

*Original Article*

## Assessment of nutritional parameter outcome in laryngeal cancer patients undergoing laryngectomy

Mohamad Taghi Khorsandi Ashtiani<sup>1</sup>, \*Nasrin Yazdani<sup>2</sup>, Seyedeh Hasti Borghei<sup>3</sup>,  
Hedayat Dehghani<sup>4</sup>, Zahra Mokhtari<sup>5</sup>, Shima Arastoo<sup>6</sup>

### **Abstract**

#### **Introduction:**

Laryngectomy in patients with laryngeal cancer can lead to the reduction of nutritional parameters. Supportive treatments and supplementary nutritional supports are recommended in all patients undergoing laryngectomy, even with acceptable preoperative nutritional indices. The aim of this study was to evaluate postoperative changes in nutritional parameters in patients with laryngeal cancer undergoing laryngectomy.

#### **Materials and Methods:**

In a prospective study from 2005 to 2007, 30 candidate patients for total laryngectomy in Amir Alam Hospital in Tehran were included for final diagnosis of squamous cell carcinoma (stage T<sub>4</sub>). Nutritional parameters including body mass index (BMI), serum levels of albumin, hemoglobin, total protein concentration, total lymphocyte number and percentage were assessed one week before and one month after laryngectomy. All patients used their routine dietary regimens and those who received nutritional supplementation after surgery were excluded from the study.

#### **Results:**

Except for white blood cell count, a significant reduction was found in BMI, lymphocyte count, serum hemoglobin, total protein and albumin levels after surgery ( $P < 0.001$ ). There were no significant differences between the change in nutritional parameters after laryngectomy and the increase in age; BMI ( $P = 0.054$ ), hemoglobin ( $P = 0.406$ ), total protein ( $P = 0.103$ ), and albumin ( $P = 0.132$ ), postoperative length of hospital stay and concomitant neck dissection.

#### **Conclusion:**

Laryngectomy in patients with laryngeal cancer leads to the reduction of nutritional parameters but these changes do not depend on the patient's age, concurrent neck dissection and length of hospital stay; however, the supportive approaches can also be recommended in patients leaving hospital without any serious complications.

**Keywords:** Laryngectomy, Laryngeal cancer, Nutrition state

Received date: 10 Jun 2010

Accepted date: 1 Sep 2010

<sup>1</sup> Otorhinolaryngology Research Centre, Tehran University of Medical Sciences, Tehran, Iran.

<sup>2</sup> Otorhinolaryngology Research Center, Tehran University of Medical Sciences, Tehran, Iran

<sup>3</sup> Otorhinolaryngology Research Center, Tehran University of Medical Sciences, Tehran, Iran

<sup>4</sup> Department of otorhinolaryngology, Tehran University of Medical Sciences, Tehran, Iran

<sup>5</sup> Department of otorhinolaryngology, Tehran University of Medical Sciences, Tehran, Iran

<sup>6</sup> Department of otorhinolaryngology, Tehran University of Medical Sciences, Tehran, Iran

**\*Corresponding author:**

Amir Alam Hospital, Tehran University of Medical Sciences, Tehran, Iran

Email: n\_yazdani@sina.tums.ac.ir

### **Introduction:**

Proper nutritional habits can prevent cancer development and it has been clearly stated that the nutritional status can predict the risk of head and neck cancers (1). It has been indicated that specific nutritional diets such as the routine consumption of fruit and vegetables can modulate the immune system in patients with head and neck cancers and also lessen the patient's susceptibility to postoperative complications (2). Also, it has been shown that patients with a weight loss more than 10% during the six months prior to surgery are at a greater risk for the occurrence of these complications (3). Moreover, dietary counseling with regular foods plus supplements could lead to quality of life improvement in patients with head and neck cancers especially in those who are undergoing radiotherapy (4). But standard practice and attitudes towards feeding regimens varies amongst consultants (5). Therefore, assessment of changes in nutritional indices in patients undergoing head and neck surgery in order to predict their surgical outcome is necessary.

