

Nutritional Challenges During Treatment for Lung Cancer

Alice C. Shapiro, PhD, RD, LN, and Karen K. Swenson, PhD, RN, AOCN®

A 60-year-old female smoker named M.P. developed a chronic cough about two months prior to scheduling a visit with her primary physician. She was evaluated by her physician for probable bronchitis and treated with antibiotics and inhalers. She had a brief improvement of symptoms before her cough became increasingly worse. Computed tomography scans were performed and demonstrated extensive mediastinal and hilar adenopathy. M.P. was referred to pulmonary medicine and underwent a bronchoscopy with a biopsy that showed small-cell lung cancer. Her past history included smoking a pack of cigarettes per day for about 40 years and she continued to smoke about a half of a pack per day after diagnosis. Her oncologist recommended cisplatin and etoposide chemotherapy combined with radiation therapy.

Nutrition Assessment

Following her first cycle of cisplatin, etoposide, and concurrent radiation therapy, M.P. was referred to the oncology dietitian for a nutrition consultation. At the time of this consultation, M.P. presented with acute nausea and vomiting, diarrhea,odynophagia, fatigue, and weight loss. Past medical history revealed prior gastroesophageal reflux disease and colitis. She also had a history of vitamin B₁₂ and vitamin D deficiencies as well as fibromyalgia and depression. In addition to her chemotherapy and antiemetic medications (aprepitant, ondansetron, and prochlorperazine), medications documented in M.P.'s electronic medical record included the following dietary supplements: 1 g of vitamin C daily, 50,000 units of vitamin D₂ weekly, 40 mg of soy isoflavones daily, and monthly injections of 1,000 mcg of vitamin B₁₂.

After her diagnosis, M.P. and her family consulted a commercial, free-standing nutrition clinic and she was encouraged to follow a meal plan that excluded meats, wheat, sugar, and dairy products. In addition, 12 dietary supplements were

recommended and sold to her that contained a high-dose multivitamin, a vitamin B-100 complex, 50 mcg of sublingual vitamin B₁₂, 200 mcg of selenium, 500 mg of magnesium, 2,000 mg of calcium, 5,000 units of vitamin D₃, 5 g of fish oil, 40 mg of soy isoflavones, 300 mg of epigallocatechin gallate, 10 mg of coenzyme Q10, 1,000 mg of St. John's wort (*hypericum perforatum*), and 30 g of Berry Green® powder. These supplements were not documented in M.P.'s medication list in the electronic medical record.

A review of M.P.'s diet history and food intake records revealed a usual breakfast of a nonwheat cereal with rice milk and a supplemental drink with whey protein and Berry Green powder mix. Medications and other dietary supplements were taken with breakfast. She reported eating one regular meal per day in the evening. Discussion with M.P. and her family revealed their commitment to use dietary supplements to enhance M.P.'s immune system, decrease the side effects of treatment, and prolong survival. They were hopeful that the supplements would support these goals during treatment. However, M.P. reported difficulty swallowing supplements and thought they may be contributing to nausea. Therefore, her nutrient intake from food was compromised.

Anthropometric measures were taken: M.P.'s height was 167.7 cm, her weight was 84 kg, and her body mass index was 30. Serum B₁₂ and 25(OH)D₃ levels were normal. Her muscle mass appeared adequate on physical examination. Her nutrient intake from food alone was about 1,100 kcal per day, with 50 g of protein and 35 g of fat. Her dietary intake was low in calcium, vitamin D, B vitamins, and potassium. Fluid intake was inadequate. M.P. had experienced a 9 kg weight loss following her first cycle of treatment. Her body mass index remained in the obese range despite losing 10% of her body weight. To maintain her current body weight and lean body mass (LBM), M.P. had an estimated caloric requirement of 1,800–2,000 per day

and a daily protein requirement of about 70–90 g per day. Her dietary supplement regimen was providing most of the daily requirements for vitamins and minerals. However, her intake of macro- and micronutrients from food alone was deficient. In addition, her dietary supplement intake was providing micronutrients above the recommended upper limit of intake for safety and known efficacy (Suitor & Meyers, 2006).

