

Examining the use of Voice Handicap Index in Patients with Pharyngeal Cancer Undergoing Organ Preservation

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ABSTRACT

Background: Patients with pharyngeal cancer have secondary complaints of voice change.

Aim: To study the impact of pharyngeal cancer and its treatment on the functional, physical, and emotional domains of the voice handicap index.

Methodology: This was a single center, prospective, case control study conducted over 2 years. Patients with pharyngeal cancer were studied before and after chemoradiation using the voice handicap index. Mann Whitney U, Wilcoxon signed ranked and Chi square tests were used for the statistical analysis.

Results: A total of twelve patients (nine men and three women) with a mean age and standard deviation of 58.50 ± 9.17 years were evaluated during study. The patients differed significantly ($P < 0.05$) from controls over all the three domains of the voice handicap index - functional, physical, and emotional – both before and after chemoradiation. There was a significant difference in the functional domain before and after treatment ($P = .05$) among patients. The voice handicap index was not associated with tumor staging, subsites, or node involvement. Pre-treatment, there was a significant difference in the functional domain ($P = .02$) and total score ($P = .05$) between the oropharynx and hypopharynx groups, however post-treatment no such difference was observed.

Conclusion: Tumour infiltration and/or radiation fields affect voice dynamically in pharyngeal cancers. Information from the functional, physical and emotional domains in the voice handicap index must be incorporated during pre-treatment counseling to set realistic expectations. It should also aid in timely voice assessments and rehabilitation before and after treatment.

Keywords: Voice handicap index, Pharyngeal cancer, Organ preservation, Chemoradiation, Quality of life, Voice rehabilitation

INTRODUCTION

Verbal communication is one of man's basic needs, a mode through which feelings, emotions and desires are expressed. To professional voice users it is a primary modality of generating income while to others it may be a source of

entertainment or hobbies. The numbers of professional voice users are increasing by the day and loss of voice means loss of livelihood.

Even though the larynx is the primary phonatory source, other areas of the aero digestive tract act as the filters which

vibrate to give it, its overall quality. [1] Organ preservation is a wide field treatment which affects both tumor and healthy tissue. Therefore, voice change even in pharyngeal cancers is inevitable and becomes an important area of focus. Thus, the impact of that voice change on the quality of life needs to be prioritized by all concerned professionals.

The prevalence of oropharyngeal cancers shows increasing trends while hypopharyngeal cancers decreasing trends. [2] Many studies have used voice related quality of life tools to comprehend the patient's perception of voice problems in both laryngeal and pharyngeal cancers. [3-14] These tools have been used in patients undergoing both surgical and non-surgical organ preserving techniques like chemoradiation. The commonly used tools cited in the above mentioned literature are voice related quality of life (VRQOL), voice handicap index (VHI -10, 30), European Organization for Research and Treatment of Cancer quality of life questionnaire (QLQ & N35 (specific Head and Neck module), QLQ-C30 (general cancer questionnaire, version 3.0), vocal performance questionnaire (VPQ) and the voice symptom score (VoiSS), functional assessment of cancer therapy- head and neck (FACT-HN), MD Anderson symptom inventory (MDASI), University Of Washington quality of life scale (UW-QOL). Most of these studies have been on laryngeal cancer, but only few studies were found in pharyngeal cancer and many being review articles. [4,9,11-12,14]

In organ preservation treatment, patients expect to attain a normal like voice as soon as possible. But studies show that voice changes are dynamic during and after treatment. [11-12,14-15] Voice rehabilitation is one of the strategies which help in improving the voice quality which in turn improves the voice related handicap. Though organ preserving treatments aim to preserve voice, many of these patients end up having voice impairments. The current study was undertaken to identify the impact

of organ preserving strategies on the patient's perception of their voice problems using the voice handicap index. It was conducted on patients with pharyngeal cancer undergoing chemoradiation in comparison with a control group. This would help us establish the need for voice rehabilitation in these patient's post-treatment.

MATERIALS AND METHODS

Study Design

This was an ethics committee approved, prospective, case control study conducted at a single tertiary care center over a period of 2 years. Group I comprised of patients with biopsy proven carcinomas of the pharynx staged between T1-T4, who presented consecutively to the department of head and neck surgery and were selected for organ preservation treatment. Patients with neurological deficits, hearing loss, other speech and swallowing deficits, nasopharyngeal carcinoma were excluded from the study. Group II comprised of healthy controls with no known history of speech, voice, or swallowing problems.

