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Malnutrition and cachexia in patients with head and neck cancer treated with (chemo)radiotherapy

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ABSTRACT

Aim: To highlight the problems associated with nutrition that occur in patients with squamous cell carcinoma of the head and neck (SCCHN).
Background: SCCHN is associated with weight loss before, during and after radiotherapy or concurrent chemoradiotherapy. Because of serious consequences of malnutrition and cachexia on treatment outcome, mortality, morbidity, and quality of life, it is important to identify SCCHN patients with increased risk for the development of malnutrition and cachexia.
Materials and methods: Critical review of the literature.
Results: This review describes pathogenesis, diagnosis and treatment of malnutrition and cancer cachexia. Treatment of malnutrition and cancer cachexia includes nutritional interventions and pharmacological therapy. Advantages and disadvantages of different nutritional interventions and their effect on the nutritional status, quality of life and specific oncological treatment are presented.
Conclusions: Nutritional management is an essential part of care of these patients, including early screening, assessment of nutritional status and appropriate intervention.

1. Background

The majority of tumours (over 90%) in the head and neck area are squamous cell carcinomas,[1] which are the 7th most common malignancy worldwide.[2] Weight loss is common in patients with squamous cell carcinoma of the head and neck (SCCHN) and may occur before and during treatment for SCCHN as well as after the therapy. At the time of diagnosis, 3–52% of SCCHN patients are malnourished. In the pre-therapy phase, this is mainly due to the cancer itself. The common treatments for SCCHN, including surgery, radiotherapy (RT), chemotherapy, or combinations of these three, also lead to changes that further complicate and challenge oral intake. During RT alone or in combination with concurrent chemotherapy (chemoradiotherapy, CRT), malnutrition is already present in 44–88% of patients.[3,4] After treatment completion, however, dysphagia and xerostomia – as the most

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frequent consequences of therapeutic intervention – can further contribute to poor nutritional status in these patients. Specifically, malnourished patients with SCCHN have multifactorial nutritional problems because of symptoms related to the tumour or specific therapy and iatrogenic causes. Symptoms related to the tumour include mechanical obstruction, dysphagia, odynophagia, anorexia and fatigue secondary to cancer cachexia syndrome.[5] In cachectic patients, weight loss of varying degree occurs in conjunction with significant metabolic abnormalities, skeletal muscle loss and increased lipolysis. Cancer cachexia may be present before any substantial weight loss.[6,7] Tumour-specific therapy has toxic effects, such as nausea, vomiting, xerostomia, mucositis, fatigue and changes in the taste. Pain or leakage linked to the inserted percutaneous endoscopic gastrostomy (PEG) tube, extraction of unhealthy teeth before radiotherapy, opioid-induced gastrointestinal changes, and unawareness of nutritional problems represent iatrogenic causes of weight loss.[8] Many of these problems are still present after completion of treatment and are more pronounced in elderly patients.[9–11] Whatever the reason of malnutrition and cachexia is, it is associated with increased rates of mortality, morbidity, and impaired quality of life (QoL) in patients with SCCHN.[12]

2. Aim

The aim of this review is to highlight the problems associated with nutrition that occur in patients with SCCHN.

3. Malnutrition and cancer cachexia: definition and development

In SCCHN studies, malnutrition is usually defined as unintended weight loss of >5–10% during the last 1–6 months and body mass index (BMI) of <18.5–20 kg/m^2.[5,13–15] Malnutrition and poor food intake are associated with lower physical functioning,[16] impaired immunity,[17] more frequent and severe RT-induced late toxicities,[18] more and longer interruptions of CRT course,[15] greater hospital re-admission rate,[19] impaired QoL, and increased mortality.[12,20] Jager-Wittenaar et al.[16] reported significantly worse scores on physical functioning ($p = 0.007$) and fatigue ($p = 0.034$) in malnourished patients after different treatments of oral/oropharyngeal cancer compared to well-nourished patients. Chang et al.[17] retrospectively analysed the data of 194 patients with stages III–IV SCCHN who were treated with CRT. On multivariate analysis, Eastern Cooperative Oncology Group performance status of >1, BMI of <19 kg/m^2, and peripheral blood total lymphocyte count of <700/μL were recognised as independent variables associated with early death that occurred in 14 patients (7.2%), 78.6% of whom died of infection. A retrospective study of 72 patients with stage III or IV SCCHN reported that patients with BMI of 25 or less survive 24.6 months on average compared with 28.3 months for patients with BMI greater than 25.[20] From the afore-mentioned studies, we can conclude that malnutrition should be considered an important risk factor, contributing to a poorer outcome, particularly when other risk factors are present. Because of serious consequences of malnutrition, it is important to recognise SCCHN patients with increased risk for the development of malnutrition and cachexia.

