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Nutritional Status and Quality of Life of Oncology Patients Prior to Pelvic Radiotherapy

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ABSTRACT

Introduction: Malnutrition among cancer patients is associated with a higher risk of gastrointestinal toxicity which develops during treatment and may affect quality of life (QOL). Thus, this cross-sectional study aimed to determine the nutritional status and QOL of 30 oncology patients (mean age 50.0±10.7 years) prior to pelvic radiotherapy at Hospital Sultan Ismail, Johor Bahru. **Methods:** Patients were assessed for anthropometry measurements, 24-h diet recall and nutritional status using Scored Patient-Generated Subjective Global Assessment (PG-SGA) questionnaire while the European Organization for Research and Treatment of Cancer Care Quality of Life Questionnaire (EORTC QLQ-C30) was used to assess QOL two weeks prior to the initiation of pelvic radiotherapy. **Results:** Mean Body Mass Index (BMI) of patients was 23.3±3.3kg/m^2 and 33% of patients experienced weight loss prior to pelvic radiotherapy. The PG-SGA rating indicated that 63% of patients were at Stage A (well-nourished) and 37% were in Stage B (moderate malnutrition). The PG-SGA numerical score was a significant predictor of QOL, after adjusting for socio-demographic factors (R^2=0.861, p<0.05). **Conclusion:** In general, the low nutritional status of the patients indicates the need for early nutritional assessment, education and intervention in ensuring optimal nutritional status throughout the pelvic radiotherapy treatment.

Key words: EORTC QLQ-C30, malnutrition, pelvic radiotherapy, PG-SGA

INTRODUCTION

Pelvic radiotherapy treatment is done as a single treatment or combination of chemotherapy and surgery of the gynecology, urology, and lower gastrointestinal malignancies (Wedlake *et al*., 2013). Cancer and malnutrition are closely related, with malnutrition being prevalent at a rate of 40 to 80% among cancer patients with neoplasia (Silva *et al*., 2015). Furthermore, malnutrition among cancer patients prior to pelvic radiotherapy treatment alone is between 11 to 33% (McGough *et al*., 2004).

The causes of malnutrition among hospitalised cancer patients are due to many factors including the location and type of tumour, stage of the disease, side effects from the treatments, socio-economic status, functional phase, and symptoms

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of nutritional impact, quality of life, and awareness of the importance of dietary requirements by medical practitioners (Silva *et al*., 2015). In addition, malnutrition is also associated with low response to anti-neoplastic treatment, decreased quality of life, high morbidity, mortality due to complications from infections, high cost of treatment and prolonged hospital stays (Silva *et al*., 2015).

In addition, weight loss is also an indicator of malnutrition amongst cancer patients; 32% of patients have been reported to experience 5% weight loss as compared to the usual weight before receiving pelvic radiotherapy treatment (*Bye et al*., 1992). On the other hand, up to 83% of patients may continue to experience weight loss during the pelvic radiotherapy treatments (McGough *et al*., 2004). This happens as pelvic radiotherapy treatment causes acute and chronic symptoms in patients, with about an estimated 70% suffering from acute gastrointestinal symptoms whilst 5 to 30% suffer from chronic gastrointestinal symptoms (Packey & Ciorba, 2010). Acute symptoms usually manifest during the first week of treatment and cause other health and economic problems such as malnutrition, abdominal pain, faecal incontinence, dehydration, weakness, and reduced QOL for patients (Fuccio *et al*., 2012; Demers, Dagnault & Desjardines, 2013), and an increase in medical fees and a delay in radiotherapy treatment (Kornblau *et al*., 2000). These health problems will impact the patients' food intake, leading to continuous weight loss during treatment and reduced QOL.

A few studies have been conducted on the nutritional status of cancer patients during the anti-cancer treatment in Malaysia which covers various types of cancer and the use of different nutritional status assessments (Shahmoradi, Kandiah & Loh, 2009; Noriati, 2009; Menon *et al*., 2014; Zalina *et al*., 2016). Nevertheless, nutritional status data from pelvic cancer patients prior to pelvic radiotherapy treatment is still scarce. Therefore, this study was conducted to obtain valuable data on nutritional status using comprehensive assessment tools prior to pelvic radiotherapy in the Southern region of Malaysia. Findings from this study should help towards formulating appropriate nutritional interventions to ensure that patients can undergo pelvic radiotherapy treatment with optimal health status.

