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Comparative Evaluation of Malnutrition Screening in Oncology Patients in an Acute Care Hospital: A Pilot Study

Chandni Sen Sinha[1,2], Colette LaSalle[1]*, Debra Argabright[2] and Clarie B Hollenbeck[1]

[1]*Department of Nutrition, Food Science and Packaging, San José State University, San Jose, CA, USA*

[2]*Good Samaritan Hospital, San Jose, CA, USA*

Abstract

Background: Malnutrition is associated with negative health consequences in the cancer population, making it imperative for an efficient interdisciplinary approach to conduct nutritional screening using an appropriate instrument. The present study compared the qualitative evaluation of nutritionally at-risk cancer patients, using an Existing Malnutrition Risk-Screening Questionnaire (EMR-SQ), with a new Comprehensive Questionnaire (CMR-SQ).

Materials and methods: The population studied consisted of 37 cancer patients. The first stage in data collection involved assessment by the nursing staff utilizing the EMR-SQ. In the second stage, these same patients were evaluated using the CMR-SQ developed by the authors containing components specific to identifying individuals at-risk for malnutrition, based on the PG-SGA and A.S.P.E.N. guidelines. The risk scores were subsequently used to classify low, moderate, and high risk of developing malnutrition.

Results: The EMR-SQ identified 81.1% at low risk of developing malnutrition, whereas the CMR-SQ determined 32.4% low, 37.8% moderate, and 29.7% at high risk. These differences between the screening instruments were statistically significant ($p < 0.0001$). Correlational analyses of factors affecting the risk of developing malnutrition using Spearman's rho indicated a positive relationship in presence of comorbidities $r = 0.63$, $p < 0.010$ and an inverse relationship between handshake strength $r = -0.40$, $p < 0.05$.

Conclusion: The combined distribution pattern of 70% for moderate and high risk of developing malnutrition identified by the CMR-SQ is consistent with the estimates of prevalence of malnutrition in hospitalized cancer patients in the literature. The increased sensitivity of the CMR-SQ could be attributed to the addition of nutrition focused clinical characteristics.

Keywords

Cancer, Malnutrition, Nutrition screening, Screening instrument

Abbreviations

EMR-SQ: Existing Malnutrition Risk-Screening Questionnaire; CMR-SQ: Comprehensive Malnutrition Risk-Screening Questionnaire; PG-SGA: Patient Generated-Subjective Global Assessment; ASPEN: American Society of Parenteral and Enteral Nutrition; GSH: Good Samaritan Hospital; IRB: Institutional Review Board; SJSU: San Jose State University; TPN: Total Parenteral Nutrition; SPSS: Statistical Package for the Social Sciences; BMI: Body Mass Index; WBC: White Blood Cells; BUN: Blood Urea Nitrogen; UBW: Usual Body Weight; SGA: Subjective Global Assessment; MNA: Mini Nutritional Assessment; NRS-2000: Nutrition Risk Screening-2000; RDN: Registered Dietitian Nutritionist

Introduction

Malnutrition is the result of a serious decline in the nutritional status of individuals. It may be characterized by unintentional weight loss, loss of muscle mass, and loss of subcutaneous fat, fluid accumulation, and reduced physical function. Malnutrition represents a major problem for the modern healthcare system and the community at large. Gout, Barker, and Crowe found that 40% of general hospitalized patients in Western coun-

***Corresponding author:** Colette LaSalle, Department of Nutrition, Food Science and Packaging, San Jose State University, San Jose, CA, USA, Tel: 408-924-3104, E-mail: Colette.LaSalle@sjsu.edu

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tries were malnourished [1].

Malnutrition, which is particularly challenging among cancer patients, may arise from interaction between a tumor, the host's response to the tumor's growth, and anticancer therapies [2]. Estimated 30-50% cancer patients die because of cachexia [3], an extreme form of malnutrition characterized by severe muscle wasting. Malnutrition has been associated with a host of negative consequences in cancer patients, including increased length of hospital stay, impaired tolerance to cancer treatments, reduced quality of life, and increased healthcare related costs [4-6].

