Psychological and Audiological Profile of Tinnitus Patients

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Abstract

The interplay of personality traits, depressed mood and tinnitus severity is highly relevant to diagnosis and prognosis in tinnitus related handicap. The aim of this work was to assess a sample of patients with annoying tinnitus audiologically and psychologically to determine whether personality factors differ with different experiences of tinnitus. This study was conducted on forty patients of both sexes complaining of tinnitus. They were assessed audiologically using; Pure tone audiometry (PTA), Transient evoked otoacoustic emission (TEOAE), distortion product otoacoustic emission (DPOAE) and were administered the Tinnitus Handicap Inventory (THI). Psychological assessment included two self assessment questionnaires: SCIDII Personality test and Middle sex psychological test. TEOAE were abnormal in 9.8% of control group (CG), 29.34% of study group (SG-1) and 58.34% SG-2. DPOAE results were abnormal in 50% CG, 67.6% of SG-1, 89.9% of SG-2 and 92.4% of SG-3. THI scores were not correlated with age, gender, duration or level of hearing loss. Obsession and antisocial personality were significantly related to THI. There was a weak significant negative statistical relationship between Depression and THI. A negative statistical correlation between DPOAE, TEOAE and THI was found. On the SCID-II Personality test, 30% of the sample (12 persons) completed the criteria for the Narcissistic Personality Disorder and also 30% (12 persons) completed the criteria for Borderline Personality Disorder. On the Middle Sex test the most frequent significant symptoms were Depression and Obsession, 17.5% of the sample. Given that this is a preliminary study of the psychological profile of Egyptian patients with tinnitus, multicenter research is needed for better understanding of the psychology of those patients.

Key Words: Tinnitus – Personality traits – Tinnitus handicap inventory – TEOAE – DPOAE – SCIDII personality test – Middle sex test.

Introduction

TINNITUS is the perception of sound that seems to originate in the head or in the ears. This term is derived from the Latin word tinnire meaning “to ring” [1].

Subjective tinnitus refers to sound perception that occurs in the absence of an external stimulus. It is a complex phenomenon, has many causes and is related to biological and psychological components. According to Jasterboff and Kaltenbach, this symptom is generally related to noise exposure, aging and hearing loss, but it can occur in normal hearing people [2].

The existing confusion between the different modes of generation of tinnitus does not permit the application of a particular etiological therapeutic method. However, it is known that the personality characteristics of the patients are strongly related to emotional reaction toward the symptom and the coping styles. As well as to the effectiveness of techniques used to fight tinnitus [3].

The subjective assessment of tinnitus intensity has been shown to be related to the beliefs of the patient concerning the nature of the symptom and to the presence of anxiety, depression or somatoform disorder and other emotional conditions of the patient at the time of onset of tinnitus [4].

These factors might explain the difference between annoying and tolerable tinnitus. Patients who think that their tinnitus is the first symptom of a psychiatric disease or a brain tumor assess the intensity of tinnitus as more loud [5].

Despite the varying etiologies and experiences associated with tinnitus, it is a percept and thus may be supposed to depend on two components: first, the necessary physiological or pathological conditions to provide a stimulus to the auditory cortex, and second the personal tendency to report a sound as present [6].

Personality reflects both underlying physiological and physical states and overt behavior, and has been shown to be a pervasive influence in people’s lives. It has been linked with tinnitus in clinical groups, where presence and degrees of tinnitus have been associated with higher anxiety, depression and neuroticism [7].
Given that tinnitus is a perceptual experience, and that personality may influence it, increased understanding of the association between the two is of interest. Therefore, in this study a sample of patients with annoying tinnitus were assessed audiologically and psychologically to determine whether personality factors differ with different experiences of tinnitus.

**Patients and Methods**

The study group (SG) included forty patients who had presented to the Audiology Unit Cairo University from March 2008 to October 2008, reporting tinnitus as their primary complaint. Twenty-three were females and seventeen were males, their ages ranged from 20 to 64 years with a mean of 40.60 years (±13.34).

