FEATURE ARTICLE

Nutritional Support During Radiotherapy for Head and Neck Cancer:
The Role of Prophylactic Feeding Tube Placement

Jormain Cady, ARNP, MS, AOCN®

Significant weight loss and resultant malnutrition in patients undergoing radiotherapy for head and neck carcinomas are recognized and preventable clinical concerns. Morbidity related to weight loss during treatment may include dehydration, hospitalization, compromised treatment efficacy, and reduced quality of life and may impact survival. Malnutrition effects on wound healing may prolong recovery following treatment and increase the risk of morbidity for those undergoing subsequent salvage surgery. Multiple interventions have been implemented to help ameliorate the impact of treatment on weight loss and nutritional status, including the use of percutaneous endoscopic gastrostomy (PEG) tubes. The value of prophylactic PEG tube placement at treatment initiation increasingly is being recognized, and evidence suggests that patients experience better outcomes. Criteria for patient selection have not been defined completely, and a great deal of variation in clinical practice exists, contributing to underuse of this supportive intervention. According to a literature review, patients who require therapeutic PEG tube placement in response to significant weight loss during treatment suffer greater morbidity than patients who receive PEG tubes prophylactically. Understanding patient-, tumor-, and treatment-related risk factors to systematically identify patients most likely to benefit from prophylactic PEG tube placement is an important aspect of nursing care.

Head and neck cancers represent a complex grouping of cancers that may originate from a variety of sites (e.g., the nasopharynx, oropharynx, oral cavity, hypopharynx, larynx) (see Figures 1, 2, and 3). Although relatively rare, an estimated 35,000 new cases of head and neck cancer will be diagnosed in 2007 (Jemal et al., 2007). Outcomes of the disease and treatment according to stage are dictated largely by the unique site of origin (see Figure 4) and often result in significant cosmetic and functional sequelae, warranting particularly attentive supportive care. Nutritional complications are common among patients with head and neck cancer and often are present before treatment is initiated because of the effects of tumor presence in the oral cavity or throat (Lees, 1999). Swallowing impairment may develop from treatment-related effects; therefore, the risk of dehydration and malnutrition during therapy is a significant clinical concern.

Radiation therapy is an effective treatment for many head and neck cancers and may be used as primary definitive treatment (with or without concurrent chemotherapy) or recommended adjuvantly after primary surgical resection. For locally advanced disease, aggressive combined modality approaches to treatment are more likely to be recommended for curative intent (Seiwart & Cohen, 2005). In addition, as interest increases in organ preservation approaches to treatment, the number of patients receiving intensive multimodality therapy is likely to increase (Hoffman et al., 2004; Shafman, 2006).

At a Glance

- About 30% of patients undergoing radiation therapy for head and neck cancer will experience weight loss and associated morbidity during treatment.
- Patients who have a percutaneous endoscopic gastrostomy (PEG) tube placed at treatment initiation experience less overall weight loss and fewer hospitalizations and toxicity-related treatment interruptions.
- Selection criteria to identify patients most likely to benefit from prophylactic PEG tube placement have not been fully described, although patients with poor baseline performance status, those receiving aggressive hyperfractionated or combined modality therapy techniques, and those with nasopharyngeal, hypopharyngeal, or base of tongue primary tumor sites appear to be at greatest risk.

