Part Two of a Two-Part Series

Collaborative Approach to Managing a 59-Year-Old Woman With Stage IIB Pancreatic Cancer and Diabetes

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Authors' disclosures of potential conflicts of interest are found at the end of this article.

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Abstract

The American Diabetes Association and the American Cancer Society recently published a consensus statement on diabetes and cancer based on the increased risk of selected cancers, including malignancies of the liver, pancreas, endometrium, colon/rectum, breast, and bladder, in patients with diabetes. The effective management of diabetes requires an understanding of the key principles of diet, exercise, and pharmacologic therapy. The pharmacologic management of diabetes has been previously reviewed in this journal. This paper reviews the principles of medical nutritional management in a patient with diabetes and newly diagnosed pancreatic cancer treated with surgical resection and adjuvant chemotherapy.

J Adv Pract Oncol 2010;1:257–265

The number of individuals with both cancer and diabetes is increasing as the population ages. Each of these diseases presents challenges to the patient and to the clinical team, including the advanced practitioner in oncology. The American Diabetes Association and the American Cancer Society recently published a consensus statement on diabetes and cancer based on the increased risk of selected cancers, including malignancies of the liver, pancreas, endometrium, colon/rectum, breast, and bladder, in patients with diabetes (Giovannucci et al., 2010).

This is the second paper in a series using case studies to illustrate key concepts and strategies in the collaborative management of the cancer patient with diabetes. This case study will focus on medical nutritional management in a patient with newly diagnosed pancreatic cancer to illustrate key management strategies.

Pancreatic Cancer

Pancreatic cancer is not the most common type of cancer in adults, representing only 3% of all new cancer diagnoses in 2010, with 21,370 cases in men and 21,770 cases in women (Jemal, Siegel, Xu, & Ward, 2010) It is, however, one of the most deadly cancer diagnoses, with estimated deaths in 2010 approaching the number of new cases (18,770 deaths in men, 18,030 deaths in women; Jemal et al., 2010). Surgically resectable disease carries the best prognosis, yet 5-year survival rates following pancreaticoduodenectomy are only 25% to 30% for node-negative tu-

mors and 10% for node-positive tumors (Donahue & Reber, 2010). The majority of newly diagnosed patients have unresectable disease—either regional (26%) or metastatic (52%)—and have an extremely poor prognosis. Risk factors for pancreatic cancer include tobacco use, increased body mass index, chronic pancreatitis, alcohol consumption, diabetes, and rare genetic familial predispositions (DiMagno & DiMagno, 2010; Andriulli et al., 2010).

Diabetes and Pancreatic Cancer as Reciprocal Risk Factors

Van de Poll-Franse and colleagues (2007) evaluated 5,555 patients in a population-based analysis of hospitalized individuals, finding pancreatic cancer to be the most common cancer diagnosis (19%) among the 9% of patients in the study population with diabetes. Patients in this study who had both diabetes and cancer were treated less aggressively. Pancreatic cancer was also found to have the highest incidence among 125,126 patients hospitalized for type 2 diabetes in Sweden, with a standardized incidence ratio of 6.08 at a median follow-up time of 15 years (Hemminki, Li, Sundquist, & Sundquist, 2010). A standardized incidence ratio of 1.0 is the expected rate in the general population.

Additional studies have suggested that 40% of patients with pancreatic cancer have diabetes mellitus, and up to 80% have abnormalities in glucose metabolism based on biochemical criteria (Chu et al., 2010). Furthermore, preexisting diabetes mellitus at the time of diagnosis for pancreatic cancer has been shown to be associated with increased tumor size and decreased survival after surgical resection (Chu et al., 2010). In a retrospective analysis of 209 patients undergoing resection for pancreatic cancer between 2000 and 2007, patients with diabetes mellitus (45%) experienced decreased median survival (15 months vs. 17 months in the group without diabetes mellitus, $p = .0015$, hazard ratio [HR] = 1.55), and this effect was more pronounced in the group with new-onset diabetes mellitus (HR = 1.75) than in patients with long-standing diabetes mellitus (HR = 1.30; Chu et al., 2010). Other studies suggest that diabetes is a paraneoplastic manifestation of undiagnosed pancreatic cancer and that older patients presenting with new-onset diabetes mellitus may benefit from screening for underlying pancreatic cancer, much like patients with unexplained thrombosis are screened for an underlying malignancy.

