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Clinical nutrition in oncology: Polish recommendations

Recommendations of:
Polish Society of Surgical Oncology
Polish Society of Oncology
Polish Society of Clinical Oncology
Polish Society for Parenteral, Enteral Nutrition and Metabolism

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ABSTRACT

Malnutrition affects a large section of patients with malignant neoplasm. Proper nutritional treatment determines the effectiveness and success of treatment in these patients. Given the importance of this issue, standards for nutritional therapy in oncology have been set thanks to the collaboration of the following scientific societies: the Polish Society of Surgical Oncology (PTChO), the Polish Society of Oncology (PTO), the Polish Society of Clinical Oncology (PTOK) and the Polish Society for Parenteral, Enteral Nutrition and Metabolism (POLSPEN). An introduction to nutritional therapy is the correct identification of malnourished patients. In Poland, hospitalized patients are subject to screening towards malnutrition. Nutrition intervention should be tailored to the clinical situation. This involves the use of dietary advice, the use of oral diet products (oral nutritional support), enteral or parenteral nutrition, in hospital or at home, in consideration of special situations.

Key words: nutrition therapy, oncology, enteral nutrition, parenteral nutrition

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1. Introduction

Malnutrition is a serious problem in patients with cancer. Symptoms and signs of malnutrition or emaciation are observed in 30–85% of patients, most frequently they accompany an advanced disease. In 5–20% of patients emaciation is a direct cause of death in the terminal stage of the disease.

The incidence of malnutrition and emaciation depends on the type of cancer, its clinical stage and the patient's age. The most exposed to emaciation are children and elderly people, patients with cancer of the gastrointestinal tract (especially stomach, esophageal and pancreatic cancer), cancer of the head-and-neck region, lung cancer and prostate cancer. The severity of disorders is often proportional to the clinical stage of a disease. The result of malnutrition is the increased incidence of complications, including mortality, the extension of the time of hospitalization and a significant increase in health care costs.

It must be emphasized that there is no clinical data indicating the risk of accelerated proliferation of a tumor

and disease progression as a result of the use of clinical nutrition. It is also known that a starvation does not stop the progression of a cancer, but significantly declines the patient's performance status. As a consequence, death from malnutrition may occur faster than due to the disease itself.

2. Pathogenesis

Although, in most cases, malnutrition is a result of an insufficient supply of nutritional products, it may also develop as a result of an increased demand for those nutrients or their loss. In patients with cancer, malnutrition is most frequently the result of cachexia, which is a syndrome of disorders caused by systemic inflammatory reactions secondary to the presence of a tumor in the body. Cachexia in cancer is a complex phenomenon — there are many factors participating in its pathogenesis, among which we distinguish:

- alimentary disorders regarding the oral route (appetite loss secondary to a chronic inflammation, mechanical impediment of food passage in the gastro-intestinal tract);
- increased loss of nutrients (absorption or digestion disorders, the exudative enteropathy or the presence of fistula in the gastro-intestinal tract);
- metabolic disorders (increased activity of the Cori Cycle, increased protein degradation, metabolic disorders of carbohydrates and lipids);
- over-reactivity of inflammatory responses as a result of pro-inflammatory cytokine activity, e.g. tumor necrosis factor type α (TNFα) or interleukine 1b and 6 — IL-1b and IL-6);
- increased catabolic processes caused by circulating factors, e.g. lipid mobilizing factor (LMF) and protein mobilizing factor (PMF);
- increased requirements related to cancer and existing comorbidities (for example infection);
- increased energy expenditure (typically low — 100–300 kcal/day — however still possibly related to loss of fat tissue of 0.5–1 kg per month or muscle tissue of 1–2.3 kg per month in cases of a lack of compensation by increased intake);
- side effects/adverse events of anti-cancer treatment (loss of appetite, loss of sense of taste and smell, nausea and vomiting, diarrhea).

3. Nutrition assessment

3.1. Screening

The cause of the screening is to identify patients with malnutrition, persons being in danger of malnutrition or at high risk of nutrition disorders. Screening tests for malnutrition are obligatory in Poland in all hospital departments — there are questionnaires to be completed at patient's admission to the hospital: SGA (Subjective Global Assessment) or NRS 2002 (Nutritional Risk Screening) — both must be repeatedly completed every 14 days of the hospitalization.

The construction of NRS 2002 questionnaire allows for the assessment of nutritional risk and points to an indication for nutritional intervention at the same time; the result is presented on numeric scale of 0 to 7 points (attachment 1). Four questions refer to nutritional status before hospitalization and the other four questions are used to assess the potential influence of the risk factors of proposed treatment. Patients who are over 70 are given an additional point into the global assessment. A result that is higher than 3 points is the indication for the introduction of a nutritional intervention.

The other tool used for risk assessment is SGA questionnaire (attachment 2). Based on its results, the patient is qualified to one of the following groups: those with normal nutritional status, those with suspicion of malnutrition or moderate malnutrition, cachexia of severe nutritional risk (the last term may be presented in some scaled versions).

Another questionnaire — the MUST questionnaire (Malnutrition Universal Screening Tool) is recommended by BAPEN (the British Association for Parenteral and Enteral Nutrition) for the assessment of adults for malnutrition. In the elderly, the use of the mini-scale for nutrition (MNA — Mini Nutritional Assessment) is recommended.

It is suggested in the literature to combine several questionnaires that allows one increase the sensitivity of the detection of malnutrition.

3.2. Assessment: medical history, questionnaires, laboratory tests and antropometric examination

In cases of risk of malnutrition or its presence, an assessment of one's nutritional state should be performed. In clinical practice, this consists of taking the medical history of the condition, filling out the questionnaires, the performance of anthropometric examination and laboratory tests. The nutritional status assessment is always based on several methods.

3.2.1. Medical history

The medical history is the simplest element of nutritional status assessment. It is based on the evaluation of the potential presence of signs that accompany malnutrition (Table 1). An important element of the assessment is information on the duration of the symptoms. Some of them can be specific to certain diseases and may be indicative of a diagnosis (for example dysphagia in the course of esophagus tumors).

Table 1. Signs of malnutrition

Time of impaired oral intake
Weight loss during last 3 months
Nutritional habits and its changes
Loss of appetite, dysphagia
Concomitant medications
Bone pain, muscle pain
Diarrhea
Fatigue
Emotional depression
Insomnia/sleep disorders

Table 2. BMI as a marker of nutritional status

Malnutrition	< 18.5
Risk of malnutrition	18.5–20
Normal	20–25
Overweight	25–30
Obesity	> 30

3.2.2. Questionnaires (scales)

The questionnaires used for the assessment of nutritional status are the same as used for screening for malnutrition. According to ESPEN (the European Society for Clinical Nutrition and Metabolism) the NRS 2002 questionnaire is preferred for the assessment of hospitalized patients and enables the evaluation of nutritional risk. Another tool recommended for the assessment of adults is the MUST questionnaire based on the relationship between impaired nutritional status and impaired organism function.

It is suggested in the literature to combine several questionnaires in order to increase the specificity and the sensitivity of the assessment.

3.2.3. Physical examination

One should pay attention to potential signs of cachexia, loss of fat tissue, gingival inflammation and stomatitis during physical examination. There are pleural effusions, ascites, pain and loss of muscle tissue present in the state of severe malnutrition. The distinct and specific clinical scenario is observed in cases of marasmus or kwashiorkor malnutrition.