The Joint Commission, an independent, non-profit accreditation organization that certifies healthcare institutions nationwide to meet certain quality standards, has mandated that nutrition screening be performed on all hospitalized patients within 24 hours of admission [6-8]. However, The Joint Commission does not endorse a universal nutrition screening instrument or method, nor does it specify particular guidelines for nutrition screening, including which staff member should be responsible for conducting the screening. These are currently decided by the individual healthcare facility. To adhere to the mandate that nutrition screening be done within 24 hours of patient admission, hospitals use a variety of nutrition screening instrument, including a set of questions typically administered by a nursing staff member. The resulting variations and inconsistencies of the screening process can lead to inefficient communication between the interdisciplinary healthcare team members and to higher incidences of morbidity and mortality in the inpatient setting [6].

The purpose of the present study was three-fold. The first purpose was to determine the distribution of patients identified under the categories of: low, moderate, or high risk of developing malnutrition between two screening questionnaires (EMR-SQ and CMR-SQ). The second purpose was to compare the EMR-SQ that is currently being used with a more Comprehensive Nutritional Screening Questionnaire (CMR-SQ) to examine whether the CMR-SQ is better able to detect nutritionally at-risk patients than the EMR-SQ. The third purpose of the study was to identify potential variables included in the CMR-SQ that may have contributed to increasing the ability in identifying patients who are potentially at increased nutritional risk for developing malnutrition, particularly at moderate and high risk levels.

Materials and Methods

Study design and patient population

The study was approved by the Institutional Review Board (IRB) of both GSH and San Jose State University (SJSU) both in San Jose, California. Written informed consent was obtained prior to initiation of the study. The study was conducted in the oncology unit at GSH. Patients were recruited for the present study sequentially from newly admitted patients to the unit, and data collected within 24 hours of admission. Inclusion criteria for the study called for newly admitted cancer patients 18 years and older, the ability to understand English and follow oral instructions, and voluntary participation in the study. Signs of impaired cognition, as well as the failure to meet the inclusion criteria, constituted the exclusion criteria.

Screening questionnaires

Two separate screening questionnaires were involved in this study. The first was the existing admissions adult nutrition risk assessment screening questionnaire (EMR-SQ) currently used in Good Samaritan Hospital to screen newly admitted patients, including patients being admitted to the oncology unit (Supplemental Information: EMR-SQ). The EMR-SQ was taken on a general admitting form and contained primary diagnosis, chief complaints, and allergies. The nutritional assessment portion included questions on swallowing difficulty affecting food intake, diet restrictions, unintentional weight loss ≥ 4.5 kg, very poor appetite > than 5 days, height, weight, BMI, abdomen appearance, GI complaints, pressure ulcers, Braden scale, and a brief medical history. The second Screening Questionnaire (CMR-SQ) is a more comprehensive malnutrition risk screening questionnaire developed specifically to identify nutritionally at-risk cancer patients (Supplemental Information: CMR-SQ). Nutritional screenings on admission to a hospital represents the first step in identifying individuals who may be at an increased risk of developing malnutrition, and may require a thorough nutrition assessment by a Registered Dietitian Nutritionist (RDN). It is important to note that nutrition screening differs from nutrition assessment. A nutrition assessment, conducted by a RDN, is an involved process that helps identify any existing or impending nutrition problem, and recommends possible nutrition interventions.

The CMR-SQ was developed by the investigators based on the Patient Generated Subjective Global Assessment (PG-SGA) [8-10]. The PG-SGA is a nutritional assessment questionnaire originally designed for oncology patients that has been validated for and extended to a wide variety of patient populations in addition to cancer patients [11,12]. The PG-SGA consists of two sections; part one is based on information obtained from the patient on weight history, nutrition history, symptoms affecting normal eating and activities of daily living. Part two consists of worksheets that calculate weight loss, metabolic

changes related to nutritional requirements, and nutritional focused physical examination [11].