Treatment modalities used in organ preservation treatment

Organ preservation treatment involved radiotherapy (RT) with or without chemotherapy (CT). The mode of treatment was decided by multidisciplinary tumor board, in accordance with the standard practicing guidelines as outlined by National Comprehensive Cancer Network. [16] In our study, radiotherapy was delivered using image guided radiation therapy (IGRT), intensity modulated radiation therapy (IMRT) or three-dimensional conformal radiotherapy techniques (3DCRT). All fields were treated at each session. The total dose delivered to the primary tumour and involved lymph nodes was 70 Gy (2 Gy per fraction, 1 fraction per day, five fractions per week). This was combined with weekly cisplatin 40 mg /m² in 6-weekly cycles starting on the first day of radiation.

VHI assessment tool

Pre-treatment and post-treatment assessment was performed using voice handicap index (VHI). [17] It is a self-administered questionnaire, which assesses the self-perceived impact of voice changes over three domains: functional (F), physical (P) and emotional (E). The participants were instructed to read the questionnaire and mark them accordingly. Once the questionnaire was filled it was collated by the primary investigator and based on the scores obtained, they were categorized into four groups – No complaints (score 0), mild voice handicap (score 1-30), moderate voice handicap (score 31-60) and severe voice handicap (score 61-120). Pre-treatment assessment was performed 2-3 days before the commencement of organ preservation treatment. Post-treatment assessment was performed at 3-9 months during follow up.

Statistical analysis

Data was analyzed using IBM SPSS® Statistics version 20. Results were represented as numbers, percentages, mean ± standard deviation. Mann Whitney U test was used to compare the findings of the patients with control group. Wilcoxon signed ranked test was used to compare the pre-treatment and post-treatment findings among the patients. Association between two variables was analyzed using Chi square test. The level of alpha was taken as 0.05 for the study.

RESULT

Demographics

A total of twelve patients were recruited during the study period of two years. There were a total of nine males and three females in the cohort. The mean ages of the patients were 58.50 ± 9.17 years.

Among the twelve patients, one had T0 tumour, one had T1 tumour, five had T2 tumours, three had T3 tumours and two had T4 stage of tumours. Out of them two had N0 nodes, four had N1 nodes, five had N2 nodes and one had N3 nodes. Two patients could not be evaluated for metastasis and the remaining ten patients had no metastasis detected. Out of the twelve patients, six patients had tumours in the oropharynx and six in the hypopharynx. Of the six oropharyngeal tumours, one had a tumour in the soft palate, two patients had tumours in the base of tongue, two in the tonsil and one in the lateral pharyngeal wall. Among the six patients who had tumours in the hypopharynx, one patient had tumour in the post cricoid region and five had tumours in the pyriform sinus. Of the twelve patients nine patients underwent IMRT and two patients underwent 3DCRT. All patients underwent CRT, one with neo-adjuvant chemoradiation and the other with neck dissection preceding organ preservation treatment. In total twenty-four assessments were conducted. The results of the study were depicted using the following variables.

Comparison of VHI scores

The differences in the mean and standard deviation between the three domains of VHI pre-treatment and post-treatment are depicted in table 1 using the Wilcoxon signed ranked test and with the control group using the Mann Whitney U test (Z and P values). The results indicated that there was a significant difference in the functional domain before and after treatment (P = .05). All the three domains namely functional, physical, and emotional were significantly different from the control group both before and after chemoradiation (P < 0.05).

Table 1: Comparison of the functional, physical and emotional domains of the Voice Handicap index (VHI) in patients pre-treatment and post-treatment

Variable	Pre-treatment		Post-treatment		Control group		Control vs pre (Z/P)	Control vs Post (Z/P)	Pre vs Post (Z/P)
	Mean	SD	Mean	SD	Mean	SD			
Functional	1.33	2.27	5.00	7.43	0.23	1.27	-2.57(0.01)	-4.00(.00)	-1.82(.05)
Physical	3.33	4.22	6.50	9.80	0.07	0.365	-4.10(0.00)	-4.85(.00)	-0.92(.35)
Emotional	1.00	2.89	3.50	6.17	0.00	0.000	-2.26(0.02)	-4.11(.00)	-1.21(.22)
Total score	5.67	8.52	15.67	22.42	0.30	1.31	-3.70(0.00)	-4.59(.00)	-1.11(.26)

Note: Pre - pre-treatment, post- post treatment, standard deviation (SD), statistic value (Z), probability value (P). Bold signifies statistical significance P < 0.05

Association between VHI and tumor characteristics

This study attempted to understand whether there were any associations between the voice handicap index and tumor characteristics using the Chi square test. Results indicated that in this sample there were no significant associations between the perception of voice handicap and tumor staging (P = .39), node involvement (P = .21) and tumor subsite (P = .39). The degrees of freedom, Chi square value (X²) and probability value (P) are depicted in Table 2.

