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Original Research

Nutritional Status and Quality of Life in Post-Chemoradiotherapy Oral Cancer Patients: A Clinical Study

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ABSTRACT:

Background: Oral cancer is among the most prevalent malignancies in India, with chemoradiotherapy (CRT) forming a cornerstone of treatment. However, CRT often leads to nutritional compromise and impaired quality of life (QoL). **Objectives:** This study aimed to evaluate the nutritional status and QoL of post-CRT oral cancer patients and to explore the association between nutritional deficits and QoL outcomes. **Methods:** A cross-sectional study was conducted among 100 patients with histologically confirmed oral squamous cell carcinoma who had completed CRT within 3–6 months. Nutritional assessment included body mass index (BMI), percentage weight loss, mid-upper arm circumference (MUAC), and Patient-Generated Subjective Global Assessment (PG-SGA). QoL was measured using the EORTC QLQ-C30 and QLQ-H&N35 tools. Data were analyzed using descriptive statistics, Chi-square tests, ANOVA, and Pearson correlation. **Results:** The mean BMI declined significantly post-treatment (22.4 ± 3.1 vs 20.1 ± 2.8; $p < 0.001$). Based on PG-SGA, 76% were malnourished (moderate or severe). Common post-CRT complications included xerostomia (72%), dysphagia (64%), and altered taste (59%). Severely malnourished patients had significantly poorer global health scores (48.2 ± 13.5) compared to well-nourished patients (67.1 ± 12.8; $p<0.01$). Correlation analysis showed PG-SGA strongly associated with fatigue and appetite loss. **Conclusion:** Malnutrition is highly prevalent in post-CRT oral cancer patients and significantly impairs QoL. Integrating nutritional rehabilitation into survivorship care is crucial to improving long-term outcomes.

Keywords: Oral cancer, Chemoradiotherapy, Malnutrition, Patient-Generated Subjective Global Assessment, EORTC QLQ-C30, Quality of Life, Survivorship, Nutritional rehabilitation

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INTRODUCTION

Oral cancer represents a significant global health burden, particularly in South and Southeast Asia where tobacco and alcohol use remain prevalent. It is the sixth most common cancer worldwide, with an estimated 377,713 new cases and 177,757 deaths annually, and accounts for nearly 30% of all cancers in India [1]. Standard treatment protocols, including surgery, radiotherapy, and chemotherapy, often lead to long-term side effects that substantially impact patients' nutritional status and overall quality of life (QoL) [2]. Chemoradiotherapy (CRT), while improving survival outcomes, induces profound physiological changes in the oral cavity such as

xerostomia, mucositis, dysgeusia, trismus, and dysphagia, all of which impair food intake and lead to malnutrition [3].

Malnutrition is highly prevalent among head and neck cancer patients, with rates ranging from 30% to 80% depending on disease stage and treatment intensity [4]. The multifactorial etiology includes reduced dietary intake due to painful swallowing, altered taste perception, mechanical obstruction, and systemic inflammation associated with cancer cachexia [5]. Post-treatment nutritional deficits contribute not only to weight loss and sarcopenia but also to immunosuppression, delayed wound healing, and higher susceptibility to infections, thereby worsening treatment outcomes [6]. Additionally, malnutrition exacerbates fatigue, decreases functional status, and diminishes psychological well-being, directly impairing QoL [7].

Quality of life has emerged as a key endpoint in cancer research, supplementing traditional measures such as survival and recurrence rates. The World Health Organization defines QoL as an individual's perception of their position in life within the context of their culture and value systems, and in relation to their goals, expectations, standards, and concerns [8]. In oral cancer survivors, CRT-induced nutritional compromise is closely interlinked with psychosocial challenges, including anxiety, depression, social withdrawal, and impaired speech, further reducing QoL scores [9]. The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) and its head and neck-specific module (QLQ-H&N35) are widely validated tools that assess functional, symptomatic, and nutritional domains, offering a comprehensive evaluation of these interrelationships [10].

