ORIGINAL PAPER

ASSESSMENT OF VOICE DISORDERS IN PATIENTS WITH LARYNGEAL DISEASES

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Abstract

Aim: Subjective assessment of voice disorders using a standardized instrument called Voice Handicap Index (VHI) in patients with laryngeal diseases prior to and after treatment, at a time interval ranging from 1 to 6 months. Methods: A research-based, quantitative, prospective survey in patients with voice disorders followed up in an outpatient phoniatric departments. Identification and other data were collected using a self-designed questionnaire; the VHI (comprising a total of 30 questions) was used for assessing voice disorders. A paired t-test was used for statistical analysis of data prior to and after treatment. Results: A group of 15 respondents included 12 women (80%) and 3 men (20%); the mean age was 53.2 years (range, 23–79 years). In the total VHI score, a difference in condition before and after treatment was confirmed at significance levels of α = 0.05 and α = 0.01. Both prior to and after treatment, patients had the most severe difficulties in the physical domain. Conclusion: A statistically significant change in the perception of voice disorders before and after treatment was proven in our respondents. The VHI is a suitable instrument for determining the extent of voice disorders.

Key words: standardized VHI questionnaire, subjective voice disorders, treatment.

Introduction

A basic prerequisite for communication is the exchange of information in both verbal and nonverbal forms, representing one of the basic needs of human social life. This article is focused on verbal communication, that is, spoken language with voice as a necessary condition (Dršata et al., 2011, p. 20). Patients with laryngeal diseases must face a number of difficulties after treatment. These include organic or functional changes (surgical intervention to the vocal cords, partial or total laryngectomy, temporary or permanent loss of voice, tracheostomy, hoarseness) and chronic or acute difficulties (pain, secretional obstruction, voice rest). Their outcome is determined by the actual disease (acute, chronic), in case of tumors by their size and histological features (malignant, benign) and subsequent treatment. One of important factors affected by laryngeal diseases is voice. Voice changes are perceived by patient totally subjectively and this may be in contradiction to objective findings. The so-called Voice Handicap Index (VHI) was developed to express the extent of subjective difficulties in patients with voice disorders. The original English version was translated into many world languages; there is also an official, linguistically validated Czech version for application in clinical practice (Švec et al., 2009, p. 132). The last decade has been characterized by a tendency to objectivize problems related to diseases and subsequent treatment. A number of standardized questionnaires evaluating the quality of life were developed for that purpose, with the quality of life being monitored in medicine in terms of the impact of an individual’s disease on his/her physical and mental condition, way of life and feeling of life satisfaction (Atkinson, Atkinson, Smith, 2003, p. 486). The approach to evaluation of the quality of life in patients can be either objective or subjective. Most essential is the patient’s subjective assessment of how he/she perceives his/her health situation including his/her self-assertion in work, family and social
environments (Slováček, Slováčková, Jebavý, 2004, p. 30).

The VHI questionnaire allows quantification of subjective difficulties in patients with voice disorders and can be used for evaluating the effect of various types of treatment, impact of voice changes on the overall perception of the quality of life with various types of diseases, etc. (Lundström et al., 2009, p. 83; Staněk, 2012, p. 13; Merrill et al., 2013, p. 404).

**Aim**

The aims were to use the VHI to evaluate subjective difficulties in patients with laryngeal diseases prior to and after treatment, at a time interval ranging from 1 to 6 months, and to determine the domain (physical, functional, emotional) perceived as most problematic by patients prior to and after treatment.

**Methods**

**Sample**

The research-based, prospective survey took place from March to December 2012 in patients with long-term voice difficulties followed up in an outpatient phoniatric department of a regional hospital. All patients invited to the phoniatric department over the stated period for treatment of long-term voice disorders were approached. Out of 63 patients addressed, forty agreed to take part in the research. Those who did not achieve a total VHI score of 28 or more points prior to their treatment, that is, the mild level of voice difficulties according to Jacobson et al. (Table 1), were excluded. A total of 26 respondents were enrolled but not all of them completed the VHI questionnaire after treatment. Data necessary for evaluating voice disorders prior to and 1 to 6 months after treatment were obtained from 15 patients. With respect to the low number of respondents, we neither divided patients according to their basic diagnosis (benign/malignant tumor, other laryngeal diseases), nor considered whether they were subjected to surgical, conservative or combined treatment. No patients underwent partial or total laryngectomy.