All participants had experienced tinnitus for at least 3 months up to 15 years with an average of 3.78 years (±3.66). Fourteen patients had bilateral tinnitus and twenty-six had unilateral tinnitus (14 left and 12 right ears).

Some of the patients suffered of a variety of audiological disorders: 6 patients had ototoxic hearing loss, 6 had hearing loss due to noise exposure, 5 suffered of endolymphatic hydrops, 4 patients had otosclerosis, 3 patients had hearing loss due to presbyacusis, 3 had chronic suppurative otitis media and one patient had autoimmune hearing loss. No restriction was imposed on the level of hearing.

The control group (CG) consisted of 10 adult volunteers selected from subjects accompanying patients attending to the audiology clinic. Their mean age was 33.9 ± 8.9 years. They were selected to match patients in age and gender.

The procedure of audiologic and psychological assessment was explained to every patient and an informed consent was taken.

All patients were subjected to the following:

1. Full history taking.
2. Otoscopic examination.
3. Audiologic assessment was performed and consisted of: a) pure tone audiometry (PTA) for octave frequencies between 0.25-8 KHz for air conduction and 0.5-4 KHz for bone conduction testing. Hearing thresholds for conventional PTA at any frequency above 25 dBHL was considered as hearing loss. b) Tympanometry was conducted and acoustic reflex threshold measurement was elicited contra laterally at frequencies 0.5, 1, 2 and 4 KHz. C) Transient evoked otoacoustic emission (TEOAE) was performed using the standard technique; non-linear click at an intensity of 80dBsPL (for patients with an average PTA threshold of 30 dBHL or better and type A tympanogram) Analysis of TEOAE results was performed according to 2 parameters: the overall echo level in dB SPL and the whole reproducibility percent. d) Distortion product otoacoustic emission (DPOAE) was conducted using two pure tone stimuli; F 1 and F2 (F2/F1 ratio=1.22). Intensity levels for the 2 primaries was about 75 dB SPL. Measurements were done at 1, 2, 4 and 6 KHz F2 frequencies. DPOAE amplitude was measured at 2F1-F2 and plotted with respect to the frequency of the second primary (done for patients with an average PTA threshold of 45dHL or better and type A tympanogram).

The equipment used in this study included: Sound treated room (Amplisilence Model E), Pure tone audiometer Madsen, Denmark (Model Orbiter 922), Immittancemeter (GSI model 33) and Otoacoustic emission otodynamic analyzer (ILO 96).

4. To evaluate the impact of tinnitus on daily life, the tinnitus handicap inventory (THI) [8,9] was administered to the study group. THI measures the impact of tinnitus on daily life. It is composed of 25 questions and the scores can vary between 0 and 100. Handicap severity categories for THI were: *No handicap: scoring range of 0-16 in the total THI. *Mild handicap: scoring 18-36. *Moderate handicap: scoring 38-56. While in *severe handicap: the score ranges between 58 and 100 of the total THI score.

5. Psychometric Testing.

Psychometric measurements were carried out for the study group using the Arabic version of two self assessment questionnaires.

**SCID-II Test:**

The Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II) [10], determines whether criteria are met for the 10 DSM-IV Axis II personality disorders which are (Avoidant personality, Dependant personality, Obsessive personality, Paranoid, Schizotypal, Schizoid, Hysterionic, Narcistic, Borderline and Antisocial personality). As well as depressive personality disorder and passive-aggressive personality disorder (included as criteria sets in an appendix to DSM-IV). This test includes 119 questions. Rating for the personality disorders can be scored both categorically (i.e., presence or absence of each personality disorder based on whether the required minimum
number of criteria has been met) and dimensionally (i.e., by noting the number of personality disorder criteria that are present). In the current study the results of SCID-II [11] were interpreted in categorical manner.

Middle Sex Test:
The test provides rapid screening of neurotic disorders. It includes 48 questions and gives scores on six categories of neurotic disorders including: Hysteria, Depression, Psychosomatic, Obsession, Phobia, and Anxiety.