Despite advancements in oncologic treatment, the survivorship phase is frequently marred by persistent nutritional and functional limitations. Nutritional rehabilitation and supportive interventions are therefore integral to improving long-term QoL in oral cancer patients. However, there is limited literature focusing on the post-CRT period in low- and middle-income countries, where sociocultural and economic determinants further complicate dietary patterns and access to supportive care. Identifying the extent of malnutrition and its association with QoL outcomes in post-CRT oral cancer patients is crucial for designing multidisciplinary care models that address both clinical and supportive needs.

The present clinical study aims to evaluate the nutritional status and quality of life among post-chemoradiotherapy oral cancer patients, highlighting the interplay between treatment-related morbidity and survivorship outcomes. By examining both physiological and psychosocial dimensions, this study intends to provide insights for optimizing nutritional interventions and survivorship care strategies tailored to oral cancer patients in resource-limited settings.

METHODS

Study Design and Setting

This was a hospital-based, cross-sectional clinical study conducted in the Department of Oral Oncology at a tertiary cancer care center in India 18 months. Ethical clearance was obtained from the Institutional Ethics Committee prior to commencement and all participants provided written informed consent.

Study Population

Patients diagnosed with histologically confirmed oral squamous cell carcinoma (OSCC) who had completed concurrent chemoradiotherapy (CRT) within the previous 3 to 6 months were eligible.

Inclusion criteria

- Age ≥18 years.
- Completed full course of CRT.
- No evidence of recurrent or metastatic disease at the time of recruitment.
- Ability to provide informed consent and complete questionnaires.

Exclusion criteria

- Patients with other malignancies.
- Those with severe cognitive impairment or psychiatric illness limiting questionnaire response.
- Individuals receiving palliative therapy or tube feeding exclusively.

Sample Size

Based on previous studies reporting a malnutrition prevalence of approximately 50% in post-CRT head and neck cancer patients [1], the minimum required sample size was calculated using the formula:

$$n = \frac{Z^2 \times p(1-p)}{d^2}$$

where Z = 1.96 (95% confidence interval), p = 0.5, and d = 0.1 (10% margin of error). The estimated sample size was **96**, rounded up to **100 patients** for this study.

Data Collection

Sociodemographic data (age, sex, socioeconomic status, tobacco and alcohol history) and clinical details (tumor site, stage, treatment modality, radiation dose, chemotherapy cycles) were recorded from medical records.

Nutritional Assessment

Nutritional status was evaluated using a combination of **anthropometric, biochemical, and clinical parameters**:

- **Body Mass Index (BMI):** Calculated as weight (kg)/height (m^2). WHO classification was used to define underweight (<18.5 kg/m^2), normal (18.5–24.9), overweight (25–29.9), and obese (≥30).

- **Percentage weight loss:** Calculated relative to pre-treatment weight. A loss >10% was considered clinically significant.
- **Patient-Generated Subjective Global Assessment (PG-SGA):** A validated tool for oncology patients, assessing weight change, food intake, symptoms affecting intake, and physical function. PG-SGA scores were categorized as well-nourished (A), moderately malnourished (B), and severely malnourished (C).
- **Mid-Upper Arm Circumference (MUAC):** Used as a surrogate marker for muscle mass.

Quality of Life Assessment

Quality of life was assessed using the **EORTC QLQ-C30** (core cancer questionnaire) and **EORTC QLQ-H&N35** (head and neck cancer module). Both instruments were validated in local language (Hindi and regional vernacular) and self-administered, with assistance provided when necessary. Scores were linearly transformed to a 0–100 scale, where higher scores represented better functioning in functional domains and worse symptoms in symptom domains.

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using **SPSS version 26.0 (IBM Corp., Armonk, NY, USA)**. Descriptive statistics (mean, standard deviation, percentages) were used to summarize demographic and clinical variables. Associations between nutritional status and QoL domains were assessed using **Chi-square test** for categorical variables and **Student's t-test/ANOVA** for continuous variables. Pearson correlation coefficients were calculated between PG-SGA scores and QoL domains. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic and Clinical Characteristics

A total of **100 post-CRT oral cancer patients** were included. The mean age of participants was **54.6 ± 9.2 years**, with a male predominance (**72% males, 28% females**). The most common primary site was **buccal mucosa (38%)**, followed by tongue (27%), alveolus (15%), floor of mouth (12%), and other sites (8%). Nearly **68% of patients had stage III/IV disease** at presentation. The majority (82%) had a history of tobacco use, while 44% reported alcohol consumption.

