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Evaluating Nutritional Health in Cases of Head and Neck Cancer Receiving Radiotherapy

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Abstract:-

➢ ***Introduction***

Patients diagnosed with head and neck cancers (HNC) are highly susceptible to malnutrition, with initial rates ranging from 35% to 60%, which can further worsen during treatment, leading to significant weight loss in up to 80% of patients. Malnutrition often remains undetected, contributing to increased morbidity, mortality, and healthcare expenses.

This study sought to evaluate the nutritional status of patients with head and neck cancer receiving radiotherapy and investigate its relationship with factors related to the disease and treatment.

➢ ***Materials and Methods***

The study is a longitudinal observational research involving 31 patients who were treated at the Radiation Oncology Unit of the National Institute of Oncology in Rabat, Morocco, between October 2023 and March 2024. Patients underwent radiation therapy using the Volumetric Modulated Arc Therapy (VMAT) technique, either alone or in combination with chemotherapy.

Data, including anthropometric measurements, PG-SGA assessments, and RTOG criteria evaluations, were gathered at the start of treatment, at the end of treatment, and three months after the treatment ended.

➢ ***Results***

The cohort consisted of 28 males and 3 females, with a mean age of 56 ± 8 years. The majority of tumors were located in the larynx (32%) and nasopharynx (30%), with 78% of patients presenting with stage III or IV cancer. Initially, 88% of patients were well-nourished; however, by the end of treatment, 79% were malnourished. The average PG-SGA score rose from 2.8 to 11.3. There was a marked decrease in food intake, with only 40.2% of patients consuming more than half of their meal portions by the end of treatment. Weight loss occurred in 85% of patients, with 27% experiencing a loss of over 10% of their initial body weight. Patients with advanced-stage cancer, oral cavity and pharyngeal cancers, and those undergoing chemo-radiotherapy were more likely to be malnourished. Higher radiation doses were associated with increased pain and swallowing difficulties.

➢ ***Conclusion***

Radiotherapy significantly worsens the nutritional status of HNC patients, particularly by the end of treatment. The most severe nutritional declines were observed in patients with oral cavity and pharyngeal cancers, advanced-stage disease, concurrent chemotherapy, and higher radiation toxicity. Incorporating routine nutritional assessments into clinical practice and assigning dedicated staff for these evaluations could enable timely nutritional interventions.

I. INTRODUCTION

Patients with head and neck cancers (HNC) are particularly vulnerable to malnutrition, with estimates suggesting that 35% to 60% are already malnourished at the time of diagnosis [1]. This issue often worsens during treatment, as up to 80% of patients may experience significant weight loss [2, 3, 4, 5, 6].

Malnutrition in these patients is caused by both the cancer itself and the adverse effects of treatments, including mucositis, xerostomia, taste changes, dysphagia, odynophagia, oral and throat pain, and a reduced appetite [7, 8, 9, 10].

Unfortunately, malnutrition is often overlooked by healthcare providers, resulting in higher morbidity and mortality rates, increased healthcare expenses, and prolonged hospital stays [2, 11, 12, 13, 14, 15, 16].

Although the impact of nutritional interventions on clinical outcomes has been investigated, results have been inconsistent [17]. Therefore, it is crucial to enhance the nutritional management of HNC patients [18, 19, 20].

This study aimed to evaluate the nutritional status of patients with head and neck cancer undergoing radiotherapy and explore its relationship with factors related to the disease and treatment. The findings are intended to enhance our comprehension of the dietary challenges encountered during treatment.

II. MATERIALS AND METHODS

A. Study Design

This study was designed as a prospective observational investigation to evaluate the nutritional status and identify its determinants in patients with head and neck cancer (HNC) undergoing radiotherapy.

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The sample consisted of 31 consecutive HNC patients treated at the Radiotherapy Department of the National Institute of Oncology in Rabat, Morocco, from October 2023 to March 2024.

All participants received volumetric modulated arc therapy (VMAT) with or without chemotherapy. The primary tumor and regional lymph nodes were irradiated with an average dose of 54–70 Gy over a period of 5 to 6 weeks.

Inclusion criteria included being aged ≥18 years and having a primary diagnosis of cancers involving the oral cavity, oropharynx, larynx, hypopharynx, nasopharynx, or maxillary sinuses.