Treatment Considerations

The triad of management tools for hyperglycemia includes exercise, diet, and medication. Modifications may be necessary to tailor these three elements for the patient with cancer because of limitations in exercise, inability to eat a regular diet, or medication options.

Medical nutrition therapy is a key component of effective diabetes management (Morris & Wylie-Rosett, 2010). Patients with pancreatic cancer who undergo extensive resection may be prone to delayed gastric emptying and often require the addition of pancreatic enzymes to overcome pancreatic insufficiency (Kelly & Layer, 2005). Similarly, patients with upper gastrointestinal malignancies may have impairment in swallowing and require enteral or parenteral nutrition. The key is to consider the need for blood sugar control within the context of the specific cancer treatment and the problems it may pose.

The optimal level of blood sugar control in diabetics undergoing cancer treatment is unclear. However, evidence from clinical trials and population-based studies show patients with diabetes and hyperglycemia have increased mortality and recurrence rates, as well as an increase in the incidence of drug toxicity (Derr et al., 2009; Basaria, Muller, Carducci, Egan, & Dobs, 2005). In a retrospective cohort study of 283 adult patients with acute myeloid leukemia, Ali and colleagues (2007) found that even modest levels of hyperglycemia (110–150 mg/dL) were associated with increased hospital mortality (odds ratio = 1.38; 95% confidence interval [CI, 1.23, 1.55], $p < .001$).

EXERCISE

Exercise can help control blood glucose levels by increasing insulin sensitivity and glucose utilization during and after the activity. This effect is lost within 48 hours, emphasizing the need for patients to engage in regular exercise to reap the benefit (Schmitz et al., 2010). Type 1 diabetics, particularly those who have not maintained a regular exercise program, may experience a worsening of blood glucose levels with exercise and must be evaluated more closely (American Diabetes Association, 2010).

Exercise has also been shown to have a myr-

Table 1. Medical nutritional therapy for the cancer patient with diabetes

Symptom	Strategies for management
Anorexia/weight loss	Educate the patient about the detrimental effects of weight loss. Loss of 5%–10% of usual weight has been associated with poorer outcomes. Recommend that patient eat small, frequent meals and snacks, including a consistent amount of carbohydrate and protein. Advise that light exercise may help stimulate appetite. Recommend a liquid nutrition supplement—drinks that are lower in carbohydrate and sugar. These are convenient for between-meal snacks or as a meal replacement if a patient is not eating well. Consider that appetite stimulants, such as megestrol acetate or dronabinol, may be used in patients with diabetes.
Nausea	Confirm patient is taking antiemetic medications as prescribed. Advise that patient eat small, frequent meals and snacks. Advise that patient eat dry carbohydrate-type foods such as crackers, pasta, potatoes, and cooked or dry cereal. Ask patient to monitor blood glucose. If fingersticks are running above 200 mg/dL, address carbohydrate control and/or a change in diabetic medication. Advise that patient avoid food smells and eat in well-ventilated areas. Advise that patient add ginger products to prescription medications. Ginger tea is a good low-carbohydrate choice. Gin Gins are hard candies with real ginger—2 candies provide 5 g of carbohydrate and 1 g of ginger.
Difficulty chewing or swallowing	Advise that patient choose soft, moist foods. Advise that patient adjust food textures as necessary. See Table 2 for diabetic nutritional supplements. Consult a speech therapist if patient is at risk for aspiration,
Constipation	Ensure an adequate fluid intake of 8 to 10 cups per day. Advise that patient eat a high-fiber diet, including whole grain foods, fresh vegetables, and fruit, as well as nuts and seeds. Consider that light exercise can help by stimulating peristalsis. Advise that a breakfast including a high-fiber cereal, such as bran flakes sprinkled with 1–2 tablespoons of ground flaxseed or unprocessed bran, and a hot beverage may offer relief. Consider adding a bulking agent, such as Citrucel or Metamucil.
Diarrhea	Advise that patient eat smaller amounts of food more often. Advise that patient avoid high-fiber cereals and breads, raw vegetables, and nuts. Include foods with water-soluble fiber in them, such as oatmeal, bananas, white long-cooking rice, applesauce, white bread, potatoes, plain noodles, and cooked carrots. Ensure an adequate fluid intake to avoid dehydration. However, avoid caffeine-containing beverages and try drinking liquids between meals rather than with them. Consider adding a supplemental source of water-soluble fiber, such as Benefiber. To replace electrolytes, choose broth or clear soups and low-sugar sports drinks, such as G2.

