REVIEWS

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Nutritional Problems in Head and Neck Cancer Patients

Problemy żywieniowe chorych na nowotwory głowy i szyi

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Abstract

Head and neck tumors are the fifth most common type of cancer and at the same time the fifth most common cause of death associated with cancer in the world. The location of a tumor in the head and neck have a negative effect on the willingness and the ability to intake food. Frequently observed, malnutrition results in an unfavorable impact on the course of cancer and reduces the effectiveness of the therapy. Nutritional status disorders result in prolonged hospitalization, increased costs of treatment, worsening of the prognosis and reduced quality of life of patients. In addition to cancer treatment, it is necessary to assess the nutritional status of the patient, as well as the risk of malnutrition. In order to increase the tolerance of the patient to treatment, reduce the incidence of complications and duration of hospital stay, it is always advisable to consider nutritional therapy parallel to cancer treatment. Dietary intervention, which consists of dietary counseling, the use of oral industrial diets, enteral or parenteral nutrition, should always be adapted to the clinical situation. For these reasons, the European Society for Clinical Nutrition and Metabolism (ESPEN) have, for several years now, appointed teams of experts entrusted with the development of guidelines on the most important aspects of nutritional therapy. In Poland, despite many efforts of the Polish Association of Parenteral and Enteral Nutrition, awareness of the importance of nutritional status and nutrition in the treatment of patients is still minimal (**Dent. Med. Probl. 2016, 53, 3, 401–407**).

Key words: nutrition, nutritional therapy, cancer of the head and neck.

Słowa kluczowe: żywienie, terapia żywieniowa, nowotwory głowy i szyi.

Head and neck cancer is the fifth most common cancer type and, at the same time, the fifth most common cause of cancer-related death [1]. National Cancer Registry data shows that malignant neoplasms constitute an ever-larger health issue in Polish society. Each year 142 500 new cases are noted, and 92,500 deaths are observed. The incidence value for head and neck cancer is estimated at 5,500 new cases annually, which constitutes 5%, and 3,500 deaths are observed each year [2, 3].

The majority of neoplasms develop due to a complex interaction between the host and environmental factors. The environmental carcinogenic factors have not yet been fully discovered. On the other hand, the outcomes of research studies concerning this interrelationship indicate that exposure to alcohol and tobacco is the key factor leading to the development of cancer within the mucosa of the upper respiratory tract and the upper part of the esophagus [2].

Head and neck cancer is usually associated with tobacco use, and the risk for the development of further primary neoplastic lesions is conversely proportional to the duration and intensity of tobacco use. In a similar way, it is estimated that prolonged alcohol use, depending on the

quantities, leads to a two-/three-fold increase in the risk of developing cancer within the upper respiratory tract and the upper part of the esophagus. More and more research studies seem to indicate that there is a relationship between human papilloma virus infection and the development of pharyngeal cancer [3].

Immunocompromised patients, i.e. HIV patients or patients after organ transplant who take immunosuppressive medications, are also within the risk group for the development of head and neck cancer. Moreover, exposure to ionizing radiation increases the risk of the development of primary malignant cancer within the thyroid, salivary glands, soft tissues and bone. Epstein-Barr virus infection can also increase the risk of the development of oropharyngeal cancer [4].

Squamous cell carcinoma (SCC) cases constitute approximately 90% of cancer cases within the upper part of the respiratory and gastrointestinal tract. The tongue and the floor of the oral cavity are the most frequently observed locations affected by primary tumors [1–3].

