ORIGINAL ARTICLE

Unintentional weight loss is the most important indicator of malnutrition among surgical cancer patients

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ABSTRACT

Background: Disease-related malnutrition is highly prevalent in hospital patients and varies from 25-40%. Early nutritional screening of patients at admission helps to improve recognition of malnourished patients to allow early interventions and enhance clinical outcomes.

Method: A total of 104 preoperative surgical patients with oesophageal (34), stomach (17) or pancreatic cancer (53) were recruited in our study. The risk of malnutrition was examined using the quick-and-easy Malnutrition Universal Screening Tool (MUST). Anthropometric data and information on percent weight change over the past six months, unintentional weight loss, dietician referrals, and history of nutritional intervention were collected.

Results: A total of 75% of our participants were at high malnutrition risk with a mean (±SD) percentage weight loss of 5.18 (±6.23)%, despite a mean BMI of 26.09 (±5.73) kgm^{-2}. Participants with a significantly higher percent weight loss, unintentional weight loss, dietician referral and nutritional intervention had a higher risk of malnutrition ($p<0.05$). Presence of unintentional weight loss was the only significant predictor (OR 3.22; 95% CI 1.23, 8.40) associated with risk of malnutrition after adjusted for all confounders.

Conclusion: In conclusion, our findings highlight the importance of routine screening of malnutrition in oncology patients. Medical personnel must be aware that unintentional weight loss is an important predictor of malnutrition risks even if the patient's BMI is not suggestive of malnutrition.

KEYWORDS

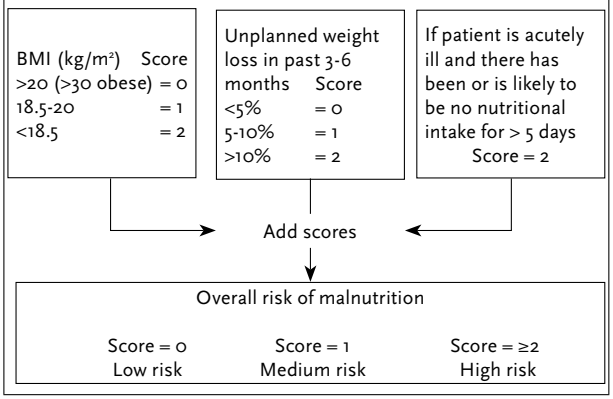
Malnutrition, Malnutrition Universal Screening Tool (MUST), weight loss, cancer

INTRODUCTION

Although a large number of studies have shown high prevalence rates (up to 40%) of disease-related malnutrition in healthcare organisations, malnourished patients often remain unrecognised in these settings.[1-5] Malnutrition can lead to many complications such as delayed wound healing, increased postoperative morbidity and prolonged hospitalisation.[6-8] Kruizenga *et al.* emphasised that early screening of patients at the time of diagnosis may improve recognition of malnourished patients by 50-80% and reduce the length of hospital stay.[9,10]

Of the many nutritional assessment methods, the Subjective Global Assessment (SGA), the Malnutrition Universal Screening Tool (MUST) (*figure 1*) and the Nutritional Risk Index (NRI) are most commonly used in hospital settings. The Patient Generated-Subjective Global Assessment (PG-SGA) was adapted from the SGA and validated for nutritional status assessment in oncology patients.[11] MUST scores were found to be consistent with PG-SGA scores,[12] demonstrating the validity and effectiveness of MUST in correctly identifying malnourished patients with cancer.

Figure 1. *MUST is composed of three components: body mass index score [BMI = weight (kg)/ height (m²)], a weight loss score and an acute illness component lasting longer than five days with or likely to have no nutritional intake. The summed scores were divided into three degrees and the risk of malnutrition can be assessed based on the summed scores. For further information on MUST and management guidelines, see http://www.bapen.org.uk/screening-for-malnutrition/must/introducing-must*



Another study assessing the feasibility of use of nutritional assessment methods has recommended the MUST as a routine nutrition evaluation tool because it is simple to use, rapid (within 3 to 5 minutes)[7,13-14] and less expensive when compared with SGA and NRI.[15] It has good predictive validity in examining the association of malnutrition with length of stay, mortality and hospital cost,[8,16] with a higher sensitivity, specificity, positive predictive value and negative predictive value than the NRI[15] when the SGA was used as a benchmark.

