Nutritional assessment of GI cancer patients at admission and seven days after major intraabdominal surgery

*[1]Gholami K., [2]Harirchi I., [1]Abdollahi Lakelayeh M., [3]Nahvijou A., [3]Yazdi Zadeh B., [4]Ahadi Barzaki M., [5]Tehrni Bani Hashemi S.A.

Department of Clinical Pharmacy, Faculty of Pharmacy, [2]Department of Surgery, Faculty of Medicine, [3]Cancer Research Center, Cancer Institute, Imam Khomeini Hospital, Tehran University of Medical Sciences, [4]Ministry of Health, [5] Rheumatology Research Center, Dr. Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran

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ABSTRACT

Pre-existing malnutrition has been reported to affect a high percentage of cancer patients. Various methods are being used to assess nutritional status in hospitalized patients. The aim of this study was to apply two different nutritional assessment techniques to determine the prevalence of malnutrition in GI cancer patients and to assess their nutritional status, at admission and seven days after surgery. For this purpose, the nutritional status of fifty one patients who underwent major intraabdominal surgery was assessed. The Subjective Global Assessment (SGA), Nutritional Risk Index (NRI), anthropometric measurements, serum albumin, prealbumin, lymphocyte count and hematocrit were used to assess nutritional status of the patients. At the time of admission, based on the SGA and NRI, 70.6% and 74.5% of the patients were malnourished respectively. Both anthropometric and laboratory data, including weight, body mass index, mid arm circumference, triceps skin fold, mid arm muscle circumference, albumin, prealbumin, hematocrit and lymphocyte decreased significantly seven days after surgery ($p<0.01$). The malnutrition rates increased significantly to 98% with both the SGA and NRI, seven days after surgery ($p<0.01$). From the findings of this study it is concluded that there was a high prevalence of malnutrition in GI cancer patients and in almost all patients, nutritional status deteriorated seven days after surgery. Both methods proved useful for detection of the prevalence and development of malnutrition. Based on these results it is suggested that nutritional care after surgery should be improved by providing enough calories via enteral and/or parenteral route.

Keywords: Nutritional Assessment, SGA, NRI, Malnutrition, Cancer, Surgery.

INTRODUCTION

Malnutrition is a common problem, affecting a high percentage of cancer patients. Nutritional depletion is usually the joint result of cancer due to dietary deficiency and the direct and indirect tumor effects, surgery, chemotherapy and physiological factors (1, 2). Malnutrition could lead to prolonged hospital stays and could put the hospitalized cancer patient at risk of complications and other adverse outcomes after surgery (2, 3). Some reports have suggested that nutritional status actually worsens during the course of hospitalization. Furthermore, the presence and development of malnutrition remains unrecognized and untreated (4). Several techniques using laboratory and anthropometric data are applied to detect malnutrition. The goals of a formal nutritional assessment are:

To detect the presence and development of malnutrition, during the course of hospitalization.

To collect the information necessary to provide guidelines for preoperative nutritional intervention.

To create a nutrition care plan

To monitor the adequacy and appropriateness of nutrition therapy.

In this study two methods including the SGA and NRI were used to improve the accuracy of nutritional assessment (5).Indicators such as significant weight loss, significantly low weight or body mass index, reduction in midarm circumference, skinfold thickness and laboratory parameters including albumin, prealbumin, hematocrit and lymphocyte count were measured at admission and seven days after surgery to determine nutritional risk (6-9).

Correspondence: kheirollah_gholami_2000@yahoo.com

PATIENTS AND METHODS

Seventy consecutive GI cancer patients scheduled for major intraabdominal surgery entered this observational case-series study. Patients had to be between the ages of 18 and 80 with normal liver and kidney functions. Nutritional status and laboratory parameters were assessed within the 24 hours after admission to 4 surgical wards of Meraj clinic of Cancer Institute as well as seven days after surgery during a period of 6 months from September 2004 to February 2005. Patients undergoing palliative surgery were excluded from the study. The methods which applied were the SGA and NRI. The Subjective Global Assessment (SGA) (4,10,11) is a clinical score, performed by a clinician using physical examination and a standardized questionnaire to obtain a nutritional history and applying clinical judgment to rate a patient's nutritional status. Patient's history, food intake, weight loss over the last six months and the recent trend in weight loss over the last two weeks prior to admission were obtained from patients or their close family members. Patients were also asked about complaints such as vomiting, diarrhea, anorexia and were examined for edema, ascites and dehydration. On the basis of these data, the clinician categorized the patients as not malnourished, mildly malnourished, moderately malnourished and severely malnourished (1). The evaluating clinician had no knowledge about the patients laboratory test results.