The CMR-SQ also incorporated certain nutrition focused clinical characteristics, such as, the presence of comorbidities, handgrip strength measurement, medications, general chemistry, more in-depth assessment of weight changes, along with the duration, and factors affecting loss of appetite, and a nutritionally focused physical examination. The nutritionally focused physical examination of malnutrition of the patient was performed at the time of data collection/interview process by the same investigator. Observations were made for protruding clavicles, squaring of the shoulders, depression of temporal area, sunken orbital sockets, dark circle around eyes. Furthermore, the CMR-SQ grouped different cancers based on an associated nutrition risk score. For example, cancer involving the reproductive system was assigned a score of one because of the relatively lower impact this cancer has regarding the nutritional status. Conversely, cancers of the lung, stomach, and colorectal were assigned a score of three, as these cancers are known to have a significant impact on patients' nutritional status [13]. Cancers of the pancreas, head and neck, mouth, pharynx, esophagus, and liver were assigned the highest score (six), indicating the greatest level of nutritional risk [13]. Finally, early stage cancers were assigned lower nutritional impact scores than cancers in later stages (two, three, and four) [14]. The scores obtained from this questionnaire are then used to determine whether the patient is at low, moderate, or high risk of developing malnutrition [13].

Data Collection

Data were collected from 37 participants during a three-month period, from mid-March to mid-June 2015. The data collection process included two stages. The first stage involved an electronically completed EMR-SQ that included the patients' nutritional status, followed by assignment of a nutrition risk score of either low risk, moderate risk, or high risk, level, based on the malnutrition diagnosis grid developed and used within the Oncology Unit of Good Samaritan Hospital. The assessment included: The patient's name, date of birth, age, sex, reason for the visit, primary diagnosis, chief complaint, allergies (if any), any swallowing difficulty affecting food intake, tube feeding or Total Parenteral Nutrition (TPN), dietary restrictions, unintentional weight loss of 4.5 kg or more, very poor appetite for more than five days, recent onset of diabetes (less than 3 months), anthropometrics, abdomen appearance, gastrointestinal comment, pressure ulcer, Braden scale, and any previous surgeries.

The second stage of the patients' nutritional status was assessed using the CMR-SQ. Specifics related to weight history, food intake, and appetite was gathered by interviewing the patient. A nutrition-focused physical exam and handshake for assessing the handgrip strength were also conducted on the patients. Data on existing treatment including general chemistry/lab values, current diagnosis, comorbidities, and medications were obtained from the patient's admission history, physician assessments, and hospital progress notes. After assigning a score to each item on the questionnaire, the scores were totaled, with each patient being assigned a nutrition risk level, i.e. low risk, moderate risk, or high risk, based on the total score. These nutrition risk level scores were assigned in accordance to the PG-SGA screening questionnaire [8-10].

Data Analysis

Data were analyzed using SPSS version 22.0 (SPSS, Chicago, IL, USA). Comparison of assigned risk levels between the two questionnaires was assessed utilizing the Wilcoxon Signed-Rank Test. Correlational analyses using Spearman's rho was used to examine the relationships between study variables, such as weight change, factors affecting appetite loss, presence of comorbidities, and handshake strength, and their placement into one of the three at-risk levels. The level of statistical significance was specified at $p \leq 0.05$ levels. A level of clinical significance regarding the distribution of nutritionally at-risk

Table 1: Clinical and demographical characteristics of study participants for malnutrition screening in the oncology unit at Good Samaritan Hospital.

Clinical characteristics	**Mean ± SD (%)**	**n (%)**
Age (yr)	67.0 ± 15.2	
Height (cm)	168.1 ± 11.1	
Weight (kg)	73.4 ± 16.8	
Body Mass Index (kg/m^2)	25.81 ± 5.2	
Gender (M/F)		18M/19F (49/51)
Type of cancer		
Breast/Prostate/Endometrium/Cervix/Kidney		22 (60)
Lung/Stomach/Colon		13 (35)
Pancreas/Head/Neck/Pharynx/Esophagus/Liver		2 (5)

Note: Yr = Years; kg = Kilogram; kg/m^2 = Kilogram per meter squared; F = Female; M = Male; lb = Pound.

individuals was defined as a level of distribution more consistent with the published literature, which estimates the prevalence of moderate to severe malnutrition between 40% and 80% among cancer patients [1,6,15-18].