B. Data Collection

Data were collected during patients' routine clinic appointments and follow-up visits at three different points: at the start of treatment (baseline), at the end of treatment, and 3 months post-treatment.

The study utilized several tools, including a questionnaire to collect personal, disease-specific, and nutritional data (including anthropometric measurements), the Patient-Generated Subjective Global Assessment (PG-SGA) for evaluating nutritional status, and the Radiation Therapy Oncology Group (RTOG) criteria for assessing radiation-related toxicity.

➢ *Anthropometric measurements*:

The principal investigator performed measurements including height, body weight, and body mass index (BMI) according to the guidelines of the National Health and Nutrition Examination Survey (NHANES) [21, 22].

➢ *PG-SGA:*

Nutritional status was assessed at all time points using the Scored Patient-Generated Subjective Global Assessment (PG-SGA). This tool comprises two components: the patient component, which includes four sections on weight history, food intake, nutrition-impact symptoms, and activities and function, and the professional component, which includes five worksheets for evaluating weight loss, disease-related nutritional needs, metabolic demands, physical examination, and PG-SGA category rating [23].

Nutritional status is categorized as well-nourished (A), moderately malnourished (B), or severely malnourished (C). For simplicity, nutritional status was further categorized into well-nourished or malnourished. Patients were also assigned a numerical score, with higher scores (over 3) indicating a need for nutritional intervention [24, 25].

➢ *RTOG Toxicity Score:*

The Radiation Therapy Oncology Group (RTOG) criteria were used to assess radiation-induced toxicity, focusing on mucosa, salivary glands, and the pharynx/esophagus. These criteria were evaluated at baseline, weekly during radiotherapy, at the end of treatment, and 3 months post-treatment, as they may influence the patients' nutritional status [26].

III. RESULTS

➢ *Patient Characteristics*

Table 1 outlines the characteristics of the patient cohort. The group consisted of 28 males and 3 females, with an average age of 56 ± 8 years. The majority of tumors were located in the larynx (32%) and nasopharynx (30%). Additionally, 78% of the patients had stage III or IV cancer, and 45% had undergone tumor resection surgery before initiating radiotherapy.

Table 1. Patient Characteristics

Characteristic	Number of patients
Sexe	
Male	28
Female	3
Tumor site	
Larynx	11
Nasopharynx	10
Oral cavity	5
Oropharynx	2
Hypopharynx	2
Maxillary sinuses	1
Tumor staging	
Stage I-II	7
Stage III	6
Stage IV	18
Tumor resection surgery	13
Current treatment	
RT	13
RT + chemotherapy	18
RT dose	
< 60 Gy	7
≥ 60 Gy	24

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➢ *Nutrition-Related Characteristics*

Table 2 shows the changes in nutritional status and related characteristics over time.

At baseline, 88% of patients were classified as well-nourished according to the PG-SGA. However, by the end of treatment, 79% of patients were deemed malnourished. The average PG-SGA score increased markedly from 2.8 at baseline to 11.3 at the end of radiation therapy (EORT), reflecting a significant rise in the need for symptom management and nutritional support.

Furthermore, while 90.5% of patients initially consumed more than half of their meal portions, this percentage decreased substantially to 40.2% by the EORT.

Table 2. Nutrition-Related Characteristics

	Baseline	**At the End of Radiotherapy**	**3 Months Later**
Well-nourished patients	27	7	26
Malnourished patients	4	24	5
Mean scores of PG-SGA	2,8	11,3	5,2
Food intake > 50% of meals < 50% of meals	 28 3	 12 19	 25 6

The anthropometric parameters, including weight and BMI, worsened during radiotherapy. By the end of treatment, 85% of patients had experienced weight loss: 33% lost more than 8 kg, 56% lost between 3 and 8 kg, and 11% lost less than 3 kg (Fig. 1). Additionally, 27% of patients experienced a weight loss exceeding 10% during treatment.

Analysis of the relationship between nutritional status and disease-related factors indicated that patients with cancers of the oral cavity and pharynx, as well as those with advanced disease stages, were more susceptible to malnutrition. The type of treatment also influenced nutritional status, with patients undergoing chemo-radiotherapy being more likely to be malnourished compared to those receiving only radiotherapy. Furthermore, the radiation dose affected nutritional status, with patients receiving ≥60 Gy reporting increased mouth pain and swallowing difficulties due to radiation toxicity.