6- Statistical analysis:
Data was coded and entered using the standard package SPSS version 15. Data was summarized using mean, standard deviation and range for quantitative variables and percent for qualitative variables. Comparison between groups was done using Chi -square test for qualitative variables and non parametrical tests (Kruskal-Wallis and Mann-Whitney test) for quantitative variables. Correlations were done to test for linear relations between qualitative variables. *p value<0.05 was considered as statistically significant.

Results
*Pure tone audiometry performed for the study group (SG) 40 patients revealed that 12 patients had normal hearing (SG-1), 11 had mild hearing loss (SG-2), 10 with moderate hearing loss (SG-3), 2 with moderately severe hearing loss, 4 with severe hearing loss and only one patient suffered of profound hearing loss.

The mean pure tone average of (500- 4000 Hz) in the right ear was 37.10±23.21 and for the left ear the mean was 37.00±21.07. Ranging from (10–112 dB).

Mean pure tone average for the control group, 10 patients (20 ears) was 17.25±7.86.

*Transient Evoked Otoacoustic Emission (TEOAE): was performed for ears with PTA average of 30dBHL or better and type A tympanogram they were 23 patients (SG) and 10 patients (CG). The whole reproducibility % and response in dB-SPL were measured in normal patients with tinnitus and those suffering of mild hearing loss and tinnitus as shown in Table (1).

TEOAE was considered to be present if the whole reproducibility percent was ≥ 50% [12]. The mean TEOAE results were abnormal in patients with mild hearing loss and tinnitus. The abnormal TEOAE were present for the 4000 and 5000 Hz frequencies mostly. Mann Whitney nonparametric test showed that there was a statistically significant difference (*p<0.05) between TEOAE reproducibility in the 3 groups.

<table>
<thead>
<tr>
<th>Test</th>
<th>Control group (N=10)</th>
<th>Normal hearing &amp; Tinnitus (N=12)</th>
<th>Mild hearing loss &amp; Tinnitus (N=11)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>90.2%</td>
<td>70.66%</td>
<td>41.66%</td>
<td>p=0.04</td>
</tr>
<tr>
<td>Absent</td>
<td>9.8%</td>
<td>29.34%</td>
<td>58.34%</td>
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</tbody>
</table>

*Distortion Product Otoacoustic Emission (DPOAE): Was performed for patients with a pure tone average of 45 dB or better and Type A tympanogram, they were 33 patients (SG) and 10 subjects (CG). Amplitude and signal to noise ratio were measured for (1,2,4 & 6 KHz).

The emission was considered to be present if the amplitude was > 0 dB above the level of the corresponding noise floor + 2 SD, (Table 2).

<table>
<thead>
<tr>
<th>Test</th>
<th>Control group (N=10)</th>
<th>Normal hearing &amp; Tinnitus (SG-1) (N=12)</th>
<th>Mild hearing loss &amp; Tinnitus (SG-2) (N=11)</th>
<th>Moderate hearing loss &amp; Tinnitus (SG-3) (N=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>50.00%</td>
<td>32.40%</td>
<td>10.10%</td>
<td>7.58%</td>
</tr>
<tr>
<td>Absent</td>
<td>50.00%</td>
<td>67.6%</td>
<td>89.9%</td>
<td>92.42%</td>
</tr>
</tbody>
</table>

Mann Whitney nonparametric test showed that the mean baseline DPOAE levels were significantly different (*p<0.05) between study and control group and between normal and moderate hearing losses (*p=0.02) and between mild and moderate hearing losses (*p=0.04) in the study group mostly at 4 & 6 KHz.

Pearson’s correlation coefficient was used to evaluate the degree of agreement between TEOAE and DPOAE in the tested frequencies (1, 2 & 4 KHz) in cases of mild hearing loss. Significant correlation between the results of the two tests was present (*p=0.001, 0.03 & 0.04 respectively).

