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Clinical Study

Subjective Voice Assessment after Endoscopic Surgery for an Obstructive Reinke Edema Using Voice Handicap Index

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Voice disorders exert a dramatic influence on patients' quality of life (QOL). The physical, functional, and emotional impact can be accurately assessed using the conventional questionnaire of "voice handicap index" (VHI) or its shorter version, the VHI-10. We evaluated the VHI scores of patients suffering from obstructive Reinke's edema, a benign laryngeal disorder, before and after endoscopic treatment. Comparison of pre- and postoperative VHI scores showed the treatment efficacy. The scores achieved were similar to asymptomatic individuals (control group), thus improving their quality of life. Furthermore, both VHI and VHI-10 tests yielded similar scores. We suggest routine systematic incorporation of the VHI-10 test for pre- and postoperative routine evaluation of patients with Reinke's edema. The results are faster and reliable.

1. Introduction

Traditionally, voice disorders and their treatment assessment protocols have focused on "objective voice measurements" [1]. These objective measures assess only a small component of voice production and do not encompass global vocal function from the patient's perspective. Moreover, neither objective voice nor video perceptual measures can assess the level of handicap that a person experiences as a result of a voice disorder [2]. Therefore, patient-based, voice specific outcome measures can potentially provide more information than the biological and physiological variables associated with voice and its production.

In 1997, Jacobson et al. [3] proposed a measure of voice handicap known as the voice handicap index (VHI). This patient-based self-assessment tool consists of a 30-item questionnaire covering the three domains of a voice disorder: functional, physical, and emotional (see Table 1). The overall aim of the VHI is to quantify the patient's perception of his handicap due to the alteration in his or her vocal functions.

The VHI-10 (see Table 2) consists of a shortened version of the original VHI including 10 selected questions that were found to be the most clinically robust [4]. Together, they allow both the assessment of initial voice handicap index and responsiveness to treatment.

The aim of this study is to provide a subjective assessment of voice quality and its impact on the quality of life of patients presenting with obstructive Reinke's edema (ORE). Results before and after endoscopic treatment are compared using both VHI and VHI-10 scores.

2. Materials and Methods

A retrospective analysis was performed on a series of consecutive patients treated for an ORE in the Otorhinolaryngology and Head and Neck Surgery Department of the Valais State Hospital, Sion, Switzerland, between 1 January 2012 and 31 March 2014. There were 6 patients, 5 females and 1 male. The mean age was 58 years (ranging from 48 to 71 years). All patients had a history of smoking (range 5–15 years), with an average consumption of 20 cigarettes per day. There was no history of cardiopulmonary diseases, other comorbidities, or previous laryngeal surgery. The main symptoms were progressive dysphonia with mild to moderate dyspnea (mainly on exertion). One patient was admitted in the emergency unit for an acute respiratory distress related to an upper

Table 1: Voice handicap index (VHI).

	Statements
Functional	
F1	My voice makes it difficult for people to hear me.
F2	People have difficulty understanding me in a noisy room.
F3	My family has difficulty hearing me when I call them throughout the house.
F4	I use the phone less often than I would like to.
F5	I tend to avoid groups of people because of my voice.
F6	I speak with friends, neighbors, or relatives less often because of my voice.
F7	People ask me to repeat myself when speaking face-to-face.
F8	My voice difficulties restrict personal and social life.
F9	I feel left out of conversations because of my voice.
F10	My voice problem causes me to lose income.
Physical	
P1	I run out of air when I talk
P2	The sound of my voice varies throughout the day.
P3	People ask, "What's wrong with your voice?"
P4	My voice sounds creaky and dry.
P5	I feel as though I have to strain to produce voice.
P6	The clarity of my voice is unpredictable.
P7	I try to change my voice to sound different.
P8	I use a great deal of effort to speak.
P9	My voice is worse in the evening.
P10	My voice "gives out" on me in the middle of speaking.
Emotional	
E1	I am tense when talking to others because of my voice.
E2	People seem irritated with my voice.
E3	I find other people do not understand my voice problem.
E4	My voice problem upsets me.
E5	I am less outgoing because of my voice problem.
E6	My voice makes me feel handicapped.
E7	I feel annoyed when people ask me to repeat.
E8	I feel embarrassed when people ask me to repeat.
E9	My voice makes me feel incompetent.
E10	I am ashamed of my voice problem.

