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DFM 484: MNT
Case Study 33: Esophageal Cancer Treated with Surgery and Radiation
10/14/2013

I. Understanding the Disease and Pathophysiology

1. Mr. Seyer has been diagnosed with adenocarcinoma of the esophagus. What does the term adenocarcinoma mean?

Adenocarcinoma is a type of cancer that occurs in the various mucus-secreting glands in the body. In esophageal cancer, adenocarcinoma forms in the glandular cells of the esophagus.

4. Cancer is generally treated with a combination of therapies. These can include surgical resection, radiation therapy, chemotherapy, and immunotherapy. The type of malignancy and stages of the disease will, in part, determine the types of therapies that are prescribed. Define and describe each of these therapies. Briefly describe the mechanism for each. In general how do they act to treat malignancy?

Surgical Resection- Is when surgery is used to remove abnormal tissue such as germ cell tumors, and may be involved in curing some cancer cases if detected early. Cure is achieved if all cancer cells are removed.

The type of surgical resection performed on a patient will be dependent on the size, location and type of cancerous tumor. If the tumor may be removed without damaging other areas, or if it is blocking a pathway (esophagus), surgical removal may be an option. If the tumor has spread to other organs, surgical resection may not be possible. If surgical resection cannot be done, radiation and chemotherapy may decrease the size of the tumor, and surgical resection may be used for cure.

Radiation therapy- Is a type of treatment that can be used on cancer patients to kill cancerous cells. It is the most commonly used treatment for cancers pertaining to the head and neck regions. It may be used when metastasis occurs, or if a malignant tumor cannot be removed with surgery. Power from X-rays, protons and other types of energy may contribute to intensifying beams of energy that target and kill these cells. Often times, high-energy beams are sourced from an external machine that aims the beam at a specific location on the body. This is often referred to as external beam radiation therapy. During brachytherapy, another form of radiation therapy, radiation is used inside the body rather than the outside. The administration of radiation is localized to the location being irradiated.

During radiation therapy, the genetic material or DNA that is responsible for controlling the growth and rate of division of cells is destroyed, damaging cells. Both cancerous and healthy cells are damaged during this process, but the goal is to damage as few healthy cells as possible.

If combined with surgery, delayed wound healing may occur if radiation therapy is administered preoperative, preoperative, or intraoperative. RT administered to the area of the esophagus may cause esophagitis and cause the tissue to be irritated. This may put the

patient at risk for dehydration due to inadequate fluid intake. Nutritional support may be required, and a surgically placed feeding tube may be used if the tumor has not obstructed the esophagus.

Chemotherapy- Chemotherapy is the treatment of cancer with one or more cytotoxic antineoplastic drugs. The use of these medications disrupts the cell's replication process. Traditional chemotherapeutic agents act by killing cells that divide rapidly, one of the main properties of most cancer cells. Unfortunately, chemotherapy also interrupts cells that divide rapidly under normal circumstances: cells in the bone marrow, digestive tract, and hair follicles.

This results in the most common side-effects of chemotherapy: myelosuppression (i.e. decreased production of blood cells, hence also immunosuppression), mucositis (i.e. inflammation of the lining of the digestive tract), and alopecia (i.e. hair loss). A few new anticancer drugs (e.g. monoclonal antibodies) are not indiscriminately cytotoxic, but rather target proteins that are abnormally expressed in cancer cells and that are essential for their growth. Such treatments are often referred to as targeted therapy, distinct from classic chemotherapy, and are often used alongside traditional chemotherapeutic agents in antineoplastic treatment regimens.

Combination chemotherapy may be used, allowing for synergistic effects of the drugs used, and decreasing the level of toxicity to any one-organ system. Adjuvant chemotherapy is chemotherapy administered after surgery to help improve patient survival by eliminating any residual cancerous cells. Neoadjuvant chemotherapy is when chemotherapy is used before surgery when the tumor is too large for effective resection.

