Original Article

Whole-course nutritional support therapy and indicators in head and neck cancer surgery

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Background and Objectives: This study investigated the effect of continuous perioperative nutritional support provided by a multidisciplinary team (MDT) to patients who underwent surgery for head and neck cancer (HNC). **Methods and Study Design:** This study enrolled 99 patients with HNC and divided them into two groups: a management group (n=48), comprising patients who underwent surgery between August and December 2020 and received continuous perioperative nutritional support from the MDT; and a control group (n=51), comprising patients who underwent surgery between June and December 2017 and received routine nutritional guidance. Data on weight, nutritional indicators, and the prognostic nutritional index (PNI) were collected. We compared the changes in weight, nutritional indicators, PNI, Patient-Generated Subjective Global Assessment (PG-SGA) scores, and body composition. Factors influencing the PNI were analysed. **Results:** The minimum weight, nutritional indicator, and PNI values observed postoperatively and at discharge were lower than those observed at admission. The serum nutritional index values observed at discharge and minimum PNI values observed postoperatively and at discharge were higher in the management group than in the control group. The PG-SGA score at 2 weeks postoperatively was higher than that on the day of surgery in the management group. The discharge PNI was influenced by management and age in these HNC surgical patients. In the management group, body composition data did not differ significantly between the preoperative and 1-, 2-, and 3-week postoperative time points. **Conclusions:** Continuous perioperative nutritional support by an MDT can improve the weight and serum nutritional index of patients receiving surgery for HNC and improve the PNI at discharge.

Key Words: head and neck cancer, surgery patients, multidisciplinary, standardised nutritional management, nutritional status

INTRODUCTION

Head and neck cancer (HNC) is a collective term for several malignant tumours occurring below the skull base, above the clavicle, and before the cervical spine, mainly including nasopharyngeal, oropharyngeal, hypopharyngeal, and laryngeal cancers. According to the global cancer statistics for 2018,[1] more than 1.45 million new cases of HNC were diagnosed; thus, HNC ranked sixth in the global incidence of malignant tumours and eighth in the leading causes of death.

In China, the main HNC treatment strategy is surgery supplemented by radiotherapy and chemotherapy. The HNC tumour occurrence site is unique, and surgery severely affects patients' eating postoperatively, leading to a high incidence of malnutrition. Malnutrition can negatively affect the quality of life and treatment toxicity of patients with cancer. According to the 2019 Chinese Society of Clinical Oncology (CSCO) guidelines for nutrition treatment for patients with malignancies, 10%–20% of patients with cancer die of malnutrition rather than the tumour itself.[2] An international study of Central European patients with advanced cancer reported that the patients exhibited greater weight loss, a lower body mass index, and shorter survival time than did other patients.[3]

Therefore, domestic and international societies have developed relevant evidence-based guidelines and expert consensus for clinical guidance regarding nutrition treatment for patients with HNC. However, a gap exists between clinical practice and guideline implementation, and no standardised reference is available for guiding frontline medical staff in the perioperative nutritional management of patients with HNC.[4] Scholars must comprehensively explore and improve the construction of a continuous perioperative multidisciplinary team (MDT) support system for such patients. Accordingly, this study

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Manuscript received 07 June 2022. Initial review completed 16 June 2022. Revision accepted 19 July 2022.
doi: 10.6133/apjcn.202209_31(3).0002

investigated the effects of employing a multidisciplinary nutritional management team perioperatively in patients with HNC undergoing surgery and provides a reference for the nutritional management of such patients.