3.2.4. Anthropometric examination

The basic procedure is an assessment of body weight. Another parameter to be assessed is BMI (body mass index).

$$\text{BMI} = \frac{\text{body weight (kg)}}{\text{body height (m)}^2}$$

BMI is a simple tool that is useful in the assessment of nutritional status (Table 2). However, it should not be used neither in pregnant women, children and the elderly, nor in patients with highly developed muscle tissue either. It is not a reliable marker in several pathological conditions as generalized oedema or ascites.

It is necessary to calculate the adequate body weight to plan the nutritional treatment correctly. This can be done, for example, according to Broc's formula:

$$\text{ideal body weight} = \text{body height (cm)} - 100$$

or more precisely using Lorentz's formula (persons aged between 20 and 40) for men:

$$\text{ideal body weight} = \text{body height (cm)} - 100 - [\text{body weight (cm)} - 150]/4$$

and for women:

$$\text{ideal body weight} = \text{body height (cm)} - 100 - [\text{body height (cm)} - 150]/2$$

The anthropometric test that describes nutritional status is a fat tissue fold measurement. The test is based on assumption that the fat tissue is 20–25% of total body weight and about 50% of this tissue is located in the subcutaneous compartment. The measurement is taken over the triceps of the non-dominating extremity. Based on this measurement the fat tissue reserves are described, while the result is adjusted for such factors as sex and age taken from specific nomograms. The other anthropometric test is the measurement of arm perimeter or the strength of the handgrip.

The measurement and analysis of BIA (bioelectrical impedance analysis) is a novel method to evaluate the body's composition. The test is based on measurement of differences in impedance of tissues that conduct the electricity of low intensity that allows assessment of fatty and non-fatty body weight. This method is non-invasive and gives reproducible results.

3.2.5. Biochemical tests

Biochemical tests allow the reproducible and objective evaluation of nutritional status. Tests for: albumin, prealbumin, transferrin, and total lymphocyte count are the most often performed (Table 3).

Albumin — a low concentration of albumin is the consequence of malnutrition only in some cases. If hypoalbuminemia is found, an effort to diagnose the problem should be made. Albumin half-life is 21 days.

Transferrin — transferrin is more helpful than albumin concentration in the evaluation of the protein turn-over in the organism. However, it always should be taken into account that there are several factors that may

Table 3. Biochemical markers and nutritional status

Malnutrition	Albumin	Transferrin	Prealbumin	TLC
Normal	> 35 g/L	> 200 mg/dL	> 20 mg/dL	1500–2000
Mild	30–35 g/L	150–200 mg/dL	10–20 mg/dL	1200–1500
Moderate	24–29 g/L	100–150 mg/dL	5–10 mg/dL	800–1200
Severe	< 24 g/L	< 100 mg/dL	< 5 mg/dL	< 800

TLC — total leukocyte count

Table 4. Indications for nutritional treatment

1	The lack of ability to introduce oral alimentation for a period of time longer than 7 days
2	Existing or potential malnutrition (BMI < 18.5 kg/m^2, unintended weight loss > 10% during 3–6 months before the introduction of treatment)
3	The lack of ability to maintain an oral intake that exceeds 60% of that recommended for a period of time longer than 10 days
4	Grade B and C on the SGA scale or the result of at least 3 points in the screening method based on NRS 2002

Table 5. Signs of the high nutritional risk

1	A reduction in body weight of > 10–15% during a time period of 6 months
2	A (relative) body mass index (BMI) of < 18.5 kg/m^2
3	An albumin serum concentration of < 30 g/L (without the impairment of liver function or kidney function)

influence the transferrin concentration such as e.g. low iron concentration. The half-life of transferrin is 8 days.

Prealbumin — is a good indicator of nutritional status, mainly due to its short half-life duration (2 days) and its low pool in the human body.

Total lymphocyte count — this test is based on the fact that there is an impairment of the immunological barrier in a state of malnutrition. The total lymphocyte count can be calculated from the formula:

Total lymphocyte count (TLC) = (% lymphocytes × leukocyte count)/100

Nitrogen balance — this test is based on the measurement of 24-hour loss of nitrogen in the urine. An adverse nitrogen balance may indicate a lack of balance in nitrogen turn-over and point to catabolism.

4. Nutritional intervention

The choice of treatment method is based on analysis of the patient's clinical status, grade and type of malnutrition, planned duration and clinical stage (preoperative, postoperative) of nutritional intervention.

There is no doubt, that the method of choice is feeding via the gastrointestinal tract (enteral nutrition), which consists of:

— oral feeding (with or without enrichment of standard diet — so called fortification of the diet);
— use of oral nutritional supplements (sip feeding);
— gastric feeding (via catheter or feeding stomy — gastrostomy);
— enteric feeding (via catheter or feeding stomy — jejunostomy);

In patients with an indication for nutritional treatment with inadequate calorie intake (at least 60% of daily allowance) via enteral access — for example in cases of fistula in upper alimentary tract — combined parenteral and enteral nutrition is applied.

The parenteral nutrition is used in cases when feeding via alimentary tract is impossible (complete parenteral nutrition), or restricted (partial parenteral nutrition).

4.1. Indications

Nutritional treatment is undertaken in patients (Table 4):

1. who cannot be supported with an oral diet for longer than 7 days;
2. with existing malnutrition or in those at risk of malnutrition (BMI < 18.5 kg/m^2, unintended weight loss > 10% during 3–6 months before introduction of the treatment);
3. not able to maintain an oral intake that exceeds 60% of the recommended daily intake for >10 days;
4. with scores of grade B and C on the SGA scale or a result of at least 3 points in screening method based on NRS 2002.

Special attention should be paid to the group of patients with high risk of malnutrition (Table 5), that includes patients being prepared for surgical treatment, in whom at least one of the above-mentioned disorders is ascertained.

All patients that belong to nutritional high risk group should receive nutritional treatment as soon as possible but only after their metabolic balance has been achieved. The intensity of nutritional intervention in this group

at the beginning (1–2 days) should not exceed 50% of the calculated total daily supply. This prevents from the occurrence of a severe complication called refeeding syndrome.

4.2. Definitions

Pre-cachexia is the complex syndrome that accompanies chronic diseases including cancer characterized by: unintended body weight loss of less than 5% over the previous 6 months, anorexia, chronic or recurrent generalized inflammatory reaction.

Immediate nutritional intervention should be undertaken at this point. The first line of intervention is nutritional consultation and oral nutritional support (ONS).

4.2.1. The rule of completeness

Parenteral nutrition may be fully efficient only if all needed substrates are delivered to the body namely: amino acids, glucose, fatty acids emulsion, dietary minerals/electrolytes (Na, K, Ca, Mg, Cl, P), trace elements, vitamins (retinol, calciferol, tocopherol, vitamin K, thiamine, riboflavin, pyridoxine, vitamin B12, pantotenic acid, folic acid, niacin, ascorbic acid) and water.

For this reason, there is classification used in clinical practice:

— total nutrition — delivery of proteins and energy as well as ions, vitamins, trace elements and water,
— incomplete nutrition — not fulfilling the rule of completeness.

4.2.2. Immunomodulatory factors

The aim of immunomodulatory substrate use is to improve the effect of nutritional treatment by its influence on the immune system. The intended result of immunomodulatory intervention is: delivery of necessary substances responsible for the function of the immunological barrier, elimination of inflammation and reduction of generalized inflammatory reaction accompanying cancer.

Immunomodulatory agents include: glutamine, arginine, nucleotide acids, omega-3 fatty acids. The mechanism of action of distinct substances is unclear. Although the negative effect of immunomodulatory factors in cancer patients has not been proved, it needs to be emphasized that there is a lack of confirmation of its positive effect in large multicenter randomized clinical trials.

