

## Nutritional Assessment of Patients Operated on for Head and Neck Cancer

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### ABSTRACT

**Background:** Most of the patients diagnosed with head and neck cancer experience swallow disorders after surgery. Most patients already experience reduced food intake before the surgery. The purpose of this study was to identify whether patients experience a decrease in their nutritional status post-surgery and if nutritional support given early after surgery could improve their nutritional status.

**Methods:** We present a retrospective 2-year study (between January 2020 and August 2022) with 50 patients operated on for advanced stages of cancer, placed in 3 groups determined by the site of the tumor: oral cavity and oropharynx, hypopharynx, and larynx. Patients were screened using the NRS (nutrition risk screening) 2002. Blood albumin and total proteins, glycemia, inflammatory markers, body mass index and weight loss were used to determine the nutritional status of the patients.

**Results:** Post-surgery patients with total laryngectomies had better albumin levels, lower systemic inflammation, and weight loss that did not exceed 10% of their initial weight, whereas the majority of patients with oral and oropharyngeal cancer (almost 85%) had albumin levels lower than normal before surgery and the percentage rose to 100 after surgery, they had higher inflammatory factors levels, greater weight loss, and lower body mass index. Patients with hypopharyngeal cancer had better outcomes than those with oral and oropharyngeal cancer, but lower than those operated for laryngeal cancer. Patients who underwent nutritional support experienced less weight loss, better body mass index and fewer systemic alterations.

**Conclusion:** Patients who underwent total laryngectomy had in general better outcomes than those operated for oral cavity, oropharynx cancer, or hypopharyngeal cancer. Although the majority of patients were at risk of malnutrition using the NRS 2002, the site of the tumor did play a role in the final outcome of the patient. Also, patients who used foods for special medical purposes had a better nutritional status. The development of protocols for the nutritional assessment of patients before and after surgery in Eastern European countries is mandatory.

**Keywords:** Head and neck cancer, NRS 2002, nutritional assessment, surgery

### Introduction

The development of suitable preventive and diagnostic measures and the early detection and treatment of dysphagia and malnutrition are all essential for the prognosis of head and neck cancer (HNC), an important oncological entity. According to GLOBOCAN,<sup>1</sup> there has been an increase in the prevalence of HNC over the past 30 years, with Central and Eastern Europe being the top geographical regions.

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As high as 40%-80%<sup>2</sup> of cancer patients and cancer survivors experience malnutrition at some point in their illness. The type of cancer, the stage, the location, and the type of therapy are all factors that can affect malnutrition caused by the disease. A cancer patient is described as “a patient with a cancer diagnosis who is either waiting for or on cancer-directed treatment, on symptomatic treatment, and/or receiving palliative care” by the European Society for Clinical Nutrition and Metabolism (ESPEN).<sup>3</sup> With 2.8% of all cancer cases, HNC is the sixth most prevalent cancer worldwide. Surgery and radiotherapy are the primary treatment modalities for HNC, though chemotherapy is playing a growing role.<sup>4</sup>

Due to factors like psychological stress, the effects of all the diagnostic procedures, and most importantly for these types of cancer, the disruptions that the tumor causes to the normal swallowing process, patients with HNC are at an increased risk of involuntary weight loss that may exceed 10% of pretreatment body weight. The word dysphagia comes from the Greek terms “phagein,” which means to eat, and “dys,” which means difficulty. The passage of food from the oral cavity to the stomach is disturbed in this condition.

Patients with HNC may have difficulty swallowing as a result of both the illness itself and the surgical procedure.<sup>4</sup> Tumor response and loco-regional control rates have increased as a result of advancements in HNC treatments. However, mortality is still significant despite advancements in diagnostic and therapeutic methods. There has been an increase in the use of functional and organ-sparing surgery in recent years, but it is crucial to make the distinction that these do not always convert into functional preservation. Malnutrition and dehydration may result from the ensuing impaired swallowing.<sup>5</sup> This impairs the ability to tolerate treatments (such as chemotherapy, radiotherapy, and anticancer medications), raises side effects, and results in unfavorable reactions, treatment interruptions, and postoperative complications.

Using methods of investigation that we currently employ in our referral oncological center in Eastern Europe, the study's objectives were to determine whether patients' nutritional status decreased after surgery and to determine whether nutritional support provided soon after surgery could improve their nutritional status. This area has some of the highest HNC incidence rates ever identified in Europe. This article presents a wide range of experience with advanced HNC treatment from a tertiary hospital in Romania, Eastern Europe because early dysphagia and malnutrition detection strategies and the implementation of effective methods for their prevention must be based on accurate and reliable information.

### MAIN POINTS

- Although the majority of head and neck cancer patients are from the beginning at risk of malnutrition, their nutritional status tends to deteriorate early after surgery.
- NRS 2002, albumin levels, body mass index, loss of weight, and inflammatory factors are useful tools for an easy and precise assessment of the nutritional status.
- Early detection and management of malnutrition is most useful in preventing cachexia in head and neck cancer patients who are operated on.
- Early nutritional support is effective and should always be used early after surgery.

## Material and Methods

This retrospective research examined patients at Colțea Clinical Hospital in Bucharest who received an HNC diagnosis between January 2020 and August 2022. The study received ethics committee approval on March 20, 2022 (Colțea Clinical Hospital, 5324/abcc). This research only included patients with stage III and stage IV cancer who underwent surgery as the first method of treatment in our hospital during the time period mentioned above. Additionally, patients were divided into 3 categories based on the location of the tumor, group 1 patients with oral and oropharyngeal cancer, group 2 patients with laryngeal cancer, and group 3 patients with hypopharyngeal cancer. A thorough head and neck evaluation, fiberoptic endoscopy examination of swallowing, a contrast-enhanced neck computed tomography (CT) scan, and a chest CT scan were all part of the workup. Using the NRS 2002 (validated by ESPEN), patients were assessed for malnutrition.

