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Association Between Pharyngeal Movements And Swallowing Function In Patients Of Oropharynx And Hypopharynx Squamous Cell Carcinoma Treated With Curative Non-Surgical Therapy: A Prospective Study.

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ABSTRACT

Aim: To prospectively study the association between pharyngeal movements and swallowing function in patients with oropharynx and hypopharynx squamous cell carcinoma treated with curative non-surgical therapy.

Materials and methods: This prospective study evaluated patients with non-metastatic oropharyngeal and hypopharyngeal cancer registered between 28/06/2022 and 31/05/2024. Data on demographics, clinical, and treatment details were recorded. Assessments were conducted pre- and post-radiation therapy (RT) using EORTC QLQ C-30, EORTC QLQ H&N43, videolaryngoscopy (VLS), CTCAE-v5 dysphagia assessment, and the performance status scale Head-Neck (PSSHN). Response evaluation was done using RECIST 1.1 criteria, and statistical analysis was performed using SYSTAT version 12.

Results: A total of 57 patients (median age 59 for oropharynx and 60 for hypopharynx) were included. The majority were male (oropharynx: 5.3:1, hypopharynx: 3.7:1), primary school literate (59.65%), farmers (54.39%), and tobacco users (smoked: 14.04%, smokeless: 15.79%). The most common sites were the tonsil (31.58%) for oropharynx and pyriform sinus (33.33%) for hypopharynx. Most patients presented with locally advanced disease (IVA: 28.07%, IVB: 38.60%) and grade II histology (56.14%). Radical treatment was administered to 38 out of 57patients (66.66%), with 26 (68.42%) receiving chemoradiotherapy (CTRT) and 12 (31.57%) receiving neoadjuvant chemotherapy followed by CTRT. While 19 patients (33.33%) defaulted immediately after registration.

Of the 21 patients who completed both pre- and post-treatment evaluations, EORTC QLQ C-30 showed significant improvement in global health status (p=0.0172), physical functioning (p=0.0163), role functioning (p=0.0026), and emotional functioning (p=0.0136). Symptom scales showed significant improvements in pain (p=0.0001), nausea and vomiting (p=0.0003), appetite loss (p=0.0184), insomnia (p=0.0001), and financial difficulties (p=0.0142).

EORTC QLQ H&N43 showed significant improvements in swallowing (p=0.0002), speech (p=0.0102), and swelling in the neck (p=0.0177). VLS showed significant improvements in vocal cord mobility (p=0.0042), epiglottis movements (p=0.0001), and pharyngeal residue/clearance (p=0.0001). Dysphagia grades significantly improved post-treatment (p=0.0001), as did performance status (p=0.0002). Improvement in vocal cord mobility (p=0.0003), epiglottis movement (p=0.0047), and pharyngeal residue (p=0.0069) correlated with reduced swallowing difficulties.

Conclusion: Subjective (EORTC QLQ), perceptive (PSSHN and CTCAEv5) and objective (VLS) assessment showed significant improvement in swallowing function after RT. Impaired vocal cord mobility, epiglottis movement and presence of pharyngeal residue is associated with impaired

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swallowing on subjective /perceptive assessment. Future studies should aim to include larger patient cohorts and implement more stringent follow-up strategies to gain a better understanding of the factors influencing swallowing functions and pharyngeal movements.

Key words: Swallowing, Quality of life, Oropharynx and hypopharynx cancer, EORTC QLQ C-30, EORTC H&N43, PSS, CTCAE, VDL.

I. INTRODUCTION

Oropharyngeal and hypopharyngeal carcinomas are head and neck cancers affecting different areas of the pharynx. Globally, oropharyngeal cancer ranks 24th in incidence and 23rd in mortality, while hypopharyngeal cancer ranks 25th in both incidence and mortality.**(1)**In India, oropharyngeal cancer ranks 16th in incidence and 17th in mortality, and hypopharyngeal cancer ranks 15th in incidence and 20th in mortality.**(2)**

GLOBOCAN 2022 reported 106,400 new cases of oropharyngeal carcinoma and 86,257 new cases of hypopharyngeal carcinoma globally. **(1)** In India, there were approximately 23,174 cases of oropharyngeal cancer and 30,510 cases of hypopharyngeal cancer. **(2)**

Major symptoms of oropharyngeal cancer include sore throat, odynophagia, and dysphagia. Swallowing difficulties are common in head and neck cancer (HNC) patients, either as presenting symptoms or due to treatment. **(3)**Organ preservation protocols such as radiation therapy can have a detrimental effect on swallowing functioning, with the impact manifested immediately or as a long-term consequence of the treatment**. (4)** Dysphagia not only leads to nutritional deficiencies but also hampers social functioning. Aspiration pneumonia arising from long-standing dysphagia is strongly associated with non-cancer-related mortality in HNC survivors.**(5)**.

Swallowing, or deglutition, involves moving substances from the mouth to the stomach via the pharynx and esophagus. **(6)**There is the alteration in swallowing function in patients of HNSCC either because of disease or the side effects of treatment. Impaired pharyngeal movements and swallowing functions affect patients physically (starvation, dehydration, aspiration pneumonia), socially (social eating difficulties, communication issues), and mentally (low self-confidence, depression), impacting their overall quality of life (QOL).**(7)**

Therefore, we undertook this prospective study to subjectively and objectively evaluate association between pharyngeal movements and swallowing function before and after RT in HNSCC patients.

II. MATERIALS AND METHODS

Ethical consideration

After obtaining clearance from ethical committee all patients fulfilling inclusion and exclusion criteria were enrolled in the study. Informed written consent in a vernacular language was obtained from all the study participants.