Note. Based on information from American Diabetes Association, 2010; Parrish & Yoshida, 2005; Leak et al., 2009; Ireton-Jones & DeLegge, 2007.

iad of positive effects in cancer patients, including easing symptoms of fatigue, maintaining functional ability during treatment, and relieving anxiety and depression (Holmes, Chen, Feskanich, Kroenke, & Colditz, 2005; Schmitz et al., 2010). Exercise may be contraindicated in some patients, such as those with very low platelet levels, uncontrolled pain or nausea, severe bone disease, or spinal compromise, and those at high risk of dehydration. Patients with peripheral neuropathy may need to restrict exercise to activities they can safely perform (Visovsky, Meyer, Roller, & Poppas, 2008).

NUTRITIONAL MANAGEMENT

Medical nutrition therapy is an integral component of an individualized diabetes management plan. Referral to a registered dietitian who is a Certified Diabetes Educator or a Certified Specialist in Oncology Nutrition is particularly appropriate for these patients (American Dietetic Association, 2010). In some communities, this may not be fea-

sible. Therefore, it is important that all team members, including advanced practitioners, be knowledgeable about medical nutrition therapy.

Chronic illnesses, by their nature, require the active involvement of the patient to mitigate potential adverse effects. Cancer patients with diabetes will need tips that are simple and clear and that incorporate key aspects of nutritional guidelines for both disease states (Table 1). Patients should be educated about the effect of macronutrients (i.e., carbohydrates, protein, and fat) on their blood glucose and the food sources of those macronutrients (American Diabetes Association, 2010). Carbohydrates exert the greatest effect on postprandial glucose levels (American Diabetes Association, 2010). Foods that contain carbohydrates provide an essential energy source, as well as fiber, vitamins, and minerals. They also make the diet palatable, and this seems to be particularly true for cancer patients. Fruits, crackers, and cereal are examples of foods that patients often can tolerate. Patients need to be able to identify food sources of carbohydrates and control them by eating consistent amounts. Carbohydrate counting or the "plate method" can be an effective tool in this endeavor (Table 2).

The amount of carbohydrate is the primary determinant of postprandial blood glucose, but the type of carbohydrate also has an effect. The specific type of food, method of preparation, and degree of processing can exert an influence on blood glucose, as can the macronutrient distribution in a meal. The glycemic index and glycemic load of foods are relatively new considerations in blood glucose control; however, the data are not compelling enough at this point to support their routine use with all diabetic patients (American Diabetes Association, 2010).

Table 2. The 'plate method' of estimating carbohydrate content in foods

Instruct patients to fill their lunch and dinner plate in the following way:

- One half or more of the plate with vegetables, excluding potatoes or corn
- One quarter or less of the plate with fish, poultry, lean red meat, meat substitutes, nuts, or seeds
- One quarter of the plate with whole grains, legumes, fruit, or low-fat dairy

Note. Based on information from the American Diabetes Association (2010) and Grant (2008).

Contrary to long-held beliefs, dietary sucrose does not increase glucose more than an isocaloric amount of starch. The American Diabetes Association (2010) urges practitioners to avoid restricting sucrose and sucrose-containing foods because of concern about aggravating hyperglycemia. There is no evidence to support the prescription of diets with no concentrated sweets or no sugar added (American Diabetes Association, 2010). Foods high in sucrose may be contributing an excess of calories for many type 2 diabetics, for whom weight control should be a priority (American Diabetes Association, 2010). But for a patient with cancer, who may be struggling to meet caloric needs, a moderate amount of sucrose may be included. Patients who are counting carbohydrates can refer to a food's Nutrition Facts label and know that the total grams of carbohydrate includes the sucrose (American Dietetic Association, 2010).

