Research Square

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Evaluation of a protocol to detect malnutrition and provide nutritional care for cancer patients undergoing chemotherapy

ELENA ÁLVARO SANZ
Hospital Costa del Sol
JIMENA ABILÉS
Hospital Costa del Sol
MARGARITA GARRIDO SILES (garridosiles.marga@gmail.com)
Hospital Costa del Sol
FRANCISCO RIVAS RUÍZ
Hospital Costa del Sol
BEGOÑA TORTAJADA GOITIA
Hospital Costa del Sol
ANTONIO RUEDA DOMÍNGUEZ
Hospital Regional Universitario de Malaga

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Abstract

Background

Patients with cancer frequently experience malnutrition, which is associated with higher rates of morbidity and mortality. Therefore, the implementation of strategies for its early detection and for intervention should improve the evolution of these patients. Our study aim is to design and implement a protocol for outpatients starting chemotherapy, by means of which any malnutrition can be identified and treated at an early stage.

Methods

Before starting chemotherapy for patients with cancer, a complete assessment was made of their nutritional status, using the Nutriscore screening tool. When nutritional risk was detected, an interventional protocol was applied.

Results

Of 234 patients included in the study group, 84 (36%) required an individualised nutritional approach: 27 (32.1%) presented high nutritional risk, 12 had a Nutriscore result ≥ 5 and 45 experienced weight loss during chemotherapy. Among this population, the mean weight loss (with respect to normal weight) on inclusion in the study was − 3.6% ±8.2. By the end of the chemotherapy, the mean weight gain was 0% ±7.3 ($p < 0.001$) and 71.0% of the patients had experienced weight gain or maintenance, with respect to the initial weight.

Conclusion

More than a third of cancer patients who start chemotherapy are candidates for early nutritional intervention. This finding highlights the importance of early identification of patients at risk in order to improve the efficacy of nutritional interventions, regardless of the stage of the disease.

Background

Cancer is highly prevalent and a major cause of morbidity and mortality worldwide, impacting severely on health systems and on patients' quality of life (QoL) [1].

In recent years, survival rates have improved, thanks to early diagnosis and more effective treatments. In this scenario of long-term survival, health care should not focus exclusively on the disease, but address all aspects of the patient's condition. In other words, oncological care is evolving to become a multidisciplinary model incorporating a wide range of services and concerns [2].

Within this broader approach, weight loss and other signs of deteriorating nutritional status require special attention, due to their impact and prevalence, and so action protocols should be established to promote comprehensive nutritional care [2].

The latest recommendations on nutritional care for cancer patients emphasise the importance of detection and prompt action for persons at nutritional risk, to prevent the onset of malnutrition and to minimise its devastating effect on the patient's clinical condition [3, 4].

Early action is especially important due to the evolutionary nature of oncological cachexia and the probability of its becoming refractory and irreversible [5]. In this respect, studies have shown that early nutritional intervention can reduce the catabolic impact of cachexia, resulting in clinical improvement and enhancing survival rates for cancer patients at high nutritional risk, such as those with oesophageal or gastric tumours [6, 7].

In 2016, the Pharmacy and Nutrition Service at our hospital designed and implemented a nutritional care model for oncology patients [8] to enable the early detection of nutritional risk, to facilitate periodic assessment and nutritional monitoring, and to provide nutritional intervention at an early stage, prior to the appearance of refractory cachexia.

The aims of the present study are to determine the effectiveness of this nutritional care model for cancer patients, in terms of weight gain or maintenance by the end of chemotherapy, and to promote the early detection of vulnerable patients.

Method

Study population

Adult patients (18 years or older) with a *de novo* diagnosis of solid tumour, regardless of stage, who started chemotherapy at least 15 months previously, were included in the study. Those who, for cultural or cognitive reasons, had difficulty understanding the study aims were excluded. All patients who met the inclusion and exclusion criteria were included consecutively; therefore, no sample size calculation was needed or performed.

The study protocol was carried out in accordance with the provisions of the Declaration of Helsinki and was approved by the local Clinical Research Ethics Committee. All patients included in the study gave their written informed consent to participate.

