The Evaluation of Beck Anxiety Scale, Voice Handicap Index, and Brief Symptom Inventory on Treatment of Patients With Vocal Fold Nodules

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SUMMARY: Introduction. Vocal fold nodules are benign lesions that cause hoarseness in all age groups including children, adolescents, and adults. These nodules may be caused either by singing or other causes of tension in vocal activity.

Objective. The aim of this study was to evaluate the psychological symptoms of adult patients with hoarseness and to investigate the relationship in psychological symptoms before and after voice therapy.

Methods. 23 Patients who were admitted with a voice complaint and diagnosed with vocal fold nodules and a matched control group were evaluated. Two inventories recommended by our psychiatrist (The Beck Anxiety Inventory, Brief Symptom Inventory) and Voice Handicap Index-10 (VHI-10), were completed to evaluate the treatment outcomes and psychosocial properties of the patients before and after voice therapy.

Results. A significant difference was observed in the BAI and BSI scores between the nodule (+) group and the control group at the beginning of the study, before voice therapy. A significant difference was found between the mean scores on the BAI and the BSI before and after therapy in the vocal fold nodules group.

Conclusion. Patients with vocal fold nodules should be evaluated more extensively using psychological assessment scales, such as the BSI, and a psychiatric consultation should be added in cases of abnormal findings.

Keywords: Vocal fold nodules−Voice therapy−VHI-10−BSI−BAI.

INTRODUCTION

Vocal fold nodules are benign lesions following persistent voice misuse especially habitual hard onsets of the voice. They are usually double sided and often symmetrical. The prevalence of vocal fold nodules among patients in the general population is between 0.5%−1.3%, while it is 15% −35% among all benign laryngeal pathologies.[1] The nodules are located at the midpoint of the membranous portion of the vocal folds. This area is the most exposed region to trauma or impact stress in the vocal folds. Nodules are more common in singers and high-pitched speakers. Vocal fold nodules are considered to be closely related to excessive and unbalanced use or abuse of muscle forces as a result of vocal hyperfunction.[2] In addition to occupational factors, internal impulses are important in nodule formation.[3] Usually there is no single reason for misuse and abuse of the voice.[4] Factors affecting the method of phonation such as emotional state, personality traits, and psychological characteristics might contribute to the development of vocal nodules.[5]

The effects of psychological characteristics on voice have been investigated in many studies. [6,7,8] Researchers initially attempted to relate perceptual and auditory assessments of voice with personality traits, such as anxiety, neurotic predisposition, and an introverted or extroverted personality. Some of the perceptual parameters were found to be related to personality. [6] Subsequently, organic and nonorganic voice disorders and the relationship between these diseases and emotional factors became an interesting topic of studies. Vocal fold nodules are among one of the most studied subjects in this context.

People with vocal fold nodules have been observed in clinical and research settings to be chatty, socially aggressive, tense, anxious, irritable, or depressive. [6,7,8] Various studies have reported a close relationship between a hostile attitude and aggressiv`e vocal behavior leading to vocal nodules formation. [9-10] A number of studies reviewing the associations between vocal expressions of emotions and acoustic profiles found that acoustic properties of voice convey different emotions. [11,12,13] A change in the acoustic parameters could be expected while expressing a feeling. If someone is angry or anxious, talking with a higher pitch provides a clue. The acoustic output becomes greater with sound intensity. Sound intensity increases the amplitude of the vocal fold vibration and causes large vibrations in the vocal fold mucosa.[14,15] Thus, chronic stress should be taken

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Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical standards: A clinical prospective observational study was conducted after obtaining approval from Karadeniz Technical University Faculty of medicine Ethics committee (2018/300).

Informed consent: Informed consent was obtained from all individual participants included in the study.

Authors confirm that there is no author identifying information anywhere in the blinded manuscript.

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into consideration as one of the underlying conditions in the development of pathological voice disorders such as nodules and polyps. The relationship of the psychological factors and vocal fold nodules is an important subject which deserves attention.

OBJECTIVE

The aim of this study was to evaluate the psychological characteristics of adult patients with vocal fold nodules and to investigate the changes in these characteristics that occur following voice therapy. We hypothesized that patients with vocal nodules would have higher levels of anxiety which would decrease after voice therapy.

