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Nutrition and Cancer

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Et al.

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Notes & Additional Reading

Summary and Key Points

1. Nutritional intake is frequently deficient in patients undergoing cancer treatment and should be assessed and treated.
2. Consider the unique nutritional needs of the patient based on their site of cancer and effects of their particular treatment.
3. There is little evidence that dietary manipulation or supplementation can produce a significant decrease in cancer risk.

Overview

A recent study in France demonstrated an overall incidence of malnutrition of 30% in patients seen at oncology clinics, ranging from 18% in patients with breast cancer to 50% in patients with cancer of the upper digestive tract.[1] Patients who are hospitalized and are malnourished require longer hospital stays and severe malnutrition is associated with higher mortality. There is also evidence that malnourished patients have higher rates of infection.

Overview of Nutrition in Cancer Care. NCI overview of nutritional issues related to cancer and cancer treatments, Although geared to patients; there is a section for health care providers.

There are many factors that predispose patients to malnutrition (National Cancer Institute-Nutrition in Cancer Care (PDQ®)):

- **Type of cancer/location of cancer**
  - Cancers which affect the head/neck and upper digestive tract have the most effect on nutrition due to their effect on functionality of oral intake.
  - Tumors in the oral cavity, pharynx and esophagus will affect chewing and swallowing– these patients may benefit from pre-emptive placement of a feeding tube.
  - Tumors of the stomach and upper intestines will affect digestion and absorption of food.

- Tumors of the pancreas and liver will affect enzymatic functions important for digestion.

– **Cachexia**– Cytokines produced by the body in response to cancer and its treatment can lead to decreased appetite, increased breakdown of lean body mass, as well as changes in carbohydrate and fat metabolism. This can lead to weight loss that is resistant to nutritional therapy.

– **Side effects of treatments (chemotherapy, surgery, radiation)**

- Anorexia
- Mouth sores– due to destruction of rapidly dividing cells by chemotherapy or radiation
- Dry mouth (xerostomia)– due to side effects of medication or radiation to the mouth
- Trouble swallowing (dysphagia)– due to tumor invasion, surgical interventions to the oral/pharyngeal/esophageal area, or tissue damage from radiation
- Nausea– due to chemotherapeutic or pain medications
- Vomiting– due to chemotherapeutic medications. There are many anti-emetic medications which can prevent this.
- Diarrhea– due to destruction of gastrointestinal lining from chemotherapeutic medications

– **Metabolic needs**

The following basic formula can be used to calculate a patient's energy needs:

> Estimated Energy Requirement = Basal metabolic rate + Thermic effect of food + Physical activity + Disease + Growth (pediatrics only)

When assessing the caloric needs of a patient with cancer, the many physiologic changes that occur during the disease process and treatment must be considered. The cancer itself will use calories for tumor growth. Rapidly growing tumors will obviously use more calories than ones that grow in a more indolent fashion. If there is

ADA Evidence Analysis Library: The American Dietetic Association's library of evidence based guidelines. Lists the guidelines and strength of evidence. (Non-ADA members can register for limited access to content.)

rapid cell turnover due to destruction of cells by the body or cancer treatment then the basal metabolic rate will increase to deal with the processing of cell waste and production of new cells. On the other hand, physical activity may decrease as patients experience fatigue or disability related to their illness. Thus some patients may have increased caloric needs but some may have decreased caloric needs if they were very physically active before treatment.

The best way to determine caloric needs would be through indirect calorimetry, but this is not feasible in most patients. Using the Harris-Benedict equation will be a close estimate for most patients. A gross estimate of needs would be 30-35 Cal/kg/day (rather than the usually recommended 20-30 Cal/kg/day). In obese patients this calculation should be done with their Ideal Body Weight rather than their actual weight (ADA Nutrition Evidence Analysis Library).

Harris-Benedict equation: (Basal metabolic rate [BMR] X the activity factor number= recommended daily calorie intake)

Ideal body weight calculation:
Women: 100 + (5 x inches over 5 feet)
Men: 106 + (6 x inches over 5 feet)

Monitoring a patient's weight on a weekly basis is the easiest method of assessing ongoing nutritional needs. Weight loss generally would indicate the patient is not receiving sufficient calories to meet their daily needs. Rapid weight loss (over days) is more indicative of dehydration or loss of lean body mass. Measuring skin fold thickness is a more accurate way of determining fat loss versus loss of lean body mass. While obese patients may not be distressed over weight loss during treatment they are also at high risk for malnutrition as they are likely to be losing lean tissue (muscle mass).

Nutrient Needs[2]

Proteins

- In general protein requirements increase in cancer patients due to cell turnover. Protein needs are estimated to be 1 – 1.2 gm/kg/day (70 gm instead of the 35-55gm RDA for healthy adults). Protein needs can go up as high as 2 to 2.5 gm/kg/day in hospitalized or critically ill patients.

Calculations should be done with ideal body weight for obese patients.