Patient selection

All consecutive nonmetastatic oropharyngeal and hypopharyngeal cancer patients treated in the Department of Radiation Oncology from June 2022 to May 2024 were included in the study. The study included patients of all age groups and both sexes with a Karnofsky Performance Scale score of ≥70, histopathologically confirmed HNSCC, literate Marathi-speaking patients who were scheduled for curative radiotherapy, provided informed written consent, and were capable of completing the questionnaire. Patient with other neoplastic aetiology or secondary primary malignancy, already operated or irradiated, congenital or acquired anomalies of HN region affecting swallowing function, unable to complete QLQ were excluded from the study.**(Image 1)**

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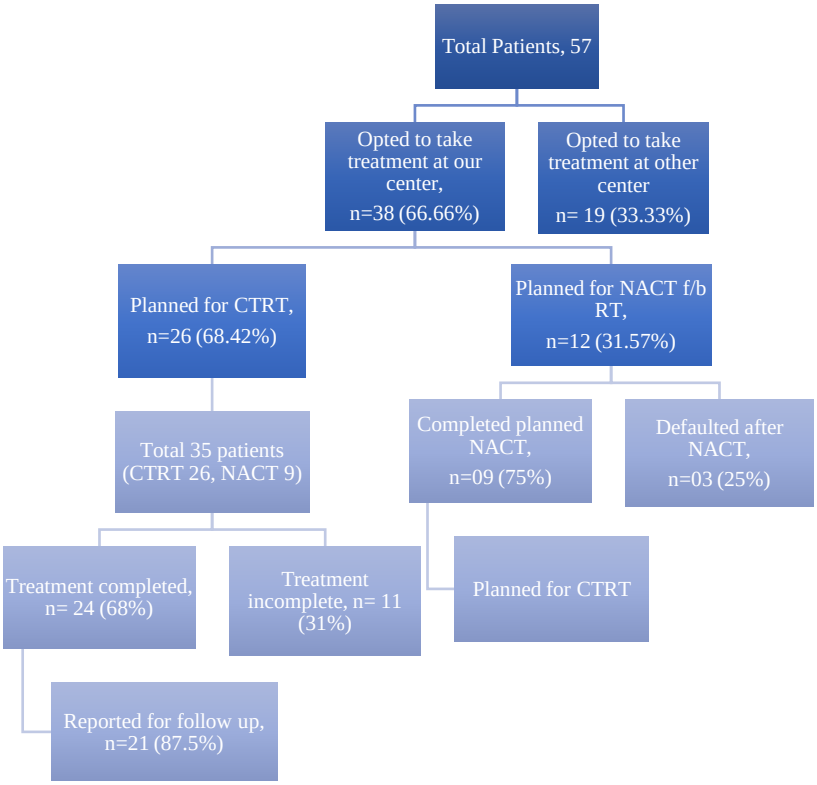

Image 1: Patient selection

Treatment plan:

All patients satisfying the above inclusion and exclusion criteria were treated with curative intent using Neo-adjuvant chemotherapy followed by radiotherapy (RT) or concurrent Chemoradiation therapy (CTRT) based on the stage and general condition of patient. Patient with high tumor burden or high nodal volume were given NACT with chemotherapy regimens such as Paclitaxel (80mg/m2) with a platinum agent such as Cisplatin (40mg/m2) or Carboplatin (AUC 2) given as a weekly regimen, Paclitaxel (80mg/m2) with Cisplatin (40m/m2) and 5-FU (1gm/m2) given as a weekly regimen, Cetuximab (500mg/m2) with Docetaxel (75mg/m2) and Cisplatin (75mg/m2), given a three weekly regimen. After NACT, patients were planned for radiotherapy based on the response to initial chemotherapy and departmental protocols. For radiation therapy, Patients were immobilized with thermoplastic moulds and treatment fields were simulated with CT simulation. Patient planned for radiotherapy were treated using either Intensity-modulated radiotherapy (IMRT) or Three-dimensional conformal radiotherapy (3DCRT) techniques. Majority of patient were treated using IMRT technique except three patients. Dose constraints to the swallowing (dysphagia aspiration-related structures [DARS]) structures were not given. A conventional fractionation schedule was used, delivering 66-70 Gy/33-35 fractions at 2 Gy per fraction per day over 6-7 weeks using six MV photons with or without weekly injection Cisplatin 40mg/m^2. In some of patients Hypo-fractionation schedule was used due to underlying cardiac issues. During RT, all patients were assessed weekly for toxicity grading, supportive care need, and RT/prophylactic exercise compliance.

Function assessment

The subjective and perceptive assessment of swallowing function was made before starting RT (pre-RT) and 4–6 weeks after the conclusion of RT, i.e., at first follow-up (post-RT).

1. Perceptive Assessment

The perceptive assessment included evaluations using the Performance Status Scale for Head and Neck (PSSHN) and dysphagia grading via CTCAE. The PSSHN assesses eating in public, understandability of speech, and normalcy of diet, similar to the PSS, with higher scores indicating better function. Scores range from zero to 300. Higher score indicates better function.**(8)** Dysphagia grading using CTCAE provides a standardized way to assess swallowing difficulties. **(9)**

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2. Subjective Assessment

The subjective assessment of swallowing function and quality of life (QoL) was conducted using the EORTC QLQ-C30 and EORTC QLQ H&N43 questionnaires. The EORTC QLQ-C30 is a core questionnaire available in a Marathi-translated and psychometrically validated version. **(10)(11)** It includes a global health status item, five multiple-item function scales, and three multi-item and six single-item symptom scales, totalling 15 item-scales.**(Table no 1)**The EORTC QLQ H&N43 is an updated version of the EORTC QLQ-H&N35, available in English and used in conjunction with the EORTC QLQ-C30. It incorporates 12 multi-item and seven single-item scales, totalling 19 item-scales. These tools measure the patients' perceived swallowing function and overall quality of life. **(12)** The score ranges from zero to 100. High score of function scale represents high/healthy (better) level of functioning, high score of global health status represents high (better) QOL while high score of symptom scale (multi-item or single-item) represents high (worse) level of symptomatology or problem.

