ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 06 | June - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

THE PROGNOSTIC SIGNIFICANCE OF THE GERIATRIC NUTRITIONAL RISK INDEX IN PATIENTS WITH ADVANCED HEAD AND NECK CANCERS – A RETROSPECTIVE ANALYSIS

Otorhinolaryngology

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ABSTRACT

Background: Head and neck cancers (HNC) are among the most prevalent malignancies in India, often presenting in elderly individuals with poor nutritional status and comorbidities. Malnutrition in cancer patients is a significant contributor to morbidity and mortality. The Geriatric Nutritional Risk Index (GNRI), a simple tool calculated using serum albumin and body weight, has been proposed as a potential predictor of outcomes in various malignancies but has limited data in HNC, especially in the Indian context. **Objective:** To evaluate the prognostic value of GNRI in predicting surgical outcomes in patients with locally advanced head and neck cancer undergoing curative surgery. **Material & Method:** This retrospective observational study analyzed records of 264 patients aged ≥55 years with histologically confirmed stage III/IVa head and neck squamous cell carcinoma who underwent surgery between January 2017 and January 2022 at a tertiary care hospital. GNRI was calculated preoperatively and patients were categorized into four risk groups. Postoperative outcomes—including wound breakdown, flap failure, fistula formation, ICU stay duration, and delay in adjuvant therapy—were compared across GNRI categories using chi-square analysis. **Results:** The mean age was 63.2 years with a female predominance (74.3%). Most tumors were located in the buccal mucosa and 76% were stage IVa. Higher GNRI scores correlated with better postoperative outcomes. Wound breakdown was significantly higher in the high-risk GNRI group (38.9%) vs. normal (15.5%) ($p=0.0087$). Flap failure and orocutaneous fistula rates also increased with worsening GNRI scores ($p=0.0076$ and $p<0.001$, respectively). ICU stay beyond one day was more common in low-GNRI patients ($p=0.0015$). Delayed adjuvant therapy was observed in 19.4% of high-risk patients. **Conclusion:** GNRI is a reliable, cost-effective tool for predicting postoperative complications and recovery in patients with advanced HNC. Its routine use can aid in preoperative risk stratification and optimization of nutritional status to improve surgical outcomes.

KEYWORDS

Geriatric Nutritional Risk Index, Head and Neck Cancer, Malnutrition, Postoperative Outcomes, Prognostic Tool, Retrospective Study

INTRODUCTION

Head and neck cancer (HNC) is one of the most common cancer in India, with globally more than 6,60,000 new cases and around 3,25,000 deaths each year [1,2]. Almost 25% of global head and neck cancer load is in India. Majority of HNC patients are elderly with multiple comorbidities. The primary risk factors for head and neck cancer (HNC) include tobacco smoking, tobacco chewing and the combined consumption of alcohol. Additionally, regional factors like areca nut chewing elevate oral cancer rates in Southeast Asia and the Asia-Pacific. In contrast, oropharyngeal cancers associated with human papillomavirus contribute to the rising incidence of HNC in the developed countries [3–6]

The research suggests that dietary status and systemic inflammation affect cancer growth and survival [7–9]. The Geriatric Nutritional Risk Index (GNRI), computed from serum albumin content and body weight, is a simple nutritional screening tool that may predict cancer prognosis. GNRI has been studied as a predictor of clinical outcomes in oesophageal, gastric, colorectal, and lung malignancies [10–13]. A meta-analysis of 14 retrospective investigations of 3981 oesophageal cancer patients found that a low pre treatment GNRI is an independent predictive factor for poor overall survival with an HR of 1.47 [10]. However, the relationship between GNRI and locally advanced HNC is not reported in this region. Understanding this affordable and widely available prognostic tool, it could assist in risk-stratifying patients and personalizing treatment.

The five-year survival rate for locally advanced head and neck cancer worldwide is around 50% [14]. The mortality rate in HNC has been reducing and the longterm survivors have increased morbidity due to aggressive treatment especially in advanced cancer [15].

