Calculating Nutrition Needs for a Patient With Head and Neck Cancer

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Patients with head and neck cancer often have distinct nutrition needs. The unique set of side effects of the disease process and treatment cause the patient to develop nutritional challenges. The challenges are complex to manage, often requiring supplemental feedings. Proper calculation of protein and caloric intake is necessary to meet the increased needs. Taking treatment and activity levels into account also is necessary when calculating nutrition requirements. Fluid balance can be delicate and requires attention, too. The dietitian determines the fluid needs of patients, using one of several calculations, and need is based on the patients’ laboratory work and overall hydration status, which can be affected by inadequate fluid intake, diarrhea, and vomiting.

The patient, a 58-year-old man named M.B., has been diagnosed with stage IIB adenocarcinoma of the esophagus. He is a smoker and consumes alcohol on a daily basis (more than two drinks per day). He has experienced severe heartburn in the past year and has been taking antacids daily. In addition, M.B. has lost more than 25 lbs from being unable to eat because of pain when swallowing (odynophagia), heartburn, and fullness soon after eating (early satiety). He has difficulty swallowing (dysphagia) anything with texture, as well as difficulty swallowing liquids. M.B. also complains of a cough that keeps him awake at night. These symptoms have caused him to seek medical attention.

M.B.’s lack of food intake has caused a significant amount of weight loss. His usual body weight was 90 kg with a height of 185.8 cm. Although M.B.’s body mass index (BMI) is 24.7 (normal BMI for this age group is 18.5–24.9), he is at increased weight status of 14%, which is indicative of severe weight loss (American Dietetic Association, 2000). Albumin and prealbumin levels were abnormal (M.B.’s albumin was 3.1 g/dl and prealbumin was 12 g/dl). The reference range for albumin is 3.5–5 g/dl and prealbumin is 15–56 g/dl. These values reveal malnutrition (Width & Reinhard, 2009). In addition, transferrin was 175 mg/dl (normal value for men is 215–365 mg/dl), hemoglobin was 13.5 mg/dl (normal value for men is 14–18 mg/dl) and hematocrit was 38% (normal value for men is 40%–54%); these low values are consistent with dietary deficiency of iron-rich foods (Width & Reinhard, 2009).

Assessment

Nutrition assessment was conducted by having M.B. provide a 24-hour food recall, an assessment in which the clinician obtains, from the patient, a list of all foods and beverages consumed in the past 24 hours. Accuracy for amounts of food consumed is validated by using food models, measuring spoons, and measuring cups. If time permits, the patient may be asked to keep a three- to five-day food diary. This can provide a better assessment of what is actually consumed over a number of days rather than just in one random day. It also provides for an accurate reflection of foods consumed, based on actual intake rather than recall (Nelms, Sucher, & Long, 2007).

The 24-hour recall revealed that M.B. was only able to consume about 800 kcal and less than 20 g of protein per day. This inevitably led to his marked weight loss and decreased albumin and nutrition status.

Treatment

The medical plan for treating M.B.’s esophageal cancer includes surgery, chemotherapy, and pre- and postoperative external beam radiation treatment (RT). M.B. will undergo chemoradiation (the sequential use of chemotherapy followed by RT) which may magnify the already present odynophagia and dysgeusia. In addition to odynophagia, dysgeusia, and esophagitis, alterations in smell, changes in taste acuity, dry mouth (xerostomia), and difficulty speaking can be complications of the treatment for head and neck cancers (Nelms et al., 2007).

In an effort to minimize these side effects and enhance nutrition for M.B.,
a percutaneous endoscopic gastrostomy (PEG) tube is placed at the time of his initial surgery. The main purpose of this tube is to bypass the oropharyngeal cavity, thus allowing nutrients to enter the stomach (Raykher et al., 2009). This step is an important part of the treatment plan because it helps treat or prevent malnutrition and dehydration and allows for treatment and medication administration to continue without disruption (Morton, Crowder, Mawesley, Ong, & Izzard, 2009).

**Calculation of Energy and Protein Needs**

For the normal weight, healthy population, caloric needs are 25 kcals/kgBW (kilogram of body weight) and protein needs are 0.8–1 g pro (grams of protein)/kgBW (Nelms et al., 2007). Cancer itself, and the treatment for cancer, increases the body’s need for energy and protein. Adequate calories and protein can help prevent protein energy malnutrition (PEM), a deficiency in the intake of energy and protein-providing foods. Severe PEM can result in a mortality rate of 40% (Morton et al., 2009). PEM leads to weight loss, muscle wasting, loss of appetite (anorexia), and general debility that often accompanies chronic disease. Calorie needs can be as high as 35–40 kcals/kgBW for the hypermetabolic or severely stressed patient (Nelms et al., 2007). In determining the energy needs of this patient, use of the Mifflin-St. Jeor equation is recommended (Mifflin et al., 1990). The Mifflin-St. Jeor equation is a predictive equation for resting energy expenditure (REE), or the energy expended by the body at rest to keep vital organ systems functioning. These organs include the heart, kidneys, brain, liver, and lungs. REE accounts for approximately 60%–75% of 24-hour energy expenditure of the body. Energy expenditure is about 1 kcal/kgBW per hour (Nelms et al., 2007). Protein needs are increased to as high as 1.5–2.5 g/kgBW and are determined based on extreme wasting, hypermetabolism, and protein-losing enteropathy (increased fecal loss of serum protein, particularly albumin, causing hypoproteinemia) (Nelms et al., 2007). M.B.’s energy and protein needs based on the Mifflin-St. Jeor equation (for males) are figured using 10(weight in kg) + 6.25(height in cm) – 5(age) + 5. Therefore, the calculation is 10(90 kg) + 6.25(185.8 cm) – 5(58) + 5. The calculation for REE is 900 + 1,156.25 – 290 + 5 = 1,726 kcals per day.