3. Objective Assessment

The objective assessment of swallowing function and pharyngeal movement was carried out using the videolaryngoscopy (VLS). VLS assessed vocal cord mobility, epiglottis movement, and pharyngeal residue to provide an objective measurement of swallowing function.

Statistical analysis

All data were compiled, tabulated, and subjected to statistical analysis. Analysis was done using (SYSTAT version-12 by Cranes software, Bengaluru, Karnataka, India). Statistical analysis was done by descriptive statistics as mean, SD, percentage, proportions. Student's Paired't' test was applied to compare EORTC QLQ 30 scale changes from pre to post RT with various parameters at 5% (p, 0.05) and 1% (p,0.01) level of significance. Z test of difference between two proportions was applied to test the proportion of qualitative variables from pre and post at 5% (p, 0.05) and 1% (p, 0.01) level of significance .Student's Paired't' test was applied to compare EORTC QLQ 43 scale changes from pre to post RT with various parameters at 5% (p, 0.05) and 1% (p, 0.01) level of significance. Chi square test was used to analyse association between swallowing function and pharyngeal movements.

III. RESULTS

A total of 57 patients of oropharynx and hypopharynx cancer were registeredduring the study period. The characteristics of study population and disease are described in Table 1 and Table 2

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Patient characteristics	Subgroups	n (%)
Age (years)	Median (range) Oropharynx	59 (26-85)
	Median (range) Hypopharynx	60 (23-79)
Gender	Male	45 (78.94)
	Female	12 (21.05)
Addictions	No addictions	05 (8.77)
	Smoking	08 (14.03)
	Tobacco chewers	09 (15.78)
	Betel nut quid	04 (7.01)
	Alcohol+ tobacco (smoked/smokeless)	24 (42.10)
	Smoked tobacco+ smokeless tobacco	07 (12.28)

Table 1: Patient characteristics

International Journal Dental and Medical Sciences Research
Volume 6, Issue 3, May - June 2024 pp 403-417www.ijdmsrjournal.com ISSN: 2582-6018

Disease characteristics	Subgroups	n (%)
Site	Oropharynx	30 (52.63)
	Hypopharynx	27 (47.37)
Subsite		
I. Oropharynx	Tonsil	18 (31.58)
	Base of tongue	4 (7.02)
	Soft palate	7 (12.28)
	Vallecula	2 (3.51)
I. Hypopharynx	Pyriform sinus	19 (33.33)
	Posterior cricoid region	6 (10.53)
	Posterior pharyngeal wall	1 (1.75)
Laterality	Right	26 (45.61)
	Left	18 (31.58)
	Central	13 (22.81)
HPR grade	I	8 (14.04)
	II	32 (56.14)
	III	17 (29.82)
Stage	I	1 (1..75)
	II	7 (12.28)
	III	10 (17.54)
	IVA	16 (28.07)
	IVB	22 (38.60)

Table 2: Disease characteristics

Treatment

A total of 38 patients who opted for treatment at our centre were planned for a suitable treatment regimen based on their stage and performance score. Out of these, 26 patients (68.42%) were planned for radical chemoradiotherapy (CTRT), while 12 patients (31.57%) were planned for neoadjuvant chemotherapy (NACT) followed by CTRT. Of the 12 patients planned for NACT, 9 (75%) completed the planned NACT, and 3 (25%) defaulted on further treatment. Therefore, a total of 35 patients were planned for CTRT. Among these, 24 patients completed their treatment. Out of these 24, 21 patients reported for follow-up and post-RT evaluation, allowing for a pre- versus post-RT evaluation to be conducted for these patients.

Assessment

The comparative assessment was conducted on a total of 21 patients who reported for follow-up after RT.

Pre Vs Post RT videolaryngoscopy evaluation

Patients were assessed pre and post RT with videolaryngoscopy for vocal cord mobility, epiglottis movements and pharyngeal residue.

Prior to RT, none of the patients (0%) had fixed vocal cords, while 1 patient (4.76%) exhibited impaired mobility, and 20 patients (95.23%) had mobile vocal cords. Following RT, all 21 patients (100%) demonstrated mobile vocal cords, with no cases of fixed or impaired mobility. This shift from 4.76% impaired mobility pre-RT to 100% mobile vocal cords post-RT highlights the effectiveness of RT in improving or maintaining vocal cord function ($p = 0.0110$).

Prior to RT, 8 patients (38.09%) experienced impaired epiglottis mobility, while 11 patients (61.90%) had mobile epiglottis. Following RT, there was a remarkable improvement, with only 1 patient (4.76%) showing impaired epiglottis mobility and 20 patients (95.23%) demonstrating mobile epiglottis. (p=0.0065).

Before RT, the majority of individuals (12, 57.14%) had pharyngeal residue present, whereas a substantial number (9, 42.85%) did not while after RT, there was a notable decrease in the number of individuals with pharyngeal residue present (4, 19.04%), accompanied by a significant increase in those without residue (17, 80.95%) (p=0.0110)

The data demonstrates a positive impact of radiotherapy on vocal cord mobility, with all patients achieving mobile vocal cords post-treatment. The beneficial effect of radiotherapy on epiglottis mobility, which is crucial for improved swallowing function, is evident. Additionally, the reduction in the number of patients with pharyngeal residue post-radiotherapy indicates a potential improvement in swallowing function.

