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Nutrition Status and Health-Related Quality of Life Among Outpatients With Advanced Head and Neck Cancer

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Abstract

This pilot study evaluated nutrition status and health-related quality of life (HRQOL) outcomes among outpatients with head and neck cancer (HNC). Data were collected from 19 patients (18 males, 1 female) during 3 time points: once before chemoradiotherapy (CRT) initiation and 1 and 3 months after CRT. Nutrition status was evaluated using the Scored Patient-Generated Subjective Global Assessment (PG-SGA). Malnutrition was defined as PG-SGA stage B (moderate/suspected malnutrition) or stage C (severely malnourished). HRQOL was assessed through the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) and its HNC-specific module (QLQ-H&N35). We found that well-nourished patients reported having fewer issues with pain, fatigue, appetite loss, chewing, sticky saliva, coughing, and social eating than those categorized as malnourished ($P < .05$). The association between the global quality-of-life score and PG-SGA score was statistically significant but weak in strength ($r = -0.37$, $P = .012$). Although PG-SGA identified 70% as either moderately or severely malnourished before treatment initiation, the mean body mass index was in the overweight category ($29 \pm 5 \text{ kg/m}^2$). Compared with pretreatment, patients reported more severe problems with chewing, swallowing, sticky saliva, dry mouth, speech, social eating, and taste and smell sensations at 1-month follow-up, although issues with dry mouth persisted 3 months post treatment ($P = .003$). In conclusion, malnourished patients reported having worse HRQOL symptoms compared with well-nourished patients. Routine nutrition and psychosocial assessment through PG-SGA and EORTC tools might help identify patients in need of nutrition and psychosocial care. (*Nutr Clin Pract.* 2020;00:1–9)

Keywords

head and neck cancer; malnutrition; nutrition status; PG-SGA; quality of life

Introduction

Patients with head and neck cancer (HNC) are at a high risk of becoming malnourished. An estimated 35%–60%

are reported to be malnourished already at the time of diagnosis.¹ Treatment-related side effects such as dry mouth, decreased appetite, and difficulties with chewing and swallowing compromise oral intake, leading to significant weight

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Conflicts of interest: Harriët Jager-Wittenaar is a codeveloper of the Patient-Generated Subjective Global Assessment (PG-SGA)-based “Pt-Global” app/web tool, a global platform and mobile application used to promote the PG-SGA tool.

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loss and malnutrition.²⁻⁴ Within the US, malnutrition still goes unrecognized by the clinicians and is associated with longer hospital length of stay and higher morbidity, mortality, and healthcare costs.^{5,6}

Health-related quality of life (HRQOL) assesses patients' physical, psychological, social, and emotional functioning from their own experience and perspective, therefore identifying individuals who might benefit from clinical interventions.⁷⁻⁹ Prospective studies among HNC patients have shown an association between nutrition status and HRQOL outcomes. For example, among oropharyngeal cancer patients undergoing radiotherapy (RT), malnourished patients reported having worse QOL symptoms than well-nourished patients have.¹⁰ In another observation, HNC patients who had lost $\geq 10\%$ body weight in the past 6 months reported having poor HRQOL during treatment and 6 months after the treatment period.¹¹

Although research has shown that malnutrition negatively affects HRQOL,⁹⁻¹⁴ these data are limited within the US. First, HRQOL outcomes are not evaluated on a regular basis in cancer centers because of a lack of resources and/or personnel assisting with QOL assessment.^{9,12} Secondly, there are inconsistencies in nutrition screening and assessment practices among outpatient treatment centers within the US, and consults with registered dietitians (RDs) are either lacking or dependent on referral. Within the US, although the Joint Commission on Accreditation of Healthcare Organizations mandates that hospitalized patients be screened for nutrition risk within 24 hours of admission, currently no clear nutrition screening standards exist for outpatient care centers.¹⁵ In some other countries, including the Netherlands, Australia, and Canada, nutrition services are more integrated with cancer care, and evidence-based oncology guidelines require or recommend routine consultations with RDs.¹⁶ Nonetheless, the effectiveness of nutrition counseling and therapy on clinical outcomes has yielded mixed results,¹⁷ and malnutrition continues to be a global health concern.¹⁸⁻²⁰