METHODS

Participants

This study applied a historical controlled design. The control group comprised patients with HNC who underwent surgery at the Otorhinolaryngology Head and Neck Surgery department of Ningbo Medical Center Li Huili Hospital from June 2017 to December 2017; these patients' basic clinical data and nutrition-related indicators such as weight fluctuation, serum albumin, and total lymphocyte counts measured during their hospitalisation were collected. The management group comprised patients with HNC who underwent surgery from August 2020 to December 2020. All patients signed written informed consent forms, and the study protocol was approved by the ethics committee of the hospital. The inclusion criteria were as follows: being aged 18 years; receiving a histological diagnosis of squamous cell head and neck carcinoma, including laryngeal, hypopharynx, tongue, or oral cancer; receiving a preferred surgical treatment; and having an estimated survival time of 3 months. The exclusion criteria were as follows: having metastatic HNC, having HNC with distant metastasis, receiving preoperative chemoradiotherapy, having communication disorders involving mental problems or depression, undergoing minimally invasive surgery, or having thyroid cancer.

Nutritional support measures

Both groups received routine treatment and care during hospitalisation. The control group did not undergo nutritional risk screening or nutritional assessment during hospitalisation, and the patients received an ununitized enteral nutrition solution through an intraoperative nasogastric tube. For patients with enteral nutrition intolerance, fixed formula parenteral nutritional support was provided, with no accurate calculation of the target energy or protein and no actual intake of energy or protein. In the management group, the patients received the optimal nutritional management system.

Establishment of MDT head and neck surgery nutritional management team

An MDT nutritional support group comprising physicians, nurses, dieticians, and clinical pharmacists was established. The group developed an optimal nutritional management programme for patients with HNC that was compatible with the actual situation of our hospital (Figure 1).