Protein needs are estimated to be slightly higher in the cancer patient (1.0–1.5 g/kg vs. the recommended daily allowance of 0.8 g/kg; American Diabetes Association, 2010). Ingested protein, which is necessary to avoid muscle wasting, cachexia, and malnutrition, should not increase plasma glucose concentration (Escott-Stump, 2008). Similarly, dietary fat has little effect on glucose levels. Current recommendations to control dietary fat in individuals with diabetes relate to risk reduction for cardiovascular disease (American Diabetes Association, 2010). During treatment, when fat may be used as a concentrated source of calories, the risk of cardiovascular disease may become a secondary concern. No clear evidence of benefit from vitamin or mineral supplementation has been shown in patients with diabetes or cancer (American Diabetes Association, 2010).

STEROIDS AND DIABETES

The administration of steroids during cancer therapy presents an additional challenge. Insulin resistance is increased after steroid administration, because hepatic glucose production is stimulated and glucose uptake is inhibited (Oyer, 2006). Steroid-induced hyperglycemia is associated with increased postprandial glucose levels, and values tend to normalize overnight. Therefore, a fasting morning blood sugar may be within normal limits. Glucose levels should be

tested before a meal as well as 2 hours after a meal, with the most sensitive time to test being 2 hours after lunch.

Treating steroid-induced hyperglycemia requires consideration of the dose of steroids, duration of therapy, presence of symptoms, and individual patient characteristics, including underlying disease, preexisting diabetes, and other comorbid conditions. If the patient has only a few days of steroid therapy and is not exhibiting any symptoms of hyperglycemia, treatment is not indicated (Dokken & Kurtin, 2010). However, patients who exhibit a fasting glucose level of more than 110 mg/dL or a postprandial level of greater than 140 mg/dL for 3 or more days should be considered candidates for diabetes therapy (Oyer, 2006).

Management should begin with diet and exercise recommendations. Again, the appropriate diet is controlled in terms of the amount of carbohydrate, if possible. Oral agents have limited efficacy due to their slow onset, lack of dosing flexibility, and potential side effects (Oyer, 2006). Insulin is more effective than oral therapy for steroid-induced hyperglycemia. Basal insulin is used to suppress hepatic glucose production, and prandial insulin is used to prevent glucose excursions after meals (Dokken & Kurtin, 2010). In steroid diabetes, basal insulin should be administered in the morning, and a starting dose is typically 10 units or 0.2 units/kg, whichever is higher (Dokken & Kurtin, 2010). The dose is then adjusted based on the morning glucose reading. Prandial insulin can be regular or analog insulin, and common starting doses are 5, 10, or 15 units three times daily with meals. The selection of a dose depends on previous results and clinical judgment. These are starting doses, and adjustments are often needed. Prandial insulin can also be dosed according to the amount of carbohydrates in a meal, with a starting ratio of 1 unit for every 10 g of carbohydrate (Oyer, 2006). In addition to basal and prandial dosing, supplemental short-acting insulin may be needed to correct a high glucose level. For patients who are unwilling or unable to administer insulin, oral secretagogues such as nateglinide or repaglinide can be considered (Oyer, 2006)

Treatment with insulin or oral agents carries the risk of hypoglycemia. The prevalence of nutrition-related side effects of treatment, such as anorexia and nausea, could increase the risk of hypoglycemia. Patients need to know the signs, symptoms, and proper self-management of low blood sugar. Symptoms include shakiness, dizziness, hunger, headache, tingling sensation around the mouth, blurred vision, tremors, and difficulty concentrating (American Diabetes Association, 2010). Hypoglycemia (plasma glucose < 70 mg/dL) should be treated with ingestion of 15 to 20 g of carbohydrate or sugar (Table 3). Glucose gels are also available. After eating, the patient should wait 15 to 20 minutes and recheck his or her glucose level (American Diabetes Association, 2010). If it is still low, the patient should repeat the treatment. Once the blood sugar is corrected, the patient should follow up with regular meals or snacks.