The Nutritional Risk Index (NRI) is an objective method using a simple equation derived from serum albumin concentration and the ratio of present weight to usual weight as follows:

NRI= (1.489×serum albumin, g/l) +41.7× (present weight/usual weight)

A nutritional risk index >100 indicates that the patient is not malnourished, 97.5-100 indicates mild malnourishment, 83.5-97.5 moderate malnourishment and <83.5 severe malnourishment (1,11,12).

Present weight was measured with bathroom scales. Weight change over the past 6 months prior to hospital admission was obtained by direct interview with the patient and/or a family member.

Triceps skinfold (TSF), as an indicator of body fat stores, was measured with a caliper on the posterior upper arm midway between the acromion and olecranon processes. TSF was measured twice and an average was recorded.

Midarm circumference (MAC) was obtained by a measuring tape placed around the patient's upper arm in the same location where TSF measurement was made. MAC and TSF were used to calculate midarm muscle circumference (MAMC) according to the following formula:

MAMC (cm) =MAC (cm)-TSF (mm) × 0.3142

Mid Arm muscle circumference (MAC) estimates muscle mass or lean tissue stores. A skinfold of 4 to 8mm suggests borderline fat stores and a thickness of 3mm or less indicates severe depletion(3,13).

Patient's height was measured with a stadiometer. Height and weight were used to calculate body mass index (BMI) by the following equation :(3)

BMI=weight (kg)/height (m^2)

A fasting blood sample was obtained for the measurement of albumin and prealbumin. Hematocrit and lymphocyte were derived from patients' daily routine tests recorded in their files. Albumin was measured by photometry. Prealbumin was measured by immunonephlometry.

Statistical Methods

The data was analyzed using SPSS (11.5) and Stata (8) software's. Differences between independent groups were assessed by Student's t-test and one way analysis of variance followed by Bonferroni correction. Characteristics are presented as mean ±standard deviation .Differences were considered to be statistically significant at $p<0.05$.

RESULTS

Seventy patients entered this study which was scheduled for intraabdominal surgery. Nineteen of these patients did not go through intraabdominal surgery and instead received palliative therapy. Fifty one patients did go through intraabdominal surgery. Intraabdominal surgeries included 20 cases of stomach, 18 cases of esophagus, 7 cases of rectum, 4 cases of colon and 2 cases of pancreas cancer. At admission, 70.6% of the patients were malnourished based on the SGA and 74.5% based on the NRI. Seven days after surgery, the prevalence of malnutrition increased significantly to 98% measured both by SGA and NRI. ($p<0.01$)

According to the SGA, 45.1% of the patients were mildly, 19.6% were moderately and 5.9% were severely malnourished at admission (Table 1) while malnutrition rates were found 15.7% mild, 51% moderate and 7.8% severe by NRI at admission (Table 2).

Fourteen patients with the SGA and 12 patients with the NRI moved from the well nourished to the malnourished group and malnutrition rates were found 31.4% mild, 51% moderate, and 15.6% severe with the SGA and 2% mild, 37.2% moderate and 58.8% severe with the NRI seven days after surgery.