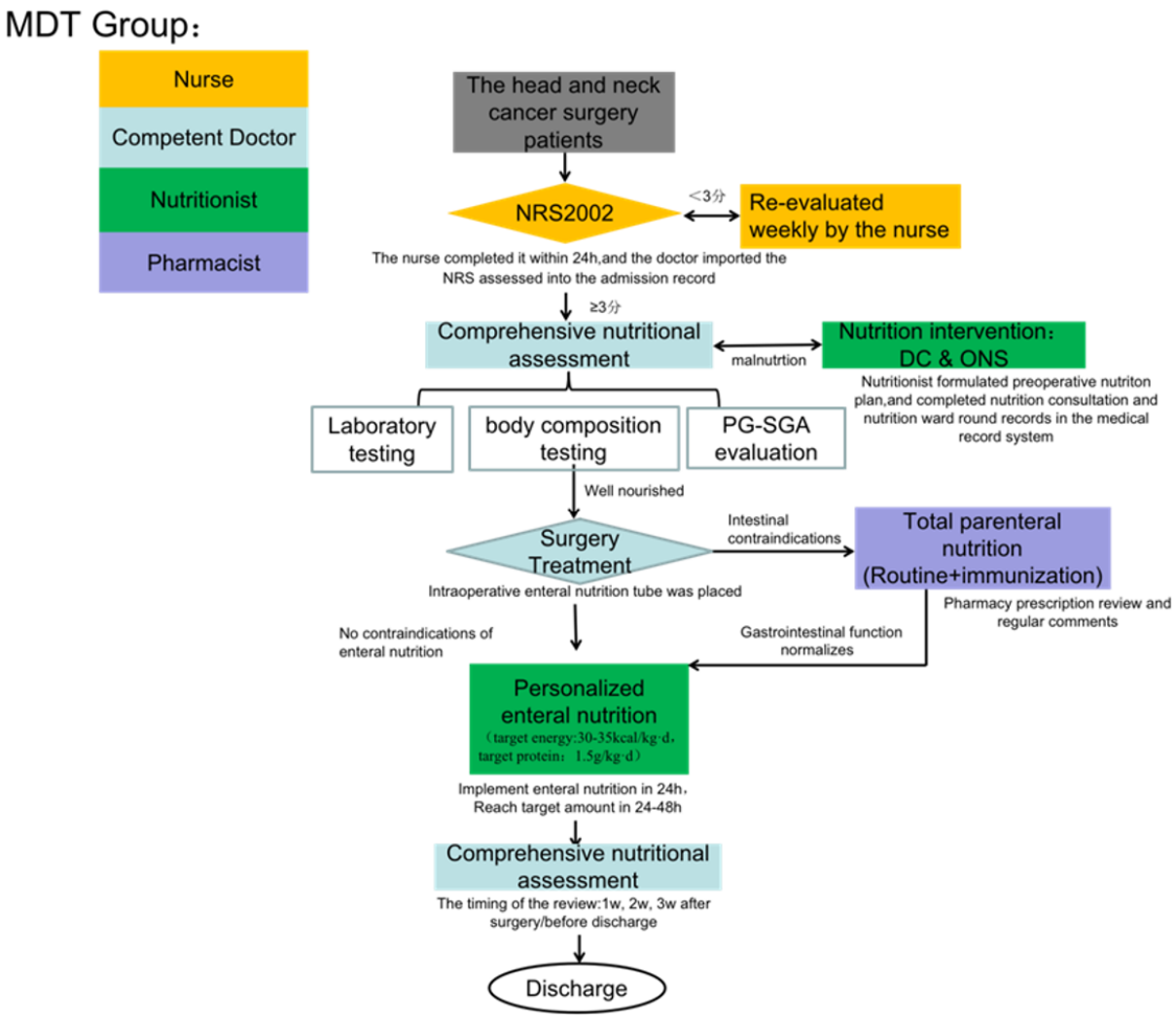

Figure 1. Standardised nutritional support system and HNC patient assignment to a multidisciplinary team (MDT).

Implementation of the optimal nutritional management programme

Regarding the preoperative nutrition screening and assessment, the Nutrition Risk Screening 2002 (NRS2002) embedded in the Nursing Scoring System was administered to the patients within 24 h of admission; <3 points were recorded for weekly screening, and ≥3 points were recorded for further comprehensive nutrition assessment using the Patient-Generated Subjective Global Assessment (PG-SGA) scale, laboratory indicators (serum albumin and prealbumin and lymphocyte counts), and body composition data. The Inbody S10 tool was used to measure body composition, such as body weight, body moisture, body fat, and skeletal muscle.

Regarding nutrition assessment, intervention, and nutrition index tracking, enteral nutrition was started within 24 h postoperatively. A nutrition treatment plan was created with an energy target of 30–35 kcal/(kg·d) and a protein target of 1.5 g/(kg·d). The first meal was a 200-mL rice soup, and the patients were required to reach the specified targets within 24–48 h. Supplementary parenteral nutritional support was implemented as soon as possible. A comprehensive nutritional assessment (1 week, 2 weeks, 3 weeks, or before discharge) was performed to determine whether a nutritional regimen adjustment was necessary.

Observed metrics

In the control group, the patients' weights, serum albumin, total lymphocyte count, and prognostic nutritional index (PNI = serum albumin + 5 * total lymphocyte count) values were assessed weekly. In addition, prealbumin was measured in the management group. Fasting venous blood was analysed preoperatively, weekly, and before discharge by using automatic biochemical analysis instruments. Body composition data, including body moisture, body fat, and skeletal muscle mass, were analysed at baseline and at 1 week, 2 weeks, and 3 weeks postoperatively.

Statistical analysis

SPSS20.0 statistical software was used to analyse the data. The t test was used to compare the measurement data. An analysis of variance was used to compare the groups. The chi-square test was used to analyse count data. The PNI was assessed as the dependent variable using multiple linear regression. Statistical significance was set at $p<0.05$.

RESULTS

Demographic characteristics of the management and control groups at baseline

No significant difference in baseline clinical data was observed between male patients in the management and control groups ($p>0.05$), as presented in Table 1.

Comparison of changes in body weight and serum nutrition indicators between the two groups

The body weight, serum albumin, lymphocyte count, and PNI values in both groups were lower at admission ($p<0.05$). The PG-SGA score at 2 weeks postoperatively was higher than that on the day of surgery ($p<0.05$).

The serum albumin ($p=0.01$) and lymphocyte count ($p=0.01$) values observed at discharge were higher in the management group than in the control group. The lowest PNI during the postoperative period ($p=0.04$) and the PNI at discharge 0 ($p<0.01$) were higher in the management group than in the control group (Table 2).

