Journal of Clinical and Nursing Research, 2026, Volume 10, Issue 10
https://bbwpublisher.com/journal/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Effects of Stepwise Eating-Based Swallowing Function Rehabilitation Training on Postoperative Nutritional Status and Immune Function in Patients with Laryngeal Cancer

Qingsi Chen, Liqin Lin*

Department of Otolaryngology, The First Affiliated Hospital of Wenzhou Medical University, Wenzhou 325000, Zhejiang, China

Author to whom correspondence should be addressed.

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Objective*: To investigate the application effect of stepwise eating-based swallowing function rehabilitation training in postoperative nursing of patients with laryngeal cancer. *Methods*: A total of 120 patients with dysphagia after laryngeal cancer surgery who underwent surgical treatment in the Department of Otorhinolaryngology Head and Neck Surgery of a tertiary hospital between January 2022 and December 2024 were selected as study subjects. They were randomly divided into a control group and an observation group, with 60 patients in each group. The control group received conventional nursing and traditional dietary education, while the observation group received stepwise eating-based swallowing function rehabilitation training in addition to the control group's care. The differences in Standardized Swallowing Assessment (SSA) scores, Functional Oral Intake Scale (FOIS) ratings, nutritional status indicators (fasting serum albumin, prealbumin), and immune function indicators (peripheral blood CD3+, CD4+, CD8+ percentages and CD4+/CD8+ ratio) were observed and compared between the two groups. *Results*: Before intervention, general data and baseline indicators were consistent between the two groups ($p > 0.05$). After intervention, the SSA score in the observation group was lower than that in the control group, and the FOIS rating was higher than that in the control group ($p < 0.05$); serum albumin and prealbumin levels in the observation group were higher than those in the control group ($p < 0.05$); peripheral blood CD3+ and CD4+ levels and the CD4+/CD8+ ratio in the observation group were higher than those in the control group, while the CD8+ level was lower than that in the control group ($p < 0.05$). *Conclusion*: Stepwise eating-based swallowing function rehabilitation training can help improve postoperative swallowing function in patients with laryngeal cancer, promote the establishment of early enteral nutrition pathways, and improve nutritional status. thereby enhancing immune function to a certain extent and benefiting long-term quality of life.
Keywords: Laryngeal cancer; Dysphagia; Stepwise eating; Nutritional status; Immune function; Rehabilitation training

Online publication: November 25, 2026

1. Introduction

As a common head and neck malignant tumor in otorhinolaryngology head and neck surgery, laryngeal cancer is currently mainly treated with partial laryngectomy or total laryngectomy as the core radical treatment. However, after laryngeal cancer surgery, patients often develop soft tissue fibrosis due to loss of anatomical structures, local scar formation, and other factors, which can affect swallowing function to varying degrees. This not only makes patients prone to delayed swallowing initiation and pharyngeal residue of the bolus after surgery, leading to choking or aspiration, but may also reduce oral intake, resulting in malnutrition and decreased immune function [1,2]. Traditional postoperative dietary management mostly relies on clinical experience guidance and lacks objective quantitative assessment of individual swallowing tolerance. In view of this, this study introduced stepwise eating-based swallowing function rehabilitation training based on the Volume-Viscosity Swallow Test (V-VST) into the nursing of patients after laryngeal cancer surgery and explored its mechanism of influence on postoperative nutritional status and immune function, aiming to provide more evidence for optimizing the postoperative rehabilitation pathway in otorhinolaryngology head and neck surgery.