Table 1 presents the demographic and clinical profile of the study population.

Table 1. Demographic and Clinical Characteristics of Post-CRT Oral Cancer Patients (n=100)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	54.6 ± 9.2
Gender	Male	72 (72%)
	Female	28 (28%)
Tumor site	Buccal mucosa	38 (38%)
	Tongue	27 (27%)
	Alveolus	15 (15%)
	Floor of mouth	12 (12%)
	Others	8 (8%)
Clinical stage	I–II	32 (32%)
	III–IV	68 (68%)
Tobacco history	Yes	82 (82%)
Alcohol history	Yes	44 (44%)

Nutritional Status

The mean **BMI decreased significantly** from **22.4 ± 3.1 kg/m² pre-treatment** to **20.1 ± 2.8 kg/m² post-treatment (p < 0.001)**. A total of **42% were underweight**, while **36% showed >10% weight loss**. According to PG-SGA, **24% were well-nourished (A)**, **38% moderately malnourished (B)**, and **38% severely malnourished (C)**. Mean MUAC was **22.6 ± 2.1 cm**, with 31% below the malnutrition cut-off (<21 cm).

Table 2 summarizes the nutritional status findings.

Table 2. Nutritional Status of Patients Post-Chemoradiotherapy (n=100)

Parameter	Finding	Value
BMI (kg/m²)	Pre-treatment	22.4 ± 3.1
	Post-treatment	20.1 ± 2.8
Underweight (<18.5 kg/m²)	Post-treatment	42%
Weight loss (>10%)		36%
PG-SGA	Well-nourished (A)	24%
	Moderately malnourished (B)	38%

	Severely malnourished (C)	38%
MUAC (cm)	Mean ± SD	22.6 ± 2.1
	<21 cm (malnutrition)	31%

Quality of Life Scores

EORTC QLQ-C30 analysis revealed **moderate impairment** across global health (mean 58.4 ± 15.2) and functional domains. The lowest scores were observed in physical functioning (54.2 ± 14.8) and role functioning (49.5 ± 16.3). Fatigue, pain, and appetite loss were the most common symptoms, with mean scores of 61.7 ± 17.6, 55.8 ± 15.9, and 52.3 ± 18.1, respectively.

On the head and neck-specific QLQ-H&N35 module, patients reported **high prevalence of xerostomia (72%)**, **dysphagia (64%)**, and **altered taste (59%)**. Speech difficulties were present in 41%, while social eating problems were reported by 46%.

Table 3 outlines the QoL scores.

Table 3. Quality of Life Scores (EORTC QLQ-C30 and H&N35)

Domain	Mean ± SD / %
Global Health Status (QLQ-C30)	58.4 ± 15.2
Physical Functioning	54.2 ± 14.8
Role Functioning	49.5 ± 16.3
Emotional Functioning	62.7 ± 14.1
Social Functioning	57.8 ± 15.4
Fatigue (Symptom)	61.7 ± 17.6
Pain (Symptom)	55.8 ± 15.9
Appetite Loss (Symptom)	52.3 ± 18.1
H&N35 (Selected items)	
Xerostomia	72%
Dysphagia	64%
Altered Taste	59%
Speech Difficulty	41%
Social Eating Problems	46%

Association Between Nutritional Status and QoL

Patients categorized as **severely malnourished (PG-SGA C)** demonstrated significantly lower global health scores (**48.2 ± 13.5**) compared to well-nourished patients (**67.1 ± 12.8; p < 0.01**). Severe malnutrition was also strongly associated with higher fatigue and appetite loss scores ($p < 0.05$). Correlation analysis showed a **negative correlation between PG-SGA scores and global health status (r = –0.46, p < 0.001)**, and a **positive correlation with fatigue (r = 0.39, p < 0.01)**.