With the advancements in the surgical techniques, anaesthesia, conceptual medicine and recent discoveries in cancer care, the survival has improved. However, the long term survival has major morbidities. The intervention for advanced cancers involves aggressive and morbid treatment. So it is important to prognosticate the outcome with regard to recovery from surgery or aggressive treatment in these patients [16–19]. Therefore we performed this study to document the GNRI in 264 patients who were planned for & underwent surgery for locally advanced head & neck cancer and correlate it with outcomes with regard to recovery from surgery, ICU stay, dependency on ventilator & persistent morbidity.

OBJECTIVES:

To assess the surgical outcome in locally advanced head and neck cancer patients using Geriatric Nutritional Risk Index (GNRI) as a prognostic tool in patients who underwent surgery for locally advanced head and neck cancer.

MATERIALS & METHODS

Ethics Statement:

Ethical clearance was recieved from the Institutional Ethical Committee of Sri Devaraj Urs MedicalCollege (Vide No: SDUAHER/KLR/R&D/CEC/SDUMC-PG/12/NF/2025-26) to conduct the research.

This was a non-funded study and did not involve animal or human experiments.

Study Design :

This retrospective observational study was conducted in the Department of Otorhinolaryngology, at a tertiary care teaching hospital in a rural area from January 2017 to January 2022.

Study Population And Sample Size:

The medical case records of patients operated between January 2017 to January 2022 were analysed for Geriatric Nutritional Risk Index (GNRI) and outcomes of surgery. A total of 264 patients aged 55 years and above who were histologically confirmed as Head and Neck Squamous cell carcinoma patients who had undergone surgery and included stage III or IVa.

Patients younger than 55 years, with stage I and II head and neck cancer; patients with acute infection, distant metastasis; patients who underwent chemotherapy, radiotherapy, and combined therapy were all excluded from the study.

Baseline parameters like age, sex, tumour site, cancer stage were recorded.

Nutritional Assessment
Geriatric Nutritional Risk Index (GNRI) was calculated by using the formula

GNRI = [1.489xserum albumin(g/L)] + [41.7x(current body weight/ideal body weight)]. [20]

Based on the GNRI score obtained, patients were categorised into 4 risk groups as follows;
- Normal (>98)
- Low risk (92-98)
- Moderate risk (82-92)
- High risk (<82)

Ideal body weight (IBW) was determined by using a standard formula (e.g., the Lorentz formula or the BMI reference)

Clinical Outcome
Surgical site infection/ wound breakdown, flap necrosis, duration of hospital stay, ventilator dependency, requirement of ICU, orocutaneous / pharyngocutaneous fistula, delay in postoperative adjuvant treatment, tolerance to adjuvant radiotherapy were analysed from the medical case records and an attempt was made to find out if there is correlation with the GNRI.

Statistical Analysis
The data was pooled from all the patients who met the inclusion criteria and entered into Microsoft Excel. The data was analysed using SPSS software version 23. Mean (SD), frequency, and percentage were recorded.

RESULTS
A total of 264 patients who met the inclusion criteria were analysed with mean age approximately 63.2

The study population displayed a significant female predominance 197 (74.3%) with only 67 (25.7%) males. The M:F ratio was 2.94.

Among the 264 cases, 126 were buccal mucosa, 40 were tongue cancers (**Figure 1)**, 42 were Lower Gingivo buccal sulcus cancers, 28 being retromolar trigone cancers, 7 were laryngeal cancers, 16 being upper Gingivo buccal sulcus cancers and 5 were lip cancers.