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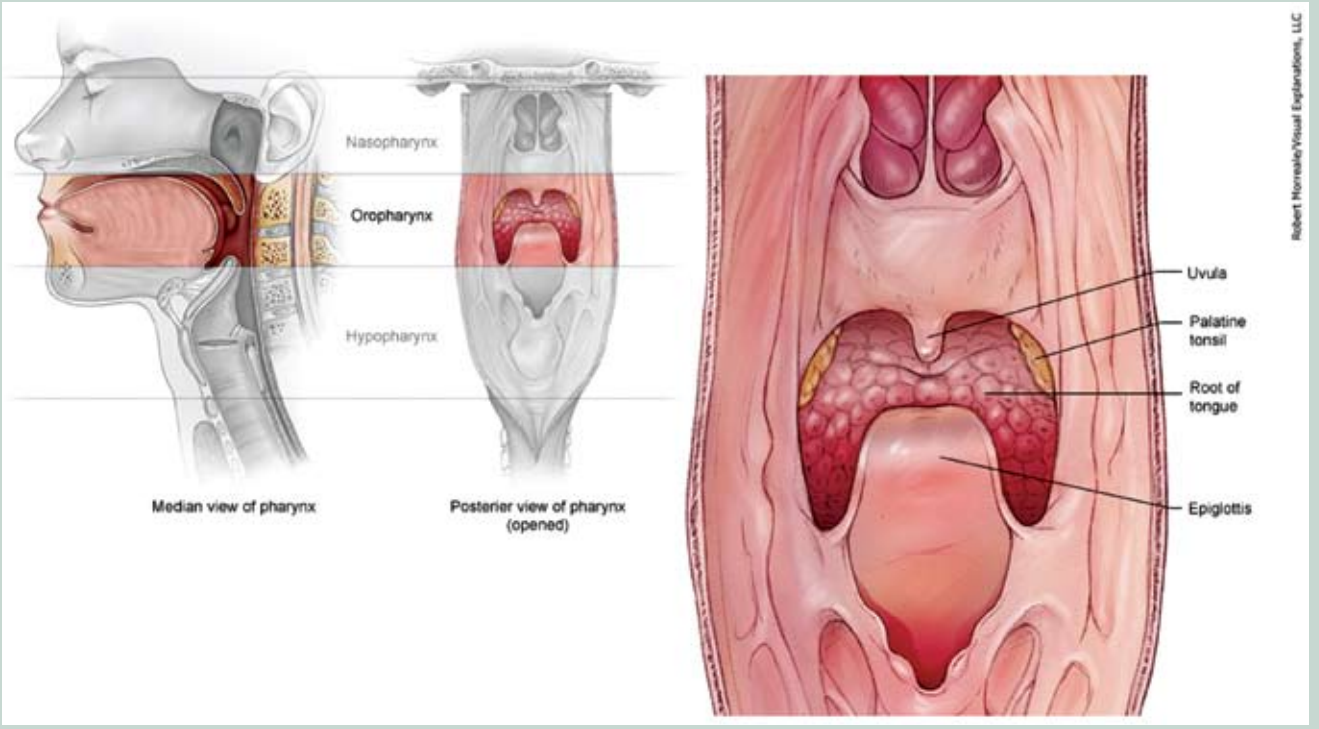

Figure 1. Anatomy of the Oropharynx

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Common Reactions in Patients With Head and Neck Cancer

Common acute reactions experienced during radiotherapy by patients with head and neck cancers include oropharyngeal mucositis, dysgeusia, xerostomia, and fatigue, which often contribute to dehydration and significant weight loss. Symptoms generally progress as the radiation dose accumulates over a six- to seven-week treatment period and may be compounded by the addition of chemotherapy (Munshi et al., 2003; Seiwart & Cohen, 2005; Shafman, 2006). Mucositis occurs in essentially all patients undergoing radiotherapy for head and neck cancer (Stokman et al., 2003). Although multimodality therapies generally are associated with increased toxicity, cetuximab has been the first agent in head and neck cancer treatment that does not amplify mucositis development when given in combination with radiation (Bonner et al., 2006). However, the role of cetuximab therapy in head and neck cancer has not been fully explored and does not preclude concurrent chemotherapy (e.g., cisplatin). Intensity-modulated radiotherapy techniques also are helping to limit the morbidity caused by treatment-related mucositis and xerostomia. Further investigations hopefully will continue to identify mucositis-sparing modalities in the treatment of head and neck cancers.

Malnutrition

Because of the expected toxicities, malnutrition in patients with head and neck cancer is a serious clinical concern for patients, their caregivers, and their providers. Malnutrition during treatment has been associated with more emergency room visits,