Nutrition Counseling

Immediate goals for nutrition counseling were to (a) assist M.P. and her family in following their preferred nutritional approach with education and strategies that would enable them to meet M.P.'s nutrient needs with a combination of food intake and safe use of dietary supplements, (b) preserve LBM and improve physical functioning and quality of life (QOL), (c) decrease the rate of weight loss and decrease the amount of chemotherapy-induced adverse effects, (d) provide education regarding the safety of dietary supplements during treatment, and (e) document details of supplement use in the electronic medical record to inform M.P.'s healthcare team.

Dietary protein and caloric intake must be adequate to prevent muscle breakdown and preserve LBM in patients with cancer. To accomplish this goal, the timing of antiemetic medications in relation to meals was reviewed. A daily meal schedule was developed to provide set times for several small frequent feedings throughout the day. M.P. understood the importance of changing her current meal schedule to meet her protein and caloric requirements to improve her strength and QOL. An oral glutamine supplement was recommended to support gastrointestinal function and mucosal health and to decrease neurologic side effects (Cerchiatti et al., 2006; Choi et al., 2007; Vahdat et al., 2001). High-calorie, high-protein recipes and commercial clear liquid supplement samples were provided. M.P. was

encouraged to drink fluids an hour before or after her solid foods and to experiment with dried ginger or ginger tea for nausea control. To slow the rate of weight loss and obtain more nutrients from foods instead of supplements, M.P. and her family agreed to expand her current food intake. On treatment days and the days following, M.P. and her family were educated about the need to allow for a decrease in food intake and to avoid forced intake, which often increases stress. Decreased intake is expected during this period, and patients need the support and acknowledgment that intake will improve in a few days.

During her treatment, it was recommended to M.P. that she discontinue all dietary supplements. However, M.P. wished to continue with the supplement regimen. Therefore, the recommendation was to avoid taking supplements for 24–48 hours before and after chemotherapy as a precaution against unknown nutrient-treatment interactions. M.P. was encouraged to avoid several antioxidant supplements during treatment, such as epigallocatechin gallate, vitamin E, CoQ10, selenium, and vitamin C. Vitamin C and other antioxidants have the potential to reduce the effectiveness of many chemotherapeutic agents in cell culture and animal models and could reduce the ability of patients to respond to therapy (Heaney et al., 2008).

M.P. already was being treated for low serum B₁₂ and a history of deficiency and was willing to discontinue the additional supplements of B₁₂ and the B-100 capsule. Her vitamin D serum levels were adequate. Although studies have linked low levels of vitamin D to higher incidence of lung cancer recurrence and survival, taking large doses of vitamin D supplements is not recommended (Goodwin, 2009). Currently, 600–800 units of vitamin D daily are recommended for patients with normal serum 25(OH)D levels.

American Cancer Society Complete Guide to Nutrition for Cancer Survivors: Eating Well, Staying Well During and After Cancer (Bloch, Grant, Hamilton, & Thomson, 2010) was suggested as a practical reference for M.P. and her family. In addition, evidence-based nutrition Web sites were reviewed (see Figure 1).

M.P. and her family expressed understanding of the information provided and had all of their questions answered during this first nutrition counseling session. They were encouraged to return for follow-up with the oncology dietitian to continue education regarding good food

sources of nutrients to support current needs for macro- and micronutrients. Additional assessment and education regarding the number and cost of the remainder of the supplements M.P. was taking were warranted.

