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Review

Assessment of nutritional status and quality of life in patients treated for head and neck cancer

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ABSTRACT

The purpose of this study was to identify tools for the assessment of nutritional status in head and neck cancer patients, to evaluate the impact of malnutrition on therapeutic management and quality of life and to propose a simple screening approach adapted to routine clinical practice. The authors conducted a review of the literature to identify tools for the assessment of nutritional status in head and neck cancer patients published in French and English. Articles were obtained from the PubMed database and from the references of these articles and selected journals, using the keywords: "nutritional assessment", and "head and neck" and "cancer". Anthropometric indices, laboratory parameters, dietary intake assessment, clinical scores and nutritional risk scores used in patients with head and neck cancers are presented. The relevance of these tools in clinical practice and in research is discussed, together with the links between nutritional status and quality of life. This article is designed to help teams involved in the management of patients with head and neck cancer to choose the most appropriate tools for assessment of nutritional status according to their resources and their objectives.

1. Introduction

In France, 75% of patients with head and neck cancer consult at an advanced stage of the disease [1]. Malnutrition is very common in patients with these cancers, with a prevalence of about 50% [2]. This malnutrition is exacerbated by treatment, especially chemoradiotherapy. It has become essential to take nutritional status into account in the patient's management, as it determines the patient's tolerance of curative treatment. Initiation of radiotherapy and/or chemotherapy and especially compliance with continuous and complete delivery is a recognized prognostic factor with an impact on survival [3].

This article is designed to identify tools for assessment of nutritional status, especially those used in patients with head and neck cancer, to propose a simple screening approach adapted to routine clinical practice, and to study the impact of nutritional status on the patient's quality of life (QoL).

2. Malnutrition: impact and screening tools

According to Soeters [4], malnutrition is a subacute or chronic condition, in which variable combinations of nutritional imbalance and inflammatory processes are responsible for modification of the body composition (reduction of muscle mass and fat mass) and alteration of organ functions (immune, muscle and cognitive deficits).

Malnutrition is commonly observed in cancer patients and is associated with increased morbidity and mortality [5]. The prevalence of malnutrition is estimated to be between 50 to 80%, depending on the tools used and the populations studied [6], with a particularly high risk of malnutrition in patients with head and neck cancer. Malnutrition is a factor of poor prognosis associated with an increased risk of treatment toxicity and consequently an increased risk of treatment gaps, resulting in decreased efficacy. Malnutrition also has an impact on the patient's quality of life [5].

Malnutrition or a risk of malnutrition must be diagnosed, but the importance of this diagnosis is often underestimated. Many screening tools for nutritional risk have been published in the literature (reviews [7,8]), but no consensus has been reached concerning their use. A survey conducted among 334 oncologists demonstrated insufficient detection of malnutrition: two-thirds of oncologists

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did not assess weight loss during the consultation and only 65% indicated the importance of malnutrition in terms of toxicity and morbidity and mortality [9]. Various tools have been proposed to assess nutritional status. Nutritionists mainly use anthropometric parameters and dietary assessment data, sometimes completed by laboratory data and rating scales. In France, a multidisciplinary task force set up by the *Fédération nationale des centres de lutte contre le cancer* (FNCLCC) [French Federation of Cancer Centres] elaborated standards, options and recommendations (SOR) on the basis of scientific data in order to define good dietary practice in oncology (FNCLCC [10] and Duguet [11]), especially for head and neck cancers [12]. The *Société francophone de nutrition clinique et métabolisme* (SFNEP) has also recently published practice guidelines for the diagnosis and management of malnutrition in adult cancer patients [13].

2.1. Anthropometric nutritional indices

Nutritional risk screening based on the use of anthropometric indices (Table 1) consists of measuring the patient's weight loss, which remains a decisive element contributing to the nutritional assessment. The importance of weight loss has been emphasized by the FNCLCC [10,11] and the SFNEP [13]. The main parameters adopted by the FNCLCC ("standards") also include measurement of height and current weight, estimation of involuntary weight loss and the rate of weight loss, and calculation of the body mass index (BMI) (ratio of weight [kg] over height squared [m^2]). Weight loss, expressed as a percentage of normal weight, constitutes a nutritional marker related to poorer survival in cancer patients (together with other markers such as BMI), as a percentage weight loss greater than 10% is associated with particularly marked excess mortality [14].