The multidisciplinary tumor board at the hospital assessed each patient's case, and cases with advanced cancer that could be operated on and were in favor of the operation were included in this study. Patients who were diagnosed with distant metastases, who had previous radiotherapy or other oncological treatments, those who declined surgery and also patients who underwent surgery but had positive margins discovered at postoperative histopathological examination were excluded from the research. Preanesthesia evaluations were done on the patients. According to the Union for International Cancer Control/American Joint Committee on Cancer (AJCC) classification, the patients were identified as having stage III and stage IV cancer.<sup>6</sup> Glucose levels, blood albumin and total proteins, the presence of inflammatory markers at admission to the hospital and 1 month after surgery, BMI before and after surgery, and weight loss were used to determine the nutritional state of the patients.

Moreover, the patients were placed in 2 groups, the group with patients whose diet was supplemented with special nutritional solutions and the other one who did not get these types of supplements. Visual Analog Scale (VAS) was used to assess the pain of the patients after surgery.

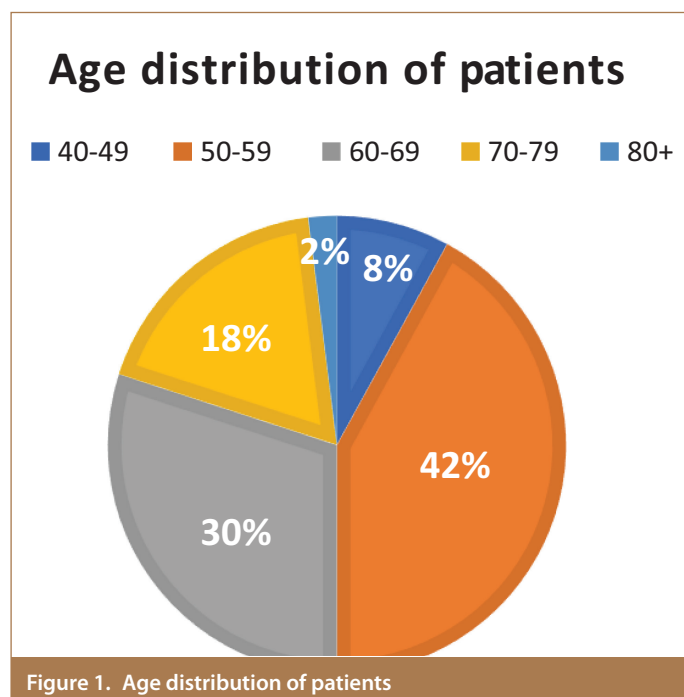
A database with all the information regarding demographic and medical data was created, and Microsoft Excel was used to process the data.

## Results

Within 2 years, 50 patients were diagnosed with advanced HNC in the Otorhinolaryngology Clinic of Colțea Hospital, Bucharest. The average age was 60.74 years for both sexes, with a range from 40 to 82 years and the highest percentage was in the 50-59 age group (42%) (Figure 1).

Regarding tumor localization, about 58% (29 patients) (Figure 2) were malignant neoplasms of the larynx, followed by oral and oropharyngeal cancer 26% and hypopharyngeal cancer 16%. According to AJCC staging, most of the tumors were stage III (27 patients) (Figure 3).

The patients were placed in 3 groups considering the site of the tumor, group 1 patients with oral and oropharyngeal cancer, group 2 patients with laryngeal cancer, and group 3 patients with hypopharyngeal cancer.



All patients were screened using the NRS 2002 which assesses if the BMI is lower than 20.5 kg/m<sup>2</sup>, if there was weight loss within the last 3 months, if reduced dietary intake in the last week, and if the patient needs intensive care therapy. The results tell us if the patients are at risk of malnutrition, a score of 1 is a mild risk, 2 is a moderate risk, and 3 or above is a severe risk of malnutrition.

As high as 83% of the patients operated on for oral cavity and oropharyngeal cancer had an NRS 2002 of 4 or higher (Figure 4). The structural impairment due to surgery is usually extensive enough to prevail upon other damages caused by concomitant treatment. The oral preparatory phase is affected in surgery for oral cavity tumors, whereas in oropharyngeal surgery, the trigger for the swallowing reflex is impaired during the pharyngeal phase.

Of the 29 patients who operated for laryngeal cancer (total laryngectomies), 62% of them had an NRS 2002 of 3 or smaller, which meant that they were at low risk of developing malnutrition (Figure 5). The NRS 2002 recommendation for this value is to re-screen weekly, no nutrition consult is yet to be applied. The other 38% had a score of 4 or bigger so they were considered at low or high risk of developing malnutrition. In this case, a thorough nutritional assessment should be implemented and a care plan should be developed considering the characteristics of the patient, his level of risk, and his nutritional needs.

The patients operated on for hypopharyngeal cancer underwent a total laryngectomy, but the resection into the pharyngeal wall was more extensive than that of the patients whose tumor was limited to the larynx. Of them, 37.5% had an NRS 2002 smaller or equal to 3 (Figure 6).

