Malnutrition and Length of Stay - A Relationship?

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Original Contributions

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The admission nutrition status of 135 consecutive general medical patients admitted to a single nursing unit was evaluated using a simple questionnaire and available laboratory studies. A statistical analysis of the data obtained indicates that prolonged length of stay may be related to admission nutritional status.

Less than optimum nutrition has been identified in 31 to 48% of patients admitted to the hospital (1-4). Severe malnutrition has been found in 11 to 22% of admissions (2). Although malnutrition clearly exist in hospitalized patients, it is less clear what the clinical implications of malnutrition may be. In surgical patients malnutrition has been associated with increased complications and worsened survival (5-8). Less compelling data exist for general medical patients. One reason for the paucity of data for the general medical inpatient may be the lack of clearly defined endpoints equivalent to wound infection or survival in the surgical patient.

Implementation of Diagnostic Related Groupings (DRGs) and their accompanying length of stay (LOS) criteria has made LOS a clearly identifiable component of outcome for the hospitalized patient. Evidence is accumulating that nutritional support can improve outcome and reduce LOS in surgical patients (5-8). Similar data relating nutritional status to LOS are lacking for medical patients.

In an effort to identify factors present on admission in general medical patients that might be predictive or at least associated with LOS, we undertook a pilot study. The concept of the study was to utilize a simple questionnaire to identify the patient at high risk for malnutrition.

Materials and Methods

A single general medical nursing unit at Henry Ford Hospital was selected as the site for a prospective study of the effect of admission nutrition status on LOS. All patients admitted to the study nursing unit during the four-month period, June 1984 to September 1984, were entered into the study. Admission demographic and nutrition data were recorded by the admitting nurse utilizing a simple questionnaire (Table I). Additional information including final diagnosis, LOS, admission serum albumin, and total lymphocyte count were recorded on review of the inpatient chart at the time of discharge.

For the purpose of analysis, the patients were divided into two groups. Group A consisted of those patients who were hospitalized for eight days or less (LOS ≤ 8), and Group B consisted of patients who were hospitalized for greater than eight days (LOS > 8). The cutpoint, eight days, represents the average LOS of a patient at Henry Ford Hospital. Individual parameters in the nutritional assessment were evaluated in terms of sensitivity and specificity in predicting LOS. In addition, a stepwise linear regression was performed for the dependent variable LOS to evaluate the association with the independent variables studied (9).

Results

During the four-month study period, 135 patients (72 men and 63 women) were admitted to the study nursing unit. These patients averaged 50 years of age (range 19 to 101 years). A summary of diagnoses is given in Table II. Of the 135 patients, 77 (57%) had a LOS ≤ 8 days, and 58 (43%) had a LOS > 8 days.

Of the study parameters, recent surgery, radiation or chemotherapy, recent steroid treatment and total lymphocyte count could not be related to LOS. Only five patients had undergone recent surgery, chemotherapy or radiation therapy. Similarly, only four patients had received recent steroid treatment. Total lymphocyte counts varied widely and bore no correlation to LOS ($v = .003$; not significant).

Table I
Henry Ford Hospital Nutrition Screening Profile

Name _____   Unit/Room _____

Medical Record Number _____   Weight: Today _____
                                                                    Usual _____

Admitted _____   Height _____

Age _____   Sex _____

Have you had an unexplained weight loss of 10 or more pounds in the last two to three months?
(a) No _____ Yes _____   If so, how much? _____

Have you had surgery, cobalt treatment, or chemotherapy for a tumor in the past six months?
(b) No _____ Yes _____   Which? _____ When? _____

Are you taking Prednisone or Decadron?
(c) No _____ Yes _____

Have you been unable to eat for any reason in the past week?
(d) No _____ Yes _____   Why? _____

*If the answer to (a), (b), (c), or (d) is YES, check the high-risk nutrition box and notify the unit dietician.

Nutritional high-risk patient _____

Serum albumin _____ g%
Total lymphocyte count _____ mm3

The relationships between LOS and the variables, recent weight loss > 10 pounds, inability to eat during the week before admission, and serum albumin < 3.5 g/dL are shown in Table III. Of the 129 patients responding, 44 (34%) reported recent weight loss > 10 pounds. An inability to eat during the week preceding admission was noted in 60 (46%) of 131 patients. A serum albumin of 3.5 g/dL was recorded in 46 (39%) of 117 patients who had a serum albumin determined. When weight loss, inability to eat, and serum albumin are considered separately, recent weight loss > 10 pounds had the highest specificity (75%). Specificity is true negative (no recent weight loss, LOS ≤ 8 days) divided by true negatives plus false positive (recent weight loss, LOS ≤ 8 days). Serum albumin had the highest sensitivity (53%). Sensitivity is true positive (serum albumin < 3.5 g, LOS > 8 days) divided by true positive plus false negative (≥ 3.5g, LOS > 8 days).