2. Materials and methods

2.1. General information

A total of 120 patients with dysphagia after laryngeal cancer surgery who underwent surgical treatment in the Department of Otorhinolaryngology Head and Neck Surgery of a tertiary hospital between January 2022 and December 2024 were selected as study subjects. The randomization method used computer software-generated random numbers combined with block randomization, and patients were allocated to the control group and observation group at a 1:1 ratio. Sample size calculation was based on the statistical power formula for comparison of means between two independent samples, with a two-sided significance level of $\alpha=0.05$ and power $1-\beta=0.90$. Referring to the effect size of the core outcome indicators in the pilot experiment and considering a 20% dropout rate, 60 patients were ultimately included in each group. In the control group, there were 56 men and 4 women; age 44.00–76.00 (60.00 ± 6.37) years; body mass index (BMI) 18.750–28.57 (22.80 ± 1.97) kg/m²; TNM staging: 17 cases in stages I–II and 43 cases in stages III–IV; surgical procedures: partial laryngectomy in 43 cases and total laryngectomy in 17 cases. In the observation group, there were 58 men and 2 women; age 44.00–72.00 (58.30 ± 6.65) years; BMI 19.53–28.86 (23.05 ± 1.83) kg/m²; TNM staging: 7 cases in stages I–II and 53 cases in stages III–IV; surgical procedures: partial laryngectomy in 44 cases and total laryngectomy in 16 cases. There was no significant difference in general data between the two groups ($P > 0.05$). This study was approved by the ethics committee , and patients and their family members signed informed consent.

2.2. Inclusion criteria

(1) Preoperative histopathological and cytological examinations confirmed a diagnosis of primary laryngeal cancer, and partial laryngectomy or total laryngectomy was planned in our hospital;
(2) Age 40–75 years;
(3) Postoperative swallowing function assessment and Kubota Water Swallowing Test indicated dysphagia;
(4) Complete baseline data.

2.3. Exclusion criteria

(1) Patients with severe primary digestive tract diseases involving the oral cavity, pharynx, esophagus, or gastrointestinal tract;
(2) Patients with primary hepatocellular carcinoma or advanced malignant tumors of other organs with an expected survival of less than six months;
(3) Patients with systemic diseases such as COPD, severe lower respiratory tract infection, or ventilatory failure;
(4) Patients with contraindications to enteral nutrition such as mechanical intestinal obstruction or massive gastrointestinal bleeding;
(5) Patients with preoperative cachexia, severe malnutrition, or immunodeficiency diseases;
(6) Patients with severe neurodegenerative diseases, sequelae of stroke, severe cognitive impairment, or mental disorders leading to poor compliance.

2.4. Methods

Both groups received nursing intervention from the same medical and nursing team in our hospital. The control group received conventional nursing in the Department of Otorhinolaryngology Head and Neck Surgery and traditional dietary education, including postoperative airway secretion management, tracheostomy tube care, incision dressing change, and vital sign monitoring; conventional peripheral intravenous parenteral nutrition or nasogastric tube enteral nutrition was given. Before removal of the nasogastric tube, patients were instructed to first try a small amount of lukewarm liquids and transition to semi-liquid and regular diets according to tolerance; if choking or other discomfort occurred, feeding was stopped immediately and reported.

The observation group received stepwise eating-based swallowing function rehabilitation training in addition to the control group's care:

(1) Basic motor training of swallowing organs

Initiated 3–5 days after surgery when vital signs were stable. This included isometric and resistance training of the lip and buccal muscle groups, multidirectional flexibility and strength training of the tongue, and jaw opening and closing resistance exercise, aiming to improve bolus control during the oral preparatory phase. Airway protection and compensatory swallowing training were also carried out, guiding patients to practice airway closure techniques such as supraglottic swallow and super-supraglottic swallow, as well as the Mendelsohn maneuver to prolong cricopharyngeal opening time.

(2) Volume-Viscosity Swallow Test (V-VST)

Before planned removal of the nasogastric tube, water was thickened with a thickener into three viscosities: pudding-like, nectar-like, and water-like. Patients attempted to swallow at three volume gradients: 5 mL, 10 mL, and 20 mL. Safety impairment (e.g., coughing, oxygen saturation decrease ≥ 3%, wet hoarseness) and efficacy impairment (e.g.,), lip leakage, pharyngeal residue, and delayed swallowing) were monitored.