Weight loss was highlighted as a common condition among patients with cancer at the time of diagnosis as early as 30 years ago.[17] In the outpatient setting, one in five patients with colorectal cancer were malnourished (weight loss >10%) when they first entered the secondary healthcare system.[18] Cancer-associated malnutrition mainly affects patients with certain cancers (e.g. gastrointestinal and pancreatic cancer) and has a significant negative impact on prognosis and survival. Cachexia is most prevalent in patients with stomach or pancreatic cancer, in which at least 80% of patients present with or develop cachexia that deteriorates further after the time of diagnosis.[19] These detrimental effects demonstrate the importance of early assessment of nutritional status among patients with cancers.

The general objective of our study was to assess the risk of malnutrition in preoperative surgical patients with gastrointestinal and pancreatic cancer using the malnutrition universal screening tool (MUST). The specific objectives of the study were:

1. To define and compare the prevalence of malnutrition using BMI <20 kgm^{-2} and MUST among preoperative surgical patients.
2. To describe the patient-dependent (age, gender, and body mass index), tumour-dependent (tumour location), and intervention-related (dietician referral and nutritional intervention) indicators among preoperative surgical patients.
3. To study the association of patient-dependent, tumour-dependent and intervention-related indicators with malnutrition risk among preoperative surgical patients.

PATIENTS AND METHODS

From January to October 2011, 104 consecutive surgical patients were recruited in the study. The eligibility criteria included adult outpatients with oesophageal, stomach, and pancreatic cancer presenting for diagnosis, therapy or follow-up to the surgery unit of the University Medical Centre Utrecht, the Netherlands. Patients were excluded from the study when they were unable to give informed consent. The study protocol was approved by the Medical Ethics Research Committee of University Medical Centre Utrecht, the Netherlands.

In this survey, we chose to screen the nutritional status of the patients using the MUST (*figure 1*). This tool involves assessment of body mass index (BMI), unintentional weight loss in the preceding three to six months and presence of an acute disease resulting in absence of dietary intake for more than five days (or likely to result in no dietary intake for more than five days). The patients in this study were categorised into low (MUST score of 0 and 1) or high risk of malnutrition (MUST score of 2 or more). We combined the intermediate risk with the low-risk group due to small sample size and no active treatment was advocated for either group.[20] Nurses involved in this study received training prior to commencement of the study.

Body weight and height were measured by trained nurses according to standard procedures. If weight and height could not be measured, self-reported measurements were used to estimate underweight, obesity and overall malnutrition risk. The presence of dietician referral was sought and recorded. Throughout the study period, all information obtained was stored on an electronic database system, which was subsequently retrieved for statistical analyses.

Statistical analyses

All data were stored, structured and analysed using the SPSS for Windows version 16. Descriptive statistical methods were used to express means, standard deviations,

percentages and frequencies. The associations between risk factors and malnutrition were analysed using logistic regression. Odds ratios (OR) with 95% confidence intervals (CI) were reported where appropriate. Significant level was preset at 0.05.

RESULTS

A total of 104 patients were recruited. The patients were affected by solid tumours, the mean age was 64.7 (±SD 10.8) years, the men-to-women ratio was 1.5, the mean BMI was 26.2 (5.6) kgm^{-2}, the mean percentage weight loss was -2.7 (6.0) % and the mean MUST score was 2.0 (1.0).

Table 1 describes the characteristics of patients according to gender. Of note, a majority of patients were more than 65 years (58.7%), had a body mass index of more than 20 kgm^{-2} (95.2%), experienced unintentional weight loss (64.4%), had a dietician referral (55.8%), and underwent nutritional intervention (51.9%). The percentage of patients with pancreatic cancer was the highest (51.0%), followed by oesophageal cancer (32.7%) and stomach cancer (16.3%).