The previous statements can be used to describe one's voice and its impact on his/her life. To each statement, a number (0–4) is given corresponding to its frequency. VHI is the mean of all values.
Answers: 0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always.

Table 2: Voice handicap index 10 (VHI-10).

	Statements
F1	My voice makes it difficult for people to hear me.
F2	People have difficulty understanding me in a noisy room.
F8	My voice difficulties restrict personal and social life.
F9	I feel left out of conversations because of my voice.
F10	My voice problem causes me to lose income.
P5	I feel as though I have to strain to produce voice.
P6	The clarity of my voice is unpredictable.
E4	My voice problem upsets me.
E6	My voice makes me feel handicapped.
P3	People ask, "What's wrong with your voice?"

respiratory tract infection with progressive laryngeal edema. Methylprednisolone (2 mg/kg) together with Amoxicillin-clavulanate (25 mg/kg) was administrated intravenously and the patient stayed under observation in the intensive care unit. The acute situation was stabilized within 48 hours after the start of treatment. All patients underwent an ENT examination, a flexible laryngoscopy, and a speech evaluation. The hospital ethics committee approved the study.

Glottic obstruction was measured at the upper edge of the edematous cords in the posterior glottis with the patient breathing spontaneously. Under propofol sedation, the larynx was exposed using a Macintosh laryngoscope and the glottis aperture was measured using a 4 mm, 0° telescope. The degree of obstruction was classified as follows:

Severe: less than 3.9 mm space in posterior glottis ($n = 1$).

Moderate: 4–7.9 mm ($n = 5$).

Mild: 8–10 mm.

All patients had normal vocal cords mobility and the degree of obstruction was measured while passing the 4 mm telescope beyond the glottis aperture. All patients were operated on by the senior author (Kishore Sandu). Microlaryngoscopy with suspension using Vaughn laryngoscope and transglottic jet ventilation were used in all patients. Insertion of a false vocal fold retractor achieved optimal egress of air during ventilation. The spatula of the retractor was placed in the ventricule of Morgagni of both sides to allow evaluation of the lateral extent of the cord edema. A subepithelial treatment of Reinke's edema was done using CO_2-laser (lumenis, Ultrapulse 250 microspot, 125 mJoules, 1–3 watts). A linear incision was made along the lateral edge of each vocal cord and the subepithelial jelly-like content was drained. Excess mucosa was excised similarly to a type I cordectomy. Polypoidal tissue was excised and rest of the mucosa was used to redrape the vocal ligament. Endoscopic treatment of both vocal cords was done simultaneously during the same anesthesia. Mucosa at the anterior commissure was untouched, even if it was edematous to avoid synechiae and subsequent glottic fusion. The pre- and 9-month postoperative endoscopic views of one of the patients with severe bilateral RE are shown in Figures 1 and 2.

All patients were given prednisone (2 mg/kg per day) for 5 days, complete voice rest for 10 days, and proton pump inhibitor (omeprazole 40 mg twice daily) for 6 weeks. Speech therapy was started at 2 weeks after surgery. The patients were followed up at 3, 6, 9, and 12 months postoperatively. All

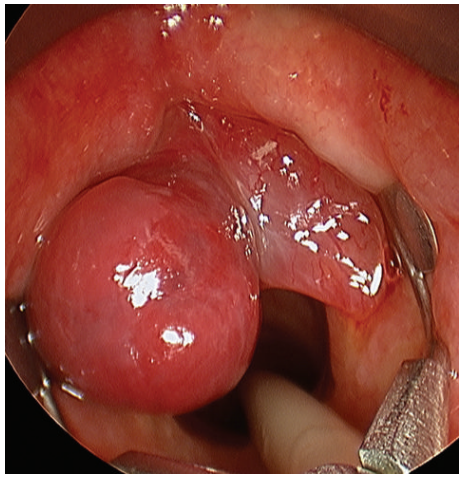

Figure 1: Preoperative endoscopic view.