Results

Clinical and demographic characteristics

The clinical and demographic characteristics of the 37 patients are provided in (Table 1). Their ages varied between 23 and 95 years, with a mean ± SD of 67 ± 15 years. Gender distribution was essentially equal with 18 males and 10 females. The mean ± SD Body Mass Index (BMI) was 25.8 ± 5.24. The study group included two outliers with BMIs of 37.3 and 42.4 kg/m^2. Since there was no reason to believe that this was due to experimental error, the two outliers were included in the data analysis.

Cancer diagnosis

The most frequently reported cancers, accounting for 22 of the 37 patients (59%) diagnosed with cancer, involved either the reproductive system (affecting one or both breasts, the prostate, the endometrium, or the cervix) or one or both kidneys (Table 1). The second most commonly reported cancers, accounting for 13 of the 37 patients (35%) diagnosed with cancer, related to the lungs, stomach, and colon. The least commonly reported cancers, accounting only two of the 37 patients (5%) diagnosed with cancer, involved the pancreas, head and neck, pharynx, esophagus, and liver.

Additional diagnoses/comorbidities

Comorbidities commonly observed in the oncology unit were listed under this category. For example, three patients (8.5%) presented with renal disease or hepatitis, followed by five patients (14%) with diabetes recorded in their medical records, and only two patients (5%) presenting with failure to thrive/malnutrition/cachexia.

Weight history

Subjects ranged in weight from 45 kg to 105 kg, with a mean ± SD weight of 73.4 ± 16.74 kg (Table 1). Fourteen of the 37 individuals (37.8%) reported weight loss during the 30 days prior to admission; of these, 11 (78.6%) reported a loss of 4.5 to 9.4 kg; three of the 14 (21.4%) reported a loss between 9.5 to 13.6 kg. On the other hand, only three of the 37 subjects (8.1%) reported a weight gain, ranging from 4.5 to 9 kg during the 30 days prior to hospitalization.

Appetite

Duration and factors affecting appetite loss are presented in (Table 2). Patients experiencing very poor appetite on CMR-SQ were equally distributed with 19 of 37 patients (51.4%) reported very poor appetite while 18 out of 37 patients (48.6%) did not report very poor appetite during the 30 days prior to hospital admission. Of the 19 individuals reporting very poor appetite, 8 of 19 (42%), reported less than a week of this condition, 6 (32%) reported very poor appetite lasting between 1 and 2 weeks, and 5 (26%) reported very poor appetite lasting more than 2 weeks. Among the factors that may have contributed to loss of appetite identified by the 19 patients, the top three included nausea (74%), vomiting (68%), and diarrhea (63%), changes in taste (47%), followed by dry mouth (26%), constipation (21%), and mouth sores (10%).

Clinical laboratory analysis

The total WBC counts of less than 4,500 and greater than 11,000 per microliter (µl) were reported as the most common laboratory abnormality, among 10 of the 37 (27%) hospitalized patients. This was followed by Blood Urea Nitrogen (BUN) levels greater than 50 mg per Deciliter (dl), in three (8%) of the patients.

Handshake strength

Handgrip strength was initially assessed using the dynamometer in 19 of 33 patients (58%), while handgrip strength was assessed using handshake in the remaining 14 (42%) due to limitations in the patients' ability to use the dynamometer. Handgrip strength in 13 of the

Table 2: Weight history, duration and factors affecting appetite loss in participants for malnutrition screening in the oncology unit at Good Samaritan Hospital.