METHODS

A clinical prospective observational study was conducted after obtaining approval from the ethics committee (2018/300).

Patient selection: The individuals who applied to the otorhinolaryngology department between May 2018 and May 2019 and diagnosed with vocal fold nodules were recruited. The exclusion criteria for this study included age < 18 years, co-existence of an additional laryngeal pathology, history of a previous laryngeal surgery, and presence of any lifetime neuropsychiatric conditions diagnosed by a medical profession that can potentially decline cognitive functions and interfere with patient's adaptation to voice therapy. Information regarding the purpose and methods of the study was provided to the patients who were eligible for the study. Twenty-three patients, aged 18−60 years, were included. Sex- and age-matched patients who were referred to our outpatient clinic during the same time period with complaints other than hoarseness were included in the control group on a voluntary basis. Written informed consent was obtained from all individuals.

In addition to a brief sociodemographic questionnaire, self-reported inventories were administered for the assessment of psychological characteristics and voice-related concerns. All of the questionnaires have been completed both at the baseline and following voice therapy in study group while in the control group, only psychological questionnaires have been administered at the baseline. Details of each assessment tool are given below.

Brief Symptom Inventory (BSI)

The BSI is a multidimensional brief psychological self-report scale to discriminate distressed and undistressed groups by measuring stress-related psychological symptoms. It is a quick and effective way of evaluating these psychological characteristics is BSI which is a short form of Symptom Check List (SCL-90). It has a 5-point Likert-type scale consisting of 53 items and covering nine symptom dimensions: somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. [16] The total score varies between 0 and 212 with no cut-off values. Higher scores indicate higher frequency of the individual symptoms. The Turkish validity and reliability of the BSI has been reported by Şahin et al.[17] (appendix 1)

Beck Anxiety Inventory (BAI)

The BAI measures only the frequency of anxiety symptoms in detail. It is a Likert-type self-assessment scale comprised of 21 items scored between 0 and 3. The higher the total score, the higher the anxiety experienced by the person (minimal: 0−7, mild: 8−15, moderate:16−25, and severe: 26−63 points). [18] The Turkish validity and reliability of the BSI has been reported by Ulusoy et al.[19] (appendix 2)

Voice Handicap Index-10 (VHI-10)

The VHI-10 is a self-administered questionnaire consisting of 10 items to quantify patients' perception of their voice handicap. It is a shortened version of the Voice Handicap Index, developed by Jacobson et al. with a high correlation. [20] It has a 5-point Likert-type scale ranging from 0 (never) to 4 (always). It evaluates three domains with four items on the emotional, three items on the physical, and three items on the functional subscales. Higher scores on the VHI-10 are indicative of a greater voice handicap The Turkish validity and reliability of the VHI-10 has been reported by Kılıç et al. [21](appendix 3).

Voice therapy sessions

A therapy modification experienced by a quarter-century practice has been used at Ege University Medical Faculty Voice Clinic. The session details are explained below.

First session: after the questionnaires were completed, information about vocal hygiene was explained to the patients, such as drinking enough water, avoiding vocal abuse, and staying away from noisy places. Relaxation training was given to the patients during the first session of voice therapy. The relaxation exercises consisted of four items:

1- Neck relaxation exercise: the patient is placed upright but without contraction. The neck is calmly tilted forward and a full circle is drawn. This should be done within 1 min. The same movement is applied starting from the opposite direction. It should be repeated in four sets of 2 min/day (timeline can be described as morning, lunch, dinner, and bedtime)
2- Stretching exercise: Exaggerated opening and closing of the mouth as if stretching. It should be repeated in four sets of 2 min/day.
3- Chewing movement: exaggerated chewing movement is performed as if there is a big bite between the teeth in the back of the mouth. Ten times on the right side and 10 times on the left side.
4- Breathing exercise: Inhale a deep breath from the nose and exhale through the mouth slowly. Four sets of 10 min/day. The patient is invited to a second session 1 week later.

