

Impact of tinnitus as measured by the Tinnitus Handicap Inventory among tinnitus sufferers in Singapore

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ABSTRACT

Introduction: The effects of tinnitus on quality of life (QOL) have never been extensively studied in Singapore. We describe the characteristics of tinnitus and its impact on QOL as measured by the Tinnitus Handicap Inventory (THI) in a series of ear, nose and throat clinic patients.

Methods: A total of 327 patients who attended a tinnitus counselling clinic completed the THI questionnaire, a self-report measure with 25 items grouped into functional, emotional and catastrophic subscales.

Results: The mean age of the 134 female and 193 male patients was 48.9 years. 36.7 percent of these patients had bilateral tinnitus and 64.6 percent had symptoms for less than one year. 270 patients had hearing loss, 74 percent of whom presented with bilateral high frequency hearing loss. Most patients (84.1 percent) perceived only one type of sound. The total THI score distribution was: 107 (33 percent) patients had THI less than 16, 100 (31 percent) had THI 18 to 36, 59 (18 percent) had THI 38 to 56, and 61 (19 percent) had THI more than 58. There were no differences in the overall THI and subscale scores between the patients' gender, those with or without hearing loss, and those with unilateral or bilateral tinnitus. However, significantly higher total THI and all subscale scores were found among patients who were hearing more than one type of tinnitus sound. The areas of concern that were commonly reported by the patients in this series were a lack of control over tinnitus, frustration and stress.

Conclusion: Tinnitus patients who hear multiple sounds tend to have a higher THI and subscale scores. The management of tinnitus should address common areas of concern, and may include counselling. The THI is a potential

screening tool to determine if patients require counselling. A series of THI assessments can be used to chart the progress of treatment.

Keywords: quality of life, tinnitus, Tinnitus Handicap Inventory

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INTRODUCTION

Tinnitus is a prevalent problem that remains poorly understood by healthcare professionals today. It is a worldwide problem that affects millions of people. It is estimated that tinnitus could seriously affect 10 million of approximately 40 million tinnitus sufferers in the United States of America.⁽¹⁾ A similar ratio has been reported in the United Kingdom.⁽²⁾ An Asian population study conducted in Korea has revealed a prevalence rate of 10.9%.⁽³⁾ A local study conducted by the Department of Industrial Health on 647 noise-exposed workers reported that 151 workers suffer from tinnitus, yielding a prevalence rate of 23.3% in this group.⁽⁴⁾

There is currently no universal agreement on the definition of tinnitus.⁽⁵⁾ One definition states that tinnitus is a phantom auditory perception,⁽⁶⁾ while another describes it as a phantom sensation.⁽⁷⁾ Lee et al have stated that tinnitus "is not a kind of hallucination of psychiatric illness".⁽⁸⁾ At present, there is no standardised and objective audiological test to detect the presence of tinnitus. Some attempts have been made to develop such a test, but none of these have been validated. Assessment of the tinnitus patient is a complex task due to the lack of a standard protocol. Numerous studies using various open-ended or self-report structured questionnaires have been conducted.

Tinnitus perception has been found to be strongly correlated with emotional impact.^(6,9,10) A recent study reported that "tinnitus can lead to significant distress, depression, anxiety and a decrease in quality of life".⁽¹¹⁾ A direct measurement of the degree of tinnitus severity is often obtained through self-report questionnaires. Such questionnaires include the Tinnitus Severity Scale,⁽¹²⁾ Tinnitus Handicap Questionnaire,⁽¹³⁾ Subjective Tinnitus

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Table I. Tinnitus characteristics of 327 patients who attended the counselling clinic.

Tinnitus characteristic	No. (%)
Tinnitus duration	
< 4 wks	44 (13.5%)
4 wks to < 1 yr	167 (51.1%)
1 yr to < 5 yrs	65 (19.8%)
> 5 yrs	51 (15.6%)
Site of tinnitus	
Bilateral	120 (36.7%)
Left ear	111 (33.9%)
Right ear	73 (22.3%)
Not from ear, but somewhere in the head	12 (3.7%)
Unsure if it is from the head or ear	11 (3.4%)
No. of tinnitus sounds heard	
Only one type	276 (84.4%)
More than one type	51 (15.6%)
Type of tinnitus sounds heard	
High-pitched ringing	185 (56.6%)
Insect/cricket sound	59 (18.0%)
Buzzing	18 (5.5%)
Hissing	23 (6.9%)
Ocean roaring	11 (3.4%)
Humming	15 (4.6%)
Others*	69 (21.5%)

* Others include water sounds, echoing, clicking, low-pitched tone, beeping, ticking, whistle, drumming and machinery sound.