Fats

- Patients who are maintaining their weight during treatment with their usual dietary intake can continue to consume a diet that has the RDA of 20 – 35 gm/day total fat. If a patient is experiencing difficulty taking in sufficient food then increasing the fat content will allow them to increase calories without increasing volume.

Carbohydrates

- Carbohydrates should make up about 60% of the daily caloric intake. This will help prevent break down of proteins to be used in gluconeogenesis.

Micronutrients

- There are many theoretical reasons and *in vitro* studies that would suggest supplementation with micronutrients might be beneficial during cancer treatment. For example, antioxidants should offer some protection to cells during chemotherapy. Unfortunately multiple studies have shown only slight effects. In the absence of evidence of specific micronutrient deficiencies there is no strong evidence to support giving more than the usually recommended doses of micronutrients. It is important to get a history of any vitamin and herbal supplements a patient regularly takes to make sure they do not interfere with treatments.

Nutritional Therapy

- For most patients who start treatment at a normal weight and are able to maintain adequate oral intake there is no need for specific nutritional intervention. Patients should be screened on a regular basis during treatment by checking weight and asking about oral intake to see if they would benefit from meeting with a dietitian for counseling about their nutritional status.

- When designing a nutritional intervention the goals of treatment are[3]:

  - Avoid unintentional weight loss by addressing any nutrition-related side effects (nausea, diarrhea, mouth sores, etc.)– a weight loss of as little as 6% predicts a reduced response to oncology treatment and reduced survival and quality of life[3].

  - Prevent or treat malnutrition problems, including preventing muscle and bone loss – the body will break down lean muscle for protein and bones for calcium and

phosphorous if intake is insufficient.

- Decrease side effects of cancer treatment and problems related to nutrition.
- Keep up the patient's strength and energy – insufficient caloric intake will cause the body to decrease its metabolic rate, increasing the fatigue already felt from treatment.
- Help the immune system fight infection – severe malnutrition can lead to decreased immune response.
- Help the body recover and heal – large amounts of protein are needed to rebuild tissue that is damaged by the cancer itself, surgery or radiation and chemotherapy.
- Improvement in quality of life – eating is a basic human function; anything which disrupts this can be demoralizing.

Oral supplements

- Patients with increased nutrient needs can begin by making simple dietary changes such as adding heavy cream or protein powders to foods to increase calories and protein. Dietitians can work closely with patients to create meal plans that provide sufficient macronutrients and are still palatable.
- Special consideration must be given to patients who are especially sensitive to the palatability of foods during treatment, especially pediatric or geriatric patients. Often the goal of getting sufficient calories takes precedence over the quality of the calories. A liberal approach to their diet allowing them to choose high calorie yet low nutrient dense foods is often recommended. Micronutrients can be given as a supplement if needed.
- Patients who are still able to take nutrition by mouth but are having a difficult time getting in sufficient calories/nutrients can use supplements such as Pediasure (for ages 1-10 years) or Ensure. These can provide a good source of protein and calories in a concentrated package. For example, 8 oz. of Ensure Plus provides 13gm of protein and 350 calories. Six bottles (48 oz.) per day would provide an adult 78gm of protein and 2100 calories.

Nutrition in the Hospitalized Patient[4]

When evaluating a patient who is ill enough to require hospitalization, the first metabolic requirement to pay attention to is hydration. If there is any doubt about the patient's ability to take oral fluids then IV fluids should be given. Some chemotherapeutic agents can be toxic to the kidneys. Dehydration and volume depletion can lead to impaired renal function; hence, maintenance of adequate hydration is particularly important for patients who are acutely ill.

If patients are admitted for dehydration, then it is possible they have also not been getting sufficient calories and are in a catabolic state. Sugar (dextrose) in IV fluids can support at least basic metabolic needs and prevent further breaking down of proteins and fats to use as an energy source. To put this in perspective, traditional maintenance fluids with dextrose will only have about 400 calories per day and although the calories are helpful they are woefully inadequate to replete the nutritional needs of a hospitalized patient.

Malnourished active alcoholics (seen occasionally in head & neck, esophagus & lung cases) who are fed (even IV glucose) require Vitamin supplementation to prevent Korsakoff's syndrome.

Patients who cannot take sufficient food orally, but who have a functioning gastrointestinal tract can be given enteral nutrition. A nasogastric tube can be placed for temporary feeding (weeks) or a percutaneous endoscopic gastrostomy tube (PEG) can be placed for longer needs (months). There are a large variety of enteral formulas; which one to use should take into account the patient's ability to tolerate and properly digest the volume and macronutrient components. For example, some patients require an elemental formula because they have an impaired ability to break down and absorb intact proteins.

Patients with a poorly functioning gastrointestinal tract may require parenteral nutrition. For example, patients who require extensive bowel resection to remove cancer or who receive therapeutic

treatments that cause temporary damage to bowel function may not be able digest or absorb enteral nutrition. Parenteral nutrition bypasses the gut and provides complete nutrition intravenously. Great care must be taken in designing and monitoring the formula that is provided; by giving macro- and micronutrients directly into the central venous system, most of the body's homeostatic mechanisms, which help to regulate blood sugar levels, fat utilization and electrolyte levels, are bypassed. Long term use of parenteral nutrition is also associated with liver injury.