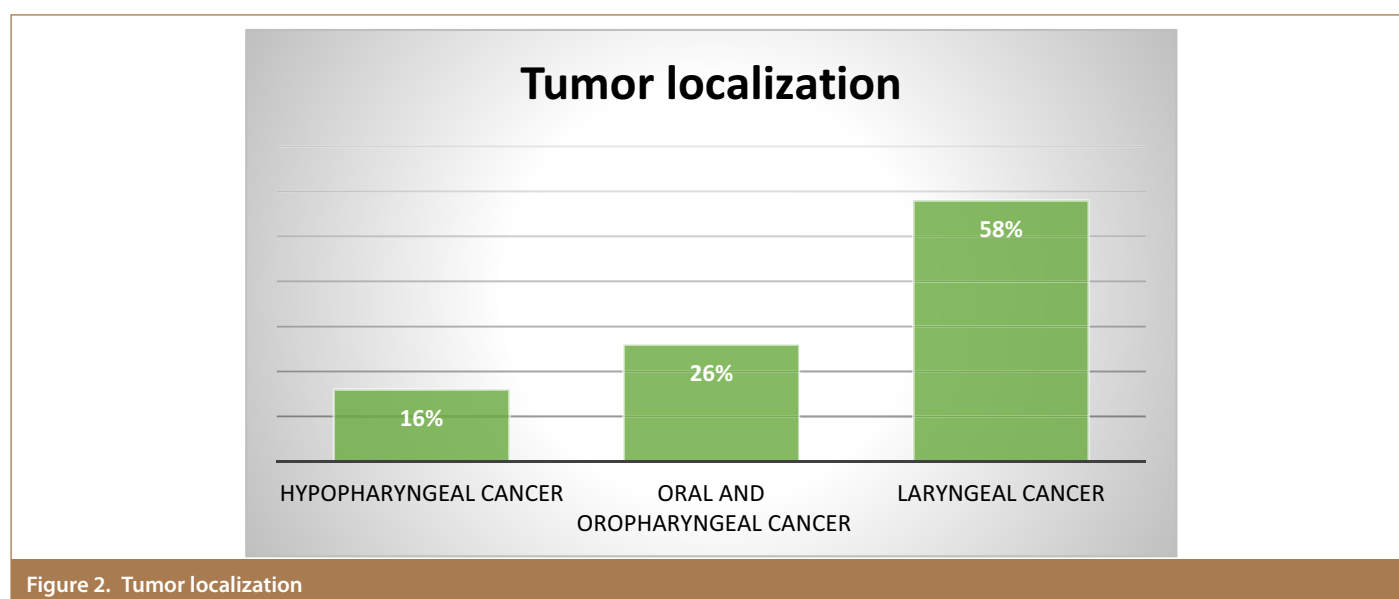
Albumin levels for patients with oral cavity or oropharynx cancer were lower than normal in 84.61% of the cases at admission, and after 1 month, the percentage reached 100 (Figure 7).

Patients operated for laryngeal cancer had significantly better albumin levels, and only 10.34% of them had levels lower than 3.4 g/dL at admission and 31% after 1 month (Figure 8).

As high as 25% of patients with hypopharyngeal cancer presented with albumin levels lower than 3.4 g/dL, and after 1 month, the numbers rose to 87.5% (Figure 9).

As for body mass index (BMI), 76.92% of patients from group 1 were underweight at admission and 92.3% after 1 month, only 17.24% (Figure 10). From group 2, 17.24% were underweight at admission and 51.72% after 1 month (Figure 11). In group 3, at admission, 37.5% had a BMI lower than 18.5, and after 1 month, the percentage rose to 62.5 (Figure 12).

As high as 84.6% of patients with oral cancer and oropharyngeal cancer experienced weight loss bigger than 5% from their initial weight previously to the presentation at the hospital, and after the surgery at 1 month, 92.3% of them lost more than 5% of their initial weight (Figure 13). For patients with laryngeal cancer, the numbers



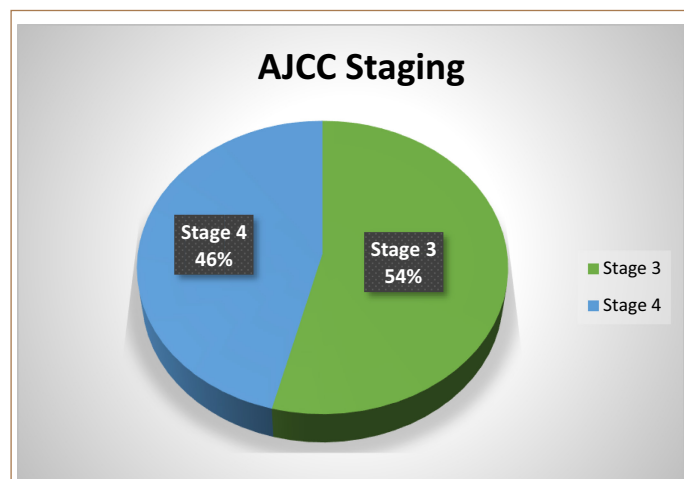


Figure 3. AJCC Staging

were significantly lower with only 20.6% of them losing more than 5% of their weight previously to the presentation and 55.17% after 1 month (Figure 14). In group 3, at admission, 25% of patients lost more than 5% of their weight, the numbers rising to 62.5% after 1 month (Figure 15).

Inflammatory factors tested in the study were erythrocyte sedimentation rate and fibrinogen levels. At admission, 80% of patients from group 1 had elevated levels, 44% from group 2, and 69% from group 3 (Figure 16). After 1 month, percentages rose to 89 for group 1, 53 for group 2, and 78 for group 3 (Figure 17).

In order to assess whether early nutritional support after surgery is effective, we additionally placed the patients in 2 groups, those who received early nutritional support and those who did not evaluate their BMI 1 month after the surgery and then 2 months after surgery. After 1 month, 92% of patients from group 1, 52% from group 2, and 62% from group 3 were underweight. After 2 months in the group of patients who did not receive nutritional support the percentages were 85 for oral cancer, 35 for laryngeal cancer, and 54 for hypopharyngeal cancer, whereas in the group with nutritional support, the