It has been shown that about 40% of newly diagnosed patients with head and neck malignancies are malnourished even before the initiation of treatment protocols. Some recent studies found that the nutritional indices such as body mass index and total lymphocyte count were lower in patients with cancer in comparison with normal subjects (6). Some others showed that weight loss was the best parameter for assessment of nutritional status in malignancy head and neck surgical patients (7). In addition it has been demonstrated that weight loss in head and neck cancer patients is rarely noticed in general practice (8). Although data is available on the description of nutritional status and postoperative complications in gastrointestinal cancerous patients (9). very few studies

have been published about the changes of nutritional behavior in patients undergoing laryngectomy. Wiel et al assessed the nutritional status and dietary intake in patients with head and neck cancer; it resulted in failure to maintain or improve the nutritional status during patients' treatment, despite sufficient intake (10). In the present study, we investigated the preoperative nutritional status and its changes in patients with laryngeal cancer undergoing total laryngectomy.

### **Materials and Methods:**

**Study population:** In a prospective study from 2005 through 2007, 30 patients with the final diagnosis of squamous cell carcinoma (stage T<sub>4</sub>) and a candidate for total laryngectomy were admitted to Amir Alam Hospital in Tehran (a referral center of laryngology). The pathological stage of the tumor was specified as a result of histopathological examination of the surgical specimen. Patients with complaints of severe dysphagia, with a poor hemodynamic status (hemoglobin < 8 gr/dl or alb < 2.8 mg/dl), a history of preoperative chemoradiation, a history of hypothyroidism, and those who had undergone intraoperative and postoperative blood transfusion were excluded. Patients who received nutritional supplementation or parenteral nutrition preoperatively and those who experienced postoperative complications such as fistulas and wound healing problems that usually receive postoperative nutritional interventions, were also excluded. The study protocol was approved by the Research Ethics Committee of Tehran University of Medical Sciences and a written informed consent was obtained from each patient prior to study entrance. The patients who did not need nutritional intervention were included in this study as the aim of this study was the assessment of patients with an appropriate nutritional index and those

with no serious problems during hospitalization.

**Patients monitoring:** One week before and also one month after operation, the following parameters were evaluated in each patient: serum levels of albumin and hemoglobin, total protein concentration, total number and percentage of lymphocytes. Body mass index (BMI) was also calculated as the body weight in kilograms divided by squared height in meters.

**Statistical analysis:** The results were reported as mean±standard deviation (SD) for quantitative variables. The changes of nutrition and laboratory parameters before and one month after surgery were compared using paired sample T-test. The changes of these indices based on their age groups were compared by the one-way ANOVA test. Independent t test was also used to compare changes of these parameters between the groups with and without concomitant neck dissection and also between the groups with and without prolonged postoperative hospital stay. A *P*-value of 0.05 or less was considered as statistically significant. All the statistical analyses were performed using SPSS software version 13.0 for windows (SPSS Inc., Chicago, IL, USA).

### Results:

Mean age of the studied patients was  $59.13 \pm 7.46$  years (ranged 46 to 74 yrs) and all of them were male. Comparison of nutritional parameters one week before and one month after laryngectomy showed a significant difference in the reduction of BMI, lymphocyte count, serum hemoglobin, total protein and albumin concentrations after laryngectomy ( $P < 0.001$ ); however no remarkable difference in white blood cell count (WBC) was detected ( $P = 0.7$ ) (Table1).

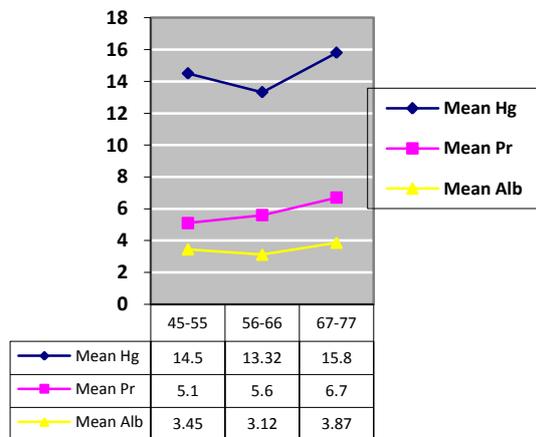
**Table 1:** Differences of nutritional parameters one week before and one month after laryngectomy

Characteristics	Before surgery (n=30)	After surgery (n=30)	P	Change of mean
BMI (kg/m <sup>2</sup> )	26.08±2.38	24.35±1.09	<0.001	1.73±0.42
Hemoglobin concentration	15.84±0.95	14.02±0.96	<0.001	1.82±0.96
Serum total protein	6.77±0.54	5.60±0.63	<0.001	1.17±0.63
Serum Albumin	4.06±0.54	3.20±0.47	<0.001	0.86±0.47
WBC count	8513.00±	8586.33±1468.74	0.786	73.33±1468.74
Lymphocytes count	2433.02			
Lymphocytes count	2322.77±	1970.84±497.80	<0.001	351.93±497.80
Lymphocytes (%)	743.46			
Lymphocytes (%)	27.37±5.23	23.24±0.42	<0.001	4.13±5.16