Figure 1: Preoperative Lesion Over Right Lateral Border Of Tongue
65 cases were staged as stage III cancers and 199 being stage IVa
Categorization of patients using GNRI is demonstrated in **Table 1**

Table 1: GNRI Category

GNRI category	Number	Percentage
Normal (>98)	97	36.6 %
Low risk (92-98)	86	32.4 %
Moderate risk (82-92)	44	16.6%
High risk (<82)	38	14.4%

Table 2: Clinical Outcomes By GNRI Category (Counts And Percentages)

GNRI Category	Wound Breakdown (n=51)	Flap Failure	Orocutaneous Fistula	Pharyngocutaneous Fistula	Delay in post operative adjuvant radiotherapy by 4 weeks
Normal (n=97)	15 (15.4%)	4 (4.1%)	4 (4.1%)	0	3 (3%)
Low risk (n=86)	12 (13%)	6 (6.9%)	5 (5.8%)	0	6 (6.9%)
Moderate risk (n=44)	10 (22.7%)	6 (13.6%)	7 (15.9%)	2 (4.57%)	5 (11.3%)
High risk (n=36)	14 (38%)	8 (22%)	12 (33.3%)	1 (2.7%)	7 (19.4%)

The correlation of different clinical outcomes with GNRI categories are demonstrated in **Table 2**

Wound Breakdown (**Figure 2)** was 15.5% in the normal group and rose to 38.9% in the high-risk group.

The chi-square test revealed a statistically significant association ($p = 0.0087$), indicating that patients with lower GNRI scores are more likely to experience postoperative wound complications.

Figure 2: Shows Wound Breakdown in a postoperative case of carcinoma buccal mucosa

The incidence of flap failure showed a similar trend, increasing from 4.1% in the normal group to 22.2% in the high-risk group.

The chi-square analysis confirmed a statistically significant association between GNRI and flap failure ($p = 0.0076$).

Orocutaneous fistula occurrence demonstrated a pronounced gradient: 4.1% in the normal group, 5.8% in low risk, 15.9% in moderate risk, and 33.3% in the high-risk group.

The association was highly statistically significant ($p < 0.001$), highlighting a strong link between declining nutritional status and fistula formation.

While pharyngocutaneous fistula was rare overall, its incidence still increased with higher GNRI risk, from 0% in normal and low-risk groups to 4.5% and 2.8% in the moderate and high-risk groups, respectively. $p = 0.18$ suggests no statistically significant difference.

Out of 264 patients, 26 patients deferred postoperative adjuvant radiotherapy

Correlation of duration of ICU stay and GNRI categories is demonstrated in **Table3**

Table 3: Duration Of ICU Stay In Correlation With GNRI

GNRI Category	Number of days in ICU following surgery			
	1 day	2 days	3 days	1 week
Normal (n=97)	75	20	2	0
Low risk (n=86)	66	15	5	0
Moderate risk (n=44)	35	5	3	1
High risk (n=36)	20	10	2	4

The duration of postoperative ICU stay shows statistical significance with GNRI classification (Chi-square = 26.86, $p = 0.0015$). Among patients with normal nutritional status, 77.3% required only a single day in the ICU, with 20.6% staying for two days, and just 2.1% requiring three days.

None of the patients in the normal group required ICU care beyond three days.

In the low-risk group, with 76.7% staying one day, 17.4% for two days, 5.8% for three days, no cases exceeding this period.

Moderate-risk group : 79.5% stayed one day, while 11.4%, 6.8%, and 2.3% required 2 days, 3 days, and 1 week of ICU care, respectively. In high-risk group, where only 55.6% were discharged from ICU after one day, 27.8% stayed for two days, 5.6% for three days, and 11.1% remained in ICU for a full week postoperatively.

These findings strongly suggest that patients with lower GNRI scores—indicative of poor nutritional status—are significantly more likely to experience extended ICU stays following surgery.

DISCUSSION

According to data from the Indian Council of Medical Research (ICMR), oral cancer is the most prevalent cancer among males (16.1%) and the second most common among females (10.4%) in India.[21]

Since there are very limited sties correlatin GNRI with recovery from surgery & treatment outcomes in HNC , this study is important.

The high prevalence of oral cancers is largely attributed to the population's addiction to tobacco quid, betel leaf with tobacco, areca nut, alcohol, and smoking.