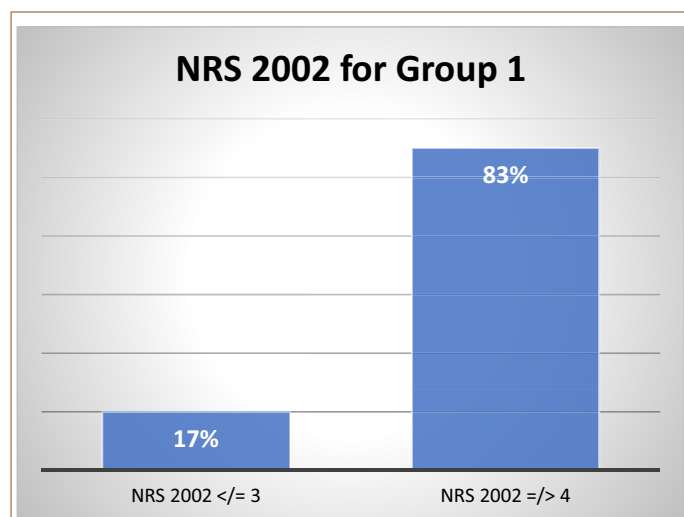


Figure 4. NRS 2002 for patients in Group 1

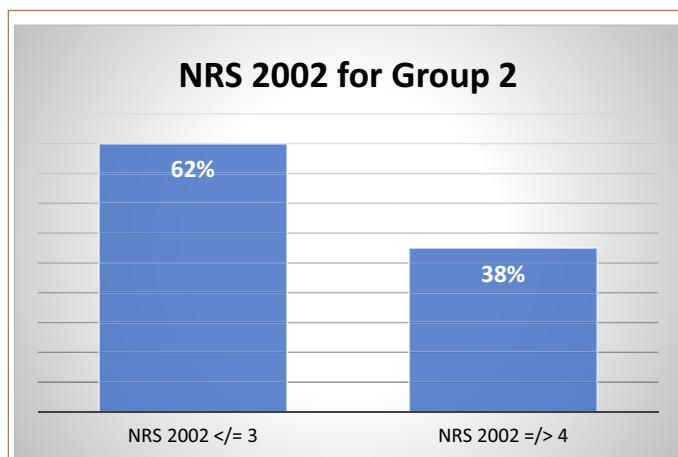


Figure 5. NRS 2002 for patients in Group 2

percentages were lower, the patients who remained underweight were 63 for group 1, 18 for group 2, and 32 for group 3 (Figure 18).

According to VAS, the majority of patients in group 1, those with oral and oropharyngeal cancer experienced severe pain (54%) and only 8% of them said they felt no pain. Group 2 had the most patients who experienced no pain (28%) and the least patients who experienced severe pain (only 14%). A quarter of patients with hypopharyngeal cancer had severe pain and moderate pain, whereas only 12% felt no pain.

## Discussion

The youngest patient diagnosed in our study was 40 years old, and the oldest patient was 82 years old; the average age was 60.74, which is a little lower than the average age of 63.84 reported in a recent study.<sup>7</sup>

The NRS 2002 Score established by ESPEN is a well-validated and easy-to-use screening tool, which allows the identification of patients who are at risk of malnutrition. In order to initiate prompt and sufficient nutritional assistance, it is essential to identify patients who are malnourished or at risk of malnutrition as soon as possible. Patients should undergo a routine nutritional risk assessment when they are admitted to the hospital since it is an easy and quick first-line method. In our study, all patients were at risk of malnutrition, the severity was