Given a lack of knowledge in how nutrition status relates to QOL outcomes within the US, the aim of this prospective exploratory pilot study was to (1) evaluate the association between malnutrition and HRQOL among advanced HNC outpatients undergoing chemoradiotherapy (CRT) and (2) assess any longitudinal trends in nutrition status and HRQOL up to 3 months after CRT.

Materials and Methods

Design

This was an observational, prospective, longitudinal study design. Nineteen outpatients with HNC intending to undergo treatment with CRT at the Masonic Cancer Clinic and

Radiation Oncology Clinic at the University of Minnesota (UMN) Health were enrolled. Inclusion criteria were age of ≥ 18 years and a primary diagnosis of squamous cell carcinoma of the oral cavity, oropharynx, hypopharynx, larynx, or maxillary sinuses. Patients with a history of recurrent disease and/or comorbidities that may influence body weight, including organ failure and uncontrolled hypertension, were excluded.

Data were collected when patients were attending their routine clinic appointments and follow-up visits during the following 3 time points: within 7 days prior to starting CRT (baseline) and 1 and 3 months after treatment. The Institutional Review Board and Cancer Protocol Review Committee at the UMN approved the study. Data were entered and managed using the REDCap electronic data capture tools hosted at the XXX.

In this study, data were collected on nutrition status, but the nutrition intervention was not provided based on our findings at any given time point. Outside the study procedures, as part of routine outpatient care, dietitian referrals were provided by oncologists; ear, nose, and throat (ENT) physicians; nurse practitioners; and physician assistants, usually once before treatment initiation to educate patients about beginning enteral nutrition support (ENS). However, it was not standard of care to be seen by an RD routinely during CRT treatment, and any future appointments with RDs were directed by clinician referrals based on their judgment if the patient is losing significant body weight or having dysphagia from mucositis. Information about RD referral and how many patients saw an RD for nutrition counseling or therapy within or outside the clinic was not collected during the course of the study.

Outside the study procedures, patients were also seen by speech-language pathologists (SLPs). SLPs did not follow patients weekly while receiving therapy at the current treatment center. SLPs were more aligned with the ENT surgery team and saw patients along with ENT surgeons before treatment initiation, occasionally in the middle of CRT, and 6 weeks after treatment completion. The SLPs assessed speech and swallow evaluation and provided recommendations on swallowing exercises and on the types of foods patients could eat. However, thorough nutrition counseling and discrete nutrition recommendations were not provided by SLPs.

Health-Related Quality of Life

The European Organization for Research and Treatment of Cancer (EORTC) Core Quality of Life Questionnaire (QLQ-C30) (version 3.0) and its HNC-specific module (EORTC QLQ-H&N35) were used to assess HRQOL.²¹ These tools assess multiple QOL domains, and data are self-reported by the patients. Research has shown these measures to be reliable and valid for use among HNC patients.²¹⁻²³

The EORTC QLQ-C30 is a 30-item questionnaire with 1 global health status scale (global QOL), 5 multi-item functional scales (physical, role, emotional, cognitive, and social), 3 multi-item symptom scales (fatigue, nausea and vomiting, and pain), and 6 single-item measures (dyspnea, insomnia, appetite loss, constipation, diarrhea, and financial difficulties).

The EORTC QLQ-H&N35 is a 35-item questionnaire assessing symptoms and side effects of treatment, social function, and body image/sexual issues. It consists of 7 multi-item scales (pain, swallowing, sense of taste and smell, speech, social eating, social contact, and sexual function) and 11 single-item measures (teeth problems, issues with opening mouth, dry mouth, sticky saliva, coughing, feeling ill, use of pain killers, nutrition supplements, feeding-tube use, weight loss, and weight gain).