**Data collection**

The VHI questionnaire, a standardized instrument for subjective evaluation of voice disorders in patients, was used for data collection. The VHI questionnaire contains 30 questions in three groups of 10 questions for physical, functional and emotional domains. Every question has five answer options – never (0 points) – almost never (1 point) – sometimes (2 points) – almost always (3 points) – always (4 points). The resulting total score reaches from 0 to 120 points and, together with scores in the individual domains (between 0 and 40), it numerically expresses the extent of the patient’s difficulties (Švec et al., 2009, p. 133). At present, no VHI normative data are available for the Czech population, but it is assumed that the results will be similar to those obtained in other developed countries. The total VHI score was assessed for mild, moderate and severe dysphonia according to an American study by Jacobson et al. (Table 1) (Jacobson et al., 1997, p. 69). Apart from subjective evaluation of voice difficulties, the study also included a phoniatric examination by a physician, and audio and video recordings of the vocal cords and voice.

A self-designed questionnaire was used for collecting identification and other data such as name, age, diagnosis, treatment, primary symptoms, smoking status and alcohol consumption.

<table>
<thead>
<tr>
<th>Voice difficulty levels</th>
<th>VHI domain</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>10.07 (1.99)</td>
<td>12.41 (1.38)</td>
<td>18.30 (1.50)</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>15.54 (1.97)</td>
<td>18.63 (1.37)</td>
<td>22.78 (1.48)</td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>8.08 (2.31)</td>
<td>13.33 (1.61)</td>
<td>20.30 (1.74)</td>
<td></td>
</tr>
<tr>
<td>VHI total</td>
<td>33.69 (5.60)</td>
<td>44.37 (3.88)</td>
<td>61.39 (4.21)</td>
<td></td>
</tr>
</tbody>
</table>

*Jacobson et al. (1997)

**Data analysis**

We used a paired t-test for statistical analysis of patients’ voice perception prior to and after treatment. Calculated values were compared with critical values at significance levels of $\alpha = 0.05$ and $\alpha = 0.01$. When assessing individual patients’ treatment, statistically significant (95% confidence interval based on a test-retest reliability of the questionnaire) were considered total score shifts by 18 or more points, and in individual domains (physical,
Results

The group of 15 respondents from whom complete data prior to and after treatment were obtained included 12 women (80%) and 3 men (20%); their mean age was 53.2 years (range, 23–79 years). Five respondents admitted smoking at the time of their visit to the phoniatic department, reporting an average number of 9.4 cigarettes a day. The remaining 10 respondents claimed that they had never smoked or had stopped smoking. No one reported frequent alcohol consumption; eleven (73%) drank occasionally and 4 (27%) respondents stated that they did not consume alcohol. Primary symptoms that brought them to the phoniatic department (in order of frequency) were hoarseness, pain and dyspnea.

Four patients were diagnosed with vocal cord polyps, three patients suffered from recurrent nerve palsy; Reinke’s edema was diagnosed in 2 patients and chorditis nodosa in 3 patients. Malignant vocal cord tumor was diagnosed in 2 patients and one patient was diagnosed with chronic laryngitis. Out of 15 patients, five received conservative treatment and 10 underwent a combination of surgical and conservative treatment.

The survey results are presented as tables and graphs in domains specified in the survey objectives. Voice difficulties in patients for whom data prior to and after treatment were obtained were classified using the total VHI scores as mild in 3 respondents, moderate in 2 respondents and severe in 10 respondents. At 1 to 6 months after treatment, voice difficulties were perceived as mild in 1 respondent, moderate in 2 respondents and severe in 2 respondents. Ten respondents showed a total score below 28, that is, mild voice difficulties according to Jacobson et al.