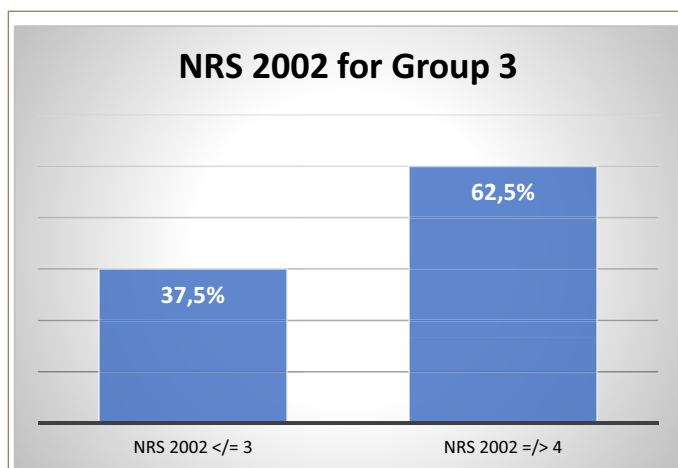
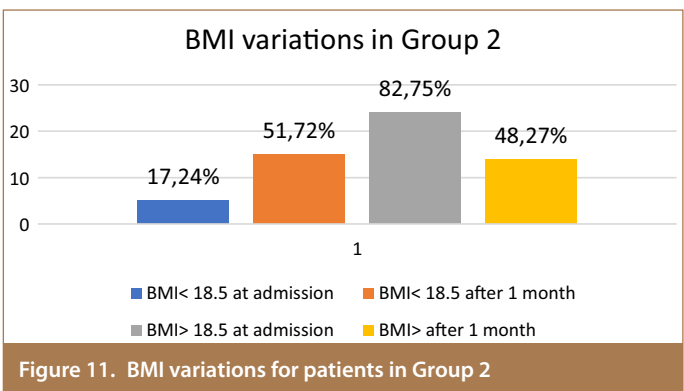
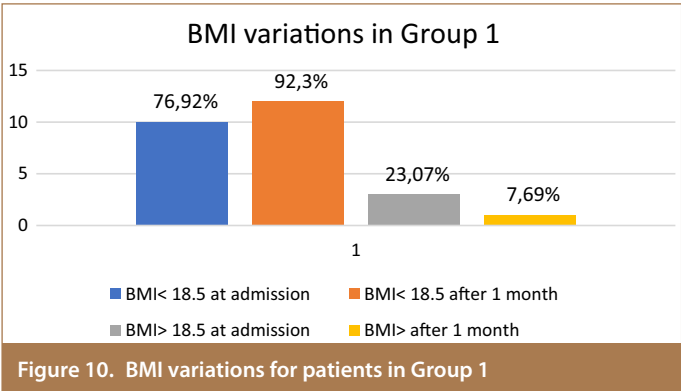
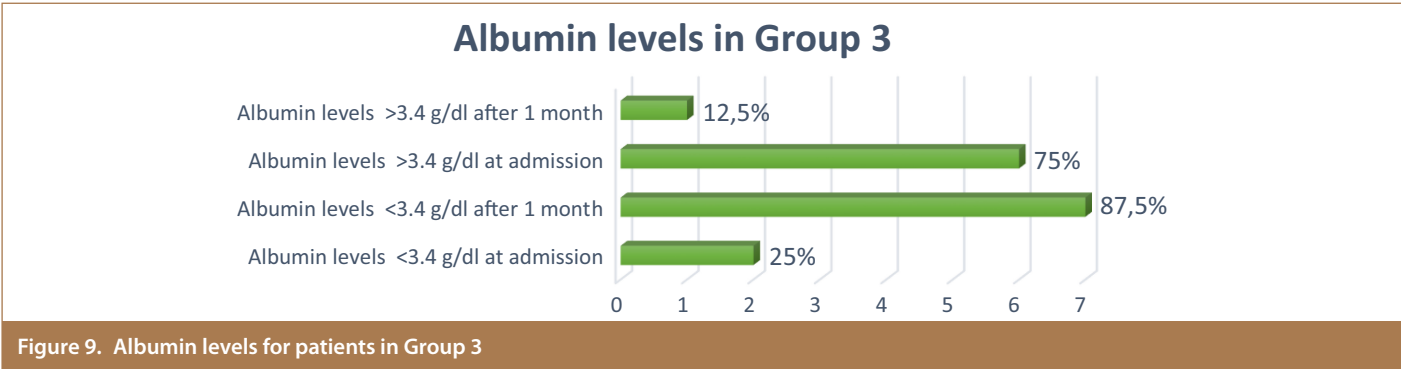
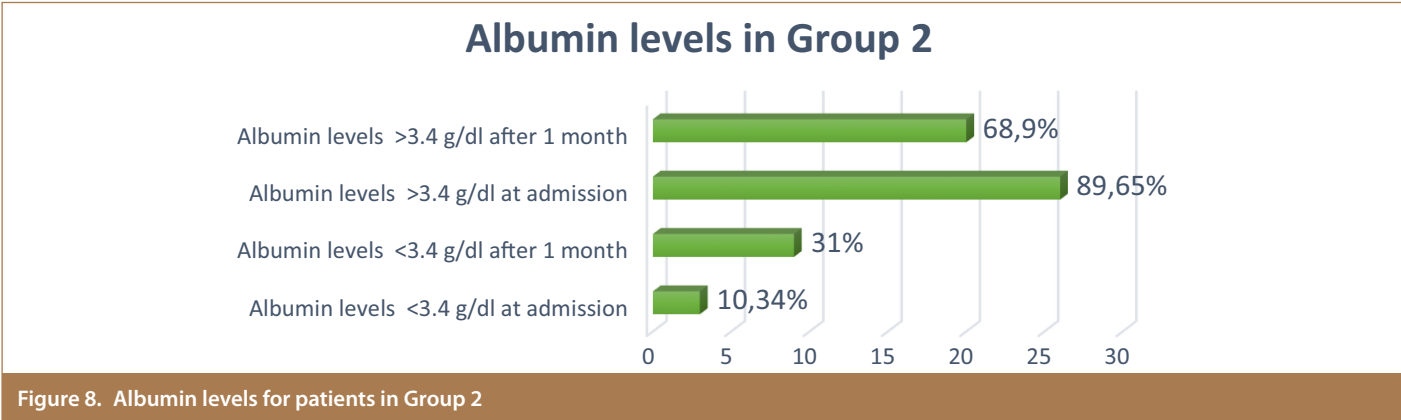
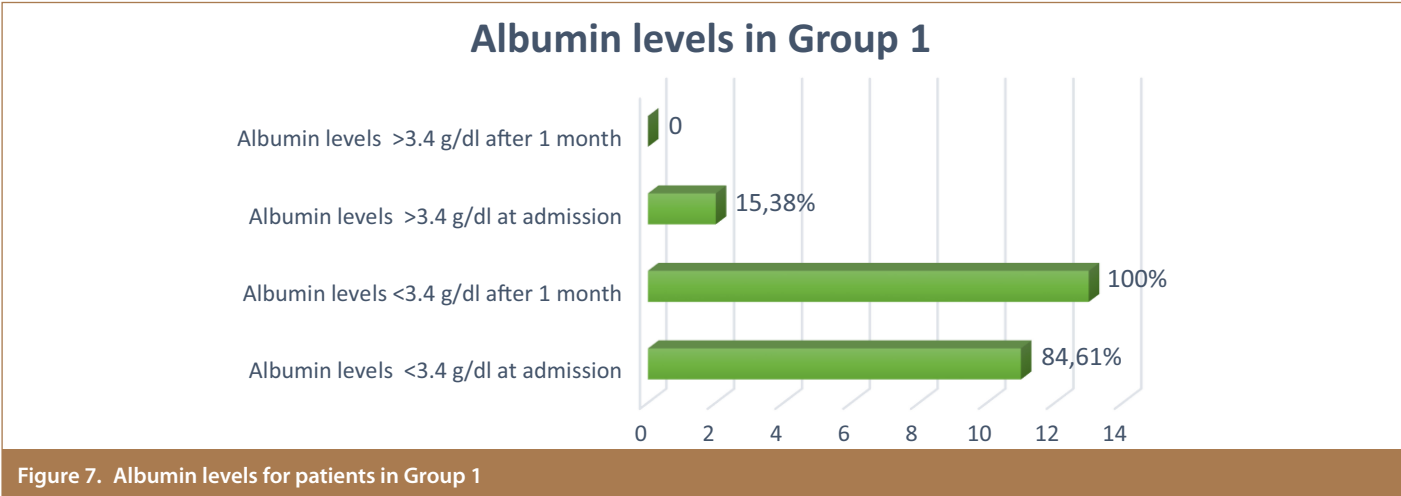
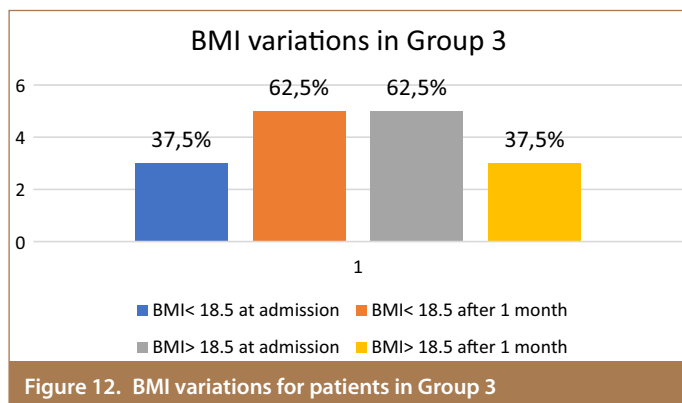


