

# A Non-Randomised Matched-Pair Prospective Study to Evaluate Nutritional Assessment and Its Impact on Postoperative Outcome in Head and Neck Cancer

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## Abstract

**Introduction:** Nutrition plays a significant role in the life of every individual and helps in recovering from any injury including surgery. Pre-treatment malnutrition is found in 15%–40% of cases and can influence treatment outcome. The study aims to determine the impact of nutritional status on the post-operative outcome after head and neck cancer surgery. **Materials and Methods:** This study was carried out in the Department of Head and Neck Surgery for a period of one year from May 1, 2020 to April 30, 2021. Only surgical cases were taken up for the study. The cases (Group A) had a thorough nutritional assessment and dietary intervention if necessary. The dietician did the assessment via Subjective Global Assessment (SGA) questionnaire. After the evaluation, they were again subdivided into two subgroups depending on their nutritional status – well nourished (SGA-A) and malnourished (SGA-B and C). Dietary counselling was given for minimum 15 days preoperatively. The cases were compared with a matched control group (Group B). **Results:** Both the groups were well matched in terms of the site of primary tumour and duration of surgery. Around 70% were found to be malnourished in Group A. With dietary counselling, there has been a significant improvement in various parameters of post-operative outcome ( $P < 0.05$ ). **Discussion:** This study highlights the close association and the importance of nutritional assessment for all head and neck cancer cases planned for surgery for an uneventful post-operative outcome. Adequate nutritional assessment and dietary intervention in the pre-operative period can go a long way in reducing post-operative morbidity in surgical patients.

**Keywords:** Head and neck cancer, nutrition, post-operative outcome

## INTRODUCTION

Head and neck cancers constitute malignant tumours in the upper aero-digestive tract involving the paranasal sinuses, nasal cavity, oral cavity, pharynx, larynx and salivary glands.<sup>[1]</sup> Incidence and prevalence of head and neck cancers are higher in developing countries.<sup>[2]</sup> It accounts for more than 650,000 cases and 330,000 deaths annually globally.<sup>[3]</sup> 57.5% of head and neck cancers occur in Asia, especially in India. The tumours are primarily squamous cell carcinomas, which constitutes more than 90% of all cases.<sup>[4]</sup> Typical presentations can be sore throat, hoarseness, swallowing difficulties and oral ulceration.<sup>[5]</sup> The main risk factors for the occurrence of head and neck cancers are tobacco and excessive alcohol use.<sup>[6]</sup>

Nutrition plays a vital role in every individual's life and is the fuel to keep the body going. It also helps in recovering

from any injury, including surgery. The European Society for Clinical Nutrition and Metabolism has defined malnutrition as a state of nutritional status in which a deficiency, excess or imbalance of energy, protein and other nutrients cause measurable adverse effects on body size, composition, function and clinical outcome.<sup>[7]</sup> Among all the cancers, head and neck cancer patients are at a higher risk of malnutrition due to its

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impact on structures responsible for daily activities such as swallowing, eating, breathing and communication.<sup>[8]</sup> They have to deal with unique challenges to maintain adequate nutrition. Pre-treatment malnutrition is found in 15%–40% of cases,<sup>[9]</sup> which further worsened to 34%–88%<sup>[10]</sup> during therapy due to treatment-related toxicities. It can influence the treatment outcomes, wound healing, muscle function and increase the risk of post-operative complications. It can also adversely affect tolerance and response to antineoplastic treatments, leading to prolonged hospital stay, increasing the risk for treatment interruptions and impacting survival.<sup>[11]</sup>

Malnutrition is still underreported despite its association with increased morbidity, mortality and hospital cost.<sup>[12]</sup> Furthermore, there is a paucity of research to look into the relationship between nutritional status and variables such as the site of disease, type of surgery and post-operative complications. The present study aims to determine the impact of nutritional status of the head and neck cancer patients planned for surgery on the post-operative outcome.

**Aims and objectives**

1. To compare the post-operative outcome between head and neck cancer patients undergoing routine nutritional assessment and counselling in the pre-operative period with a control group.

**MATERIALS AND METHODS**

**Study design**

This was a matched-pair case–control prospective study carried out for one year. Cases who had attended head and neck outpatient department and required surgical intervention for their disease condition were selected for the study. The waiting period for the surgery was at least three weeks.