Pre Vs Post RT dysphagia grade

Prior to RT, the majority of patients exhibited severe dysphagia, with 13 (61.90%) patients classified as Grade III and smaller proportions in Grades I, II, and IV with 1(4.76%), 6 (28.57%) and 1 (4.76%) respectively, following RT, there was a notable improvement in dysphagia severity, as 16 (76.19%) of patients improved to Grade I, 5 (23.80%) had grade II dysphagia, while Grade III and Grade IV categories were completely resolved. This significant shift indicates a substantial reduction in dysphagia severity post-RT, underscoring the efficacy of radiotherapy in managing dysphagia symptoms.

The improvement in the distribution of dysphagia grades post-radiotherapy,(p= 0.0097) particularly the reduction in severe dysphagia cases, suggests a positive treatment outcome in terms of swallowing function for some patients.

Pre Vs Post RT performance status scale Head-Neck (PSSHN)

There is an overall increase in average PSS scores from 173 pre-RT to 245 post-RT (p = 0.0112) suggests a notable improvement in the patients' functional abilities related to swallowing and speech after undergoing radiotherapy. Also on subscales there was an improvement in all parameters.

The average score for eating in public increased from 70 to 89, indicating that patients experienced less difficulty and greater ease in eating in social settings after treatment. The understandability of speech scores improved from 71 pre-RT to 8 post-RT, reflecting enhanced speech clarity and communication abilities post-treatment.The normalcy of diet scores showed a substantial increase from 32 pre-RT to 69 post-RT, suggesting that patients were able to consume a more regular and varied diet after receiving radiotherapy.

Pre Vs Post RT EORTC QLQ C-30 and EORTC QLQ H&N43

EORTC QLQ C-30 had 3 parameters global health status, functional status and symptom scale. **(Table 3)**

The global health status showed significant improvement (pre RT 52.91, post RT 69.19,p=0.0172).

The functional scale showed improvement in all subscales such as physical functioning improved (pre RT 57.77 to 76.38, p=0.0049), Role functioning improvement (pre RT 55.92 to74.23, p=0.0026), Emotional functioning improvement (pre RT43.87 to 67.93, p=0.0136), There was an improvement in cognitive functioning from 63.95 to 77.52, but this change was not statistically significant (p = 0.1015). The improvement in social functioning from 46.47 to 62.33 was not statistically significant (p = 0.1022).

The symptoms scale includes, Fatigue, decreased (pre RT57.72 to 43.14, p=0.01888) but not statistically significant (p=1888), Nausea and vomiting,dropped dramatically (pre RT34.3 to7.81, p=0.0003), Pain significantly dropped (pre RT 53.80 to 26.62, p=0.0001),Dyspnoea decreased (pre RT22.92 to 14.19,p=0.1065) but not statistically significant, Insomnia showed improvement (pre RT47.72 to20.42, p=0.0001), Appetite loss showed reduction (pre RT 56.00 to 39.38, p=0.0184), Constipation decreased (pre RT20.17 to4.71, p=0.0020), Diarrhoea showed a minor yet significant reduction (pre RT 6.42 to 3.14, p=0.3872) but not statistically significant, Financial difficulties were lessened (pre RT64.36 to45.42±32.21, p=0.0142).

EORTC H&N43 had multi item scale and single item scale, which showed Pain in the mouth decreased (pre RT48.66 to19.77, p=0.0002), Swallowing decreased (pre RT 56.75 to 29.51, p=0.0002), Problems with teeth showed reduction (pre RT 28.61 to15.76, p=0.0177), Problems with senses, there was a notable reduction (pre RT 25.30 to17.04, p=0.0299), Speech, Scores improved (pre RT 42.92 to24.93, p=0.0102), Body image, a significant increase in scores (pre RT45.25 to33.19,

International Journal Dental and Medical Sciences Research
Volume 6, Issue 3, May - June 2024 pp 403-417www.ijdmsrjournal.com ISSN: 2582-6018

p=0.0105), Social eating, scores decreased (pre RT 52.30 to 29.31, p=0.0005), Sexuality, there was a substantial reduction(pre RT 16.05 to1.57, p=0.0086), Fear of progression, scores decreased (pre RT 64.83 to56.90, p=0.1566) but not statistically significant. In contrast dry mouth/sticky saliva increased from 29.77 to 58.72 (p=0.0529) and increased in skin problems from 10.28 to 33.77 (p=0.0002)

In single item, Problem opening mouth, scores improved (pre RT27.50 to12.57, p=0.0143), Coughing scores decreased (pre RT 21.11 to15.76, p=0.8307), Social contact showed there was a notable reduction(pre RT52.30 to RT 28.00, p=0.0032), Swelling in the neck, scores decreased (pre RT26.66 to11.00,p=0.0177), Weight loss showeda significant reduction(pre RT 43.08 to 29.90, p=0.0741), Problems with wound healing showed improvement (pre RT 38.50 to14.14, p=0.0021),Neurological problems showed significant reduction (pre RT 30.25 to 15.71, p=0.0155)**(Table 4)**

Association between pre and post RT subjective and objective assessment

Vocal cord mobility and QLQ swallowing

The data show a significant association between vocal cord mobility and swallowing function both before and after RT. Initially, patients with impaired vocal cord mobility had a higher mean QLQ Swallowing score (50.0) compared to those with mobile vocal cords (56.05 ± 19.58, p=0.0123). Post-RT, improved vocal cord mobility correlated with decreased swallowing difficulties, as indicated by the reduced mean QLQ Swallowing score of 29.51 ± 21.34 (p=0.0003).**(Figure 1)**