METHODS

Study design and recruitment

This cross-sectional study involved patients aged 18 years and above with pelvic cancer area (endometrium, cervix, colon, rectum and prostate) scheduled to undergo pelvic radiotherapy treatment at the Department of Oncology and Radiotherapy, Hospital Sultan Ismail Johor Bahru (a referral centre for cancer treatment for the southern region run by the Ministry of Health, Malaysia). During the screening, between May 2015 to May 2016, 80 patients were screened; however only 30 patients were eligible and agreed to be recruited through the convenience sampling method. The inclusion criteria were 18 years old and above, scheduled for pelvic radiotherapy treatment as an outpatient or inpatient, first pelvic radiotherapy treatment scheduled at least 14 days after the study started and received radiotherapy or concurrent chemo-radiotherapy. Exclusion criteria were patients receiving enteral or parenteral nutrition or were terminally ill. The patients were then grouped based on the PG-SGA Global Assessment Categories for further analysis to compare the nutritional status and quality of life prior to the pelvic radiotherapy treatment.

Measured parameters and instruments

Data acquisition involved socio-demographic profile which included age, gender, race, education level, household income, marital status, occupation, and

residency status. These data were obtained from medical records and interview with patients. Clinical data including diagnosis and TNM Classification of Malignant Tumours (a system for classifying cancer that uses codes to declare a class of patients' cancer), current medical issues, cancer origin, metastasis area, cancer stage, radiotherapy prescription, and underlying co-morbidities were obtained from the medical records of the patients.

Anthropometric measurements which included height were measured using the SECA stadiometer Model 220 (SECA, Germany) scale to the nearest 0.1 cm, whilst the weight and body composition were measured using the Tanita UM-052 (Japan) scale to the nearest 0.1kg. Body mass index (weight/height^2) was calculated based on a formula recommended by the World Health Organisation(2004) while body composition such as body fat percentage and total body water were determined by the scales to the closest 0.1% and 0.1 kg respectively. The mid-upper arm circumference (MUAC) and calf circumference (CC) were measured by the Lufkin tape (Apex Tool Group, UK) to the nearest 0.1cm. Measurements were taken twice and the average of the two readings was used in the data analysis.

Dietary intake was assessed using 24-h diet recall while the patients were interviewed by researchers on the consumption of food and beverages, starting from the time they woke up to the time they went to bed. The Food Atlas (Suzana *et al.,* 2015) was used as a guide and reference during the session for those patients with communication or language barrier. Food intake was recorded in household measurements such as cups, bowls, teaspoons, and tablespoons. Nutrient intake was analysed using the Nutritionist Pro version 3.1.0 Software (Axxya Systems US) while the macronutrient intake was calculated based on individualised requirements according to the Dietetic Standard Operating Procedures for Cancer Patients by the Ministry of Health Malaysia 2013 guideline and classified to either exceed or was lower than the recommendations.

Nutritional status of patients was assessed using the Scored Patient-Generated Subjective Global Assessment (PG-SGA), which is a comprehensive and detailed method for assessing the nutritional status of cancer patients (Ottery, 2000). This method determines the nutritional status based on the medical history (changes in body weight and food intake, the presence of symptoms of the nutritional impact and functional capacity of the body) and physical assessment (subcutaneous fat loss, muscle loss, water retention, and ascites). Based on the evaluation and scores obtained, patients were classified into A (well nourished), B (moderate malnutrition) or C (severe malnutrition) and the total numerical score was classified into nutritional triage recommendations as shown in Table 1. A higher score indicates requiring more intensive nutrition intervention.