Immunotherapy- sometimes called biotherapy, is treatment that uses an individual's own immune system to fight diseases such as cancer. This can be done by stimulating the immune system to work harder in attacking cancer cells, or by administering immune system components, such as man-made immune system proteins. A variety of treatments can be used as immunotherapy by working in different ways. Some treatments work by increasing the body's immune system response in general ways, while others train the immune system to attack cancer cells. In many cases, it has been shown to work more effectively in combination with other types of cancer treatment. Researchers continue to learn more about how the body's immune system works, and have begun to discover more in depth how it can be used more effectively to help treat cancer.

II. Understanding the Nutrition Therapy

6. Many cancer patients experience changes in nutritional status, briefly describe the potential effect of cancer on nutritional status.

The nutritional status of a patient may be affected by cancer cachexia, a primary symptom of cancer that involves unintentional and progressive weight loss. Possible causes of this weight loss include:

- Increased energy needs due to tumor growth.
- Metabolic changes that occur in response to the tumor, increasing calorie needs, muscle wasting.
- Decreased intake associated with taste changes, fatigue, and anorexia (poor appetite.

All these examples may contribute to the patient's weight loss and affect their nutritional needs and nutrition status.

7. Both surgery and radiation affect nutritional status. Describe potential and metabolic effects of these treatments

Both surgery and radiation affect nutritional status in a cancer patient. Post surgical barriers may be presented, preventing the patient from receiving adequate nutrition. These barriers may be physiological or mechanical, depending on the nature of the surgery.

Surgery may be required for a person with esophageal cancer, which may affect their ability to digest or even eat food. Nutrition therapy such as enteral nutrition, parenteral nutrition, and nutritional supplement drinks may help the patient meet their nutritional needs.

A metabolic response is often initiated post surgery where energy needs of the patient are increased and necessary for recovery and wound healing.

Radiation therapy (RT) is often used in conjunction with surgery, and contributes to delay in wound healing. RT may be given before, during or after surgery. Side effects such as fatigue, mucositis, dysphagia, and odynophagia may be apparent during RT targeting the head and neck region. The risk for dehydration increases, and may require the need of intravenous fluids. A feeding tube may be required to provide nutrition support, but may not be used if there is a obstruction of the esophagus, preventing the placement of the tube.

8. Calculate and Evaluate Mr. Seyer's %UBW and BMI.

Patient has noticed a weight loss of over 30 lbs over the course of the last several months. His current weight is 198 lbs. His usual body weight would be 198 lbs + (.>30 lbs) = >228 lbs.

%UBW = 100 x Actual weight/ usual body weight.
= 100 x 198 lbs/ 228lbs
= 100 x 0.868
= 86.8 % UBW

Patient has loss more than 13.2% of his usual body weight within the past couple of months, which is considered to be severe weight loss.

BMI= weight kg / (ht m) square

Current weight= 198 lbs, Height = 6'3"
198 lbs x 1 kg/2.2 lbs= **90 kg**
6'3" = 6 ft x 12 in/ 1 foot= 72 in + 3 in= 75 in
75 in x 2.54 cm/1 in = 190.5 cm
190.5 cm x 1 m/100 cm = **1.9 m**

BMI= 90 kg/ (1.9m)(1.9m)
= 90 kg/ 3.61 m squared
= 24.9

A BMI range of 18.5- 24.9 is considered to be in the normal range. With a BMI of 24.9, the patient is in a normal weight range according to this ratio of height to weight.

9. Summarize your findings regarding his weight status. Classify the severity of his weight loss. What factors may have contributed to his weight loss? Explain.

With a current weight of 198 lbs and a usual body weight of > 228 lbs, the patient has experienced > 13.2% weight loss over the past several months. This indicates severe weight loss and puts the patient at risk. (>10% weight loss of UBW over 6 months indicates severe weight loss.)