Severity Scale,⁽¹⁴⁾ Tinnitus Reaction Questionnaire,⁽¹⁵⁾ Tinnitus Questionnaire⁽¹⁶⁾ and the Tinnitus Handicap Inventory (THI).⁽¹⁷⁾

Among these questionnaires, the THI appears to be widely endorsed in many clinical practices and is gaining recognition as a useful tool for quantifying the impact of tinnitus on daily life.⁽¹⁸⁾ This study of tinnitus sufferers attending a counselling clinic aimed to describe the general characteristics of tinnitus experienced by sufferers and the impact of tinnitus on quality of life, as well as to examine any factors that may be associated with the severity of tinnitus.

METHODS

Patients who underwent tinnitus counselling as part of the Tinnitus Evaluation and Rehabilitation Programme in a tertiary hospital were recruited. A total of 327 patients who were managed in our centre between November 2006 and August 2008 were enrolled in this study. There were generally two categories of patients: those who had more severe symptoms and who were more affected by the tinnitus, and those who wished to understand more about their condition and who wanted reassurance.

All the patients underwent a thorough ear, nose and throat examination and pure-tone audiogram prior to referral to the tinnitus counselling clinic. Hearing

thresholds within 25 dB across frequencies of 250–8,000 Hz were classified as being within normal hearing limits. Age, gender, ethnic group, medical history and tinnitus characteristics were recorded as baseline information. Patients were asked to complete the THI questionnaire as part of the initial assessment at the tinnitus counselling clinic.

The THI is a self-administered 25-item questionnaire that is scored on a 3-point Likert scale (No = 0, Sometimes = 2 and Yes = 4) in three subscales: emotional, functional and catastrophic. The emotional subscale was assessed in this study by adding the scores of nine questions relating to anger, frustration, irritability, anxiety, depression and insecurity. The functional subscale was determined by totalling the scores of 11 questions pertaining to stress, loss of concentration and sleep, interference with job, household responsibilities and social activities. The catastrophic subscale of tinnitus was evaluated using the total score of five questions relating to a sense of desperation, perception of having a terrible disease, lack of control, and inability to escape and cope. The total THI score was the sum of the scores for all three subscales. Based on the total THI score, tinnitus sufferers were classified into four categories denoting handicap severity: no handicap (0–16), mild handicap (18–36), moderate handicap (38–56) or severe handicap (58–100).

The results were analysed using the Statistical Package for the Social Sciences version 16.0 (SPSS Inc, Chicago, IL, USA). The chi-square test was used to test for statistical significance between categorical variables, and the *t*-test was used to test for differences between continuous data. Multiple logistic regression analysis was used to study the effect of gender, hearing loss and the number of tinnitus sounds heard for patients who had severe, moderate and mild THI handicap compared to a reference group of those with no THI handicap. Multiple linear regression analysis was used to study the effect of gender, hearing loss and the number of sounds heard on the overall THI score as well as the functional, emotional and catastrophic subscales. All p-values were two-sided and the level of statistical significance was 0.05.

RESULTS

Of the 327 patients, 77 (23.5%) were aged 15–40 years, 190 (58.1%) were aged 41–60 years, and the remaining 60 (18.4%) patients were > 60 years of age. The mean age was 48.9 years, with a standard deviation (SD) of 13.4 (range 15–90) years. There were 134 female (41%)

Table II. Percentage of the 327 respondents who had positive responses to the Tinnitus Handicap Inventory (THI) questions.