Table 3. Suggested foods to treat hypoglycemia

The following foods have 15–20 g of carbohydrates

- 4 oz (½ cup) regular soda
- 2 tbsp raisins
- 4–5 saltine crackers
- 4 tsp sugar
- 1 tbsp honey or corn syrup

Note. Based on information from the American Diabetes Association (2010).

ENTERAL NUTRITION

Enteral nutrition can be successfully implemented in the diabetic patient. In all patients, tube feeding should be initiated at a slow rate or with a small bolus (Charney & Malone, 2006). Blood glucose should be closely followed to allow medication management and appropriate advancement of tube-feeding rate. Patients receiving continuous feeding should check blood glucose every 4 to 6 hours initially. Once stable, they can decrease this to once or twice a day. For those on intermittent feeding, blood glucose should be checked prior to a feeding and no sooner than 4 hours after the end of the prior feeding. For stable, non–critically ill patients, blood glucose between 100 and 150 mg/dL is recommended to avoid incidents of hypoglycemia (Ireton-Jones & DeLegge, 2007)

Short-acting insulin should be used when beginning enteral feeding (Merritt, 2005). This lessens the possibility of hypoglycemia in the event that the feeding must be stopped. Hospitalized and critically ill patients may require an extended

Table 4. Diabetic nutritional supplements

Product	Calories	Protein	Carbohydrate	Sugar
Boost Glucose Control (8oz serving)	190	16 g	16 g	4 g
Glucerna (8-oz serving)	200	10 g	27 g	6 g
Carnation Instant Breakfast Essentials, no sugar added (1 packet with 8 oz whole milk)	220	12 g	24 g	20 g
Enterex Diabetic (8-oz serving)	237	12 g	27 g	< 1 g
Scandishake, sweetened with aspartame (3-oz serving mixed with 8 oz whole milk)	600	16 g	53 g	9 g
Isosource Original (20-oz bottle)	260	40 g	25 g	0 g
Slim-Fast Low Carb (11-oz serving)	190	20 g	6 g	1 g

period to reach the goal rate. However, patients who are more medically stable typically progress to their goal rate of feeding in a shorter period of time (Merritt, 2005). The decision to increase the tube-feeding rate should be based on physical tolerance as well as adequate glucose control. Once the patient has demonstrated tolerance to the feeding, intermediate-acting insulin may be used. Patients who receive continuous feeding for 24 hours can be managed with twice-daily doses of intermediate-acting insulin. For type 2 diabetics, administration of intermediate-acting insulin prior to the initiation of nocturnal feeds is adequate. Patients who are on a bolus schedule, which is similar to a normal eating pattern, can frequently be managed with a mixed insulin regimen similar to that used for patients who are eating an oral diet. Some type 2 diabetics may achieve adequate blood glucose control using oral diabetic agents (Hise & Fuhrman, 2009). Oral hypoglycemic medications can be administered via the feeding tube with careful attention to flushing the tube afterwards (Ireton-Jones & DeLegge, 2007).

Diabetes-specific enteral formulas provide a lower amount of carbohydrate and an increased amount of fat compared with a standard enteral formula (Table 4). A review of several studies found that use of the diabetic formulas led to lower postprandial blood glucose levels and were well tolerated, but they did not show any statistical evidence for improved patient outcomes. The authors concluded that there is insufficient evidence to warrant the additional cost of these formulas (Hise & Furhman, 2009). The routine use of these formulas is not indicated in instances of blood glucose levels that remain uncontrolled despite appropriate pharmacologic intervention. Avoidance of overfeeding diabetes formulas may offer improved glycemic control (Charney & Malone, 2006)

PARENTERAL NUTRITION

The American Society for Parenteral and Enteral Nutrition has published guidelines for the use of parenteral nutrition in the adult oncology patient and patients undergoing hematopoietic stem cell transplant (World Cancer Research Fund/American Institute for Cancer Research, 2008). For those patients with diabetes, total parenteral nutrition (TPN), when implemented, can make glycemic control difficult. And hyperglycemia can increase the incidence of catheter-related sepsis (Hise & Fuhrman, 2009). Most hospitals will have a multidisciplinary nutrition support team, and their assistance with these patients is invaluable. A pharmacist or dietitian employed by the home care company often provides the management of home care patients, with input from the oncology provider.