There was also negative significant relationship between PTA average and TEOAE reproducibility % averages (*p=0.00) and PTA average and amplitude of DPOAE (*p=0.22).
Tinnitus Handicap Inventory (THI) scores done for the study group showed the following results: 16 patients (40%) reported mild tinnitus, 11 patients (11%) had moderate tinnitus and 13 patients (32.5%) had severe tinnitus.

There was significant statistical relationship between THI scores and Obsession in the Middle Sex Test \((p=0.03)\) and with the Antisocial personality in the SCIDII Test \((p=0.02)\).

A significant negative correlation was found between THI scores and TEOAE reproducibility \((p=0.48, r=0.383)\) and with the amplitude of DPOAE \((p=0.52, r=0.364)\). THI was not significantly correlated with the gender or age of the patient, nor was correlated to the duration of hearing loss or the level of hearing.

Psychological assessment. SCID personality test results:

On the SCID-II Personality test, 30% of the sample (12 persons) completed the criteria for the Narcissistic Personality Disorder and also 30% (12 persons) completed the criteria for Borderline Personality Disorder.

A significant negative relationship \((p=0.18)\) was found between Dependant personality and duration of hearing loss. A significant relationship was also found between Paranoid personality and the laterality of tinnitus \((p=0.27)\) being higher when tinnitus was found in both ears.

Middle sex test results:

On the Middle Sex test the most frequent significant symptoms were Depression and Obsession, 17.5% of the sample.

Depression subtest showed a weak significant negative correlation with THI \((p=0.06)\).

There was a significant negative correlation between age and anxiety \((p=0.15)\). Mann Whitney nonparametric test showed a weak statistical significant \((p=0.07)\) relationship between Phobia and gender being higher in females.

The highest probability in this sample was found between Anxiety and Depression \((p=0.00)\).

Discussion

In this study TEOAE and DPOAE were chosen to verify cochlear dysfunction in patients with normal hearing and tinnitus and those with hearing loss and tinnitus, as they are the most commonly used OAE tests in clinical practice. They also have more standardized methodology [13,14].

In the present study, we found altered TEOAE results in 29.34% in patients with normal hearing and tinnitus, 58.34% in tinnitus patients with mild hearing loss and 9.8% in CG (Table 1). Granjerio et al. [15] found altered TEOAE in 70.20% in normal hearers with tinnitus and 16.1% in normal hearers without tinnitus. The disagreement in the results may be due to the difference in the number of patients in the two studies being 12 in our study and 57 in the latter study. Harrison and Norton [16] however, found normal TEOAE in 97% to 100% in normal hearing people without tinnitus.

As regards DPOAE results, the test was normal in 32.4% of normal hearers with tinnitus, 10.10% of patients with mild hearing loss and tinnitus, 7.58% of moderate hearing loss and tinnitus and 50% in CG (Table 2). DPOAE levels were significant \((p<0.05)\) between patients with tinnitus and reduced hearing, patients with tinnitus and normal hearing and patients with normal hearing and no tinnitus. Same results were reached by Ami et al. [1].

Outer hair cell dysfunction detected by TEOAE and DPOAE are not sufficient to cause tinnitus. Yet, normal hearing people with tinnitus have more abnormal results of TEOAE and DPOAE than normal hearing people without tinnitus. In some patients, levels of dysfunction not detectable by OAEs may be sufficient to trigger tinnitus. In others, levels of dysfunction may not be sufficient to cause the symptoms. Jasterboff [18] states that all levels of the auditory pathways may be involved in the production of tinnitus, but the trigger is most likely at the OHC level, in the majority of cases.

The highest percentage of abnormality was found at 4000 & 5000 Hz in the SG tested with TEOAE, these results are in agreement with other authors [15,17] who reported altered TEOAE in tinnitus patients with hearing loss mainly for frequencies above 2000 Hz. The DPOAE results were mostly altered at 4000 & 6000 KHz since most of the study group had downward sloping audiograms at the high frequencies.