Item*	Patients who answered 'Yes' (%)
Emotional subscale	
E3 Does your tinnitus make you angry?	15.3
E6 Do you complain a great deal about your tinnitus?	20.5
E10 Because of your tinnitus, do you feel frustrated?	29.4
E14 Because of your tinnitus, do you find that you are often irritable?	21.7
E16 Does your tinnitus make you upset?	28.7
E17 Do you feel that your tinnitus problem has placed stress on your relationships?	10.7
E21 Because of your tinnitus, do you feel depressed?	16.2
E22 Does your tinnitus make you feel anxious?	27.8
E25 Does your tinnitus make you feel insecure?	11.9
Functional subscale	
F1 Because of your tinnitus, is it difficult for you to concentrate?	13.8
F2 Does the loudness of your tinnitus make it difficult for you to hear people?	17.7
F4 Does your tinnitus make you feel confused?	15.9
F7 Because of your tinnitus, do you have trouble falling asleep at night?	24.2
F9 Does your tinnitus interfere with your ability to enjoy social activities?	8.6
F12 Does your tinnitus make it difficult for you to enjoy life?	12.8
F13 Does your tinnitus interfere with your job or household responsibilities?	13.5
F15 Because of your tinnitus, is it difficult for you to read?	7.3
F18 Do you find it difficult to focus your attention away from your tinnitus and on other things?	17.4
F20 Because of your tinnitus, do you often feel tired?	22.3
F24 Does your tinnitus get worse when you are under stress?	32.1
Catastrophic subscale	
C5 Because of your tinnitus, do you feel desperate?	18.7
C8 Do you feel as though you cannot escape your tinnitus?	45.3
C11 Because of your tinnitus, do you feel that you have a terrible disease?	24.8
C19 Do you feel that you have no control over your tinnitus?	53.2
C23 Do you feel that you can no longer cope with your tinnitus?	14.7

* Item describes the subscales (E: emotional, F: functional and C: catastrophic) and the question number as it appears in the THI questionnaire.

and 193 male (59%) patients. 264 (80.7%) patients were Chinese, 34 (10.4%) were Malay, 13 (4.0%) were Indian and 16 (4.9%) belonged to other ethnic groups. The tinnitus characteristics of the 327 patients attending the counselling clinic, in terms of the duration of tinnitus and whether the condition was bilateral or unilateral, are presented in Table I. 57 (17.4%) tinnitus patients had normal hearing limits, as evident in their audiograms. 200 (74%) of all the patients who presented with hearing loss had bilateral sensorineural high frequencies. Eight patients had conductive hearing loss, while the others had other types of hearing loss.

Patients were asked whether their tinnitus consisted of one sound or more than one type of sound. Most of the tinnitus patients (84.1%) perceived the same type of sound on all occasions, while others complained of hearing more than one type of sound on different occasions. The types of sound heard by most patients were subjectively described as high-pitched ringing sounds (described by 56.6% of patients). The other descriptions of tinnitus included sounds resembling that of insects or crickets, buzzing, hissing, ocean roaring, humming and others (Table I).

The percentages of patients who answered 'yes' to the various questions in the THI questionnaire are presented in Table II. The highest number of 'yes' responses were noted for the following two questions relating to the emotional subscale: "Because of your tinnitus, do you feel frustrated?" (29.4%) and "Does your tinnitus make you upset?" (28.7%). The highest number of 'yes' responses were noted for the following questions relating to the functional subscale: "Does your tinnitus get worse when you are under stress?" (32.1%) and "Because of your tinnitus, do you have trouble falling asleep at night?" (24.2%). The two questions with the highest number of 'yes' responses for the catastrophic subscale were: "Do you feel that you have no control over your tinnitus?" (53.2%) and "Do you feel as though you cannot escape your tinnitus?" (45.3%).

Of the 327 patients, 107 (33%) had no handicap from tinnitus, 100 (31%) had a mild handicap, 59 (18%) had a moderate handicap and 61 (19%) had a severe handicap. There was no difference in the THI overall handicap severity score between genders, those with or without hearing loss, and those with unilateral or

Table III. Comparison of the THI severity score and the subscale severity score between genders, the presence or absence of hearing loss, and tinnitus characteristics.