Table 1. Demographic characteristics of the management and control groups at baseline

Clinical data	Management group (n=48)	Control group (n=51)	Statistic	*p*
Age (age)	61.9±8.22	64.8±7.46	−1.77	0.08
BMI (kg/m^2)	22.1±2.80	22.2±2.47	−0.27	0.79
degree of education				
Primary school and below	27	32		
Junior middle school	16	10	1.80	0.41
High school and above	5	5		
Smoke				
No	20	20	0.01	0.92
Yes	28	27		
Drink				
No	22	22	0.01	0.92
Yes	26	25		
History of diabetes				
No	42	42	0.08	0.78
Yes	6	5		
Medical history of hypertension				
No	31	31	0.02	0.89
Yes	17	16		
Tumour species				
Laryngocarcinoma	31	35		
Carcinoma of the mouth	11	12	6.28	0.10
Other	6	0		
By stages				
I–II designated time	31	34	1.79	0.25
III–IV designated time	10	5		

Table 2. Differences in weight and nutritional indices between management and control groups

	Management (n=48)	Control (n=51)	t	*p*
Weight (kg)				
On admission	63.6±8.96	64.7±10.5	0.53	0.60
The lowest postoperative period	60.5±8.13†	60.5±13.3†	0.01	0.99
When discharged from hospital	60.9±8.04†‡	58.9±16.1†‡	−0.75	0.45
Serum albumin (g/L)				
On admission	43.5±3.11	42.8±4.53	−0.88	0.38
The lowest postoperative period	33.7±3.23†	32.6±2.74†	−1.67	0.10
When discharged from hospital	39.1±2.90†‡	37.4±3.42†‡	−2.57	0.01
Lymphocytes (10^9/L)				
On admission	1.68±0.67	1.42±0.41	−2.31	0.02
The lowest postoperative period	0.92±0.39†	0.79±0.33†	−1.72	0.09
When discharged from hospital	1.52±0.53†‡	1.26±0.38†‡	−2.75	0.01
PNI				
On admission	51.9±5.09	49.0±0.83	−1.80	0.08
The lowest postoperative period	38.2±4.52†	36.5±3.74†	−2.02	0.04
When discharged from hospital	46.7±4.55†‡	43.8±4.50†‡	−3.20	<0.01
Serum prealbumin (g/L)				
On admission	0.33±0.09	0.31±0.08	−1.24	0.22
The lowest postoperative period	0.21±0.08†	–		
When discharged from hospital	0.30±0.09†‡	–		
NRS2002				
After surgery, 0 days	3.58±0.65	–		
PG-SGA				
After surgery, 0 days	5.75±2.70	–		
After surgery, 2 weeks	7.69±2.77§	–		

PNI: prognostic nutritional index; NRS2002: Nutrition Risk Screening 2002; PG-SGA: Patient-Generated Subjective Global Assessment.
†*p*-value<0.05 compared with the base value at admission.
‡*p*-value<0.05 compared with the lowest postoperative value.
§*p*-value<0.05 compared with the 0-day postoperative score.

Changes in body composition preoperatively and postoperatively

The body composition data of the patients at baseline, 1 week, 2 weeks, and 3 weeks postoperatively are presented in Table 3. As indicated in this table, no significant changes in body composition data, including body moisture, body fat, body fat percentage, visceral fat area, or skeletal muscle mass, were observed between the preoperative and postoperative time points (p>0.05).

Factors associated with PNI

Results obtained from the univariate analysis of the PNI are summarised in Table 4. The PNI at discharge was negatively associated with patient age (r=−3.20, p=0.01). Patients with hypertension had a lower PNI at discharge (p=0.04). According to the results in Tables 2 and 4, group, age, and hypertension influenced the PNI at discharge (Table 4).

We also conducted a multiple linear regression analysis of the PNI by using the PNI at discharge as the dependent variable and positive indicators (group, age, and hypertension) in the univariate analysis as independent variables (Table 5). Management group and age influenced the PNI of patients who underwent HNC surgery (Table 5); that is, the PNI of the management group was higher than that of the control group (p=0.01), and the PNI decreased with age (p=0.01).