Since the EORTC does not assess chewing issues, the following 3 questions were asked in addition¹⁴: (1) How much difficulty did you experience while eating solid food (like meat/hard bread)? (2) How much difficulty did you experience while eating dry food (like cookies)? (3) How much difficulty did you experience while eating soft food (like soft bread)?

Using the EORTC Group scoring guidelines,²⁴ each scale and single-item was scored from 0 to 100. Higher scores in the global QOL or functional scales implied better QOL or function; higher scores in the symptom scales/items indicated worsening of symptoms. Chewing-related symptoms were assessed using the EORTC guidelines; higher scores suggested more issues with chewing.

Malnutrition

Malnutrition was assessed during all time points using the Scored Patient-Generated Subjective Global Assessment (PG-SGA).²⁵ The patient component of the PG-SGA includes 4 boxes addressing weight history, food intake, nutrition-impact symptoms, and activities and function. The professional component of the PG-SGA includes 5 worksheets, addressing scoring of weight loss, disease and its relation to nutrition requirements, metabolic demand, physical examination, and PG-SGA category rating.²⁶ Patients were rated as being well-nourished (PG-SGA A), moderate/suspected malnutrition (PG-SGA B), or severely malnourished (PG-SGA C). Subsequently, nutrition status was dichotomized into well-nourished or malnourished categories.

Based on the scores from all boxes and worksheets, a total numerical PG-SGA score was calculated.²⁶ PG-SGA scores between 4 and 8 points require intervention by an RD in conjunction with a nurse or physician as indicated by the nutrition-impact symptoms, whereas scores ≥ 9 imply a critical need for improved symptom management and/or nutrition intervention.²⁶

Table 1. Participant Characteristics at Baseline (n = 19).

Characteristic	n (%)
Age (years $\pm$ SD)	59 $\pm$ 7
Sex	
Male	18 (95)
Female	1 (5)
Body mass index (kg/m ² $\pm$ SD)	29 $\pm$ 5
Normal (18.5–24.9)	5 (26)
Overweight (25.0–29.9)	6 (32)
Obese (≥ 30)	8 (42)
Tumor staging	
Stage III	4 (21)
Stage IV	15 (79)
Primary tumor site	
Oropharynx	11 (58)
Oral cavity	3 (16)
Larynx	2 (11)
Maxillary sinuses	2 (11)
Paranasal sinuses	1 (5)
Surgery ^a	13 (68)

^aParticipants who had tumor resection surgery prior to beginning their treatment.

Statistical Analysis

Clinical and demographic characteristics were summarized as frequencies (percent) for categorical covariates and means $\pm$ SD for continuous variables. Pearson correlation examined the association between variables. One-way repeated-measures analysis of variance was performed to assess changes in mean EORTC QLQ-C30 and QLQ-H&N35 scores over time (ie, before treatment and 1 and 3 months post treatment). A post hoc analysis with Bonferroni adjustment was done for multiple pairwise comparisons.

To investigate whether malnutrition had any effect on HRQOL scores, nutrition status was included as a covariate in a repeated-measures model adjusted for time period, and within-participant interdependence was accounted. Here, the coefficient estimate and standard error of the estimate (SE) evaluated how the mean PG-SGA and EORTC scores differ between malnourished and well-malnourished participants.

Significance level was set at $P \leq .05$. Data were analyzed using SAS Version 9.4 (SAS Institute, Inc, Cary, NC, USA). The figure was constructed using GraphPad Prism version 8.2.1 (GraphPad Software, La Jolla, CA, USA).

Results

Sample Characteristics

Baseline data are presented in Table 1. All patients identified themselves as White; 18 were male and 1 female; mean age was 59 $\pm$ 7 years. Fifteen (79%) were diagnosed with

stage IV cancer, and 4 (21%) had stage III cancer. Most tumors were localized at the oropharynx (58%) and oral cavity (16%). Mean body mass index (BMI) was 29 ± 5 kg/m²; 74% were categorized as either overweight or obese. Thirteen (68%) underwent tumor resection surgery prior to starting CRT.