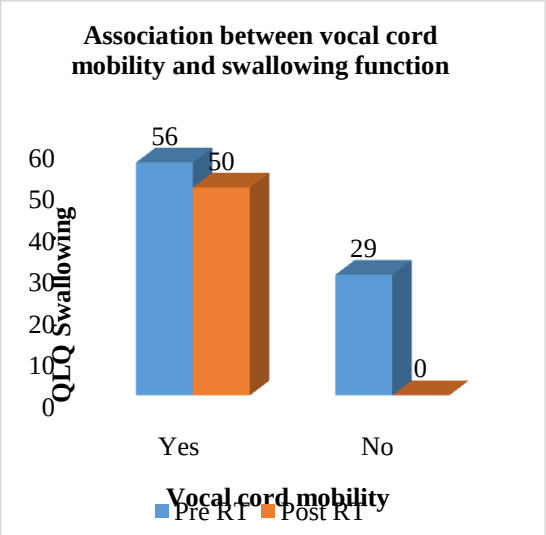

Figure 1: Association between vocal cord mobility and swallowing function

Epiglottis movements and QLQ swallowing

The data reveal a significant association between epiglottis movement and swallowing function. Before treatment, impaired epiglottis movement was linked to higher QLQ Swallowing scores, indicating more severe swallowing difficulties compared to patients with normal epiglottis movement (p=0.0368). Post-RT, improvement in epiglottis movement correlated with a significant reduction in swallowing difficulties, highlighting the critical role of epiglottis function in swallowing efficiency (p=0.0047). **(Figure 2)**

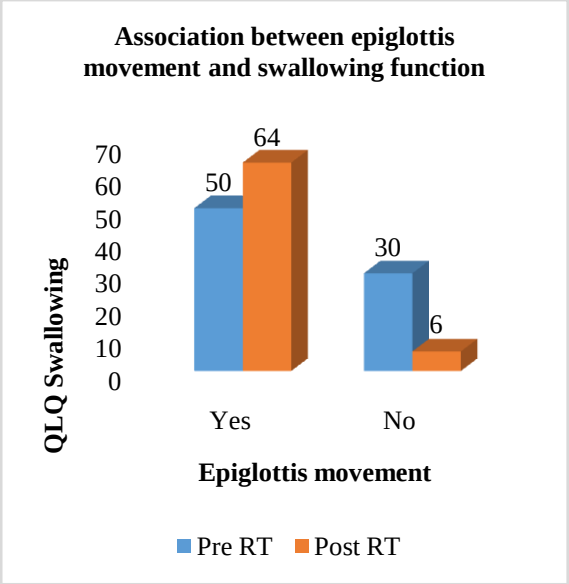

Figure 2: Association between epiglottis movement and swallowing function

Pharyngeal residue and QLQ swallowing

Pre-RT analysis revealed that among the 12 patients (57.14%) with pharyngeal residue, the mean QLQ Swallowing score was 52.66 ± 22.17, while the 9 patients (42.85%) without residue had a mean score of 59.88 ± 12.53. Although this difference was not statistically significant (p=0.0956), it indicated a trend toward better swallowing function in patients without residue. Post-RT analysis showed significant improvement: only 4 patients (19.04%) exhibited pharyngeal residue, with a mean QLQ Swallowing score of 49.75 ± 21.47. In contrast, the 17 patients (80.95%) without residue post-RT had a substantially lower mean score of 24.75 ± 18.31, indicating

International Journal Dental and Medical Sciences Research
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significantly better swallowing function (p=0.0069).**(Figure 3)**

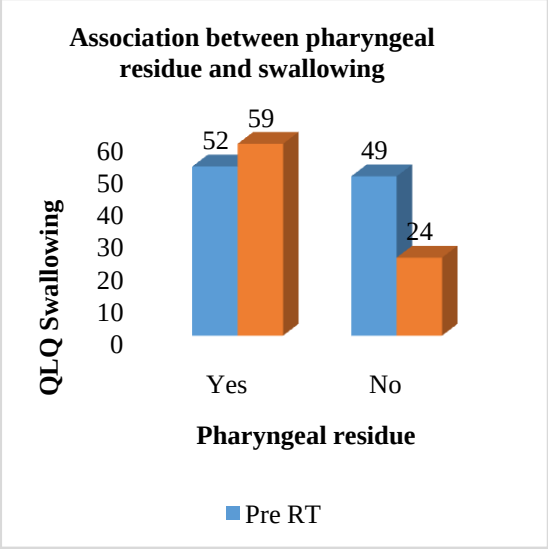

Figure 3: Association between pharyngeal residue and swallowing

Vocal cord mobility and PSS swallowing

The data reveal a significant association between vocal cord mobility and swallowing function both before and after RT. Pre-RT, impaired vocal cord mobility correlated with lower PSS Swallowing scores, indicating more severe swallowing difficulties compared to patients with mobile vocal cords (p=0.0223). Post-RT, the complete restoration of vocal cord mobility was associated with a marked improvement in swallowing function, as evidenced by the substantial increase in PSS Swallowing scores and the absence of impairment in any patient (p=0.0003).**(Figure 4)**