Dietary Supplements

Observational studies have found beneficial effects of fruits and vegetable consumption on reduced rates of lung cancer, particularly among smokers (Block, Patterson, & Subar, 1992). In the European Prospective Investigation into Cancer and Nutrition study, a significant inverse association was found with dietary consumption of fruits and vegetables and lung cancer risk (Gonzalez & Riboli, 2010). These findings regarding the beneficial effects of consumption of certain food groups has led to randomized clinical trials of dietary supplements containing the purified nutrient of interest. Dietary supplements containing substances found in foods and herbs (vitamins and minerals and plant chemicals, called phytochemicals) are widely used among patients with cancer (Barnes, Powell-Griner, McFann, & Nahin, 2008; Lo, Desmond, & Meleth, 2009; Richardson, Sanders, Palmer, Greisinger, & Singletary, 2000). These products often are perceived as safe and efficacious because they are “natural” and easily obtained over the counter. Unfortunately, many of these products, such as St. John’s wort, contain active compounds that can interact or interfere with chemotherapy and other cancer therapies (He, Yang, Li, Du, & Zhou, 2010). Because herbal therapies and dietary supplements are not regulated by federal agencies, active ingredients listed on the product label may be variable and they may contain pesticides, heavy metals, and contaminants including hormones and commonly prescribed medicines (National Center for Complementary and Alternative Medicine, 2011). The relationships of diet, cancer prevention, and cancer recurrence have been studied in large cohort studies. Most of the controlled chemoprevention clinical trials of dietary supplements have shown no beneficial effects or that they actually have led to an *increased* risk of the patient developing cancer (Albanes et al., 1996; Omenn et al., 1996; Slatore, Littman, Au, Satia, & White, 2008). Certain food groups in the diet appear to have an impact on lung cancer rates in population-based studies (Gonzalez & Riboli, 2010). However, the results from randomized trials substitut-

Integrative Care for the Future
www.integrativecareffuture.org

National Center for Complementary and Alternative Medicine
www.nccam.nih.gov

The Office of Dietary Supplements
<http://ods.od.nih.gov/factsheets/list-all>

Figure 1. Evidence-Based Nutrition Resources

ing the food groups with purified dietary supplements, such as alpha-tocopherol (vitamin E), beta-carotene (a precursor of vitamin A), and other supplements have shown disappointing results (Roswall et al., 2010).

Implications for Nursing

If patients report the use of multiple supplements, referral to an oncology dietitian or nutritionist is essential. Complete nutritional assessment and counseling must be conducted for patients with cancer who are consuming many dietary supplements. Time is needed not only for individual nutritional measurements and assessment, but also for education regarding food intake and accurate documentation of all dietary supplements. Patients scheduled for oncology nutrition consultations in the authors’ cancer center are asked to keep daily food records for four days prior to the nutrition visit. They also are instructed to bring in the actual bottles of all dietary supplements, including vitamins, minerals, and herbal preparations.

Patients require education in meeting nutritional needs from foods, safe use of dietary supplements (herbal, vitamins, and minerals) and information regarding the upper limits of intake for nutrients from dietary supplements. The use of dietary supplements is not recommended at many cancer centers during treatment for cancer because of the lack of information regarding nutrient-drug interactions and safety issues.

Oncology nurses must have access to current information regarding dietary supplements and must be able to recognize possible interactions of supplements and chemotherapy. Referral to a licensed or registered oncology dietitian or nutritionist who will provide counseling for patients is essential, particularly for patients who wish to continue using supplements during treatment for cancer. Web sites such as those listed in Figure 1 provide current, peer-reviewed

Clinical Highlights: Nutrition During Treatment for Lung Cancer

Nutritional Challenges

Patients receiving treatment for lung cancer often require a combination of chemotherapy and radiation therapy. This can present a challenge for patients' consumption of adequate nutritional intake to preserve lean body mass, support physical functioning, and maintain activities of daily living. In addition, patients often perceive dietary supplements such as vitamins and herbal products as important for maintaining general health, preventing cancer recurrence, and improving quality of life. They may perceive these "natural" products as safe and efficacious because they are easily obtained over the counter and advertised as beneficial for various maladies. Nutritional assessment and counseling are important to provide strategies to assist patients in meeting nutrient needs, provide education regarding the safety of dietary supplements during treatment, preserve patients' lean body mass, and improve physical functioning and quality of life during cancer treatment (Bloch, Grant, Hamilton, & Thomson, 2010; National Center for Complementary and Alternative Medicine, 2011)