Oral cavity cancer develops in the lining mucosa of various structures within the oral cavity, such as the lips, cheeks, gums, anterior two-thirds of the tongue, the floor of the mouth, the hard palate, and the retromolar trigone posterior to the 3rd molar[22]

Since the treatment involves surgical resection followed by adjuvant therapy like radiotherapy with or without chemotherapy, the surgical outcome is crucial for timely adjuvant treatment.

It is observed that malnutrition, rather than the tumour itself, is responsible for up to 20% of cancer fatalities and occurs in 30 % to 85% of cancer individuals [23] Patients with head and neck cancer are especially vulnerable to malnutrition, impacting up to 67% of this demographic [24]. Malnutrition correlates with organ failure, disruption of gut microbiota, and impairment of metabolic and immunological pathways [25]. This results in diminished disease resistance, lower physical activity, and compromised wound healing, all of which correlate with poorer patient outcomes. Consequently, it is imperative to recognize and address malnutrition in cancer patients via approved screening instruments. [26]

In our study, the duration of postoperative ICU stay demonstrated a statistically significant association with GNRI classification (Chi-square = 26.86, p = 0.0015). These findings strongly suggest that patients with lower GNRI scores—indicative of poor nutritional status—are significantly more likely to experience extended ICU stays following surgery. This underscores the prognostic value of GNRI in predicting postoperative resource utilization and supports the importance of preoperative nutritional optimization.

A progressive increase in wound breakdown rates was observed across worsening GNRI categories. The chi-square test revealed a statistically significant association (p = 0.0087), indicating that patients with lower GNRI scores are more likely to experience postoperative wound complications. This finding underscores the critical role of preoperative nutritional assessment in surgical outcome optimization.

The incidence of flap failure showed a similar increasing trend, The chi-square analysis confirmed a statistically significant association between GNRI and flap failure (p = 0.0076). These results suggest that compromised nutritional status may impair vascularization and tissue healing, leading to an elevated risk of flap loss.

Orocutaneous fistula occurrence demonstrated a pronounced gradient: 4.1% in the normal group, 5.8% in low risk, 15.9% in moderate risk, and 33.3% in the high-risk group. The association was highly statistically significant (p < 0.00001), highlighting a strong link between declining nutritional status and fistula formation. This outcome further validates the prognostic utility of GNRI in head and neck cancer surgery.

While pharyngocutaneous fistula was rare overall, its incidence still increased with higher GNRI risk. Although this trend did not reach statistical significance (p = 0.18), it suggests a potential pattern that may warrant further investigation with a larger cohort.

However, there is no standardized method to identify malnutrition. The GNRI was initially created as a novel index for assessing vulnerable elderly people. The GNRI is independently correlated with morbidity and mortality in those with chronic heart failure, sepsis, and those using peritoneal dialysis. Previous studies have assessed the efficacy of the GNRI in patients with various cancers, including oesophageal carcinoma, renal cell carcinoma, lung tumours, and malignant lymphoma, and there have been no studies on its role in head and neck cancers. [27,28]

The link between low GNRI and worse survival is also in line with what has been found in other studies. In a study conducted by Yamahara et al. [29] among 164 people with advanced head and neck cancer and found that three-year survival rates corresponding to the Geriatric Nutritional Risk Index (GNRI) categories were 95.5% for individuals with normal nutritional status, 84.3% for those at low risk, 53.8% for moderate risk, and 23.4% for high-risk individuals.

Similarly a study conducted by Nakayama et al. showed amongst 248 people with advanced head and neck cancer that the three-group GNRI score increased, the risk for mortality significantly increased (adjusted hazard ratio [HR] for intermediate to normal, 1.73 [95% CI, 1.02-2.92]; adjusted HR for high to normal, 4.31 [95% CI, 2.71-6.84]). [20]

More recently, Yamagata et al. found that the GNRI was a reliable indicator of overall survival in a group of 162 people with oral squamous cell cancer [30].