TABLE 1.
Patient Demographic Characteristics

Demographic Features	Nodule Group	Control group	Statistical results
age (x̄±SD)	41.39 (± 7.86)	38.69 (±8.16)	t=0.111, $P>0.05$
Sex	n (%)	n (%)	$X^2=0.000$ $P>0.05$
female	12 (52.17)	12 (52.17)	
male	11 (47.83)	11 (47.83)	
Occupation	n (%)	n (%)	$X^{2=}0.090$ $P>0.05$
Risk of voice abuse	14 (60.86)	10 (43.47)	
no risk of voice abuse	9 (39.14)	13 (56.53)	

Second session: The second step is dedicated to therapy to catch the normal lip resonance of the /föf/, /sös/, /söm/, /möm/ sounds. Each exercise lasts about 2 min. The patient is invited to a third session 2 weeks later.

Third session: Normal nasal resonance of the /mum/ /mu/, /u/ sounds is developed. Each exercise lasts about 2 min. If the patient cannot perform the previous session exercises, the new session should not be performed. The patient is invited to a fourth session 1 week later.

Fourth session: Normal resonance of the /u/ sound is developed. The resonance of the sound and the vibration should be felt around the lips. The patient must make this sound at the lowest pitch possible. The /u/ sound is practiced in different pitches. Each exercise lasts about 2 min. If the patient cannot perform the previous session exercises, the new session should not be completed. The patient is invited to the next session[1].

Fifth session: The resonant phonation is transferred to other vowels based on the /u/ sound. After finding the targeted voice, resonant phonation is transferred into conversation. The patient is invited to a sixth session 1 week later.

Sixth session: The voice exercises were completed and the targeted voice was found. Daily conversations were studied, the BAI, the BSI, and the VHI-10 were re-administered to the patients. The sessions were concluded.

Statistical analysis

The statistical analysis was performed using IBM SPSS version 22 software (IBM Corp., Armonk, NY, USA). The suitability of the variables to a normal distribution was analyzed with the Kolmogorov–Smirnov and Shapiro–Wilk tests. Descriptive analyses were performed using mean and standard deviation values. Student's *t* test was used to compare the mean distribution of the parameters (assuming a parametric test). The Mann–Whitney *U*-test was used for continuous variables that did not fit a normal distribution. The chi-square test was used to compare categorical variables (sex, educational background, and occupational risk groups). The paired Student's *t* test and Wilcoxon test for nonparametric data were used to compare the differences between the mean scores of BAI, BSI, and VHI-10 of the groups (dependent groups) before and after voice therapy in the cases with vocal fold nodules. Spearmen's correlation analyses were carried out in order to investigate the relationship of VHI-10 with both BAI and BSI scores. A *P*-value < 0.05 was considered significant. The number of subjects to be included in this study was calculated with the OpenEpi program assuming a Type II error level of 20%. Based on the difference between the average of the VHI (before and after voice therapy) the power analysis performed by OpenEpi program was 100% indicating that the power of the study was high.

RESULTS

The study group consisted of 23 patients with vocal fold nodules and 23 age and sex matched controls. The ages of the patients in the control group ranged from 25 to 58 years, with a mean age of 38.69 (±8.16) years. The age of the patients in the vocal fold nodule group ranged from 27 to 57 years with a mean age of 41.39 (±7.86) years. Demographic characteristics were summarized in Table 1.

The baseline BSI total scores were significantly higher in vocal nodule group compared to that of control group (58.57±12.40 and 45.57±6.90, respectively; $P= 0.00$). However, a significant difference was only found in anxiety, hostility, and phobic anxiety subscales of BSI between these 2 groups ($P< 0.01$ for all). Similarly, the baseline BAI scores were also significantly higher in vocal nodule group compared to that of control group (16.26 ±7.00 and 9.87±5.04, respectively; $P= 0.02$) (Table 2).

When the treatment outcomes of patient with vocal fold nodules measured with VHI-10, a statistically significant improvement was observed following voice therapy (17.26± 4.8 vs. 10.70±2.5, $P < 0.001$). In addition to the improvement in voice-related concerns, anxiety levels of the patients measured with BAI also decreased from moderate (16.26 ±7.00) to mild (10.87±5.32) ($P < 0.001$). BSI total scores was also significantly decreased following voice therapy ($P < 0.001$). However, a significant decrease has been observed for only hostility and phobic anxiety subscales of BSI ($P< 0.001$ and $P= 0.001$, respectively). Detailed comparisons for each subscale were summarized in Table 2.