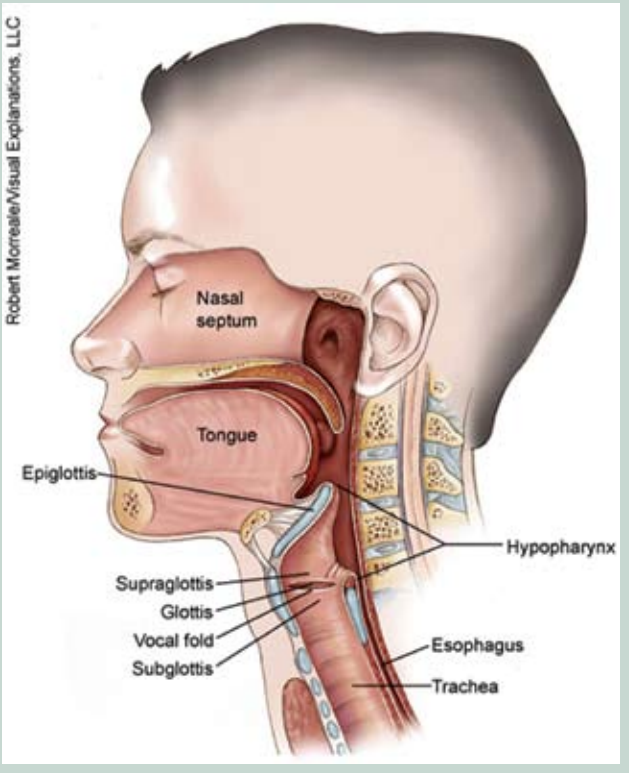

Figure 2. Anatomy of the Larynx

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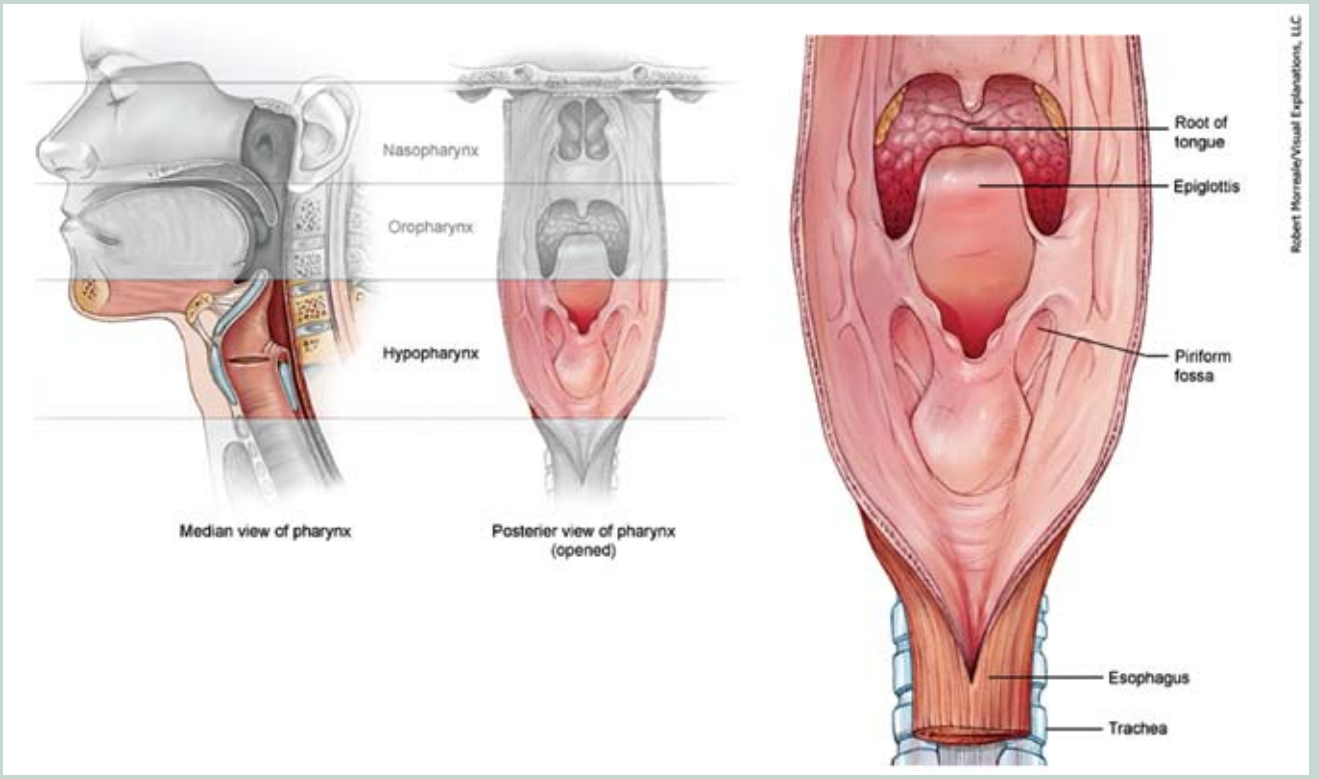