The greatest difficulties were encountered by respondents prior to and after treatment in the physical (P) domain, followed by the functional (F) and emotional (E) domains (Figure 1). In the physical domain, prior to their treatment, patients were mainly bothered by voice changes throughout day, other people asking what was wrong with their voice, and dry and creaky voice. After treatment, the major voice-related problems remained in the physical domain but to a lesser extent. In the functional domain prior to and after treatment, respondents most frequently indicated problems such as: “people have difficulty understanding me in a noisy room”, “my voice makes it difficult for people to hear me” and “my family has difficulty hearing me when I call them throughout the house”. After treatment, these changes appeared to a limited extent. Improvement after treatment was also noted in the last part of the VHI questionnaire, the emotional domain. There, prior to and after treatment, patients indicated as most bothering the following problems: “my voice problem upsets me”, “I am tense when talking to others because of my voice” and “people seem irritated with my voice”. For the total VHI score, statistical tests confirmed a difference in the condition before and after treatment at significance levels of $\alpha = 0.05$ and $\alpha = 0.01$ which may be considered highly statistically significant. Highly statistically significant differences were also found when evaluating individual VHI domains (P, F and E) at significance levels of $\alpha = 0.05$ and $\alpha = 0.01$. When evaluating the total VHI score, the calculated value $t = 6.5880$ was higher than the critical value for $\alpha = 0.05$ $t(\text{crit}) = 2.1448$ and even higher than the critical value for $\alpha = 0.01$ $t(\text{crit}) = 2.9768$. The calculated values were $t = 5.9732$ for VHI P, $t = 4.8317$ for VHI F and $t = 5.2821$ for VHI E. In all three areas, the calculated values were higher than the critical values for $\alpha = 0.05$ $t(\text{crit}) = 2.1448$ and even higher than the critical value for $\alpha = 0.01$ $t(\text{crit}) = 2.9768$ (Table 2). When evaluating treatment in various patients, statistically significant were changes in the total score by 18 or more points, and by 8 or more points in individual domains (P, F and E). In the present group of respondents, statistically significant differences in the total VHI scores caused by treatment were observed in 12 (80%) patients; in two (13%) patients, there was no statistically significant difference resulting from treatment, and in one respondent (7%), voice disorder worsened after treatment, as shown by the VHI. Statistically significant changes after treatment in individual respondents for the three domains (P, F and E) are specified in Table 2 section “differences prior to and after treatment”.
prior to their treatment, 3 respondents had subjective mild voice difficulties, 2 had moderate difficulties and 10 had severe problems. At 1 to 6 months after treatment, voice difficulties, based on the total VHI scores, were perceived as mild in 1 respondent, moderate in 2 respondents and severe in 2 respondents. The remaining 10 respondents indicated voice difficulties below a total score of 28 points, a threshold for mild by Jacobson et al. In a 2009/2010 study that took place in a phoniatic department of a regional hospital and used the same voice evaluation instrument in patients with benign laryngeal disease, data prior to and after treatment were obtained from only 8 patients out of 21 addressed respondents. Prior to treatment, 5 respondents had mild voice difficulties, 3 respondents had moderate difficulties and no one had severe difficulties. The level of voice problems after treatment was mild in 6 respondents; no one had moderate or severe difficulties. In two respondents, the total score was below 28, that is,
mild difficulties (Bernardová, 2010, p. 45). The present study showed a higher proportion of patients with severe voice difficulties although only 2 patients out of 15 were diagnosed with a malignant disease. Twenty-two respondents were included in a 2009/2010 study of patients with malignant laryngeal disease. Complete data prior to and after treatment were obtained from 9 respondents. In the study, the number of patients with a moderate level of voice difficulties changed from 5 to 6 after treatment. A mild level of voice difficulties was reported by the same number of patients prior to and after treatment. One respondent indicated severe voice difficulties prior to treatment; no respondent indicated severe difficulties after treatment (Fousková, 2010, p. 66-67). The perception of voice difficulties after treatment in respondents with malignant laryngeal disease increased in the category of moderate difficulties, while many patients perceived voice problems as more intensive after surgical intervention and additional limitations related to radiation therapy were perceived. In respondents after total laryngectomy, the post-operative period was connected with a total loss of voice and continuous adoption of alternative voice mechanisms. Although our population of patients included no cases of total or partial laryngectomy, two respondents diagnosed with malignant laryngeal disease reported severe voice difficulties prior to and after treatment. For clarity purposes, respondents’ voice difficulty levels prior to and after treatment in the above three studies are specified in Table 3.

### Table 3 Levels of voice difficulties prior to and after treatment

<table>
<thead>
<tr>
<th></th>
<th>The present population of respondents, N = 15</th>
<th>Bernardová’s population of respondents, N = 8</th>
<th>Fousková’s population of respondents, N = 9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prior to treatment</td>
<td>After treatment</td>
<td>Prior to treatment</td>
</tr>
<tr>
<td>Mild</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Moderate</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Severe</td>
<td>10</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

In the present survey, the greatest difficulties were encountered by respondents both prior to and after treatment in the physical domain, followed by the functional and emotional domains. Also Bernardová and Fousková arrived at the same conclusions in their studies. In the present survey, in the physical domain, both prior to and after treatment, patients were mainly bothered by voice changes throughout the day; in the functional domain, respondents most frequently indicated difficulties such as: “people have difficulty understanding me in a noisy room”; in the emotional domain, patients mainly stated “my voice problems upset me”. Also in Bernardová’s and Fousková’s studies, these responses were most frequently evaluated as most severe.

