Impact of Nutritional Status on Postoperative Outcomes in Patients with Oral and Maxillofacial Malignancies

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KEYWORDS
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ABSTRACT
Background: Nutritional status plays a critical role in postoperative outcomes for patients undergoing surgery for oral and maxillofacial malignancies. Malnutrition is common in these patients due to tumor-related dysphagia, metabolic alterations, and treatment-induced catabolic stress, increasing the risk of postoperative complications. This study aims to assess the impact of nutritional status on postoperative outcomes and highlight the need for perioperative nutritional management. **Methods:** This retrospective study analyzed 60 patients with oral squamous cell carcinoma (OSCC) who underwent surgery at the Oral & Maxillofacial Surgery Department of Bangabandhu Sheikh Mujib Medical University from January 1st to December 31st, 2020. Patients were categorized as well-nourished, moderately nourished, or malnourished based on preoperative clinical and biochemical parameters. Postoperative complications were classified into local (minor and major) and systemic. Statistical analysis included chi-square and Student's t-tests, with $p < 0.05$ considered significant. **Results:** Postoperative complications occurred in 17 patients (28%), with a higher prevalence among malnourished individuals (53%). Malnourished patients experienced greater weight loss (-3.5 kg vs. -2.1 kg, $p < 0.001$) and more severe nitrogen depletion (-4.3 g/day vs. -2.6 g/day, $p < 0.01$). Although complications were more common in patients undergoing major surgeries, the difference was not statistically significant. **Conclusion:** Poor preoperative nutritional status significantly increased postoperative complications and worsened recovery outcomes. These findings underscore the importance of early nutritional assessment and perioperative nutritional support in reducing postoperative morbidity and optimizing surgical recovery in patients with oral and maxillofacial malignancies.

INTRODUCTION

Oral and maxillofacial malignancies, including oral squamous cell carcinoma (OSCC), represent a significant global health concern, with OSCC being the most prevalent subtype, accounting for over 90% of oropharyngeal cancers【1,3】. The incidence of these malignancies is rising, particularly in developed nations, with an estimated five-year survival rate of approximately 50%【1,2】. Known risk factors include tobacco use, alcohol consumption, human papillomavirus (HPV) infection, and poor oral hygiene. Diagnosis is

confirmed through histopathological biopsy, and treatment primarily involves surgical resection, often combined with radiotherapy, chemotherapy, or targeted therapies【3】.

Nutritional status is a critical determinant of prognosis and postoperative outcomes in patients with oral and maxillofacial malignancies. Many patients present with malnutrition due to tumor-related dysphagia, masticatory dysfunction, and metabolic alterations【4,5】. Studies indicate that nearly half of patients with oral malignancies are malnourished at diagnosis, a condition that has been linked to poorer treatment tolerance, increased complications, and lower survival rates【6】. Furthermore, surgical stress, oncological therapies, and prolonged hospitalization contribute to protein depletion, weight loss, and immune suppression, leading to increased susceptibility to infections and impaired wound healing【7】.

Postoperative complications in oral and maxillofacial malignancies are influenced by preoperative nutritional deficiencies, immune dysfunction, and systemic metabolic imbalances【8】. Malnutrition is a well-documented risk factor for delayed recovery, prolonged hospital stays, and higher rates of surgical site infections【9】. However, despite its clinical importance, malnutrition remains underdiagnosed and inadequately managed in cancer patients, exacerbating weight loss, muscle depletion, and postoperative morbidity【9】. In addition, psychological distress and the complex nature of oncological treatment further impact recovery【10】.

Given the significant impact of nutritional depletion on postoperative complications, nutritional assessment should be integrated into preoperative evaluations and perioperative management strategies. Identifying nutritionally at-risk patients before surgery and implementing nutritional interventions could potentially improve postoperative outcomes, reduce complication rates, and enhance recovery.

This retrospective study aims to assess the impact of nutritional status on postoperative outcomes in patients with oral and maxillofacial malignancies. By evaluating nutritional parameters at different treatment stages, this study seeks to establish a clear relationship between nutritional status and postoperative complications. The findings may contribute to enhanced perioperative nutritional management strategies, ultimately reducing postoperative morbidity, improving surgical recovery, and optimizing patient outcomes.