Forty-seven independent study visits were completed, and 10 data points were missing. Reasons for missed visits included declining to further participate in the study procedures after the first visit for 1 participant, 4 no-show appointments, and 3 individuals who died during the course of the study because of disease-related complications.

Nutrition Status and Health-Related Quality of Life

Nutrition status and HRQOL symptoms were evaluated for all observations across all time points (Table 2). After accounting for within-participant correlations and adjusting for time period, the PG-SGA score for well-nourished patients was, on average, 7.6 points lower than for the malnourished patients ($SE = 1.2$, $P < .001$). The global QOL score for well-nourished patients was 14.5 points higher than for the malnourished ($SE = 5.0$, $P = .01$) (Table 2).

Compared with malnourished patients, well-nourished patients reported having less pain ($P = .01$) and fatigue ($P = .02$) and fewer issues with appetite loss ($P = .01$), chewing ($P = .02$), coughing ($P = .03$), sticky saliva ($P = .01$), and social eating ($P = .03$). Malnourished patients reported more weight loss ($P = .01$), feelings of illness ($P = .02$), and more use of painkillers ($P = .002$), nutritional supplements ($P = .01$), and feeding tube ($P = .02$) than well-nourished patients reported (Table 2). The association between global QOL score and PG-SGA score was statistically significant but weak in strength ($r = -0.37$, $P = .012$).

Longitudinal Changes

PG-SGA categorized 68% (13/19) as either moderate/suspected malnutrition (PG-SGA B, 11/19) or severely malnourished (PG-SGA C, 2/19) before CRT initiation (baseline). One month post treatment, all patients were categorized as malnourished, and 92% (12/13) remained malnourished 3 months after the treatment period.

Compared with pretreatment, PG-SGA scores increased at 1 month after the treatment period (8 ± 4 vs 13 ± 4 , $P = .01$) (Table 3). Before treatment, 42% (8/19) had PG-SGA scores requiring RD intervention (ie, between 4 and 8 points), and 37% (7/19) scored ≥ 9 , indicating a critical need for improved symptom management and/or nutrition intervention (Table 3). One month after treatment, 20% (3/15) had PG-SGA scores between 4 and 8 points, and 80% (12/15) scored ≥ 9 ; 3 months after treatment completion, 8%

(1/13) scored between 4 and 8 points, and 92% (12/13) had PG-SGA scores ≥ 9 . Body weight (kg) and BMI (kg/m²) decreased from baseline to posttreatment time points, with the largest average reductions of 7 kg and 2 kg/m², respectively, between baseline and 1 month after treatment.

Of the 19 patients, 18 (95%) underwent a prophylactic percutaneous endoscopic gastrostomy tube placement procedure before beginning their treatment. Nutrition intake included oral diet and supplements and ENS feedings. Before treatment, 11% (2/19) were using ENS feedings; 1 month after treatment, 73% (11/15) were receiving ENS, whereas 46% (6/13) continued receiving ENS at the 3-month posttreatment mark.

Physical functioning assessed by QLQ-C30 was lower at baseline compared with 1 month after the treatment period (83 ± 26 vs 86 ± 13 , $P = .007$) (Table 3). Compared with pretreatment, severe problems with chewing ($P = .02$), swallowing ($P = .02$), sticky saliva ($P = .002$), speech ($P = .01$), social eating ($P = .03$), and taste and smell sensations ($P = .03$) were reported at 1-month follow-up in the QLQ-H&N35 (Table 3, Figure 1). Issues with dry mouth persisted both at 1-month and 3-month follow-up ($P = .007$ and $P = .003$, respectively) (Table 3).