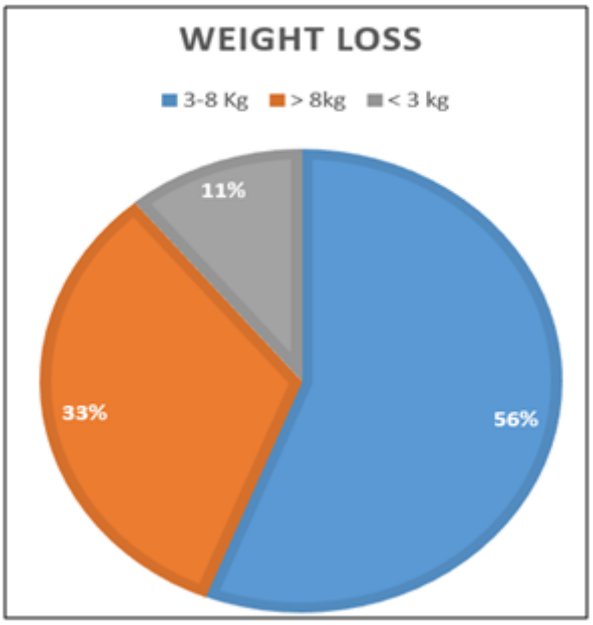

Fig 1 Degrees of Weight Loss

➢ *Radiation-Induced Toxicity*

Table 3 presents data on radiation-induced toxicity according to the RTOG criteria. Toxicity levels worsened during treatment, reached their highest point at the end of treatment, and began to improve after treatment ended. Most parameters returned to their pre-treatment levels, with the exception of the salivary glands, which required a longer period to recover (Fig. 2).

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Table 3. RTOG Acute Radiation Toxicity

	At the end of radiotherapy	3 months later
Radiodermatitis		
Grade 0	0	29
Grade 1	16	2
Grade 2	12	0
Grade 3	3	0
Grade 4	0	0
Radiomucositis		
Grade 0	0	28
Grade 1	15	2
Grade 2	13	1
Grade 3	3	0
Grade 4	0	0
Dysphagia		
Grade 0	3	24
Grade 1	10	6
Grade 2	16	1
Grade 3	2	0
Grade 4	0	0
Mouth dryness		
Grade 0	2	9
Grade 1	17	18
Grade 2	12	4
Grade 3	0	0
Grade 4	0	0

The RTOG criteria were evaluated as factors affecting patients' nutritional status. Analysis of the correlation between malnutrition and RTOG toxicity criteria showed predictable results: poorer nutritional status was associated with higher toxicity scores for radiomucositis, dysphagia, and mouth dryness.