The prevalence of malnutrition was 75% and 4.8% using MUST and BMI, respectively. The mean BMI of those with malnutrition was in the overweight category (>25 kgm^{-2}) and mean percent weight loss was about 5% (*table 2*). A significant mean difference of percent weight loss ($p<0.05$) was observed between groups of patient with high risk and low risk of malnutrition.

Table 1. *Characteristics of patients according to gender*

Variables	Male	Female	Total	P
Patient, n (%)	63 (60.6)	41 (39.4)	104 (100.0)	
Age (years)				0.984
<65	26 (41.3)	17 (41.5)	43 (41.3)	
≥65	37 (58.7)	24 (58.5)	61 (58.7)	
Body mass index (kg/m^2)				0.335
<20.0	2 (3.2)	3 (7.3)	5 (4.8)	
≥20.0	61 (96.8)	38 (92.7)	99 (95.2)	
Tumour location				0.888
Oesophagus	21 (33.3)	13 (31.7)	34 (32.7)	
Stomach	11 (17.5)	6 (14.6)	17 (16.3)	
Pancreas	31 (49.2)	22 (53.7)	53 (51.0)	
Unintentional weight loss				0.278
Yes	38 (60.3)	29 (70.7)	67 (64.4)	
No	25 (39.7)	12 (29.3)	37 (35.6)	
Dietician referral				0.118
Yes	39 (61.9)	19 (46.3)	58 (55.8)	
No	24 (38.1)	22 (53.7)	46 (44.2)	
Nutritional intervention				0.187
Yes	36 (57.1)	18 (43.9)	54 (51.9)	
No	27 (42.9)	23 (56.1)	50 (48.1)	

Table 2. *Characteristics of different patient groups based on the risk of malnutrition (mean ± SD)*

Variables	High risk (n=78)	Low risk (n=26)	Mean difference (95% CI)
BMI (kg/m^2)	26.09 ± 5.73	26.63 ± 5.09	0.54 (-1.96,3.05)
Percent weight loss (%)	5.18 ± 6.23	1.26 ± 4.38	3.92 (1.70, 6.14)

Table 3. *Association of patients' characteristics with nutritional status classified by MUST*

Variable	High risk	Low risk	p
Age (years)			0.135 (NS)
<65	29 (67.4)	14 (32.6)	
≥65	49 (80.3)	12 (19.7)	
Sex, n (%)			0.297 (NS)
Male	45 (71.4)	18 (28.6)	
Female	33 (80.5)	8 (19.5)	
Body mass index, n (%)			0.186 (NS)
<20	5 (100.0)	0 (0)	
≥20	73 (73.7)	26 (26.3)	
Tumour location			0.830 (NS)
Oesophagus	25 (73.5)	9 (26.5)	
Stomach	12 (70.6)	5 (29.4)	
Pancreas	41 (77.4)	12 (22.6)	
Unintentional weight loss, n (%)			0.007
Yes	56 (83.6)	11 (16.4)	
No	22 (59.5)	15 (40.5)	
Dietician referral			0.040
Yes	48 (82.8)	10 (17.2)	
No	30 (65.2)	16 (34.8)	
Nutritional therapy			0.013
Yes	46 (85.2)	8 (14.8)	
No	32 (64.0)	18 (36.0)	

Table 3 shows the association of nutritional status classified by MUST with patients' characteristics. Patients who had unintentional weight loss (83.6%), at least one dietician referral (82.8%) and nutritional intervention (85.2%) were significantly associated with a high risk of malnutrition. All significant variables were further analysed using multiple logistic regression. After being adjusted for confounders, unintentional weight loss was the only significant predictor of risk of malnutrition, with an adjusted OR of 3.22 (95% CI 1.23, 8.40) (*table 4*).