These data must be completed by physical examination (looking for any signs of mucocutaneous deficiency, oedema, etc.) and assessment of any associated gastrointestinal disorders.

Triceps skin fold thickness and mid-upper arm circumference are anthropometric parameters that constitute "options" according to the FNCLCC [10]. However, they are not used in routine clinical practice as they are difficult to measure.

2.2. Dietary intake assessment

Tumours situated adjacent to or invading the gastrointestinal tract are commonly associated with decreased food intake [10]. The various treatments used to treat the cancer frequently compromise the patient's already precarious nutritional status. Iatrogenic mucositis can dramatically reduce food intake. Head and neck irradiation can induce dysphagia with alteration of smell and taste, associated with decreased salivary secretion depending on the zones irradiated. These various factors can lead to complete aphagia. Bernier et al. [15] reported that the chemoradiotherapy combination in patients with head and neck cancer induced a higher rate of severe grade 3 and 4 mucositis (41%) compared to radiotherapy alone (21%); these data were confirmed on a larger cohort by Cooper et al. [16].

Dietary intake assessment with recording over 24 to 72 hours enables the dietician to calculate the patient's energy and protein intake and to compare this intake to the patient's optimal nutritional requirements. The various assessment techniques are listed in Table 2. The FNCLCC [10] uses calculation of food intake as the standard method. Dietary intake less than 25 kcal/kg/day is associated with a high risk of malnutrition (PNNS[1]). This essential assessment must be performed regularly in order to determine and then adapt optimal nutritional management according to the course of nutritional status during treatment.

2.3. Laboratory nutritional parameters

Determination of laboratory parameters (Table 3) such as albumin or even transthyretin (prealbumin) and markers of inflammation such as CRP should ideally be part of the systematic laboratory work-up at the time of the patient's admission to hospital [17]. Postoperative morbidity and mortality have been reported to be increased in the presence of hypoalbuminaemia [10]. The cut-off of 35 g/L is used as a prognostic factor in medical oncology. Transthyretin, a protein with a short half-life (two days), appears to be a more reliable marker of malnutrition and appears to be particularly relevant to rapidly evaluate the efficacy of renutrition. Albumin and transthyretin levels are difficult to interpret in the presence of an inflammatory syndrome, as these markers decrease in parallel with elevation of plasma cytokines. Interpretation of these markers must therefore be systematically combined with assay of CRP (C-reactive protein).

The Prognostic Inflammatory and Nutritional Index (PINI) proposed by Ingenbleek and Carpentier [18] combines the analysis of two proteins of inflammation (CRP and orosomucoid) and two proteins sensitive to variations of nutritional status (albumin and transthyretin). This index can be used to classify patients into five classes according to the severity of malnutrition, but is not used in routine clinical practice. It was proposed for the assessment of chronic malnutrition and has been validated in paediatric and elderly populations and constitutes an "option" according to the FNCLCC criteria [10].

2.4. Nutritional scores

Several scores integrating various clinical or even laboratory parameters have been elaborated to complete the nutritional assessment. Some of these scores are used for screening of malnutrition (clinical nutritional scores, Table 4), while others are used for prediction of morbidity related to postoperative complications (risk scores, Table 5).

2.4.1. Clinical nutritional scores

The Mini Nutritional Assessment (MNA [19]) was developed and validated in elderly subjects over the age of 65 years, to assess nutritional status (screening) and to quantify the risk of malnutrition. It comprises a dietary survey as well as a general assessment (dependency, disease, treatment). The short version of the MNA (MNA-SF) is recommended by the *Haute Autorité de la snté* (French National Authority for Health) to detect malnutrition in the elderly or hospitalised patients [20]. The MNA constitutes an "option" in the elderly [10].