Methodology

This retrospective study was conducted at the Oral & Maxillofacial Surgery Department of Bangabandhu Sheikh Mujib Medical University over a one-year period, from 1st January to 31st December 2020. The study aimed to assess the impact of preoperative and postoperative nutritional status on surgical outcomes in patients undergoing surgery for oral squamous cell carcinoma (OSCC). A total of 60 patients diagnosed with primary OSCC and treated surgically during the study period were retrospectively analyzed. Patients with other malignancies of the oral and maxillofacial region or pre-existing systemic conditions affecting nutritional status, such as chronic liver disease, renal failure, uncontrolled diabetes, or gastric ulcers, were excluded. Only patients with complete medical records, including preoperative nutritional assessment, postoperative nutritional changes, and complication data, were included.

Surgical procedures were categorized into limited, intermediate, and major surgeries based on the extent of resection. Limited surgery involved minor tumor resection with primary closure, such as floor of the mouth resection or partial glossectomy. Intermediate surgery consisted of larger soft tissue and bone excisions, with or without modified neck dissection, skin grafting, or tracheostomy, such as marginal mandibulectomy with partial glossectomy and skin grafting. Major surgery included radical procedures such as maxillectomy or segmental mandibulectomy combined with neck dissection.

Nutritional status was assessed preoperatively through patient history, physical examination, and biochemical markers. History-taking focused on weight changes, dietary intake, swallowing difficulties, and overall nutritional habits. Physical examination included weight, triceps skinfold thickness (TSF), mid-upper arm circumference (MAC), and mid-upper arm muscle circumference (MAMC). Biochemical markers, including serum albumin, transferrin, hemoglobin, and creatinine-height index, were measured to assess nutritional reserves. Based on a composite score derived from these parameters, patients were classified as well-nourished, moderately nourished, or malnourished.

Postoperative nutritional assessment was conducted on the seventh postoperative day, evaluating changes in body weight, muscle mass, nitrogen balance, and biochemical parameters. Postoperative food intake, including daily nitrogen and caloric intake, was recorded. Nitrogen balance was calculated using the formula: Nitrogen balance=nitrogen in minus nitrogen excreted = protein intake in g/6.25− (24 h urinary urea nitrogen + 4). where 4 accounts for estimated nitrogen loss through skin and feces. Patients undergoing major surgery received liquid nutrition (milk-based or elemental diet) via a nasogastric tube, whereas those with limited or intermediate procedures consumed semiliquid diets orally.

Postoperative complications were classified as local (minor or major) and systemic. Minor local complications included stitch abscesses, minor flap necrosis, and suture line dehiscence, which were managed conservatively. Major local complications included orocutaneous fistulas and major abscesses, which often required surgical intervention. Systemic complications included pneumonia and mediastinal abscesses. Additional surgical parameters recorded included blood loss during surgery, measured based on the number of blood-soaked surgical dressings (each absorbing approximately 30 mL of blood), transfusion requirements, and postoperative antibiotic use. Antibiotic regimens were based on surgical extent: intramuscular antibiotics for 3 days in limited surgery, intravenous antibiotics for 3 days in intermediate surgery, and intravenous antibiotics for 3 to 7 days in major surgery. Penicillin was the first-line antibiotic, while erythromycin and gentamicin were used in penicillin-allergic patients.

The primary outcome measure was the occurrence of postoperative complications, including minor and major local wound complications and systemic infections. The secondary outcome was postoperative nutritional decline and its association with recovery. Statistical analysis was performed using descriptive and inferential methods. Categorical variables such as nutritional status, surgical extent, and presence of complications were analyzed using the chi-square test, while continuous variables such as body weight loss, nitrogen balance, and caloric intake were analyzed using the student's t-test. A p-value < 0.05 was considered statistically significant.

Results

Among the patients who underwent surgical treatment for Oral and Maxillofacial Malignancies during the study period, 60 cases were identified and included in the analysis. The mean age of the study population was 53 years (SD: 14 years), with a predominance of male patients (68%). Squamous cell carcinoma (78%) was the most commonly observed malignancy, followed by malignant tumors of the salivary glands (12%), tumors of soft tissue and bone (8%), and melanoma (2%). Surgical records indicated that 70% of patients underwent major surgery, while 25% had intermediate procedures, and 5% underwent limited resection (Table 1).

Table 1: Clinical and Demographic Characteristics of the Study Population

Category	N (%)
Sex	
Male	41 (68)
Female	19 (32)
Age (years)	53 (14)
Type of tumour	
Squamous cell carcinoma	47 (78)
Malignant tumours of the salivary glands	7 (12)
Tumours of soft tissue and bone	5 (8)
Melanoma	1 (2)
Extent of surgery	
Major	42 (70)
Intermediate	15 (25)
Limited	3 (5)

Retrospective review of patient records showed that postoperative complications were documented in 17 patients (28%), while 43 patients (72%) recovered without complications. Complications were categorized into local (minor and major) and systemic. Among local complications, minor issues such as stitch abscesses (n=3), minor flap necrosis (n=4), and suture line dehiscence (n=2) were reported. Major local complications included orocutaneous fistula (n=1) and major abscess formation (n=7). Systemic complications were less frequent, with one case of pneumonia and one case of mediastinal abscess documented (Table 2).