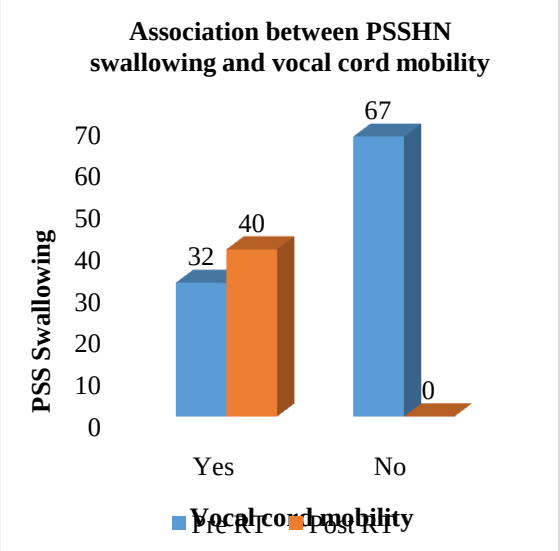

Figure 4: Association between PSSHN swallowing and vocal cord mobility

Epiglottis movement and PSSHN swallowing

The mean PSS Swallowing score was 36.92 ± 13.80 for patients with mobile epiglottis movement and 26.25 ± 8.56 for those with impaired movement, suggesting more pronounced swallowing difficulties among patients with impaired epiglottis movement, though the difference was not statistically significant (p=0.0639). Post-treatment, there was a notable improvement in swallowing function. The mean PSS Swallowing score increased to 67.5 ± 17.57 for patients with mobile epiglottis movement, while no impairment was reported for any patient (p=0.0437, significant). Patients with mobile epiglottis movement post-RT demonstrated higher PSS Swallowing scores compared to those with impaired movement**. (Figure 5)**

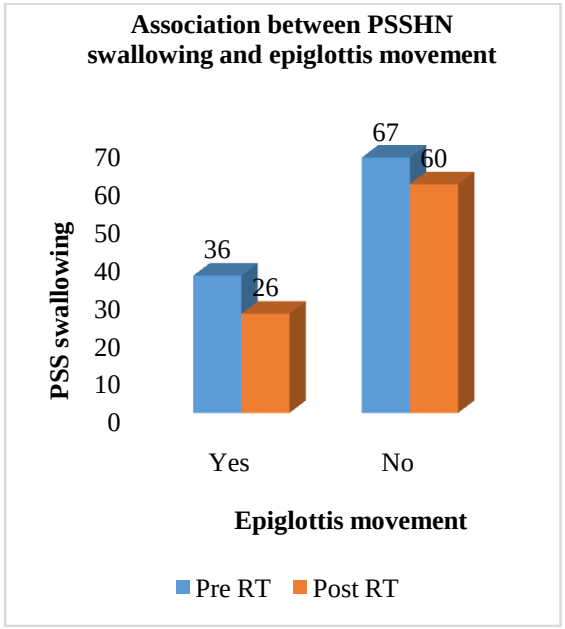

Figure 5: Association between PSSHN swallowing and epiglottis movement

Pharyngeal residue and PSSHN swallowing

The mean PSS Swallowing score was 34.16 ± 13.81 for patients with pharyngeal residue and 31.11 ± 11.96 for those without residue, indicating more pronounced swallowing difficulties among patients with residue, with the difference being statistically significant (p=0.0221). Post-treatment, there was a significant improvement in swallowing function. The mean PSS Swallowing score increased to 62.5 ± 12.99 for patients with pharyngeal residue and 68.23 ± 17.90 for those

International Journal Dental and Medical Sciences Research
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without residue, demonstrating a notable enhancement in swallowing outcomes post-RT (p=0.0078, significant).**(Figure 6)**

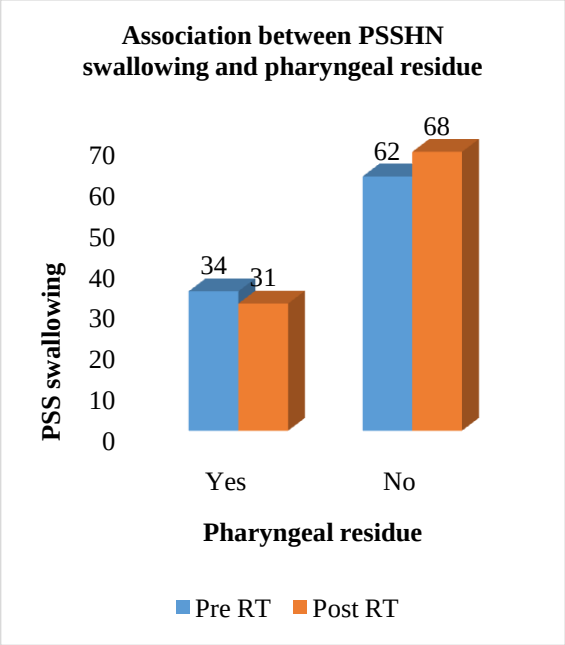

Figure 6: Association between PSSHN swallowing and pharyngeal residue

IV. DISCUSSION

HNSCC constitutes a significant burden in India. It is a potentially preventable and curable malignancy. Despite multimodal treatment and advancements in delivery techniques, survival rates in HNSCC patients have plateaued. Therefore, evaluating functional status and quality of survival is essential to measure the success of treatment.Quality of life (QoL) has always been an important aspect of the EORTC approach to treatment as stated in the aims of the organisation: "to conduct, develop, coordinate, and stimulate laboratory and clinical research in Europe to improve the management of cancer and related problems by increasing survival, but also patients' quality of life."

In this study, 35 out of 38 patients were treated either with 3DCRT or IMRT radiation technique. 3DCRT was used in 3 (8.57%) of the cases and IMRT was utilized in 32 (91.42%) of the cases, making it the predominant technique indicating predominant use of IMRT technique. 3 (25%) out 12 patients from NACT group defaulted for further treatment. In a similar study by **Ghosh-Laskar S** on comparison 3DCRT with IMRT in HNSCC showed that Incidence of grade ≥2 xerostomia at 8 weeks posttreatment was significantly lower with IMRT compared with 3D conformal RT, Long-term weight loss was higher in patients in the 3D conformal RT arm compared to IMRT but Disease-related outcomes between arms (median follow-up, 70 months) were similar.**(13)Petkar I et. al.** on dysphagia-optimised intensity- modulated radiotherapy (Do-IMRT) versus standard intensity- modulated radiotherapy (S-IMRT) in head and neck cancer is the RCT investigating the effect of swallow sparing strategies on improving long-term swallowing outcomes in pharyngeal cancers**. (14)**

Assessment:

In this study, 21 patients underwent pre-RT and post-RT assessment using videolaryngoscopy to evaluate vocal cord mobility, epiglottis movement, and pharyngeal residue, these findings potentially correlating with the normalcy of diet and understandability of speech on the PSS and EORTC QLQ swallowing parameter.