Study Design

In this prospective study, the nutritional care model for cancer patients differentiates two groups of patients according to the location of the tumour and its impact on nutritional status: group 1 includes patients with high-risk tumours (cancers of the head and neck and of the upper digestive tract, oesophagus, stomach, pancreas or bile duct); group 2 contains patients with low nutritional risk tumours and all other malignancies.

In the course of the study, the group 1 patients were referred directly for nutrition consultation, either after presentation of their data to the corresponding oncology committee or during the admission in which they were diagnosed with the tumour pathology. The “Individualised nutritional care programme” was then launched, involving nutritional assessment, intervention and vigilant follow-up. This process begins with a complete nutritional assessment of food intake and symptoms that could affect nutritional status, following international guidelines of The European Society for Clinical Nutrition and Metabolism (ESPEN) on nutritional support for cancer patients [3]. The type and degree of malnutrition observed determines the nutritional intervention stipulated, ranging from nutritional advice to specialised nutritional support, as recommended in the ESPEN guidelines [3].

A vigilant, individualised monitoring plan was then established, with periodic reviews to assess the patient’s treatment adherence, tolerance and efficacy.

The group 2 patients received a nutritional screening at their first consultation with the oncologist or at the day-patient hospital pharmacy consultation, before starting chemotherapy. Patients whose screening results were positive, showing them to be at risk of malnutrition, were assigned a degree of malnutrition, according to the patient-generated subjective global assessment (PG-SGA), a validated method that produces the following classifications: A) Normally nourished; B) At nutritional risk or presenting moderate malnutrition; C) Presenting severe malnutrition [9]. Patients classed as being at risk of malnutrition, with moderate malnutrition or with severe malnutrition (B/C) were referred to the nutrition consultation, and the “Individualised nutritional care programme” was initiated.

Group 2 patients whose screening results were negative and who, therefore, were not considered to be at nutritional risk, received periodic re-evaluations, with continuous monitoring in each treatment cycle or during the perioperative period. All the patients included in this study were given nutritional recommendations on request, whether or not nutritional risk was observed. The procedure shown in Fig. 1 was followed.

The screening process was conducted using the Nutriscore instrument [10]. This nutritional screening test, which has been validated for use in outpatient cancer patients, identifies involuntary weight loss in the last three months, decreased appetite, tumour location and cancer treatment received. Patients are assumed to be at nutritional risk if the Nutriscore result is 5 points or more (out of the maximum 9 points). When the score is less than 5, the patient does not present nutritional risk.

Each patient’s body weight was recorded at different times during the nutritional care, and was defined as follows:

Normal weight (NW)

Weight during the last three months, as reported by the patient.

Initial weight (IW)

Weight when the nutritional care model was first applied. Weight loss is quantified as NW-IW/NW*100. This value is expressed as the percentage of weight loss (**%WL**) on first application of the nutritional care model.

Chemotherapy start weight (CSW)

Weight at the start of chemotherapy.

Chemotherapy end weight (CEW)

Weight on concluding chemotherapy.

The effectiveness of the nutritional care protocol was evaluated by reference to the percentage of weight gained **(%WG**) or maintained (**%WM**) at the end of the treatment, quantified as the difference between the patient's weight on concluding chemotherapy and the initial weight recorded.

A weight loss of 2% or more was considered significant. Smaller losses were not taken into consideration, since they might reflect intra and interpersonal variability when the weight was recorded (for example, shortly after eating or fasting, or differences in the weight of clothing).

The nutritional care protocol was considered to have been applied at an early stage when the patient was first attended in this respect before starting chemotherapy or during the first seven days thereafter.

Statistical analysis

Descriptive analysis was performed using measures of central tendency, dispersion and position for the quantitative variables and of frequency distribution for the qualitative ones. Differences between two measurements were evaluated by the Wilcoxon rank test or the Mann-Whitney U test for independent samples referring to quantitative variables. Average differences between two groups were evaluated by the chi-square test. In all cases, statistical significance was assumed at $p < 0.05$.

Results

Of the initial 295 patients included in the study when the nutritional care model was initiated for cancer patients, 51(17%) did not complete chemotherapy. In addition, there were ten losses to follow-up. Thus, 234 patients remained in the final analysis.