[1] 1 week later

TABLE 2.
Comparison of Voice-related and Psychological Characteristics of Participants

Scales	Control group	Nodule group		*P*-value*	*P*- value**
		Pre-therapy	Post-therpay		
Voice Handicap Index-10		17.26±4.8	10.70±2.5		**< 0.001**[a]
Beck Anxiety Inventory	9.87±5.04	16.26 ±7.00	10.87±5.32	**0.02**	**< 0.001**[a]
Brief Symptom Inventory	45.57±6.90	58.57±12.40	50.9±10.7	**< 0.01**	**< 0.001**[b]
Somatization	*6.30±2.43*	*6.52 ±1.85*	*5.65± 1.74*	0.73	0.001
Obsession-Compulsion	*6.35±2.10*	*7.04±2.98*	*6.09±2.72*	0.75	0.004
Interpersonal sensitivity	*5.48 ± 1.78*	*5.30± 1.69*	*4.35± 1.58*	0.73	0.001
Depression	*4.78± 1.80*	*4.87± 1.96*	*4.43± 1.67*	0.87	0.039
Anxiety	*6.74±2.30*	*7.26±2.68*	*6.74±2.30*	**< 0.01**	0.192
Hostility	*6.30±2.05*	*11.52±2.37*	*9.83±2.44*	**< 0.01**	**< 0.001**
Phobic anxiety	*4.17± 1.61*	*6.22± 1.88*	*5.17± 1.64*	**< 0.01**	**0.001**
Paranoid ideation	*3.26± 1.68*	*3.52± 1.73*	*3.26± 1.68*	0.61	0.222
Psychotism	*3.57±2.37*	*3.74± 1.71*	*2.91± 1.50*	0.11	0.004
Additional	*1.80± 1.03*	*2.78± 1.65*	*1.83± 1.03*	0.72	0.003

[a] : using Wilcoxon test.
[b] : using paired Student *t* test.
P-value*: *P* values in control group and nodule group-before voice therapy- (Mann-Whitney *U* test).
P-value**: *P* values in before and after voice therapy- (Wilcoxon test).

VHI-10 scores showed a significant moderate correlation with BSI scores both before and after voice therapy (r= 0.441 with *P*= 0.035 and r = 0.458 with *P*= 0.024, respectively). No significant correlation was observed between VHI-10 scores and BAI scores neither before nor after therapy (Table 3).

DISCUSSION

Voice therapy is defined as the primary treatment in literature according to numerous authors and surgery is only needed when voice therapy fails.[22,23,24] There are many approaches for treating vocal fold nodules during voice therapy, including vocal hygiene, patient education, relaxation exercises, direct facilitation, and respiratory exercises.[25-26] The etiological mechanism should also be taken into consideration while planning the vocal fold nodule treatment.[22,27]

TABLE 3.
Spearman's Correlation of VHI-10 With BAI and BSI Scores Before and After Voice Therapy

		BAI (pre-therapy)	BSI (pre-therapy)
VHI-10 (pre-therapy)	r	0.231	0.441
	p	0.288	0.035*
		BAI (post-therapy)	**BSI (post-therapy)**
VHI-10 (post-therapy)	r	0.415	0.458
	p	0.050	0.024*

* $P < 0.05$.
BAI, Beck Anxiety Inventory; BSI, Brief Symptom Inventory; VHI-10: Voice Handicap Index-10 (VHI-10).