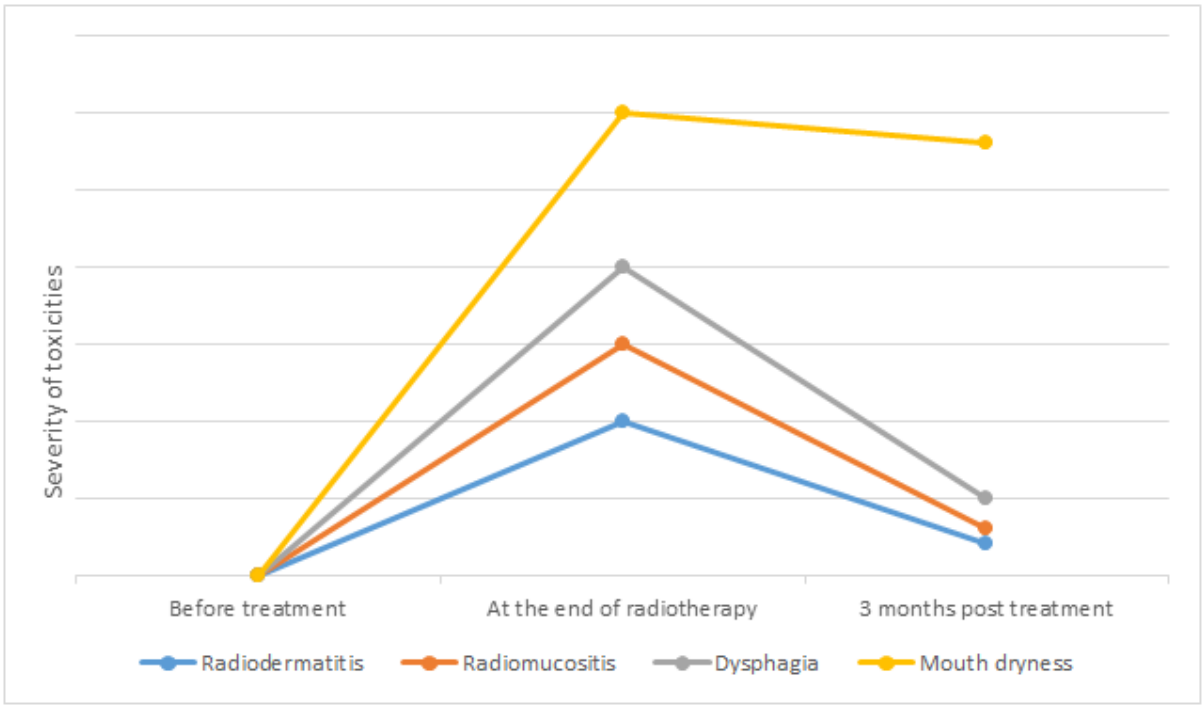

Fig 2 The Evolution of Toxicities Over Time

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IV. DISCUSSION

The link between head and neck cancer (HNC) and the risk of malnutrition during radiotherapy (RT) is well-documented, with weight loss being a critical indicator [10, 27, 28].

Several studies have highlighted the association between malnutrition and increased mortality and morbidity in these patients [2, 15, 16, 29].

In our study, 79% of patients were classified as malnourished (PG-SGA B or C) at the end of RT (EORT), compared to 88% who were well-nourished (PG-SGA A) at baseline. This finding is consistent with other research showing high rates of malnutrition (>70%) at EORT [4, 30].

Additionally, food intake, defined as consuming more than 50% of a meal, decreased from 90.5% at baseline to 40.2% at EORT, reflecting the impact of RT on eating and swallowing functions. This aligns with previous studies indicating reduced dietary intake as RT progresses [2, 28, 30, 31, 32].

Anthropometric measures followed a similar pattern, with 85% of patients experiencing weight loss by the end of treatment. Notably, 27% of patients lost more than 10% of their initial body weight, and BMI decreased significantly from baseline to the end of treatment. These results corroborate findings from other studies [6, 10, 30, 32, 33]. Research in the Netherlands also reported that HNC patients could lose up to 5% of their pre-treatment body weight during RT, with two-thirds of this loss being lean tissue [34]. Preventing weight loss is crucial for improving morbidity, mortality, treatment tolerance, and overall quality of life [35, 36].

Our study also revealed associations between nutritional status and disease-related factors. Patients with cancers of the oral cavity and pharynx, and those with advanced-stage disease, were significantly more likely to be malnourished. Advanced disease stage is a well-known risk factor for malnutrition [6, 27, 37].

Additionally, patients undergoing chemo-radiotherapy were more likely to be malnourished than those receiving RT alone, as concomitant chemotherapy has been linked to nutritional decline [3, 30, 38, 39, 40].

Radiation-induced toxicity affecting the mucosa, salivary glands, and pharynx/esophagus was also more severe in malnourished patients, highlighting the role of severe RT toxicity as a predictor of weight loss and malnutrition [6, 8, 41].

These findings underscore the importance of regular nutritional assessments. The routine use of the PG-SGA tool can aid in identifying patients who require nutritional care [42]. The American Society for Parenteral and Enteral Nutrition Clinical Practice Guidelines for adult anticancer treatment also advocate for regular nutritional screening of cancer patients [43].

This study has limitations, including a relatively small sample size and a follow-up period of only three months after treatment. Future research should involve larger sample sizes and longer follow-up periods. A strength of the study is the consistency in assessments conducted by the same individual (the first author), which helped standardize evaluations. Additionally, the prospective design provided valuable insights into changes in nutritional parameters over time.

V. CONCLUSION

This study highlights the detrimental impact of radiotherapy on the nutritional status of patients with head and neck cancer. Nutritional status deteriorated during treatment, reaching its lowest point at the end of radiotherapy. Malnutrition was particularly pronounced in patients with cancers of the oral cavity and pharynx, advanced-stage disease, those receiving concomitant chemotherapy, and those experiencing higher levels of radiation toxicity.

Integrating regular nutritional assessments into clinical practice and designating dedicated staff for these assessments could facilitate the timely identification of patients in need of nutritional support [44].

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