The nutrition consultation showed that 84 patients required individualised nutritional care: 27 (32.1%) belonged to group 1 (high-risk tumours), and another 12 had Nutriscore ≥ 5 at the start of treatment (the 27 patients with high-risk tumours also had Nutriscore ≥ 5), and 45 patients, although not at nutritional risk at the start of treatment, had recorded weight loss during one or more of the periodic re-evaluations, on day 1 of each cycle of chemotherapy.

The clinical characteristics recorded at the start of chemotherapy, for all patients and also for those who required assessment, nutritional intervention and vigilant follow-up are shown in Table 1.

Table 1
Patients' characteristics.

	All patients	Patients needing assessment, nutritional intervention and vigilant follow-up
	N (%)	(%)
Overall	234	84
Sex	136(58.1)	33(39.3)
Male	98(41.9)	51(60.7)
Female		
Age(years), mean ± SD	59 ± 11	60 ± 11
Location of primary tumour	5(2.1)	5(6.0)
Head-neck	37(15.8)	26(31.0)
Colon-rectum	13(5.6)	13(15.5)
Oesophagus-Stomach	32(13.7)	10(11.9)
Gynaecological	72(30.8)	5(6.0)
Breast	9(3.8)	9(10.7)
Pancreas-Bile ducts	45(19.2)	9(10.7)
Lung	12(5.1)	3(3.6)
Urothelial	9(3.8)	4(4.8)
Other		
Treatment intention	154(65.8)	45(52.4)
Curative/Radical	80(34.2)	39(46.4)
Palliative		
BMI(mean ± SD)	26.6 ± 4.8	24.5 ± 4.0
Initial %Weight Loss (NW-CSW) (mean ± SD)	3.9 ± 7.3	10.1 ± 7.4
Nutritional risk(Nutriscore)	39(16.7)	39(46.4)
≥5	195(83.3)	4(53.6)
<5		

BMI: body mass index; NW: Normal weight; CSW: Chemotherapy start weight.

Table 2
Percentage of patients with weight gained/maintenance at the end of treatment according to tumour location

LOCATION (n)	% patients with weight gain or maintenance at the end of treatment (compared to start of protocol)	% Weight loss at the start of the protocol, with respect to Normal Weight (median,IQR)	%weight gained or maintained at the end of treatment (compared to start of protocol)(median, IQR)	Statistical significance (start of protocol vs. end of chemotherapy) p < 0.005
Head-Neck(5)	80.0	-16.3(18.1)	1.7(15.6)	0.080
Oesophagus-Stomach(13)	46.2	-7.8(11.5)	-2.9(10.6)	0.101
Pancreas-Bile ducts(9)	44.4	-7.9(14.5)	-5.6(12.5)	0.678
Colorectal(37)	64.9	-6.1(9.7)	0.0(6.7)	0.002
Gynaecological(32)	71.9	-5.2(2.2)	1.7(3.9)	0.003
Lungs(45)	68.9	-0.6(15.5)	0.0(7.3)	0.044
Other(9)	77.8	-3.8(7)	0.0(16.8)	0.028
Breast(72)	80.6	0.0(5.8)	0.0(4.8)	0.226
Bladder(12)	75.0	-2.0(5.8)	1.0(4.1)	0.308
TOTAL SAMPLE(234)	71.0	-3.6%±8.2(mean ± SD)	0%±7.3(mean ± SD)	< 0.001

Patients with high-risk tumours (group 1) and patients in group 2 with Nutriscore ≥ 5 and PG-SGA B/C (n = 39)

On their first visit to the nutrition consultation, these patients presented a median %WL of 9.2% (IQR = 10.8) (with respect to normal weight). After establishing an individualised nutritional care plan, the median %WL (with respect to initial weight) was 0% (IQR = 1.6) at the start of chemotherapy. By the end of the chemotherapy programme, 58% of the patients presented weight gains or had maintained their previous weight (with respect to the initial weight). Figure 2 shows the evolution of these weights.

The median time elapsed from the first nutrition consultation and the start of the “Individualised nutritional care programme” until the start of chemotherapy was 26 days (IQR = 54). The median time elapsed from disease diagnosis until the first nutrition consultation was 9 days (IQR = 9).

