



ASSESSMENT OF QUALITY OF VOICE USING VHI-10, VAGMI SOFTWARE FOR PATIENTS OF LARYNGOPHARYNX CANCER UNDERGOING RADIATION.

Oncology/Radiotherapy

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ABSTRACT

Introduction: Laryngeal cancer is the ninth most common cancer head and neck cancers in males in Asia. Voice preservation is an important component of the management of laryngopharyngeal cancer. As the primary goal of Radical chemo radiation approach is larynx function preservation, in this context the study on effects of Radiotherapy on achieving this goal becomes very important. **Aims and objectives:** 1) To grade the quality of voice using VHI-10, VAGMI software before, at completion, 2 weeks and 3 months after radiotherapy. 2) To compare Pre- Radiation and Post radiation changes. **Materials and methods:** Patients with histopathologically proven laryngopharyngeal cancer who were receiving radical radiotherapy with or without chemotherapy. Voice quality was analysed using VHI-10 based questionnaire, VAGMI software. Patient based questionnaire VHI-10 (Voice Handicap index) were filled by patients pre- treatment, at completion and Post 2 weeks and 3 months of radiotherapy; score was calculated and compared pre and post radiotherapy. Patient's voice was recorded using VAGMI software and parameters compared pre and post radiotherapy. **Results:** On objective comparison of pre- and post-RT voice parameters, there was a significant improvement in in MPD and shimmer parameter. No improvement in Dysphonia index in pre-RT and post-2 weeks of RT. On Subjective evaluation, there were significant improvement in voice quality post radiotherapy compared to pre radiotherapy. **Conclusion:** Radiation for head and neck cancer results in transient worsening of both perceptual and acoustic components of Voice. However they return to pre-radiotherapy levels by 3 months post radiation hence achieving the ultimate goal of not only organ preservation but also functional restoration.

KEYWORDS

Head and Neck cancer, Chemoradiation, Laryngeal function, VHI, VAGMI, radiotherapy.

INTRODUCTION

In Asia, laryngeal carcinoma is the ninth most prevalent cancer of the head and neck in male. With an incidence of 1.26–8.18 per 100,000 people in India, this is the 7th most common cancer in male. (1) The occurrence is closely linked to advanced age (from the fifth decade onwards) and is rare before the age of 40. (2)

According to Globocan data, 151,000 new cases of laryngeal carcinoma were detected worldwide in 2008. The glottis is the most common site of laryngeal cancer (about 49 percent), followed by Supraglottis. (2) Because most patients present in advanced stages of disease, the most prevalent subsites of involvement in India are combined supraglottic and glottis, followed by Supraglottis and glottis alone. (3) In today's oncology practise, combined modality therapy (CMT) is the gold standard for advanced head and neck cancer treatment (HNC). Voice preservation is an important part of laryngopharyngeal cancer treatment. The major treatment technique, radiotherapy, has resulted in high control rates and voice preservation.

According to WHO, a handicap is "a social, economic, or environmental disadvantage caused by an impairment or disability." (4) As a result, in order to fully quantify the impact of a voice issue on a patient's life, a subjective measurement is required. Patient-based voice-specific outcome measures could potentially add to the anatomic and physiological variables, which could subsequently be employed as part of a longitudinal assessment of voice impairment. The Voice Impairment Index was introduced by Jacobson et al in 1997 as a questionnaire that subjectively quantified voice handicap (VHI). (5)

The data produced by the VHI differs from that provided by objective voice metrics, according to several studies. The VHI was also validated by the Agency or Health Care Research and Quality in 2002 as meeting the requirements for reliability, validity, and availability of normative data. (5) The VHI is the only instrument on voice-related metrics that has been reported to meet their demanding diagnostic tool requirements. VHI has been shown to accurately assess a patient's voice handicap; however, it is a lengthy and inconvenient questionnaire that patients must complete at each clinic visit. Rosen et al. created a new shortened VHI-10 questionnaire in 2009 that includes 10 statements from the 30-item VHI form. (6) These 10 statements were chosen for having the highest mean difference between the study and control groups and/or for significant clinical relevance. (7)

Further analysis revealed that the 10 questions included in the VHI-10 had the highest mean difference between pre- and post-treatment groups in comparison to the VHI. A score of more than 18 was regarded indicative of a clinical voice problem (8) As the primary goal of Radical chemo radiation approach is larynx function preservation, in this context the study on effects of Radiotherapy on achieving this goal becomes very important. Mapping and reporting these functional changes obviously are an important aspect of evaluation of organ preservation protocols.

MATERIALS AND METHODS:-

Patients with laryngopharyngeal cancer receiving Radiotherapy at Ramaiah medical college and hospital, Bangalore from October 2018 to March 2021. Patients with histopathologically proven laryngopharyngeal cancer who were receiving radical radiotherapy with or without chemotherapy were included in the study.