Figure 6. NRS 2002 for patients in Group 3

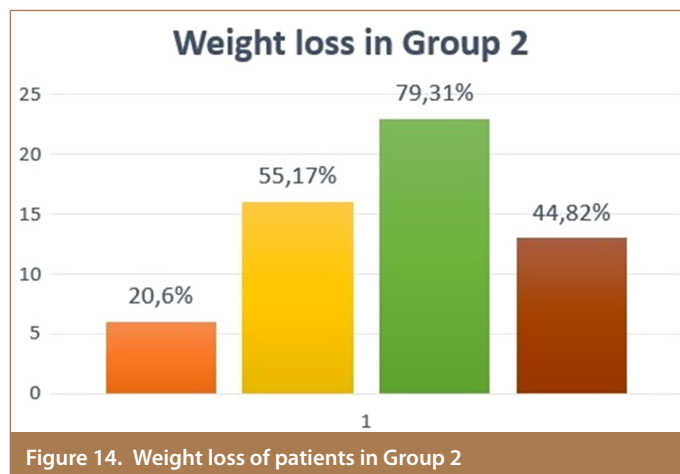
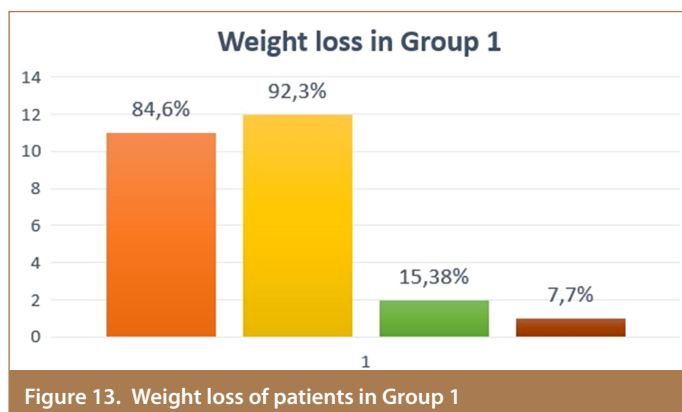






different according to the NRS 2002 but still, they were all at risk. The effectiveness of toleration of various therapies, including antibiotic therapy, chemotherapy, radiotherapy, and surgery, is also impacted by malnutrition. The increased metabolism brought on by the stress of potential surgical procedures worsens the nutritional metabolic risk. It is characterized by sympathetic nervous system activation, endocrine responses, immunological changes, and hematological changes, all of which can result in a hypermetabolic state and raise a patient's nutritional requirements. Further inadequate food intake and worsening of patients' nutritional status are caused by the fasting periods prior to many examinations and interventions. In the Balkan region there are often cases of inappropriate meal services, poor quality, and flexibility of hospital catering. Also, insufficient assistance given by the medical staff to the most vulnerable patients due to lack of personnel, insufficient knowledge among all healthcare professionals, and lack of standardized protocols are the main problems.

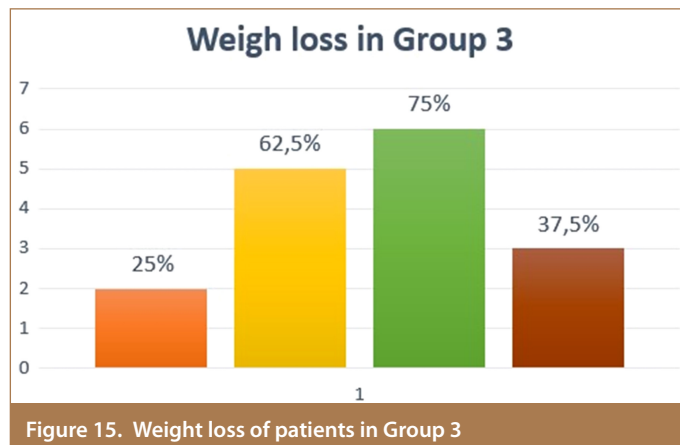
The majority of patients who underwent oropharyngeal and oral cancer surgeries were at significant risk of becoming malnourished. In comparison to laryngeal cancer patients, the majority of those in this group had a minimal risk of becoming malnourished. More than 60% of the patients who received surgery for hypopharyngeal cancer had a high risk of developing malnutrition because their resection into the pharyngeal wall was more extensive than it was for patients whose tumor was restricted to the larynx. We can infer from those figures that patients with oral cavity and oropharyngeal cancer are most at risk for developing malnutrition, so this group of patients requires thorough nutritional assessment, and a care plan should be put into place as soon as possible taking into account the patient's characteristics and nutritional needs. There are some specificities in



the treatment and follow-up care of oncological patients in Eastern European countries, such as a late presentation to the specialist that results in a late diagnosis, high treatment and follow-up costs, a dearth of centers that can treat oncological patients, and a lack of standardized protocols.

The amount of serum albumin is well-known to be a reliable indicator of nutritional health and is crucial to the physiology of the human body. Malnutrition may be indicated by a low amount of serum albumin. Serum albumin levels and all-cause mortality in elderly individuals are clearly correlated.<sup>10</sup> Due to the numerous mechanisms it is engaged in that can affect the patient's outcome, malnutrition is linked to poor prognoses in cancer patients and is a serious issue.<sup>11</sup> Due to the implications that albumin has on prognosis, future research should be conducted to determine the most effective ways to supplement serum albumin, which were lower after the operation than they were at admission in all 3 groups.