The Subjective Global Assessment (SGA or Detsky index), recommended by the ASPEN (American Society for Parenteral and Enteral Nutrition) assesses the degree of malnutrition by integrating the degree of weight loss, the severity of gastrointestinal and clinical signs of malnutrition, functional impairment and associates the concept of the intensity of any metabolic stress. It allows simple and reproducible classification of patients into three groups: (A): well nourished, (B): moderate or suspected malnutrition, (C): severe malnutrition [21]. In particular, the SGA can be used to assess nutritional status at the time of diagnosis of head and neck cancer [22].

Ottery [23] adapted a self-administered questionnaire derived from the SGA for use by cancer patients, the PG-SGA (patient-generated SGA), the only tool specifically designed to assess malnutrition in oncology. This self-administered subjective global

[1] PNNS 2010: *Dénutrition – une pathologie méconnue en société d'abondance*: http://www.sante.gouv.fr/les-syntheses-du-pnns.html

Table 1
Anthropometric indices.

Index	Target population	Reference/use	Definition of parameters and cut-off values used to define malnutrition
Weight loss: % weight loss (involuntary)	Elderly	HAS[b]	Age ≥ 70 years: weight loss ≥ 10% in 6 months
	Hospitalised adults	HAS[c]	Age < 70 years: weight loss ≥ 10%
	All subjects	PNNS[a]	Malnutrition if weight loss of 5% in 1 month or 10% in 6 months
	Cancer	[10,11]	"Standard": evaluation of weight variations "Recommendation": nutritional intervention recommended if the patient has lost more than 10% of usual body weight in 6 months
		[13]	In medical oncology, weight loss ≥ 5% (compared to usual weight or healthy weight or in 6 months) is a factor of poor prognosis (also for surgery if weight loss ≥ 10%)
	Head and neck cancer	[12]	Weight loss of 10% in 6 months considered to have a prognostic value in oncology, requiring urgent nutritional management
	Head and neck cancer	[30]	Measurement of the percentage weight loss over the last 6 months. The patient's weight loss during radiotherapy for head and neck cancer is limited when regular, early and adapted nutritional management is prescribed
Body mass index (BMI)			Current weight/height^2 (kg/m^2)
	Elderly	HAS[b]	BMI < 21
	Hospitalised adults	HAS[c]	BMI < 17
	All subjects	PNNS[a]	BMI < 18.5 in adults; BMI < 21 in the elderly
	Cancer	[10,11]	Calculation of BMI; moderate malnutrition if BMI is between 60 and 80% of normal ("Standard")
	Head and neck cancer	[30]	Measurement of BMI; existence of a correlation between weight variations and BMI variations
Triceps skinfold thickness		[10,11]	Moderate malnutrition if triceps skinfold thickness between 60 and 80% of normal ("option")
Mid-upper arm circumference		[10,11]	This measurement constitutes an "option"

[a] PNNS 2010: *Dénutrition – une pathologie méconnue en société d'abondance*: http://www.sante.gouv.fr/les-syntheses-du-pnns.html
[b] HAS 2007: *Stratégie de prise en charge en cas de dénutrition protéino-énergétique chez la personne âgée*: http://www.has-sante.fr/portail/upload/docs/application/pdf/synthese_denutrition_personnes_agees.pdf
[c] HAS 2003: *Évaluation diagnostique de la dénutrition protéino-énergétique des adultes hospitalisés*: http://www.has-sante.fr/portail/upload/docs/application/pdf/denutrition_recos_2006_09_25__14_20_46_375.pdf

nutritional assessment is recommended as standard assessment in this type of population by the American Dietetic Association for the detection of malnourished subjects or at high risk of malnutrition. The French version of the PG-SGA is recommended as an "option" by the FNCLCC [10]. A weighting score for the various items has been introduced into the Scored PG-SGA, allowing less subjective interpretation and more accurate monitoring of individual variations of nutritional status [24]. One of the strong points of the PG-SGA

Table 2
Assessment of the subject's dietary requirements.