Group A–The cases who met the inclusion criteria were subjected to nutritional assessment and dietary counselling, wherever needed. The dietician did the assessment via Subjective Global Assessment (SGA) questionnaire [Figure 1a and b]. After the evaluation, they were again subdivided into two subgroups depending on their nutritional status – well-nourished (SGA-A) and malnourished (SGA-B and C). Cases in the malnourished

group were given individualised dietary counselling along with a dietary chart according to their calorie and protein requirements. The requirements are case specific and depend on various factors such as anthropometry, biochemical reports, diagnosis and type of surgery. There are various guidelines such as ESPEN,<sup>[13]</sup> IAPEN, KDIGO and the recently published guidelines ‘Clinical Cancer in Nutrition: Practical Guidelines and Dietary Recommendations’ specially designed for Indian population. For a 50-years-old average build patient, the calorie requirement is calculated at 30–35 kcal per kg body weight and protein requirement at 1.2–1.5 per kg body weight. Oral route was preferred in most cases, except for those having dysphagia or mucositis where nasogastric or PEG feeding was utilised. Perenteral route was seldom used.

All well-nourished patients were advised to continue with their existing diet plan. This group was assessed every week till their surgery.

Group B – This was the control group who were matched according to age, gender, site of primary disease and duration of surgery. This group did not undergo active nutritional assessment and directly underwent surgery as per their pre-fixed date.

The study has been carried out in the Department of Head and Neck Surgery for 1 year from 1<sup>st</sup> May, 2020, to 30<sup>th</sup> April, 2021 after obtaining due clearance from the institutional medical ethics committee (MEC–240/2021). The sample size calculated was 82 (41 in each group) [Flowchart 1].

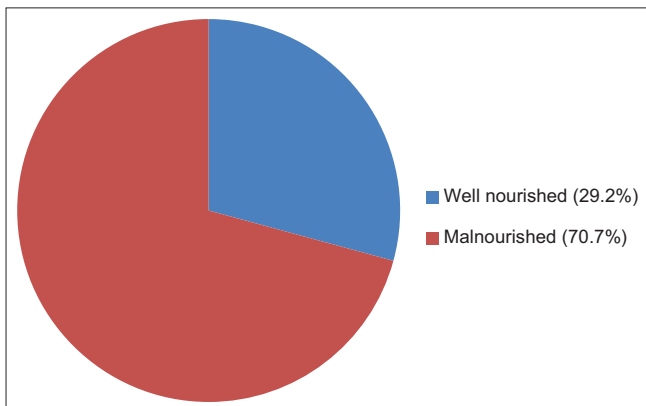
**Inclusion criteria**

- Biopsy proven head and neck cancer patients who are planned for surgery
- Age ≥18 years.

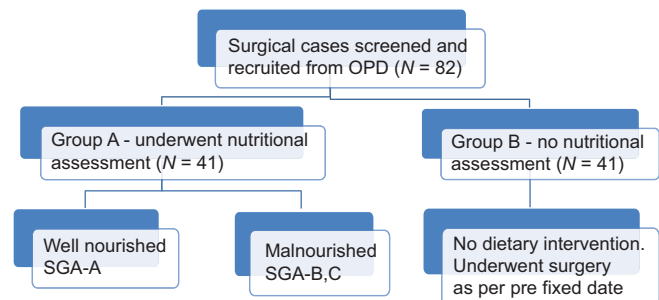
**Exclusion criteria**

- Patients with comorbidities that may affect wound healing, e.g., diabetes mellitus
- Patients with second primary tumour, within or outside head and neck region
- Unfit for anaesthesia
- Prior cancer-related treatment
- Palliative cases
- Patients with psychiatric disease.

All the participants in both the groups were assessed on the basis of age, gender, site of primary disease, type of surgery,