All indices decreased significantly seven days after surgery. Mean values of albumin, prealbumin, lymphocyte, hematocrit; Weight, MAC, TSF, MAMC and BMI decreased from

Table 1. Categorization of patients' nutritional status according to the SGA

Degree	Number (%)	
	At admission	7 days after surgery
Well nourished	15(23)	1(2)
Mild	23(45.1)	16(31.4)
Moderate	10(19.6)	26(51)
Severe	3(5.9)	8(15.6)
Total	51(100)	51(100)

SGA=Subjective Global Assessment

Table2. Categorization of patients' nutritional status according to the NRI

Degree	Number (%)	
	At dmission	7 days after surgery
Well nourished	13(25.5)	1(2.0)
Mild	8(15.7)	1(2.0)
Moderate	26(51.0)	19(37.2)
Severe	4(7.8)	30(58.8)
Total	51(100)	51(100)

NRI= Nutrition Risk Index

38.5 ±4.2g/l, 0.161± 0.065 g/l, 2717±883, 40.0± 6.0, 58.2± 9.3 kg, 26.3±3.2 cm, 9.5± 5.2 mm, 23.4 ±2.8 cm, 22±3.0 kg/m^2 to 30.9 ± 3.9g/l, 0.086±0.034 g/l, 2024 ± 894, 33.7±5.0, 54.8± 12kg, 25.6±3.3 cm, 8.8±5.4 mm, 22.9 ± 2.8 cm, 21.0 ± 2.9 kg/m^2 respectively. With the SGA method, weight, BMI, MAC, MAMC, albumin and hematocrit were significantly lower in the malnourished group than in the well nourished group (Table 3). Weight loss was significantly higher in the malnourished group. With the NRI method, MAC, albumin, prealbumin and hematocrit were significantly lower in the malnourished group (Table 4). Length of stay (days) was longer in the malnourished groups for both methods but these differences were not statistically significant.

Albumin differed significantly among all four groups (well nourished, mildly, moderately and severely malnourished) based on the SGA and NRI methods. Other nutritional characteristics are compared between the four groups and recorded in tables 5 and 6.

DISCUSSION

Some studies report that 40-80% of cancer patients have malnutrition (2). In one study on patients with cancer of the esophagus 57.8% of the patients were malnourished (7). Malnutrition in hospitalized patients is a critical issue and has been associated with a significant increase in morbidity and mortality (1,14). No single nutritional measurement can be considered 100% sensitive and specific because non-nutritional responses to illness affect many nutrition indicators (5). The SGA is used primarily by clinicians to assess nutritional status in hospitalized patients (10). This technique has good specificity and sensitivity (16). Studies have reported high correlation between the SGA and objective measures of nutritional status assessment such as anthropometry, albumin and total serum protein (10, 16).

Albumin concentration is considered a good marker of nutritional status and its correlation with longer hospital stays, medical complications, and an increased mortality have been demonstrated in some studies (17, 18). However; there are arguments for not considering hypoalbuminemia as a marker of malnutrition. In addition, serum albumin may stays unchanged with nutritional support. This could restricts the specificity of the NRI in the diagnosis of malnutrition in some hospitalized patients (3). Because of its long half life and its large body pool, serum albumin does not indicate acute changes in nutritional status.

Prealbumin, with its short half life and small body pool and quick response to changes in protein and energy status better reflects a patient's current nutritional status (8, 19- 21)

Prealbumin differed significantly between malnourished and well nourished groups with the NRI but the differences between these two groups were not significant with the SGA probably because our sample size was not large enough.

Studies have shown that protein deficiency could directly affect erythropoiesis (22). Therefore hematocrit usually decreases in malnutrition. In this study, mean hematocrit significantly decreased seven days after surgery and it was significantly higher in the well nourished groups than the malnourished groups with both SGA and NRI.

Lymphocyte count has been shown to decrease after surgery. Mean lymphocyte decreased significantly in our study but lymphocyte did not show a significant difference between malnourished and well nourished groups based on the SGA and NRI. Lymphocyte was higher in the malnourished group with the SGA, probably due to the presence of infection in some patients of this group.

Consistent with other studies, anthropometric data including weight, BMI, MAC, MAMC and TSF, significantly decreased seven days after surgery.