Dietary intake assessment	Target population	References/recommendation	Definition of parameters and cut-off values used to define malnutrition
Dietary intake	All subjects	PNNS[a]	Risk of malnutrition if dietary intake < 25 kcal/kg/day (semiquantitative assessment by dietary record)
	Cancer	[10,11]	Calculation of energy-protein intake ratio ("standard")
		[13]	Systematic evaluation of recommended dietary intake, as a reduction of the recommended intake is a major risk factor for malnutrition
	Head and neck cancer	[10,12]	The recommended daily energy intake is 1600 to 2400 kcal with a protein intake of about 1.25 to 1.85 g of protein/kg/day
24-hour dietary recall	Cancer	[10,11]	Estimation of dietary intake based on the subject's description of the food ingested over the previous 24 hr. This measurement is an "option"
Dietary record	Cancer	[10,11]	Prospective written record, over several days, of dietary intake with estimation of portions or weights of foods. This measurement is an "option"

[a] PNNS 2010: *Dénutrition – une pathologie méconnue en société d'abondance*: http://www.sante.gouv.fr/les-syntheses-du-pnns.html

Table 3
Laboratory parameters.

Laboratory parameters	Target population	References/recommendation	Definition of parameters and cut-off values used to define malnutrition
Serum albumin	Elderly	HAS[b]	Age ≥ 70 years, serum albumin < 35 g/L
	Hospitalised adults	HAS[c]	Age < 70 years, serum albumin < 30 g/L
	All subjects	PNNS[a]	< 30 g/L: prognostic value, increased mortality
	Cancer	[10,11]	"Option" in the absence of inflammatory syndrome
		[13]	In medical oncology, increased risk of morbidity and mortality if < 35 g/L
Transthyretin (Prealbumin)	All subjects	PNNS[a]	Decreased survival if < 50 mg/L
	Cancer	[10,11]	"Option" in the absence of inflammatory syndrome
CRP	All subjects	PNNS[a]	Quantifies inflammation
PINI: Prognostic Inflammatory and Nutritional Index		[18]	Prognostic index in the case of chronic malnutrition Combines the analysis of two proteins of inflammation (C-reactive protein: CRP and orosomucoid: oro) and two proteins sensitive to variations in nutritional status (albumin: alb and transthyretin: prealb) PINI = oro (mg/L) × CRP (mg/L)/alb (g/L) × prealb (mg/L) Patient at moderate risk of malnutrition (PINI between 11 and 20); PINI constitutes an "option" according to the FNCLCC [10]

[a] PNNS 2010: *Dénutrition – une pathologie méconnue en société d'abondance*: http://www.sante.gouv.fr/les-syntheses-du-pnns.html
[b] HAS 2007: *Stratégie de prise en charge en cas de dénutrition protéino-énergétique chez la personne âgée*: http://www.has-sante.fr/portail/upload/docs/application/pdf/synthese_denutrition_personnes_agees.pdf
[c] HAS 2003: *Évaluation diagnostique de la dénutrition protéino-énergétique des adultes hospitalisés*: http://www.has-sante.fr/portail/upload/docs/application/pdf/denutrition_recos_2006_09_25_14_20_46_375.pdf

is that, in addition to recent weight loss, assessment of nutritional status includes symptoms (loss of appetite, nausea, swallowing difficulties, etc.), the patient's dietary intake and functional capacities, resulting in a particularly relevant multidimensional score [13,25]. Studies using the PG-SGA to evaluate nutritional status in patients with head and neck cancer are listed in Table 4.

The ESPEN (European Society for Clinical Nutrition and Metabolism) recommends the MUST (Malnutrition Universal Screening Tool) as screening tool for malnutrition. The MUST and NRS-2002 were recently used to detect malnutrition in cancer patients and to consequently identify patients at high risk of prolonged hospitalisation [26]; these tools, as well as the MST (malnutrition screening tool), have also been used to identify head and neck cancer patients presenting the highest nutritional risk [26]. The MST also constitutes one of the recommended tools to detect malnutrition and has been validated for use in oncology [17].