Cachexia is not always present in all malnourished patients, while all cachectic patients suffer from malnutrition.[21,22] Cancer cachexia is a multifactorial metabolic syndrome associated with an underlying malignant disease. Its main characteristics are decreased appetite, weight loss, metabolic alterations, and inflammatory state.[23] Clinical features in patients with cachexia are loss of adipose tissue, skeletal muscle mass and function, resulting in progressive loss of body weight. Furthermore, cachexia is associated with reduced QoL and poor prognosis of the underlying malignant disease. Cachexia is often accompanied by anorexia, which is caused by production of pro-inflammatory cytokines (IL-1α, IL-1β, IL-6, TNF-α). This leads to predominance of anorexigenic signals, such as pro-opiomelanocortin, and lack of orexigenic signals, such as neuropeptide Y.[10,24,25]

A three-stage classification system of cancer cachexia was proposed by Fearon et al., distinguishing between pre-cachexia, cachexia, and refractory cachexia (Fig. 1). The rate of cancer cachexia progression varies between individuals. Factors such as degree of food intake, absence/presence of systemic inflammation, cancer type, and stage and lack of response to anti-cancer therapy may affect the rate of progression. Pre-cachexia is described as metabolic changes or substantial involuntary weight loss (i.e. ≤5%). Cachexia is diagnosed as weight loss of >5% over past 6 months; or a BMI of less than 20 kg/m^2 and ongoing weight loss of more than 2%; or sarcopenia and ongoing weight loss of more than 2%. Patients with metastatic cancer or very poor response to oncological treatment can develop refractory cachexia. Characteristics of refractory cachexia are poor performance status (WHO score 3 or 4) and short life expectancy (less than 3 months).[21]

The principal initial mechanisms in cancer cachexia that lead to hypercatabolism are systemic inflammatory response with increased production of pro-inflammatory cytokines (interleukins, interferon-γ, TFNα, NFkβ), reactive oxygen species and catabolic mediators produced by tumour and host cells.[10,26] This causes changes in metabolism in terms of altered metabolism of carbohydrates, lipids and proteins. Insulin resistance, glucose intolerance, increased gluconeogenesis from amino acids and lactate are the most important changes in carbohydrate metabolism.[27] Loss of adipose tissue in cachexia is a result of increased lipolysis by tumour or host products.[24,27] The tumour (and host) factor, zinc-alpha-2 glycoprotein, and the lipid-mobilising factor (LMF) also contribute to the loss of adipose tissue with a direct lipolytic effect and increased sensitivity to lipolytic stimuli. Loss of skeletal muscle in cachexia is mainly due to diminished synthesis of muscle protein and increased degradation of proteins.[24] Despite metabolic changes in cancer cachexia, studies show that progressive resistance training (PRT) increases lean body mass. In a series of 41 patients, Lønbro et al. reported that 12 weeks of PRT after RT completion increased lean body mass by more than 4%; self-selected physical activity resulted in a significantly lower increase of lean body mass.[28] Furthermore, studies in healthy subjects showed an additive effect of protein and creatine supplementation on the effect of PRT, which was not confirmed in SCCHN patients.[29]