Group 2 patients not presenting nutritional risk at the start of chemotherapy, but subsequently with Nutriscore ≥ 5 and PG-SGA B/C (n = 45)

Of the patients not assigned to group 1 (high-risk tumours) and who presented no deterioration in nutritional status at the start of treatment, 19% required individualised nutritional care after the post-chemotherapy re-evaluation detected weight loss and PG-SGA reflected the risk or presence of malnutrition.

These patients presented a median %WL of 6.1 (IQR = 11.6) at the start of chemotherapy (with respect to normal weight). During treatment, the %WL was 12.2 (IQR = 11.4) and the patients were referred to nutrition consultation. Figure 3 shows the evolution of the weights recorded for these patients.

Although on average the nutrition consultation took place 43 days (IQR = 85) after the start of chemotherapy, the time elapsed did not influence the effectiveness of the “Individualised nutritional care programme”. By the end of chemotherapy, the patients’ %WL had slowed considerably, to only 0.68 (IQR = 2.45).

Analysis of the evolution of these patients’ weight, according to tumour location, showed that all groups presented weight gain or maintenance at the end of chemotherapy (with respect to the initial weight). The patients with oesophageal-gastric cancer or pancreatic cancer did not achieve weight gain, but in 46.2% and 44.4% of these cases, respectively, there was no further weight loss during treatment. Moreover, the amount of weight loss had decreased by the end of the treatment, with respect to the initial weight, although the difference was not statistically significant.

In the overall study sample, the mean %WL on inclusion in the “Individualised nutritional care programme” (with respect to normal weight) was − 3.6%±8.2. At the end of chemotherapy, the average weight gain was 0%±7.3, and the differences between the two periods were statistically significant ($p < 0.001$). At this time point, 71.0% of the study sample had experienced weight gain or had maintained their initial weight.

Discussion

Although the considerable prevalence of malnutrition among cancer patients is well documented, as are the facts that it negatively impacts on the prognosis and that nutritional intervention improves patients’ survival and QoL [11], many malnourished patients remain unidentified and hence are not treated appropriately.

The NUPAC study [12], which to our knowledge is the only one carried out in Spain to determine the incidence of malnutrition among cancer patients, revealed that over 50% had moderate or severe degrees of malnutrition. However, the most alarming aspect reported in the preliminary results of this study is the large number of cancer patients in Spain for whom no nutritional diagnosis is made. In this respect, Duran-Poveda et al. conducted a study using the Delphi method, involving 52 medical specialists who treated cancer patients, and found that fewer than 30% of these patients were screened to assess their risk of malnutrition [13].

According to Kruizenga et al., the application of an early detection protocol, when the cancer is diagnosed, can improve the recognition of malnourished patients by 50–80% [14].

Effectiveness of the nutritional care model

In our study, application of the “Individualised nutritional care programme” to cancer patients enabled 100% of those with solid tumours and undergoing chemotherapy to be approached; of these, 36% were found to be at nutritional risk.

Detected weight loss

According to the ESPEN guidelines, the degree of weight loss is the most reliable indicator of nutritional deficit [3].

Forty years ago, studies reported that weight loss at diagnosis was common among cancer patients [15] and was strongly related to poor outcomes at all stages of cancer [16]. In 2015, Martin et al. supplied data showing that weight loss not exceeding 2.4% is a predictor of survival, regardless of tumour location, stage or performance status [17]. The risk of complications increases with the amount and speed of weight loss [18]. Quality of life is also related to weight loss at diagnosis, as shown by a recent study in which patients who had lost weight prior to chemotherapy experienced a greater impoverishment of their quality of life, compared to those who had not lost weight [19].

In 1980, as part of the ECOG study, De Wys et al. retrospectively evaluated weight loss in over 3,000 cancer patients. Moderate to severe weight loss was observed in 40–80% of patients, according to the type of tumour. The frequency of weight loss was greater among patients with gastric or pancreatic neoplasia. This study was criticised for not including head and neck cancer patients in its study group [15]. In our own research, patients with head or neck cancer presented the highest %WL (%WL = 16.3), while gastric and pancreatic neoplasia were associated with higher rates of weight loss than other digestive tumours.