DISCUSSION

To our best knowledge, this is the first study to clinically assess the risk of malnutrition among surgical patients with gastrointestinal and pancreatic cancer using MUST as the mode of assessment. The results of our

Table 4. *Crude and adjusted odds ratio of patient-dependent and intervention-related indicators with risk of malnutrition*

Variables		Crude OR	95% CI	Adjusted OR	95% CI
Unintentional weight loss	Yes	3.47	1.38-8.72	3.22	1.23-8.40
	No	1.00		1.00	
Dietician referral	Yes	2.56	1.03-6.38	0.39	0.05-3.34
	No	1.00		1.00	
Nutritional intervention	Yes	3.23	1.25-8.34	6.65	0.76-58.3
	No	1.00		1.00	

study show that three out of four patients in the study population presenting to the surgery outpatient clinic had malnutrition, a figure which is high and should be recognised. We identified unintentional weight loss as an important predictor of malnutrition risks even if the patient's BMI was not suggestive of malnutrition. Weight loss is strongly associated with poor outcomes across all stages of cancer.[21] The negative nitrogen balance underlying cancer cachexia leads to a significant wasting of skeletal muscle. Muscle loss jeopardises respiratory function, and impairs patient mobility and performance status.[22]

In our study, many patients with malnutrition and weight loss would be missed if BMI alone was used as a single measure of malnutrition risk. A similar observation has also been seen in other studies,[18,23] which suggested that BMI may be a poor indicator of nutritional risk in this group of patients. The principal limiting factor in the use of BMI is an artificial increase in body weight due to fluid retention, which is a common complication seen in cancer patients.[24]

A significant 82.8% of high-risk patients having had dietician referral suggested that early dietician referral for a suspected malnourished patient is crucial to improve clinical outcome. Many studies have shown that, beyond a certain point, starvation, weight loss and malnutrition result in progressive deterioration in both mental and physical function leading to eventual death.[25] It must be noted that nutritional intervention is not necessarily beneficial as malnutrition can be an inevitable consequence of progressive disease and may not be reversible by nutrition alone.[26] However, a substantial volume of evidence shows that early nutritional support is beneficial in certain groups of patients with increased risk of developing malnutrition.[25,27]

The small number of patients in the intermediate group (4.8%) may suggest that the MUST can discriminate very effectively between a high-risk and the low-risk group, but is less effective for the intermediate group. Until a new diagnostic approach is ascertained, MUST is an effective and validated means for identifying patients at malnutrition risk.[21,22,24,28-31] It is effective as the results are linked to a pathway of interventions appropriate for patient care. Early detection of nutritional risk would permit early intervention and improve clinical outcome.[8]

The findings of our research study reflect the urgent need for increased awareness of surgeons, nursing staff, and dieticians to the problem of unintentional weight loss among oncology patients. The high prevalence of malnutrition and associated poorer clinical outcome as suggested in many studies highlights the importance of routine screening with MUST in oncology patients as early intervention results in improved outcome.[3,32] Medical personnel must be aware that malnutrition afflicts even patients whose BMI is not suggestive of malnutrition

This study faced several limitations that need to be recognised. Our limited sample size did not allow comparison of various subgroups of patients, such as those who were young versus old, and the outcome of patients in the medium-risk group. The small sample size may have overestimated the effect of malnutrition risks. MUST may not be specifically designed for older adults as compared with other tools such as the Mini Nutritional Assessment (MNA). Use of MUST may be difficult among patients with communication difficulties such as dementia, delirium and hearing impairment. However, our study is one of the few that assessed malnutrition among gastrointestinal and pancreatic cancer patients in the surgery unit. We recommend the MUST as a simple and rapid tool in routine screening of nutritional risk in cancer patients.

CONCLUSIONS

In summary, the present study demonstrates that there is a high prevalence of malnutrition in patients with gastrointestinal and pancreatic cancer based on MUST. This highlights the importance of routine screening with MUST in oncology patients. Presence of unintentional weight loss is the only significant predictor of risk of malnutrition. Medical personnel must be aware that malnutrition afflicts even patients whose BMI is not suggestive of malnutrition. Identifying patients at risk is easy and feasible using MUST. After identification of patients at risk for malnutrition, thorough nutritional assessment must be performed.

AUTHOR'S NOTE

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