Weight history	**n (%)**
No change in weight	20 (54)
Decreased weight	14 (38)
4.5-9.4 kg	11 (30)
9.5-13.6 kg	3 (8)
Increased weight	
4.5-9.4 kg	3 (8)
9.5-13.6 kg	0 (0)
> 13.6 kg	0 (0)
Appetite	**Frequency (%)**
Loss of appetite	
No	18 (48)
Yes	19 (51)
Duration of appetite loss	
< 1 week	8 (42)
1-2 week	6 (13)
> 2 weeks	5 (26)
Major factors affecting appetite loss in 19 patients experiencing very poor appetite for 30 days prior to admission	**n (%)**
Nausea	14 (74)
Vomiting	13 (68)
Diarrhea	12 (63)
Taste changes	9 (47)

19 patients (68%) using a handheld dynamometer were assessed as normal, 5 of the 19 (26%) as strong, and only a single individual (5%) was assessed as weak. A similar pattern emerged in the 14 individuals that were assessed using handshake strength. Nine of the 14 (64%) were assessed as normal, and 5 (36%) assessed as strong. It should be noted that the CMR-SQ incorporated handshake strength measurements, while this assessment was not part of the EMR-SQ.

Physical assessment

The CMR-SQ also involved a nutrition focused physical assessment covering five physical attributes potentially relating to nutritional conditions, protruding clavicle, depression of temporal area, sunken orbital sockets, dark circle around eyes and shoulder squaring, which are relatively easy to observe. None of the study participants exhibited any abnormal findings in this regard.

Associations among measured variables and levels for of risk of malnutrition

The correlations between weight change, appetite loss, comorbidities, and handshake, the dependent variables on the questionnaires, and the levels of risk of malnutrition, are presented in (Table 3). Results from Spearman's rho indicated statistically significant positive relationships between three particular variables, weight change ($r = 0.40$, $p < 0.05$), factors affecting appetite loss ($r = 0.42$; $p < 0.05$), and presence of comorbidities ($r = 0.63$; $p < 0.01$), and an inverse relationship between handshake strength ($r = -0.40$; $p < 0.05$) and the level of risk with regard to developing malnutrition.

Differences between the two questionnaires, EMR-SQ and CMR-SQ

Results of the Wilcoxon-Signed Rank Test of the null hypothesis that there is no difference between the two screening instruments indicated that the difference between the two screening instruments was below the critical level. This leads to rejection of the null hypothesis and conversely, support for the alternate hypothesis that there is a significant difference between the two screening instruments ($p = 0.0001$). As presented in (Table 4), the EMR-SQ identified 30 of the 37 patients (81%) as being at low risk for malnutrition, while five of the 37 (14%) were identified as being at moderate risk, and only two (5%) at high risk. The CMR-SQ, in contrast, identified 12 of the 37 patients (32%) as being at low risk, 14 (38%) at moderate, and 11 (30%) at high risk for developing malnutrition.

Table 3: Associations between weight change, appetite loss, comorbidities and handshake strength and the level of risk of malnutrition.

Variables	Spearman's rho		
	r	r^2	p value
Weight change	0.400	0.160	0.014
Factors affecting appetite loss	0.420	0.176	0.01
Comorbidities	0.630	0.397	0.0001
Handshake strength	-0.400	0.160	0.014

Note: r = Correlation coefficient; r^2 = Coefficient of determination.

Table 4: Comparison of nutrition risk scores in the questionnaires EMR-SQ and CMR-SQ for malnutrition screening in the oncology unit at Good Samaritan Hospital.

EMR-SQ	Frequency (%)
Low	30 (81)
Moderate	5 (14)
High	2 (5)
CMR-SQ	
Low	12 (32)
Moderate	14 (38)
High	11 (30)

Note: EMR-SQ = Existing Malnutrition Risk Screening Questionnaire; CMR-SQ = Comprehensive Malnutrition Risk Screening Questionnaire.