Quality of life was evaluated using a specific quality of life proforma for cancer patient [EORTC QLQ-C30 version 3.0 (The European Organisation for Research and Treatment of Cancer Care Quality of Life Questionnaire)] (Aaronson *et al.,* 1993). It covers the functional scales (physical, role, emotional, cognitive, and social), symptoms (fatigue, nausea and vomiting, pain, dyspnea, insomnia, loss of appetite, constipation, diarrhoea, and financial constraints) and global health scale. A higher score for functional scale and global health status shows a high or healthy level of functioning in patients whilst a high score in symptoms scale indicates a high level of symptomatology or problems (Scott *et al*., 2008). In addition, the functional status was assessed using the Eastern Cooperative Oncology Group (ECOG) scales. ECOG has six scales that measure the disease impact on a patient's daily living abilities with the higher scores

Table 1. Classification of numerical score on the PG-SGA nutritional recommendations triage

Triage category based on PG-SGA point score	*Recommended nutrition intervention*
0-1	No intervention required at this time. Re-assessment on routine and regular basis during treatment
2-3	Patient and family education by dietitian, nurse, or other clinician with pharmacologic intervention as indicated by symptom survey and lab values as appropriate
4-8	Requires intervention by dietitian in conjunction with nurse or physician as indicated by symptoms
>9	Indicates a critical need for improved symptoms management and/or nutrient intervention options

Source : Ottery (2000)

indicating worsening of functional ability (Blagden, Charman & Sharples, 2003).

Statistical analysis

Descriptive and statistical analysis were performed using the Statistical Package for Social Sciences (SPSS) version 22 (IBM Corp., USA) licensed by the National University of Malaysia with a significant difference set at $p<0.05$. Descriptive analysis was used to describe the demographic, clinical, anthropometric measurements, PG-SGA and QOL. Numerical data were expressed as median and IQR. All data were assessed for normality using the Shapiro-Wilk test. Mann-Whitney test was used to determine the median difference in the QOL scores between PG-SGA categories. Spearman test was used to investigate the association between PG-SGAs numerical score and the mean score from nutritional parameters and QOL while linear regression analysis was employed to determine nutritional risk factors to QOL.

Ethical approval

The study was approved by the Medical Research and Ethics Committee of The National University of Malaysia (NN-175-2014) and the Medical Research & Ethics Committee of the Ministry of Health Malaysia [14-1501-23172 (IIR)]. Informed consent was obtained from patients who participated in this study.

RESULTS

A total of 80 patients were shortlisted based on the inclusion criteria of the study but only 30 patients who met the criteria agreed to participate in the study (22 women and 8 men) with a mean age of 50±10.7 years. The majority of patients only had primary school education and were unemployed with a household income of less than RM1500 per month. Almost all patients were living with their family when the study was conducted (Table 2). As assessed using the Eastern Cooperative Oncology Group (ECOG) scales for functional status, 50% of patients were at level 1, indicating that they had limited movement for physical activities but could still carry out simple daily activities. The majority of the patients were diagnosed with rectum cancer (33.3%) followed by cervical (30.0%), endometrium (16.7%), colon (16.7%), and prostate cancer (3.3%). Most of them were in stage 3 (47.8%) followed by stage 4 (26.1%) and 41.7% of them had no underlying co-morbidities.

Figure 1 shows that according to the total numerical score of the PG-SGA, most patients in category B PG-SGA were

Table 2. Characteristics of the participants, n(%)

