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COMPARATIVE EVALUATION OF NUTRITIONAL RISK SCORES IN PREDICTING TREATMENT OUTCOMES IN HEAD AND NECK CANCER PATIENTS

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ABSTRACT

Background:

Malnutrition is prevalent among head and neck cancer (HNC) patients and significantly influences treatment tolerance and outcomes. Early identification of at-risk individuals using validated nutritional screening tools is essential for optimizing care. However, comparative data on the prognostic accuracy of various tools remain limited.

Aim:

To evaluate and compare the effectiveness of Nutritional Risk Screening 2002 (NRS-2002), Patient-Generated Subjective Global Assessment (PG-SGA), and Malnutrition Universal Screening Tool (MUST) in predicting treatment outcomes among HNC patients.

Methods:

This prospective observational study was conducted over 12 months at the Department of Oncology, Sree Mookambika Institute of Medical Sciences, Tamil Nadu. Thirty-six patients with histologically confirmed head and neck cancers undergoing definitive treatment were assessed using NRS-2002, PG-SGA, and MUST at baseline. Patients were followed up during and post-treatment (up to 6 months) to evaluate treatment response, complications, and survival. Data were analyzed using SPSS v25, with significance set at $p < 0.05$.

Results:

High nutritional risk was identified in 38.9% (NRS-2002), 52.8% (PG-SGA), and 50.0% (MUST) of patients. High-risk patients had significantly lower treatment response rates, higher complication rates, and poorer 6-month survival. PG-SGA showed the highest sensitivity in predicting adverse outcomes.

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Conclusion:

All three tools demonstrated prognostic value, but PG-SGA was the most effective in identifying high-risk patients. Routine nutritional risk screening using PG-SGA can guide early intervention and improve outcomes in HNC patients.

Keywords:

Head and Neck Cancer, Nutritional Risk, PG-SGA, NRS-2002, MUST, Treatment Outcome, Malnutrition, Survival Prediction, Cancer Complications, Nutritional Screening.

INTRODUCTION

Head and neck cancers (HNCs) are a diverse group of malignancies arising from the mucosal surfaces of the oral cavity, pharynx, and larynx. They constitute a significant global health burden, accounting for more than 930,000 new cases and over 467,000 deaths annually, according to GLOBOCAN 2020 data[1]. In India, the burden is disproportionately high, with HNCs representing approximately 30% of all cancer cases, largely attributed to prevalent risk factors such as tobacco use, alcohol consumption, and poor oral hygiene[2].

Malnutrition is a common and critical issue in patients with head and neck cancer, with prevalence rates ranging from 30% to 80% depending on the stage and site of the tumor[3]. Tumor-related factors such as dysphagia, mucositis, and cachexia, along with treatment-related side effects, significantly impair oral intake and nutritional status. Malnutrition, in turn, compromises immune function, delays wound healing, increases treatment-related complications, and adversely affects survival and quality of life[4].

To address the nutritional burden in cancer patients, several nutritional risk assessment tools have been developed, including the Nutritional Risk Screening 2002 (NRS-2002), the Patient-Generated Subjective Global Assessment (PG-SGA), and the Malnutrition Universal Screening Tool (MUST). Studies have demonstrated the utility of these tools in identifying patients at risk and guiding timely nutritional intervention.

For example, Arribas et al.[5] (2013) found that malnutrition, as assessed by PG-SGA, independently predicted poorer tolerance to radiotherapy in head and neck cancer patients. Similarly, a study by van Bokhorst-de van der Schueren et al.[6] (1999) confirmed that malnourished patients had significantly higher complication rates and reduced overall survival. However, there is limited comparative evidence on the relative effectiveness of

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different scoring systems in predicting treatment outcomes in HNC patients, especially in the Indian context.

Given the high prevalence of malnutrition in HNC and its profound impact on treatment outcomes, early and accurate identification of at-risk patients is essential. While various nutritional risk scores are available, their comparative utility in head and neck cancer populations, particularly in low- and middle-income settings, remains inadequately explored. This study aims to bridge this gap by evaluating and comparing the predictive performance of NRS-2002, PG-SGA, and MUST in assessing nutritional risk and correlating it with treatment response, complication rates, and survival outcomes.

Understanding which tool offers the best predictive value in this specific population will help clinicians choose the most appropriate method for routine nutritional screening, optimize patient management, and improve overall prognosis in head and neck cancer care.

AIM AND OBJECTIVES

Aim

To evaluate and compare the effectiveness of different nutritional risk scoring systems in predicting treatment outcomes in patients with head and neck cancer.

Objectives

1. To assess the nutritional status of head and neck cancer patients using established nutritional risk scoring systems (e.g., NRS-2002, PG-SGA, MUST).
2. To correlate nutritional risk scores with treatment outcomes such as response to therapy, complication rate, and overall survival.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted at the Department of Oncology, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu, over a period of 12 months (from June 2023 to May 2024).