Figure 3. Anatomy of the Hypopharynx

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hospitalizations, and treatment interruptions; compromised treatment efficacy; and diminished quality of life (Beaver, Matheny, Roberts, & Myers, 2001; Larsson, Hedelin, & Athlin, 2003; van Bokhorst-de van der Schuer et al., 1999; Zogbaum, Fitz, & Duffy, 2004). Significant weight loss prior to surgery for head and neck cancer has been correlated with worse outcomes (van Bokhorst-de van der Schuer et al., 2000). Involuntary weight loss greater than 5% in one month, or more than 1%–2% per week, is a reliable indicator of malnourishment (Beaver et al.). Despite awareness, malnutrition continues to contribute to significant morbidity during and after therapy, and evidence suggests persistent undertreatment of patients (Larsson, Hedelin, Johansson, & Athlin, 2005). Although providers and patients are cognizant of the morbidity that severe malnutrition may entail, the pervasive attitude that some weight loss during treatment is inevitable may impede aggressive intervention. Maintaining adequate nutrition during treatment requires considerable commitment and motivation for most patients. Swallowing difficulty, loss of appetite, dry mouth, and taste changes may increase the time and effort required for optimal intake, and for some, the prospect of weight loss is viewed as a benefit of therapy. Patients without support at home to prompt feeding at regular intervals are more likely to find maintaining adequate intake difficult.

Percutaneous Endoscopic Gastrostomy Tubes

Feeding tubes are beneficial in facilitating adequate nutrition and hydration during head and neck cancer treatment because they do not result in mucosal irritation and taste changes (Riera et al., 2002). Percutaneous endoscopic gastrostomy (PEG) tubes are preferred in patients with head and neck cancer over nasogastric tubes (Lee et al., 1998; Piquet et al., 2002) (see Figure 5). Although PEG tube placement is considered relatively safe and has a low rate of significant associated complications, it is not an entirely benign invasive procedure. Common complications associated with PEG tube placement include local site infections, tube blockage, and migration or dislodgement. Serious complications, such as peritonitis, abscess, or fistula development, are relatively uncommon (Riera et al.). Rare case reports of metastasis of the primary tumor to the gastrostomy site have been documented (Sinclair, Scolapio, Stark, & Hinder, 2001). Therapeutic PEG tubes (TPT) commonly are placed during treatment in patients who

- Oral cavity
  - Floor of mouth
  - Buccal mucosa
  - Gingiva
  - Anterior tongue
  - Hard palate
  - Retromolar trigone
- Oropharynx
  - Base of tongue
  - Tonsil
  - Soft palate or uvula
  - Posterior or lateral pharyngeal walls
- Hypopharynx
- Larynx
  - Supraglottis
  - Glottis
  - Subglottis

Figure 4. Head and Neck Cancer Sites in the Nasopharynx

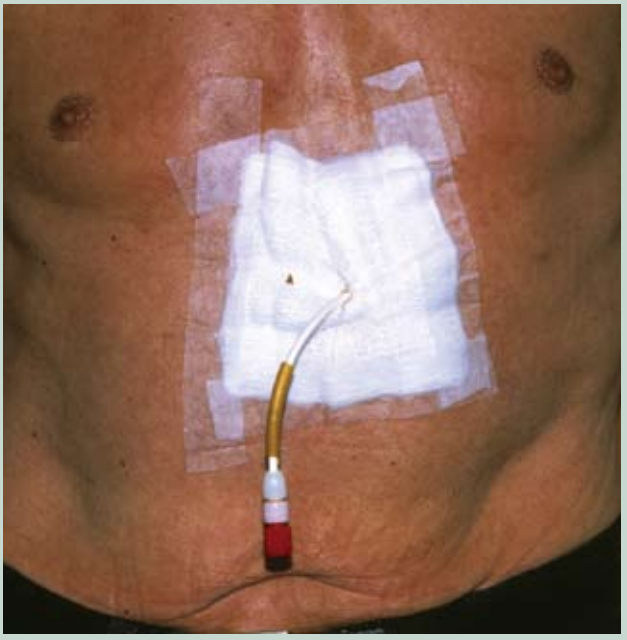

Figure 5. Patient With a Percutaneous Endoscopic Gastrostomy Tube in Place

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develop severe swallowing difficulty (e.g., when swallowing fluids) (Munshi et al., 2003). The benefit of prophylactic PEG tube (PPT) placement at treatment initiation, prior to development of mucositis and weight loss, is being increasingly recognized (Scolapio, Spangler, Romano, McLaughlin, & Salassa, 2001).