Parameter	Mean value ± SD	p-value
Total THI Score		
Gender		
Male (n = 193)	33.73 ± 25.11	0.40
Female (n = 134)	33.33 ± 23.29	
Hearing loss		
Hearing within normal limits (n = 57)	32.35 ± 23.12	0.67
Hearing loss present (n = 270)	32.82 ± 24.63	
No. of tinnitus sounds heard		
Only one type (n = 276)	30.66 ± 23.09	0.00
More than one type (n = 51)	49.29 ± 25.17	
Site of tinnitus		
Bilateral (n = 120)	34.72 ± 25.14	0.51
Unilateral, head or unsure (n = 207)	32.90 ± 23.91	
THI subscale – emotional		
Gender		
Male (n = 193)	11.85 ± 10.29	0.59
Female (n = 134)	12.46 ± 9.70	
Hearing loss		
Hearing within normal limits (n = 57)	11.65 ± 9.75	0.71
Hearing loss present (n = 270)	12.20 ± 10.12	
No. of tinnitus sounds heard		
Only one type (n = 276)	11.00 ± 9.63	0.00
More than one type (n = 51)	12.20 ± 10.22	
Site of tinnitus		
Bilateral (n = 120)	11.87 ± 10.09	0.75
Unilateral, head or unsure (n = 207)	12.24 ± 10.04	
THI subscale – functional		
Gender		
Male (n = 193)	13.22 ± 11.27	0.41
Female (n = 134)	12.21 ± 10.26	
Hearing loss		
Hearing within normal limits (n = 57)	11.65 ± 9.75	0.71
Hearing loss present (n = 270)	12.20 ± 10.12	
No. of tinnitus sounds heard		
Only one type (n = 276)	11.55 ± 10.16	0.00
More than one type (n = 51)	19.61 ± 12.08	
Site of tinnitus		
Bilateral (n = 120)	13.82 ± 11.11	0.20
Unilateral, head or unsure (n = 207)	12.21 ± 10.70	
THI subscale – catastrophic		
Gender		
Male (n = 193)	8.65 ± 5.74	0.88
Female (n = 134)	8.55 ± 5.56	
Hearing loss		
Hearing within normal limits (n = 57)	8.18 ± 5.19	0.52
Hearing loss present (n = 270)	8.70 ± 5.76	
No. of tinnitus sounds heard		
Only one type (n = 276)	8.08 ± 5.53	0.00
More than one type (n = 51)	11.61 ± 5.46	
Site of tinnitus		
Bilateral (n = 120)	8.95 ± 6.17	0.41
Others (n = 207)	8.42 ± 5.34	

THI:Tinnitus Handicap Inventory;SD: standard deviation

bilateral tinnitus (Table III). Similarly, no significant differences in the scores for each of the emotional,

functional or catastrophic subscales were noted for each of these variables. A significantly higher total THI as well as emotional, functional and catastrophic subscale scores were found among patients who heard more than one type of tinnitus sound compared to those who heard only one type of tinnitus sound (Table III).

Compared to patients with no handicap (THI score < 16), gender and hearing loss were not associated with an increased odds ratio for patients with mild (THI score 18–36), moderate (THI score 38–56) or severe (THI score > 58) handicap (Table IV). However, the adjusted odds ratio for those who heard more than one type of tinnitus sound compared to those who heard only one type of tinnitus sound increased from 2.51 (95% confidence interval [CI] 0.91, 6.93) for mild THI handicap to 3.91 (95% CI 1.36, 11.24) for moderate THI handicap, and 9.01 (95% CI 3.37, 24.11) for severe THI handicap.

Similarly, gender and hearing loss were not associated with an increase in total THI score, or an increase in the scores for the functional, emotional or catastrophic subscales. However, those who heard more than one type of tinnitus sound were more likely to have a higher total THI score (95% CI of adjusted β 11.57, 25.68), as well as higher scores for the emotional (95% CI of adjusted β 4.12, 9.97), functional (95% CI of adjusted β 4.95, 11.25) and catastrophic (95% CI of adjusted β 1.88, 5.20) subscales (Table V).