Statistical analysis with the paired t-test of the total VHI scores prior to and after treatment showed a statistically significant difference (level of significance α = 0.05) or even a highly statistically significant difference (level of significance α = 0.01) in the present group of respondents. Highly statistically significant differences were also calculated for individual VHI domains (P, F and E).

The results of a 2009 Swedish study by Lundström et al. give evidence of the importance of voice in the overall perception of the quality of life. Data were collected from 43 respondents after total laryngectomy. All respondents were at least 6 month after termination of treatment and 38 of them used tracheoesophageal fistulas for communication and 5 communicated using an electrolarynx. Subjective voice assessment using the VHI and evaluation of the quality of life using the standardized questionnaires EORTC QLQ-C30 (European Organization for Research and Treatment of Cancer Quality of Life Questionnaire C30) and EORTC QLQ-H&N35 (European Organization for Research and Treatment of Cancer, Quality of Life Questionnaire Head and Neck Module) were carried out. The results of EORTC QLQ-C30 functional scales were at the same level as in the normal population with the exception of a lower global quality of life scale. The results of the VHI in the monitored group of respondents significantly correlated with the EORTC QLQ-C30 global quality of life, the functional scales, dyspnea, pain, nausea and financial difficulties. Significant correlation was shown between the VHI and EORTC QLQ-H&N35 speech-related problems, social contacts, pain in the head and neck area, sense problems, sexuality and social eating. The results of standardized questionnaires (EORTC QLQ-C30 and EORTC QLQ-H&N35) indicated a number of difficulties in patients after laryngectomy, significantly affecting their quality of life including their subjective perception of voice disorders as indicated by the VHI (Lundström et al., 2009, p. 83-85).
An extensive study published in 2013 by Merrill et al. tested the importance of voice in the overall perception of quality of life. Data were collected from 461 respondents in the course of an athletic contest for seniors. Respondents were contests participants and their spouses aged 50 years or more, of whom 89% resided in the USA, 6% in Canada and 5% in other countries. Apart from evaluating demographic data, health and medical history, questions were asked about voice difficulties, a total of 9 questions on hoarseness, chronic dryness of throat, wobbly or shaky voice, discomfort while using one’s voice, etc. Respondents were divided into three groups by number of difficulties: respondents with no difficulties at all, respondents with 1-2 symptoms, and finally, respondents with 3-5 symptoms out of the nine symptoms specified in the questionnaire. Quality of life was evaluated by the standardized questionnaire SF-36 (Short Form 36 Health Survey Quality of Life). Respondents with voice and speech difficulties had significantly negative correlation with the overall perception of their own health, pain and vitality according to the SF-36 (Merrill et al., 2013, p. 404-405).

Conclusion
The survey quantified the subjective perception of voice changes in patients with laryngeal disease and proved clearly statistically significant changes in the perception of voice difficulties prior to and after treatment, without subdividing respondents by the type of treatment due to the low number of respondents. Similar to respondents in 2009/2010 studies by Bernardová and Fousková, our respondents perceived major problems in the physical domain.

The subjective voice disorder evaluation questionnaire VHI was a suitable instrument for identifying their level of voice difficulties (comprehensibility of questions, scope of the questionnaire). Since it is a standardized voice evaluation instrument applied in foreign studies, it allows a comparison of the study results. The VHI is applied to evaluate the effectiveness of treatment, impact of voice difficulties on the overall perception of the quality of life, evaluation of voice difficulties in professionals (teachers, singers), etc.

Foreign studies evaluated the impact of voice difficulties on the quality of life and suggested the importance of timely diagnosis and initiation of treatment in case of pathological changes in the larynx. In the Czech Republic, the World Voice Day is organized (April 16), whose main objective is to increase the level of public awareness of the prevention of vocal cord diseases and the importance of voice. On this day, the general public may have their voice examined in specialized ENT departments.

The limitation of the survey is the low number of respondents for whom complete VHI data were obtained both before and after treatment. The survey continues in the following period with consequent data collection in an outpatient phoniatic department and extension of the study by evaluation of the overall quality of life using standardized questionnaires.

Ethical aspects and conflict of interest
From the perspective of possible conflict of interests, we did not find any circumstances that would threaten the fundamental publication principles. The research was preceded by an approval of data collection by the Ethic Committee of the medical institution in question, including an evaluation and approval of patients’ written informed consent to participation in the study.

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References