(3) Formulation of individualized eating plans: based on the above test results

For patients at risk of aspiration with water-like liquids, high-viscosity paste food was initially required; the single-bolus volume started from the smallest volume confirmed safe in the test and gradually increased; for patients who had pharyngeal residue or delayed swallowing at larger volumes (20 mL) but tolerated small

volumes (5 mL, 10 mL) well, the single swallowing volume was limited, and a small-bolus multiple-swallow strategy was adopted; if patients had severe efficacy impairment under multiple test combinations, partial nasogastric tube feeding was retained, and only the safest single-consistency food in the test was selected for adaptive training of oral intake. The initial feeding position was a semi-recumbent position with the trunk elevated 30–45°, combined with a chin-down posture, to widen the vallecula space and slow the bolus flow rate. After swallowing coordination and airway protection improved, a gradual transition to a sitting position and a regular diet was made. Both groups received continuous intervention until discharge.

2.5. Outcome measures

2.5.1. Swallowing function indicators

Before intervention (at the first swallowing assessment) and after intervention (at discharge), the Standardized Swallowing Assessment (SSA) was used, mainly covering consciousness, head and neck control, respiratory status, and water swallowing test; higher scores indicated more severe dysphagia. The Functional Oral Intake Scale (FOIS) was used for rating, ranging from grade 1 to 7; grade 1 indicated complete tube-feeding dependence, and grade 7 indicated complete oral intake without food texture restrictions; higher grades indicated better swallowing function.

2.5.2. Nutritional status indicators

Fasting peripheral venous blood (5 mL) was collected in the morning before intervention and at week 4 after intervention, and serum albumin (ALB) and prealbumin (PA) levels were measured using an automatic biochemical analyzer.

2.5.3. Immune function indicators

Peripheral venous blood (2 mL) was collected before intervention and at week 4 after intervention and sent for testing within 2 h; flow cytometry was used to determine the percentages of T lymphocyte subsets, and the percentages of CD3+, CD4+, and CD8+ and the CD4+/CD8+ ratio were recorded.

2.6. Statistical methods

SPSS 23.0 statistical software was used. Continuous data conforming to a normal distribution by the Shapiro-Wilk test were expressed as mean ± SD; between-group comparisons used the independent-samples *t*-test, and within-group pre- and post-comparisons used the paired-samples *t*-test. Categorical data were expressed as rate (%), using the chi-square test. Ordinal data were analyzed using the Mann-Whitney U test, and within-group pre- and post-intervention comparisons used the Wilcoxon signed-rank test. $p < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of swallowing function indicators between the two groups

After intervention, the SSA score in the observation group was lower than that in the control group, and the FOIS rating was higher than that in the control group ($p < 0.05$). See **Table 1**.

Table 1. Comparison of swallowing function indicators between the two groups

Group	n	SSA score (points, mean ± SD)		FOIS rating (grade)	
		Before intervention	After intervention	Before intervention	After intervention
Control group	60	25.38 ± 3.37	22.32 ± 2.35[1)]	2.000 (1.0, 3.0)	3.00 (2.0, 3.0)[1)]
Observation group	60	26.27 ± 3.80	20.32 ± 1.32[1)]	2.000 (1.0, 3.0)	3.00 (3.0, 5.0)[1)]
t/Z		-1.346	5.752	-1.654	-4.230
p		0.181	< 0.001	0.098	< 0.001

Note: [1)] Compared with the same group before intervention, $p < 0.05$.

3.2. Comparison of nutritional status indicators between the two groups:

After intervention, serum ALB and PA levels in the study group were significantly higher than those in the control group ($p < 0.05$). See **Table 2**.

Table 2. Comparison of nutritional status indicators between the two groups

Group	n	ALB (g/L, mean ± SD)		PA (mg/L, mean ± SD)	
		Before intervention	After intervention	Before intervention	After intervention
Control group	60	37.38 ± 2.45	39.21 ± 2.85[1)]	211.23 ± 12.84	229.04 ± 14.21[1)]
Observation group	60	36.58 ± 2.18	41.03 ± 2.94[1)]	215.16 ± 11.17	240.25 ± 16.40[1)]
t/Z		1.889	-3.469	-1.786	-4.002
p		0.061	< 0.001	0.077	< 0.001

Note: [1)] Compared with the same group before intervention, $p < 0.05$.