Characteristics	*Total (n=30)*	*Men (n=8)*	*Women (n=22)*
Ethnicity			
Malay	14 (46.6)	3 (37.5)	11 (50.0)
Chinese	16 (53.3)	5 (62.5)	11 (50.0)
Education level			
No formal education	3 (10.0)	0 (0.0)	3 (14.3)
Primary school	13 (43.3)	3 (42.9)	10 (47.6)
Secondary school	11 (42.5)	4 (57.1)	7 (33.3)
College/University	1 (2.5)	0 (0.0)	1 (4.8)
Occupation			
Private sector	2 (6.7)	1 (12.5)	1 (4.5)
Self-employed	3 (10)	2 (25.0)	1 (4.5)
Retired	3 (10)	1 (12.5)	2 (9.1)
Unemployed	22 (73.3)	4 (50.0)	18 (81.8)
Household income(*n*=21)			
<RM1500	13 (43.3)	4 (66.7)	9 (60.0)
RM1500-3000	2 (6.7)	0 (0.0)	2 (13.3)
>RM3000	6 (20.0)	2 (33.3)	4 (26.7)
Resident status			
With family	29 (96.7)	8 (100.0)	21 (95.5)
Home care institution	1 (3.3)	0 (0.0)	1 (4.5)
ECOGstatus (*n*=26)			
0	10 (38.5)	3 (42.9)	7 (36.8)
1	15 (57.7)	4 (57.1)	11 (57.9)
2	1 (3.8)	0 (0.0)	1 (5.3)
Type of cancer			
Endometrium	5 (16.7)	0 (0.0)	5 (22.7)
Cervic	9 (30.0)	0 (0.0)	9 (40.9)
Colon	5 (16.7)	1 (12.5)	4 (18.2)
Rectum	10 (33.3)	6 (75.5)	4 (18.2)
Prostate	1 (3.3)	1 (12.5)	0 (0.0)
Metastasis (*n*=26)			
Yes	5 (19.2)	1 (12.5)	4 (22.0)
No	21 (80.8)	7 (87.5)	14 (78.0)
Cancer stage (*n*=23)			
Stage 1	2 (8.7)	0 (0.0)	2 (13.3)
Stage 2	4 (17.4)	0 (0.0)	4 (26.7)
Stage 3	11 (47.8)	6 (75.0)	5 (33.3)
Stage 4	6 (26.1)	2 (25.0)	4 (26.7)
Co-morbidities			
Diabetes mellitus	9 (25.0)	2 (25.0)	7 (25.0)
Hypertension	9 (25.0)	0 (0.0)	9 (32.1)
Heart disease	1 (2.8)	0 (0.0)	1 (3.6)
Others	2 (5.5)	0 (0.0)	2 (7.1)
No co-morbidities	15 (41.7)	6 (75.0)	9 (32.1)
PG-SGA category			
Well nourished	19 (63.3)	6 (75.0)	13 (59.1)
Moderate malnutrition	11 (36.7)	2 (25.0)	9 (40.9)

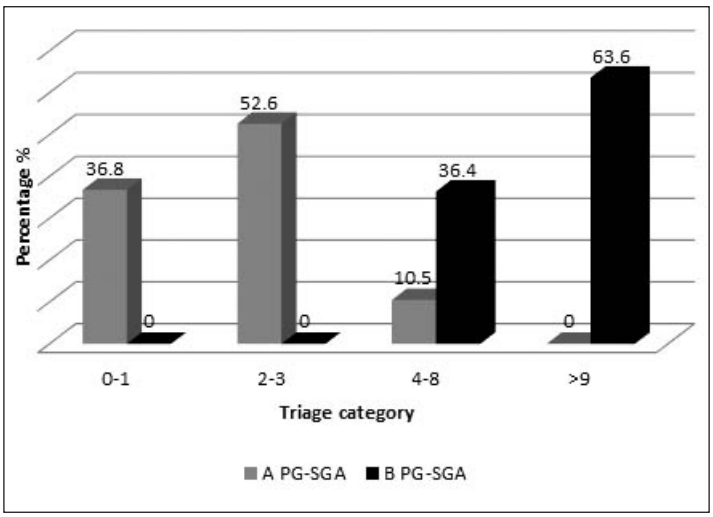

Figure 1. PG-SGA numerical score between PG-SGA categories according to nutritional triage recommendation classification

classified into score >9 (63.6%) of the nutritional triage recommendations and followed by a 4–8 score (36.4%) suggesting that they required dietetic and critical interventions. However, the majority (52.6%) of the category A PG-SGA required only health education on pre-treatment with a 2–3 score (Classification as in Table 1).

As shown in Table 3, the majority of patients were aged between 51 to 70 years (76.7%) regardless of the PG-SGA categories. Patients in PG-SGA A were mostly diagnosed with rectum cancer (31.6%) whilst cervix and rectum cancer were the common diagnosis in category B PG-SGA (36.4% respectively). According to the stage of cancer, the majority in category A PG-SGA had stage 3 cancer, whilst stage 2 was found in the category B PG-SGA. The BMI for both groups was within the normal weight range (World Health Organisation, 2004). There were no significant differences for anthropometry, biochemical parameters, and food intake between both groups. In view of the food intake, the majority of the patients did not meet the macronutrients recommendation regardless of the PG-SGA category classification but patients in category B PG-SGA had a higher percentage of estimated inadequate food intake (Table 3).