The mean changes in nutritional parameters before and after laryngectomy were reported as BMI ( $1.73 \pm 0.42$ ), hemoglobin concentration ( $1.82 \pm 0.96$ ), total protein ( $1.17 \pm 0.63$ ), albumin ( $0.86 \pm 0.47$ ), white blood cell count ( $73.33 \pm 1468$ ), lymphocyte count ( $351.93 \pm 497.8$ ) and lymphocyte percentage ( $4.13 \pm 5.16$ ) as depicted in Table1. Meanwhile, it was determined that the mean body weight loss after surgery was  $5.1 \pm 1.09$  kilograms. As the graph shows parameter such as serum levels of protein, albumin and hemoglobin increased slightly in patients over 55 years. Nevertheless; no statistically significant relationship was detected between the changes of nutritional parameters and the increase in age: hemoglobin ( $P = 0.406$ ), total protein ( $P = 0.103$ ) and albumin ( $P = 0.132$ ) (Fig 1).

Age also had no significant association with the changes of BMI ( $P = 0.054$ ), WBC count ( $P = 0.374$ ) and lymph count ( $P = 0.259$ ). Fourteen patients underwent

laryngectomy with unilateral or bilateral neck dissection.



**Fig 1:** Relationship between the mean changes of nutritional parameters (before and after operation) and increment of age.

Changes of nutritional parameters in patients undergoing neck dissection were similar to those who did not (Table2).

**Table 2:** Mean changes of nutritional parameters one week before and one month after laryngectomy in patients with and without concomitant neck dissection

Characteristics	With neck dissection (n=14)	Without neck dissection (n=16)	p-value
Weight (kg)	5.00±1.11	5.19±1.11	0.648
BMI (kg/m <sup>2</sup> )	1.68±0.44	1.77±0.42	0.584
Hemoglobin concentration	1.74±0.84	1.88±1.08	0.701
Serum total protein	1.21±0.70	1.14±0.59	0.746
Serum albumin	0.85±0.45	0.87±0.49	0.915
WBC count	300.00±1301.48	400.00±1568.01	0.198
Lymphocytes count	324.36±500.32	376.06±510.74	0.782
Lymphocytes (%)	5.14±5.30	3.25±5.03	0.324

Seven patients were discharged from hospital within 4 days from surgery while the others remained hospitalized for 7 to 10 days. For the mentioned 7 cases the

mean change in body weight was 5.43±1.27 and for the ones who stayed longer it was 5.00±1.04. According to Table 3 which shows the changes of nutritional parameters, no significant difference in nutritional status of patients based on their duration of hospital stay was observed.

**Table 3:** Mean changes of nutritional parameters one week before and one month after laryngectomy based on duration of hospital stay

Characteristics	4 days of hospitalization (n=7)	7-10 days of hospitalization (n=23)	P
Weight (kg)	5.43±1.27	5.00±1.04	0.37
BMI (kg/m <sup>2</sup> )	1.84±0.46	1.70±0.42	0.43
Hemoglobin concentration	2.09±1.18	1.73±0.90	0.40
Serum total protein	1.44±0.81	1.09±0.56	0.20
Serum albumin	0.80±0.61	0.88±0.43	0.70
WBC count	14.29±2219.18	91.30±1224.34	0.90
Lymphocytes count	383.71±385.02	342.26±534.61	0.85
Lymphocytes (%)	4.29±5.31	4.09±5.23	0.93

### Discussion

Several health councils such as the International Union against Cancer (UICC) and World Health Organization (WHO) have announced global programs for keeping preventive actions, early detection and appropriate treatment of tumors (11). The outcome of head and neck surgery is based on many factors, but vigorous nutritional support during the initial treatment stages has a major effect on morbidity, tumor recurrence and

survival time (12,13). Therefore, preventive approaches in supportive programs should be mainly focused on nutritional indices assessment and regulation of dietary regimens to obtain an optimal therapeutic result (14).

