Nutritional Assessment of the Hospitalized Patient

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LINDA MATTINGLY *(Dietitian):* Poor nutrition is an important but frequently overlooked factor that contributes to the outcome of an illness. Studies show that as many as 40 to 50 percent of hospitalized patients have evidence of protein-calorie malnutrition.[1,2] Since malnutrition is associated with decreased resistance to infection, poor wound healing, and decreased tolerance for surgery and chemotherapy, a nutritional assessment of the hospitalized patient should be considered an essential part of medical care. As much as a three- to tenfold increase in morbidity and mortality may be attributed to undiagnosed and untreated malnutrition.[3]

In today's Grand Rounds we will focus on how to assess the nutritional status of a hospitalized patient by discussing L.S., a patient I was asked to evaluate. L.S. is a 58-year-old single male with a chronic, painful, infected leg ulcer that developed following an episode of superficial phlebitis. Despite outpatient management with oral antibiotics and local skin care, the ulceration worsened, and L.S. was hospitalized for more aggressive treatment. His medical record indicated an undocumented history of Crohn's disease but no history of any other serious ailments.

Before we continue, can anyone identify any feature from this brief history that might suggest a significant nutritional problem?

DR. MONICA YOUNG *(Third-Year Family Practice Resident):* A chronic ulcer that fails to heal might be due to poor nutrition.

DR. MARLON TWYMAN *(Second-Year Family Practice Resident):* This patient will need more than his usual nutritional requirements because of the infection and loss of protein from the drainage.

DR. MARTIN LIPSKY *(Assistant Director of Family Medicine):* The possibility of Crohn's disease should also raise the question of malabsorption and its concomitant nutritional problems.

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MS. MATTINGLY: As you can see, even this brief history has identified a patient at risk for a number of potential problems. Our assessment is incomplete, however, until we obtain more information. One obvious consideration is any recent change in weight. An involuntary weight loss exceeding 10 percent of body weight strongly suggests malnourishment even in the obese patient.[4] A voluntary weight loss of 10 percent may also indicate a potential for malnutrition, since weight-reduction diets are often low in essential nutrients. Certainly, one must consider social factors affecting diet, such as the ability to buy and prepare food, when assessing a patient's nutrition. Another important part of the history is reviewing medications, since some drugs may interfere with absorption or utilization of various nutrients. One example is phenytoin therapy, which can interfere with vitamin D metabolism, and bile sequestrants that can bind fat-soluble vitamins.

Checking for a history of alcoholism, depression, diabetes, and other chronic disease states is important, as these diseases can contribute to nutritional deficiencies. Often overlooked are dental or neuromechanical problems of the oropharynx that may affect the ability to chew or swallow. Previous gastrointestinal surgery or disease may affect the ability to digest or to absorb various nutrients. Recent physical stresses such as surgeries, acute illnesses, or hospitalizations can also affect nutrition and metabolic needs (Table 1).

In L.S. we have already identified several factors placing him at increased risk for malnutrition, including increased metabolic needs resulting from infection and protein loss from an open, draining wound, as well as the possibility of Crohn's disease. Additional information about L.S. is that his usual weight is 240 pounds but he has gained about 20 pounds over the last two years. Also, the diagnosis of Crohn's disease was felt to be unlikely because his only gastrointestinal complaint was occasional bloating and diarrhea that was due to a mild milk allergy. There was no history of rectal bleeding or steatorrhea.

With this information in mind, my next step in evaluation would be to obtain a diet history. Can anyone suggest how to do this?