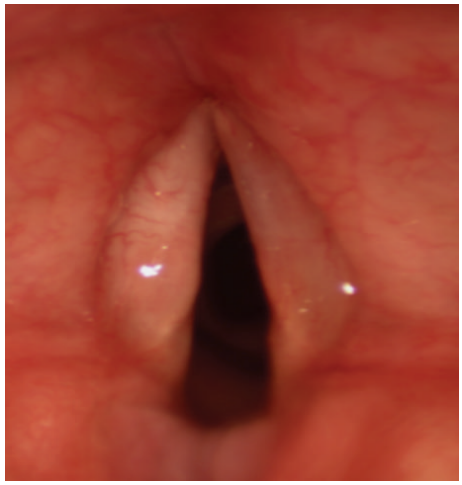

Figure 2: 9 months' postoperative endoscopic view.

patients were asked retrospectively to complete the VHI and VHI-10 questionnaires both before and after treatment. VHI questionnaire consists of 30 questions (10 questions for each physical, functional, and emotional item) that the patient must answer according to the frequency of each statement. This provides a score from 0 to 4 in increasing order of frequency. VHI score is obtained by adding the values of each question and ranges from 0 to 120 (maximum of 4×30).

The impact of the voice disorders related to the ORE on the patient's quality of life is more important with a higher score of VHI.

3. Results

The voice quality was impaired in all patients and the main symptoms were progressive dysphonia (6 patients) and breathlessness (of variable severity) on exertion. One patient presented with an acute respiratory distress and severe laryngeal edema secondary to an upper respiratory tract infection. No patient presented with dysphagia. The intraoperative endoscopic evaluation showed severe edema of the vocal folds, bilaterally in five patients and unilaterally in one patient. This was compatible with stage 3 of RE classification according to the Yonekawa scale (see Table 3—adapted from [5]). There were no benign (keratosis), premalignant conditions (leuco-erythroplasy) or frank tumor seen on endoscopy. The postoperative voice evaluation showed a subjective significant improvement in all patients. The postoperative endoscopic control at 9 months showed an optimal healing of the vocal folds without scarring in all patients.

Table 3: Reinke's edema classification, Yonekawa scale.

Stages	Location and extension of edema of vocal folds	Vocal folds adhesion during respiratory phase
Stage 1	Superior surface	None
Stage 2	More advanced edema of superior surface	Anterior parts of the vocal folds free edges
Stage 3	Severe swelling along the entire surface	Respiratory surface limited to posterior part of the glottis

Preoperative retrospective voice assessment using the VHI showed an average score of 70.6 out of 120. The postoperative assessment during follow-up at 9 months showed an average score of 1.16. The preoperative analysis of the different subscales showed an average score of 30.3 for the physical, 20.6 for the functional, and 21.1 out of 40 for the emotional aspects. The postoperative average score was 0.5 for both physical and functional aspects and 0.16 for the emotional aspect. According to this analysis, the physical aspect had the highest impact on patient's quality of life before the treatment. Using the VHI-10 scale, the preoperative assessment showed an average score of 24.6 and 0.16 out of 40 at 9 months postoperatively. According to the different items in the VHI, the preoperative assessment showed an overall higher score in the units P4, P5, P7, P8, E1, and F2. This again reflects the impact of the physical aspect in the preoperative assessment. Results are shown in Table 4.

4. Discussion

Traditionally, voice disorders and treatment assessment have focused on "objective voice measurements" [1]. These objective measures assess only one small component of voice production and do not encompass global vocal function from the patient's perspective [6].

Patients' voice demands are highly individualized based on the unique social and occupational use of their voice [4]. Subjective voice assessment or patient-based voice specific outcome measures can potentially provide more information than the biological and physiological variables, because neither "objective voice" nor video perceptual measures can assess the level of handicap that a person experiences as a result of a voice disorder.

Multiple measures of patient-based voice outcome have been developed. In 1997, Jacobson et al. [3] proposed a measure of voice handicap known as the voice handicap index

Table 4: Treatment scores.

Patient scores	VHI (total of 120)		VHI-10 (total of 40)		Physical (total of 40)		Functional (total of 40)		Emotional (total of 40)	
	Preop.	Postop.	Preop.	Postop.	Preop.	Postop.	Preop.	Postop.	Preop.	Postop.
P 1	58	0	20	0	30	0	16	0	21	0
P 2	53	0	19	0	32	0	9	0	12	0
P 3	93	0	34	0	32	0	31	0	30	0
P 4	72	1	25	0	30	1	25	0	17	0
P 5	92	5	30	1	32	2	25	2	35	1
P 6	56	1	20	0	26	0	18	1	12	0
Average	70.6	1.16	24.6	0.16	30.3	0.5	20.6	0.5	21.1	0.16

(VHI) that consists of 30 statements distributed over three domains, functional, physical, and emotional aspects, and was designed to assess all types of voice disorders. The VHI-10 consists only of 10 items that were founded to be the most clinically robust and proposed by a clinical consensus conference of the University of Pittsburgh [4].