The most important etiological factors in the development of vocal fold nodules are phonotrauma and voice abuse. Various occupations, personality and psychological characteristics have been investigated when classifying the etiological factors of vocal abuse.[26] Several studies argued that emotions, personality traits, and psychological characteristics contribute to or are primary causes of voice. Due to a vicious cycle, voice disorders might lead to psychological problems as well.[5-7]

In this study, we investigated the relationship between vocal fold nodules and several psychological characteristics related to the emotional state of the patients and also the changes in these characteristics following voice therapy. As expected, patients with vocal fold nodules were found to have more psychological problems measured with BSI. They were also more anxious. Seifert et al reported that voice disorders are associated with psychological symptoms. The increase in psychogenically originating laryngeal muscle tension caused by psychological conflict, anxiety, and depression-suppressed emotional expression is thought to be a factor leading to the development of a functional voice disorder.[24]

It has been reported that patients with vocal fold nodules have more extroverted, aggressive, and hostile personality characteristics than patients with other voice disorders. Consistent with the literature, hostility and phobic anxiety subscales scores were both higher in the vocal nodule group and also showed improvement following voice therapy. Besides, the anxiety scores of the patients with vocal fold nodules were higher than those of the control group. Anxiety or depression is more common in patients with muscle tension dysphonia, paradoxical vocal fold movement disorder, and benign vocal fold lesions.[9,14] The inability to cope with anxiety and

psychological stress are very common factors, particularly in patients with vocal fold nodules. [9]

In our study, the anxiety scores measured by BAI and BSI-anxiety subscales decreased following voice therapy. Although a direct causal relationship could not be put forth, several mechanisms might well be argued in this process. First of all, improvement of voice quality following therapy helps the patients to express themselves in a better way leading to decreased anxiety in social communications. In addition to breaking of this vicious cycle between negative voice quality and anxiety, implementation of appropriate relaxation and breathing exercises might well be another factor reducing anxiety. [15] Similar to our findings, Misono et al showed that voice-related perceived control can be associated with adaptive emotional and behavioral responses, which appeared to facilitate symptom improvement. [28]

A close relationship has been reported between hostility and anxiety disorders.[9-10] In our study, the results also supported the hostility and anxiety hypothesis by providing significantly high results for hostility and anxiety, which are BSI-subscales. The authors usually try to distinguish vocal fold nodules from other voice disorders, such as functional dysphonias and other mass lesions. Aronson et al classified vocal fold nodules as a functional disorder and highlighted the role of psychological precursors and predisposition of personal factors. [6] They stated that patients with vocal fold nodules were "talkative, socially aggressive, tense, with acute or chronic personal problems, and hostile or depressive characteristics. Stein et al. reported increased anxiety levels and high extraversion in patients with vocal nodules. [29] Besides, it is known that many patients with anger attacks have high levels of anxiety. When anger and anxiety increase so does the pitch of voice. Various studies have reported that a hostile attitude leads to aggressive vocal behavior and may cause nodules to form. Although in this study we haven't assessed self-reported trait anger or presence of anxiety disorders in detail, the scores on the BSI-hostility subscale were higher than those in the control group in the present study which is consistent with the literature. The presence of a mutual relationship between anger and anxiety which have been discussed in literature might explain the significant decrease in BSI hostility subscale scores after voice therapy in patient with vocal fold nodules. [30-31]

Therefore, otorhinolaryngologists and phoniatricians who are interested in voice disorders need to understand the importance of psychological factors in patients with voice problems, recognize the clues, and communicate with mental health professionals in different disciplines to form a multidisciplinary team, provide appropriate guidance, and coordinate optimal patient care. Voice therapy and avoiding vocal abuse may not be enough per se.

Strength and Limitations

The lack of the use of specific questionnaires assessing the personality traits and anger level of the patients is a limitation of our study. Besides self-reported scales may have flaws in evaluation of psychological characteristics and more structured assessment are suggested in future studies. Other limitations for this study can be considered as the low number of patients and short terms of follow-up. However, the prospective design and the presence of a control group can be named as the strength of our study.

CONCLUSION

Anxiety and other stress related psychological characteristics should not be ignored since they might well contribute to the development of vocal fold nodules through a complex mechanism as the vicious cycle. Although the relationship of psychological problems with voice disorders have been studied, it remains controversial whether the relationship is the cause or a result or a co-occurring problem. Psychological evaluation and support, when necessary, will eliminate the deficiencies in the diagnosis and treatment of the problem and provide more satisfactory results.

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SUPPLEMENTARY DATA

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