When initiating TPN, dextrose provision should be limited to 150 to 200 g on the first day. Blood glucose should be monitored four times a day initially in a patient with diabetes or significant hyperglycemia until stable and then decreased to twice a day (Moghissi et al., 2009). The majority of diabetic patients will require exogenous insulin when glucose is infused. For patients previously treated with insulin and oral hypoglycemic drugs, adding a basal amount of insulin to the TPN formula is recommended. A common

starting point is 0.1 unit of insulin per gram of dextrose. Supplemental subcutaneous insulin is then used regularly on a sliding-scale basis. If supplemental subcutaneous insulin is being used on a consistent basis, the amount of insulin in the TPN should be increased, usually to two thirds of the previous day's supplemental requirements (Moghissi et al., 2009).

Patients with difficult blood glucose control on a 2-in-1 parenteral solution (dextrose and protein) may improve when switched to a 3-in-1 solution (dextrose, protein, and fat). Patients receiving parenteral nutrition at home are often transitioned to a cyclic feeding schedule. In order to avoid hyperglycemia or hypoglycemia, the formula should be tapered at the beginning and end of the infusion. Blood glucose should be checked within the first hour of infusion, midcycle, and 1 hour after infusion. (Ireton-Jones & DeLegge, 2007)

Pancreatic Cancer and Newly Diagnosed Diabetes: A Case Study

M.S. is a 59-year-old woman with a 20-year history of nonalcoholic chronic pancreatitis. She developed severe midepigastric pain and progressive weight loss (18 pounds over 6 months). A computed tomography scan showed a dilated pancreatic duct and possible mass involving the body/tail of the pancreas. An endoscopic ultrasound confirmed the presence of the mass with no evidence of adenopathy. She underwent total pancreatectomy, splenectomy, and cholecystectomy. Surgical pathology confirmed adenocarcinoma of the body of the pancreas, measuring 3.5 cm in the largest diameter, with surgical margins ranging from 1 to 4 mm. Evidence of severe intraductal hyperplasia with perineural invasion was present throughout the pathology specimens, and three of seven lymph nodes were positive for adenocarcinoma. A small incidental islet cell tumor was found.

Of note, the patient had a 3-year history of monoclonal gammopathy of unknown significance (MGUS). Evaluation of the MGUS at the time of referral showed no increase in paraprotein or any evidence of progression to myeloma, as confirmed by bone marrow biopsy, skeletal survey, and complete laboratory analysis (Kurtin, 2010). In addition, the family history included a brother who died of pancreatic cancer at age 50 and a second brother with chronic pancreatitis and melanoma, alive at age 50. M.S. was referred to a genetic counselor at the time of her consultation. She was tested and found to have mutations in the *SPINK1* gene with two copies of N34S, an anomaly known to be associated with hereditary chronic pancreatitis and an increased risk of developing pancreatic cancer (Keiles & Kammesheidt, 2006).

POSTSURGICAL FOLLOW-UP

Postoperatively, M.S. developed intermittent steatorrhea, primarily immediately after eating, and was found to have a fasting blood glucose level of 300 g/dL and a hemoglobin A1c of 12.1% (upper limit of normal = 6% of total hemoglobin). No baseline hemoglobin A1c was obtained, as the patient did not have a history of diabetes or hyperglycemia. Development of pancreatic insufficiency following pancreatectomy is common. This may also occur with unresectable disease due to injury to the pancreatic tissue or pancreatic ducts (Dominguez-Muñoz, 2007). Insulin-dependent diabetes is a common sequela of pancreatectomy (Litwin, Dobrowolski, Orlowska-Kunikowska, & Sledzinski, 2008; Morrison, 2010).