DR. THOMAS KLEVER *(Associate Director of Family Medicine):* I think in the hospitalized patient a diet diary

TABLE 1. HISTORICAL INFORMATION CONCERNING NUTRITIONAL STATUS

Medication
Weight loss
Presence of chronic disease
Alcoholism
Dental disorders
Oropharyngeal disorders
Gastrointestinal disorders
Previous gastrointestinal surgery
Recent stress (acute illness, hospitalization, surgery, etc)
Social factors affecting diet and ability to prepare meals
Diet history

TABLE 2. DIETARY EVALUATION

Demographics	
Age	58 years
Marital status	Single
Occupation	Retired auto worker
History	
Clinical	Presents with infected draining ulcer of left leg
Past medical	1965—Cerebral vascular accident with no significant residual deficits
Diet (usual daily intake)	
Meat	Two 6-oz high-fat meats, eg, bologna, bacon, hamburger
Milk	None
Fruits	2 to 3 servings per week
Vegetables	Rarely
Breads and cereals	5 to 6 servings
Fats	8 to 10 servings
Desserts	2 to 3 servings
Carbonated beverages	5 to 6 12-oz cans of soda
Alcohol	None
Anthropometrics	
Height	5 ft 10 in
Weight	262.5 lb
Usual weight	240 lb (2 years ago)
Ideal body weight	182.6 lb (large frame)

Comments: *Irregular eating patterns, snacks throughout day. Evening meal is L.S.'s only regular meal, consisting of "meat-and-potatoes" frozen entree plus dessert and carbonated beverage. Eats out at fast-food restaurants 5 to 6 times per week. Lives with his mother but does his own cooking and his cooking skills are limited. Avoids milk because of associated bloating and diarrhea. No other food intolerance.*

would not reflect his usual habits, so I would recommend a dietary recall with a food frequency checklist.

MS. MATTINGLY: I agree. To illustrate the value of a diet history, Table 2 displays the dietary evaluation summary of L.S. A quick review shows that L.S. is deficient in two of the four basic food groups— dairy foods, and fruits and vegetables. These deficiencies raise concerns about poor intake of calcium and vitamins such as A, C, and folic acid. Also, L.S. has a high-fat, high-simple-sugar diet that is excessive in calories.

Two other important points in the history that need to be addressed as part of any long-term nutritional plan are the patient's inability to cook and what clinically appears to be a mild lactose intolerance. Before we develop a nutritional plan, however, we need to complete our nutritional assessment by utilizing anthropometric measurements, biochemical measurements, and immuologic testing. For example, what type of anthropometric data might be helpful?

DR. MARK WORTHEN *(Third-Year Family Practice Resident):* We could measure the height and weight and do skinfold measurements.

MS. MATTINGLY: I agree, although I typically use only height and weight. Unfortunately, in many patients even these simple measurements are often overlooked. One survey showed that height was not measured in about one half of patients, and body weight was not recorded in about 25 percent.[5] Other common anthropometric measurements include skinfold thickness, which reflects body fat stores, and arm circumference, which is an indicator of skeletal muscle stores. Although these measures provide additional information about energy stores and protein reserves, they also require more skill to measure correctly.

In general, I feel that an accurate height, weight, and visual inspection is sufficient to diagnose caloric malnutrition. This caloric type of malnutrition, marasmus, is characterized by depressed anthropometric measurements with the preservation of visceral proteins and immune function. Marasmus is usually well tolerated in the absence of stress unless the calorie deficiency is very severe.

A second type of malnutrition, kwashiorkor, or protein-calorie malnutrition, cannot be diagnosed by visual inspection. This type of deficiency is usually due to an imbalanced diet, adequate in calories but deficient in protein. In the hospital setting, protein-calorie malnutrition is often complicated by a sudden drop in food intake associated with the increased metabolic demands from illness or trauma. Typically, a patient may look well nourished but is deficient in visceral proteins. Since visceral proteins are essential components of host defense, enzymatic processes, and wound healing, these losses are more ominous than the loss of fat or somatic protein stores. Although patients may present with a mixed picture, some differences between marasmus and kwashiorkor are presented in Table 3.

Can anyone suggest some measurements to assess the status of visceral proteins?