Table 2: Association of Voice Handicap Index (VHI) outcomes with tumour staging, node involvement and tumour subsite

Variable	Degrees of freedom	X ²	P value
Tumour staging	21	22.13	.39
Node involvement	21	25.7	.21
Tumour subsite	7	7.33	.39

Note: X²- Chi square statistic value, P value- probability value

Frequency and percentage of the severity of voice handicap

The frequency and percentage of the patients within a category of severity pre-treatment and post-treatment is depicted in table 3. The results revealed that the four patients did not have any complaints both pre-treatment and post-treatment. Eight patients reported of minimal voice handicap before treatment and six patients after treatment. There was one patient each who reported of moderate and severe voice handicap after treatment. No severe voice handicaps were reported both pre-treatment and post-treatment.

The frequency and percentage of the patients across the various severity categories pre-treatment and post treatment are depicted in table 4. Pre-treatment, four patients had no complaints, eight patients had reported a mild voice handicap and

none reported a moderate or severe voice handicap. Post-treatment the same number of patients did not have any complaints, but two patients of the minimal category deteriorated to the moderate and severe category.

Table 3: The frequency and percentage of the severity of the Voice Handicap Index across treatment

Category		Pre-treatment	Post-treatment	Total Scores
No complaints	N	4	4	8
	%	50	50	100
Minimal	N	8	6	14
	%	57.1	42.9	100
Moderate	N	0	1	1
	%	0	100	100
Severe	N	0	1	1
	%	0.0	100	100
Total	N	12	12	24
	%	50	50	100

Note: N- total number, %- percentage

Table 4: The frequency and percentage of the severity of the Voice Handicap Index pre-treatment vs post-treatment

		Pre-treatment	Post-treatment	Total Scores
No complaints	N	4	4	8
	%	33.3	33.3	33.3
Minimal	N	8	6	14
	%	66.7	50	58.3
Moderate	N	0	1	1
	%	0	8.3	4.2
Severe	N	0	1	1
	%	0	100	100
Total	N	12	12	24
	%	100	100	100

Note: N- total number, %- percentage

Comparison between the tumours of the oropharynx and hypopharynx

The comparison of the functional, physical and emotional domains of the VHI between the oropharynx and hypopharynx groups were studied using the Wilcoxon signed ranked test. The results displayed in table 5 showed that there was a significant difference in the functional domain (P = .02) and total score (P = .05) between the groups pre-treatment and post-treatment.

Table 5: The mean and standard deviation across the domains of VHI between the oropharynx and hypopharynx groups pre-treatment and post-treatment

	Oropharynx				Hypopharynx				Oro vs Hypo	
	Pre-treatment		Post-treatment		Pre-treatment		Post-treatment		Pre	post
VHI	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Z/P	Z/P
F	.00	.00	3.00	6.87	2.67	2.65	7.00	8.05	-2.28/.02	-1.66/.09
P	1.50	2.81	6.33	10.55	5.17	4.83	6.67	9.99	-1.67/.09	-.40/.68
E	.00	.00	3.67	8.04	2.00	4.00	3.33	4.36	-1.47/.14	-.77/.44
Total score	1.50	2.81	14.33	25.28	9.83	10.49	17.00	21.51	-1.91/.05	-.72/.46

Note: Oro- oropharynx, hypo- hypopharynx, pre- pre-treatment, post-post treatment, VHI- voice handicap index, functional (F), physical (P), emotional (E), Standard deviation (SD), statistic value (Z), probability value (P). Bold signifies statistical significance P < 0.05

DISCUSSION

Voice handicap is one of the major impediments experienced by patients with pharyngeal cancer following organ preservation treatment. As voice is a major means of communication with society, its handicap affects patients both socially as well as emotionally. Cancer treatment modalities have evolved over time from surgical resection to more organ preserving strategies like chemoradiation, with the main aim of voice preservation post-treatment. Voice rehabilitation is also one of the strategies used to improve quality of life in these patients. This study was conducted to examine the impact of organ preserving treatment protocols on voice post-treatment, and to examine the need for voice rehabilitation in these patients post-treatment.

Effect of tumour stage, node, and subsite

There are contrasting views on the effect of tumour stage, node or subsite on voice, with some authors attributing no effect while some attributing negative affect on voice. In our cohort we also found that voice is affected in pharyngeal cancer. [15] However, effect of tumour on voice was independent of stage, node or subsite in our study. But in contrast when the oropharynx / hypopharynx were studied separately we saw a significant difference in the perception of the functional domain and total score before treatment. This could be attributed to the anatomic location of the hypopharynx being just behind the larynx. The infiltration of large hypopharyngeal tumours can affect the recurrent laryngeal nerve impacting vocal cord mobility. In some cases, the cricoarytenoid joint can also get fixed leading to voice changes.