Glutamine — represents the body's main nitrogen reservoir and is utilized especially by dynamically proliferating cells. It is believed that deliverance of glutamine to cancer patients allows the correct function of immune cells and epithelial cells of the intestinal mucosa. However, some literature that has been published recently shows the negative effect of glutamine (in *in vitro* studies) in some breast cancer cell lines.

Argninine — is a substrate in protein synthesis and is necessary in many metabolic reactions. Its deficiency is often caused by large injuries and cachexia. It positively influences wound healing.

Nucleotide acids — the supplementation of nucleotide acids is necessary especially in states of increased metabolism. It is believed that the nucleotide supplementation reduces the time needed for the regeneration of enteric villi and improves the function of the immune system.

Multi-unsaturated fatty acids

As the synthesis of multi-unsaturated fatty acids is impossible in the human body, their supplementation seems essential. A high concentration of these acids is found in oils and in the muscle tissue of marine fish that eat algae. In the human body, it is present in the phospholipids of cell membranes and takes part in cell growth and differentiation and interferes with inflammation and immunological processes. Indeed, omega-3 fatty acids can restrict inflammatory reactions while derivatives of fatty acids from the omega-6 group have pro-inflammatory activity. There is some literature to confirm the anti-cancer effect of multi-unsaturated fatty acids.

4.3. The daily allowance

The protein intake of an adult should be at a level of 0.8–1.5 g/kg of body weight/day and with an energy intake of 25–35 kcal/kg of body weight/day. Patients with severe cachexia should receive 35–45 kcal/kg of body weight/day and 2–3 g of proteins/kg of body weight/day. The diversification of the energy intake coming from distinct macronutrients should be as follows: carbohydrates — 35–50%; lipids — 30–50%; proteins — 15–20%.

The daily allowance should be calculated with an adjustment to the ideal body weight. The simplest formula to calculate the ideal body weight is the body height (–) 100.

The nutritional treatment should be complete as only under this condition it is effective and all ingredients of a correct diet including electrolytes, vitamins and trace elements should be provided in the amount that reflects the recommended daily allowance (RDA).

In case of the enteric nutritional intervention this rule is fulfilled if a diet based on nutritional supplements is provided in the amount adequate to each kilogram of the ideal body weight per day. In parenteral nutritional intervention, an intravenous nutritional solution should be chosen (three-compartment bag or a solution prepared during mixing process by the nutritional section of pharmacy department in the hospital).

Table 6. Daily allowance for electrolytes

Sodium	1–2 mM/kg
Potassium	0.5 mM/kg
Calcium	0.1 mM/kg
Magnesium	0.1–0,2 mM/kg
Phosphorus	0.1–0,5 mM/kg

The daily demand for the dietary minerals is presented in Table 6, and demand for water (for an adult patient) usually does not exceed 30–40 ml/kg of body weight/day.

4.4. The choice of route for administration of nutritional support and general strategy for intervention

The choice of route for the administration of nutritional support is the fundamental question while planning the intervention. A general schedule of intervention is presented on Figure 1.

4.4.1. Enteric nutritional treatment

4.4.1.1. Oral enteric nutritional treatment

Dietetic counselling

The dietetic consultation is the first step of nutritional intervention. According to ESPEN guidelines, the relevance and effectiveness of dietetic consultation in cancer patients is of Category A in evidence-based medicine (EBM). Nutritional support should be routinely used as a part of the complex treatment of cancer patients. A properly scheduled dietetic consultation is safe for the patient, the most simple and cheapest way for maintaining and/or improving of patient's nutritional status and is suitable for the majority of patients. It is recommended to introduce a dietetic consultation at every step of the oncology treatment: from the diagnosis, through the period of active treatment (regardless of the treatment modality that is being conducted), the recovery, in secondary prophylaxis or palliative care. It is important to take care of patients after the completion of oncologic treatment (so-called the special groups), who, while actually are free from the cancer, are still suffering from severe malnutrition due to their changed anatomy and/or disturbed physiology of the alimentary tract (for example patients with cancer of the head and neck region or cancer of the upper part of alimentary tract). In turn, the prevention of obesity and its treatment are extremely important as a part of the secondary prophylaxis (the risk reduction for recurrence) in postmenopausal women with estrogen-dependent breast cancer.

Each dietetic consultation must contain:

— an analysis of medical records/documentation;
— a detailed medical history addressing the nutritional problem;
— an evaluation of nutritional status;
— a calculation of the demand for macro- and micronutrients;
— a decision regarding the diet recommendations (a diet based on regular products, fortification/enrichment of the diet, oral nutritional supplements [ONS]);
— the dispensing of recommendations that are readable for the patient and its introduction into the patient's specific medical records.

Decision regarding the diet recommendations

Dietetic recommendations must cover the patient's allowance for basic dietetic ingredients: proteins, carbohydrates, lipids, vitamins, mineral substrates and water. It is not allowed to use diets that eliminate the basic macro-elements, especially protein eliminating diets. However there are some clinical conditions that require modifications of the quantity and quality of proteins, lipids and carbohydrates to be provided.

The dietetic consultation may result in recommendations that are based on regular and food products commonly available on the market or the diet based on the fortified natural products or the oral nutritional supplements (ONS).

The fortification of the diet

The fortification ("enhancement") of the diet is the way to increase nutritional value of the diet by:

1. the addition of natural products with high calorie-density (for example butter, cream, chocolate, honey, egg yolk, oils, coco-nut milk, dense cereals, ground nuts, meat etc.);
2. the addition of industrially prepared products — made of one or several ingredients. The simple products contain proteins, carbohydrates or lipids, while complex products — different combinations of the aforementioned macro-components, usually with the addition of vitamins and minerals. Due to the patient's restricted appetite and complaints, it is often necessary to change the texture of the diet during the process of diet fortification, as well as the volume and frequency of the meals. The process of diet fortification should always be supervised by the medical staff. A diet that is improperly fortified cannot cover the requirement for nutritional ingredients and/or disturbs the balance between them. Moreover, it may yet become a deficient diet and — in cases of improperly prescribed ONS — have a negative impact on symptoms from the digestive tract (for example, the exacerbation of diarrhea).