In another study, Davidson et al. reported that patients with pancreatic cancer presented 12.2% weight loss at six months prior to diagnosis and that their nutritional intake was below recommended levels [20].

The location and extent of the tumour are clearly relevant to the degree of nutritional deterioration. Gastric and pancreatic tumours cause rapid and progressive deterioration, which on many occasions (80–85%) is already present at diagnosis [21], while in patients with colon cancer the prevalence of malnutrition is lower (45–60%) [22].

Nutritional intervention before starting chemotherapy

Standard health care practice should include nutritional intervention, beginning with appropriate nutritional screening of the patient [23]. The main aim of this approach is to identify patients with malnutrition or at high risk of nutritional complications caused by the disease or by the treatment received (surgery, chemotherapy or radiotherapy).

Nutritional intervention is effective in reducing weight loss, alleviating the effects associated with malnutrition, reducing the incidence of hospital admissions and improving QoL. Therefore, it should be considered part of the standard treatment provided to cancer patients [11, 24]. Nutritional intervention is more effective at earlier stages of the disease, before a state of refractory cachexia becomes established. Another study, of patients with lung cancer, concluded that maintaining adequate protein intake in the initial cycles of chemotherapy is important to maintain muscle mass [25].

With our nutritional care model for cancer patients, an early approach is taken to monitor and treat patients at nutritional risk, based on applying the triple technique of assessment, nutritional intervention and vigilant follow-up, in many cases up to a month before starting chemotherapy.

A review carried out in 2015, evaluating different types of nutritional treatment for patients with pancreatic cancer and the impact produced on nutritional status, QoL and survival, concluded that given the high prevalence of malnutrition and the rapid development of cachexia, early nutritional intervention is crucial for these patients. Unfortunately, few studies have been undertaken to evaluate the effect of nutritional intervention for patients with pancreatic cancer, partly due to the short survival times of these patients [21].

A retrospective study of patients with head and neck tumours showed that early, intensive nutritional intervention improved tolerance to chemotherapy, reduced the duration of hospital stay and minimised weight loss and treatment discontinuation due to toxicity [26]. Comparable results were found in a later study of this question [27].

In a study of the effectiveness of a comprehensive nutritional approach, conducted on a sample of 96 patients with oesophageal cancer undergoing chemo-radiotherapy, the patients were randomised into two groups: an intervention group, receiving individualised nutritional care, and a control group, in which the patients received general measures of nutritional supplementation, but did not receive intensive follow-up. The authors concluded that the individualised nutritional approach reduced the side effects of treatment and improved QoL [28]. Another study reported that patients prefer individualised nutritional treatment [29].

Nutritional intervention during chemotherapy

The incidence of malnutrition in cancer patients increases as the disease progresses, since both the tumour and the treatment have a direct impact on diet, gradually generating changes in the body [30].

Therefore, it is essential to monitor the patient's weight throughout the treatment process. Our "Individualised nutritional care programme" for oncology patients detected 45 patients, who despite not obtaining a Nutriscore result of ≥ 5 points at diagnosis, presented weight loss during cancer treatment, which was detected by monitoring the patient's weight on the first day of each cycle of chemotherapy. Accordingly, the hospital pharmacist, who sees patients in each of these cycles, plays a role of fundamental importance in the protocol.

A study was conducted in Spain with 997 patients, seeking to determine the prevalence and degree of malnutrition in cancer patients who had been referred to a nutrition consultation. The authors found that 57.5% of the patients were referred for consultation due to weight loss after starting chemotherapy, and that in 42.8% of these cases, the degree of weight loss was over 10% [31].

Weight gain or maintenance by the end of chemotherapy

Our results show that by identifying vulnerable patients (with high-risk tumours or identified as such by Nutriscore and PG-PGSA-B/C) and then applying assessment, nutritional intervention and vigilant follow-up, 70% of patients achieve weight gain or maintenance by the end of the treatment programme, which corroborates the effectiveness of our "Individualised nutritional care programme" for cancer patients.

Although for some types of cancer the differences were not statistically significant, our study shows that patients tend to recover from, or at least slow, their weight loss when the "Individualised nutritional care programme" is applied. Comparable data were reported by Bellestero-Pomar et al. [32], who implemented a similar protocol for screening and nutritional intervention with hospitalised onco-haematological patients.