Patients who had suffered from laryngeal cancer and have undergone laryngectomy complain not only about physical disability and psychological changes, but also nutritional impairment. In the present study, we tried to evaluate postoperative changes in nutritional parameters and laboratory indices in patients with stage T<sub>4</sub> laryngeal cancer and undergoing laryngectomy within one month after their surgery. We found that most of these parameters such as BMI, lymphocyte percentage, serum hemoglobin, total protein and albumin concentrations were reduced after laryngectomy; these changes were not dependent on age. Wiel et al found that all nutrition parameters including weight, weight variation, BMI and biological indices such as serum albumin and lymphocytes worsened in the postoperative period (7). In another study in Netherlands, it was shown that the parameters applied all identified different aspects of the nutritional status, as malnutrition varied between 20% and 67% in patients undergoing major surgery for advanced head and neck cancer (3). In addition, Martin Villares et al indicated that 54% of patients with head and neck carcinomas who underwent surgery presented with malnutrition postoperatively (15).

Jager et al assessed the nutritional status of patients who underwent radiotherapy alone or along with chemotherapy or surgery due to head and neck cancers. Patients were re-evaluated one week before, also 1 and 4 months after treatment. Similar to the current study, they found a significant declination of BMI after treatment ( $P=0.024$ ) (10).

Therefore, it is believed that the control of surgical complications, assessment of hormonal secretions and also the

administration of various nutritional supports can lead to acceptable surgical outcome in patients undergoing head and neck surgeries.

In the present study, as age increased no significant relation between the changes of nutritional parameters and age was seen, probably because more than two-third of the studied patients were in the elderly group (more than 60 years of age). To the authors' best knowledge, this study is the only one which significantly describes the relationship between changes of nutritional indices and advanced age; however, some studies have shown that among all head and neck cancer patients scheduled for surgery, the malnourished old cases had the poorest surgical outcomes, with significantly more complications and morbidity rates. However, among all malnourished cases, the elderly had similar outcomes in comparison with younger patients (16). Also, some recent studies have documented that complications of head and neck surgery are no more common in the elderly than in younger patients (17). More studies are recommended for assessing the changes of nutritional parameters and age in patients with laryngeal cancer undergoing laryngectomy. In this study no significant relationship was found between the changes of parameters mentioned with increase in age. Postoperative length of hospital stay was not significantly different due to changes of these parameters; this could be because a prolonged hospital stay (more than 10 days) had not occurred in any of the studied patients. The relationship between the changes of nutritional parameters in cancer patients and prolonged length of hospital stay in various surgical wards has been demonstrated in recent studies (18-20). Also it was shown that the duration of hospital stay may be shortened in patients who were given early postoperative feeds (21). According to the results of this study, supportive treatments and supplementary nutritional supports is

highly suggested in all patients undergoing laryngectomy, even with acceptable preoperative nutritional indices. These supportive approaches can be also advisable in patients leaving hospital without any serious problem. In regards to the high catabolism waste in cancer patients due to underlying diseases or surgery (22,23), especial attention to the patients' nutritional dietary regimens is recommended. This finding has not been studied in patients undergoing laryngectomy due to head and neck malignancies and therefore the relationship

between nutritional parameter changes and prolonged hospital stay in patients undergoing laryngectomy should be assessed in further studies. We recommend nutritional consultation and support in all patients as a routine program.

***Acknowledgements:***

This work was supported by a grant from Otorhinolaryngology Research Center, Tehran University of Medical Sciences. We express our sincere appreciation for the assistance and cooperation of all members. The authors report no conflicts of interest.