Patients with connective tissue disorders and Patients with history of prior radiation treatment to the area being treated were excluded from the study. After prior informed consent, 27 patients who have fulfilled the inclusion and exclusion criteria underwent routine investigations (CBC, RFT, LFT, Serum electrolytes). These patients were treated by External beam radiotherapy to a dose of 66-60Gy/ 2 Gy per fraction in around 30-35 fractions using 3-dimensional radiation therapy (3DCRT) or intensity modulated radiation therapy (IMRT) technique on 6MV LINAC with radical intent with or without chemotherapy. Patient characteristics and treatment characteristics were documented. After immobilization with Orfit cast and CT Simulation, images were transferred to oncentera computer system. Volumes were contoured as i.e. Gross tumor volume; the clinical target volume encompassed the entire larynx with coverage of bilateral Vocal folds and planning target volume. These patients were assessed weekly for acute toxicities like mucositis, dysphagia etc. and documented as RTOG guidelines and compared grade of toxicities to Gross tumor volumes and planning target volumes. Patients were assessed for voice quality at baseline, at end of treatment & at 3 months post Radiotherapy.

RESULTS:-

On objective comparison of pre and post RT parameters using online software VAGMI there was a significant improvement in MPD (measurement and normative value). Whereas there is no difference in

shimmer, dysphonia index in pre-RT and post 2 weeks of RT but statistically significant improvement in shimmer parameters in pre-RT and post 3 months of RT. (Figure 1-6)

On subjective evaluation of VHI questionnaire, patient presented with higher side effects on completion of radiotherapy as compared to pre-RT which become almost similar to pre-RT after 2 weeks of radiation and significantly improved post 3 months of radiation. (Table 1, 2)

Our study is single arm prospective study. In this study we reported Effect of radiotherapy on voice and laryngeal function in laryngopharyngeal cancer patients on radical chemo-radiation. While it is widely assumed that voice quality after radiation therapy is pretty good, few research have published the findings of objective voice assessment after radiation therapy. (9, 10) In our study we assessed patient subjectively using patient based questionnaire i.e. Voice Handicap Index-10 and objectively as well with help of VAGMI software. Although radiation therapy cures a large percentage of laryngeal cancer patients, the quality of their voice does not return to normal after treatment. (11) Previous Study in 1997 by Dagli, A. S. demonstrated that voice quality after radiotherapy was poor and that voice after radiotherapy could not be called normal. (12)

Similarly trial published by Lehman in 1988, the video-stroboscopic findings on correlation indicated a poor vibratory source, characterized by diffuse stiffness. (13) In most of these trials, radiotherapy techniques were conventional techniques which might explain poor outcome in quality of voice. As compare these trials by Lehman et al and Dagli et al, in present study 27 Patients were treated with Intensity modulated radiotherapy (IMRT) uniformly.

Meta-analysis by So Hyun Lee, on comparing acoustic analysis between the two modalities (radiotherapy and Laser surgery), jitter, shimmer, NHR had more favourable values in the Radiotherapy group than those in the Laser surgery group, similar to results Kono et al and Sjogren et al (14). Our Study showed significant improvement in mean Maximum Phonation duration (increased), average Frequency, Shimmer (reduced) and S/z Ratio (improved) parameters post radiotherapy when it compared to Pre-radiotherapy parameters whereas no statistically difference in Jitter and dysphonia index which could be because of edema and late tissue effects on voice quality post radiation.

Hong et al (15) found that delayed tissue effects of human vocal fold following radiation therapy and found fibrotic changes in human superficial lamina propria and thyro arytenoid muscle impairing vocal fold closure, pliability, and dynamic changes in tension and length on 2 years of follow up, post radiotherapy showed better voice quality and restored the original function and appearance of the larynx, whereas follow up in our study was only 3-6 months, late tissue effects were not observed, hence further difference could be observed.

CONCLUSION:

Radiation for head and neck cancer results in transient worsening of both perceptual and acoustic components of Voice. However they return to pre radiotherapy levels by 3 months post radiation hence achieving the ultimate goal of not only organ preservation but also functional restoration.

FIGURES:

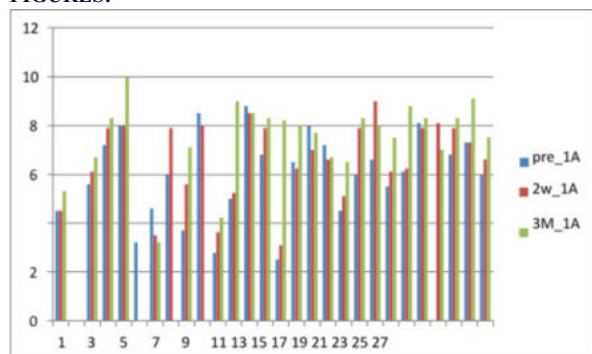
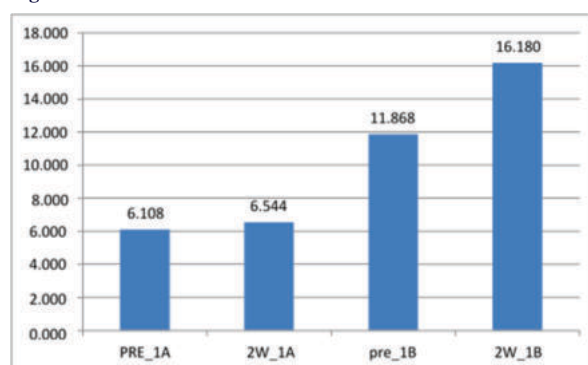