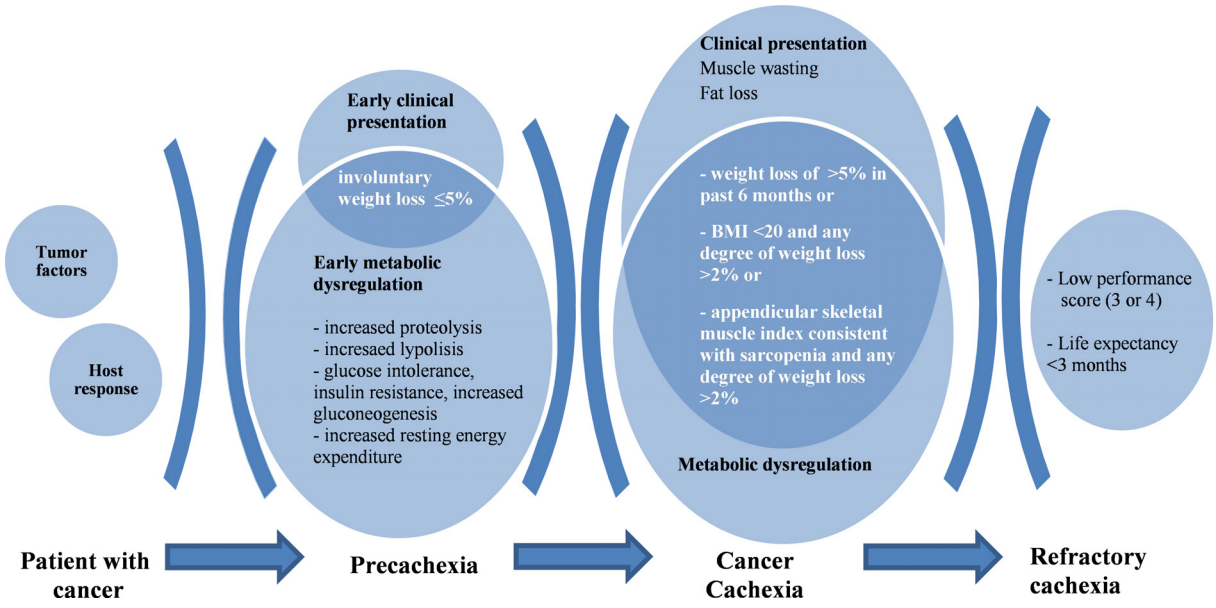

Fig. 1 – Development of cancer cachexia.Adapted from refs. 23,25.

4. Nutritional screening and assessment

Nutritional screening is the first in the process of identifying patients who are or may be at higher risk for malnutrition and need more extensive nutritional assessment. Nutritional assessment confirms and classifies the degree of malnutrition (Figs. 2 and 3).

Screening tools, such as Patient-Generated Subjective Global Assessment (PG-SGA), Nutritional Risk Screening 2002 (NRS 2002), Malnutrition Universal Screening Tool (MUST), Nutritional Risk Index (NRI) and Malnutrition Screening Tool (MST) have been successfully used in different cancer patient populations.[30–32] Screening tools use several criteria for determining the total risk of malnutrition, such as percentage of weight loss, BMI, serum albumin concentration and questions related to low food intake.

The scored PG-SGA was recommended by the Oncology Nutrition Dietetic Practice Group of the American Dietetic Association as the standard for nutritional assessment for patients with cancer. It is a simple and reliable tool used for identification of patients with malnutrition who need nutrition support.[33] The PG-SGA comprises medical history (intake, nutrition-effect symptoms, weight loss, and functional capacity), which is completed by the patient, as well as physical

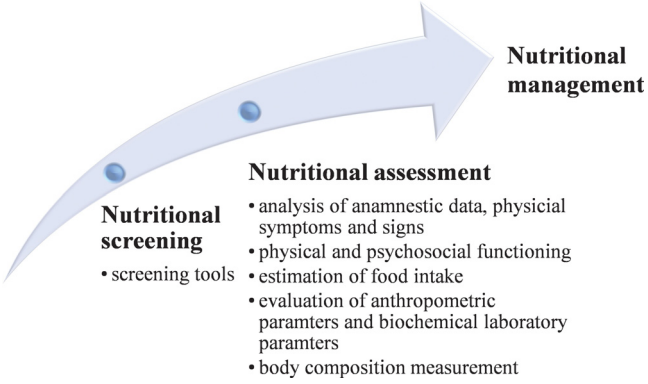

Fig. 2 – Assessment of malnutrition and cachexia.