Another study, by Davidson et al., reported that weight loss was attenuated and QoL improved by a nutritional intervention which resulted in increased protein intake [20].

The fact that no weight gain was achieved (weight maintenance was the best result obtained) in the group of patients with high-risk tumours leads us to believe that perhaps a more intensive follow-up programme or a more aggressive nutritional intervention, such as home parenteral nutrition (HPN), should be applied. HPN is recommended, with a strong degree of evidence, in the ESPEN guidelines [3] for patients with insufficient nutritional intake and malabsorption of nutrients.

A recent study carried out in Canada to evaluate patterns of use of HPN by cancer patients concluded that those with gastro-intestinal and gynaecological tumours are most likely to use HPN, although there is great variability among these patients. The authors highlight the need for consensus on the use of HPN by cancer patients since, despite the benefits that may be obtained from this type of nutritional intervention, as yet there are no clear recommendations on its use [33].

Limitations

This study is subject to certain limitations, which should be acknowledged. Firstly, due to ethical constraints, we were unable to establish a control group to properly evaluate the effectiveness of the protocol. In consequence, we can only compare our results with those published previously.

Furthermore, most published studies addressing issues of nutritional intervention refer to specific tumour lines, and most have been conducted focusing on tumour locations considered to produce a high risk of malnutrition. Our study encompasses the entire cancer population, which makes it more complex to compare our results with those published previously.

Conclusions

Although numerous studies have been conducted on the prevalence of malnutrition in cancer patients, and many have recommended the application of nutritional screening at diagnosis, to our knowledge none have evaluated the effectiveness of implementing a protocol based on nutritional screening, individualised treatment and monitoring, together with periodic re-evaluation.

The distinctive elements of our study are that it was carried out with outpatient patients and that the model proposed allows early nutritional care to be provided, regardless of tumour location, and so different levels of action may be taken according to the nutritional risk assessed. In contrast, most previous studies have been performed with hospitalised patients [32, 34] or take the form of action protocols for specific tumour locations. It is important to note that the early application of our protocol means that when chemotherapy is started the patient has an optimum nutritional status, which could favour treatment tolerance and facilitate weight recovery or maintenance during or after this process. We also show that an early, systematised and individualised approach can prevent or reduce the nutritional deterioration associated with chemotherapy. In fact, the model described has been incorporated into normal clinical practice at our hospital, enabling a comprehensive nutritional approach to be provided to all patients.

Abbreviations

QoL
Quality of life
ESPEN
The European Society for Clinical Nutrition and Matabolism
PG-SGA
patient-generated subjective global assessment.
NW
Normal weight
IW
Initial weight
%WL
Percentage of weight loss
CSW
Chemotherapy start weight
CSW
Chemotherapy end weight

WG
Weight gained
WM
Maintained
IQR
Interquatile range
HPN
Home parenteral nutrition

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Medical Ethics Committee at the Hospital Costa del Sol Hospital.

All patients included in this study provided written informed consent.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

Competing interests

MGS and JA have participated in an Advisory Board for Fresenius-Kabi.

The authors declare they have no conflict of interest.

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Author contributions

Conception and design of the study: EAS, MGS, JA, ARD.

Manuscript drafting: Elena Álvaro Sanz (EAS), Antonio Rueda Domínguez (ARD), Margarita Garrido Siles (MGS), Francisco Rivas Ruíz (FRR), Begoña Tortajada Goitia (BTG), Jimena Abilés (JA).

EAS, MGS, JA, ARD, contributed equally to the conception and design of the research; all authors contributed to the acquisition of the data; EAS, MGS, FRR and JA contributed equally to data analysis and interpretation. All authors have read and critically revised the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and have read and approved the final manuscript. JA and ARD contributed equally to the manuscript as senior authors.

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Disclaimers

Having reading the procedure for submissions, the authors declare there is no conflict of interest.