Discussion

The purpose of the present study was three-fold. The first purpose was to determine the distribution of patients identified under the categories of low, moderate, or high risk of developing malnutrition on each of the two screening questionnaires (EMR-SQ and CMR-SQ). The second purpose was to compare the EMR-SQ that is currently being used with a more Comprehensive Nutritional Screening Questionnaire (CMR-SQ) and to examine whether the CMR-SQ is better able to detect nutritionally at-risk patients than the EMR-SQ. The third purpose of the study was to identify potential variables included in the CMR-SQ that may have contributed to increasing the ability in identifying patients who are potentially at increased nutritional risk for developing malnutrition. The comparison between the two screening questionnaires clearly indicates that there were major differences in their ability to identify individuals with moderate and high risk of malnutrition. The CMR-SQ identified 32.4% at low, 37.8% at moderate and 29.7% at high risk of developing malnutrition, while the EMR-SQ identified less than 20% at a moderate or high risk, with the vast majority of patients (81.1%) being classified at low risk of developing malnutrition. Thus, the CMR-SQ was capable of identifying a greater number of patients who were potentially at an increased risk of developing malnutrition ($p < 0.001$). Moreover, the distribution pattern identified by the CMR-SQ is consistent with recent evidence in the literature that reported the prevalence of malnutrition between 40% and 80% among the hospitalized cancer patients in typical western hospitals [1,5,15-18].

There were certain aspects of the CMR-SQ identified in the present study that potentially increased the precision and sensitivity of the CMR-SQ that contributed to the greater number of patients being identified at a moderate and high risk of developing malnutrition. As weight loss is a strong indicator of prognosis in the cancer patients, weight history recorded by the CMR-SQ allowed for a much more in-depth analysis. There were three main variables, current body weight, Usual Body Weight (UBW), and history and degrees of weight changes specifically with regard to the previous 30 days. The addition of weight changes to the CMR-SQ is consistent with similar screening instruments designed for the adult hospitalized patients including patients with cancer [8,19]. In contrast, the EMR-SQ assessed patients based only on current body weight and unintentional weight loss of more than 4.5 kg.

Anorexia, which is a severe form of loss of appetite, is common among cancer patients and may potentially lead to malnutrition. In the CMR-SQ, poor appetite, for less than one week, one to two weeks, or more than two weeks was further associated with eight factors that could have possibly affected appetite loss in the cancer patients. These factors that were associated with decreased food intake prior to admission to the hospital included, nausea, vomiting, diarrhea, mouth sores, constipation, dry mouth, loose dentures and change in taste. The addition of these questions to CMR-SQ was consistent with other studies in this area involving screening cancer patients [8]. The EMR-SQ, on the other hand, only identified patients with poor appetite for more than five days, as well as with difficulty swallowing, which may have affected food intake.

A measure evaluating handgrip strength of patients that was not in the current practice was introduced in the CMR-SQ. The strength of the coefficient of determination suggest that approximately 14% ($r^2 = 0.137$) of the variation in degree of risk was related to handshake strength. This finding is consistent with the evidence in the literature indicating that patients demonstrating higher handgrip strength had a decreased risk of being nutritionally at-risk [20].

The CMR-SQ, unlike the EMR-SQ, included a wide range of comorbidities that are commonly observed in the oncology unit at Good Samaritan Hospital. The strength of the coefficient of determination suggest that approximately 40% ($r^2 = 0.396$) of the variation in placement in the three categories was related to comorbidities. This is considered clinically significant in assessing the risk of malnutrition; however, research is limited in the area exploring the association of comorbidities and malnutrition within the cancer population.

Nutritional status was also assessed using five physical attributes, potentially relating to nutritional condition, which were relatively easy to observe. The addition of these physical attributes were consistent with the American Society of Parenteral and Enteral Nutrition (A.S.P.E.N.), guidelines for detecting malnutrition among hospitalized patients and other nutrition screening questionnaires in this area involving screening of cancer patients [10]. These identifiers, however, were not present in the EMR-SQ.

Corticosteroids are commonly used in cancer patients to help prevent side effects such as nausea, vomiting to anticancer treatment, as appetite stimulants, and also in pain management [21]. The addition of these medications to the CMR-SQ was unique especially for malnutrition screening among the cancer patients and may have enhanced the ability to identify the nutritionally at-risk patients. However, none of the other popularly used malnutrition screening questionnaires, such as the PG-SGA, SGA, MNA, NRS-2002, have incorporated the use of medications [22]. The EMR-SQ, on the other hand, did not assess patients based on current medications.