Relationship of Diet and Lung Cancer

The relationships of diet, cancer prevention, and cancer recurrence have been studied in large cohort studies. Certain food groups in the diet appear to have an impact on lung cancer rates in population-based studies (Gonzalez & Riboli, 2010). A pooled analysis of cohort studies found that increased fruit and vegetable consumption was associated with a decreased risk of lung cancer (Smith-Warner et al., 2003). The beneficial effects of fruit and vegetable consumption in lung cancer prevention and in possibly reducing recurrences are likely from the effects of micronutrient composition and the phytochemical composition of the foods themselves working synergistically.

Supplements During Treatment

The results from randomized clinical trials using dietary supplements, such as alpha-tocopherol (vitamin E), beta-

carotene (a precursor of vitamin A), and others have shown disappointing results (Roswall et al., 2010). The Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study examined whether beta-carotene supplements versus placebo prevented lung cancer in a group of male smokers (Albanes et al., 1996). Results were surprising in that patients who took beta-carotene had an increased incidence of lung cancer and overall mortality. A higher incidence of lung cancer also was found in the Beta-Carotene and Retinol Efficacy Trial among people taking beta-carotene daily along with retinyl palmitate (vitamin A) compared to placebo (Omenn et al., 1996). Therefore, beta-carotene or vitamin A supplements are not recommended for lung cancer prevention or as complementary therapies during lung cancer treatment.

St. John's wort is an herbal product commonly used to treat depression, anxiety, and sleep disorders. Metabolism occurs by the cytochrome P450 pathway, which also is responsible for the metabolism of several chemotherapy drugs. Synchronous use of St. John's Wort with chemotherapy may decrease the potency of chemotherapy drugs (He, Yang, Li, Du, & Zhou, 2010).

Other antioxidants, such as vitamin C and coenzyme Q10, have been reported to reduce the effectiveness of many chemotherapeutic agents in cell culture and animal models and could reduce the ability of patients to respond to lung cancer treatments (Heaney et al., 2008).

Implications for Nursing

Nutritional assessment and counseling is an important adjunct to lung cancer treatment. Patients need to know how to best maintain their nutrient needs to preserve their lean body mass during treatment and information should be provided about the safety of dietary supplements during treatment. Nutrition counseling by a registered dietitian should be available for all patients with cancer. Counseling should be provided by an registered dietitian who is knowledgeable about current oncology nutrition research and familiar with oncology treatments and symptoms related to treatments. Patients should be asked to bring in the bottles of all of their supplements so that an accurate

assessment can be performed regarding the use of dietary supplements.