**Chart 1:** Nutritional status of patients in Group A



**Flowchart 1:** Segregation of cases

Subjective Global Assessment Form	Subjective Global Assessment Guidance For Body Composition
<b>MEDICAL HISTORY</b>	
Patient name: _____ Date: ____/____/____	
<b>NUTRIENT INTAKE</b>	
1. <input type="checkbox"/> No change; adequate 2. Inadequate; duration of inadequate intake _____ <input type="checkbox"/> Suboptimal solid diet <input type="checkbox"/> Full fluids or only oral nutrition supplements <input type="checkbox"/> Minimal intake, clear fluids or starvation 3. <b>Nutrient Intake in past 2 weeks*</b> <input type="checkbox"/> Adequate <input type="checkbox"/> Improved but not adequate <input type="checkbox"/> No improvement or inadequate	
<b>WEIGHT</b>	
Usual weight _____ Current weight _____ 1. <b>Non fluid weight change past 6 months</b> <input type="checkbox"/> <5% loss or weight stability <input type="checkbox"/> 5-10% loss without stabilization or increase <input type="checkbox"/> >10% loss and ongoing If above not known, has there been a subjective loss of weight during the past six months? <input type="checkbox"/> None or mild <input type="checkbox"/> Moderate <input type="checkbox"/> Severe 2. <b>Weight change past 2 weeks*</b> Amount (if known) _____ <input type="checkbox"/> Increased <input type="checkbox"/> No change <input type="checkbox"/> Decreased	
<b>SYMPTOMS</b> (Experiencing symptoms affecting oral intake)	
1. <input type="checkbox"/> Pain on eating <input type="checkbox"/> Anorexia <input type="checkbox"/> Vomiting <input type="checkbox"/> Nausea <input type="checkbox"/> Dysphagia <input type="checkbox"/> Diarrhea <input type="checkbox"/> Dental problems <input type="checkbox"/> Feels full quickly <input type="checkbox"/> Constipation <input type="checkbox"/> None <input type="checkbox"/> Intermittent/mild/low <input type="checkbox"/> Constant/severe/multiple 2. <b>Symptoms in the past 2 weeks*</b> <input type="checkbox"/> Resolution of symptoms <input type="checkbox"/> Improving <input type="checkbox"/> No change or worsened	
<b>FUNCTIONAL CAPACITY</b> (Fatigue and progressive loss of function)	
1. No dysfunction 2. Reduced capacity; duration of change _____ <input type="checkbox"/> Difficulty with ambulation/normal activities <input type="checkbox"/> Bed/chair ridden 3. <b>Functional Capacity in the past 2 weeks*</b> <input type="checkbox"/> Improved <input type="checkbox"/> No change <input type="checkbox"/> Decrease	
<b>METABOLIC REQUIREMENT</b>	
High metabolic requirement <input type="checkbox"/> No <input type="checkbox"/> Yes	
<b>PHYSICAL EXAMINATION</b>	
Loss of body fat <input type="checkbox"/> No <input type="checkbox"/> Mild/Moderate <input type="checkbox"/> Severe Loss of muscle mass <input type="checkbox"/> No <input type="checkbox"/> Mild/Moderate <input type="checkbox"/> Severe Presence of edema/ascites <input type="checkbox"/> No <input type="checkbox"/> Mild/Moderate <input type="checkbox"/> Severe	
<b>SGA RATING</b>	
<input type="checkbox"/> A Well-nourished Normal <input type="checkbox"/> B Mildly/moderately malnourished Some progressive nutritional loss <input type="checkbox"/> C Severely malnourished Evidence of wasting and progressive symptoms	
<b>CONTRIBUTING FACTOR</b>	
<input type="checkbox"/> CACHEXIA - (fat and muscle wasting due to disease and inflammation) <input type="checkbox"/> SARCOPENIA - (reduced muscle mass and strength)	
*See page 2 SGA Rating for more description. April 2017	

SUBCUTANEOUS FAT			
Physical examination	Normal	Mild/Moderate	Severe
Under the eyes	Slightly bulging area	Somewhat hollow look, Slightly dark circles,	Hollowed look, depression, dark circles
Triceps	Large space between fingers	Some depth to fat tissue, but not ample. Loose fitting skin.	Very little space between fingers, or fingers touch
Ribs, lower back, sides of trunk	Chest is full; ribs do not show. Slight to no protrusion of the iliac crest	Ribs obvious, but indentations are not marked. Iliac Crest somewhat prominent	Indentation between ribs very obvious. Iliac crest very prominent

MUSCLE WASTING			
Physical examination	Normal	Mild/Moderate	Severe
Temple	Well-defined muscle	Slight depression	Hollowing, depression
Clavicle	Not visible in males; may be visible but not prominent in females	Some protrusion; may not be all the way along	Protruding/prominent bone
Shoulder	Flattened	No square look; acromion process may protrude slightly	Square look; bones prominent
Scapula/ribs	Bones not prominent; no significant depressions	Mild depressions or bone may show slightly; not all areas	Bones prominent; significant depressions
Quadriceps	Well defined	Depression/atrophy medially	Prominent knee, Severe depression medially
Interosseous muscle between thumb and forefinger (back of hand)**	Muscle protrudes; could be flat in females	Slightly depressed	Flat or depressed area