The preliminary choice of treatment strategies depends on the location and classification of the primary tumor, histopathological diagnosis, anatomical location, and the response to implemented treatment. Usually, in cases of low-grade tumors (I, II), only one method of therapy is used, i.e. only one treatment modality is used at once, either radiation therapy or surgical treatment. The choice between these methods is made depending on the size, location and classification of the tumor, as well as on the distance between the lesion and the bone, or the grade of soft tissue infiltration. Essentially, treatment outcomes for low-grade cases are comparable, independently of whether radiation therapy or surgery was implemented. However, the treatment of high-grade cancer cases (III, IV) requires that multidisciplinary treatment be implemented, which means that surgical treatment is used concomitantly with chemotherapy or radiation therapy, and that knowledge of many specialties is integrated in such a way that the desired outcomes can be achieved. Treatment outcomes for head and neck cancer in Poland are not satisfactory. The main reason for this is the fact that the majority of patients report for treatment at an advanced stage of the disease.

The symptoms observed in cancer patients caused by local malignant neoplasm growth, such as pain, burning within the oral cavity, and dysphagia, lead to patients ingesting smaller amounts of semi-fluid and, in the end, fluid foods whose nutritional value is low. The location of the neoplasm within the upper part of the gastrointestinal tract generates nutritional problems both in the pre-operative, as well as in the post-operative period. Extreme malnutrition leads to the development of the state defined as cancer cachexia (from Greek *cachexia* – "bad condition"). Depending on the type and advancement of the neoplastic process, a decrease in body mass is observed in 30–80% of patients, and significant loss (i.e. loss that exceeds 10% of the initial body mass) – in about 15% of the patients [5, 6].

Researchers still discuss whether nutritional treatment influences the development of the neoplasm. There is no proof which would confirm that the development of the disease accelerates after nutritional treatment has been implemented in the patient. The researchers are, however, confident that non-treated nutritional deficiencies influence the state of the patient negatively, and, as a consequence, lead to death.

Causes and Effects of Nutritional Disorders in Cancer Patients

The location of the neoplasm within the upper part of the respiratory or gastrointestinal tract significantly influences the willingness and possibility for ingesting food. Symptoms observed frequently in head and neck cancer patients include nausea and vomiting, taste and smell disturbances, and saliva secretion disorders. Other causes of nutritional disorders include insufficient supply of food through the natural oral pathway (appetite loss, anorexia, blockage of the food passage within the gastrointestinal tract, adverse drug effects) and increased loss of nutritional substances (absorption and digestion disorders). Also, an increase in nutritional needs is frequently observed in such patients, and is related to the presence of the neoplasm, and fever or infection [7]. Malnutrition results in rapid body mass loss, weakening of the muscles, deterioration in psychomotor and immune function, as well as in digestion and peristaltic disorders. Moreover, impaired wound healing is also observed, as are infections, an increase in hospitalization and recuperation time, which all in turn lead to an increase in treatment costs [8, 9].

As has already been mentioned, the development of a neoplasm is accompanied by several negative processes that influence the state of the human body. Metabolic disorders that result from the development of neoplasms within the head and neck can result not only from cancer cachexia, but also from surgery that has been performed, or chemo- or radiation therapy that has been implemented [10]. It should also be underlined that

the mere diagnosis of cancer evokes negative emotions in the patients. They include, *inter alia*, fear, depression, anger, and the fear concerning functioning in the closest environment and society. These emotions are also fueled by the fear associated with the planned surgical procedure. A group of oncological psychologists from the Department of Oncological Surgery at Medical University of Gdańsk conducted research studies whose aim was to evaluate the emotional state in the group of 91 patients that had been qualified for surgery. It was shown that medium and high stress levels are observed in more than 60% of patients awaiting surgery [11]. Such high stress levels, and the depressed mood resulting from it, may lead to a decrease in appetite and the willingness of eating *per se*. As a result of that, malnutrition is observed in 30–50% of all cancer patients who are admitted to hospitals, and in 70% of them malnutrition becomes more severe within 14 days after admission, which leads to an increase in the incidence of complications that prolong the hospitalization period and increase treatment costs. Improper nutritional status is another reason for a worse response to cancer treatment, and, consequently, to worse prognosis, shorter survival time, and more common occurrence of adverse effects and severe complications [12, 13].