On videolaryngoscopy, vocal cord status, pre and post-radiotherapy data indicate a notable increase in mobility of vocal cords post-treatment, while the absence of fixed or impaired mobility post-treatment could indicate improvement or resolution. Epiglottis status, there was notable improvement, with most patients demonstrating mobile epiglottises and a reduction in impaired mobility post-radiotherapy, suggesting potential improvement in epiglottis function. Pharyngeal residue status, reduction in the number of patients with pharyngeal residue post-radiotherapy indicates potential improvement in swallowing function following treatment. **Pauloski B R et. al.** on Comparison of swallowing function after intensity-modulated radiation therapy and conventional radiotherapy for head and neck cancer, used the video-fluoroscopic swallowing study (VFSS) to compare the swallowing function following conventional radiotherapy and IMRT showed patients treated with IMRT demonstrated shorter bolus transit times, less oral and pharyngeal residue, longer laryngeal closure (LAC), and larger oropharyngeal swallowing efficiency (OPSE) and greater airway protection. **(15)**

In our study, the analysis of EORTC QLQ C30 pre- and post-RT scores demonstrates that radiotherapy significantly enhances the quality of life for patients with head and neck cancers. These improvements encompass both global health perceptions and specific aspects of physical, emotional, and social functioning. The reductions in symptom severity, such as pain, fatigue, nausea, and insomnia, further highlight the effectiveness of radiotherapy in symptom management. **Wan Leung S et al.** done on HR-

QoL in HNSCC after radiotherapy using EORTC QLQ-C30 and QLQ-H&n35showed that with the advance of modern RT technology, head-and-neck related symptoms after RT could be significantly reduced and reflected to the improvement of broad aspects of HR-QoL in HNC survivors. **(16)**

In this study, the analysis of EORTC H&N43 pre and post RT scores demonstrate that there is a significant improvements in scores across most domains except dry mouth/sticky saliva and skin problems which showed increased toxicities. **Deb Barma M et. al.** on Quality of life among head and neck cancer treated patients in South India showed that there was no significant difference in the scores of quality of life among the patients who have undergone different modality of treatment, Therefore, psychological therapy along with surgery, chemotherapy and radiotherapy should be considered for improved treatment outcomes in Head and Neck cancer patients.**(17)**

Performance status score, there is an overall increase in average PSS scores from 173 pre-RT to 245 post-RT suggests a notable improvement in the patients' functional abilities related to swallowing and speech after undergoing radiotherapy even on subscales there was an improvement in all parameters.**Aggarwal V. V et al** showed that results using PSSHN showed significant improvement in swallowing function when the total score was studied. However, the subscale analysis revealed the improvement was significant only with “understandability of speech” domain while “eating in public” and “normalcy of diet” did not show significant improvement. **(18)**

Dysphagia assessment showed, overall, radiotherapy appears to have a positive impact on the severity of dysphagia post-treatment, particularly in reducing moderate to severe cases. In a study **by Van Daele D. J. et al** , showed that at baseline, subjects < 1 year post radiation had significantly better function than subjects >2 years post RT in several measures. **(19)**

Association between vocal cord mobility and swallowing function

We found a significant association between vocal cord mobility and swallowing function both before and after RT. Before treatment, patients with impaired vocal cord mobility had higher mean QLQ Swallowing scores (50.0) compared to those with mobile vocal cords (56.05 ± 19.58, p=0.0123). Following RT, improved vocal cord mobility correlated with reduced swallowing difficulties, as shown by the decreased mean QLQ Swallowing score (29.51 ± 21.34, p=0.0003).

The PSS Swallowing scores confirmed these findings. Pre-RT, the mean score was 32.50 (± 13.36) for patients with mobile vocal cords and 40.0 for those with impaired mobility (p=0.0223). Post-RT, the complete restoration of vocal cord mobility led to significant improvement in swallowing function, with a substantial increase in PSS Swallowing scores and no impairment (p=0.0003).

Association between epiglottis movement and swallowing function

Our study revealed a significant association between epiglottis movement and swallowing function. Pre-RT, patients with impaired epiglottis movement had higher QLQ Swallowing scores, indicating more severe swallowing difficulties compared to those with normal movement (50.38 ± 20.75 vs. 64.80 ± 11.58, p=0.0368). Post-RT, improved epiglottis movement correlated with reduced swallowing difficulties, emphasizing its importance in swallowing efficiency (p=0.0047).

Similarly, PSS Swallowing scores showed a trend where pre-RT, patients with impaired movement had lower scores (26.25 ± 8.56) than those with mobile movement (36.92 ± 13.80, p=0.0639). Post-RT, swallowing outcomes improved significantly, with the mean score for patients with mobile epiglottis movement increasing to 67.5 (± 17.57) and no impairment in any patient (p=0.0437).

Association between pharyngeal residue and swallowing function

In this study, pre-RT analysis showed that among the 12 patients (57.14%) with pharyngeal residue, the mean QLQ Swallowing score was 52.66 (± 22.17), while the 9 patients (42.85%) without residue had a mean score of 59.88 (± 12.53). Although not statistically significant (p=0.0956), this suggested better swallowing function in patients without residue. Post-RT analysis revealed significant improvements: only 4 patients (19.04%) had pharyngeal residue with a mean score of 49.75 (± 21.47), while the 17 patients (80.95%) without residue had a much lower mean score of 24.75 (± 18.31), indicating significantly better swallowing function (p=0.0069).