Limitation:

We have various study constraints. At one hospital, we retrospectively examined patient demographics and features. This context had minimal data, thus we only employed one nutritional status assessment method. The GNRI could be used with other nutritional assessments to better measure cancer patients' nutrition. However, its simplicity and availability make it suited for practical use. Finally, our study's small sample size may restrict its generalizability. Prospective research with larger cohorts and more nutritional evaluation techniques is needed.

CONCLUSION

The findings of our study indicate that GNRI serves as a good prognostic predictor for patients with locally advanced HNC. The GNRI serves as an efficient and economical instrument that can be utilized to prognosticate outcomes of aggressive treatment like surgery and disease control with timely adjuvant treatment by using measurements of serum albumin levels.

REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3).
2. Johnson DE, Burtness B, Leemans CR, Lui VWY, Bauman JE, Grandis JR. Head and neck squamous cell carcinoma. Vol. 6, Nature Reviews Disease Primers. 2020.
3. Mehanna H, Beech T, Nicholson T, El-Hariry I, McConkey C, Paleri V, et al. Prevalence of human papillomavirus in oropharyngeal and nonoropharyngeal head and neck cancer - Systematic review and meta-analysis of trends by time and region. Vol. 35, Head and Neck. 2013.
4. Gillison ML, Chaturvedi AK, Anderson WF, Fakhry C. Epidemiology of human papillomavirus-positive head and neck squamous cell carcinoma. Vol. 33, Journal of Clinical Oncology. 2015.
5. Gormley M, Creaney G, Schache A, Ingarfield K, Conway DI. Reviewing the epidemiology of head and neck cancer: definitions, trends and risk factors. Br Dent J. 2022;233(9).
6. Shield KD, Ferlay J, Jemal A, Sankaranarayanan R, Chaturvedi AK, Bray F, et al. The global incidence of lip, oral cavity, and pharyngeal cancers by subsite in 2012. CA Cancer J Clin. 2017;67(1).
7. Diakos CI, Charles KA, McMillan DC, Clarke SJ. Cancer-related inflammation and treatment effectiveness. Vol. 15, The Lancet Oncology. 2014.
8. McMillan DC. The systemic inflammation-based Glasgow Prognostic Score: A decade of experience in patients with cancer. Vol. 39, Cancer Treatment Reviews. 2013.
9. Hung KC, Sun CK, Chang YP, Wu JY, Huang PY, Liu TH, et al. Association of prognostic nutritional index with prognostic outcomes in patients with glioma: a meta-analysis and systematic review. Vol. 13, Frontiers in Oncology. 2023.
10. Yu J, Zhang W, Wang C, Hu Y. The Prognostic Value of Pretreatment Geriatric Nutritional Risk Index in Esophageal Cancer: A Meta-Analysis. Nutr Cancer. 2022;74(9).
11. Mariani P, Russo D, Maisto M, Troiano G, Caponio VCA, Annunziata M, et al. Pre-treatment neutrophil-to-lymphocyte ratio is an independent prognostic factor in head and neck squamous cell carcinoma: Meta-analysis and trial sequential analysis. Vol. 51, Journal of Oral Pathology and Medicine. 2022.
12. Xu J, Sun Y, Gong D, Fan Y. Predictive Value of Geriatric Nutritional Risk Index in Patients with Colorectal Cancer: A Meta-Analysis. Vol. 75, Nutrition and Cancer. 2022.
13. Shen F, Ma Y, Guo W, Li F. Prognostic Value of Geriatric Nutritional Risk Index for Patients with Non-Small Cell Lung Cancer: A Systematic Review and Meta-Analysis. Vol. 200, Lung. 2022.
14. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. Vol. 45, Oral Oncology. 2009.