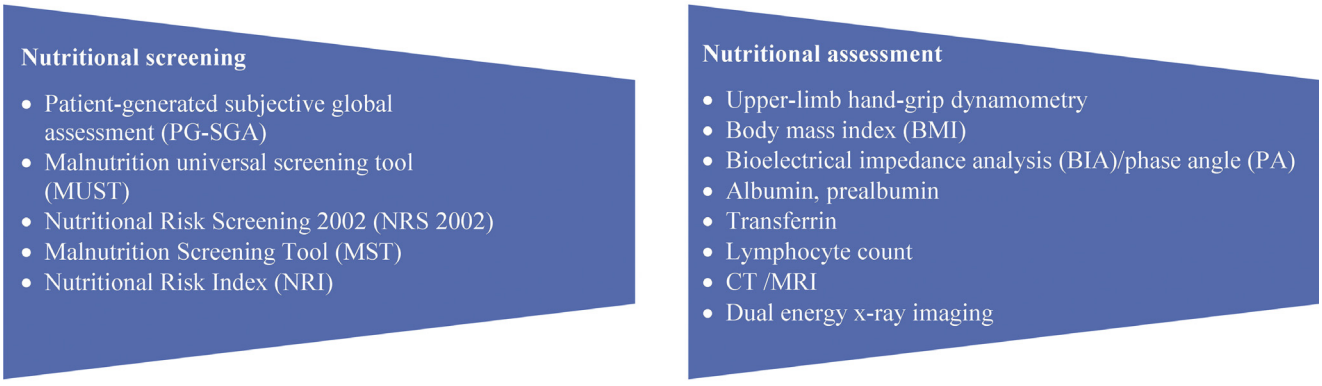

Fig. 3 – Nutritional screening and assessment tools.Adapted from ref. 23.

examination, which is completed by the examiner to evaluate the fluid status, muscle stores and fat.[34]

Both NRS 2002 and MUST have been agreed upon by the European Society for Clinical Nutrition and Metabolism (ESPEN) for hospital use.[35–37] Neelemaat et al. compared malnutrition screening tools MST, MUST and NRS 2002 in patients at moderate or severe risk of malnutrition and in no-risk group of the patients. Sensitivities and specificities of all tested screening tools were ≥70%.[38]

Nutritional assessment is the quantitative evaluation of the nutritional status. A detailed clinical pathway for nutritional assessment has not been determined.[32] Nutritional assessment is usually based on the analysis of anamnestic data, physical symptoms and signs; estimation of food intake; evaluation of anthropometric and biochemical laboratory parameters; and body composition measurements.

In general, higher BMI, which represents one of the anthropometric parameters, positively influences survival outcomes and vice versa, while being underweight and having a low haemoglobin level were associated with locoregional failure. Recently, Takenaka et al.[39] found that the impact of BMI depends on the treatment modality administered: the overall survival hazard ratio of BMI was 0.95 for surgery, whereas for chemoradiation and radiation groups it was 0.91 and 0.79, respectively ($p < 0.05$). Bioelectrical impedance analysis (BIA) allows body composition measurement (i.e. determination of fat-free mass and total body water) and direct calculation of the phase angle (PA), an indicator of membrane integrity and distribution of water between intra- and extracellular space.[40] PA is a prognostic indicator that is validated in malignant and chronical diseases.[41] Among biochemical markers, albumin, pre-albumin and transferrin have been traditionally used to define nutritional depletion, although no single marker can comprehensively measure the nutritional status.[32] In SCCHN patients, pre-albumin was found to be a more sensitive marker than albumin, and a significantly lower mean pre-albumin level was measured in malnourished patients than in well-nourished patients (17 ± 5 g/dl vs. 22 ± 5 g/dl, respectively, $p = 0.004$). On the other hand, the albumin level did not differ significantly between the two groups.[42,43] In immunocompetent patients, a total lymphocyte count lower than the range 1200–1500 mm^{-3} was recognised as another indicator of malnutrition.[40]

4.1. *Nutritional assessment during treatment*

Motivation of the patient is needed to maintain appropriate nutrition during treatment of SCCHN. Taste changes, dry mouth, loss of appetite and swallowing difficulty require more time and effort to optimise food intake. Patients with insufficient information about the importance of adequate food intake have more problems maintaining appropriate body weight during treatment. Typically, the majority of patients undergoing RT for SCCHN experience weight loss.[44] Patients with weight loss have greater and longer duration of treatment-related morbidity.[45] Moreover, critical weight loss during RT (>5% weight loss during radiotherapy or >7.5% weight loss until week 12) and worse disease-specific survival were found significantly associated ($p = 0.004$).[46]