DR. GERRY A. STEINER *(Assistant Director of Fam-*

TABLE 3. DIFFERENCES BETWEEN KWASHIORKOR AND MARASMUS

Characteristics	Kwashiorkor	Marasmus
Clinical setting	Decreased protein and stress	Decreased calories
Appearance	Can appear well nourished	Emaciated
Time course	Weeks to months	Months to years
Response to stress	Poor	Reasonably well
Serum albumin	Decreased	Normal
Total lymphocyte count	Decreased	Normal
Weight	Normal, may even be increased	Decreased
Arm circumference	Normal	Decreased

TABLE 4. LEVELS OF PROTEIN DEFICIENCY

	Malnutrition		
Assays	Mild	Moderate	Severe
Albumin (g/L)	31–35	25–30	<25
Transferrin (g/L)	1.8	1.6–1.8	<1.6
Total lymphocyte count (per cubic centimeter)	1500–1800	900–1500	<900

From Latanich and Gallagher-Allred[6]

ily Medicine): Serum albumin would be one measurement.

MS. MATTINGLY: Serum albumin is an excellent measurement and the one most frequently used. In general, an albumin less than 35 g/L (3.5 mg/dL) suggests a visceral protein deficiency. The deficiency can be classified as mild, moderate, or severe based on the albumin level: between 31 g/L (3.1 mg/dL) and 35 g/L (3.5 mg/dL), mild visceral protein deficiency; 25 to 30 g/L (2.5 to 3.0 mg/dL), moderate; and less than 25 g/L (2.5 mg/dL), severe depletion (Table 4).

A second serum protein, transferrin, may also be measured. With a shorter biological half-life than albumin, transferrin is believed to reflect more accurately acute changes in the status of visceral proteins.[7] A major disadvantage to measuring transferrin levels, however, is that these levels are less readily available and more expensive to obtain than serum albumin determinations. A serum transferrin level between 1.8 g/L (180 mg/dL) and 2.0 g/L (200 mg/dL) is indicative of mild visceral protein depletion; 1.6 g/L (160 mg/dL) to 1.8 g/L (180 mg/dL), moderate depletion; and less than 1.6 g/L (160 mg/dL), severe depletion. If a laboratory is unable to measure transferrin, formulas derived from the serum total iron-binding capacity can be used to estimate transferrin levels.

Another laboratory test commonly available that provides nutritional information is the complete blood count and differential. The results from the peripheral blood smear, hemoglobin determination, and cell indices can provide clues to iron, B_{12}, and folate deficiencies. The absolute count of one population of white blood cells provides especially useful information in assessing immunocompromise resulting from malnutrition.

Does anyone know to which subgroup of white blood cells I am referring?

DR. LIPSKY: The total lymphocyte count provides a measure of the degree of immunosuppression resulting from malnutrition. Counts of less than 900 cells per cubic centimeter, between 900 to 1,500 cells per cubic centimeter, and between 1,500 and 1,800 cells per cubic centimeter indicate, respectively, severe, moderate, and mild malnutrition with corresponding degrees of immunocompromise. Since the immune function of lymphocytes is so important to the body, a depressed lymphocyte count is one of the first measurements to respond to nutritional support. The total lymphocyte count, therefore, is also useful for following nutritional repletion as well as in assessing the degree of malnutrition.[8]

DR. PAUL EBY *(Second-Year Family Practice Resident):* Isn't skin testing a means of assessing immune status?

MS. MATTINGLY: Yes, skin testing measures cell-mediated immunity, which can be depressed in malnourished individuals. Mullen et al[9] have shown that patients exhibiting anergy to common skin test antigens such as Candida have an increased risk for complications following surgery. Other conditions, however, such as old age, cancer, sarcoidosis, and severe infections, can also produce anergy and may limit the usefulness of skin testing in assessing malnutrition.

To summarize our discussion so far, we have decided that a nutritional assessment should consist of a diet and medical history, physical examination, anthropometric measurements, and selected laboratory tests. In the case of L.S., despite his well-nourished appearance, he has biochemical evidence of mild to moderate kwashiorkor, or protein-calorie malnutrition. His biochemical values are as follows: serum albumin 33.0 g/L (3.3 mg/dL), total lymphocyte count 1,172 per cubic centimeter, total iron-binding capacity 45 μmol/L (249 μg/dL), transferrin 1.56 g/L (156 mg/dL), hemoglobin 141 g/L (14.1 g/dL), hematocrit 0.42 (42 percent) and cholesterol 3.85 μmol/L (149 mg/dL).