Table 2: Distribution of Postoperative Complications Among Study Participants

Complication	No. of Patients
Local	
Minor	
Stitch abscess	3
Minor flap necrosis	4
Suture line dehiscence	2
Major	
Orocutaneous fistula	1
Major abscess	7
Systemic	
Pneumonia	1
Mediastinal abscess	1

Preoperative nutritional status was assessed based on recorded clinical and biochemical parameters. Among patients who developed complications, 9 were malnourished, 4 were moderately nourished, and only 4 were well-nourished. In contrast, 26 out of 43 patients without complications were well-nourished. The prevalence of malnutrition among patients with complications (53%) was significantly higher than in those without complications (21%), reinforcing the association between poor nutritional status and adverse postoperative outcomes (Table 3).

Table 3: Preoperative Nutritional Status and Its Association with Postoperative Complications

Nutritional Status	Complications (n=17)	No Complications (n=43)
Well-nourished	4	26
Moderately-nourished	4	9
Malnourished	9	9

Postoperative nutritional decline was observed to be more severe in patients who developed complications compared to those who did not. Body weight loss was significantly higher among patients with complications (-3.5 kg vs. -2.1 kg, $p < 0.001$), as well as reductions in skinfold thickness (-0.6 mm vs. -0.3 mm, $p < 0.01$) and midarm circumference (-1.1 cm vs. -0.5 cm, $p < 0.001$). Additionally, midarm muscle circumference loss was greater in the complication group (-0.9 cm vs. -0.4 cm, $p < 0.001$). Biochemical parameters indicated that serum albumin and transferrin levels were similar between the two groups ($p > 0.80$ and $p > 0.20$, respectively). However, the creatinine-height index was significantly lower in patients with complications (-19.6% vs. -1.9%, $p < 0.001$), and nitrogen balance was also more negatively impacted in this group (-4.3 g/day vs. -2.6 g/day, $p < 0.01$) (Table 4).

Table 4: Postoperative Nutritional Changes in Patients with and without Complications

Nutritional Variables	Complications (n=17)	No Complications (n=43)	p-value
Body weight loss (kg)	-3.5	-2.1	<0.001
Skinfold thickness (mm)	-0.6	-0.3	<0.01
Midarm circumference (cm)	-1.1	-0.5	<0.001
Midarm muscle circumference (cm)	-0.9	-0.4	<0.001
Hemoglobin (g/L)	-9.0	-14.7	>0.30
Albumin (g/L)	-3.0	-3.0	>0.80
Transferrin (g/L)	-0.4	-0.3	>0.20
Creatinine-height index (%)	-19.6	-1.9	<0.001
Nitrogen balance (g/day)	-4.3	-2.6	<0.01

Review of surgical records indicated that complications were most frequent among patients undergoing major surgical procedures (76%), with 13 out of 17 cases occurring in this group. In contrast, complications were documented in only 3 patients (18%) undergoing intermediate surgery and in 1 patient (6%) undergoing limited surgery. Despite the increased complication rate in major surgeries, the difference was not statistically significant (Table 5).

Table 5: Association Between Extent of Surgery and Postoperative Complications

Extent of Surgery	Complications (n=17)	No Complications (n=43)
Major	13	29
Intermediate	3	12
Limited	1	2

Postoperative nutritional intake was found to be lower among patients who developed complications. Nitrogen intake was significantly reduced in the complication group (5.4 g/day vs. 7.2 g/day, $p < 0.001$), as was caloric intake (1095 kcal/day vs. 1514 kcal/day, $p < 0.001$).

These findings suggest that inadequate postoperative nutrition may have contributed to prolonged recovery and increased susceptibility to complications (Table 6).

Table 6: Postoperative Nutritional Intake and Its Association with Complications

Variable	Complications (n=17)	No Complications (n=43)	p-value
Nitrogen intake (g/day)	5.4	7.2	<0.001
Caloric intake (kcal/day)	1095.0	1514.0	<0.001

Discussion

Postoperative morbidity and recovery are influenced by nutritional status, surgical extent, blood loss, transfusion, antibiotic use, and wound management. While antibiotics are crucial for infection control, their role is often overestimated, leading to the neglect of other critical factors like nutrition【1,4,6,8】.