2.4.2. Nutritional risk scores

These nutritional risk scores combine anthropometric and laboratory indices (Table 5) and are designed to guide decisions concerning more intensive nutritional management in certain situations. They are part of the "options" recommended by the FNCLCC [10].

The Buzby index [27] or Nutrition Risk Index (NRI) combines serum albumin and weight loss. It is used both for assessment of nutritional status and as a prognostic factor. It is recommended in the perioperative setting to select patients likely to benefit from preoperative artificial nutrition before major surgery. It has been validated for use in oncology [17].

The Mullen index (or PNI [28]) is more complex (integrating albumin, triceps skinfold thickness, serum transferrin and hypersensitivity skin tests) and is considered to be the only tool able to prospectively predict the patient's outcome. The *score d'aide décisionnelle à l'assistance nutritive* (SADAN) can be used to determine the need for nutritional support in patients with chronic gastrointestinal disease. The PNI and SADAN indices (Table 5) are not used in routine clinical practice.

2.4.3. Other methods

Functional and instrumental measurements can also be performed (impedancemetry, calorimetry). Impedancemetry provides an assessment of muscle mass by measuring the water content of muscles. Indirect calorimetry provides an assessment of the patient's basal energy expenditure. These methods can complete, but do not replace nutritional assessment. They can be useful in particular situations, but require specific equipment and therefore cannot be used routinely in all centres.

3. Malnutrition: consequences on therapeutic management and quality of life

3.1. Consequences on therapeutic management

The "standards, options and recommendations" (SOR) task force [12] highlighted the importance of nutritional management before, during and after treatment of patients with head and neck cancer. Regular weight surveillance in all patients was defined as a "standard" with the need to institute urgent nutritional management in patients with a weight loss of 10% during the previous 6 months.

3.1.1. During radiotherapy

Patients treated by radiotherapy require at least weekly weight surveillance and enteral nutrition must be rapidly considered when malnutrition becomes threatening despite nutritional management [12], as it has been clearly established that a mean weight loss of 4 to 5 kg is commonly observed during radiotherapy for head and neck cancer in the absence of any particular nutritional management and justifies early, personalized and regular nutritional surveillance to limit this weight loss [29]. In head and neck cancer patients treated by radiotherapy, Garabige [30] showed that early systematic nutritional management significantly limited weight loss, the number of treatment interruptions and the severity of mucositis. Moreover, the primary importance of

Table 4
Nutritional clinical scores.

Clinical nutritional scores: nutritional status and risk of malnutrition	Validation reference	Target population	Reference/use	Parameters studied/recommendations
MNA: Mini Nutritional Assessment (global) (18 items)	[19]			Quantification of nutritional status or risk of malnutrition in the elderly
				Screening (assessment of nutritional status) Global assessment (diagnosis of malnutrition or risk of malnutrition) Integrates the weight curve, dietary intake, physical activity, emotional state and anthropometric measurements
		Elderly	HAS[a]; [42]	HAS: malnutrition if global MNA < 17
		Cancer	[10,11,13]	MNA: "option" in the elderly
MNA-SF (short-form) (6 items)	[20]	Hospitalised adults Elderly	HAS[b] HAS[a]	"Screening" part of MNA Age ≥ 70 years, MNA-SF ≤ 11
SGA (Subjective Global Assessment)	[21]	All subjects		Assesses the degree of malnutrition based on severity of weight loss, severity of gastrointestinal and clinical signs of malnutrition, functional alteration and includes the concept of the intensity of metabolic stress
Validated in French		Cancer	[10,11,13]	SGA is useful to complete assessment of malnutrition ("option") SGA recommended by SFNEP
PG-SGA & scored-PG-SGA (17 items) = self-administered subjective global nutritional assessment (validated in oncology and in French)	[23,24]	Cancer		Self-assessment of the degree of malnutrition by: 1) weight changes, symptoms, altered dietary intake and functional capacities. 2) disease and related nutritional requirements 3) clinical examination
			[10,13]	PG-SGA: French version recommended by FNCLCC ("option") Recommended PG-SGA by SFNEP
		Head and neck cancer	[17]	Only tool specifically designed for oncology
			[25,34,39,41,43–45]	
MST (Malnutrition Screening Tool)	[46]	Hospitalised adults		The MST comprises 3 items: involuntary weight loss, evaluation of this weight loss and food/appetite
	[47]	Cancer	[13,17,26]	
MUST (Malnutrition Universal Screening Tool)	[48]			The MUST comprises the percentage involuntary weight loss, BMI and presence/absence of acute illness. Official tool used by the British Dietetic Association, the Royal College of Nursing, the Registered Nursing Homes Association, the British Association for parenteral and enteral nutrition (BAPEN), and ESPEN (European Society for Clinical Nutrition and Metabolism)
		Adults	[42]	
		Cancer	[13,49]	According to Boléo-Tomé [49], MUST (widely used in Europe) should be used as first-line tool to identify patients requiring follow-up, and follow-up is then adapted according to PG-SGA
			[17,26]	
NRS (nutrition risk screening) 2002	[50]			Rapid identification of patients requiring nutritional management; based on analysis of randomized clinical trials; patients assessed according to 2 characteristics: malnutrition (weight loss) and severity of disease
		All patients	[50]	
		Cancer	[13,17,26]	