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Figures

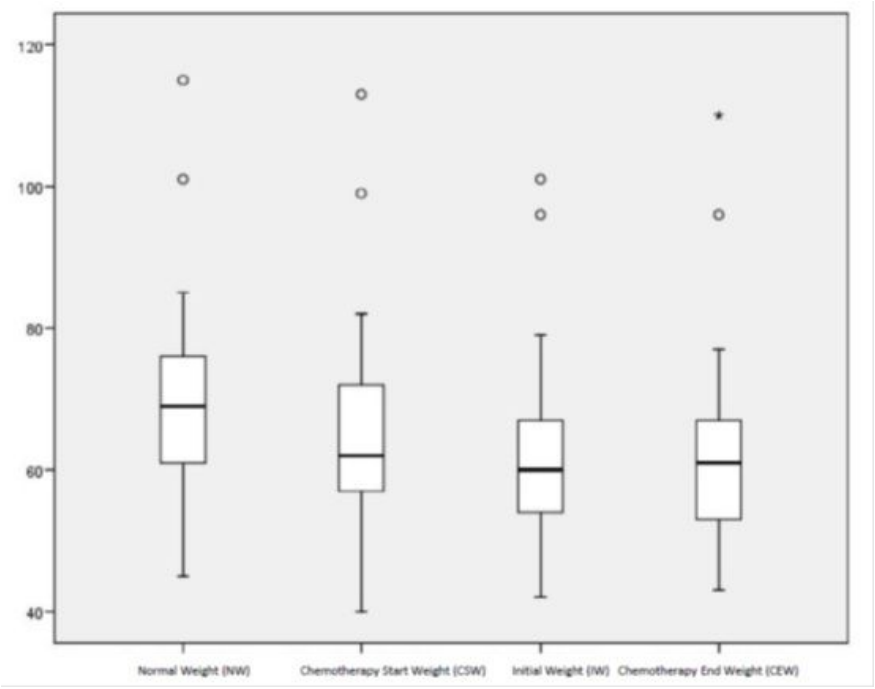

Figure 1

Evolution of weights in group 2 patients with Nutriscore≥5 and PG-SGA B/C after starting chemotherapy - Normal Weigth (NW) - Chemotherapy Start Weigth (CSW) - Initial Weigth (IW) - Chemotherapy End Weigth (CEW)

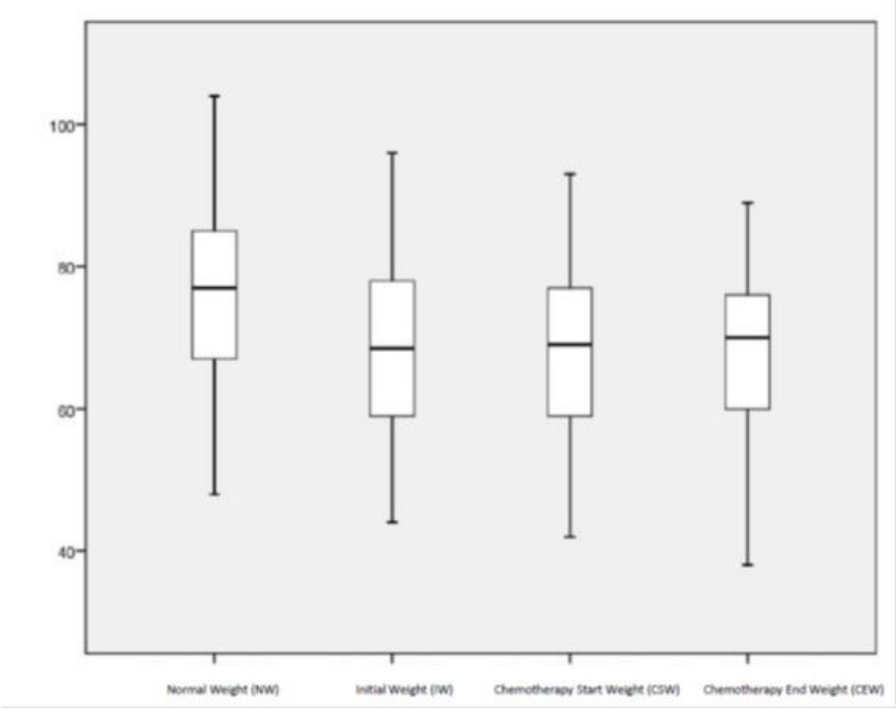

Figure 2

Evolution of body weight in patients in group 1 and 2(Nutriscore ≥5 and PG-SGA B/C) - Normal Weigth (NW) - Initial Weigth (IW) - Chemotherapy Start Weigth (CSW) - Chemotherapy End Weigth (CEW)