References

- Albanes, D., Heinonen, O.P., Taylor, P.R., Virtamo, J., Edwards, B.K., Rautalahti, M., . . . Huttunen, J.K. (1996). Alpha-tocopherol and beta-carotene supplements and lung cancer incidence in the Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study: Effects of baseline characteristics and study compliance. *Journal of the National Cancer Institute, 88*, 1560-1570.
- Bloch, A.S., Grant, B., Hamilton, K.K., & Thomson, C.A. (2010). *American Cancer Society complete guide to nutrition for cancer survivors: Eating well, staying well during and after cancer*. Atlanta, GA: American Cancer Society.
- Gonzalez, C., & Riboli, E. (2010). Diet and cancer prevention: Contributions from the European Prospective Investigation into Cancer and Nutrition (EPIC) study. *European Journal of Cancer, 46*, 2555-2562.
- He, S.M., Yang, A.K., Li, X.T., Du, Y.M., & Zhou, S.F. (2010). Effects of herbal products on the metabolism and transport of anticancer agents. *Expert Opinion on Drug Metabolism and Toxicology, 6*, 1195-1213.
- Heaney, M.L., Gardner, J.R., Karasavvas, N., Golde, D.W., Scheinberg, D.A., Smith, E.A., & O'Connor, W.A. (2008). Vitamin C antagonizes the cytotoxic effects of antineoplastic drugs. *Cancer Research, 68*, 8031-8038. doi:10.1158/0008-5472.CAN-08-1490
- National Center for Complementary and Alternative Medicine. (2011). Using dietary supplements wisely. Retrieved from <http://nccam.nih.gov/health/supplements/wiseuse.htm>
- Omenn, G.S., Goodman, G.E., Thornquist, M.D., Balmes, J., Cullen, M.R., Glass, A., . . . Hammar, S. (1996). Risk factors for lung cancer and for intervention effects in CARET, the beta-carotene and retinol efficacy trial. *Journal of the National Cancer Institute, 88*, 1550-1559.
- Roswall, N., Olsen, A., Christensen, J., Dragsted, L.O., Overvad, K., & Tjønneland, A. (2010). Source-specific effects of micronutrients in lung cancer prevention. *Lung Cancer, 67*, 275-281. doi:10.1016/j.lungcan.2009.11.010
- Smith-Warner, S.A., Spiegelman, D., Yaun, S.S., Albanese, D., Beeson, W.K., van den Brandt, P.A., . . . Hunter, D.J. (2003). Fruits, vegetables and lung cancer: A pooled analysis of cohort studies. *International Journal of Cancer, 107*, 1001-1011. doi:10.1002/ijc.11490

information on dietary supplements and a variety of complementary and alternative medicine methodologies.

Alice C. Shapiro, PhD, RD, LN, is a research scientist at the Park Nicollet Frauenshuh Cancer Center and Melrose Institute and Karen K. Swenson, PhD, RN, AOCN® is the oncology research director at the Park Nicollet Frauenshuh Cancer Center, Park Nicollet Institute, both in Minneapolis, MN. No financial relationships to disclose. Mention of specific products or opinions related to those products do not indicate or imply endorsement by the *Oncology Nursing Forum* or the Oncology Nursing Society. Shapiro can be reached at Alice.Shapiro@parknicollet.com, with copy to editor at ONFEditor@ons.org.