With respect to the quality of life, category A PG-SGA had a better functioning level and less symptoms manifestation compared with category B PG-SGA. In particular, the median score of role, emotional, social, fatigue, pain, and appetite loss was better in category A PG-SGA, compared to category B PG-SGA (p<0.05). The median score of the global health score was significantly higher in category A PG-SGA as compared to category B PG-SGA [83.3(16.7) and 50.0(33.30] respectively (p<0.05) (Table 4).

As shown in Table 5, BMI, and protein intake were positively correlated with QOL, whilst an inverse relationship was found for PG-SGA numerical score (p<0.05). Furthermore, the multiple linear regression analysis found that PG-SGA score was a significant predictor of quality of life after adjusting for socio-demographic factors (R^2=0.861, p<0.05).

DISCUSSION

This cross-sectional study revealed that 37% of pelvic cancer of multiple etiology

Table 3. Demography, clinical, anthropometric, biochemical data and estimated daily macronutrient intake profiles between PG-SGA groups (*n*,%)

PG-SGA Category/ Parameter	*Total n=30*	*A Well nourished n=19*	*B Moderate malnutrition n=11*	*p value*
Gender				
Male	8(26.7)	6(31.6)	2(18.2)	0.672
Female	22(73.3)	13(68.4)	9(81.8)	
Age				
20-50	7(23.3)	3(15.8)	4(36.4)	0.372
51-70	23(76.7)	16(84.2)	7(63.6)	
Cancer type				
Endometrium	5(16.7)	4(21.1)	1(9.1)	0.830
Cervic	9(30.0)	5(26.3)	4(36.4)	
Colon	5(16.7)	3(15.8)	2(18.2)	
Rectum	10(33.3)	6(31.6)	4(36.4)	
Prostate	1(3.3)	1(5.3)	0(0)	
Cancer stage (*n*=23)				
Stage 1	2(8.7)	2(14.3)	0(0)	0.041*
Stage 2	4(17.4)	0(0)	4(44.4)	
Stage 3	11(47.8)	8(57.1)	3(33.3)	
Stage 4	6(26.1)	4(28.6)	2(22.2)	
Anthropometry				
BMI (kg/m^2) (*n*=29)				
<18.5	2(6.9)	0(0.0)	2(18.2)	0.149
18.5 – 24.9	16(55.2)	10(55.6)	6(54.5)	
25.0 – 29.9	11(37.9)	8(44.4)	3(27.3)	
Mid upper arm circumference (cm)[a](*n*=27)				
Muscle wasting	1(3.7)	0(0.0)	1(12.5)	0.296
Female <22.0				
Male <23.0				
Normal	26(96.3)	19(100.0)	7(87.5)	
Calf circumference (cm)[b](*n*=26)				
Muscle wasting	2(7.7)	0(0.0)	2(25.0)	0.086
Female <27.3				
Male <30.1				
Normal	24(92.3)	18(100.0)	6(75.0)	
Biochemical profile[c]				
Albumin (g/L) (*n*=14)				
Low (<33)	6(42.9)	2(22.2)	4(80.0)	0.091
Normal	8(57.1)	7(77.8)	1(20.0)	
Hemoglobin (g/L)(*n*=16)				
Low				
Female <11.5				
Male <13.0	12(75.0)	7(70.0)	5(83.3)	0.511
Normal	4(25.0)	3(30.0)	1(16.7)	

Table 3 continued

Nutrient intake[d](n=29)				
Energy (kcal/d)				
Below requirement (<30kcal/kg)	25(86.2)	14(77.8)	11(100.0)	0.268
Met requirement (30-40 kcal/kg)	4(13.8)	4(22.2)	0(0.0)	
Carbohydrate (g/d)				
Below requirement				
(<50% from calorie requirement)	19(65.5)	10(55.6)	9(81.8)	0.234
Met requirement				
(50-60% from calorie requirement)	10(34.5)	8(44.4)	2(18.2)	
Protein (g/d)				
Below requirement (<1.2g/kg)	21(72.4)	11(61.1)	10(90.9)	0.110
Met requirement (1.2-2.0g/kg)	8(27.6)	7(38.9)	1(9.1)	
Fat (g/d)				
Below requirement				
(<30% from calorie requirement)	26(89.7)	16(88.9)	10(90.9)	1.000
Met requirement				
(30-35% from calorie requirement)	3(10.3)	2(11.1)	1(9.1)	