Patients who are significantly malnourished are at risk for re-feeding syndrome when given adequate nutrition again. During times of decreased calorie intake the body uses ketone bodies for an energy source and insulin production is decreased. Intracellular electrolyte levels are depleted while serum levels are maintained. When normal nutrition is started suddenly, the body releases insulin causing increased glycogen, fat and protein synthesis. This sudden burst of metabolism leads to decreased serum levels of certain nutrients (phosphate, potassium and magnesium most noticeably, but also glucose) as the body attempts anabolism without sufficient nutrient stores to support it. This can lead to arrhythmia, coma or cardiac failure. Thus, patients who have been without significant nutrient intake for more than 5 days should have feeding started and advanced slowly. Patients should be monitored for signs of refeeding syndrome especially during the first 7 days of refeeding. This includes checking serum levels of potassium, magnesium, and phosphorous and repletion as needed. Excess fluid retention or edema should be monitored as well.[5-8]

Cancer Prevention

About 40% of people born now will be diagnosed with a cancer at

some time in their life. Cancer is the second leading cause of death in this country. Due to this high incidence and mortality the best "treatment" for cancer would be primary prevention– stop cancer from developing in the first place.

It is obvious to think that nutritional supplements may be helpful in preventing cancer. Considering the anti-oxidant effect of something like Vitamin E, it would make sense that taking large doses of Vitamin E could lead to decreased rates of cancer by preventing DNA damage that would lead to oncogenic mutations. Unfortunately large studies looking at supplementation, or even just healthy eating, do not show robust evidence of lower rates of cancer.

The European Prospective Investigation Into Cancer and Nutrition (EPIC) study was a prospective study of about 500,000 men and women from various sites around Europe. It looked at self-reported health indicators, such as fruit, vegetable, and whole grain intake, smoking, exercise, alcohol intake and BMI. It then gathered data about the incidence of diseases such as cancer, diabetes and heart disease. Unfortunately it only showed a 2-3% decrease in risk of developing cancer for those with higher fruit and vegetable intake. While this can make a big difference over large populations, it has little significance for an individual.[3]

The Selenium and Vitamin E Cancer Prevention Trial (SELECT)[4] was designed to follow up on two randomized, controlled trials which had shown significant reductions in prostate cancer risk among men taking selenized yeast (63% reduction) and Vitamin E (32% reduction). Men were randomized to take supplements of selenium, vitamin E, both or neither. This study was stopped early when it became clear that after 7 years there was no reduction in prostate cancer rates; in fact the men taking only vitamin E had slightly higher

rates of prostate cancer.[6]

At this time there is no evidence that giving supplements of any micronutrients will significantly reduce the risk of cancer (http://www.uspreventiveservicestaskforce.org/uspstf/uspsvita.htm). While diabetes and heart disease risks can be significantly decreased by lifestyle interventions, the difference is not as dramatic in cancer. The best advice for cancer prevention is the same advice we give for healthy living:

- Eat a diet with lots of fruits, vegetables and whole grains while limiting meat intake
- Maintain a healthy weight
- Exercise on a regular basis
- Consume alcohol in moderation
- Don't smoke
- Avoid excessive sun exposure
- Vaccinate yourself against known infectious causes of cancer and limit your exposure to those infectious agents

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Thought Questions

1. Conditions other than cancer, such as burns or sepsis, can also result in nutritional abnormalities. How do you think the nutritional challenges presented by cancer are similar to these other conditions? How are they different?

   Your answer:

Expert answer

2. If it appears that diets rich in fruits and vegetables help lead to a reduced risk of cancer, what explanations might there be for the failure of nutritional supplements to lower the risk of developing cancer?

   Your answer:

Expert answer

Glossary

Anorexia– decreased appetite (any cause)

Anti-emetic– to prevent nausea/vomiting

Catabolism– breaking down molecules, usually to release their energy

Enteral– relating to the digestive tract. Enteral nutrition is nutrition that is given somewhere into the digestive tract.

Harris-Benedict equation– mathematical model that allows you to calculate basal metabolic rate based on a person's gender, age, weight and height

Indirect calorimetry– calculating energy usage (= heat production) by O2 use and CO2 production by continuous instantaneous breath by-breath electronic measurement of pulmonary gas exchange, either during bursts of physical activity or at rest. See: http://www.ucsdeparc.org/index.php?option=com_content&view=article&id=104&Itemid=82

Parenteral – not in the digestive tract. Parenteral nutrition is given directly into the blood stream.

RDA (Recommended Dietary Allowance) - the amount of a nutrient that will meet the needs of >97% of people if taken on a daily basis

Skin fold thickness – calipers are used to measure subcutaneous fat at various sites on the body. This allows calculation of an estimate of body fat.

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