FLUID RETENTION			
Physical examination	Normal	Mild/Moderate	Severe
Edema	None	Pitting edema of extremities / pitting to knees, possible sacral edema if bedridden	Pitting beyond knees, sacral edema if bedridden, may also have generalized edema
Ascites	Absent	Present (may only be present on imaging)	


**A - Well-nourished** no decrease in food/nutrient intake; < 5% weight loss; no/minimal symptoms affecting food intake; no deficit in function; no deficit in fat or muscle mass **OR** an individual with criteria for SGA B or C but with recent adequate food intake; non-fluid weight gain; significant recent improvement in symptoms allowing adequate oral intake; significant recent improvement in function; and chronic deficit in fat and muscle mass but with recent clinical improvement in function.

**B - Mildly/moderately malnourished** definite decrease in food/nutrient intake; 5% - 10% weight loss without stabilization or gain; mild/some symptoms affecting food intake; moderate functional deficit or recent deterioration; mild/moderate loss of fat and/or muscle mass **OR** an individual meeting criteria for SGA C but with improvement (but not adequate) of oral intake, recent stabilization of weight, decrease in symptoms affecting oral intake, and stabilization of functional status.

**C - Severely malnourished** severe deficit in food/nutrient intake; > 10% weight loss which is ongoing; significant symptoms affecting food/nutrient intake; severe functional deficit **OR** recent significant deterioration obvious signs of fat and/or muscle loss.


**Cachexia** - If there is an underlying predisposing disorder (e.g. malignancy) and there is evidence of reduced muscle and fat and no or limited improvement with optimal nutrient intake, this is consistent with cachexia.

**Sarcopenia** - If there is an underlying disorder (e.g. aging) and there is evidence of reduced muscle and strength and no or limited improvement with optimal nutrient intake.



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\*\*In the elderly prominent tendons and hollowing is the result of aging and may not reflect malnutrition.



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Figure 1: (a) SGA Questionnaire (Part 1). (b) SGA Questionnaire (Part 2). SGA: Subjective global assessment

nutritional status and haematological/radiological investigations. Written informed consent was taken from all the participants before the commencement of the study. They were then followed up for one month post-surgery for assessing post-operative complications. These were measured in terms of wound infection and dehiscence, flap failure, delay in oral feeding (more than 10 days), length of hospital stay (more than seven days), wound re-exploration, re-admission due to post-operative complications and delay in adjuvant therapy (more than two months).

**Statistical analysis**

All the data were analysed using SPSS Version 21 (Developer IBM, Stanford, California, USA). The descriptive statistics were employed and tables and pie-charts were used to display the data. The data were checked for normality using Kolmogorov–Smirnov and Shapiro–Wilk test. Independent t-test was used depending on the fulfilment of normality assumption for continuous variables. Chi-square or Fisher’s exact test was used for comparing proportions (for gender, age-group, t) to evaluate the association between categorical variables. The significance level was set at 5% (P < 0.05).

**RESULTS**

This study was done in the department of head and neck surgery for a period of one year. Only the surgical cases were

taken for the study. All cases were evaluated thoroughly. The observations of the study are depicted as follows:

**Demographic distribution**

The majority of the patients were more than 50 years of age (69.5%), with a male to female ratio of 2.3:1. Buccal mucosa was the most common primary site involved [Table 1].

**Nutritional status of patients in Group A**

Among the cases in Group A, 70.7% were found to be malnourished [Chart 1].

**Nutritional parameters used for assessing the efficacy of dietary intervention in malnourished cases (n = 29)**

The following parameters were used to assess the efficacy of the intervention. Assessment was done on the basis of SGA form. The minimum duration of dietary counselling and evaluation was 3 weeks, following which they were evaluated again and compared. The analysis showed that the intervention showed a significant improvement in the majority of the parameters [Table 2].