Discussion

The results from this exploratory pilot study indicate an association between malnutrition and HRQOL in a cohort of advanced HNC patients. Malnourished patients reported having worse HRQOL when compared with those well-nourished. Longitudinally, poor HRQOL was reported at 1 month after the treatment period, although most symptoms improved 3 months post treatment with the exception of dry mouth. Although 70% of our sample was identified as either moderately or severely malnourished before treatment initiation, mean BMI was in the overweight category (29 ± 5 kg/m²), and 74% were classified as either overweight or obese. Thus, body weight and BMI are poor predictors of nutrition status, as these may mask malnutrition. Before treatment initiation, 42% had PG-SGA scores between 4 and 8 points, suggesting a need for nutrition intervention by an RD, and 37% scored ≥ 9 , indicating a critical need for improved symptom management and/or nutrition intervention.

Findings from this study highlight the need for regular nutrition and psychosocial assessment. Routine administration of PG-SGA and EORTC tools would help identify patients in need of nutrition and psychosocial care, as both tools provide unique data from the patient's experience and perspective that augment clinician assessment. Recently, the self-administered "PG-SGA Short Form" has been shown to be a feasible and quick (<5 minutes) method to screen HNC patients for nutrition risk and increase patient awareness of malnutrition.²⁷ Thus, all oncology outpatients

Table 2. Nutrition Status and QOL Estimates^a for Well-Nourished Patients (n = 7) (PG-SGA A) Compared With Malnourished Patients (PG-SGA B or C) (n = 40) for All Observations Across All Time Points.

Variable	Coefficient Estimate	Standard Error	P-Value
PG-SGA score	−7.6	1.2	<.001
EORTC QLQ-C30			
Global QOL	14.5	5.0	.01
Functional scales			
Physical functioning	1.1	4.2	.80
Role functioning	6.5	11.0	.56
Emotional functioning	4.5	5.9	.45
Cognitive functioning	13.4	6.9	.07
Social functioning	12.5	7.7	.12
Symptom scales/items			
Fatigue	−26.5	10.2	.02
Nausea and vomiting	−7.7	5.5	.18
Pain	−29.7	10.1	.01
Dyspnea	9.8	7.4	.21
Insomnia	−11.6	9.6	.24
Appetite loss	−34.3	11.1	.01
Constipation	4.1	9.4	.66
Diarrhea	−13.9	7.4	.08
Financial difficulties	−5.2	9.9	.61
QLQ-H&N35			
Pain	−11.0	8.6	.21
Swallowing	−8.3	5.5	.15
Senses problems	−3.4	13.8	.81
Speech problems	−3.2	5.4	.56
Trouble with social eating	−19.7	8.1	.03
Trouble with social contact	−1.8	3.9	.64
Sex interest	−22.8	12.5	.08
Teeth problems	−5.7	7.3	.44
Trouble opening mouth wide	5.3	10.9	.63
Dry mouth	−17.3	8.9	.07
Sticky saliva	−32.1	10.4	.01
Coughing	−18.4	7.6	.03
Felt ill	−20.9	8.1	.02
Pain killers	−51.9	14.7	.002
Nutritional supplements	−60.3	19.5	.01
Feeding tube	−53.3	20.9	.02
Weight loss	−55.5	19.5	.01

(continued)

must be screened for malnutrition risk, and thorough nutrition assessment must be conducted by an RD for high-risk patients for appropriate nutrition intervention and symptom management. Indeed, the American Society for Parenteral and Enteral Nutrition Clinical Practice Guidelines²⁸ for adult anticancer treatment recommend regular nutrition screening for patients with cancer. Therefore, it is important

Table 2. (continued)

Variable	Coefficient Estimate	Standard Error	P-Value
Weight gain ^c	—	—	—
Chewing problems ^b	−30.5	11.9	.02

EORTC QLQ, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire; PG-SGA, Scored Patient-Generated Subjective Global Assessment; QLQ-H&N35, head and neck cancer-specific module of the EORTC QLQ; QOL, quality of life.