A gradual loss in body mass is associated with systemic inflammation in cancer patients. A process of improperly controlled protein synthesis and breakdown results in progressive skeletal muscle wasting in cancer cachexia. A number of newly discovered mechanisms, including an upregulation of cytokines that results in the downregulation of genes that promote protein synthesis<sup>13-16</sup> and an upregulation of the ubiquitin-proteasome pathway,<sup>17</sup> have been identified in a recent study as potential causes of malnutrition associated with cancer.<sup>12</sup>



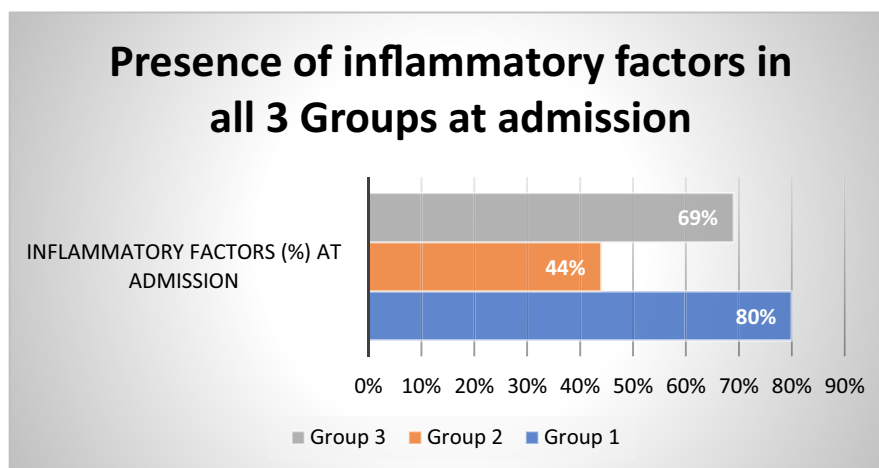


Figure 16. Presence of inflammatory factors in all three groups at admission

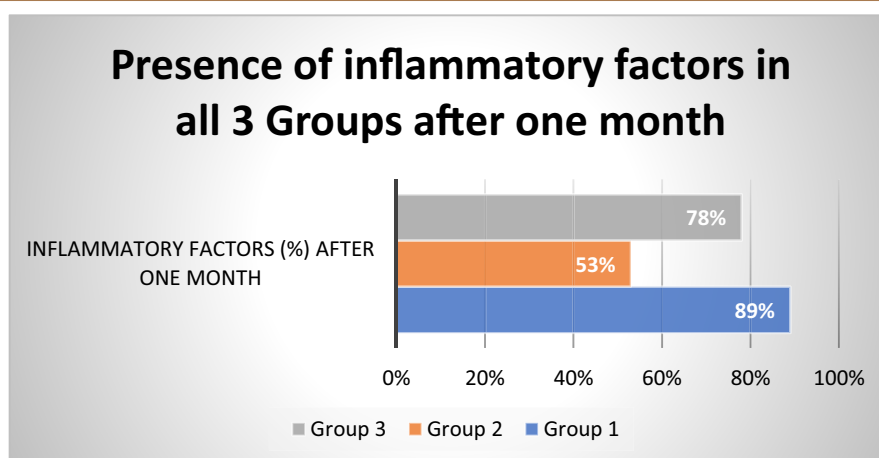


Figure 17. Presence of inflammatory factors in all three groups after one month

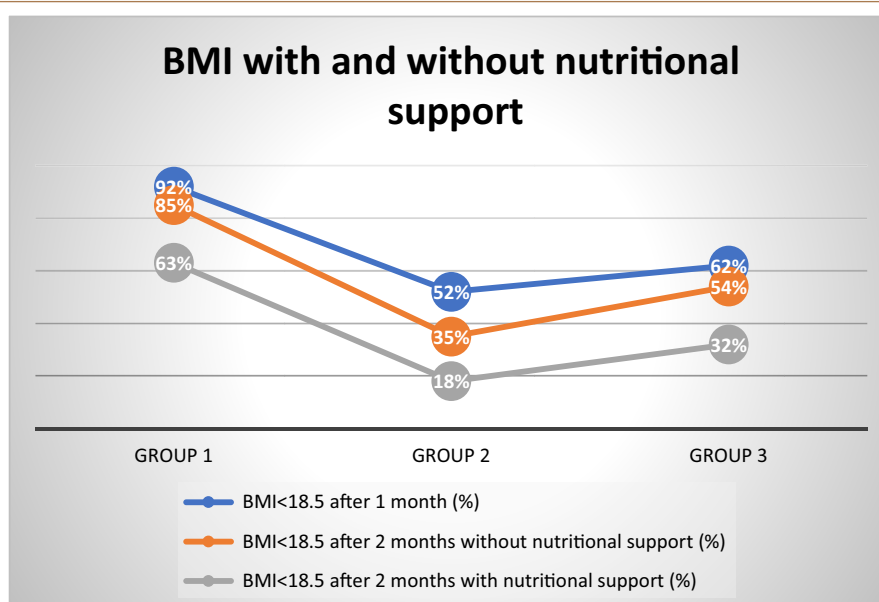


Figure 18. BMI with and without nutritional support

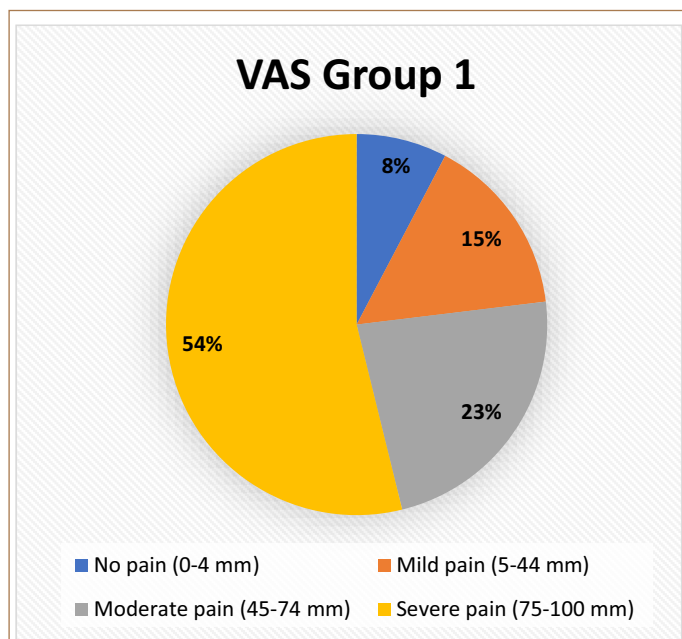


Figure 19. Pain Severity for Group 1.