Study Population

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Patients diagnosed with head and neck cancers, attending the oncology outpatient department or admitted for treatment at Sree Mookambika Institute of Medical Sciences, were recruited after obtaining informed consent.

Inclusion Criteria

- Patients aged ≥18 years.
- Histologically confirmed head and neck malignancy (e.g., oral cavity, oropharynx, larynx, hypopharynx).
- Planned for definitive treatment (surgery, radiotherapy, chemotherapy, or combination).
- Willing to participate and provide written informed consent.

Exclusion Criteria

- Patients with recurrent disease or metastatic disease at presentation.
- Patients with known severe comorbid illnesses affecting nutrition independently (e.g., advanced liver disease, CKD).
- Patients unable to participate in nutritional assessment due to cognitive impairment or communication difficulties.

Sample Size

A total of 36 patients were included in the study, based on convenience sampling during the study period.

Data Collection

Data were collected using a structured proforma including:

1. Sociodemographic details: Age, gender, occupation, socioeconomic status.
2. Clinical data: Site of cancer, stage at diagnosis (TNM staging), performance status (ECOG).
3. Anthropometric measurements: Height, weight, BMI.
4. Nutritional risk assessment using the following validated tools at baseline:

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- Nutritional Risk Screening (NRS-2002)
- Patient-Generated Subjective Global Assessment (PG-SGA)
- Malnutrition Universal Screening Tool (MUST)

Assessments were done at the time of diagnosis, prior to initiation of definitive treatment.

Follow-up and Outcome Assessment

Patients were followed up throughout the treatment and up to 6 months post-treatment to assess outcomes.

Treatment Outcomes Measured:

- Treatment response: Based on RECIST criteria (Complete Response, Partial Response, Stable Disease, Progressive Disease).
- Complications: Nutritional complications, treatment-related morbidity (e.g., mucositis, infection).
- Survival status at 6 months.

Statistical Analysis

- Data were entered into Microsoft Excel and analyzed using SPSS version 25.
- Categorical variables were expressed as frequency and percentage; continuous variables as mean ± standard deviation.
- Association between nutritional risk scores and outcomes was analyzed using Chi-square test or Fisher's exact test.
- p-value < 0.05 was considered statistically significant.

Ethical Consideration

- The study was approved by the Institutional Ethics Committee of Sree Mookambika Institute of Medical Sciences.

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- Written informed consent was obtained from all participants.
- Confidentiality and anonymity of the participants were maintained throughout the study.

RESULTS

Table 1: Baseline Demographic and Clinical Profile of Patients (N = 36)

Variable	Mean ± SD / n (%)
Age (years)	58.4 ± 9.6
Gender (Male/Female)	26 (72.2%) / 10 (27.8%)
Stage of Cancer (III/IV)	20 (55.6%) / 16 (44.4%)
BMI (kg/m²)	19.8 ± 2.1
Tobacco/Alcohol History	30 (83.3%)

Table 2: Nutritional Risk Classification (NRS-2002, PG-SGA, MUST)

Nutritional Score	Low Risk n (%)	Moderate Risk n (%)	High Risk n (%)
NRS-2002	8 (22.2%)	14 (38.9%)	14 (38.9%)
PG-SGA	5 (13.9%)	12 (33.3%)	19 (52.8%)
MUST	7 (19.4%)	11 (30.6%)	18 (50.0%)

Table 3: Association Between Nutritional Risk and Treatment Outcomes

Nutritional Score	Treatment Response (CR+PR)	Non-Responders	Complications (%)	6-Month Survival (%)
NRS-2002 Low Risk	7/8 (87.5%)	1	1 (12.5%)	8 (100%)

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Nutritional Score	Treatment Response (CR+PR)	Non-Responders	Complications (%)	6-Month Survival (%)
NRS-2002 High Risk	5/14 (35.7%)	9	10 (71.4%)	7 (50%)
PG-SGA Low Risk	5/5 (100%)	0	0 (0%)	5 (100%)
PG-SGA High Risk	6/19 (31.6%)	13	14 (73.7%)	10 (52.6%)
MUST Low Risk	6/7 (85.7%)	1	1 (14.3%)	6 (85.7%)
MUST High Risk	7/18 (38.9%)	11	13 (72.2%)	9 (50%)

CR: Complete Response, PR: Partial Response

DISCUSSION

This study evaluated the ability of three nutritional risk scores—NRS-2002, PG-SGA, and MUST—in predicting treatment outcomes for patients with head and neck cancer (HNC). Our findings suggest that higher nutritional risk scores are significantly associated with poorer treatment responses, increased complications, and reduced survival rates, supporting the prognostic importance of malnutrition in HNC care.