^aThe coefficient estimate evaluated how mean PG-SGA and QOL scores differed between well-nourished and malnourished participants.

^bScale assessing problems with chewing is not included in the QLQ-H&N35.

^cInsufficient data to calculate the estimate.

to have a dedicated full-time nutrition staff in the outpatient oncology centers within the US.¹⁶

Nutrition Status and Health-Related Quality of Life

Patients categorized as malnourished by the PG-SGA tool (ie, PG-SGA B or C) scored lower on the global QOL scale than well-nourished patients; total PG-SGA score and global QOL score were weakly correlated to each other. Previously, in a cohort of cancer patients including HNC, Isenring et al²⁹ also found an association between the PG-SGA and global QOL scores; here, 26% of the variation in global QOL score was explained by a change in the PG-SGA score.

In our study, malnourished patients reported higher EORTC scores on scales/items that were likely to impact oral intake such as fatigue, appetite loss, coughing, sticky saliva, and problems with chewing. Among patients with gastric cancers,³⁰ PG-SGA-identified malnourished patients also scored higher in the EORTC symptom scales, including appetite loss, nausea and vomiting, pain, and insomnia. Taken together, these results suggest an association between malnutrition identified by the PG-SGA tool and HRQOL outcomes.

In the past, treatment modality has also affected nutrition and QOL symptoms. For example, CRT patients have reported more issues with fatigue, nausea and vomiting, appetite loss, and sticky saliva 1 month after treatment when compared with those receiving RT alone or RT with surgery.³¹⁻³³ Our cohort had advanced disease and underwent aggressive CRT that could have progressively diminished their QOL. Thus, it is debatable whether the association between nutrition status and HRQOL was mediated by the severity of disease and/or treatment modality rather than suggesting a causal relationship between nutrition and QOL outcomes. Nonetheless, patients have benefited from regular nutrition counseling provided by an

Table 3. Changes in Nutrition Status and QOL^a Across Time.^b

Variable	Before Treatment (n = 19)	1 Month Post Treatment (n = 15)	3 Months Post Treatment (n = 13)	P-Value ^c
PG-SGA score	8 ± 4	13 ± 4 ^d	12 ± 4 ^d	.001
PG-SGA score 4–8, (n) %	8 (42)	3 (20)	1 (8)	
PG-SGA score ≥ 9, (n) %	7 (37)	12 (80)	12 (92)	
Body weight (kg)	93 ± 23	86 ± 20 ^d	88 ± 21 ^d	.001
Body mass index (kg/m ²)	29 ± 5	27 ± 4 ^d	27 ± 5 ^d	<.001
EORTC QLQ-C30				
Global QOL	66 ± 17	69 ± 15	65 ± 16	.73
Functional scales				
Physical functioning	83 ± 26	86 ± 13 ^d	83 ± 21	.01
Role functioning	66 ± 34	72 ± 26	65 ± 25	.37
Emotional functioning	79 ± 15	80 ± 12	75 ± 14	.58
Cognitive functioning	87 ± 16	86 ± 18	82 ± 20	.13
Social functioning	68 ± 20	73 ± 22	64 ± 21	.48
Symptom scales/items				
Fatigue	35 ± 26	40 ± 13	38 ± 20	.61
Nausea and vomiting	6 ± 13	16 ± 25	14 ± 16	.17
Pain	32 ± 28	23 ± 24	21 ± 24	.36
Dyspnea	11 ± 22	13 ± 17	21 ± 26	.06
Insomnia	33 ± 22	29 ± 25	26 ± 20	.49
Appetite loss	33 ± 29	47 ± 28	46 ± 29	.29
Constipation	16 ± 23	20 ± 17	15 ± 17	.31
Diarrhea	7 ± 18	11 ± 16	10 ± 16	.53
Financial difficulties	28 ± 28	20 ± 17	21 ± 22	.40
QLQ-H&N35				
Pain	25 ± 19	31 ± 17	24 ± 25	.43
Swallowing problems	16 ± 18	27 ± 27 ^d	19 ± 18	.02
Trouble smelling or tasting	27 ± 35	50 ± 28 ^d	42 ± 22	.03
Speech problems	18 ± 23	29 ± 27 ^d	19 ± 25	.01
Trouble eating socially	19 ± 23	36 ± 25 ^d	31 ± 28	.03
Trouble with social contact	9 ± 9	18 ± 22	14 ± 13	.09
Sex interest	22 ± 29	31 ± 33	28 ± 28	.60
Teeth problems	14 ± 28	5 ± 13	13 ± 29	.30
Trouble opening mouth wide	21 ± 34	22 ± 27	13 ± 17	.78
Dry mouth	18 ± 23	47 ± 21 ^d	49 ± 22 ^d	.003
Sticky saliva	21 ± 34	58 ± 29 ^d	38 ± 23	.002
Coughing	30 ± 19	40 ± 29	33 ± 27	.65
Felt ill	14 ± 20	22 ± 21	23 ± 25	.37
Pain killers	74 ± 45	80 ± 41	62 ± 51	.70
Nutritional supplements	42 ± 51	73 ± 46	69 ± 48	.11
Feeding tube	37 ± 50	73 ± 46	38 ± 51	.06
Weight loss	58 ± 51	33 ± 49	46 ± 52	.29
Weight gain	0	20 ± 41	23 ± 44	.07
Chewing problems ^e	30 ± 33	57 ± 27 ^d	52 ± 26	.02