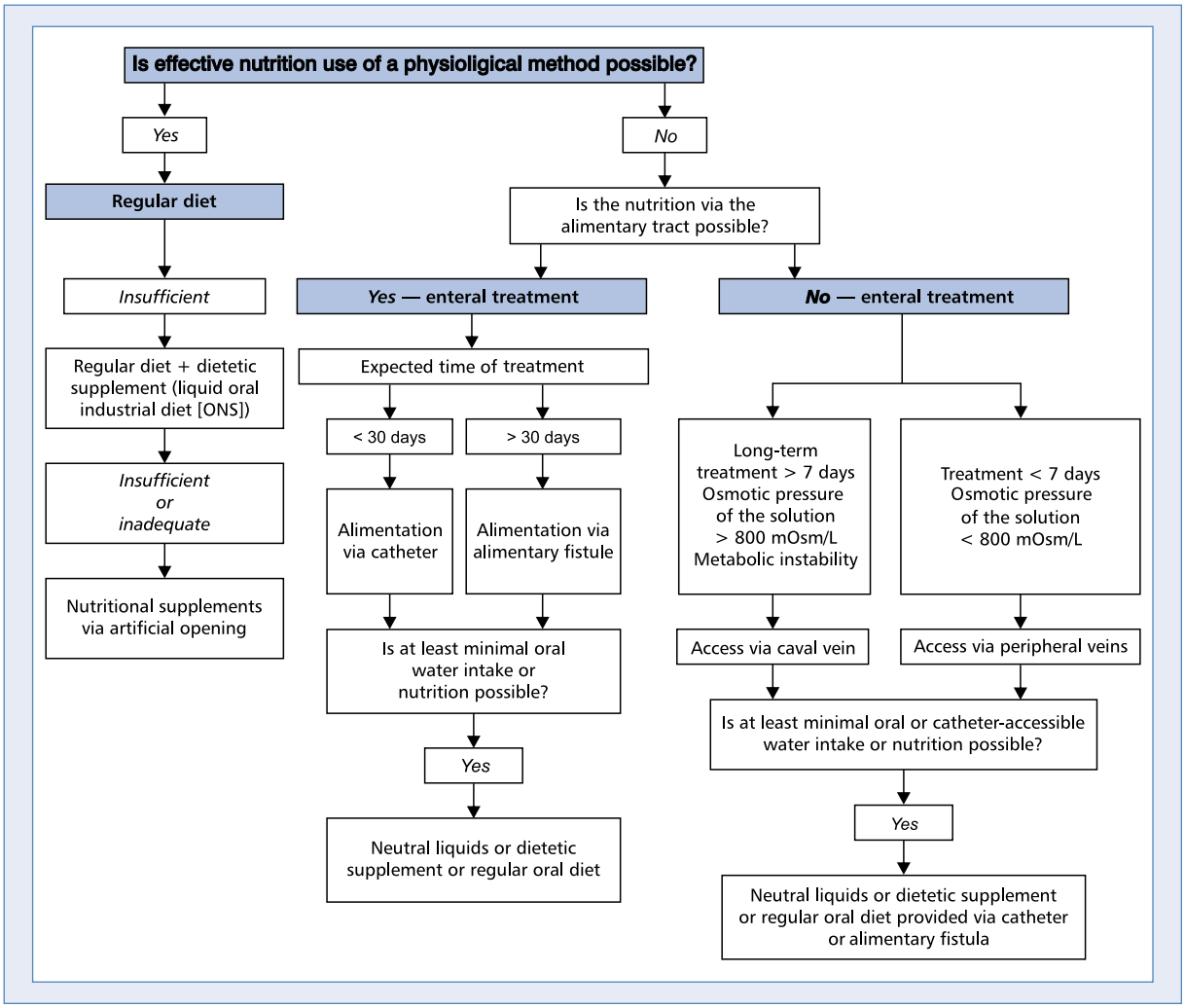

Figure 1. An algorithm for choosing the method of nutritional treatment

Dispensing the recommendations to the patient

Dispensing of recommendations should be done in the way that is fully understood by the patient and/or his/her family. The clear recommendations (optimally written) regarding what should be eaten, how often and the consistency of the meals should be given. It can be helpful to provide the exemplary menu and education brochures. The patient should be instructed how to fortify ("enhance") the diet and about the rules concerning the use of oral industrial diets. The ONS that is adequate to the clinical problem faced by the patient should be chosen. In cases supported by clinical counseling and the nutrition team, the consultation should be put into the patient's medical records.

Oral industrial diets (ONS)

Oral industrial diets are a special category of medical nutrients dedicated for nutritional support of patients diagnosed with malnutrition or being at risk of malnutrition. They should be introduced into the diet under the supervision of professional medical staff (directive of European Union 1999/21/EC 25.03.1999). Medical doctors, registered dietitians, pharmacists and specifically qualified nurses are obliged to supervise the process (including prescription and monitoring of the effects of the intervention).

The formulae of the ONS type may be incomplete or complete in terms of their composition (it may contain only selected or all macro- and micro-components). There are standard formulae (reflecting the composition and proportions found in a normal oral diet) or special formulae (prepared to reflect the nutritional needs arising from specific diseases — diabetes mellitus, renal insufficiency etc.) that can be distinguished.

Oral nutritional supplements exist as liquid diets (milk or fruit cocktails), soups, instant formulae, tablets as well as bars, cakes and other products.

They can support the use of the natural diet while some of them can completely replace it.

The most important advantages of ONSs are as follows:

1. concentration of calories and nutritional products in a small volume;
2. comfort of use: balanced formulae — ready for use, not requiring the complex culinary preparations, allowed to be mixed with natural products, cooled down or gently warmed-up;
3. the possibility to customize the formula to specific nutritional requirements secondary to the underlying disease, for example low-protein products for patients with renal insufficiency not requiring dialysis etc.;
4. they do not contain potentially harmful substances (lactose, gluten, purines, cholesterol); there is a possibility to choose products with or without fiber dependent on the clinical indications;
5. they are packed in sterile conditions (UHT sterilized) what means that they are free of bacterial contamination.

Indication for use of oral industrial diets

Products of the ONS type are indicated in every patient who is not able to cover his individual allowance for nutritional components with a natural diet. The use of ONS-type products is indicated in patients who fulfill two conditions:

1. fully control the act of swallowing (the patient with dysphagia requires the diet of a special texture or the oral alimentation is completely impossible);
2. enteral nutrition is possible; none of the following are present: ileus, severe inflammation of the intestine or its insufficiency, fistulae of the alimentary tract, uncontrolled vomiting.

The basic macro-substrates used for production of ONS are isolated from the natural products. The ONS formulations contain the addition of vitamins, minerals as well as so-called special ingredients (for example glutamine, arginine, nucleotides, omega-3 fatty acids, anti-oxidants).

Based on the calorie intake, three different types of diets can be distinguished:

— hypo-caloric (0.5–0.9 kcal/ml of the solution),
— iso-caloric (1–1.12 kcal/ml of the solution),
— hyper-caloric (1.3–2.4 kcal/ml of the solution).

The hypo-caloric diets are rarely used and their use is usually restricted to cases when patients are being prepared to undergo surgery (products with carbohydrates and dietary minerals).

The iso-caloric complex ONSs are used in cases of diabetes mellitus, in patients who are cachectic, as well as who have been starving for a long time. In the latter, iso-caloric ONS are used to prevent the development of refeeding syndrome during an adaptation period when full allowance for proteins and energy is gradually reached. Clinical experience shows that iso-caloric diets are better tolerated by patients after surgery on the alimentary tract, especially after a gastrectomy, resections of the pancreas or if an ileostomia has been formed. The iso-caloric diet for an adaptive period can then be replaced with hyper-caloric one.

The hyper-caloric diets are used in patients with malnutrition, decreased appetite, those who cannot cover their allowance for proteins and energy with the regular diet. Their major disadvantage is a high osmotic pressure that can provoke diarrhea, flatulence or nausea.

The proper choice of ONS formulae that match the requirements and abilities of a patient's alimentary tract is crucial. An ONS of inappropriate choice can not only provoke symptoms but even increase the grade of malnutrition and make the patient reject this kind of nutritional support.

Nowadays, there are several types of ONS products that can be introduced in cases of: diabetes mellitus, renal insufficiency, cancers, liver disorders, disorders of the pancreas and biliary tract, Alzheimer disease as well as immunomodulatory products, products used for preparation for surgery and many others.

4.4.1.2. Enteral nutritional treatment via artificial access

Enteral nutritional treatment via artificial access to alimentary tract is indicated in all patients who cannot receive oral nutritional support. The most common reasons for its use in cancer patients are:

— dysphagia caused by a tumor,
— mucosal reactions and side-effects of radio- and chemotherapy for head-and-neck tumors,
— early post-surgery period and treatment of surgery complications in the region of upper part of alimentary tract.