$p<0.05$, Pearson chi-square test,

[a] MUAC reference : Ferro Luzzi & James (1996)
[b] CC reference : Sakinah *et al. (*2004)
[c] Albumin & haemoglobin reference : Kamel *et al.* (2000)
[d] Individual intake compared to individual requirement based on recommendation from Dietetic Standard Operating Procedures for Cancer Patients (Ministry of Health Malaysia 2013 guideline).

Table 4. QOL characteristics between group [Median(IQR)]

Quality of life parameters	*PG-SGA A (n=19)*	*PG-SGA B (n=11)*	*p value*
[a]Fuctioning			
Physical	93.3(13.4)	73.3(46.7)	0.070
*Role	100.0(33.4)	33.0(67.0)	0.006*
*Emotional	91.6(25.0)	66.6(58.6)	0.006*
Cognitive	83.3(33.4)	83.3(33.4)	0.553
*Social	83.3(33.4)	33.3(33.6)	0.021*
[b]Symptoms			
*Fatigue	0.0(13.8)	44.3(55.7)	0.002*
Nausea/Vomiting	0.0(0.0)	16.6(33.3)	0.077
*Pain	0.0(16.6)	50.0(41.6)	0.000*
Dyspnoea	0.0(0.0)	0.0(33.3)	0.250
Insomnia	0.0(8.33)	33.3(49.9)	0.123
*Appetite loss	0.0(0.0)	66.6(83.3)	0.003*
Constipation	0.0(0.0)	0.0(66.6)	0.103
Diarrhea	0.0(0.0)	0.0(16.6)	0.445
Financial difficulties	33.3(41.6)	33.3(83.3)	0.250
[a]*Global Health	83.3(16.7)	50.0(33.3)	0.004*

[a]Higher score indicates a higher level of functioning, [b]Higher score indicates a higher level of problems, *$p<0.05$, Mann-Whitney test

Table 5. Correlation of QOL score with associated factors of nutritional status

Parameters	*r*	*QOL score p value*
Anthropometry		
BMI	0.476	0.009*
MUAC	0.204	0.307
Calf circumference	0.214	0.283
Biochemical		
Albumin	0.223	0.444
Hemoglobin	0.519	0.039*
Nutrient intake		
Energy	0.341	0.065
Carbohydrate	0.246	0.191
Protein	0.491	0.006*
Fat	0.344	0.063
PG-SGA		
PG-SGA numerical score	-0.590	0.001*
Clinical		
Cancer stage	0.081	0.714
Cancer extent	-0.262	0.178
ECOG	-0.341	0.088
Socio-demography		
Age	0.127	0.503
Income	0.042	0.860
Educational status	0.136	0.491

*$p<0.05$, Significant correlation between QOL and nutritional status factors by Pearson test

Table 6. Multiple linear regression analysis of QOL score as dependant variable and nutritional risk factors as independent variables

Parameters	*Regression coefficient (B)*	*95%,CI*	*P value*
Anthropometry			
BMI	7.596	-0.42-15.61	0.060
Biochemical			
Hemoglobin	-1.408	-6.52-3.71	0.543
Nutrient intake			
Energy	-0.008	-0.04-0.02	0.597
Protein	-0.096	-1.40-0.90	0.829
PG-SGA			
PG-SGA score	-3.946	-7.46- -0.43	0.032*