**Comparison of post-operative complications in both the groups**

This analysis indicates that patients who got dietary interventions from dietician (Group B) had lesser post-operative

**Table 1: Demographical distribution**

Variables	Group A, n (%)	Group B, n (%)	Total, n (%)
Gender			
Male	27 (65.8)	30 (73.2)	57 (69.5)
Female	14 (34.2)	11 (26.8)	25 (30.5)
Age (years)			
20-50	10 (24.4)	15 (36.6)	25 (30.5)
51-75	31 (75.6)	26 (63.4)	57 (69.5)
Site of the primary disease			
Buccal mucosa	7 (17.1)	10 (24.4)	17 (20.7)
Tongue	6 (14.6)	5 (12.2)	11 (13.4)
Alveolus	4 (9.8)	5 (12.2)	9 (11)
RMT	2 (4.8)	3 (3.7)	5 (6.1)
Thyroid	2 (4.8)	1 (2.4)	3 (3.7)
Laryngopharynx	1 (2.4)	2 (4.8)	3 (3.7)
Simonasal	2 (4.8)	1 (2.4)	3 (3.7)
Lower gingivobuccal sulcus	21 (51.2)	19 (46.3)	40 (48.8)
Duration of surgery (h)			
<5	8 (19.5)	5 (12.2)	13 (15.8)
5-8	26 (63.4)	28 (68.3)	54 (65.8)
>8	7 (17.1)	8 (19.5)	15 (18.3)

RMT: Retro molar trigone

**Table 2: Nutritional parameters**

Nutritional indicators	Mean (SD)		P
	Before dietary counselling	After dietary counselling	
Arm circumference	27.44	28.32	0.00192
Triceps skinfold thickness	16.97	17.97	0.000548
Arm muscle circumference	28.28	29.38	0.013452
Arm fat area	27.81	28.78	0.000652
Haemoglobin level	12	11	0.34
Serum albumin	3.0	3.2	0.07
Lymphocyte count	4000	4200	0.58

SD: Standard deviation

**Table 3: Post-operative complications**

Type of complications	Group A (n)	Group B (n)	P
Delay in adjuvant therapy	14	24	0.0076
Wound infection and dehiscence	10	21	0.0065
Flap failure	13	26	0.0031
Delay in oral feeding	10	18	0.0115
Prolonged hospital stay (>6 days)	3	10	0.0121
Wound re-exploration and re-admission	4	6	0.6144

complications than those cases in Group A and his difference was found to be statistically significant ( $P < 0.05$ ) [Table 3].

## DISCUSSION

This study highlights the close association and the importance of nutritional assessment for all head and neck cancer cases planned for surgery for an uneventful post-operative outcome.

In this study, majority of the cases were male and were more than 50 years of age. These findings were in accordance with studies by Righini *et al.*<sup>[14]</sup> and Singh *et al.*,<sup>[15]</sup> who also found a higher male preponderance. Various studies<sup>[16]</sup> have also reported the sixth decade to be the most expected age group for head and neck cancer. Regarding the primary tumour site, most of our patients had a disease in the gingivobuccal sulcus (47.6%), followed by buccal mucosa (20.7%), which was found in the literature.<sup>[17]</sup> This can be due to the common habit of tobacco chewing and keeping the quid at the gingivobuccal sulcus.

Among the cases that underwent active nutritional assessment, around 70.7% were found to be malnourished. After dietary counselling and intervention, a significant positive impact was seen on the health of the patients. Various physiological aspects such as arm circumference, triceps skinfold thickness, arm muscle circumference and arm fat area have also improved as the patients received customised diet plans according to their individual needs. An analysis of the post-operative complications among the two groups showed that dietary intervention had the maximum benefit in reducing flap failure, followed by a decreased incidence of wound infection and delay in adjuvant therapy.

SGA nutritional triage recommendations can be used as an effective tool for preventing post-operative complications in patients with head and neck cancer. Tsai *et al.*<sup>[18]</sup> also observed that patients with malnutrition exhibited significantly higher Patient Generated Subjective Global Assessment scores, lower serum albumin levels, more post-operative complications and more extended hospitalisation than the well-nourished patients did. Tsantes *et al.*<sup>[19]</sup> found malnutrition to be a poor prognostic marker for surgical wound infection.

However, this was a non-randomised study and the bias associated with such study is the most important limiting factor. Furthermore, confounding factors such as smoking, drinking, low haemoglobin and low serum albumin levels were not considered which can have a bias effect on such case-control studies.

## CONCLUSION

Nutrition is an essential factor that directly impacts the post-operative outcome of head and neck cancer patients. Adequate nutritional assessment and dietary intervention in the pre-operative period can go a long way in reducing post-operative morbidity in surgical patients. Hence, we recommend a routine pre-operative nutritional evaluation and counselling for better results.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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