[a] HAS 2007: *Stratégie de prise en charge en cas de dénutrition protéino-énergétique chez la personne âgée*: http://www.has-sante.fr/portail/upload/docs/application/pdf/synthese_denutrition_personnes_agees.pdf

[b] HAS 2003: *Évaluation diagnostique de la dénutrition protéino-énergétique des adultes hospitalisés*: http://www.has-sante.fr/portail/upload/docs/application/pdf/denutrition_recos_2006_09_25__14_20_46_375.pdf

nutritional surveillance in this type of patient and its repercussions on nutritional parameters (weight), tolerability of treatment, but also quality of life, was recently emphasized by the French *Programme national nutrition santé* (PNNS).

3.1.2. During chemotherapy

Nutritional surveillance of head and neck cancer patients is recommended during each cycle of chemotherapy and prolonged total interruption of oral feeding must be avoided by initiating enteral

Table 5
Clinical and laboratory scores and risk indices.

Clinical and laboratory scores and risk indices	Validation reference	Target population	Reference/use	Parameters studied/recommendation
NRI: Nutrition Risk Index (2 items)	[27]			NRI = 1.519 × (albumin in g/L) + 41.7 × (current weight/usual weight)
		Cancer	[10,11,13,17]	Moderately malnourished patients: NRI between 83.5 and 97.5 (option) Completes the nutritional assessment of malnourished subjects ("option")
PNI: (Mullen index)	[28]			PNI% = 1581.66 (alb) 0.78 (TSF) 0.02 (TFN) 5.8 (DH) [alb = serum albumin in g/L; TSF: triceps skinfold (mm); TFN: serum transferrin (mg/L); DH: skin hypersensitivity test: 0: no reaction; 1 if wheal < 5 mm; 2 if wheal > 5 mm]
Prognostic Nutritional Index		Cancer	[10,11]	Completes the nutritional assessment of malnourished subjects ("option")
SADAN: aid to the decision concerning nutritional support				Predictive score of the need for nutritional support
				SADAN: 826 (5.2 × dietary intake) (3.3 × % weight) (2.8 × % MUAC) (4.5 × albumin in g/L); dietary intake in kcal/kg of ideal weight per day; % weight: weight as % of ideal weight; % MUAC: mid-upper arm circumference as % of predicted
		Cancer	[10,11]	Completes the nutritional assessment of malnourished subjects ("option")

nutrition whenever necessary, when oral intake, even completed by nutritional supplements, is unable to cover the patient's energy and protein requirements. Enteral nutrition is not routinely recommended during chemotherapy when the patient's nutritional status and/or dietary intake are sufficient (grade A) [31].