$p<0.05$, multiple linear regression, Coefficient of determination (R^2) = 0.861

patients had moderate malnutrition prior to pelvic radiotherapy as assessed using PG-SGA which is a combination of both objective and subjective clinical measures of nutritional status. This finding was higher than the 11 to 33% prior to pelvic radiotherapy reported by Pia de la Maza *et al.* (2001) and Ferguson *et al.* (1999). Using objective measurements alone, 7% of patients were classified as underweight using BMI, 4% had upper limb muscle wasting using MUAC and 8% had lower limb muscle wasting using calf circumference. Global assessment using PG-SGA is considered an accurate assessment as compared to parameters such as anthropometric and biochemical alone as it also takes into account the gastrointestinal system and physical examination of the body (Neil *et al.*, 2011). A recent study from the East Coast of Malaysia reported a much higher percentage (more than one third) of underweight patients based on BMI at the time of cancer diagnosis with various location of cancer sites compared to this current study (Menon *et al*., 2014).

The study also found that 33% of the patients experienced a weight loss of up to 2% over 1 to 6 months prior to pelvic radiotherapy treatment. The rate of weight loss in this study was lower than an earlier study conducted by Bye *et al.* (1992) where 32% of patients had 5% weight loss before the pelvic radiotherapy treatment. However, the incidence of weight loss is likely to increase during the pelvic radiotherapy treatment by up to 83% (McGough *et al*., 2004). This is due to the pelvic radiotherapy treatment itself causing inflammation of the intestines, diarrhoea, abdominal pain, fever, weight loss, and rectal bleeding which are symptoms that contribute to the risk of malnutrition (Koboziev, Karlsson & Grisham, 2010). Thus, early assessment for risk of malnutrition is desirable.

By using PG-SGA, this study also found that those in malnutrition categories using PG-SGA were at a higher risk of inadequate intake of macronutrients requirement based on energy and protein recommendations for cancer patients of 30-40kcal/kg and 1.2-2.0g/kg body weights, respectively (Dietetic Standard Operating Procedures for Cancer Patients of the Ministry of Health Malaysia, 2013). All patients in category B PG-SGA did not meet the energy recommendation while only 78% belonged in category A PG-SGA. Inadequacy of protein intake was also higher in category B PG-SGA (91%) compared to category A PG-SGA (61%). The low dietary intake could be due to the older age of the patients and restricting intake of certain foods based on traditional food beliefs or health reasons that were also reported among the local elderly (Suzana, Kan & Pa' Wan Chik, 2002; Suzana, Earland & Rahman, 2000). A total of 77% of the patients in the study said they faced no difficulty in food consumption and did not have any symptoms that were detrimental to nutrient intake.

Based on this study, the nutritional status of patients significantly influenced their quality of life in terms of functional ability and many symptom manifestations (except dyspnea, insomnia, constipation, diarroea, and finance). In this study, a 1 unit decrease in PG-SGA score (indicates improving nutritional status) improved the quality of life by almost 4%. Well-nourished patients had a better functioning and global health status with fewer symptoms prior to the pelvic radiotherapy treatment. This finding is consistent with previous studies that had also showed that nutritional status can have an impact on physical function and psycho-social parameters (Laky *et al.*, 2010; Gupta *et al*., 2006).

Early screening and assessment of malnutrition risks should be conducted on an individual basis based on individual and medical needs (DeWitt & Terrin, 2014) where early nutritional intervention for patients undergoing pelvic radiotherapy

can reduce the incidence of continuous weight loss and improve nutritional status, and quality of life during treatment. With this, the patients will be able to prepare themselves with good nutritional status in preparation for the possible side-effects of treatment that would interfere with bodily functions. Even though the current study had a small sample size and was conducted in a single study centre, the comprehensive nutritional assessment and quality of life findings provide valuable local data on patients prior to anti-cancer treatment for healthcare providers to design early intensive interventions programs.

CONCLUSION

This study found that 37% of patients suffering from pelvic cancer of multiple etiologies were moderately malnourished and 33% experienced some weight loss prior to the pelvic radiotherapy treatment. Furthermore, 86% and 72% of them did not meet the energy and protein recommendations, respectively. Poor nutritional status as assessed using PG-SGA contributed to the poor QOL at a variance of 86%. Thus, nutrition assessment, education, and interventions for pelvic cancer patients undergoing pelvic radiotherapy treatment should be carried out proactively in order to provide early preventive measures to prevent malnutrition and its undesirable clinical outcomes, leading to poor quality of life.

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