The VHI and the VHI-10 have been shown to be valid and sensitive in a wide range of voice disorders. Both of these indices capture and quantify a patient's "overall" state of voice handicap [4].

The objective of our study was to have a subjective voice and quality of life assessment in a group of 6 patients treated for severe obstructive RE.

The anterior glottis generates voice and posterior glottis is important for respiration. Severe forms of RE with swollen vocal cords present with both, voice and potential respiratory problems during an acute attack of upper airway infection. One of our patients presented with stridor and had to be hospitalized in an intensive care setup for treatment of the acute stage 3 respiratory distress is the priority. Once the acute phase is treated, the actual endoscopic treatment of the edematous cords is undertaken. The following surgical objectives must be achieved at the end of the procedure to guarantee optimal voice results:

(1) Near-complete evacuation of the subepithelial edematous jelly-like content of each vocal cord.

(2) Maximum preservation of the *lamina propria*.

(3) The process of which anterior commissure mucosa must be left intact.

Voice disorder related to a bilateral obstructive vocal folds edema has a nonnegligible impact in different aspects of a patient's life. Our study provides a subjective assessment of the quality of voice and its impact on the patient's life after the endoscopic treatment of this severe vocal folds edema.

In our study we used the patient-based, self-assessment VHI and VHI-10 questionnaires to provide a subjective evaluation for the voice disorder's impact of this pathology before and at 9 months after surgical treatment.

The analysis of results showed a significant difference in both VHI and VHI-10 outcomes before and after the surgical treatment with approximately similar results between both indices. The posttreatment outcomes were similar to nondysphonic normal individuals.

The comparison of pre- and postoperative VHI scores showed a significant reduction from an average score of 70.6 out of 120 to an average of 1.16. This showed an excellent clinical improvement in the quality of life of all patients. Our study shows that the VHI-10 questionnaires should be considered for a rapid voice analysis in cases of ORE with potential respiratory problems. The results can be achieved quickly without compromising the respiration and are reliable as the conventional VHI set of questions.

Inflammation induced by toxic chemical substances is responsible for the edema observed in RE. This mechanism is further accentuated by excessive negative pressure exerted during smoking, which leads to increased mucosal prolapsed from Morgagni's ventricles into the laryngeal inlet, thereby causing airway obstruction. The typically slow progression and habituation to the glottic edema are often responsible for a delay in seeking medical care for progressive dysphonia. This might explain the excess quantity of jelly-like edema content in the vocal folds, as was the case in all our patients. During inspiration, the posterior cricoarytenoid muscles open the posterior commissure by abducting the vocal cords. Probably, swelling of the glottis and accumulation of edema fluid within the vocal cords would make the vocal cords heavy and slightly sluggish in their mobility. Excess prolapse of the laryngeal mucosa by increased Bernoulli effect during smoking will add on to the reduced posterior glottis space thereby causing respiratory symptoms. This hypothesis needs to be confirmed by doing specific electrophysiological tests on randomized control patients.

There are several drawbacks in this study: typically, the retrospective nature, small number of patients, and its focus on only one type of vocal folds disorders. RE is a very common condition. Nonetheless, a severe degree that can potentially cause obstruction of the airway is rarely encountered. This explains the limited number of cases in this study. Needless to say, future multi-institutional studies with a large number of patients and different RE stages should provide a better statistical analysis.

5. Conclusion

Patients presenting with obstructive RE suffer from deterioration in their quality of life due to progressive voice change and occasional respiratory symptoms. Our findings suggest that the physical domain portrayed in the VHI questionnaires

is the most frequent cause of impact on patients' life in the pretreatment period. In our study, the treatment of this benign laryngeal disorder by endoscopic surgery showed to be efficient, allowing patients to become asymptomatic and establish an improved voice quality.

Moreover, the VHI and VHI-10 tests yielded similar scores. We believe that VHI-10 is a powerful tool and recommend it for the patients' pre- and postoperative routine evaluation. The results are quick and reliable especially in patients with severe RE having a potentially obstructed airway.

Summary Point

The VHI-10 is a powerful tool for the routine and quick evaluation in patients with severe RE.

Consent

Patients' authorization was obtained for the use of their data and pictures.

Conflict of Interests

The authors state no conflict of interests.

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