Enteral treatment is contraindicated in patients with the intestine impairment caused by:

— ileus,
— absorption disorders and fistulae,
— severe shock,
— intestine ischemia,
— uncontrolled diarrhea and vomiting.

The enteral nutrition may be (depending on the indications) administered to the stomach or into the intestine. The choice of access to the alimentary tract depends on the type of the cancer being treated, its clinical stage and expectations regarding the duration of the treatment. Additionally, the choice of the access should take into consideration the possibility of its use by the patient and quality of life, the type of scheduled treatment, as well as the reimbursement options.

Naso-gastric tubes and naso-enteric tubes

When the expected duration of the treatment is shorter than 30 day the naso-gastric or naso-enteric tube is the access of choice. Thanks to its small diameter it is possible to lead the catheter under an endoscopic control through narrowings that cause severe dysphagy in patients who are planned to undergo surgery after a preparation period lasting a couple of weeks.

The total liquid artificial diets dedicated to enteral feeding should be used for nutritional treatment via tube. It can be administered as gravity infusion or with use of special peristaltic pumps. It is recommended to start the infusion at rate of 10 ml/hour and then gradually increase the rate to reach the required supply during the next 5–7 days. Although, it is also possible to administer the diet in boluses of 200–300 ml each, it should be used in cases of gastric tubes only.

The restrictions regarding the use of feeding tubes are related to their diameter and, secondly — the possibility of being blocked in case of incorrect care; the unintended removal of the tube by the patient; the need to administer other concomitant medications in liquid formulation or properly prepared suspension.

Gastrostomy

Gastrostomy is the direct access to the stomach created surgically (formal or laparoscopic) or by endoscopy (PEG — percutaneous endoscopic gastrostomy). PEG is used as the access of choice because it is less invasive and easy to take care of. Both in case of an endoscopic or an open gastrostomy it is recommended to use special sets during its implantation. The catheters dedicated for of other medical indications should not be used.

The indication for gastrostomy is an expected necessity of feeding for longer than 30 days.

The endoscopic implantation of the gastrostomy is contraindicated in patients with:

— a severe coagulation disorders,
— the peritoneal dissemination of the cancer,
— a peritonitis or the severe ascites,
— interposition of visceral organs within the abdominal cavity.

The common complications of gastrostomy are as follows:

— wound infections and infections in the region of the gastrostomy opening,
— feeding tube obstruction,
— leak of the gastrostomy,
— gastrostomy drop-out,
— buried bumper syndrome.

Feeding via gastrostomy can be done as bolus injections of 200–300 ml 5–6 times a day, as microboluses of 50–100 ml injections or as a continuous infusion with a rate of 20–30 ml/hour.

Artificial diets are recommended to be used during the gastrostomy nutritional support. Although it is also possible to use a regular mixed kitchen diet, it is more difficult, and calculation of the nutritional value of such a mixture is problematic. In addition, it is not possible to get reimbursement from Polish national healthcare insurer (*Narodowy Fundusz Zdrowia*, NFZ) for this form of nutritional support.

Microjejunostomy

The microjejunostomy is used in patients who require the nutritional support for longer than 30 days. It should be the access of choice when the installation of a gastrostomy is impossible or contraindicated, as well as in cases when the stomach is planned to be used during surgery on the esophagus and/or the oesophago-gastric junction to restore alimentary tract continuity. It can be installed during formal or laparoscopic surgery or with use of specialized sets for needle catheteric jejunostomy.

Only sterile artificial diets can be administered into the intestine that have its composition and osmotic values customized to the physiological conditions of the jejunum. These diets should only be administered as continuous gravity infusions or with the support of peristaltic infusion pumps at a starting rate of 10 ml/hour which is gradually increased during the subsequent 5–7 days. The administration of the nutrient mixture in bolus or rapid infusion may cause intolerance of nutritional support presented as diarrhea, abdomen pain and flatulence.

4.4.2. Parenteral nutritional treatment

If enteral nutritional treatment is impossible it has to be administered with parenteral access. The parenteral nutrition can be the only way to provide the nutritional substances — then it is called total parenteral nutrition (TPN) or as the addition to enteral nutritional treatment or oral diet — then called the partial parenteral nutrition. In all cases, the method of all-in-one should be used.

This enables one to achieve better tolerance of nutritional support, a reduction of infection rates and better cost-effectiveness. The all-in-one strategy allows the use of the hospital's own formulae prepared by mixing of available products, mixtures prepared in internal pharmacy departments in mixing devices or can be based on prefabricated ready-for-use bags (tri-compartment).

The parenteral nutritional treatment can be administered with the use of:

— catheter inserted into central vein with its end usually located at the junction between the superior caval vein and the right cardiac atrium — know as parenteral nutritional treatment with central access;

— catheter inserted into a peripheral vein, usually on the forearm — known as parenteral nutritional treatment with peripheral access;
— arterio-venal anastomosis used for dialysis or created with the intention for nutritional treatment in patients who cannot be implanted with a catheter into the central vein;
— vascular port (totally implanted device, TID).

The duration of the nutritional support with peripheral vein access should not be longer than 7 days. Otherwise, it is used only in cases when central access is not possible. Parenteral treatment is administered as continuous infusion (22–24 hours/day) or in cyclic schema (12–18 hours/day).

Adverse events of parenteral nutritional treatment may be related to venal access (technical or infectious complications), as well as to the secondary metabolic disorders. The most often are an imbalance of glycemia and hydro- and electrolyte homeostasis. One of the most dangerous complications is refeeding syndrome. However, adhering to the rules of nutritional treatment helps to minimize the risk of its complications.

4.5. Refeeding syndrome

The refeeding syndrome is a life-threatening multiorgan-dysfunction syndrome of the cardio-vascular system, lungs, liver, kidneys, neuro-skeletal system, as well as metabolic and hematologic disorders caused by incorrect nutritional resuscitation of persons with severe malnutrition. The huge and sudden supply of glucose and another energy substrates is fundamental for metabolic pathogenesis of the syndrome. As the phosphorus is the essential substrate for adenosine triphosphate (ATP) synthesis catalyzed by ATP-synthetase, it is hypophosphatemia and a general phosphorus deficiency in whole body that leads to these metabolic disorders. The lack of the energy reduces the efficiency of the ion pump (ATP-ase Na^+/K^+) responsible for maintaining of the membrane's electrostatic potential. The imbalance between albumin degradation and its synthesis leads to hypoalbuminemia and then to fluid shift and its retention in the body. The clinical signs of multi-organ failure occur. There are signs of circulatory insufficiency, cardiac arrhythmias, while the risk of ventricular arrhythmias and sudden cardiac death is increased. The energy deficit leads to diaphragm malfunction, as well as that of other muscles responsible for the act of respiration with respiratory insufficiency occurring. Anemia due to an iron deficit and increased erythrocyte destruction can be observed. Innate immunity is impaired lading to an increased risk of infection. Muscle strength and their efficiency are reduced due to protein degradation and muscle atrophy arises. Signs of Wernicky's encephalopathy may occur. Moreover, circulatory and respiratory insufficiency may lead to death.

The high risk of the syndrome is observed in patients with at least 10% weight loss within 1–3 preceding months, who are less than 70–80% of their appropriate body weight, have visible muscle atrophy or complain of chronic dysphagia. There are also patients suffering from uncontrolled nausea, vomiting or diarrhea resulting in restrictions in oral nutrition. Starving that lasts longer than 7 days or insufficient supply of vitamins, microelements and electrolytes (in an amount that is inadequate against one's needs), while enteral and parenteral nutritional treatment that lasts longer than 10 days also increases the possibility of refeeding syndrome.