## References

1. Riboli E, Kaaks R, Esteve J. Nutrition and laryngeal cancer. *Cancer Causes Control* 1996; 7(1): 147-56.
2. De Luis DA, Aller R, Izaola O, Cuellar L, Terroba MC. Postsurgery enteral nutrition in head and neck cancer patients. *Eur J Clin Nutr* 2002; 56(11): 1126-9.
3. Van Bokhorst-de Van der Schueren MA, Van Leeuwen PA, Sauerwein HP, Kuik DJ, Snow GB, Quak JJ. Assessment of malnutrition parameters in head and neck cancer and their relation to postoperative complications. *Head Neck Surg* 1998; 19(5): 419-25.
4. Ravasco P, Monteiro-Grillo I, Marques Vidal P, Camilo ME. Impact of nutrition on outcome: a prospective randomized controlled trial in patients with head and neck cancer undergoing radiotherapy. *Head Neck Surg* 2005; 27(8): 659-68.
5. O'Hara J, Lock C, Paleri V, Wight R. Oral feeding regimes following laryngectomy--a qualitative study of consultants' opinions in the North of England. *Oral Oncol*. 2009 Aug;45(8):727-30.
6. Friedlander AH, Tajima T, Kawakami KT, Wang MB, Tomlinson J. The relationship between measures of nutritional status and masticatory function in untreated patients with head and neck cancer. *J Oral Maxillofac Surg* 2008 Jan; 66(1):85-92.
7. Wiel E, Costecalde ME, Séguy D, Merrot O, Erb C, Chevalier D, Vallet B. Preoperative evaluation of the nutritional status in head and neck surgical patients. Prospective and Descriptive case series. *Ann Fr Anesth Reanim* 2005 Jun; 24(6):600-6.
8. van Wayenburg CA, Rasmussen-Conrad EL, van den Berg MG, Merckx MA, van Staveren WA, van Weel C, van Binsbergen JJ. Weight loss in head and neck cancer patients little noticed in general practice. *J Prim Health Care*. 2010 Mar;2(1):16-21.
9. Garth AK, Newsome CM, Simmance N, Crowe TC. Nutritional status, nutrition practices and post-operative complications in patients with gastrointestinal cancer. *J Hum Nutr Diet*. 2010 Aug;23(4):393-401.
10. Jager-Wittenaar H, Dijkstra PU, Vissink A, Langendijk JA, van der Laan BF, Pruim J, Roodenburg JL. Changes in nutritional status and dietary intake during and after head and neck cancer treatment. *Head Neck*. 2010 Aug 24. [Epub ahead of print]
11. Trzcieniecka-Green A, Bargiel-Matusiewicz K, Borczyk J. Quality of life of patients after laryngectomy. *J Physiol Pharmacol* 2007 Nov; 58 Suppl 5(Pt 2):699-704.
12. Lopez MJ, Robinson P, Madden T, Highbarger T. Nutritional support and prognosis in patients with head and neck cancer. *J Surg Oncol* 2006; 55(1): 33-36.
13. Williams EF, Meguid MM. Nutritional concepts and considerations in head and neck surgery. *Head Neck* 2006; 11(5): 393-9.
14. Santacroce L, Leone D, Valenzano A, Luperto P, Bottalico L, Losacco T. Nutritional problems in the surgical patients with head and neck tumours. Literature review and personal experience. *Clin Ter* 2005 Sep-Oct; 156(5):227-30.
15. Martín Villares C, San Román Carbajo J, Fernández Pello ME, Tapia Risueño M, Domínguez Calvo J. Nutritional status in head and neck cancer patients: the impact on the prognoses. *Nutr Hosp* 2003 Mar-Apr; 18(2):91-4.
16. Linn BS, Robinson DS, Klimas NG. Effects of age and nutritional status on surgical outcomes in head and neck cancer. *Ann Surg* 1988 Mar; 207(3):267-73.
17. Shaari CM, Urken ML. Complications of head and neck surgery in the elderly. *Ear Nose Throat J* 1999 Jul; 78(7):510-2.
18. Gianotti L, Braga M, Nespoli L, et al. A randomized controlled trial of preoperative oral supplementation with a specialized diet in patients with gastrointestinal cancer. *Gastroenterology* 2002; 122: 1763-70.
19. Shaw-Stiffel TA, Zarny LA, Pleban WE, Rosman DD, Rudolph RA, Bernstein LH. Effect of nutrition status and other factors on length of hospital stay after major gastrointestinal surgery. *Nutrition* 1993 Mar-Apr; 9(2):140-5.
20. Santoso JT, Canada T, Latson B, Aaaadi K, Lucci JA 3rd, Coleman RL. Prognostic nutritional index in relation to hospital stay in women with gynecologic cancer. *Obstet Gynecol* 2000 Jun; 95(6 Pt 1):844-6.

21. Eustaquio M, Medina JE, Krempf GA, Hales N. Early oral feeding after salvage laryngectomy. *Head Neck*. 2009 Oct;31(10):1341-5.
22. Shaw RJ. Glucose metabolism and cancer. *Curr Opin Cell Biol*. 2006 Dec; 18(6):598-608.
23. Wu GH, Cao DX, Wei J, Quan YJ, Wu ZH. Assessment of energy expenditure and body composition in cancer patients. *Zhonghua Wai Ke Za Zhi* 2008 Dec 15; 46(24):1906-9.