Now that we have diagnosed a nutritional deficiency, we must develop a plan for correcting it. To do so, we must estimate his protein and caloric requirements. Generally, a nonstressed, inactive patient in good nutritional status requires 25 to 30 kcal/(kg · d) while a malnourished patient requires 35 to 40 kcal/(kg · d).[10] However, for overweight patients, I calculate their daily requirements using their ideal body weight plus one quarter of the excess body weight. For example, if the patient's ideal body weight is 75 kg but he weighs 95 kg, I take 75 kg plus one quarter of the excess 20 kg for a total of 80 kg. I would then use 80 kg to calculate my per-kilogram nutritional requirements.

Ideal body weight may be determined by using tables available in any standard nutrition textbook, or calculated by using one of many formulas. The formula I find the easiest for calculating ideal body weight for men is to figure 106 pounds for the first 5 feet, and 6 pounds for each additional inch. For women, the calculation is 100 pounds for the first 5 feet, and 5 pounds for each additional inch. Patients with small frames require a 10 percent subtraction, while those with large frames a 10 percent addition.[11] I then follow the patient very carefully to avoid overfeeding of calories as well as to ensure that the patient does become nutritionally repleted.

In the case of L.S., because of the stresses of illness, I would recommend a 25 percent increase above the calculated caloric intake. In patients who are more severely stressed, such as burn patients, I frequently recommend 50 to 100 percent increases above their normal caloric intake.

Now, can anyone recommend a goal for L.S.'s protein intake?

DR. KATHLEEN KRUK *(Third-year Family Practice Resident):* Generally, people need approximately 0.8 g of protein per kilogram per day. However, since L.S. is already protein deficient and has ongoing protein losses, he will need more than this.

MS. MATTINGLY: I would recommend at least 1.5 kg/d and perhaps even 2 kg/d.

Another point I would like to mention is that L.S. appears to be mildly lactase deficient. Does anyone have any suggestions for dealing with this?

DR. STEINER: We could use a reduced-lactose milk.

MS. MATTINGLY: Yes, a reduced-lactose milk is available at many large supermarkets. It is slightly sweeter than regular milk and has only 1 percent fat. In this particular patient the lower fat content would actually be beneficial. One therapeutic intervention I suggested for L.S. was to provide three glasses (24 oz) of reduced-lactose milk per day, which added calcium and approximately 24 g of protein to his diet. We supplemented this amount by adding a commercial instant breakfast to two glasses of milk each day, which has about 15 g of protein when mixed with 1 percent milk and yields 230 calories per 8-oz serving. I feel that this widely available supplement is more readily accepted by patients and much less expensive than the supplements traditionally prescribed, such as Ensure, Sustacal, or Osmolite. Despite L.S.'s history of mild lactose intolerance, he had no difficulties tolerating a commercial instant breakfast preparation and enjoyed the flavor.

Another possibility for patients with lactase deficiencies is to use lactate drops. Added to milk, these drops reduce the lactose content by approximately 70 percent, enabling most lactase-deficient individuals to tolerate milk.

Returning to our patient, in addition to adjusting protein and calories, I would also recommend a supplement of multivitamins and minerals. Although these recommendations will help L.S. while he is hospitalized, I feel that an essential part of an inpatient nutritional assessment is to plan for problems after discharge.

What problems can you anticipate after L.S. is discharged from the hospital?

DR. MICHAEL KRUK *(Third-Year Family Practice Resident):* As you stated earlier, L.S. is single and has very limited cooking skills. To comply with any dietary advice, he will need to acquire some new skills as well as alter his lifestyle. Certainly he will need to cut down on his fast-food intake or be very selective when he eats out.

MS. MATTINGLY: I feel this is one of L.S.'s most important problems. Our social history has identified a number of problems, and L.S. will need to be counseled with this in mind. We will either need to recommend easily prepared nutritious food or perhaps have his mother, who generally cooks for herself, cook for him as well. In addition, community resources, such as Meals-On-Wheels or home health aides, may also be available.

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