Table 3. Perioperative body composition in the management group

Body composition index	Preoperative	After surgery, 1w	After surgery, 2w	After surgery, 3w
Body moisture (L)	37.8±3.69	38.0±4.21	37.7±3.71	37.4±4.35
Intracellular moisture (L)	23.4±2.40	23.6±2.78	23.2±2.40	23.1±2.89
Extracellular moisture content (L)	14.4±1.35	14.4±1.66	14.4±1.39	14.4±1.52
Body fat (kg)	11.0±4.38	10.5±4.34	10.5±4.48	9.56±4.55
Body fat percentage (%)	17.2±5.58	16.5±5.20	16.7±5.55	15.5±5.46
Visceral fat area (m^2)	40.3±16.2	40.9±16.5	40.5±16.4	37.1±13.9
Fat free mass (kg)	51.6±5.15	51.8±5.85	51.3±5.15	51.0±6.16
Skeletal muscle (kg)	28.5±3.13	28.5±3.78	28.3±3.13	28.1±3.77
Upper arm circumference (cm)	27.5±2.34	27.7±2.42	27.5±2.51	26.7±2.84
Upper arm muscle circumference (cm)	25.0±1.80	25.2±1.90	25.2±1.93	24.5±2.02
Waistline (cm)	70.6±5.75	71.8±6.83	70.3±7.54	69.5±6.21
Basal metabolic rate (kcal/d)	1483±111	1487±126	1484±110	1481±127

Table 4. Perioperative body composition in the management group

Factors	Prognostic nutrition index	t	*p*
Group			
Management	46.7±4.55	−3.20	<0.01
Control	43.8±4.50		
Age (age)	–	−2.29†	0.01
Degree of education		0.70	0.50
Primary school and below	44.8±4.88		
Junior middle school	46.2±4.65		
High school and above	45.6±4.29		
Smoke			
No	45.1±5.41	−0.29	0.77
Yes	45.4±4.45		
Drink			
No	44.5±5.15	−1.46	0.15
Yes	45.9±4.31		
History of diabetes			
No	45.5±4.86	1.52	0.13
Yes	43.3±3.31		
Medical history of hypertension			
No	46.0±4.59	2.20	0.04
Yes	44.0±4.88		
Tumour type			
Laryngocarcinoma	45.0±4.98		
Carcinoma of the mouth	45.3±4.19	1.44	0.24
Other	48.4±3.18		
By stages			
I–II designated time	45.9±4.80	0.70	0.49
III–IV designated time	44.9±3.89		
Complication			
No	45.6±4.88	−1.75	0.08
Yes	43.2±3.06		

†The statistic is R correlation coefficient.

Table 5. Multiple linear regression analysis for determinants of PNI at discharge after HNC surgery

Factor	Non-standardised coefficient		Standardised coefficient	t	*p*
	Beta	S.E	Beta		
Constant term	53.8	3.85		14.0	0.00
Groups†	2.52	0.92	0.27	2.73	0.01
Age	−0.16	0.06	−0.26	−2.65	0.01

S.E: standard error.
†Groups include management groups and control group.

DISCUSSION

The growth of tumours at particular sites associated with feeding is often accompanied by dysphagia, swallowing obstruction, pain, oral mucositis, and other symptoms. Therefore, patients with HNC have an increased risk of malnutrition.[5] Sufficient nutritional support is necessary for patients to tolerate surgery, radiotherapy, and chemotherapy, in addition to disease rehabilitation. Therefore, the nutrition problems encountered by patients with HNC must be addressed through effective nutritional management programmes in clinical practice. An MDT can effectively integrate and fully utilise existing medical resources, maximise the advantages of various departments, and develop needle-based and personalised patient treatment plans. MDTs comprising personnel from nutrition, pharmacy, and rehabilitation departments can establish cooperative clinical intervention programmes for nutrition guidance and swallowing rehabilitation to provide maximum benefits to patients. In addition, to help patients with swallowing problems, personnel from the nutrition department should prepare foods recommended by the International Dysphagia Diet Standardisation Initiative.