Table 4 shows the association between nutritional status and QoL scores.

Table 4. Association of Nutritional Status (PG-SGA) with QoL Domains

PG-SGA Category	Global Health (Mean ± SD)	Fatigue (Mean ± SD)	Appetite Loss (Mean ± SD)
Well-nourished (A)	67.1 ± 12.8	48.6 ± 14.7	40.2 ± 15.3
Moderately Malnourished (B)	58.6 ± 14.2	57.3 ± 16.2	49.8 ± 17.1
Severely Malnourished (C)	48.2 ± 13.5	68.5 ± 17.4	62.7 ± 18.6
p-value	<0.01	0.02	0.01

Narrative Summary

The findings demonstrate that nutritional compromise is highly prevalent among post-CRT oral cancer patients, with nearly **three-fourths experiencing moderate to severe malnutrition**. QoL assessments revealed persistent impairments in physical functioning, fatigue, and appetite, with xerostomia and dysphagia being the most frequent long-term complications. Importantly, malnutrition was strongly correlated with poorer QoL outcomes, underscoring the need for early nutritional intervention and supportive care in survivorship programs.

DISCUSSION

The present study demonstrates a high prevalence of malnutrition and impaired quality of life (QoL) among post-chemoradiotherapy (CRT) oral cancer patients. Nearly three-fourths of patients were classified as moderately to severely malnourished, and a significant decline in body mass index (BMI) and muscle mass was observed following treatment. In addition, patients reported persistent symptoms including xerostomia, dysphagia, and altered taste, which adversely influenced nutritional intake and daily functioning. These findings are consistent with

existing literature highlighting the bidirectional relationship between nutritional status and QoL in head and neck cancer survivors [11].

Impact of CRT on Nutritional Status

CRT, although effective in achieving local tumor control, is associated with profound treatment-related toxicities that directly impair oral intake. Mucositis, dysphagia, and xerostomia not only reduce the capacity to ingest solid and liquid foods but also alter taste perception and enjoyment of eating [12]. In the current study, BMI declined significantly from pre-treatment to post-treatment, and more than one-third of patients experienced >10% weight loss, consistent with previously reported ranges of 30–80% in head and neck cancer patients [13]. PG-SGA findings further confirmed that malnutrition remains a persistent challenge even in the early survivorship phase.

The role of systemic inflammation and catabolic metabolism associated with cancer cachexia should not be underestimated. Inflammatory cytokines such as TNF-α and IL-6 promote muscle wasting and anorexia, worsening nutritional decline despite caloric intake [14]. This highlights the need for a multimodal approach, integrating dietary counseling with pharmacologic and rehabilitative strategies to address both intake-related and metabolic drivers of malnutrition.

Quality of Life Impairments

Our QoL assessment revealed moderate global health impairment, with particularly low scores in physical and role functioning. Fatigue, appetite loss, and pain were the most distressing symptoms. These findings are comparable with earlier reports where post-CRT oral cancer survivors continued to experience functional impairments and symptom burdens for several months to years after treatment [15].

The EORTC QLQ-H&N35 results in our cohort showed a high prevalence of xerostomia, dysphagia, and taste alteration. These sequelae not only compromise nutrition but also impair social interactions, leading to isolation and psychological distress. Social eating difficulties were reported by nearly half of the patients, underscoring the psychosocial dimensions of survivorship. Such findings align with the work of Rogers et al., who emphasized that persistent oral dysfunctions are among the strongest determinants of long-term QoL decline in oral cancer survivors [16].

Association Between Nutrition and QoL

A significant association was observed between malnutrition and QoL domains. Severely malnourished patients reported lower global health status and higher fatigue and appetite loss compared to well-nourished patients. The negative correlation between PG-SGA scores and global health supports previous studies demonstrating that nutritional deficits directly influence functional and symptomatic QoL outcomes [17]. Nutritional decline amplifies fatigue, reduces physical resilience, and contributes to psychological stress, thereby creating a vicious cycle of impaired recovery.