3.1.3. Cancer surgery

Weight loss is a decisive element for assessment of the operative risk related to cancer surgery. ESPEN published guidelines for perioperative nutritional management in 2006 [32]. A nasogastric enteral nutrition tube must be placed during surgery whenever oral feeding is expected to be interrupted for several days to avoid compromising the patient's nutritional status and therefore to ensure optimal healing conditions. Enteral nutrition should be started on postoperative D1 and is then rapidly and progressively increased [12].

The FNCLCC has proposed decisional flow diagrams adapted to head and neck cancer patients corresponding to the situations encountered before and during the various treatments, postoperatively and at the time of the patient's discharge from hospital [12].

3.2. Consequences on quality of life

Malnutrition in cancer patients alters their quality of life [10], particularly in the case of cancers that are difficult to treat, such as head and neck cancers. The recent review by Lis et al. [33] examined the impact of nutritional status on the quality of life of cancer patients. Out of the 26 publications reviewed, 24 concluded that better nutritional status was associated with improved quality of life. Six of these publications were exclusively devoted to head and neck cancers [1,34–38]. Various tools were used to assess nutritional status, but weight loss was one of the parameters evaluated in five studies. Weight loss was usually evaluated alone [1,35–37], or in combination with PG-SGA [34] or other anthropometric indices (mid-upper arm circumference and triceps skinfold thickness), weight index (current weight divided by the reference weight for height), BMI and serum albumin [38]. The tools mainly used to evaluate quality of life are the EORTC-QLQ-C30 questionnaire, used in five studies, either alone [1,34] or in combination with the EORTC-QLQ-H& N-35 module specific to head and neck cancer [36] or with an equivalent questionnaire [38]. The two EORTC tools were associated with the Hospital Anxiety and Depression Scale (HADS) in the study by Petruson [37].

These six studies on head and neck cancer quoted by Lis et al. [33] all concluded that a better nutritional status was positively correlated with better quality of life. Each study evaluated the role of the various parameters likely to influence this correlation. For example, Morton et al. [35] reported an association between weight loss and decreased speech and swallowing functions, leading to decreased oral food intake. Van den Berg [36] concluded that weight loss of more than 10% at the time of the diagnosis significantly impacted quality of life scores and worsened not only global quality of life, but also fatigue and pain. This study also suggested the value of limiting weight loss as much as possible from the time of the diagnosis and for the first 6 months after treatment. Petruson [37] showed that patients with more than 10% of weight loss over a period of 6 months corresponded to those patients with the most severely impaired quality of life and also showed that quality of life was a predictive factor of weight loss in head and neck cancer patients. In the study by Capuano [34], total weight loss of more than 20% was significantly correlated with treatment interruption, infections, early mortality, post-treatment readmission and survival.

Although the percentage weight loss since onset of the disease appears to be a relatively objective parameter, it does not take into account either the kinetics of weight loss or the presence of oedema or fluid retention and other clinical and laboratory effects. A tool like the PG-SGA therefore constitutes one of the most reliable parameters to assess nutritional status. The results reported by Capuano [34] showed a strong correlation between involuntary weight loss and PG-SGA. This tool has often been correlated with various prognostic criteria, including quality of life, especially in head and neck cancers [39]. The authors of the review concluded that nutritional status is a highly predictive factor of quality of life and that correction of malnutrition (by renutrition) could have a beneficial effect on the quality of treatment response in cancer patients and a positive impact on their quality of life [33].

4. Practical recommendations

Simple screening for malnutrition must be performed systematically and early in the course of the disease, i.e. at the time of the first visit at which the diagnosis is announced and must then be regularly repeated at each visit to follow the course of weight. This assessment must at least comprise measurement of weight and weight loss plotted on a time scale, as well as calculation of BMI. It must be combined with rapid assessment of oral dietary intake, with the assistance of a dietician whenever possible, or otherwise by using scales to estimate the portions ingested, for example dietary intake analogue scales [40]. In practice, the clinician must monitor the patient for warning signs such as dysphagia, xerostomia or decreased dietary intake (less than two-thirds of the usual dietary intake), possibly associated with even minimal weight loss, indicating the need for appropriate nutritional management. Early nutritional intervention is more effective than delaying intervention until the stage of excessive weight loss, which is more difficult to treat and treatment may sometimes less effective when the patient has already developed advanced cachexia.