M.S. is an avid runner and practices yoga daily. She was not able to continue her running routine after surgery and found yoga difficult to continue. The changes in her exercise tolerance and routine, together with newly diagnosed diabetes and probable pancreatic insufficiency (as suggested by postprandial steatorrhea), presented a significant challenge for M.S. and the clinical team. She was referred to a diabetes education program, an endocrinology nurse practitioner, and a clinical dietitian. She was also referred to a clinical psychiatrist specializing in oncology to assist with necessary adjustments given her pancreatic cancer (with a genetic predisposition to the disease), insulin-dependent diabetes (which will require lifelong insulin therapy and lifestyle modifications), and MGUS (with a small, but possible, risk of progression to multiple myeloma). Insulin therapy for diabetes has been covered in detail in part 1 of this series (Dokken & Kurtin, 2010). The patient did choose to have an insulin pump to facilitate her normally active lifestyle and fluctuating diet.

M.S. was seen by the medical oncologist 10 weeks after her surgery to discuss adjuvant chemotherapy. Given the node-positive disease, small surgical margins, and presence of chronic

pancreatitis for many years, gemcitabine (Gemzar; 1,000 mg/m^2 weekly for 3 of 4 weeks) was recommended as adjuvant therapy, with a plan for 6 months of treatment (Tempero et al., 2010). Premedications included ondansetron at 8 mg IV and dexamethasone at 8 mg IV. She was also started on pancreatic enzymes, 2 tablets with each meal or snack.

ADJUVANT CHEMOTHERAPY

M.S. began adjuvant treatment with single-agent gemcitabine. She developed a patchy mobilliform rash with her second dose of gemcitabine, requiring the administration of additional steroids and antihistamines. The rash gradually subsided with subsequent doses and continued use of the antihistamines and steroids the night before and 30 minutes prior to treatment. As a result of the additional steroids, she required increased doses of insulin on the day of therapy and the day after each treatment.

The patient developed an aversion to meats and eggs, losing 6 pounds during the first 3 months of treatment. She continued to work with the clinical dietitian and endocrinology nurse practitioner to tailor her nutritional intake and insulin needs. Recommendations included use of nutritional supplements specific to diabetics as well as adjustment of the insulin dose on days she received steroids. M.S. also began participating in a support group for pancreatic cancer patients and found the Pancreatic Cancer Action Network website helpful (www.pancan.org/).

Reinforcement of the principles of diet, exercise, and nutrition tailored to the individual patient, with ongoing modifications as changes in clinical status and personal lifestyle occur, are necessary for effective management of diabetes (Leak, Davis, Houchin, & Mabrey, 2009). The educational, emotional, and clinical support for M.S. involved principles similar to those entailed in a patient after pancreatectomy (Morrison, 2010).

She completed 5 of the 6 months of adjuvant therapy and chose to discontinue the treatment, primarily due to continued difficulty with regulating her insulin and maintaining her weight, as well as the development of clinical depression. She has been seen in follow-up every 3 months, with laboratory measures for both pancreatic cancer and MGUS, and is followed monthly in the diabetes clinic. She continues to see the oncology psychiatrist on a regular basis.

Read the first part in this series on diabetes in the cancer patient at www.advancedpractitioner.com

Summary

Medical nutritional therapy is an integral component of effective diabetes management. The patient with pancreatic cancer and diabetes presents a unique challenge. Balancing the nutritional needs of healing after surgery for pancreatic cancer, tolerating adjuvant cancer therapy, and adapting to a new diagnosis of pancreatic insufficiency and diabetes represents a daunting lifetime commitment for any patient.

Patients who have undergone pancreatic resection or pancreatectomy often require insulin therapy, pancreatic enzymes, and significant dietary modification to reduce symptoms, minimize secondary effects of the diabetes, and maintain quality of life. These patients will require intensive multidisciplinary support in the diagnostic and postoperative period and will require ongoing support to effectively develop self-management strategies for this new and complicated lifestyle. A coordinated system of support, including registered dietitians, diabetic specialists, advanced practitioners in oncology, surgeons, endocrinologists, primary care physicians, social workers, and organizations such as the American Dietetic Association and Pancreatic Cancer Action Network, will provide the best opportunity for success.

DISCLOSURES

The authors have no potential conflicts of interest to disclose.

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