Nutritional Risk Scores and Treatment Response

In our cohort, the NRS-2002 identified a significantly lower response rate to therapy among high-risk patients (35.7%) compared to low-risk patients (87.5%). Similarly, PG-SGA high-risk patients showed a reduced treatment response rate (31.6%) compared to their low-risk counterparts (100%), as did the MUST (38.9% vs. 85.7%). These findings align with previous studies indicating that malnutrition, as assessed by various tools, can impair treatment efficacy. Capuano et al.[7] (2010) found that malnourished head and neck cancer patients had significantly lower response rates to radiotherapy, similar to our results with reduced treatment responses in high-risk patients. Malnutrition impairs immune function and

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reduces the body's ability to tolerate therapy, thus diminishing the overall treatment response[8].

In contrast, a study by Ravasco et al.[9] (2005) highlighted that early nutritional interventions could improve treatment responses in malnourished patients, a perspective that supports the need for early screening and management in HNC patients to optimize therapy outcomes.

Nutritional Risk and Complication Rates

High-risk patients, as identified by all three scoring systems, experienced significantly higher complication rates. For instance, 71.4% of high-risk patients according to NRS-2002 had complications compared to only 12.5% of low-risk patients. The PG-SGA and MUST tools showed similar trends, with high-risk patients having complication rates of 73.7% and 72.2%, respectively. These results are consistent with the findings of van Bokhorst-de van der Schueren et al.[6] (1999), who reported that malnutrition in cancer patients is associated with a higher incidence of treatment-related complications, such as infections, mucositis, and delayed wound healing. Our study corroborates this, suggesting that nutritional status plays a critical role in treatment tolerance and recovery.

Moreover, a study by DellaValle et al.[10] (2006) noted that HNC patients with compromised nutritional status were more likely to experience complications such as severe mucositis, which is often exacerbated by chemoradiotherapy. This underlines the necessity of proactive nutritional care in preventing complications and improving the overall clinical course for HNC patients.

Nutritional Risk and Six-Month Survival

Our findings indicate a stark contrast in survival between high- and low-risk patients. At six months, 50% of high-risk patients (according to NRS-2002) had died, compared to 100% survival in low-risk patients. The survival rates for PG-SGA and MUST also reflected similar trends, with high-risk patients exhibiting reduced survival. This is in line with the research of Cardellini et al.[11] (2013), who demonstrated that malnutrition in HNC patients is an independent prognostic factor for poor survival outcomes. Their study found that nutritional deficiencies significantly correlated with decreased survival rates, particularly in advanced stages of disease. Our results reinforce these findings and suggest that nutritional assessment should be incorporated into routine clinical practice to identify high-risk patients early and initiate appropriate interventions to improve outcomes.

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The study by Arends et al.[12] (2024) also supports our results, showing that cancer patients with poor nutritional status had a significantly worse prognosis, not only due to direct effects of malnutrition on treatment tolerance but also due to its role in increasing susceptibility to infections and other treatment complications. Therefore, early identification of malnutrition could help in personalizing treatment plans to improve long-term survival.

Comparative Effectiveness of Nutritional Scoring Systems

Among the three nutritional risk tools, the PG-SGA demonstrated the highest sensitivity in detecting malnutrition and predicting poor outcomes, which is consistent with studies by Marta et al.[13] (2021) and Antonio[14] (2021), who found PG-SGA to be a more reliable indicator of nutritional status and prognostic outcomes compared to other tools like NRS-2002 and MUST. The ability of PG-SGA to integrate subjective symptoms, such as weight loss and appetite changes, alongside objective measures like BMI and dietary intake, gives it an edge in identifying patients at greater nutritional risk, which in turn predicts worse outcomes[15].

On the other hand, NRS-2002, though widely used, did not show as strong an association with treatment outcomes as PG-SGA. However, NRS-2002 is easier to administer in routine clinical settings, making it a practical option for widespread use in malnutrition screening, as highlighted by the studies of Kondrup et al.[16] (2003). While it may not be as sensitive as PG-SGA in predicting adverse outcomes, its simplicity and applicability in resource-limited settings make it a valuable tool.

Study Limitations and Future Directions

This study was conducted with a small sample size of 36 patients, which may limit the generalizability of the findings. Additionally, our results were obtained from a single institution, so further multi-center studies with larger cohorts are needed to validate the findings. Future studies could also explore the role of early nutritional intervention in improving treatment outcomes and survival in head and neck cancer patients, particularly those identified as high-risk by nutritional assessments.

CONCLUSION

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This study demonstrated that nutritional risk scores such as NRS-2002, PG-SGA, and MUST are valuable tools in identifying head and neck cancer patients at increased risk of poor treatment outcomes. A significant association was observed between higher nutritional risk and adverse outcomes, including reduced treatment response, increased complication rates, and lower 6-month survival. Among the scoring systems, PG-SGA showed the highest sensitivity in detecting malnutrition and predicting poor prognosis. Early nutritional risk assessment using validated tools should be an integral part of cancer care to guide timely nutritional interventions, improve treatment tolerance, and enhance overall outcomes in head and neck cancer patients.

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