One factor contributing to sever weight loss may be due to fewer intake of calories due to dysphagia or trouble swallowing over the past 3-4 months. The weight loss may also be impacted by odynophagia, causing painful swallowing during the past 5-6 months, and heartburn experienced while eating. Other factors include lack of absorption due to regurgitation of some foods.

11. Estimate Mr. Seyer's energy and protein requirements based on his current weight.

BMI= 24.9
Weight: 90 kg
Height: 190 cm
Age: 58 y.o.
Stress factor: 1.5

REE for Male = 66.5 +13.8W +5H-6.8A
= 66.5 + 13.8(90kg) + 5(190 cm) – 6.8(58)
= 66.5 + 1,242 + 950 -394.4
= 1,864.5 kcal x stress factor (1.5) = 2,797 kcal

Compare above energy requirement to that calculated using kcals/kg:

2,797 kcal/ 90 kg= 31 kcal/kg. Patient exhibits muscle wasting, and this number falls within range (30-35 kcal/kg) for a patient in a slight hypermetabolic state.

Protein Requirements - Healthy person 0.8g protein /kg of body weight
Increased protein needs = 1.5-2.5g protein/kg of body weight

1.5g protein x 90kg = 135g protein/ per day.

Average protein requirement for a healthy individual is 0.8g/kg, but because patient exhibits muscle wasting and severe weight loss, his protein requirement should range from 1.5g/kg-2.5g/kg.

12. Estimate Mr. Seyer's fluid requirement based on his current weight.
Fluid Requirements = 30-35ml/kg
30-35ml x90kg = 2700-3150ml.
Patient has increased need for fluid intake due to dehydration. Recommend giving 2900 ml of fluid.

13. What factors noted in Mr. Seyer's history and physical may indicate problems with eating prior to admissions.

The patient's history and physical indicate several issues with his food intake. The patient has experienced dysphagia (difficulty swallowing) for the past 3-4 months, as well as odynophagia (painful swallowing) for the past 5-6 months. Patient complained of heartburn and difficulty swallowing, especially textured foods for the past 4-5 months.

Patient exhibits dry mucous membranes in nose and throat, which likely exacerbated his dysphagia and odynophagia. These issues may all be contributing factors in patient's difficulty in consuming foods in diet.

16. Are any clinical signs of malnutrition noted in patient's admission history and physical?

History- Patient reports weight loss along with loss of appetite and painful swallowing.

Physical- Signs such as dry mucous membranes of the nose and mouth may influence patient's dysphagia and odynophagia, preventing usual intake of food, thus affecting calorie intake and contributing to malnutrition.

17. Review the patient's chemistries upon admission. Identify any that are abnormal and describe their clinical significance for this patient, including the likely reason for each abnormality and its nutritional implication.

Abnormal chemistry lab results upon admission (9/5) indicate low total protein levels, low albumin levels, low prealbumin levels, low PT levels, low RBC, low Hgb, low Hct, and high mean cell Hgb.

The abnormally low values of total protein, albumin, and prealbumin may stem from an inadequate protein and caloric intake. Cancer cachexia is a symptom of cancer in which the patient experiences progressive weight loss, along with generalized wasting such as muscle wasting.

The liver makes albumin, and low levels may indicate increased immune response due to the patient's esophageal cancer. Low levels may be due to protein-loosing enteropathy, cirrhosis or infection. Providing adequate nutrition requirements may help to increase albumin levels.

Prealbumin has short half life of about two days, and low levels are a good indicator of malnutrition, and can be associated with liver disorders and malabsorption. However, prealbumin like albumin may decrease due to illness or stress as well. Prealbumin levels respond to short term modification in nutrition intake which can be monitored.

Low PT levels, low RBC, low Hgb, low Hct, and high mean cell Hgb are indication of anemia that may be related to the patient's cancer diagnosis or low protein intake from diet. Low levels of vitamin B12 and folate and iron due to inadequate caloric intake may also be contributing factors of anemia.