Table3. Patients' characteristics, anthropometric and laboratory data at admission in two groups according to the SGA

Characteristic	Well nourished (n=15)	Mal nourished (n=36)
Weight(kg)	64.6±2.5	55.3±1.2*
Weight loss%	5.5±3.7	8.9±4.2*
BMI(kg/m2)	23.4±3.2	21.4±2.7*
MAC(cm)	27.7±2.6	25.8±3.3*
TSF(mm)	9.8±5.6	9.3±5.2
MAMC(cm)	24.7±2.5	22.9±2.8*
Albumin(g/l)	42±3.2	36.6±4.1*
Prealbumin(g/l)	0.180±0.071	0.154±0.063
TIBC(µg/dl)	375±61	335±83
Transferrin(g/l)	2.7±0.4	2.3±0.6
Lymphocyte	2620±686	2758±959
Hematocrit	43.5±3.7	38.6±6.3*
Length of stay(days)	21.5±9.4	24±12.6

- P value< 0.05 compared with the well nourished group. SGA=Subjective Global Assessment, BMI=Body Mass Index, MAC=Mid Arm Circumference, TSF= Triceps Skin Fold, MAMC=Mid Arm Muscle Circumference, TIBC=Total Iron Binding Capacity

Table 4. Patients' characteristics, anthropometric and laboratory data at admission in two groups according to the NRI

Characteristic	Well nourished (n=13)	Mal nourished (n=38)
Weight (kg)	60.3±10.0	57.2±8.8
Weight loss%	6.3±3.6	8.4±4.5
BMI(kg/m2)	22.6±3.5	21.8±2.8
MAC(cm)	28.0±3.3	25.8±3.0*
TSF(mm)	9.9±6.1	9.3±4.9
MAMC(cm)	24.9±3.3	22.9±2.5
Albumin(g/l)	44.1±2.5	36.2±3.1*
Prealbumin(g/l)	0.2219±0.053	0.142±0.06*
TIBC(µg/dl)	371±62	339±83
Transferrin(g/l)	2.6±0.4	2.4±0.59
Lymphocyte	2753±864	2705±901
Hematocrit	43.9±3.9	38.7±6.1*
Length of stay(days)	23.2±12.6	23.5±9.4

- P value< 0.05 compared with the well nourished group, NRI= Nutrition Risk Index, BMI=Body Mass Index, MAC=Mid Arm Circumference, TSF= Triceps Skin Fold, MAMC=Mid Arm Muscle Circumference, TIBC=Total Iron Binding Capacity

Table5. Patients' characteristics, anthropometric and laboratory data at admission in four groups according to the SGA

Characteristic	None(n=15)	Mild(n=23)	Moderate(n=10)	Severe(n=3)
Weight(kg)	64.6±6.8	56.5±6.6	54.4±8.6*	48.3±7.0*
Weight loss%	5.5±3.7	7.3±3.4	11.1±3.6*	13.3±6.7*
BMI(kg/m2)	23.4±3.2	22.2±2.5	20.3±2.4	22.3±2.5*
MAC(cm)	27.7±2.6	26.9±3.0	23.9±2.9*@	22.3±2.5*@
TSF(mm)	9.8±5.6	10.7±5.8	6.8±2.1	6.7±2.3
MAMC(cm)	24.7±2.5	23.8±2.7	21.5±2.4*	20.2±1.9*
Albumin(g/l)	42.0±3.2	37.4±4.0*	36.0±3.4*@	31.7±3.0*@$
Prealbumin(g/l)	0.180±0.07	0.164±0.061	0.129±0.065	0.147±0.08
TIBC(µg/dl)	375±61	358±60	311±97	221±117*@
Transferrin(g/l)	2.7±0.4	2.5±0.4	2.2±0.7	1.6±0.8*@
Lymphocyte	262±687	2941±802	2600±1275	1766±473
Hematocrit	43.5±3.7	37.8±6.9*	39.8±5.0	41.4±4.6
Length of stay(days)	21.5±9.4	23.5±12.5	22.9±13.5	31.0±13.5

* P value< 0.05 compared with the well nourished group
@ P value< 0.05 compared with the mildly malnourished group
$ P value< 0.05 compared with the moderately malnourished group, SGA=Subjective Global Assessment, BMI=Body Mass Index, MAC=Mid Arm Circumference, TSF= Triceps Skin Fold, MAMC=Mid Arm Muscle Circumference, TIBC=Total Iron Binding Capacity