Pearson’s correlation coefficient revealed significant correlation between TEOAE & DPOAE that is to say, when TEOAE results are altered, DPOAE results will be altered and vice versa. This is in agreement with the work of Granjeiro et al. [15] and Gorga et al. [13].
The duration of hearing loss and the level of hearing have not proved to be an important factor regarding the subjective assessment of tinnitus as shown by the insignificant correlation of THI and duration and the level of hearing (average PTA thresholds). Same conclusion was reached by Vallianatou et al. [3] who suggested that, the psychological factors are more important than the organic factors. This was further supported by the literature on suppressing tinnitus with behavioral therapy [19]. However, a negative significant relationship was found between THI and TEOAE, DPOAE results suggesting that a lower THI score will be more commonly found with functioning OHCs.

Depression subtest in the Middle Sex, Test showed a weak significant negative correlation with THI, this could be explained by the less need to express by somatic symptoms when the depressive score is increasing.

On the Middle Sex test the most frequent significant symptoms were Depression and Obsession, 17.5% of the sample. This finding is consistent with the prevalence of depression in the community (3-17% lifetime prevalence of depression in the USA according to National Comorbidity Survey) [20]. These findings are consistent with the findings of other authors [3,21,22]. Who found that depression often occurs together with tinnitus and frequently augments functional disability in individuals with tinnitus.

Vallianatou et al. [3], who studied tinnitus patients in the island of Crete, found that certain tinnitus patients in their study were less depressed than tinnitus patients who were studied in England, France, Sweden and the United States. They thought that this might be attributable to the interplay of geographical, climatological, economic, social and cultural factors. The importance of climate in physical and mental disorders is evident by the renewed interest in climatotherapy. As for sunshine, it is well known that light exposure elevates mood (phototherapy for depression) by influencing the daily melatonin rhythm.

The presence of depressive symptoms also indicated the presence of anxiety conditions \( p=0.00 \). This was consistent with the hypothesis of a learned helplessness syndrome. An individual subjected to a potentially threatening stimulus (tinnitus in this case) reacts by increasing his/her arousal to resolve the threat [22].

On the other hand, the prevalence of obsession in our sample is much higher than the lifetime prevalence in the community; this may reflect the preoccupation with tinnitus and fear from somatic disease as a possible way of coping with tinnitus in our sample.

On the SCID-II Personality test, 30% of the sample (12 persons) completed the criteria for the Narcissistic Personality Disorder and also 30% (12 persons) completed the criteria for Borderline Personality Disorder. Both types of personality disorders are in the cluster B of the DSM-IV personality section, characterized by dramatic and emotional instability.

A significant negative correlation was found between patient’s age and anxiety \( p=0.15 \) in the present study. This is in agreement with the results of Langguth et al. [21]. Phobia (anxiety) was higher in women than in men in the present study. This finding is consistent with the prevalence of phobia in the community being 2-3 times higher in females than in males [20]. In a study conducted by Langguth et al. [21], they reported strong correlation between Neuroticism (anxiety) and female gender in tinnitus patients.

On the other hand, Valliantou et al. [3], David and Patrick [6] reported men with tinnitus to show higher scores of depressed mood, hysteria and psychosomatic symptoms in comparison with women. A possible explanation for this finding could be the limited emotional expression regarding organic symptoms which is usually used by men.

One of the difficulties we encountered during this study was that a large number of patients were illiterate and needed assistance completing the questionnaires which were also time consuming.

We can conclude that, additional research is needed to determine the value of routine OAE testing of normal hearing patients with tinnitus and its potential benefit on the clinical outcome of those patients. If a patient reports a high THI, the otolaryngologist should investigate the diagnosis in depth with psychological tests and if necessary, a psychiatric consultation.

Given that there is little in the literature known about the psychological profile of Egyptian patients with tinnitus, multicenter research is needed in this area on a larger number of patients. To help better understand the coping style of each patient and assist in applying the therapeutic intervention and suppression methods suitable for each individual.
References