DISCUSSION

Population-based studies have reported that the prevalence of tinnitus increases during young adulthood and middle age, plateaus between 65 and 74 years of age, and then gradually declines.⁽¹⁹⁾ Several adult epidemiological and clinical studies have shown a positive relationship between tinnitus and hearing impairment, with high frequency hearing loss commonly seen in many tinnitus patients.^(2,20,21) However, a small group of tinnitus patients (7%–10%) have hearing thresholds within normal limits.^(22–24) A recent study conducted in China for 462 tinnitus sufferers reported 14% of the patients with a “normal audiogram” and 46% with high frequency loss.⁽²⁵⁾ Several studies have attempted to explain the origin of tinnitus among patients with normal hearing but have not been able to offer any conclusive explanations.⁽⁵⁾ Consistent with the abovementioned findings, 57 (17.4%) of our tinnitus patients had hearing within the normal limit (< 25 dBHL). The majority of our patients (n = 270; 82.6%) had hearing impairments, 200 (74%) of whom had bilateral high frequency hearing loss of 3,000–8,000 Hz.

Table IV. Crude and adjusted odds ratio for multiple logistic regression analysis comparing those with a THI score < 16 (i.e. no handicap) as a reference group vs. those with severe, moderate and mild THI handicap.

Variable	OR	Adjusted OR	95% CI of adjusted OR
THI score > 58: Severe (n = 61)			
Gender (male vs. female)	0.91	0.94	0.46, 1.91
Hearing loss (within normal vs. hearing loss)	1.02	0.80	0.31, 2.05
No. of sounds heard (one vs. multiple)	8.84	9.01	3.37, 24.11
THI score 38–56: Moderate (n = 59)			
Gender (male vs. female)	1.36	1.37	0.70, 2.66
Hearing loss (within normal vs. hearing loss)	0.98	0.94	0.38, 3.25
No. of sounds heard (one vs. multiple)	3.86	3.91	1.36, 11.24
THI score 18–36: Mild (n = 100)			
Gender (male vs. female)	1.27	1.21	0.69, 2.13
Hearing loss (within normal vs. hearing loss)	0.59	0.61	0.30, 1.24
No. of sounds heard (one vs. multiple)	2.52	2.31	0.91, 6.93

THI:Tinnitus Handicap Inventory; OR: odds ratio; CI: confidence interval

Table V. Multiple linear regression models for the total THI and the three subscales (functional, emotional and catastrophic) as dependent variables in 327 patients who attended the tinnitus counselling clinic.

Variable	Beta	Adjusted Beta	95% CI of adjusted Beta
Total THI ($R^2 = 0.078$)			
Gender (male vs. female)	-0.40	-0.58	-5.88, 4.72
Hearing loss (within normal vs. hearing loss)	1.47	0.58	-6.29, 7.45
No. of sounds heard (one vs. multiple)	18.64	18.62	11.57, 25.68
Functional Subscale ($R^2 = 0.075$)			
Gender (male vs. female)	-1.01	-1.17	-3.54, 1.19
Hearing loss (within normal vs. hearing loss)	0.30	-0.32	-3.39, 2.75
No. of sounds heard (one vs. multiple)	8.06	8.10	4.95, 11.25
Emotional Subscale ($R^2 = 0.066$)			
Gender (male vs. female)	0.61	0.57	-1.63, 2.76
Hearing loss (within normal vs. hearing loss)	0.55	0.41	-2.44, 3.26
No. of sounds heard (one vs. multiple)	7.08	7.05	4.12, 9.97
Catastrophic Subscale ($R^2 = 0.053$)			
Gender (male vs. female)	-0.10	-0.10	-1.34, 1.15
Hearing loss (within normal vs. hearing loss)	0.53	0.36	-1.26, 1.98
No. of sounds heard (one vs. multiple)	3.55	3.54	1.88, 5.20

THI:Tinnitus Handicap Inventory; CI: confidence interval

There were no significant differences in the handicap scores in our study between those with normal hearing and those with hearing loss with regard to the degree of handicap severity. A previous smaller study reported no statistically significant perceived tinnitus handicap ($p > 0.05$) for total THI and its subscales between subjects with normal hearing ($n = 25$) and those with hearing loss ($n = 38$).⁽¹⁷⁾ A study conducted in Brazil reported that 42 out of the 100 elderly (> 60 years old) tinnitus patients who presented at an ear, nose and throat (ENT) clinic expressed emotional distress when asked about the impact of tinnitus on their daily lives, and symmetrical hearing loss was found in 80% of the total sample. However, the authors did not find a correlation between hearing impairment and the degree of disturbance that these patients felt with regard to their tinnitus using a visual analog scale.⁽²⁶⁾