The use of intensity-modulated RT techniques (IMRT) with more controlled dose deposition in irradiated tissues can reduce radiation-associated toxicity, including mucositis, xerostomia and fibrotic changes in pharyngeal constrictor muscles and ligaments of supraglottic larynx.[47,48] Thus, sparing of pharyngeal constrictor muscles, esophageal inlet, glottic and supraglottic larynx during RT and CRT is an important objective in the RT planning. It helps to preserve quality of swallowing process and nutritional status of the patient. Accurate identification of structures involved in swallowing on RT-planning computer tomography scans is mandatory to achieve this goal.[49] In the study reported by Al-Mamgani et al., 65% of 204 patients with locally advanced oropharyngeal cancer completed treatment by employing a tube feeding. The feeding tube was inserted significantly more frequently in patients treated with CRT compared to RT alone (70% vs. 41%, $p = 0.002$). Moreover, IMRT significantly reduced feeding tube dependency compared to 3D CRT (49% vs. 72%, $p = 0.04$).[50] For more detailed evaluation of relationship between RT technique and dysphagia, together with its effect on QoL of patients with head and neck cancer, the M. D. Anderson Dysphagia Inventory can be used.[51]

In addition to sophisticated techniques, dietary counselling tailored to individual needs of SCCHN patients during RT and CRT treatment also has positive effect on nutritional intake, nutritional status and QoL.[52] Reduction in the incidence/severity of grades I–II anorexia, nausea/vomiting, xerostomia, and dysgeusia was present in 90% of patients with SCCHN receiving dietary counselling before RT compared with patients who maintained their usual diet with or without supplements, where reduction in the incidence of the afore-mentioned symptoms was 67% and 51%, respectively ($p < 0.0001$).[53] Nutritional intervention is aimed at preventing hypermetabolism and decrease in dietary intake associated with cachexia. The negative effects of RT on nutritional intake are well known, so it is important to start nutritional support from the beginning of RT. Such measures enable the patient to complete the planned therapy with reduced morbidity.[54–56]

4.2. *Post-treatment follow up*

The goal of post-treatment follow up is the early detection of tumour re-appearance locally and regionally, second primary tumour and systemic metastases, but also evaluation of treatment-related complications. In the majority of patients, Larsson et al. showed that eating problems persisted after completion of treatment. Pain, chewing and swallowing difficulties were most common and were recorded in 70% of patients after 1 month and in 65% of patients after 6 months, having a significant effect on oral intake. In 80% of the patients, oral health problems were documented after 3 weeks of RT, the predominant among them being mucositis, which may lead to serious eating problems.[9]

Whale et al. reported that high pain was present in 57.14% of SCCHN patients treated with RT and surgery, while it was described in 25% of patients treated with RT alone ($p = 0.039$).[57] Other studies also show that pain may be present even after completion of oncological treatment, especially after multimodal treatment.[9,57,58] Therefore, it is very important to inform the patient about possible symptoms following

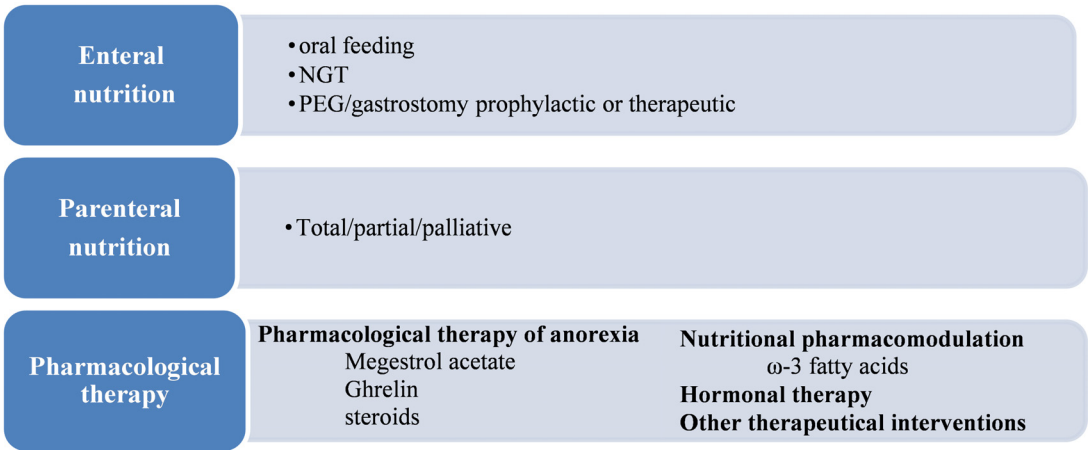

Fig. 4 – Nutritional interventions and pharmacological therapy for cachexia.

completion of oncological treatment and about the need to visit a physician as soon as possible after the onset of a new symptom. Moreover, regular clinical visits are mandatory for monitoring treatment effects and nutritional status and for providing adequate clinical care of side effects, including nutritional intervention, if necessary.