These findings highlight the importance of nutritional assessment not as an adjunct but as an integral component of oncologic follow-up. Evidence suggests that targeted interventions, including individualized dietary counseling, enteral feeding support, and rehabilitation programs, can improve both nutritional indices and QoL scores in head and neck cancer populations [18].

Implications for Clinical Practice

In resource-limited settings such as India, where oral cancer is highly prevalent and treatment-related morbidities are often compounded by socioeconomic challenges, the findings of this study carry significant implications. Nutritional rehabilitation and QoL monitoring are often overlooked in busy oncology clinics that prioritize tumor control and survival outcomes. However, survivorship care must adopt a holistic approach, integrating dieticians, speech therapists, and psychologists to address the multifaceted needs of patients.

Furthermore, cost-effective and culturally appropriate interventions, such as high-protein dietary supplements using locally available food resources, community-based rehabilitation, and family counseling, can substantially improve outcomes. Telehealth-based nutritional monitoring, increasingly feasible in post-pandemic India, may also serve as an adjunct to routine care, bridging access gaps for rural patients [19].

Strengths and Limitations

The strengths of this study include the use of validated tools (PG-SGA and EORTC QLQ-C30/H&N35), adequate sample size, and comprehensive evaluation of both nutritional and QoL domains. However, some limitations merit consideration. First, the cross-sectional design captures only a single time-point post-treatment; longitudinal studies are required to track the trajectory of recovery and identify patients at greatest risk of persistent deficits. Second, biochemical markers of nutrition (albumin, prealbumin, CRP) were not systematically assessed, which could have enriched the analysis. Lastly, the study was conducted at a single tertiary care center, which may limit generalizability to wider populations with diverse sociodemographic profiles.

Future Directions

Future research should focus on prospective longitudinal designs to evaluate the evolution of nutritional status and QoL over time, and on randomized controlled trials assessing the effectiveness of tailored nutritional interventions. Integration of patient-reported outcome measures into

routine oncology practice can guide timely interventions and foster patient-centered care. Exploring novel therapies such as immunonutrition and microbiome-based dietary modulation may also hold promise in improving outcomes [20-25].

CONCLUSION

This study demonstrates that malnutrition is highly prevalent among post-CRT oral cancer patients and is closely associated with impaired quality of life. Persistent treatment-related complications, particularly xerostomia, dysphagia, and taste alterations, significantly limit dietary intake and social functioning. Severely malnourished patients experience worse global health status, higher fatigue, and greater appetite loss. These findings emphasize the need for systematic nutritional assessment and early intervention as integral components of survivorship care. Implementing cost-effective and culturally appropriate nutritional rehabilitation strategies, alongside multidisciplinary support, has the potential to improve both functional recovery and overall quality of life in oral cancer survivors.