Nutritional Status Assessment

The aim of nutritional status assessment is to identify the patients that are at risk of malnutrition or those who already suffer from it, to determine the type and grade of malnutrition, and later on, to monitor the efficacy of the nutritional therapy implemented [14]. Nutritional status assessment methods include a nutritional interview, anthropometric measurements (current body mass, involuntary body mass loss, BMI – border value, below which nutritional intervention should be implemented, is 18.5 kg/m^2, the diameter of the shoulder, the thickness of the flap over the triceps muscle, grip strength, bioimpedance) and biochemical tests (serum levels of albumin, prealbumin, transferrin, total lymphocyte count). Nowadays, scales such as the Mini Nutritional Assessment, Malnutrition Universal Screening Tool (MUST), Nutritional Risk Screening 2002 (NRS 2002) and Subjective Global Assessment (SGA) are used to evaluate the state of nutrition. The regulation of the Health Ministry, which has been in force in Polish hospitals for 3 years, states that patients who are admitted to the hospital (except for patients admitted to Emergency Units) should have their nutritional status evaluated according to the SGA or NRS 2002 scale. What seems important is the evaluation of nutritional status should be made with the diagnosis and repeated later on, as there is a risk of deterioration in nutritional status over the course of the disease, and during cancer treatment [14].

Nutritional treatment is advisable if an oral diet cannot be implemented for over 7 days, or if the patient exhibits life-threatening malnutrition (BMI < 18.5 kg/m^2, involuntary body mass loss > 10% within 3–6 months preceding the treatment), if there is no possibility of keeping daily food intake at values exceeding 60% of the normal value for over 10 days, if the score achieved in the SGA scale is B or C, or if the outcome in the NRS 2002 screening method is 3 points or more [15].

If malnutrition is observed or if a high risk of malnutrition is ascertained**,** nutritional therapy is implemented. In patients who have been qualified for surgical treatment, the therapy should last 10–14 days prior to the procedure, even if the date of the procedure has to be postponed. The risk of complications is significantly lower and the prognosis much better in patients in whom nutritional status has improved before surgery.

The method of nutritional therapy should depend on the patient's clinical state, the type and grade of malnutrition, and the duration time of the planned therapy. The choice of food administration pathway is also important. Feeding with the use of the GI tract is the method of choice nowadays and includes the oral pathway (both kitchen and industrial diet), gastric feeding tube (with a tube or gastrostomy) or jejunal feeding (using a tube or jejunostomy). Intravenous (parenteral) feeding is used if the pathway of the digestive tract is impossible (total parenteral feeding) or insufficient (partial parenteral feeding), and can be performed with the use of short- and long-term vascular access pathways [15, 16]. Short-term vascular access pathways include non-tunneled catheters inserted into central veins and peripheral venous cannulas. If the latter are used, preparations can be used that have a formulation that makes them suitable to be administered via peripheral veins (low osmolarity). The majority of preparations used for parenteral feeding have high values of osmolarity (> 800mOsm/L), due to which they have to be administered to central veins. Long-term vascular pathways include tunneled catheters of the Broviac type, and intravenous ports. These pathways are used if parenteral feeding has to be used in the long term

Nutritional therapy, which is implemented after the diagnosis of cachexia is made, carries the risk of the patient developing refeeding syn-

drome. Sudden supply of a large quantity of nutrients to the body may cause a cascade of numerous metabolic complications. Hypophosphatemia is particularly dangerous, as the lack of phosphorus makes it impossible for the body to synthesize adenosine triphosphate (ATP). As a consequence of that, the deficiency of energy induces the occurrence of multi-organ failure and death [17, 18].