A total of 111 patients in our series experienced tinnitus in the left ear, while 73 patients had tinnitus in the right ear. This finding of unilateral tinnitus being more common in the left ear has been consistently reported in several other studies.^(2,10,27-30) An Asian series of patients reported from Korea, consisting of 167 patients seen at a medical centre, reported that 25.7% of the patients had tinnitus in the right ear, 34.1% in the left, 29.3% in both ears and 10.8% in the head.⁽⁸⁾ A plausible explanation for the preponderance of left-sided tinnitus has yet to be proposed. Nonetheless, the perceived localisation of the patient's tinnitus can potentially be of diagnostic significance, especially since unilateral tinnitus may be a symptom of an underlying acoustic neuroma.⁽³¹⁾

The prevalence of tinnitus appears to be similar in both genders.⁽⁵⁾ Our female patients had a slightly higher

mean THI score on the emotional subscale as compared to that of the male patients (12.46 vs. 11.85). However, on the functional subscale, male patients had a higher mean score compared to female patients (13.22 vs. 12.21). However, these differences are small and not statistically significant, and are therefore unlikely to be clinically significant.

It is not uncommon for tinnitus sufferers to perceive more than one type of tinnitus sound. An online Tinnitus Archive, comprising data for 1,630 adult patients who presented at a tinnitus clinic in the United States of America, found that 46.1% of the patients reported experiencing more than one sound.⁽³²⁾ The association between the severity and impact of tinnitus and the number of different types of tinnitus sounds heard has not previously been well documented. In a Swedish audiology clinic study of 87 tinnitus patients, 35 (40.2%) patients reported hearing "combined" sounds (a combination of tonal and buzzing tinnitus). The authors found that those who heard more than one sound had more concentration difficulties, irritability and sleep disturbance.⁽³⁰⁾ This finding was also noted in our study, where tinnitus patients who perceived more than one type of sound were more likely to suffer a more severe tinnitus handicap compared to those who perceived one type of sound.

In the THI questionnaire, item C19 ("Do you feel that you have no control over your tinnitus?") had the highest percentage of positive responses (53.2%) in our study. Three other THI studies reported similar results. In the first study, conducted by Newman et al, 63% of the 66 subjects had a positive response to this question, and the authors cited lack of control as a common feeling and one of "the most severe reactions to the tinnitus sensation".⁽¹⁷⁾ In the second study, 65% of the 80 consecutive tinnitus clinic patients had a positive response to this question.⁽³³⁾ In the third and most recent study,⁽³⁴⁾ the author reported that among 274 tinnitus patients seen at an ENT clinic, the mean score for question C19 was 2.78 and the SD was 0.97. This question had the most number of 'yes' responses across the no handicap (25.8%), mild handicap (56.7%), moderate handicap (71.6%) and severe handicap (83.4%) categories. The author agreed that experiencing a lack of control was a particularly severe response, which was significant enough to prompt people to seek help, even when their tinnitus did not have a particularly large impact on their overall life.⁽³⁴⁾

A Korean study of 167 patients presenting at a medical centre utilised a Korean translated THI. The authors observed that if the tinnitus patients have

catastrophic thoughts ("they cannot escape from tinnitus", "tinnitus is a terrible disease" or "they have no control over their tinnitus"), they may experience more emotional and functional distress, which leads to greater levels of anxiety and depression. This study also found that catastrophic thoughts are less likely to be associated with personality traits or the severity of the tinnitus (duration, subjective loudness, number of times tinnitus is experienced in a day).⁽⁸⁾ Findings from the published literature and the present study suggest that "loss of control" is an important factor in determining whether or not the tinnitus is intrusive. The management of such patients should address emotional problems related to frustration and feeling upset as well as functional difficulties such as stress and sleep problems. Directive counselling plays an important role in assisting such patients. This case series of tinnitus sufferers comprises patients who were referred for tinnitus counselling by ENT doctors, and they are thus not representative of those with tinnitus in the general population.

In conclusion, this study has shown that tinnitus sufferers who hear multiple sounds tend to have higher THI and subscale scores. At present, there are no set guidelines or indications for doctors to refer patients for tinnitus counselling. The THI may be a useful screening tool for this purpose, and repeated THI assessments can potentially be used to chart the progress of treatment.

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