5. Nutritional interventions in malnourished/cachectic SCCHN patients

In addition to nutritional counselling, nutritional intervention and supplements also play an important role in the prevention of deterioration of nutritional intake and status.[26,59] There are two main routes of artificial nutrition support: enteral nutrition (EN) and parenteral nutrition (PN) (Fig. 4). Nutrition support may decrease the rate of catabolic processes in cachectic patients, but it seems that it does not reverse them to anabolism.[60]

5.1. *Enteral nutrition*

Nutrition support requires continuing care by a multidisciplinary team, especially dietician. Patients with SCCHN have a normally functioning gastrointestinal tract but severe problems with oral intake. Thus, nutrition support through enteral route is superior to the parenteral route. Indications for EN are existing malnutrition and anticipated interruption of oral feeding lasting more than 7 days.[54] Despite several published studies in the field of enteral nutrition, it is still difficult to determine which method is more appropriate for the prevention of malnutrition.[61–65] There are several different options for enteral nutrition, but the optimal method of EN in patients with SCCHN has yet to be established.

5.1.1. *Feeding tubes compared to optimal oral feeding*

When patients with SCCHN or oesophageal cancer have swallowing disorders or gastrointestinal obstruction, EN should be given through feeding tubes. Feeding tubes are also indicated in SCCHN patients treated with intensive RT or CRT regimens, in which severe mucositis is expected.[54]

In the study of Hearne et al., 26 stages III–IV SCCHN patients were stratified by tumour site (nasopharynx vs. others) and randomised into the tube-fed group and the oral-fed group. Patients with other carcinomas in the tube-fed group had significantly lower mean weight loss than patients in the oral-fed group (0.2% vs. −7.3%; $p = 0.005$). To continue, the tube-fed group also maintained higher caloric and protein intakes, even though no difference in the body weight of patients with nasopharyngeal carcinoma was observed between the two groups (mean+; 3.8% vs. 3.3%).[61] On the other hand, and in addition to higher caloric and protein intake, Daly et al.[62] reported less mean body weight loss in the tube-fed group (0.6% vs.6.1%, $p = 0.04$).

Lee et al. analysed the data of 79 oropharyngeal cancer patients undergoing RT who were stratified by whether or not they had a PEG tube. Thirty-nine patients received nutritional supplementation: patients treated with RT alone had a decreased need for PEG tube placement (a decrease from 31% to 6%).[8]

5.1.2. *No prophylactic PEG compared to prophylactic PEG*

PEG is a method of providing food and liquids directly into the stomach, which is useful in patients with insufficient oral intake. PEG insertion is associated with improved QoL and survival in patients with SCCHN, growth failure in children, gastric decompression, acute stroke, neurogenic and muscle dystrophy syndrome.[66]

In a prospective randomised comparison of prophylactic gastrostomy vs. no prophylactic gastrostomy in patients with unresectable SCCHN reported by Salas et al.,[65] QoL scores at 6 months post-treatment were significantly higher in the group receiving systematic prophylactic gastrostomy. Significant factors related to improved QoL were lower initial Karnofsky index and higher initial BMI. In another randomised study conducted in 134 patients with advanced SCCHN, prophylactic PEG insertion correlated with a significantly earlier start and longer use of EN, improved health-related QOL at 6 months post-treatment, and fewer malnourished patients over time.[63] Both studies suggest that PEG improves QoL in patients with SCCHN and is an effective method in the prevention of malnutrition.