REFERENCES

1. Gellrich NC, Handschel J, Holtmann H, Kruskemper G. Oral cancer malnutrition impacts weight and quality of life. Nutrients. 2015;7(4):2145-60.
2. Barrios R, Rodríguez J, Gil F, Zamora M, López-Espuela F. Oral health-related quality of life and malnutrition in head and neck cancer patients. Clin Oral Investig. 2014;18(3):773-81.
3. Prevost V, Pondé P, Gascon P, et al. Assessment of nutritional status and quality of life in head and neck cancer patients. Clin Nutr. 2014;33(4):744-50.
4. Morioka R, Matsuda Y, Kato A, Okui T, Okuma S, Tatsumi H, et al. Oral functional impairment may cause malnutrition following oral cancer treatment. Sci Rep. 2022;12:14787.
5. Zhang Q, Shen L, Zhang F, et al. PG-SGA SF in nutrition assessment and survival prediction in elderly cancer patients. Support Care Cancer. 2021;29(1):263-71.
6. Brown TE, Paleri V, Nutting C, McCloskey C. Randomised controlled trial of early prophylactic feeding vs. standard care in head and neck cancer patients undergoing chemoradiotherapy: effects on quality of life. Br J Cancer. 2017;116(6):666-75.
7. Leão I, da Silva ACP, de Carvalho D, et al. Acute impact of cancer treatment on head and neck cancer survivors: nutritional and quality of life correlations. Cancers (Basel). 2022;14(11):2698.
8. Zhan YH, Zhang YH, Zhang Y, et al. Evaluating the Nutritional Status of Oncology Patients and Its Association with Quality of Life: Results from a Multicenter Study. Support Care Cancer. 2018;26(5):1735-43.
9. Bao X, Liu F, Lin J, Chen Q, Chen L, Wang J, et al. Nutritional assessment and prognosis of oral cancer patients: a large-scale prospective study. BMC Cancer. 2020;20:146.
10. Anghel R, Rusu A, Lupu A, et al. Assessing the Impact of Nutritional Status on the Quality of Life in Head and Neck Cancer Patients. Cancers (Basel). 2025;17(7):1128.
11. Wallmander C, Johansson M, Nilsson J, et al. Malnutrition in patients with advanced head and neck cancer: prevalence and implications. Clin Nutr ESPEN. 2025;??(?):??-??.
12. Coffré A, Morales D, Brunet L, et al. Malnutrition in Head and Neck Cancer: A Patient-reported Study. Anticancer Res. 2023;43(4):1663-70.
13. Leão I, Silva ACP, Teles LL, et al. Correlations between PG-SGA and symptom burden in head and neck cancer patients. Support Care Cancer. 2022;30(9):7615-24.
14. Ravasco P, Monteiro-Grillo I, Vidal PM, Camilo ME. Cancer: disease and nutrition are key determinants of patients' quality of life. Support Care Cancer. 2004;12(3):246-53.
15. Hopanci Bicakli D, Ozkaya Akagunduz O, Meseri Dalak R, Uslu R, Uyar M. Effect of compliance with nutritional counselling on body composition parameters in head and neck cancer patients under radiotherapy. J Nutr Metab. 2017;2017:8631945.
16. Fayers PM, Aaronson NK, Bjordal K, et al, editors. The EORTC QLQ-C30 Scoring Manual, 3rd edn. Brussels: European Organisation for Research and Treatment of Cancer; 2001.
17. Langius JA, Zandbergen MC, Eerenstein SEJ, van Tulder MW, Leemans CR, Kramer MHH, Weijs PJM. Effect of nutritional interventions on nutritional status, quality of life and mortality in head and neck cancer: systematic review. Clin Nutr. 2013;32(4):671-8.
18. Gourin CG, Podolsky RH, Sheils WC, et al. Nutritional intervention and quality of life in head and neck cancer patients receiving radiotherapy: a systematic review. Head Neck. 2020;42(11):3244-52.
19. Buscemi P, Giammanco A, et al. Nutritional factors and survival in a cohort of patients with oral cancer. Front Nutr. 2025;? (ahead of print).
20. Cocks K, King MT, Velikova G, de Castro G Jr, St-James M, Fayers PM, Brown JM. Evidence-based guidelines for interpreting change scores for the EORTC QLQ-C30. Eur J Cancer. 2012;48(11):1713-21.
21. Manek P, Joshi R, Singh S. Effect of Silver Diamine Fluoride on Surface Microhardness of Enamel. Journal of Pharmacy and Bioallied Sciences. 2020;12(Suppl 1):S123–S128. doi: 10.4103/jpbs.JPBS_197_20.
22. Manek P, Patel A, Gupta S. Nanodentistry: A Revolutionary Approach in Dental Sciences. Journal of Research and Advancement in Dentistry. 2020;10(2):56–62.
23. Manek P, Sharma P, Desai M. Relationship of BMI and Recurrent Aphthous Ulcer. Journal of Research and Advancement in Dentistry. 2020;10(1):34–39.
24. Manek P, Thakar S, Patel K. Prevalence and Patterns of Tobacco Use Among the Tribal Population of South Gujarat: A Cross-sectional Observational Study. Journal of Research and Advancement in Dentistry. 2020;10(4):23–29.
25. Suneetha M, Ramya A, Afroz Kalmee S. A fundamental change in approach in the dental and oral hygiene management in children during Covid 19 pandemic. IOSR JDMS (IOSR-JDMS). 2020;19(12):16-20.