15. Bosetti C, Carioli G, Santucci C, Bertuccio P, Gallus S, Garavello W, et al. Global trends in oral and pharyngeal cancer incidence and mortality. Int J Cancer. 2020;147(4).
16. Imai T, Nakamura K, Morita S, Hasegawa K, Goto T, Katori Y, et al. Preoperative serum interleukin-6 level in head and neck cancer reflects systemic inflammatory response and is a predictor of postoperative prognosis. Jpn J Clin Oncol. 2023;53(3).
17. Yu B, Ma SJ, Khan M, Gill J, Iovoli A, Fekrmandi F, et al. Association of pre-treatment lymphocyte-monocyte ratio with survival outcome in patients with head and neck cancer treated with chemoradiation. BMC Cancer. 2023;23(1).
18. Silva FFV e., Padín-Iruegas ME, Caponio VCA, Lorenzo-Pouso AI, Saavedra-Nieves P, Chamorro-Petronacci CM, et al. Caspase 3 and Cleaved Caspase 3 Expression in Tumorogenesis and Its Correlations with Prognosis in Head and Neck Cancer: A Systematic Review and Meta-Analysis. Vol. 23, International Journal of Molecular Sciences. 2022.
19. Budach V, Tinhofer I. Novel prognostic clinical factors and biomarkers for outcome prediction in head and neck cancer: a systematic review. Vol. 20, The Lancet Oncology. 2019.
20. Nakayama M, Gosho M, Adachi M, Ii R, Matsumoto S, Miyamoto H, et al. The Geriatric Nutritional Risk Index as a Prognostic Factor in Patients with Advanced Head and Neck Cancer. Laryngoscope. 2021;131(1).
21. Mehrotra R SSMJKT. Tobacco related cancers. CancerMonograph:ICMR. 2019. 137–185 p.
22. 30. Watters C BSPT. Cancer of the oral mucosa. Treasure Island.
23. Kubrak C, Martin L, Gramlich L, Scrimger R, Jha N, Debenham B, et al. Prevalence and prognostic significance of malnutrition in patients with cancers of the head and neck. Clinical Nutrition. 2020;39(3).
24. Bwakura-Dangarembizi M, Amadi B, Bourke CD, Robertson RC, Mwapenya B, Chandwe K, et al. Health Outcomes, Pathogenesis and Epidemiology of Severe Acute Malnutrition (HOPE-SAM): Rationale and methods of a longitudinal observational study. BMJ Open. 2019;9(1).
25. Kono T, Sakamoto K, Shinden S, Ogawa K. Pre-therapeutic nutritional assessment for predicting severe adverse events in patients with head and neck cancer treated by radiotherapy. Clinical Nutrition. 2017;36(6).
26. Yamana I, Takeno S, Shimaoka H, Yamashita K, Yamada T, Shiwaku H, et al. Geriatric Nutritional Risk Index as a prognostic factor in patients with esophageal squamous cell carcinoma –retrospective cohort study. International Journal of Surgery. 2018;56.
27. Bo Y, Wang K, Liu Y, You J, Cui H, Zhu Y, et al. The geriatric nutritional risk index predicts survival in elderly esophageal squamous cell carcinoma patients with radiotherapy. PLoS One. 2016;11(5).
28. Miyake H, Tei H, Fujisawa M. Geriatric Nutrition Risk Index is an Important Predictor of Cancer-Specific Survival, but not Recurrence-Free Survival, in Patients Undergoing Surgical Resection for Non-Metastatic Renal Cell Carcinoma. Curr Urol. 2017;10(1).
29. Yamahara K, Mizukoshi A, Lee K, Ikegami S. Pretherapeutic nutritional/inflammatory factors as predictors for survival of both early and advanced staged head and neck cancer patients. Auris Nasus Larynx. 2021;48(4).
30. Yamagata K, Fukuzawa S, Uchida F, Terada K, Ishibashi-Kanno N, Bukawa H. Does the geriatric nutrition risk index predict the prognosis of patients with oral squamous cell carcinoma? British Journal of Oral and Maxillofacial Surgery. 2022;60(4).