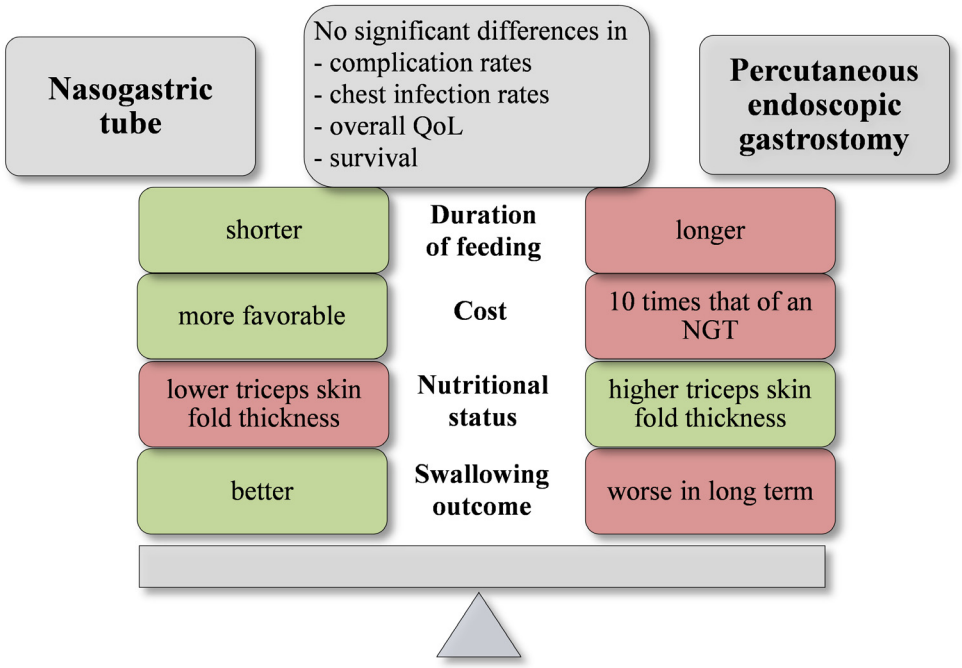

Fig. 5 – Nasogastric tube vs. percutaneous endoscopic gastrostomy: advantages and disadvantages.

On the other hand, a high rate of unnecessary PEG placements was reported when done prophylactically in patients with SCCHN. Of 23 patients with prophylactic PEG tubes, 11 (47.8%) patients had been using the tube for less than 2 weeks or not at all.[67] It seems that comprehensive nutritional assessment of each individual patient before treatment, taking into consideration the position and extent of the tumour, patient's socio-economic status and psychological characteristics, as well as intensity of the planned therapy, is essential before setting the indication for prophylactic PEG insertion, particularly in view of its possible negative impact on swallowing function.

5.1.3. *Nasogastric tube (NGT) compared to percutaneous endoscopic gastrostomy*

Both NGT and PEG are effective in maintaining the nutritional status, and there is no clear evidence suggesting which method is preferable in SCCHN patients.[68] 20 years ago, NGT was the most common method for tube feeding. PEG is another method for tube feeding that is increasingly used for long-term enteral tube feeding.[63] According to ESPEN, PEG may be preferred in patients with expected or already developed radiation-induced oral and oesophageal mucositis.[54] However, both feeding strategies have their advantages and disadvantages (Fig. 5).[68] Clavel et al.[69] and Sheth et al.[70] suggested that nasogastric feeding, which is introduced after the indication is recognised by a multidisciplinary team, is a more suitable method of EN in SCCHN patients treated with CRT or RT alone, rather than prophylactic gastrostomy tube feeding. No differences were found in survival when comparing patients with or without NGT.[69]

A study performed by Corry et al. included 33 patients with SCCHN, of which 18 received an NGT and 15 a PEG tube. The two groups were comparable in regard to overall complication rate, chest infection rate and patients' self-assessment of their overall QoL, and no conclusion could be made regarding the most optimal method for routine use. PEG was 10 times more expensive than NGT, and the duration of use of PEG was also significantly longer ($p = 0.0006$).[64] On the other hand, triceps skinfold thickness was significantly lower ($p = 0.03$) in the NGT patients compared to the PEG patients six weeks after completion of treatment.[64,71] PEG insertion reduces the use of swallowing musculature because patients have less need for swallowing. Not surprisingly, retrospective and prospective studies suggest that swallowing outcome is better during CRT when NGT is used, rather than PEG.[47] Wang et al. reported that patients with NGT have a statistically significantly lower incidence of dysphagia than patients with PEG (OR = 0.81, 95% CI (0.04, 18.25), $p = 0.90$).[68] Another study also reported that patient-reported long-term swallowing outcome was worse in patients who used PEG during CRT compared to patients with NGT during CRT ($p < 0.001$).[72]

5.2. *Parenteral nutrition*

Parenteral nutrition (PN) is intravenous administration of nutrients and is indicated for SCCHN patients with gastrointestinal insufficiency (e.g. bowel, radiation enteritis), where oral intake and absorption of food is limited.[73] PN is recommended in patients when inadequate food and enteral intake (<60% of the estimated energy expenditure) is anticipated to last for >10 days.[74]