Nutritional therapy, particularly with the use of the parenteral pathway, is an aggressive treatment and should be under supervision at all times. Before nutritional treatment is begun and while it is performed, the following values should be determined: platelet count, white blood cell pattern, gasometry, blood lipid profile, ionogram, osmolarity and blood concentration of total protein, albumin, electrolytes, glucose, urea, and creatinine. A general urine test is also crucial, as is the determination of its volume. The frequency of tests depends on the primary disease and the state of the patient, as well as on the grade and type of malnutrition, and the time period from the commencement of nutritional therapy (if nutritional therapy has been used for a longer period of time, the tests may be performed less frequently). Monitoring the patient's state makes it possible to assess the efficacy of nutritional treatment, and also to determine the patient's needs [15, 19].

Nutrition in the Pre- and Post-Operative Period

Nutritional issues in head and neck cancer patients affect the patients not only in the pre-operative, but also in the post-operative period. Most frequently, secondary disorders of food intake and absorption are observed in patients after surgical procedures. After resection surgery within the oral cavity and the pharynx, it is related with the limitation of food intake through the natural pathway within a few days after surgery, and this is the time period in which nutritional needs are higher as the nutrients are crucial for healing processes to occur [5].

Early-grade cancer patients are usually treated using one out of two possible methods – surgery or radiation therapy. In patients in more advanced stages of the disease, combined treatment is implemented – surgery with radiation therapy, or radiation and chemotherapy. In complex treatment, radical concurrent radiation and chemotherapy is associated with the risk of developing acute and delayed adverse effects. In 34–43% of the patients in whom radiation therapy was implemented, with or without chemotherapy, acute oral mucositis develops in the irradiated area, which may significantly impede correct nutrition using the natural pathway and is associated with the risk of having to implement an artificial feeding pathway. These changes influence the patient's quality of life as they limit such basic functions as speaking, mastication, and swallowing. Late complications of chemo- and radiation therapy include: oral dryness (xerostomia) caused by the decrease in saliva secretion due to destruction of the salivary gland stroma, fibrosis of masticatory muscles, which leads to trismus, stenosis of the pharynx and the esophagus, which makes it necessary to widen these structures endoscopically, and osteoradionecrosis of the bone. Patients feel constant burning, have problems with denture use, swallowing, and mastication [20, 21].

Along with the occurrence of the first symptoms of the reaction, the patients are advised to abstain from irritating foods, smoking, and drinking alcohol. In order to maintain proper oral hygiene, it is advisable to rinse the oral cavity and the pharynx with a liquid containing glycerol and vitamins, chamomile or sage rinse. These medications make it possible to diminish the local inflammatory reaction. In order to relieve the pain, the patients are advised to used local anesthetics, such as a lignocaine-containing aerosol, or analgesics, e.g. non-steroidal anti-inflammatory drugs. *Candida* spp. (*Candida albicans*), *Herpes* spp. (*Herpes simplex*) and *Varicella* spp. (*Varicella zoster*) infections, which result from significant deterioration of the immune system, are a frequent complication of radiation and chemotherapy [21]. Symptoms related to inflammation within the oral mucosa are exacerbated by significantly smaller amounts of saliva. Irradiation of the neck lymph nodes may also lead to atrophic mucositis of the oral cavity, the larynx and the esophagus. Unfortunately, in the majority of patients after radiation therapy, the changes in saliva secretion are irreversible because necrosis of glandular cells is observed, and because of the fact that the stroma undergoes fibrosis. Trismus is a frequently observed adverse effect of radiation therapy. It usually results from the loss of elasticity and fibrosis of the tissues within the oral cavity. Osteoradionecrosis of the bone is a particularly dangerous complication, and it results from the relaxation and degradation of blood vessels [22, 23].

As has been indicated already, all the above-mentioned symptoms that are observed in oncology patients treated due to head and neck cancer lead to significant impairment in proper nutrition in this patient group. Dietary advice available at each treatment stage should make it easier for the patient to understand the importance and the role of proper nutrition. It is important that the

oncology patients' diet should cover their nutritional needs completely when it comes to proteins, carbohydrates, lipids, vitamins, mineral salts and water. Usually, the patients are advised to eat ordinary alimentary products that are available in shops.