Analysis of paired variables (Table IV) does not increase the sensitivity or specificity of weight loss, inability to eat, and

serum albumin as predictors of LOS > 8 days. However, when a stepwise regression is performed against actual LOS rather than categorical LOS (ie, LOS ≤ 8 days or LOS > 8 days), both inability to eat and serum albumin < 3.5 g/dL are found to be associated with LOS. Weight loss, age, total lymphocyte count, and gender did not add to the prediction of LOS when inability to eat and serum albumin are included in the regression model. The R^2 was 0.16, implying that 16% of the variability in LOS in the study group was explained by inability to eat and serum albumin level, both measured at admission.

Discussion

The failure to recognize and treat the malnourished inpatient has been termed "the skeleton in the hospital closet" (10). In the past 15 years dramatic increases have been made in our ability to provide nutritional support for the hospitalized patient. Parallel to this growth in nutritional technology has grown a considerable body of evidence that nutritional support is of benefit to the surgical patient (5-8). Similar evidence for the effectiveness of nutritional support in general medical patients has not been as compelling (10-12).

Two problems seem to underly attempts at establishing the role of nutritional support in the general medical patient. The first problem has been a simple cost-effective means of identifying the population at risk (1-5,11,12). In this study a simple questionnaire coupled with two laboratory tests were utilized in an attempt to relate nutritional status to LOS. From the data obtained, if LOS can be considered as a

Table II
Summary of Diagnoses

Malignancy	13
Cardiovascular Disease	19
Hepatic Disease	13
Pulmonary Disease	20
Bowel Disease	10
Pancreatic Disease	6
Metabolic Disease	16
Renal Disease	7
Neurologic Disease	4
Drug Abuse	4
Soft Tissue Infections	9
Miscellaneous	14

Table III
Relationships Between Length of Stay and Weight Loss,
Inability to Eat, and Serum Albumin

		Weight Loss ≥ 10 lbs		
	Not Recorded	Yes	No	Total Responses
LOS ≤ 8 days	4	18 (25%)	55 (75%)	73 (100%)
LOS > 8 days	2	26 (46%)	30 (54%)	56 (100%)
Totals		44 (34%)	85 (66%)	129 (100%)

Sensitivity 26/56 = 46%
Specificity 55/73 = 75%

		Unable to Eat		
	Not Recorded	Yes	No	Total Responses
LOS ≤ 8 days	4	31 (42%)	42 (58%)	73 (100%)
LOS > 8 days	0	29 (50%)	29 (50%)	58 (100%)
Totals		60 (46%)	71 (54%)	131 (100%)

Sensitivity 29/58 = 50%
Specificity 42/73 = 56%

		Serum Albumin		
	Not Recorded	< 3.5	> 3.5	Total Responses
LOS ≤ 8 days	9	20 (29%)	48 (71%)	68 (100%)
LOS > 8 days	9	26 (53%)	23 (47%)	49 (100%)
Totals		46 (39%)	71 (61%)	117 (100%)

Sensitivity 26/49 = 53%
Specificity 48/68 = 71%

complication of nutritional status, then it appears that a) recent inability to eat and b) serum albumin; < 3.5 g/dL are the most useful of the parameters we evaluated in predicting a prolonged LOS (Table III). While history of weight loss has the largest value for specificity, it does not provide information beyond that given by serum albumin and inability to eat. Of these two parameters, serum albumin < 3.5 g/dL provides the most accurate assessment with a sensitivity of 53% and a specificity of 71%. This finding is in agreement with the conclusions of several studies of a wide variety of nutritional assessment profiles (1-8,11,12). In general, high sensitivity would be preferred over high specificity. It is more important to correctly identify those who will have long LOS and need nutritional supplements than to correctly identify those who will not have long LOS and do not need nutritional supplements. Of course, there

Table IV
Analysis of Paired Variables

	Any Two Variables Positive?*		
	Yes	No	Totals
LOS ≤ 8 days	20 (28%)	51 (72%)	71 (56%)
LOS > 8 days	27 (49%)	28 (51%)	55 (44%)
Totals	47 (37%)	79 (63%)	126 (100%)

Sensitivity 27/55 = 49%
Specificity 27/47 = 72%

*Weight loss, unable to eat, serum albumin < 3.5 g/dL

are cost savings associated with correctly identifying those who do not need supplements, but the greater savings comes from decreasing the LOS for patients by administering nutritional supplements appropriately. However, given the many different diagnoses, it is impressive that 16% of the variability in LOS for this diverse group can be explained by the two nutrition variables.

The second problem is demonstrating that nutritional status has an impact on outcome. In surgical patients, wound infection and survival provide two generally accepted endpoints for the evaluation of changes in therapy. In surgical patients, reversal of malnutrition has been shown to both decrease complications and to improve survival (5-8). In this study, LOS was chosen as the dependent variable. By regression analysis, inadequate nutrition as evidenced by a decrease in serum albumin was shown to be significantly associated with an increased LOS.

The results of this study indicate that variables related to malnutrition and associated with LOS can be identified simply and inexpensively. Further studies to identify the relationship between malnutrition and LOS should be conducted on a more homogeneous, perhaps disease specific population. The goal of these studies is to identify that subsegment of the malnourished population that might be expected to respond favorably to appropriate nutritional intervention.

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