In a prospective randomised study performed by Ryu et al., nasogastric tube feeding was compared with parenteral feeding after laryngopharyngeal cancer surgery in 81 patients. No difference in time to oral feeding, hospital stay or fistula occurrence was observed between the two groups, although the daily costs were lower in patients with nasogastric

tube nutrition. The conclusion was that each method has particular advantages and disadvantages. Consequently, a comprehensive consideration of patient's conditions is mandatory before deciding on the most appropriate nutrition support.[75] On the other hand, in a study performed by Scolapio et al., most individuals preferred intravenous (IV) feeding to tube feeding. The preference was influenced mainly by older age and perceived comfort of IV feeding.[76]

Parenteral nutrition also has a place in palliative care. It is suitable for patients who are not candidates for radical treatment and are in good physical and mental condition with life expectancy of 3 months or more, and for those who cannot receive enteral nutrition due to intestinal obstruction or fistulas.[60] Suitability of the SCCHN patient for parenteral nutrition should be carefully discussed by a multidisciplinary team, taking into account also ethical considerations, particularly in terminally ill patients.[77]

6. Pharmacological therapy

6.1. *Pharmacological therapy for anorexia*

Megestrol acetate (MA) is classified as a female hormone. At times, it is used in palliative care to improve the appetite of patients with anorexia-cachexia syndrome. It improves appetite but has a small effect on weight gain, and it does not improve QoL. Also, side effects, such as increased risk of thrombosis, fluid retention and death, are more frequent in patients treated with MA.[78]Ghrelin is a stomach-derived hormone that increases appetite and plays a key role in whole-body energy metabolism.

Evidence suggest that long-term provision of ghrelin to weight-losing cancer patients supports host metabolism, improves appetite, and attenuates catabolism.[79] On the other hand, in order to outweigh adverse side effects, such as the catabolic effect on skeletal muscle, steroids must be administered only for short periods of time. Only after a limited duration of steroid administration, the patient will experience their benefits in terms of increased appetite and improved performance status.[24,54]

6.2. *Nutritional pharmacomodulation*

Enteral nutrition rich in ω-3 fatty acids may improve parameters of nutritional and functional status in patients with head and neck cancer during CRT. Patients treated with CRT and with ω-3 fatty acids in enteral nutrition lost only 0.82 ± 0.64 kg compared to 2.82 ± 0.77 kg in the control group ($p = 0.055$).[80] On the other hand, it is unlikely that ω-3 fatty acids prolong survival in advanced cancer (Fig. 4).[54]

6.3. *Hormonal therapy for cachexia*

Muscle loss in cachexia has been treated with steroidal and non-steroidal androgens which stimulate muscle growth and appetite. The newly developed non-steroidal selective androgen receptor modulator, enobosarm, showed promising results in phases I and II clinical trials. It increases total lean body mass, enhances functional performance and decreases total tissue percent fat.[81]

6.4. *Other therapeutic interventions in cachexia*

There are different therapeutic strategies for treatment of cachexia. Studies reported that NSAIDs (celecoxib), anti-cytokines (thalidomide), antioxidant agents (α-lipoic acid, N-acetyl cysteine, L-carnitine) improve body weight and appetite.[82,83] They are often part of a multimodal approach in the treatment of cachexia. Continued investigation of these potential substances is needed.

7. Conclusion

Malnutrition and cachexia are common problems among patients with SCCHN. Nutrition management is an essential part of care of these patients, with early screening and assessment of nutritional risk being of paramount importance.

Comprehensive care of patients with SCCHN must include evaluation of their nutritional status before initiating cancer treatment, as well as frequent re-evaluation during and after therapy. A flexible, individualised and integrated multidisciplinary approach seems to be more favourable than a prescriptive one. Early counselling by a dietician, who guides and evaluates nutritional management, is of great importance. Treatment of cancer cachexia and malnutrition includes nutritional and pharmaceutical interventions. Nutrition support through EN or PN is beneficial, but potential side effects and patient satisfaction should be taken into consideration. Different options for treatment and prevention of cachexia had been studied but later proved to be only partially effective or to have too many side effects.

The goal for the future should be to improve clinical pathways for metabolic support in malnourished/cachectic SCCHN patients with nutrition support and other multimodal measures, especially physical training. Refinement of pertinent guidelines following the results of well-designed phase III randomised studies is essential, but comprehensive analyses and critical observations of routine clinical practice can also be of great help in reaching this goal.

Conflict of interest

None declared.

Financial disclosure

None declared.

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