In adults with a high risk of the syndrome, the nutritional treatment starts with an assessment of the daily energy demand at a level of 25–75% that is 5–20 kcal/ kg of body weight/day. The nutritional value of the diet is increased gradually by 10–25% per day during 3–10 consecutive days which makes about 200–250 kcal per day. If the signs and symptoms of refeeding syndrome occur the nutritional treatment should be reduced or withheld until their resolution. The treatment can be restarted at a half of the initial rate. The supply of the vitamins (B group vitamins are crucial here especially vitamin B1) and microelements is the means of refeeding syndrome prophylaxis, as well as the careful monitoring of fluid balance with cardiac function and changes of body weight on a daily bases.

Active and properly organized multidisciplinary nutritional support teams play an extremely important role in the prophylaxis and treatment of refeeding syndrome.

4.6. Treatment monitoring

The monitoring of a patient's status is essential both before the start and during nutritional treatment. The monitoring of serum biochemical parameters is especially important in cases of parenteral treatment. The spectrum of this monitoring — anthropometric examinations and biochemical tests — should always dependent on the patient's performance status, comorbidities (diabetes mellitus, liver insufficiency, renal insufficiency), the stage of the underlying disease and the presence of potential complications.

4.6.1. Monitoring before nutritional treatment

The patient's nutritional and metabolic status (Table 7) should be assessed before the treatment begins.

4.6.2. Monitoring during the nutritional treatment

Clinical inspections with fluid balance, body temperature and body weight measurements are performed daily during the nutritional treatment. Table 4 presents the schedule of routine laboratory tests performed in patients during nutritional treatment.

Table 7. Laboratory tests performed during parenteral nutritional treatment

Test	Before treatment	Just on treatment	During the treatment
Gasometry (in case of parenteral treatment)	Yes	Yes	1–2 times a week
Ions: Na, K, Mg, Cl, P)	Yes	Yes	
Glicaemia	Yes	Yes	In urine every day
Total protein, Albumin	Yes		Once a week
Urea, creatinine	Yes	Yes	Once a week
AspAT, AlAT, GGTP, bilirubin	Yes		Once a week
Haematology, coagulation	Yes		Once a week
CRP	Yes		Once a week
Triglycerides, cholesterol	Yes	Yes	

AspAT — aspartate aminotransferase; AlAT — alanine aminotransferase; GGTP — gamma-glutamyltranspeptidase; CRP — C-reactive protein

Table 8. Exemplary list of assessments used to monitor the efficacy of nutritional treatment

Anthropometric assessment	BMI
	Fatty fold measurement
	Bioimpedance analysis
Laboratory tests	Albumin, total protein,
	transferrin, prealbumin
	Nitrogen balance

The daily monitoring of venal and/or enteral accesses (peripheral and central venal accesses, vascular ports, PEG, jejunostomy and other) is a separate activity. The findings regarding the aforementioned accesses should be put into the patient's medical documentation on a regular basis. Detailed medical records regarding the monitoring of the central venous access in Poland are required only in patients undergoing nutritional treatment reimbursed by the national health insurer (NFZ).

The monitoring of efficacy is essential to evaluate the effects of treatment and identify potential adverse events. A physical examination, antropometric assessment and laboratory tests (Table 8) are performed.

This monitoring allows one to identify the moment when the planned end-point is reached and may be the reason for change or even termination of the intervention.

5. Special conditions

5.1. Cancers of head-and-neck region

In many patients with cancers of head-and-neck region the first symptoms of malnutrition are present at the time of diagnosis and treatment initiation – mainly body weight loss. Malnutrition is diagnosed even in 80% of patients admitted to oncology departments.

Although in most cases the nutritional treatment is a supportive intervention, it can prevent the adverse effects of starvation and, for that reason, it is an important part of treatment that requires tight integration with the rest of the procedures.

According to the ESPEN recommendations, the routine use of enteral nutritional intervention in patients with head-and-neck cancer during radio- and chemotherapy is not required if there is no present or threatening dysphagia as it does not influence either the cancer therapy nor leads to reduction of cancer treatment-related adverse events. Nutritional intervention is indicated if the daily supply of nutritional products does not exceed the 60% threshold of the daily demand for longer than 10 days.

It is recommended to use the nutritional counseling and oral nutritional supplements to increase the consumption of food and to prevent weight loss during the anti-cancer treatment. The decision to start the nutritional intervention should be made if the indications listed in point 4 are identified.

According to ESPEN recommendations, alimentation via the digestive tract, if possible, is preferred in cancer patients, also with the use of ONSs.

If the natural oral alimentation is insufficient or impossible (for example, because of dysphagia in patients with cancer of head-and-neck region or esophagus), feeding via naso-gastric, naso-duodenal, naso-jejunal tubes or via nutritional anastomoses, namely gastro- or jejunostomy, can be used. Feeding anastomoses are used when insertion of feeding tube is impossible (commonly in patients with mucositis of the oral cavity and esophagus as the consequence of radiotherapy) or if the nutritional treatment is going to be administered for a longer period of time. Nowadays, a gastrostomy created with an endoscopic approach (namely-PEG) is the access of choice. In selected cases, patients are qualified for parenteral nutritional treatment.

It is the responsibility of each physician supervising the treatment of patients with head-and-neck cancers to assess the nutritional status and potentially make a decision to start the nutritional intervention. Such decision made early in the course of treatment helps to improve patients' quality of life and the effectiveness of the treatment.

5.2. Post-radiation enteritis

Radiotherapy of the abdomen or pelvis may cause significant gastro-intestinal complications. The increased incidence of post-radiation enteropathy has been observed during recent years due to increasing role of radiotherapy in the multidisciplinary approach in cancer treatment. It is difficult to assess the actual incidence of this complication as its mild forms are not diagnosed while those, which are late or severe, usually occur many years after the completion of radiotherapy when patients are treated at different centers or undergo urgent surgery. It is believed that the post-radiation enteropathy in various grades occurs in 2% to 30% of patients who previously underwent radiotherapy.

The signs of the post-radiation enteropathy recover with time and its treatment is usually based on administration of fluids or on parenteral nutritional intervention, which enables one to turn-off the digestive tract. There are two treatment methods in sub-acute forms of this complication that depend on its stage:

1. Localized post-radiation enteropathy: pharmacotherapy with fluids or parenteral nutritional support (depending on the duration of the intervention); in cases of a lack of improvement — surgery;
2. Diffused post-radiation enteropathy: firstly an attempt at parenteral nutritional treatment. If the signs abate a natural extra-enteral home diet should be considered (> 4–6 months). Surgery should be considered only if the signs do not improve or are present during oral alimentation/enteral treatment that has been introduced subsequently to parenteral treatment.

In some patients, a syndrome of chronic disorders develops. There is a different approach in these cases: many patients in this group have to undergo surgery because the ileus, or intestine narrowing, is irreversible at that stage. Continuous parenteral nutritional treatment is a broadly used alternative that efficiently eliminates the need of subsequent urgent surgical interventions and, in some cases, provides time required for comprehensive preparation for surgery if indicated. In Poland, home parenteral nutritional treatment is provided by specialized centers under contract with national healthcare insurer (NFZ).

5.3. Alimentation during chemotherapy

In most cases the energy supply during systemic treatment may be provided as an oral diet. However, both the symptoms of the underlying disease and side effects of chemotherapy cause the patients' susceptibility to the occurrence of malnutrition.