Table6. Patients' characteristics, anthropometric and laboratory data at admission in four groups according to the NRI

Characteristic	None(n=13)	Mild(n=8)	Moderate(n=26)	Severe(n=4)
Weight(kg)	60.3±10.0	62.7±7.5	57.1±8.4@	47.6±6.0
Weight loss%	6.2±3.6	4.7±3.6	9.3±4.5	9.7±1.3
BMI(kg/m2)	22.6±3.5	23.9±2.0	21.5±2.7	19.2±1.9
MAC(cm)	28.0±3.3	26.9±1.8	26.1±2.9	21.2±1.5*@$
TSF(mm)	9.8±6.13	10.32±5.8	9.4±5.0	7.1±2.9
MAMC(cm)	24.9±3.3	23.7±2.7	23.2±2.01	19.02±1.06
Albumin(g/l)	44.1±2.5	39.5±1.2*	35.9±2.2*@	31.5±3.8*@$
Prealbumin(g/l)	0.219±0.053	0.148±0.057*	0.142±0.058*	0.129±0.080*
TIBC(µg/dl)	371±62	391±52	335±80	257±99
Transferrin(g/l)	2.6±0.4	2.8±0.4	2.8±0.6	1.8±0.7
Lymphocyte	2754±864	2875±602	2777±975	1900±523
Hematocrit	43.9±3.9	41.0±5.3	37.5±6.3*	41.6±5.4
Length of stay(days)	23.5±9.4	18.2±9.4	24.0±13.7	28.0±12.6

* P value< 0.05 compared with the well nourished group, @ P value< 0.05 compared with the mildly malnourished group, $ P value< 0.05 compared with the moderately malnourished group, NRI= Nutrition Risk Index, BMI=Body Mass Index, MAC=Mid Arm Circumference, TSF= Triceps Skin Fold, MAMC=Mid Arm Muscle Circumference, TIBC=Total Iron Binding Capacity

All anthropometric data differed significantly between malnourished and well nourished groups with the SGA, while only MAC differed between these two groups by the NRI method, probably because our sample size was not large enough. Also, the fact that the measurement of anthropometric data is an error-prone method could be considered. There have been similar studies for assessment of the nutritional status of surgical and non-surgical hospitalized patients on admission and discharge. These studies have shown higher malnutrition rates at discharge. (1, 3) Nutritional status usually worsens during the course of hospitalization due to fasting periods for investigations, unpalatable foods, nausea, depression or feeding difficulties, etc(3). In this study, the nutritional status of the patients deteriorated significantly between their admission and seven days after surgery by both methods. Day seven after surgery was chosen instead of discharge time with the intention of assessing nutritional status after a particular period of time for all patients.

The differences between the results of two methods may be due to the difference between the bases of the SGA and NRI methods as the SGA relies on subjective and the NRI relies on objective findings. In other studies as well as this study, the SGA in comparison with the NRI usually underestimates the prevalence of malnutrition.

CONCLUSION

The results of this study demonstrate a high prevalence of malnutrition in GI cancer patients at admission and the deterioration of their nutritional status seven days after surgery during the course of hospitalization. Both applied methods, the SGA and NRI, proved predictive for malnutrition. In this study, the significant fall in both anthropometric and laboratory data also proved to indicate the worsening of the patients' nutritional status reliably. SGA is less time-consuming and more cost-effective than the NRI.