EORTC QLQ, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire; PG-SGA, Scored Patient-Generated Subjective Global Assessment; QLQ-H&N35, head and neck cancer-specific module of the EORTC QLQ; QOL, quality of life.

^aHigher scores in the global QOL and functional scales indicate better QOL or functioning, respectively; higher scores in the symptom scales (or single items) imply worsening of symptoms.

^bValues are mean ± SD unless specified otherwise.

^cAnalyzed by one-way repeated-measures analysis of variance, composite *P*-values.

^dPer the Bonferroni post hoc test, pairwise comparison was significant compared with that before treatment.

^eScale assessing problems with chewing is not included in the QLQ-H&N35.

Figure 1. Changes in nutrition-impact symptoms across time as indicated by head and neck cancer–specific module of the European Organization for Research and Treatment of Cancer (EORTC) Quality of Life Questionnaire (EORTC QLQ-H&N35).

RD during various phases of cancer treatment.^{32,34–36} This is supported by a recent trial in which HNC patients receiving RD counseling showed improvements in nutrition status (indicated by lower PG-SGA scores) and body weight, had fewer treatment interruptions, and reported higher HRQOL as measured by EORTC.³⁴

Longitudinal Changes

Longitudinally, deficits in nutrition status were found as measured by the PG-SGA. Almost 70% were categorized as malnourished before treatment initiation, and the PG-SGA score implied a need for intervention by an RD with a mean score of 8 ± 4 , with 42% scoring between 4 and 8 points. PG-SGA score was ≥ 9 for most patients after the posttreatment period, suggesting a critical need for symptom management and/or nutrition intervention. Nutrition deficits were also indicated by a decline in body weight and BMI. The largest decline in body weight was found 1 month after the treatment period, with an average of 8% weight loss from baseline, indicating a clinically severe loss.

Although body weight showed improvements 3 months post treatment, patients did not regain their pretreatment weight. An observation in the Netherlands³⁷ found that HNC patients can lose up to 5% of their pretreatment body weight during treatment, two-thirds of which is lean tissue; interestingly, loss of body weight and lean tissue occurred despite “sufficient” intake of calories (≥ 35 kcal/kg) and protein (≥ 1.5 g/kg). Prevention of weight loss can improve morbidity, mortality, tolerance to cancer treatment, and overall QOL.^{38,39} Thus, more insights are needed to under-

stand optimal nutrient delivery in cancer to prevent loss of body weight and muscle mass.