Effect of treatment

The scores of the voice handicap index revealed no significant changes after treatment which suggested that even during follow up between 3-9 months there was a considerable voice related impact on the quality of life. This is secondary to the radiation effects such as edema, mucositis, xerostomia, fibrosis etc. Also, the radiation

dose received by the larynx in hypopharyngeal cancers would be higher than that of the oropharynx thus the perceived voice problems are more. In oropharyngeal lesions the larynx gets radiated as part of the neck region, but in hypopharyngeal lesions a part of larynx gets similar dose compared to the primary lesion. In large hypopharyngeal lesions the impaired mobility of the vocal cord may not recover due to permanent damage to the nerve thus compensatory voice therapy techniques may be indicated once the post-radiation side effects subside. The significant differences seen with the control group clearly demonstrate that the voice had not recovered to normalcy during follow up, thus voice rehabilitation is indicated. This study suggests a baseline voice assessment for all patients with pharyngeal cancer so prophylactic voice rehabilitation could begin as early as possible preventing overuse and misuse which could further damage the vocal apparatus. It also stresses the importance of ongoing voice assessments due to the dynamic nature of the impairment, suggesting the use of tailor-made rehabilitation based on the problems at hand.

In the current study the mean voice handicap index was 15.7. A long-term study in patients with advanced hypopharyngeal carcinoma using both 3DCRT and IMRT found at around five years follow up, patients had a mean score of 30.8. [4] We found a mean functional score of 5, mean physical score of 12.7 and mean emotional score of 6.8. They also report of a mean score of 11.3 in the functional domain, 12.7 in the physical domain and 6.8 in the emotional domain. Similarly, a worsening trend was also seen in another study of long term follow up of 5 years in patients with oropharyngeal carcinoma. [18] This reflects long term voice deterioration even after organ preservation which further emphasizes the need for ongoing voice assessments and appropriate rehabilitation.

Among the domains studied the functional and physical domains were most

affected, followed by the emotional domain which was least affected. Only question three of the physical domain which stated that people enquired about what was wrong with their voice was statistically significant with $P = .03$. It meant that the voice change post-treatment was clearly perceivable to the naïve listeners. Along with the physical challenges of speaking with an affected voice the reactions of people would also impact their psychosocial aspects.

The functional domain was significant before and after CTRT because the tumour impacted the voice functions more than the physical production of voice. This indicates that the physiological changes perceived by the patients in their daily lives whatever their professions were revealed that it was an important marker to be monitored and followed up. Both the tumor and treatment impacted the perception of the handicap of voice as seen subjectively across the severity categories. Patients undergoing organ preservation do not expect voice to be affected as they believe that the tumor is in the food pipe and swallowing would be the problem. This study highlights that as clinicians we must counsel patients on the reasons of why the voice could be affected both before and after treatment in pharyngeal cancers. We must also stress the importance of vocal hygiene and voice therapy which would help in recovery. Voice could be a secondary problem in pharyngeal cancers but would also have an impact on their quality of life.

Strengths and limitations of the study

The importance of analyzing across the same voice handicap category and between the categories before and after treatment directs clinicians to monitor the overall changes in the voice, which lead to change in perception. The clinicians are urged to discuss all the questions with the patients and then analyze what kind of rehabilitation would be required to bring about an overall change in the patient not only restricted to the structural changes.

Though our analysis shows significant differences between the control group and patients with pharyngeal cancer over different domains of VHI, this data needs to be validated on a larger cohort over a longer follow up duration. The effects of the treatment modalities and techniques could also be studied. A comparison of all the three subsites of the pharynx including nasopharynx could yield additional information.

CONCLUSION

Even with the increased use of organ preservation treatment, voice changes are dynamic and inevitable. The voice handicap index is a valuable tool which helps both clinicians and patients identify problems in the functional, physical and emotional domains. This would help in initiating timely and overall voice rehabilitation which would impact the quality of voice.

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Footnote:

Dr Naveen Chandrashekar Hedne is currently working at the Department of Head and Neck Oncology, Apollo Proton Centre, Chennai, Tamil Nadu, India. This study is part fulfilment of the PhD research work done by Ms. Smita Caren Mathias at Dr. S.R. Chandrashekar Institute of Speech and Hearing, Bangalore University, Karnataka, India.

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