Dietary advice must be based on personalized patient management prior to any treatment with weekly follow-up until the end of treatment and assessment 1 to 3 months after completion of radiotherapy or chemoradiotherapy. Nutritional management must cover the patient's daily energy requirements by taking into account the patient's eating habits and the adverse effects of treatments. The studies by Ravasco [41] showed that dietary advice was more effective than nutritional supplements prescribed alone, as only patients receiving dietary advice maintained or improved their quality of life during radiotherapy. After three months, a significant 90% reduction of the incidence of grade A and B toxicities (anorexia, nausea, vomiting, xerostomia and dysgeusia) was also observed in the dietary advice group versus 67% in the oral supplement group and 51% in the oral feeding only group. A dietetic consultation is therefore recommended in all patients receiving radiotherapy for head and neck cancer (grade B) [31]. However, it would be illusory to try to meet the patient's energy and protein requirements by simple oral nutritional supplements when dysphagia is already severe or in the presence of marked anorexia; in these settings, enteral nutrition by nasogastric probe or gastrostomy, depending on the situation, should be initiated without delay. Prophylactic gastrostomy should be considered before chemoradiotherapy involving the oral cavity, due to the risk of development or deterioration of dysphagia, particularly in previously malnourished patients or when the irradiation field includes the oropharynx [31]. Finally, the use of pharmaconutrients during chemoradiotherapy is not recommended on the basis of the current data of the literature (grade C) [31]; although some data support the use of pharmaconutrients, these findings need to be validated by comparative studies based on larger sample sizes.

In the perioperative setting, weight loss and the SGA appear to be the most appropriate nutritional markers and must therefore be evaluated. For patients who are malnourished preoperatively, systematic management of malnutrition is recommended on the basis of the following criteria: weight loss greater than 10–15% during the previous six months; body mass index less than 18.5, grade C SGA or serum albumin less than 30 g/L. Ideally, artificial nutrition should be initiated 10 to 14 days before surgery, via the enteral route whenever possible [32]. The patient's enteral nutrition must be continued postoperatively after major head and neck surgery (grade A), in patients who are malnourished preoperatively (grade A) but also in non-malnourished patients when oral intake is likely to be less than 60% of the target energy intake during the first 10 days after surgery (grade C), according to ESPEN guidelines [32].

When anthropometric measurements cannot be interpreted, serum albumin or serum prealbumin may be helpful, in the absence of an associated marked inflammatory syndrome, or renal or liver failure.

In patients at high risk of malnutrition, such as patients with head and neck cancer, the FNCLCC recommends use of the PG-SGA as systematic screening tool to monitor individual variations of nutritional status and to demonstrate minor modifications of this status, including in response to nutritional intervention. This tool, specifically designed for cancer patients, is very commonly used in scientific publications devoted to nutritional assessment of head and neck cancer patients, but its use in routine clinical practice remains limited.

5. Conclusion

Nutritional assessment is essential in view of the morbidity, complications and impaired quality of life induced by malnutrition.

Optimization of the nutritional management of head and neck cancer patients must constitute a major objective for therapists, alongside treatment of the cancer itself. The first "cancer plans" instituted in France have enabled us to partly regain lost ground in this field in comparison to other European countries.

Nutritional assessment must be simple, effective, adapted and reproducible in order to allow early and effective nutritional management. In the absence of a validated approach and an ideal assessment tool, the nutritional assessment of head and neck cancer patients must be based on a combination of various parameters comprising anthropometric, dietary and clinical and laboratory data. The tools described here do not constitute a rigorous approach (the gold standard does not exist), but constitute a guide so that each team can choose the most appropriate nutritional assessment adapted to its resources.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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