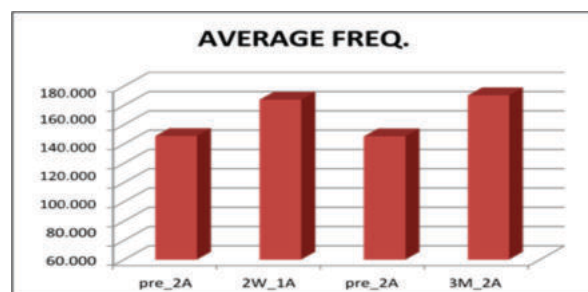
Figure 1 MPD (Maximum Phonation duration):-
MPD Pre-RT (pre_1A), Post 2 weeks (2W_1A) & Post 3 months of Radiation (3M_1A) Mean values

Figure 2:



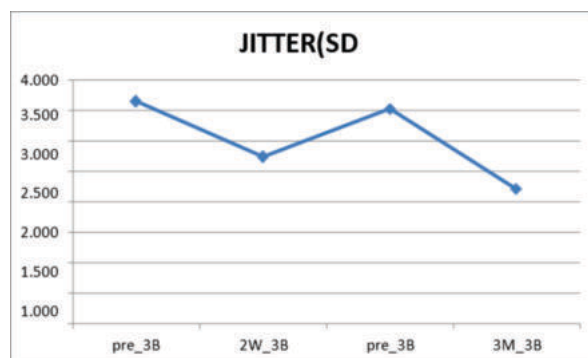
MPD (Pre-RT & Post 2 week of Radiation) 1A) MEASURED 1B) NORMATIVE

Figure 3



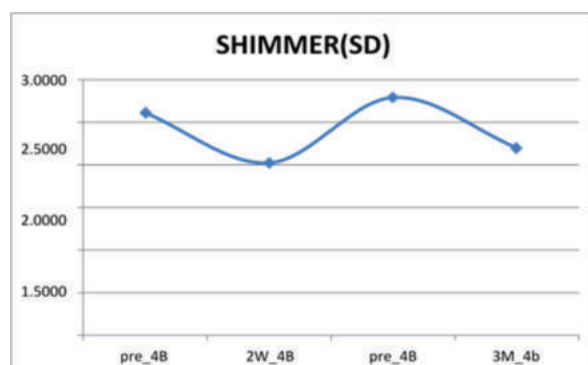
Average Frequency comparison between Pre- Radiotherapy (pre_2A), Post 2 weeks (2W_2A) and Post 3 months (3M_2A) of Radiation

Figure 4



Jitter standard deviation comparing values Pre-RT (pre_3B), post 2 weeks (2W_3B) & Post 3 months of Radiation (3M_3B)

Figure 5



Shimmer (standard deviation values) comparison Pre-RT (pre_4B), at 2 weeks (2W_4B) & Post 3 months of Radiation (3M_4B)

Tables:

Table 1: Voice handicap index

VHI-10 statement	Score				
1. My voice makes it difficult for people to hear me.	0	1	2	3	4
2. I run out of air when I talk.	0	1	2	3	4
3. People have difficulty understanding me in a noisy room.	0	1	2	3	4
4. The sound of my voice varies throughout the day.	0	1	2	3	4
5. My family has difficulty hearing me when I call them throughout the house.	0	1	2	3	4
6. I use the phone less often than I would like to.	0	1	2	3	4
7. I'm tense when talking to others because of my voice.	0	1	2	3	4
8. I tend to avoid groups of people because of my voice.	0	1	2	3	4
9. People seem irritated with my voice.	0	1	2	3	4
10. People ask, "What's wrong with your voice?" 0 1	0	1	2	3	4

VHI : Voice Handicap Index
0 = never, 1 = almost never (occasionally), 2 = sometimes, 3 = almost always, 4 = always

Table-2 VHI-10 (voice handicap index) Questionnaire-

VHI-Pre	26	16.423	7.596	1.490	1.508	.144
VHI-Post	26	17.808	5.593	1.097		
VHI-Pre	24	15.875	7.566	1.544	1.806	.084
VHI-2Weeks	24	13.917	6.711	1.370		
VHI-Pre	22	16.045	7.743	1.651	7.270	.0001**
VHI- 3Months	22	8.773	4.800	1.023		

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