Finally, lab values with potential relevance to nutrition status were also identified using the CMR-SQ, in contrast with the existing practice, which did not take this information into consideration. The inclusion of lab values in CMR-SQ was also another unique addition that was not found in any of the other screening questionnaires.

In the inpatient setting, the typical timeframe for being assessed by a RDN for mildly at-risk individuals is 72 hours. For moderately at-risk patients, the timeframe is 24 to 48 hours, while for severely at-risk patients, it is 24 hours. However, as the EMR-SQ had a tendency to place the majority of patients into the lower risk level of developing malnutrition, it is possible that patients who were identified by the CMR-SQ at higher risk may have been overlooked, and therefore, would not have been assessed by a dietitian in an appropriately time-sensitive manner. The CMR-SQ, in contrast, was more comprehensive and specific to nutrition assessment in cancer patients; thus, it appears that the CMR-SQ may be more capable of identifying individuals at a moderate or higher risk of developing malnutrition. Specifically, the CMR-SQ identified patients with roughly equal distribution at the low, moderate, and high levels. Support for this conclusion lies in the observation that the distribution pattern of percentages at the three levels of risk obtained using the CMR-SQ, is consistent with the documentation in the literature in this area suggesting that malnutrition is prevalent in 40-80% of hospitalized cancer patients [1,6,15-18]. Thus, the CMR-SQ appears to be more sensitive and precise estimate than the percentages obtained with the EMR-SQ.

Conclusion

Evidence from the present study clearly indicated that the EMR-SQ as an initial nutrition screening instrument was not highly effective, in the sense that it skewed the majority of nutritionally at-risk patients into the low risk category for developing malnutrition. Thus, the present study indicates the importance of an instrument that is specifically designed to assess the risk of malnutrition by incorporating the nutritionally relevant information. This will provide a more sensitive indication of an individual's actual risk for developing malnutrition. In this regard, it highlights the importance of the RDN as an integral member of the interdisciplinary healthcare team. The use of an appropriately developed instrument based on important nutritional markers of nutritional status conducted by formally trained healthcare professionals would assure more time-sensitive referrals for nutrition related interventions, that can help reduce morbidity and mortality, especially with regard to moderate and high risk in hospitalized patients.

Strengths and Limitations

Study strengths

A strength of the present study was that the CMR-SQ was specifically designed for malnutrition screening of the oncology population. This contrasted with the EMR-SQ, which was designed for general medical and physical assessment and was also not specifically designed to assess the nutritional status. Moreover, even though the CMR-SQ did not include all variables that might have helped to accurately assess a patient's risk for malnutrition, it did include substantially more than the EMR-SQ in standard use, as explained above.

Study limitations

The present study had several potential limitations. First, the study included only 37 individuals, and it could be argued that the sample size was relatively small; however, since they are paired studies, a major source of variation (inter-individual variability) was eliminated. Second, information obtained on weight history and loss of appetite in the assessment of malnutrition on the CMR-SQ was self-reported by the patients, with no independent verification regarding the accuracy of these data. Self-reporting is a common technique of assessing patient's weight changes and food intake that has been adopted by several nutrition screening questionnaires, including the PG-SGA [13]. Third, information concerning edema, which could have affected a person's nutritional status and constituted one of the criteria for malnutrition assessment under the A.S.P.E.N. guidelines [6] was not included in the CMR-SQ. In the present study, there were two participants with edema who may have been at a higher risk of malnutrition. Other conditions (e.g., dyspnea, pleural effusion, and severe abdominal pain) that may have affected appetite and thereby affected risk of malnutrition were identified in nine patients. However, these problems were not assessed on the CMR-SQ under comorbidities, which could have potentially impacted the nutritional status of the patients. Finally, information on dietary intake and nutritional supplements with possible effect on nutritional status was not collected by the CMR-SQ. These limitations are the same for both questionnaires and therefore inherent in the nature of the data collected.

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