REFERENCES

1. Naber TH, Schermer T, De Bree A, Eggink L, Krumiel JW, Bakkeren J, Van Heereveld H, Katan MB. Prevalence of malnutrition in nonsurgical hospitalized patients and its association with disease complications. Am J Clin Nutr. 1997; 66:1232-9.
2. Barrera R. Nutritional support in cancer patients. J Parent Ent Nutr. 2002; 26:5 S63-S71.
3. Sungurtekin H, Sungurtekin U, Balci C, Zencir M, Erdem E. The influence of nutritional status on complications after major intraabdominal surgery. J Am Coll Nutr. 2004; 23:227-32.
4. Weinsier RL, Hunker EM, Krumedieck CL, Butterworth CE. A prospective evaluation of general medical patients during the course of hospitalization. Am. J Clin Nutr. 1979; 32:418-26.
5. Sungurtekin H, Sungurtekin U, Hanci V, Erdem E. Comparison of two nutrition assessment techniques in hospitalized patients. J Am Coll Nutr. 2004; 20:428-32.
6. Young GA, Chem C, Hill GL. Assessment of protein –calorie malnutrition in surgical patients, from plasma proteins and anthropometric measurements. Am J Clin Nutr. 1978; 31:429.
7. Gurski RR, Schirmer CC, Rosa AR, Brentano L. nutritional assessment in patients with squamous cell carcinoma of the esophagus. Hepatogastroenterology. 2003; 50(54): 1943-7.
8. Logan S, Hildebrandt LA. The use of prealbumin to enhance nutrition intervention screening and monitoring of the malnourished patients. Nutrition Today. 38(4): 134-8.
9. Campillo B, Paillaud E, Uzan I, Merlier I, Abdellaoui M, Perrenec JF, Bories PN. Value of body mass index in the detection of severe malnutrition and influence of the pathology and changes in anthropometric parameters. Clin Nutr 2004; 23(4): 551-9.
10. Detsky AS, Laughlin JR, Baker JP, Johnston n, Mendelson RA, Jeejeebhoy KN.What is Subjective Global Assessment of nutritional status? J Parent Ent Nutr 1987; 11:8-11.
11. Baker JP, Detsky AS, Wesson DE, Woman SL, Stewart S, Whitewell J, Langer B, Jeejeebhoy KN. Nutritional assessment. A comparison of clinical judgment and objective measurements .N Engl J Med 1982; 306:969-72.
12. Buzby GP, Williford WO, Peterson OL, Crosby LO, Page CP, Reinhardt GF, Mullen JL. A randomized clinical trial of total parenteral nutrition in malnourished surgical patients. Am J Clin Nutr 1988; 47:357-65.
13. Frisancho AR. New norms of upper limb fat and muscle areas for assessment of nutritional status. Am J Clin Nutr 1981; 34:2540-45.
14. The Veterans Affairs Total Parenteral Nutrition Cooperative study Group: Perioperative total parenteral nutrition in surgical patients. N Engl J Med 1991; 325:525-32.
15. Hill GL, Blackett RL, Pickford I, Burkinshaw L, Young GA, Warren JV, Schorath CJ, Morgan DB. Malnutrition in surgical patients. Lancet. J Parent Ent Nutr. 1977; 1(8013):689-92.

16. Detsky AS, Baker JP, Mendelson RA. Evaluating the accuracy of nutritional assessment techniques applied to hospitalized patients, methodology and comparisons. 1984; 8:153-9.
17. Hirsch S, de Obaldia N, Petermann M, Rojo P, Barrientos C . Subjective global assessment of nutritional status: further validation. Nutrition. 1991; 7(1):35-37.
18. Gibbs J, Cull W, Henderson W, Daley J, Hur K, Khuri SF. Preoperative serum albumin level as a predictor of operative mortality and morbidity: results from the national VA Surgical Risk Study. Arch Surg 1999; 134:36-42.
19. Spiekerman MA. Proteins used in nutritional assessment. Clin Lab Med. 1993; 13:353-69.
20. Pleban WE. Prealbumin: a biochemical marker of nutritional support. Connecticut Med. 1989; 53:405-7.
21. Winkler MF, Gerrior SA, Pomp A, Albina JE. Use of retinol binding protein and prealbumin as indicators of the response to nutrition therapy. J Am Diet Assoc 1989; 89:684-7.
22. Kung SP, Tang GJ, Wu CW, Lui WY. Serum albumin concentration as a prognostic indicator for acute surgical patients. Chung- Hua- I- Hsueh- tsa- Chih- Taipei. 1999; 62(2): 61-7.
23. Mortazavi M., Balali N. Intra oral effect of persica mouthwash, Irsha, Poidone Iodine 1%, chlohixidine and hypertonic chloride sodium on the rate of mutants streptococci of saliva. School of Dentistry, Shiraz Univ. of Med. Sci. 2001; Dentistry Doctoral Dissertation, 797.