5.3.1. Dietary recommendations dependent on medical condition

Nausea: small and frequent meals, rather cold, not aromatic and light. A supply of fluids and minerals that may be provided with the food is essential. Recommended food: soups and creams, fruit cocktails and cocktails of fruits and milk, vegetable and fruit mousses, watery juices, jelly, puddings, ice-creams, sorbets, omelets, pancakes, cottage cheese, and porridges.

Diarrhea: the BRAT diet is recommended (**B** — bananas: light ripe, **R** — rice: white, **A** — apple: fried/boiled, **T** — toast: wheat) and an oral supply of the water and electrolytes. Other obstructive products: boiled root vegetables, hard-boiled eggs, boiled lean meat, black currant fresh and its brew, black tea without sugar, carrot juice.

Constipation: it is crucial to diagnose the cause of the constipation (to exclude the ileus or sub-ileus) and the time of duration. For example, constipation that is secondary to 5HT-3 receptor inhibitor may spontaneously recover and do not require a dietary intervention. On the other hand, constipation associated with opioid treatement require nutritional intervention and pharmacotherapy.

5.3.2. Dietary recommendations

5.3.2.1. Protein-rich diet

The passage of gastrointestinal tract (hydration, laxatives, enema, manual removal of the stool) must be ensured before the introduction of a protein-rich diet. The protein-rich diet (whole grains, starch-low vegetables, fruits rich with sorbitol, nuts, fermented dairy products) should always be supported with an adequate supply of fluids (6–8 glasses/day).

5.3.2.2. Lactose-free diet

There is no indication for a routine use of a lactose-free diet in cancer patients. The lactose intolerance that develops as the consequence of chemotherapy or radiotherapy is secondary and is related to the impaired function of the enteral mucosa (a shortage of lactase production, which is responsible for enzymatic lactose [milk sugar] hydrolysis). Nausea, flatulence and diarrhea are the signs of lactose intolerance. If lactose withdrawal from the diet is necessary, a lactose-free diet should be provided for 6–10 weeks after completion of the treatment.

The detailed indications for elimination of milk products are:

— history of lactose intolerance (about 20% of elderly population in Poland);
— chemotherapy based on agents such as: lapatinib, capecytabine, 5-fluorouracil, irinotecan, topotecan,

tyrosine kinases inhibitors (erlotinib, gefitinib, sorafenib, sunitinib), immunotherapeutics (ipilimumab, nivolumab); patients treated with taxanes or metotrexate rarely require elimination of lactose from their diet;
— high-dose chemotherapy of hematological tumors or lymphomas;
— radiotherapy in the abdomen and pelvis (eg.: gastric cancer, rectal cancer, pancreatic cancer, cervical cancer, prostate cancer).

5.3.2.3. Gluten-free diet

There is no indication in oncology to use a gluten-free diet except in patients who are diagnosed celiac. It should be emphasized that gluten products (wheat, rye, barley, oats) are not only a source of carbohydrates but also the source of proteins, a whole group of vitamins B, vitamins E, iron, magnesium, potassium, calcium, selenium, zinc and many other dietary substances. A gluten-free diet is used in cases of severe post-radiation enteritis (mainly due to radiotherapy as treatment for cervical cancer) or severe cases of post-chemotherapy enteritis (bone-marrow stem-cells transplantation) and has a positive effect on diarrhea. However, there are no clinical trials that unequivocally indicate the relevance of such treatment in clinical practice.

5.3.3. Indications for supplementation

According to ESPEN guidelines, the National Institute for Health and Clinical Excellence (NICE), as well as the guidelines of most of dietary societies worldwide, no indications for routine vitamin or minerals supplementation exist in cancer patients. However, supplementation should be used if there is:

1. documented deficiency of the substance (presence of particular laboratory test results or clinical symptoms) — for example, osteoporosis resulting from the deficiency of calcium and vitamin or anemia resulting from iron deficiency;
2. clinical situation that always leads to a particular deficiency e.g. development of secondary vitamin B12 deficiency (lack of internal factor) or mal-absorption syndromes requiring supplementation of vitamins and minerals in patients who underwent gastrectomy.

5.4. Nutritional treatment in patients undergoing surgery

5.4.1. Preparations for surgery

5.4.1.1. Patients with malnutrition

Although malnutrition is an important risk factor for the complications of surgery, it is under-diagnosed in this clinical situation.

The incidence of malnutrition in cancer patients scheduled for surgery varies and depends on the tumor's location. Malnutrition is more common in cancers of the upper part of gastrointestinal tract, as well as in pancreatic cancer and cancer of the biliary tract than in colon cancer. In each case, the decision regarding the potential nutritional intervention depends on the results of a careful assessment of the nutritional status.

Regardless of the method of nutritional status assessment, the value of preoperative nutritional intervention is emphasized in every cancer patient with signs of severe malnutrition (Table 4 and 5).

Nutritional intervention improves treatment outcomes (both temporary and late) and improves quality of life. The lack of improvement of a patient's nutritional status in clinical assessments and laboratory tests usually indicates advanced cancer, questions the relevance of primary tumor resection and mandates conservative treatment. In patients with moderate malnutrition and those at risk of malnutrition, a nutritional intervention may reduce the risk of several complications. However, its benefit is not as spectacular and unequivocal as in patients with severe malnutrition. Despite equivocal opinions regarding the clinical benefits of immunomodulatory support in the preoperative period, immunomodulatory products are used as an addition to therapeutic nutritional agents. This practice is based on literature indicating the advantages of such intervention.

Universally recognized as safe and broadly recommended, the intervention of Enhanced Recovery After Surgery (ERAS) assumes the need of a preoperative assessment of a patient's nutritional status and a nutritional intervention in case of malnutrition. In patients who are well prepared for surgery and have no comorbidities (such as diabetes mellitus), ERAS recommends the supply of 400 ml oral fluids and carbohydrates 2 hours before the surgical procedure, as a method of prophylaxis of postoperative insulin-resistance, hyperglycemia, excessive protein and body weight loss. It maintains the functionality of muscle tissue, reduces postoperative anxiety and decreases the risk of nausea and vomiting. A 20% solution of glucose at a dose of 5 mg/kg of body weight can be administered instead of a supply of oral carbohydrates.

5.4.1.2. Patients without malnutrition

According to international guidelines, in patients without signs of malnutrition and those with no indications for preoperative intensive nutritional treatment, efforts to prevent the deterioration of patient's nutritional status and for preparation of patient's metabolic state for further treatment, should be undertaken.

5.4.2. Post-operative nutritional support

In patients with normal nutritional status the post-operative care should follow ERAS recommenda-

tions. Moreover, in patients without malnutrition, oral alimentation should be introduced as early as possible and the efforts to supply at least 60% of the energy daily demand should be undertaken. If oral alimentation is not possible, nutritional support via feeding tubes and enteral feeding anastomoses is preferred because of the potentially higher risk of complications if nutritional support is provided via central vein catheter. The nutritional intervention should be based on nutritional supplements.

5.4.3. Treatment of complications

The introduction of nutritional treatment should be considered if any indication mentioned in Tables 4 and 5 occur after surgery.

The development of a fistula as a surgical complication presents a specific indication for nutritional therapy. Its appearance may lead to the development of secondary complications such as sepsis, severe deterioration of a patient's performance status, or even death. The most common reasons for the development of fistulas are complications of surgery on the gastro-intestinal tract and abdomen. It can also appear spontaneously, as the consequence of cancer progression, an inflammatory process and others. Due to its clinical presentation and consequences, fistulas are treated in surgical departments.