The Mifflin-St. Jeor equation uses stress and activity factors for patients who are hypermetabolic. Depending on the average injury or activity, the activity and stress factor changes (Kudsk & Sacks, 2005); the healthcare team further calculated M.B.’s needs on the added stress factor of surgery and the activity factor appropriate for him by using 1,726 x 1.3 stress factor (surgery) = 2,243 kcals per day and 2,243 x 1.2 activity factor (out of bed) = 2,691 kcals per day. This indicates that M.B.’s caloric needs are about 2,700 kcal per day.

**Interventions**

Protein needs are determined based on actual body weight, and can range from 0.8–2.5 g/kgBW. For M.B., since he has lost 14% of his body weight and has a low albumin and prealbumin, his protein needs are to be based on a hypermetabolic range of 1.5–2.5 g/kgBW. Given his present weight of 198 lbs, or 90 kg, his protein needs range from 135–225 g per day. If additional protein is needed that cannot be provided with the chosen tube feeding, additional modules such as Casec® and Promod® (protein modules) or Juven® (amino acids glutamine and arginine) used for wound healing can be added to the PEG feeding. These may be needed where skin breakdown from the radiation therapy is seen.

Based on M.B.’s energy and protein needs, Isosource® 1.5 was chosen as his tube feeding formula. Isosource is a high-calorie (1.5 kcal/ml), high-protein complete formula. M.B. will require Isosource 1.5 at 75 mol per hour. This rate is achieved by taking his caloric need of 2,700 and dividing by 1.5 (the calories per ml) and then further dividing by 24 hours per day to determine an hourly rate of flow. This rate should not be the initiation rate, rather, the feeding should be started at 30 ml per hour and increased by 15 ml every six to eight hours until the goal rate of 75 ml per hour is achieved (Matarese & Gottliebslich, 2003). Starting a formula slowly helps to ensure the patient will tolerate the feeding without undue complication, such as diarrhea, aspiration, or high residuals (greater than 250 ml of formula in the gut when residuals are checked).

Isosource is a low-volume feeding that provides increased nutrient needs without increased volume. This formula can provide the needed nutrients in a shortened feeding schedule. Isosource provides 100% of the recommended daily intake of micronutrients (the vitamins and minerals that are required for daily body maintenance). The following is the calculation of the calories and protein provided by Isosource 1.5 at goal rate:

Energy provided by Isosource based at 75 ml per hour = 75 x 24 hours = 1,800 ml. Then, 1,800 x 1.5 kcals = 2,700 kcals.

Isosource has 68 gpro per 1,000 ml. Therefore, 68 gpro x 1.8 L of Isosource equals 122.4 gpro. This alone does not meet M.B.’s required protein needs, so a protein supplement of an additional 20 g is added.

Without proper hydration, dehydration will occur. Dehydration, a deficit of fluid in the body, can rapidly take place. Sensible losses (i.e., fluid that can be measured such as fluid lost through urine and emesis) and insensible losses (i.e., fluid that cannot be measured, such as fluid lost through perspiration and respiration) need to be replenished. Fluid intake should equal fluid output, and that is not always possible when odynophagia and dysgeusia are present. If a patient is unable to meet fluid needs adequately, PEG tube feeding may be necessary. It is important to monitor the hydration status of this patient, as dehydration can lead to complications such as electrolyte imbalances and decreased effectiveness of medications.
be individualized based on illnesses that require additional replenishment (e.g., diarrhea, vomiting, dehydration, fever), when fluid restrictions are necessary (e.g., congestive heart failure, hyponatremia), and for patients on dialysis. Fluid needs for M.B. were calculated (Nelms et al., 2007) based on 25–30 ml per 90 kgBW as (a) 25 ml x 90 kg = 2,250 ml of fluid per day or (b) 30 ml x 90 kg = 2,700 ml of fluid per day.

Another way of looking at fluid maintenance is to calculate based on caloric needs. To maintain adequate hydration, fluid needs can be calculated as 1 ml/1 kcal per day. If caloric needs are 2,700 kcals per day, M.B. will need 2,700 ml of free water per day (Nelms et al., 2007). This is a basic calculation; fluid needs may need to be adjusted based on laboratory values and possible emesis or diarrhea. To determine the additional fluid needed but not provided by tube feeding, first determine the fluid provided by tube feeding through the following formula: Isosource 1.5 contains 778 ml/L of free fluid (778 ml x 1.8 L = 1,400 ml). The total daily fluid needs then are 2,700 ml. 2,700 ml – 1,400 ml = a 1,300 ml difference; therefore, M.B. will require three additional 433 ml bolus amounts of free water per day.

Conclusion

Nutrition is needed for the body to stay healthy and to maintain a strong immune system. During times of stress, such as an illness like cancer and its treatment, meeting the increased demands placed on the body can be difficult. Cancers of the head and neck make it extremely difficult. Odynphagia and dysgeusia can very easily lead to malnutrition. Studies have shown that early nutrition intervention can have a positive effect on the outcome of the patient. Prophylactic placement of a feeding tube prior to the initiation of the treatment for patients with head and neck cancer can ensure that patients are able to meet their energy and fluid needs during treatment. Meeting these needs also can help maintain continuity of treatment and decrease interruptions from dehydration, weight loss, and fatigue. The feeding tube also allows access for medication to be administered. Being well nourished allows for a better quality of life both during and after treatment as the body is able to maintain weight (Raykher et al., 2009). Nurses must relay any changes in a patient’s food intake as soon as possible so that the nutritionist can assess the patient’s needs and make necessary recommendations to ensure that the patient receives the foods or supplements needed to maintain good nutrition status.

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References