Prevalence of Protein-Caloric Malnutrition in an Extended Care Facility

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The prevalence of protein-caloric malnutrition has been documented in the acute care hospital. Thirty randomly selected patients at an extended care facility were studied as to their nutritional status. Anthropometric measurements of height, weight, arm circumference, and triceps skin fold were obtained as well as laboratory studies of hematocrit, white blood cell count, albumin, and transferrin. Between 47 and 66 percent of the patients had moderate or severe protein-caloric malnutrition by anthropometric measurements, and 60 percent had a serum albumin level less than 3.5 g/100 mL. There was a significant correlation ($r > .5$) between the percent of standard weight/height and arm muscle circumference ($r = .601$, $P < .001$) as well as triceps skin fold ($r = 6.13$, $P < .001$). Serum albumin was highly correlated to hematocrit ($r = .721$, $P < .001$). Sixty percent of the patients were anemic and 24 percent were leukopenic. There was no correlation between length of stay and serum albumin. Physicians will need to increase their awareness and observation of this problem in patients in extended care facilities and become cognizant of the potential detrimental effects protein-caloric malnutrition may have on the rehabilitative process.

Malnutrition is being recognized with increasing frequency in many settings. The prevalence of protein-caloric malnutrition in patients in both municipal[1] and university hospital settings[2-4] has been evaluated. A prevalence of malnutrition in greater than 50 percent of the patients was not unusual.

These previous studies have looked at hospitalized patients. While nutrition is a vital aspect of the care of hospitalized patients, the status of patients with a chronic illness in an extended care facility may be even more influenced by malnutrition. A prevalence of up to 85 percent for an indicator of malnutrition has been reported in a nursing home population.[5]

Not infrequently individuals are placed in an extended care facility following hospitalization. They are there with a chronic illness (eg, rheumatoid arthritis) or from an acute insult (eg, fractured hip, stroke) to undergo rehabilitation. Their ability to undergo an extensive rehabilitation program, maintain their present level of health, and be discharged may be influenced by their nutritional status.

This study was undertaken to begin to define the prevalence of protein-caloric malnutrition in an extended care facility and to determine whether age, sex, primary diagnosis, diet order, or length of stay in the extended care facility correlated with protein-caloric malnutrition.

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Methods

The John L. Deaton Medical Center is a 200-bed extended care facility located in the inner city. At the time of this one-day survey, there were 180 patients in the center. Utilizing a table of random numbers, 30 patients were selected.

During the morning hours, all patients had blood drawn for determining values of hematocrit, white blood cell count, white cell differential, albumin, and transferrin. Upper arm circumference and triceps skin fold measurements were obtained utilizing a metal measuring tape and Lange Skin Fold Calipers by an accepted technique.[6] Arm muscle circumference was calculated from a nomogram.[7] The patient's weight obtained within the previous seven days was recorded, and the patient or family provided the patient's current height. The age, sex, primary diagnosis, length of stay, and current diet order were obtained from the patient's chart.

Standards for weight and height, arm muscle circumference, triceps skin fold, and serum albumin were from a frequently used source.[5] If the patient's values fell within 60 to 90 percent of the standard, they were classified as having moderate depletion; having less than 60 percent was classified as severe depletion.

Results

Eighty percent of the patients were women; the mean age of the group was 63.5 (± 21.0) years (range 24 to 90). The variety of medical problems represented is shown in Table 1. Many patients had several primary diagnoses. The predominant problem was vascular disease manifested peripherally.

The distribution of severe and moderate malnutrition for the three anthropometric criteria is shown in Table 2. The serum albumin was less than 2.8 g/100 mL in six (20 percent) patients and between 2.8 and 3.5 g/100 mL in 12 (40 percent) patients.

Significant (linear regression) correlation with r values greater than 0.5 were noted between percent of standard of arm muscle circumference and percent of standard weight/height ($r = .601$, $P < .001$) and percent of standard weight/height and percent of standard triceps skin fold ($r = .613$, $P < .001$). Serum albumin vs hematocrit was highly correlated ($r = .721$, $P < .001$) whereas albumin vs transferrin was less significant ($r = .399$, $P < .05$).

Results of triceps skin fold, arm muscle circumference, and serum albumin were divided into three categories (severe depletion, moderate depletion, and normal). A significant correlation (Table 3) is noted between triceps skin fold and albumin and between arm muscle circumference and albumin. There was no correlation between age and albumin, nor between age and percent of standard of any of the anthropometric measurements.

Table 1. Primary Diagnosis of Patients Studied

	No. of Patients
Neurologic Problems	
Cerebrovascular accident	14
Multiple sclerosis	3
Mental retardation	2
Seizure disorder	2
Paraplegia	1
Senile dementia	1
Cancer	
Bladder	1
Breast	1
Larynx	1
Vascular Problems	
Diabetes mellitus	8
Arteriosclerotic vascular disease	4
Congestive heart failure	4
Trauma	
Fractured hip	3
Stab wound	1
Gastrointestinal Problems	
Colitis, Colostomy	1
Peptic ulcer disease	1
Other (rheumatoid arthritis)	2

Of the prescribed diets, 16 (54 percent) were regular, 7 (23 percent) were tube feeding, and 7 (23 percent) were restricted protein or calories.