It should also be kept in mind that clear-cut dietary advice should be completely comprehensible to the patient. In cases in which ordinary nutrition may not be sufficient, so-called food fortification is used. This means that the nutritional value of the diet is increased by adding natural products of high caloric value (e.g. butter, cream, chocolate, honey), or adding the mono- or multi-ingredient preparations, prepared industrially, that include proteins, carbohydrates, and lipids [6, 24].

In cases in which the risk of malnutrition is highest, it is crucial that the patient should be prescribed the so-called oral industrial diet. This is a special category of medical food that reflects the ingredients and proportions of an ordinary oral diet. A significant concentration of calories and nutrients, as well as the possibility of adapting the ingredient list of the preparation to one's nutritional needs, comprise the advantage of this diet. Moreover, the simplicity and swiftness of food preparation is also important.

As has been mentioned before, the percentage of cancer patients affected by malnutrition is so high that research aimed at finding a diet that would enable a quick recovery are still being done. The studies by Abdelwahab et al. [25] seem very important, as these researchers attempted to evaluate the influence of a ketogenic diet with limited amounts of carbohydrates on the development of neoplasms in mice. Decreased production of reactive oxygen species in cells was observed, as was a decreased expression of genes that play a role in the transduction of growth signals that play a key role in neoplasm progression [25]. There is little information in the literature concerning the use of a low-carbohydrate diet or low glycemic index diet in human subjects. Fine et al. [26] performed a trial that involved the use of a low-carbohydrate diet (5% of total energy need) for 4 weeks in patients with advanced cancer. It was established that the implemented diet was well tolerated in this group of patients, and the ketosis that was observed in the body led to a decrease in blood insulin levels, as well as a stabilization in the pathological process [26]. Research that has been conducted for a longer period of time showed that the lipids in an everyday diet and the fatty acids that form them, particularly polyunsaturated ones, play an important role in the development and treatment of neoplastic processes. The n-3 family acids, i.e. eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), as well as the n-6 family fatty acids, including γ-linolenic (GLA) and dihomo-γ--linolenic (DGLA) acids of the n-6 family, as well as conjugated linoleic acid, exhibit potential cancer-fighting properties. Some of them, i.e. GLA, DHA, EPA, and ALA, intensify the cytotoxic properties of cancer drugs. It has also been shown that EPA and DHA have an influence on the decrease in concentration of E_2 – prostaglandin – a factor that promotes the development of metastases. Increased concentration of omega-3 acids supports cancer treatment, which has been shown e.g. in an *in vitro* study concerning the influence of omega acids on the growth of neoplastic A459 line cells. It was observed that the proliferation of neoplastic cells was suppressed to various extent depending on the concentration used and exposure time to DHA [27–29].

The health of the cancer patient is influenced not only by appropriate diet, but also by a proper way of food administration. If there is no possibility for the patients to eat by themselves orally, artificial parenteral feeding should be considered [30]. It is commonly believed that artificial parenteral treatment should be considered in cases in which it is ascertained that the intake of food using the natural pathway is going to be insufficient for a time period that exceeds 2–3 weeks. Before a feeding tube is inserted, each case should be considered individually by taking into account the clinical state, diagnosis, prognosis, ethical considerations, the patient's will, and the expected influence of feeding on the quality of life [31]. If the duration time of enteral treatment is expected to last for less than 30 days, it may be performed using a tube (nasogastric tube), or directly to the small intestine (nasojejunal tube) [15, 32]. If the duration time of nutritional therapy is expected to exceed 30 days, gastrostomy or microjejunostomy constitute the access methods of choice. If there is no possibility to perform enteral nutrition, the intravenous access pathway should be chosen. It should be underlined that it should not be used for more than 7 days. As has been mentioned, if parenteral nutrition treatment is going to performed for a longer period of time, long-term central venous access should be ensured in the patient [33–35].