3.3. Comparison of immune function indicators between the two groups:

After intervention, the percentages of CD3+ and CD4+ in the study group increased significantly, the CD8+ level decreased significantly, and the CD4+/CD8+ ratio was higher than that in the control group ($p < 0.05$). See **Table 3**.

Table 3. Comparison of immune function indicators between the two groups

Group	n	CD3+ (%, mean ± SD)		CD4+ (%, mean ± SD)	
		Before intervention	After intervention	Before intervention	After intervention
Control group	60	48.12 ± 4.08	51.72 ± 3.71[1)]	32.22 ± 3.17	34.70 ± 3.00[1)]
Observation group	60	47.81 ± 4.57	55.43 ± 4.31[1)]	31.82 ± 3.31	38.03 ± 3.18[1)]
t/Z		0.385	-5.061	0.682	-5.899
p		0.701	< 0.001	0.496	< 0.001

Continued Table 3

Group	n	CD8+ (%, mean ± SD)		CD4+/CD8+	
		Before intervention	After intervention	Before intervention	After intervention
Control group	60	30.61 ± 2.61	28.42 ± 2.05[1)]	1.06 ± 0.13	1.23 ± 0.13[1)]
Observation group	60	30.84 ± 2.59	25.17 ± 2.36[1)]	1.04 ± 0.15	1.54 ± 0.22[1)]
t/Z		-0.471	8.066	0.813	-9.209
p		0.638	< 0.001	0.418	< 0.001

Note: [1)] Compared with the same group before intervention, $p < 0.05$.

4. Discussion

Laryngeal cancer surgery often requires resection of tissues such as the epiglottis, ventricular folds, and vocal cords. The resulting anatomical changes not only affect the upward and forward movement of the laryngeal complex during swallowing but also reduce sensory feedback and the glottic closure reflex as the bolus passes through the pharynx, leading to frequent postoperative delayed swallowing and silent aspiration [3]. Conventional empirical postoperative dietary guidance mostly suggests that patients try foods of different consistencies, but it lacks support from objective quantitative indicators, resulting in a relatively high risk of choking and aspiration pneumonia in some patients with poor swallowing coordination; repeated choking also increases patients' fear of eating and may increase the risk of intestinal function degeneration, malnutrition, and immunosuppression [4,5]. In response, this study introduced stepwise eating-based swallowing function rehabilitation training, focusing on its effects on postoperative nutritional status and immune function in laryngeal cancer.

The results of this study showed that after intervention, the study group showed improvements in SSA score, FOIS rating, ALB and PA levels, and various immune function indicators. This suggests that stepwise eating rehabilitation training has definite clinical application value in postoperative rehabilitation of laryngeal cancer. The reasons are that the observation group introduced lip and buccal muscle, tongue resistance exercises, and jaw training early after surgery, which can improve central nervous system compensation by increasing sensory input from peripheral receptors. With airway protection training such as supraglottic swallow and Mendelsohn maneuver, patients in the observation group were able to compensate to a certain extent for the effects of laryngeal anatomical changes by prolonging cricopharyngeal opening time and promoting glottic closure [6]. In addition, under the guidance of V-VST, the observation group used high-viscosity paste food for patients with poor tolerance to liquid viscosity, which reduced the gravity flow rate of liquids in the oropharynx and provided reaction time for delayed swallowing reflex; for patients with poor volume tolerance, a limited single-bolus small-volume multiple-swallow strategy was adopted, effectively avoiding pharyngeal retention and overflow caused by a single large bolus; for patients with mixed severe impairment, partial tube feeding was retained and adaptive training with the safest single-consistency food was combined, thereby maintaining physiological stimulation of swallowing muscles under the premise of ensuring safety. Finally, combined with the compensatory position of semi-recumbent trunk elevation and chin-down, the vallecula buffer volume was further expanded, reducing the risk of food spilling into the airway [7,8]. Through the above measures, the observation group ultimately covered the intervention needs of patients with different tolerance levels and promoted improvement in SSA scores and FOIS ratings. In terms of nutrition, the study group used a stepwise eating program to determine safe swallowing boundaries, encouraging patients to resume oral intake as early as possible under safe conditions, stimulating gastrointestinal hormone secretion, and improving nutritional status and negative nitrogen balance, as reflected by significant improvements in ALB and PA [9]. On the other hand, because the observation group achieved early enteral nutrition intake earlier, exogenous amino acids and other substances participated in intracellular signal transduction, helping to reduce the trend of lymphocyte apoptosis caused by surgical trauma. Ultimately, while improving the patient's nutritional status and immune microenvironment, it promoted granulation tissue formation and vascularization of the neck surgical wound. Combined with improved swallowing coordination, it avoided mechanical tearing of tissues caused by severe choking [10]. Moreover, with early resumption of oral intake, patients not only relieved their fear of eating but were also