The percentage of patients in either the moderate or severe category of protein-caloric malnutrition for each diet category is shown in Table 4. The tube-fed patients were presumably more ill and had a higher frequency of protein-caloric malnutrition than those in the other diet categories. Sixty percent of patients were anemic. (For men the hematocrit was less than 41 percent; for women the hematocrit was less than 36 percent.) Twenty-four percent of patients were leukopenic (white cell count of less than 4,800/mm^3) and 28 percent were lymphopenic (white cell count of less than 1,200/mm^3).

Table 2. Anthropometric Measurements of Protein-Caloric Malnutrition

Percent of Standard	Weight and Height No. (%)	Arm Muscle Circumference No. (%)	Triceps Skin Fold No. (%)
Less than 60 percent (severe)	0 (0)	2 (7)	7 (23)
60 to 90 percent (moderate)	14 (47)	17 (56)	13 (43)
Greater than 90 percent (normal)	16 (53)	11 (37)	10 (33)

Table 3. Anthropometric Measures and Serum Albumin

	Albumin (g/100 mL)		
Percent of Standard	Less than 2.8	2.8 to 3.5	Greater than 3.5
Triceps skin fold*			
Less than 60	4	3	1
60 to 90	0	7	5
Greater than 90	2	2	6
Arm muscle circumference**			
Less than 60	2	0	1
60 to 90	3	9	4
Greater than 90	1	3	7

Note: Numbers represent patients in each category
*$X^2 = 10.52$, $P < .01$
**$X^2 = 9.11$, $P < .01$

Table 4. Diet and Patients with Moderate or Severe Protein-Caloric Malnutrition

	Percent Moderate/Severe Depletion		
Diet	Albumin	Arm-Muscle Circumference	Triceps Skin Fold
Regular (n = 16)	50	63	63
Tube feeding (n = 7)	86	100	71
Restricted protein and calories (n = 7)	57	29	71

The length of time in the extended care facility vs serum albumin was not significantly correlated ($r = .147$, $P > .5$) in this study.

Discussion

Bistrain et al[3,4] have documented the use of anthropometric measurements and the serum albumin to identify patients with protein-caloric malnutrition and the rather high prevalence of protein-caloric malnutrition in hospitalized patients. They also indicated the need to extend this work to other populations. Shaver et al[5] found a high prevalence in their evaluation of nursing home patients.

This study of a small sample of patients in an extended care facility shows that many patients had moderate or severe protein-caloric malnutrition. The impact of this malnutrition on their course of rehabilitation is generally considered to be detrimental.

Serum albumin may not be an adequate index of nutritional status because it is affected by more than dietary intake. However, the serum albumin is an inexpensive test to assess nutritional status, and while certain disease states may contribute to hypoalbuminemia other than diminished intake, it would be difficult to think of these patients as well nourished. Furthermore, since arm muscle circumference and albumin were significantly correlated, this would support the use of albumin as a criterion, since arm muscle circumference would not be primarily affected by renal, gastrointestinal, or hepatic disease.

The various methods utilized in this study for assessing protein-caloric malnutrition represent different biological tissue. Triceps skin fold thickness represents fat stores, and arm muscle circumference, the muscle protein reserves. Transferrin and albumin indicate visceral protein, while weight/height is a composite measure.

The relationship between the prescribed diet and prevalence of protein-caloric malnutrition may represent that these patients were the most seriously ill, although the extremely high prevalence may reflect the inadequacies of the diet and the failure to recognize the probable negative nitrogen balance of those patients.

No correlation was found to the length of time the patients had been in the extended care facility. It is possible that many of the patients arrived at the center malnourished, since all of the patients are transfers from an acute care hospital. The worsening nutritional status of patients hospitalized has been demonstrated.[8]

The causes of leukopenia and lymphopenia seen in this group were presumably multiple but could be expected to be associated with impaired cellular immunity[9] and increased susceptability to opportunistic infection.[10]

Although McFarlane et al[11] have indicated that serum transferrin is a rapid and sensitive indicator of protein-caloric malnutrition, this study failed to find a correlation between decreased transferrin and the other indicators of protein-caloric malnutrition. Transferrin testing is not recommended as an inexpensive means of assessing protein-caloric malnutrition. A less expensive means of calculating transferrin is to use the value of the total iron-binding capacity (TIBC) and to calculate transferrin from the following formula:

$$\text{Transferrin} = (0.8 \times \text{TIBC}) - 43$$

The findings of this study would be of theoretic interest only if no effective therapy were available to accomplish nutritional repletion. However, new techniques of support are available.[12-16]

Underscored in this study is the need for all involved in the rehabilitation process to be cognizant of the nutritional status of patients. The review of the literature also indicated the need for a prospective study of the incidence and natural course of protein-caloric malnutrition in patients in extended care facilities.

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