Figure 1 shows a scheme that makes it possible to optimize the choice of food insertion pathway to the GI tract.

Conclusion

Treatment of head and neck cancer patients involves not only pharmacological, rehabilitative and psychological therapy, but also nutrition-

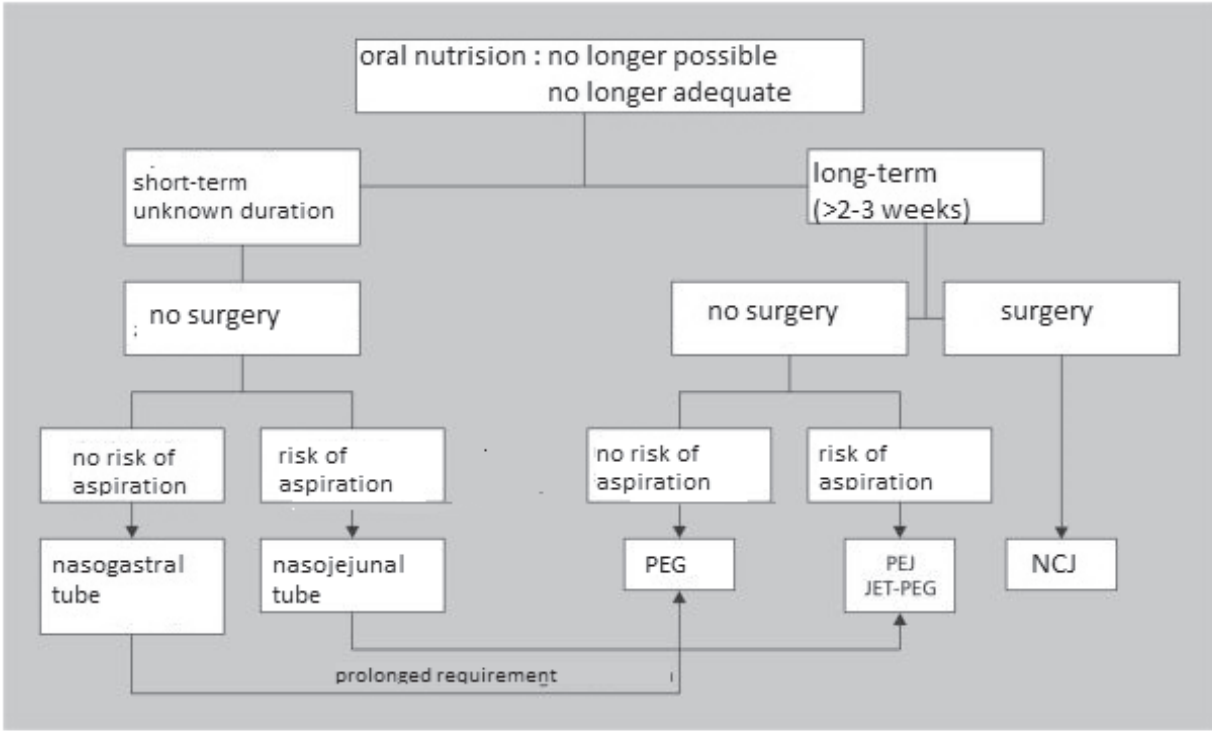

Fig. 1. Decision tree for the selection of the appropriate tube system for the enteral nutrition: PEG (percutaneous endoscopic gastrostomy), PEJ (percutaneous endoscopic jejunostomy), NCJ (needle catheter jejunostomy), JET-PEG (jejunal tube PEG)

al therapy. Even though a lot of these patients exhibit the traits of malnutrition, in many cases the condition remains undiagnosed and has a negative influence on the course of therapy and recuperation. The introduction of standardized algorithms that would enable the identification of patients with malnutrition, and, in turn, enable quick implementation of appropriate nutritional intervention may significantly improve treatment outcomes in patients with head and neck cancer.

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