helped to re-participate in family and social activities, which would directly benefit the improvement of quality of life scores [11].

5. Conclusion

In summary, stepwise eating-based swallowing function rehabilitation training can effectively improve postoperative swallowing function in patients with laryngeal cancer and promote the recovery of nutritional intake and immune function. However, this study has a limited sample size and is a single-center study, with a short postoperative follow-up period, and could not comprehensively evaluate the impact of this strategy on long-term survival and tumor recurrence. Future multicenter, large-sample, long-term randomized controlled trials are needed to further verify the generalizability of the conclusions of this study.

Funding

Wenzhou Basic Public Welfare Scientific Research Projects, Project Title: Development of a Personalized Predictive Model for the Risk of Pharyngeal Fistula in Patients After Laryngeal Cancer Surgery (Project No.: Y20220852)

Disclosure statement

The authors declare no conflict of interest.

References

[1] Liu S, Liu L, Peng Y, 2026, Current status and influencing factors of oral frailty in patients with tracheotomy after laryngeal cancer surgery (report of 188 cases). Journal of Modern Oncology, 34(3): 357–365.

[2] Hong X, Shu M, Liu Y, et al., 2015, Study on the effect of cluster nursing on rehabilitation outcomes and quality of life in patients with post-stroke dysphagia. Chinese General Practice, 2015(8): 950–953.

[3] Wang L, Yan W, Chen L, 2022, Meta-analysis of the intervention effect of swallowing rehabilitation training in patients with laryngeal cancer. Chinese Journal of Hospital Statistics, 29(5): 388–396 + 400.

[4] Lü Y, Chen A, 2024, Clinical effect of early swallowing rehabilitation training in elderly patients with laryngeal cancer after partial laryngectomy. Reflexology and Rehabilitation Medicine, 5(4): 151–154.

[5] Zhou C, Zhou X, Wu X, 2016, Effect of rehabilitation nursing intervention in patients with post-stroke dysphagia. Chinese Journal of Rural Medicine and Pharmacy, 23(10): 87–88.

[6] Xie W, Tan J, Ai J, et al., 2024, Effect of early active respiratory circulation technique on aspiration in patients with dysphagia after partial laryngectomy. Journal of Audiology and Speech Pathology, 32(2): 129–133.

[7] Zhuang Y, Wang J, Bian L, 2022, Effect of nutritional intake method based on food viscosity adjustment on immune and nutritional function in patients with laryngeal cancer undergoing postoperative radiotherapy. China Medical Herald, 19(35): 169–171 + 180.

[8] Wu H, Zhang J, Cao A, et al., 2026, Timing of thickened liquid intake after tongue and floor-of-mouth tumour reconstruction: A randomised controlled trial. Journal of Oral Rehabilitation, 53(2): 357–367.

[9] Lu J, Guan X, Zhou M, 2023, Application effect of stepwise eating-based swallowing function rehabilitation

training combined with tongue function exercise in patients with laryngeal cancer. Nursing of Integrated Traditional Chinese and Western Medicine, 9(1): 157–159.

[10] Guo Y, Li J, Wang H, et al., 2024, Research progress on early enteral nutrition support in patients with post-stroke dysphagia. Journal of Modern Clinical Medicine, 50(1): 59–62.

[11] Chen S, Cheng P, Chen S, et al., 2022, Application research and nursing progress of early enteral nutrition after surgery for head and neck malignant tumors. Modern Nurse, 29(7): 16–20.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.