Similarly, the mean PSS Swallowing score increased to 62.5 (± 12.99) for patients with pharyngeal residue and 68.23 (± 17.90) for those

without, demonstrating significant improvement post-RT (p=0.0078).

In a similar study by **Gillespie, M.B et. al**. on Swallowing-Related Quality of Life after Head and Neck Cancer Treatment showed that chemoradiation may provide superior swallowing outcome to surgery/radiation in patients with oropharyngeal primary.**(20)**

In contrast, a study by **Agarwal, J et. al**. on Objective Assessment of Swallowing Function after Definitive Concurrent (Chemo) radiotherapy in Patients with Head and Neck Cancer, showed that there is significant impairment of objective swallowing function in all domains following CRT, with residue and aspiration domains being affected most significantly.**(21)**

V. CONCLUSION

Perceptive evaluation of swallowing showed improved performance status and CTCAEv5 revealed a reduction in adverse events related to swallowing difficulties. Subjective assessments using the EORTC QLQ-C30 and EORTC QLQ-H&N43 questionnaires indicated significant improvements in swallowing functions post-treatment, despite radiation-related toxicities such as dry mouth, sticky saliva, and skin reactions. Objective assessment via videolaryngoscopy demonstrated notable enhancements in vocal cord and epiglottis mobility and a significant reduction in pharyngeal residue, correlating with improved swallowing function.

The overall impact on quality of life (QoL) was positive, combining subjective and objective assessments. Improved swallowing functions post-RT significantly enhanced patients' QoL, leading to better overall well-being and reduced psychosocial distress. However, the study highlighted a significant number of defaulted cases, indicating that despite the treatment's effectiveness, many patients are not completing their prescribed treatment and follow-up, which could lead to poorer long-term outcomes.

The study concludes that pharyngeal movement plays a critical role in effective swallowing and overall QoL. A larger cohort study is recommended to implement more stringent follow-up strategies and gain a better understanding of the factors influencing swallowing function.

Variables	**EORTC QLQ 30 - PRE RT score**	**EORTC QLQ 30 - POST RT score**	**'p' value and significance**
	Mean ± SD	**Mean ± SD**	
Global health status	**52.91±13.07**	**69.19±21.48**	p=0.0172, significant
Functional scale			
Physical functioning	57.77±19.57	76.38±18.72	p=0.0163, significant
Role functioning	55.92±19.53	74.23±20.29	p=0.0026, significant
Emotional functioning	43.87±17.83	67.93±28.06	p=0.0136, significant
Cognitive functioning	63.95±15.44	77.52±21.38	p=0.1015, not significant
Social functioning	46.47±16.80	62.33±27.97	p=0.1022, not significant
Symptom scale			
Fatigue	57.72±16.99	43.14±23.52	p=0.1888,not significant
Nausea and Vomiting	34.38±19.08	7.81±16.97	p=0.0003, significant
Pain	53.80±16.92	26.62±19.89	p=0.0001, significant
Dyspnoea	22.92±15.41	14.19±24.80	p=0.1065, not significant
Insomnia	47.72±21.66	20.42±24.42	p=0.0001, significant
Appetite loss	56.00±22.22	39.38±29.01	p=0.0184, significant
Constipation	20.17±18.12	4.71±15.77	p=0.0020, significant

Diarrhoea	6.42±13.26	3.14±14.40	p=0.3872, not significant
Financial difficulties	64.36±23.88	45.42±32.21	p=0.0142, significant

Table 3: Comparison of scores obtained by EORTC QLQ C-30 - PRE RT and POST RT

Variables	**EORTC QLQ 43 - PRE RT score**	**EORTC QLQ 43 - POST RT score**	**'p' value and significance**
	Mean ± SD	**Mean ± SD**	
Multi item scale			
Pain in the mouth	48.66±17.04	19.77±20.33	p=0.0002, significant
Swallowing	56.75±16.75	29.51±21.87	p=0.0002, significant
Problems with teeth	28.61±15.62	15.76±22.00	p=0.0177, significant
Dry mouth and sticky saliva	58.72±36.13	29.77±11.39	p=0.0529, significant
Problems with senses	25.30±16.00	17.04±13.35	p=0.0299, significant
Speech	42.92±22.45	24.93±23.53	p=0.0102, significant
Body image	45.25±20.49	33.19±26.01	p=0.0105, significant
Social eating	52.30±18.59	29.31±25.78	p=0.0006, significant
Sexuality	16.05±23.51	1.57±7.20	p=0.0086, significant
Problems with shoulder	11.42±15.17	0.00±0.00	p=0.0071, significant
Skin problems	33.77±18.77	10.28±10.76	p=0.0002, significant
Fear of progression	64.83±20.47	56.90±32.02	p=0.1566, not significant
Single item scale			
Problem opening mouth	27.50±18.50	12.57±19.45	p=0.0143, significant
Coughing	21.11±25.22	15.76±27.00	p=0.8307, not significant
Social contact	52.30±22.94	28.00±25.76	p=0.0032, significant
Swelling in the neck	26.66±23.33	11.00±19.05	p=0.0177, significant
Weight loss	43.08±22.05	29.90±25.49	p=0.0741, not quite significant
Problems with wound healing	38.50±22.9	14.14±19.72	p=0.0021, significant
Neurological problems	30.25±19.91	15.71±22.42	p=0.0155, significant

Table 4: Comparison of scores obtained by EORTC QLQ H&N43 - PRE RT and POST RT

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