Our study highlights nutritional status as a key determinant of postoperative outcomes in oral and maxillofacial surgery. Patients with complications exhibited greater nutritional deficiencies than differences in surgical factors like resection extent, blood loss, or antibiotic use. Poor preoperative nutrition significantly increased complication risks, emphasizing the need for perioperative nutritional optimization. Although complications were more frequent in extensive surgeries, this difference was not statistically significant, reinforcing that nutritional factors play a more decisive role in recovery than surgical complexity alone【1,4,6,8】.

Postoperative Nutritional Depletion and Its Impact on Recovery

Comparison of postoperative nutritional parameters between the two groups showed that patients who developed complications had more severe nutritional depletion than those who did not. Significant body weight loss, muscle mass reduction, and deterioration in nitrogen balance were observed in the complication group. These findings suggest that the catabolic response following surgery was more profound in malnourished patients, leading to increased risk of infections, poor wound healing, and prolonged recovery.

Biochemical markers such as hemoglobin, albumin, and transferrin were assessed to determine their reliability in evaluating nutritional status. While hemoglobin is not considered a sensitive indicator of nutritional state, albumin and transferrin are widely recognized for assessing protein reserves and nutritional status【9】. However, their relatively long half-lives (albumin: 20 days, transferrin: 8 days) limit their ability to detect acute postoperative nutritional changes【10】. Our study assessed patients on the seventh postoperative day, which might explain why albumin and transferrin levels showed no significant difference between the groups, despite marked nutritional depletion in the complication group.

Role of Nutrition in Immunity and Wound Healing

Nutritional status directly affects the body's immune defense system, influencing susceptibility to postoperative infections. Over 60 years ago, Studley【11】reported that patients who lost 20% or more of their preoperative body weight had significantly increased rates of postoperative infections and mortality. Furthermore, when body weight loss exceeds 35%–40%, survival is critically compromised【12】.

Numerous clinical and laboratory studies have established that malnutrition impairs immune function, reducing resistance to infections【13–15】. Protein depletion, in particular, compromises cell-mediated immunity, phagocytosis, and wound healing, leading to higher rates of surgical site infections, prolonged hospital stays, and increased mortality. One of the

most significant advancements in postoperative infection control in the 1970s was the recognition of the relationship between nutrition, immunity, and infection【16】.

Current research has increasingly focused on the role of specific nutrients in wound healing. Vitamins A, B1, B2, C, K, and E, along with arginine, zinc, iron, copper, manganese, and omega-3 fatty acids, have been shown to play a crucial role in tissue repair and immune function【17,18】. However, clinical nutrition remains an underutilized aspect of perioperative care, particularly among head and neck surgeons, who often underestimate the impact of malnutrition on surgical outcomes.

Preoperative Nutritional Optimization and Postoperative Support

Our findings underscore the need for early identification and intervention for malnourished patients undergoing oral and maxillofacial surgery. Preoperative nutritional optimization should be integrated into standard surgical care to improve outcomes. This includes nutritional screening, supplementation, and dietary adjustments before surgery to enhance protein reserves and immune function. Additionally, postoperative nutritional support is essential to counteract the catabolic state induced by surgical stress.

In our study, patients with complications had significantly lower nitrogen and caloric intake during the first postoperative week. This suggests that postoperative nutritional deficiencies further worsened recovery in an already vulnerable group. Therefore, aggressive nutritional intervention in the early postoperative period may reduce complications and enhance recovery.

Clinical Implications and Recommendations

As the focus on postoperative recovery and quality of life continues to grow, it is imperative to recognize the impact of nutrition on surgical outcomes. Our study emphasizes that perioperative nutritional support should be considered as an essential part of patient management, alongside surgical and antibiotic protocols. By integrating nutritional assessment and intervention into routine surgical care, the risk of postoperative complications can be significantly reduced, ultimately leading to improved patient outcomes.

Conclusion: This study highlights the significant impact of nutritional status on postoperative outcomes in patients with oral and maxillofacial malignancies. Malnourished patients had a higher incidence of postoperative complications, including wound infections, delayed healing, and systemic complications, compared to well-nourished individuals. Preoperative malnutrition was strongly associated with greater postoperative nutritional depletion, increased weight loss, and poorer nitrogen balance, which contributed to prolonged recovery and increased morbidity. Although major surgical procedures were linked to a higher complication rate, the findings suggest that nutritional factors play a more decisive role in postoperative recovery than surgical complexity alone. Given these results, early nutritional assessment and perioperative nutritional support should be integrated into standard surgical care to optimize patient outcomes, reduce complications, and improve overall recovery in patients with oral and maxillofacial malignancies.

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