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References

- Albanes, D., Heinonen, O.P., Taylor, P.R., Virtamo, J., Edwards, B.K., Rautalahti, M., . . . Huttunen, J.K. (1996). Alpha-tocopherol and beta-carotene supplements and lung cancer incidence in the Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study: Effects of baseline characteristics and study compliance. *Journal of the National Cancer Institute*, 88, 1560–1570.
- Barnes, P.M., Powell-Griner, E., McFann, K., & Nahin, R.L. (2008). Complementary and alternative medicine use among adults: United States, 2007. *National Health Statistics Report*, 10(12), 1–23.
- Bloch, A.S., Grant, B., Hamilton, K.K., & Thomson, C.A. (2010). *American Cancer Society complete guide to nutrition for cancer survivors: Eating well, staying well during and after cancer*. Atlanta, GA: American Cancer Society.
- Block, G., Patterson, B., & Subar, A. (1992). Fruit, vegetables, and cancer prevention: A review of the epidemiological evidence. *Nutrition and Cancer*, 18, 1–29.
- Cerchiatti, L.C., Navigante, A.H., Lutteral, M.A., Castro, M.A., Kirchuk, R., Bonomi, M., . . . Uchima, P. (2006). Double-blind, placebo-controlled trial on intravenous L-alanyl-L-glutamine in the incidence of oral mucositis following chemoradiotherapy in patients with head-and-neck cancer. *International Journal of Radiation Oncology, Biology, Physics*, 65, 1330–1337. doi:10.1016/j.ijrobp.2006.03.042
- Choi, K., Lee, S.S., Oh, S.J., Suk, J.O., Seong, Y.L., Lim, S.Y., . . . Kim, J.W. (2007). The effect of oral glutamine on 5-fluorouracil/leucovorin-induced mucositis/stomatitis assessed by intestinal permeability test. *Clinical Nutrition*, 26, 57–62. doi:10.1016/j.clnu.2006.07.003
- Gonzalez, C., & Riboli, E. (2010). Diet and cancer prevention: Contributions from the European Prospective Investigation into Cancer and Nutrition (EPIC) study. *European Journal of Cancer*, 46, 2555–2562. doi:10.1016/j.ejca.2010.07.025
- Goodwin, P. (2009). Vitamin D in cancer patients: Above all, do no harm. *Journal of Clinical Oncology*, 27, 2117–2119. doi:10.1200/JCO.2008.20.8629
- He, S.M., Yang, A.K., Li, X.T., Du, Y.M., & Zhou, S.F. (2010). Effects of herbal products on the metabolism and transport of anticancer agents. *Expert Opinion on Drug Metabolism and Toxicology*, 6, 1195–1213. doi:10.1517/17425255.2010.510132
- Heaney, M.L., Gardner, J.R., Karasavvas, N., Golde, D.W., Scheinberg, D.A., Smith, E.A., & O'Connor, W.A. (2008). Vitamin C antagonizes the cytotoxic effects of antineoplastic drugs. *Cancer Research*, 68, 8031–8038. doi:10.1158/0008-5472.CAN-08-1490
- Lo, C.B., Desmond, R.A., & Meleth, S. (2009). Inclusion of complementary and alternative medicine in U.S. state comprehensive cancer control plans: Baseline data. *Journal of Cancer Education*, 24, 249–253. doi:10.1080/08858190902972897
- National Center for Complementary and Alternative Medicine. (2011). Using dietary supplements wisely. Retrieved from <http://nccam.nih.gov/health/supplements/wiseuse.htm>
- Omenn, G.S., Goodman, G.E., Thornquist, M.D., Balmes, J., Cullen, M.R., Glass, A., . . . Hammar, S. (1996). Risk factors for lung cancer and for intervention effects in CARET, the beta-carotene and retinol efficacy trial. *Journal of the National Cancer Institute*, 88, 1550–1559.
- Richardson, M.A., Sanders, T., Palmer, J.L., Greisinger, A., & Singletary, S.E. (2000). Complementary/alternative medicine use in a comprehensive cancer center and the implications for oncology. *Journal of Clinical Oncology*, 18, 2505–2514.
- Roswall, N., Olsen, A., Christensen, J., Dragsted, L.O., Overvad, K., & Tjønneland, A. (2010). Source-specific effects of micronutrients in lung cancer prevention. *Lung Cancer*, 67, 275–281. doi:10.1016/j.lungcan.2009.11.010
- Slatore, C.G., Littman, A.J., Au, D.H., Satia, J.A., & White, E. (2008). Long-term use of supplemental multivitamins, vitamin C, vitamin E, and folate does not reduce the risk of lung cancer. *American Journal of Respiratory and Critical Care Medicine*, 177, 524–530. doi:10.1164/rccm.200709-1398OC
- Suitor, C.W., & Meyers, L.D. (Eds.). (2006). *Planning committee on dietary reference intakes research synthesis*. Washington, DC: Food and Nutrition Board, Institute of Medicine, National Academies Press.
- Vahdat, L., Papadopoulos, K., Lange, D., Leuin, S., Kaufman, E., Donovan, D., . . . Balmaceda, C. (2001). Reduction of paclitaxel-induced peripheral neuropathy with glutamine. *Clinical Cancer Research*, 7, 1192–1197.

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