The CSCO guidelines recommend the implementation of a three-level nutritional assessment, complete nutrition screening within 24 h of admission in a continuous perioperative support programme, and further PG-SGA assessment and comprehensive nutrition assessment for screening patients with an NRS2002 score of ≥3. The three-level nutrition assessment should also be executed throughout the nutritional management programme to ensure that patients with nutritional risk are provided with a timely and effective intervention. For patients with a severe nutritional risk that suspends surgery, continued nutrition intervention should be provided until the patients' condition is sufficiently improved to resume surgery. In addition, predictive nutrition treatment should be provided to patients with postoperative stress. For exam-

ple, in this study, the PNI at discharge was higher in the management group than in the control group.

Studies on patients with HNC who underwent radiotherapy and chemotherapy have reported that those who receive standard nutritional management exhibit lower declines in wellbeing,[6,7] serum albumin, and lymphocyte count than do those who do not receive this management; these findings suggest that the standardisation of nutritional management for patients with HNC undergoing chemotherapy can effectively improve the nutritional status. The present study revealed that for patients with HNC who underwent surgery, standardised perioperative nutritional support provided continually by an MDT could improve the nutritional status at discharge. However, the weight, serum albumin, lymphocyte count, PNI value, and prealbumin observed at discharge were lower than those observed at admission and at 2 weeks postoperatively. The PG-SGA score observed at 2 weeks postoperatively was also higher than that observed on the day of surgery, indicating that the HNC-induced trauma affected the nutritional status. Nutritional status did not return to that preoperative until discharge. Such findings argue for home nutritional support for such patients.

Recent studies have used the PNI to predict prognosis where there are multiple solid tumours.[8] In the present study, we conducted univariate and linear regression analyses with the postoperative PNI as the dependent variable; regression demonstrate that the PNI was higher in the management than in the control group and that it decreased with age. The PNI is based on the total serum albumin and lymphocyte count, which partly reflect t nutritional status and immune function.[8] Previous studies have shown that the PNI is closely associated with prognosis for tumours such as gastric, liver, lung, and oesophagus.[9] A high PNI indicates the stability of growth factors and inflammatory factors in the internal environment, lessening further tumour progression in patients with malignant tumours. A low PNI often reflects damage to immune function, increased vascular permeability, and other dysfunctions which can favour continuous tumour progression.[10,11] The correlation of PNI with the prognosis of HNC tumours demonstrated that PNI can be a prognostic indicator in nasopharyngeal and oral cancers treated with chemoradiotherapy; such studies also report that PNI is correlated with survival time.[12,13] In the present study, the PNI at discharge was significantly higher in the management group than in the control group. We recommend follow-up research on discharge prognosis and long-term survival of HNC patients by PNI.

We observed that continuous perioperative nutritional support provided by the MDT to patients with HNC undergoing surgery resulted in improved fat-free mass, skeletal muscle mass, and serum protein values at 1 week, 2 weeks, and 3 weeks postoperatively. I Improvement engendered by the MDT support might be more recognisable with a larger sample size.

Conclusion

In this study, an MDT was shown to provide continuous perioperative nutritional support advantage to patients undergoing surgery for HNC. The MDT provided nutritional screening, dynamic assessment, nutrition index evaluation, personalised nutrition intervention, an integrated nutritional management system, and supportive care to patients with HNC undergoing surgery from admission through to discharge. This helped improve the nutritional status postoperatively, a foundation for enhanced postoperative rehabilitation, improved tolerance to treatment, and the active involvement of clinicians.

ACKNOWLEDGEMENTS

We want to thank all medical workers, especially the frontline medical workers, for their cooperation and support.

AUTHOR DISCLOSURES

The authors declare that they have no any conflict of interests.

This work was supported by the Medical Health Science and Technology Project of Zhejiang Provincial Health Commission (2021KY309).

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