IV. Nutrition Diagnosis

0. Select two high priority nutrition problems after Mr. Seyer's surgery and complete the PES statement for each.

a. Involuntary weight loss related inadequate energy intake as evidenced by severe weight loss of more than 30 lbs within the past several months.

b. Inadequate hydration levels related to dysphagia and odynophagia as evidenced by dry mucous membranes.

V. Nutrition Intervention

21. For each of the PES statements you have written, establish an ideal goal (based on the signs and symptoms) and appropriate intervention (based on the etiology).

a. Enteral Nutrition

Esophageal tissue may become extremely irritated and friable making oral intake is impossible. A surgically placed feeding tube may be needed to provide nutritional support for these patients.

Goal: To meet energy needs of patient by providing adequate enteral intake meeting >50-65% of goal calories.

Expected outcome: To decrease symptoms of cancer cachexia such as malnutrition, weightless and muscle wasting.

Intervention: To increase protein intake to 135g/day and caloric intake to 2,797 kcal/day

b. Correct Hydration Status

Patient is at high risk of developing hyperosmolar, non-ketoic dehydration due to previous dehydration status along with enteral feeding.

Goal: To increase and maintain appropriate hydration status of patient.

Expected outcome: To maintain hydration levels by monitoring dryness of mucous levels of membranes and BUN levels.

Intervention: To increase fluid intake with enteral feeding of about 1 ml/ 1kcal, or about 2,900 ml of fluid/d.

VI. Nutritional Monitoring and Evaluation

25. Mr. Seyer will receive radiation therapy as an outpatient. In question #7, you identified potential nutritional complications with the radiation therapy. Choose one of these nutritional complications and describe the nutrition intervention that would be appropriate.

Nutritional complications with radiation therapy include mucositis, xerostomia, and odynophagia. The patient may have inadequate fluid intake, increasing risk for severe dehydration and electrolyte imbalance. Esophageal tissue may become irritated to the point where oral intake is not possible. Nutrition support for the patient in this case may require a surgically placed feeding tube as the primary nutrition intervention.

26. Identify major assessment indices you would use to monitor his nutritional status once he begins therapy.

Radiation therapy may delay wound healing, and maintain nutritional status becomes imperative. Malnutrition is one of the most significant nutritional issues that can arise during cancer treatment, which is why monitoring nutritional status is very important.

The effect of radiation therapy on healthy tissue during treatment may produce changes in normal physiologic function such as diminishing a patient's nutritional status by interfering with ingestion, digestion, absorption of nutrients and hydration status.

Once the patient begins therapy, the following major indices will be monitored: visceral protein status including serum albumin, transferrin, and prealbumin and hematologic measures monitoring RBC, Hgb, Hct, MCV, MCH, MCHC, RDW. In addition to these biochemical indices, the patient's weight will continue to be monitored, including his hydration status, kcal and protein intake to ensure these values sufficiently meet the patient's nutritional needs.

The assessment indices were chosen for the following reasons:
Serum hepatic protein (e.g. albumin, transferrin, and prealbumin) levels have been linked to nutritional status. Serum hepatic protein levels correlate with morbidity and mortality and thus are useful indicators of severity of illness. Although serum hepatic proteins do not measure nutritional repletion (with the exception of prealbumin), it has been shown to be useful in identifying those who are the most likely to develop malnutrition. Secondly, radiation therapy, among other factors (e.g. hypermetabolic state, angiogenesis) increase the patient's micronutrient needs and is the reason why the hematologic indices are measured to prevent and monitor anemia. Thirdly, another important assessment is checking the patient's hydration status (e.g. examining urine color, urine flow rate, dry mouth, acute weight loss) because patients undergoing radiation therapy can become dehydrated easily. Lastly, the patient's weight should be monitored for weight loss, as it is associated with increased mortality.