Clinically important, the malnutrition brought on by cancer cachexia can contribute to treatment toxicity or the early termination of therapies, increasing morbidity and mortality. Numerous studies have revealed that chronic systemic inflammation plays a crucial role in both the onset and maintenance of malnutrition in cancer patients. In all 3 groups, high prevalence values for systemic inflammation were discovered; these values were reduced at admission and increased after 1 month. This has been linked to a worse prognosis and a higher chance of infectious complications.<sup>18</sup> Patients with oropharyngeal and oral cancer lost more weight overall, and this was correlated with greater levels of inflammation and lower levels of albumin. In contrast to patients who had not lost weight and were adequately

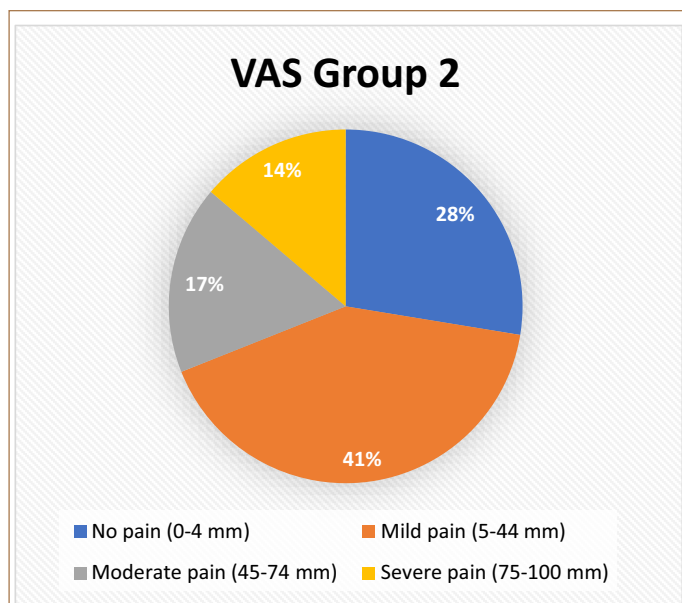


Figure 20. Pain Severity for Group 2.

fed, those with malnutrition had significantly higher erythrocyte sedimentation rates and fibrinogen levels.

As high as 92% of patients in group 1, 52% of patients in group 2, and 62% of patients in group 3 were underweight after 1 month. After 2 months, the percentages for oral cancer, laryngeal cancer, and hypopharyngeal cancer in the group of patients who did not receive nutritional support were 85, 35, and 54 respectively, whereas in the group receiving nutritional support, the percentages of patients who continued to be underweight were significantly lower. In patients with malnutrition or those who are at risk for nutritional problems, nutritional counseling is the first line of therapy. Nutritional counseling was discovered to be linked with reduced treatment toxicity and improved quality of life in patients with HNC.<sup>19</sup>

Hospitals frequently face the threat of malnutrition. When nutrition is properly managed, it is a disorder that is mostly manageable. Early detection of patients who are malnourished or at risk for malnutrition is essential because it enables prompt and efficient nutritional treatment to begin. The initial stage in providing nutritional treatment in a multimodal care system is identifying patients who are at risk of malnutrition. To identify patients who are nutritionally vulnerable or undernourished, a comprehensive nutritional risk screening procedure using quick and easy methods should be carried out on each patient upon admission to the hospital. Patients who have been recognized as malnourished or at risk of malnutrition should thereafter undergo a thorough, in-depth nutritional examination. This screening should utilize both subjective and objective criteria, including clinical history, physical examination, body composition measurements, functional assessment, and laboratory results. New assessment techniques may be highly beneficial because they are quick and precise. Reduced healthcare expenditures may also be a result of routine dietary risk assessment and systematic nutritional management.

One of the measures for assessing pain was the VAS, which Hayes and Patterson used for the first time in 1921.<sup>20</sup> It is frequently used to gauge the severity or occurrence of different symptoms in epidemiologic and clinical research. For instance, the level of pain that a patient experiences can be anywhere along a continuum, from none to extremely high levels. The patient sees this spectrum as continuous rather than in discontinuous jumps as would be implied by the categories of none, mild, moderate, and severe. The VAS was developed in order to capture this notion of an underlying continuity.

A set length, usually 100 mm, straight horizontal line serves as the basic VAS. The extreme boundaries of the parameter to be measured (in our case, pain) are referred to as the ends<sup>21</sup> and are oriented from left to right (worst to best), no pain (0-4 mm), mild pain (5-44 mm), moderate pain (45-74 mm), and severe pain (75-100 mm). Patients in group 1 experienced higher levels of pain according to VAS, and they were also the ones who had the highest levels of inflammatory factors before and also after the surgery (Figure 19). Contrary, those in group 2 who had the lowest levels of inflammatory factors also had the lowest percentage of patients experiencing severe pain and the highest percentage of patients feeling no pain (Figure 20).

Our research demonstrated that postoperative nutritional condition tends to deteriorate in HNC patients, placing them at risk for



malnutrition. Malnutrition in cancer patients can be prevented with the assistance of nutritional counseling, early dysphagia and malnutrition detection, and nutritional support.

To improve the prognosis of these patients, Eastern European nations should adopt better prevention strategies, enhanced screening techniques, increased knowledge among all healthcare professionals, and standardized protocols.

**Ethics Committee Approval:** This study was approved by the Ethics Committee of Coltea Clinical Hospital (Approval No: 5324/abcc, Date: March 20, 2022).

**Informed Consent:** N/A

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Conception – S.D.E.T., O.D.I.; Design – C.A.I.; Data collection and processing – B.P.L., R.S.A.; Analysis and interpretation – S.A.C.B., B.G.S.; Literature review – S.D.E.T.; Supervision – B.S.V.G., T.B.P., M.M.; Materials – E.A.G., N.R.I.; Writing – S.D.E.T.; Critical review – P.B., S.D.E.T.

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