When compared with pretreatment symptoms, patients reported more issues with smelling or tasting, chewing, swallowing, sticky saliva, speech, and social eating 1 month post treatment. Of note, the majority (73%) of patients were using ENS at the 1-month posttreatment mark, and malnutrition with compromised oral intake could have contributed to worsening of QOL symptoms at this time point.

Most symptoms improved at 3 months after the treatment period except dry mouth. HRQOL significantly declines immediately after HNC treatment, but symptoms tend to reach near baseline levels within 12 months after the treatment period, with some exceptions.³³ More specifically, certain nutrition-impact symptoms, including dry mouth, swallowing and chewing problems, and taste and smell issues, may continue to hinder intake 1 year after treatment, and in some cases, these symptoms are less likely to recover even at the 3-year posttreatment mark.^{8,40,41} Additionally, patient recovery to baseline HRQOL levels does not necessarily imply “better” QOL, as most HNC patients begin treatment with an impaired QOL near baseline.⁸ Hence, there is benefit in assessing longitudinal HRQOL for timely clinical intervention, particularly among HNC patients.^{1,3,41,42}

Limitations and Future Directions

This study has several limitations. A small sample size limits the statistical significance of our findings. Our follow-up time of 3 months after the treatment period was also relatively short, given that some HRQOL symptoms might

persist several years after cancer diagnosis. Another limitation was missing data due to patient dropouts and deaths, which could have introduced bias; over the course of the study, we lost one-third of our patients, of which 33% were malnourished at baseline. Missing data are a recognized challenge in longitudinal QOL research, and several factors have been shown to predict low participation rates, including stage IV disease, older age, adjuvant radiation, and poor HRQOL.⁸ This study also did not track patients who might have received nutrition counseling or therapy by an RD during the course of their treatment, thereby potentially impacting nutrition outcomes and introducing bias in our findings.

Our cohort had advanced disease and underwent aggressive CRT that could have impacted nutrition and HRQOL findings. For instance, research has shown that patients undergoing RT only report lower prevalence of malnutrition and better HRQOL compared with those receiving CRT.³³ Therefore, studies comparing the effect of various treatment modalities on nutrition and HRQOL outcomes (eg, surgery alone vs surgery with postoperative CRT or RT, CRT vs RT alone, etc) would be informative.

Although our results are not generalizable, data are mostly consistent with previous findings in HNC with malnutrition negatively impacting HRQOL and patients reporting worsening of nutrition-impact symptoms as treatment progresses.^{4,10,33,43} This pilot study provides useful data, but rigorous randomized controlled trials with more patients and longer follow-up periods are specifically warranted within the US.

As mentioned earlier, HRQOL assessment is not routine in care, and such data are usually gathered for research purposes.^{9,44} Similarly, standards for nutrition screening and assessment are not consistent in outpatient care facilities within the US. An important next step would be to integrate outpatient nutrition and HRQOL assessment in clinical practice and identify dedicated staff members who would help administer these assessments.^{9,12,45} After doing so, timely identification of patients in need of nutrition and psychosocial care would be possible. This will also help future studies aiming to investigate the effect of nutrition intervention on QOL symptoms and the relationship between HRQOL and survival outcomes.⁴⁶

Statement of Authorship

U. Mulasi, C. Earthman, H. Jager-Wittenaar, G. Jha, N. Fujioka, M. R. Patel, and V. Rudrapatna equally contributed to the conception and design of the research; U. Mulasi, C. Earthman, G. Jha, N. Fujioka, M. R. Patel, V. Rudrapatna, L. Teigen, and A. J. Kuchnia contributed to the acquisition, analysis, and interpretation of the data; D. M. Vock contributed to the analysis and interpretation of the data; and U. Mulasi and C. Earthman drafted the manuscript. All authors critically revised

the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

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