profound range) and those who state they have sleep disturbance or symptoms suggestive of anxiety or depression should be identified as being at higher risk of significant handicap from tinnitus and appropriate referral for psychological assessment or support (where indicated) and hearing aid evaluation (where appropriate) and structured sleep hygiene counselling should be considered and scheduled in addition to reassurance alone [6,7].

Limitations

There are some limitations of this study. It was a retrospective design and used a brief screening questionnaire to document sleep and psychological symptoms, so may have resulted in under or over reporting of symptoms. The single-center design and the small number of patients (100) may reduce the generalizability of the findings, and tinnitus-specific audiological measures (e.g., pitch and loudness matching) were not evaluated which have been shown to be related to overall tinnitus status in other studies [9]. To confirm and expand on these findings larger prospective studies, including validated psychological instruments and tinnitus psychoacoustic characteristics, are warranted.

Conclusion

In this retrospective analysis of 100 patients presenting with subjective tinnitus to PMCH over a 1-year period, nearly one-third of patients had severe or catastrophic tinnitus handicap. Severe-to-profound hearing loss, sleep disturbance, and anxiety/depressive symptoms were identified as independent predictors of severe handicap, while tinnitus characteristics such as duration did not retain independent significance after adjustment. Routine assessment of hearing status, sleep quality, and psychological well-being at the time of initial presentation may help clinicians identify patients at higher risk of severe tinnitus handicap and facilitate timely referral for audiological rehabilitation and psychological support as part of a multidisciplinary management approach.

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