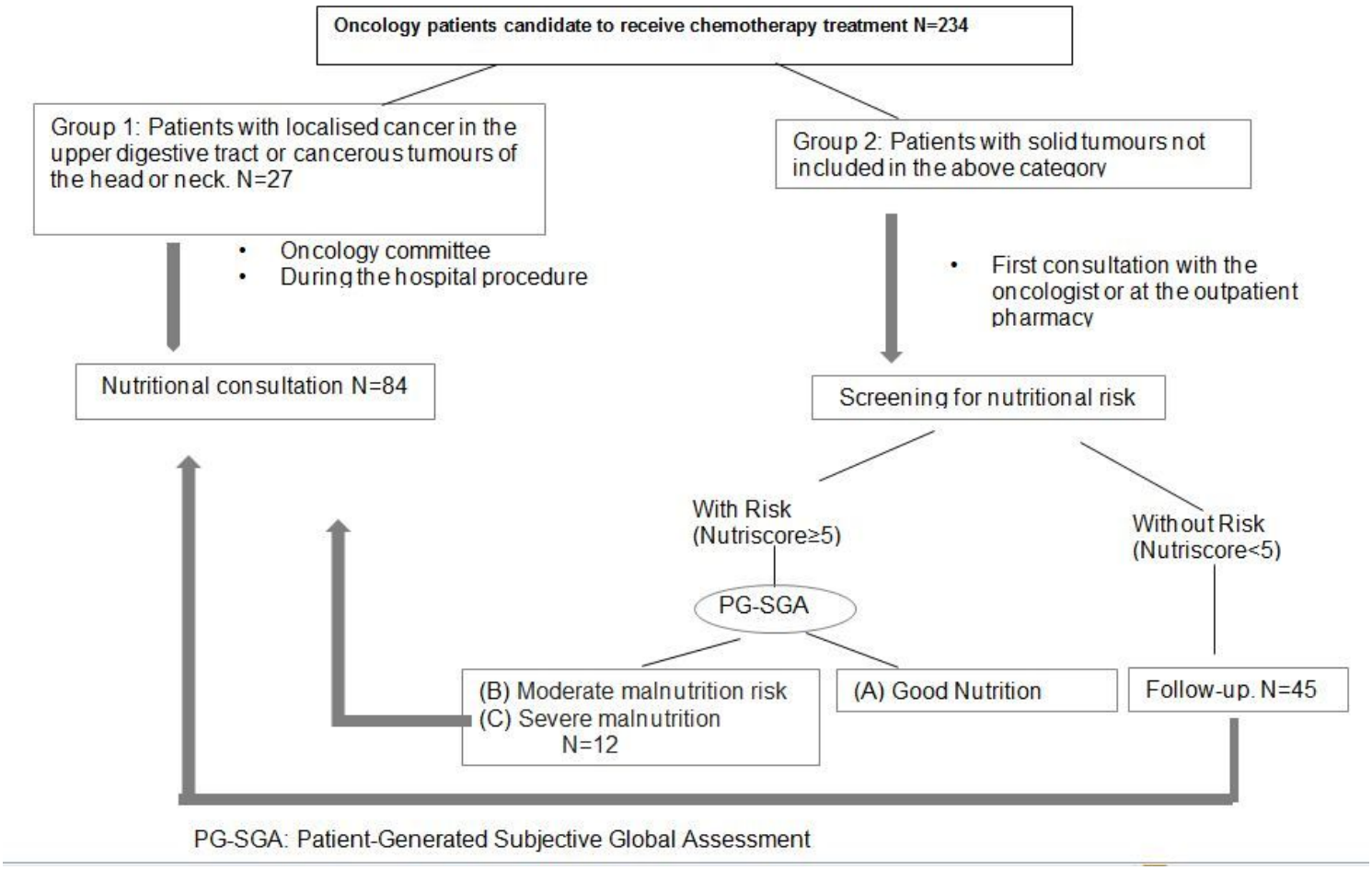

Figure 3

Nutritional Care Model