Detailed recommendations regarding the diagnosis and treatment of the fistulas are described in the recommendations of the Polish Society of Surgical Oncology.

5.4.4. Nutritional support after treatment

Usually, following surgical resections in the colon or rectum, patients do not require specialistic nutritional support except for complications. Thus, a diet properly composed by a dietician is sufficient.

A dietary consultation is actually required in every patient after a surgical resection of the esophagus, stomach and pancreas. It is especially important in patients who underwent resection of esophagus and stomach as they often develop recurrent diarrhea or dumping syndrome.

In patients after extensive resections, short bowel syndrome (SBS) may develop. It is the consequence of a specific condition when the resection of small bowel leads to such a decrease of nutritional product absorption that is not sufficient to maintain the integrity and function of the whole body. The minimal length of the intestine sufficient to provide adequate absorption varies and depends on the general status and absorption ability of the remaining part of the small bowel. However, it is believed that the length of the remaining intestine that allows one to avoid permanent nutritional treatment in patients with definitive ileostomy must exceed 100 cm, and 65 cm in cases of jejuno-colonal anastomosis. Otherwise, survival only on an oral diet is not possible.

The clinical signs of SBS are: diarrhea, fatty stools, weight loss, dehydration and malnutrition that result from the impaired absorption of nutritional macro-elements, vitamins, fluids, electrolytes and trace elements. The consequences of the aforementioned clinical symptoms are hypovolemia, hypoalbuminemia and metabolic acidosis.

The complications of the SBS comprise as follows: over-secretion of hydrochloric acid, D-lactase acidosis, nephrolithiasis, as well as oxalate nephropathy, cholelithiasis and liver disorders.

The three periods can be distinguished in the metabolic and nutritional treatment of SBS:

— early postoperative period,
— period of the adaptation of the intestine,
— chronic treatment.

The post-operative support consists of:

— supplementation of fluids and electrolytes,
— depletion of hydrochloric acid secretion, inhibition of the excretory and motor activity of gastro-intestinal tract,
— parenteral nutritional treatment.

The loss of large amount of fluids caused by diarrhea, excretion via stomas or their evacuation via naso-gastric feeding tube should be carefully monitored and supplemented — the fluid supply should balance its loss and maintain a daily diuresis at a level higher than 1000 ml.

Nutritional treatment should be introduced early for fluid resuscitation and for prevention or treatment of malnutrition. The intensity of enteral treatment should be increased gradually and monitored with the amount of stool produced. Chronic parenteral nutritional treatment with secretion depletion that prevents progressive malnutrition and potentially life-threatening water and electrolytes deficiency, should be conducted in severe SBS. In such cases, parenteral nutritional treatment (total or supplementary) is administered as home parenteral nutrition (HPN).

5.5. Ambulatory nutritional treatment

Ambulatory nutritional treatment is administered as a part of a complex support to patients who are being prepared for cancer treatment or after it. The treatment is supervised by specialist nutritional or dietary out-patient clinics if such intervention is considered safe.

It can be administered in several variants customized to patient's individual needs:

— dietary counselling,
— dietary supplementation (oral nutritional supplements, ONS),
— home enteral nutrition (HEN) — based on a supply of nutrient mixtures via artificially created accesses directly into the patients' digestive tract if the oral supply only is not sufficient to cover the daily al-

lowance for nutrients and energy. It is supervised by nutritional out-patient clinics. It should be introduced in every patient who requires chronic nutritional treatment and whose digestive tract functions properly. Home parenteral nutrition is indicated in every patient who cannot be sufficiently alimented via the gastro-intestinal tract due to intestine insufficiency. The treatment is administered under the close supervision of nutritional out-patient clinics with the use of standard supplementary diets or customized and specific nutritional mixtures. Home enteral and parenteral nutritional support in Poland is administered by specialist sites and reimbursed by the national healthcare insurer (NFZ).

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Appendix 1. Nutritional Risk Screening 2002

<table>
<tr><th colspan="4">Nutritional Risk Screening 2002</th></tr>
<tr><th colspan="2">Deterioration of nutritional status</th><th colspan="2">Severity of the disease (= increased demand for nutrients)</th></tr>
<tr><td>0 points none</td><td>normal nutritional status</td><td>0 points
none</td><td>regular allowance for nutrients</td></tr>
<tr><td>1 point
mild malnutrition</td><td>weight
loss > 5% during 3 months or
oral alimentation < 50–77% of
allowance during last week</td><td>1 point
mild malnutrition</td><td>fracture of femural bone,
chronic diseases with acute
complications: liver cirrhosis,
chronic obturative lung disease,
hemodialysis, diabetes mellitus,
cancers</td></tr>
<tr><td>2 points
moderate malnutrition</td><td>weight loss > 5% during
2 months or BMI 18,5–
20,5 with deterioration of
general performance status or
oral alimentation at level of
25–60% of allowance during
last week</td><td>2 points
moderate malnutrition</td><td>large surgery in abdomen,
brain stroke, severe pneumonia,
hematologic cancer</td></tr>
<tr><td>3 points
severe malnutrition</td><td>weight loss > 5% during
1 month (> 15% during
3 months) or BMI < 18,5
with deterioration of general
performance status or oral
alimentation at level of 0–25%
of normal demand during last
week</td><td>3 points
severe malnutrition</td><td>head injury, bone marrow
transplantation, patients
requiring intensive
care (performance
status > 10 points according to
APACHE scale)</td></tr>
<tr><td colspan="2">Total: .....points</td><td colspan="2">Total: .....points</td></tr>
<tr><td colspan="2">Age</td><td colspan="2">If patient is > 70 years old add 1 point to total result</td></tr>
<tr><td colspan="4">Total score: .....points</td></tr>
<tr><td colspan="4">Result of ≥ 3 indicates the risk of malnutrition and the need to start the nutritional support (treatment);
the result < 3 points indicates the need to repeat the screening assessment next week</td></tr>
</table>

Appendix 2. SGA form

Subjective global assessment of nutritional status

I. History

1. Age…..(yr) **Height**…….(cm) **Body weight**…….(kg) **Sex**….. ☐ F…… ☐ M

2. Body weight changes Weight loss during last 6 months ……(kg)……(%)

Body weight changes during last 2 weeks

☐ increased ☐ no change ☐ decreased

3. Changes in alimentation

☐ no change ☐ changes: duration……..(weeks)

Diet type:

☐ similar to optimal solid diet

☐ complete liquid diet

☐ hypo-caloric liquid diet ☐ starvation

4. Symptoms of gastro-intestinal tract (lasting longer than 2 weeks)

☐ no symptoms ☐ nausea ☐ vomiting ☐ diarrhea ☐ anorexia

5. Physical efficiency

☐ no change ☐ change: duration…….(weeks)

Type: ☐ estricted work

☐ walking

☐ lying

6. Underlying disease and nutrient demand

Increase in metabolic demand secondary to underlying disease

☐ none ☐ mild ☐ moderate ☐ severe

II. Physical examination

Grade assessment

(0 — no change, 1 — mild, 2 — moderate, 3 — sever)

☐ loss of subcutaneous fat tissue over the triceps and on thorax (grade……)

☐ muscle weight loss (quadriceps, deltoideus)(grade…….)

☐ sacral bone region edema (grade……..)

☐ edema of ankle region (grade…….)

☐ ascites

III. Subjective global assessment of nutritional status (SGA)

☐ normal nutritional status (level A)

☐ malnutrition suspected or moderate malnutrition present (level B)

☐ Cachexia (level C)

.....

Signature