Currently, criteria for patient selection regarding PPT placement are not standardized. Clinical judgment, in addition to patient and family preferences, most commonly guides the decision on an individual basis and may vary greatly based on the practice setting (Zogbaum et al., 2004). Chart reviews of patients with head and neck cancer undergoing irradiation consistently demonstrate that a significant number ultimately require TPT during treatment and have worse outcomes (i.e., significantly greater weight loss and increased hospital admissions for dehydration) than high-risk patients selected for PPT placement, thus illustrating the underuse of the intervention (Beaver et al., 2001; Larsson et al., 2005; Lee et al., 1998).

Some patients have reported feelings of indignity and shame when contemplating feeding tube placement (Larsson et al., 2003), which may contribute to resistance to PPT placement before significant mucositis is experienced. Nurses working with patients with head and neck cancer are in a position to significantly impact care by identifying those at risk for nutritional-related complications, providing support and education about nutrition during treatment, and influencing patient and provider decisions about invasive supportive care (e.g., PPT, TPT) when appropriate. Because it is not feasible or appropriate to place PPTs in all patients undergoing irradiation for head and neck cancer, careful selection of patients at significant risk for treatment morbidity because of malnutrition is essential. Until greater systematic selection of patients appropriate for PPT is implemented, understanding the risk factors associated with morbidity from treatment-related weight loss aids nurses in identifying at-risk patients and providing appropriate counseling and intervention.

Literature Review

Munshi et al. (2003) attempted to describe the pattern of weight loss and associated causative factors for patients during radiotherapy for head and neck cancer. They retrospectively reviewed the course of 140 patients with head and neck cancer undergoing irradiation (i.e., definitive radiotherapy, combined chemoradiotherapy, or adjuvant radiotherapy). Weight loss occurred as early as the second week of therapy; the greatest decline in weight occurred during weeks 3 and 4 of treatment, with approximately 37% of patients, including those who were selected for feeding tube placement before or during treatment, losing 5 kg or more overall during the treatment course. Risk factors that were significantly associated with serious weight loss (greater than 5 kg) were initial Karnofsky performance status less than 80, combination chemoradiotherapy, and receiving a total dose 60 Gy or more. The study may have underestimated the incidence of serious weight loss during treatment because patients who required more than a five-day break in treatment were excluded from evaluation. Patients who require a prolonged treatment delay have poor treatment tolerance and may be at even greater risk of nutritional deficiencies.

In a retrospective, descriptive chart review of 50 patients undergoing head and neck cancer treatment, a decline in weight was documented by the second week of treatment, with all patients losing 2%–11% of their weight despite implementation of interventions (Larsson et al., 2005). By the third week of treatment, 26% of patients received a TPT, which increased to 42% by treatment completion. Most patients had nasopharyngeal, oropharyngeal, or hypopharyngeal tumors or significant pretreatment swallowing impairment. Although no characteristics were identified with significant differences in weight loss among groups, the small sample size and incomplete records may have made that more difficult to detect. Pre- and post-treatment weights were not documented consistently, making evaluation of the efficacy of placing TFTs so late in treatment difficult to determine.

Another retrospective chart review of 249 patients with head and neck cancer aiming to identify characteristics associated with significant weight loss during treatment reported that, of the 32% of patients in whom feeding tubes were placed, most were placed during treatment in response to a malnutrition-related event (Beaver et al., 2001). Significantly greater weight loss, hospitalizations, and emergency room visits for dehydration and the need for TPT occurred in patients with nasopharyngeal tumors and those receiving concurrent chemoradiotherapy. In addition, patients receiving postoperative radiation or with oropharyngeal tumors were more likely to be considered high risk based on clinical criteria. Those patients were more likely to have a PPT placed and had significantly less incidence of severe weight loss. The need for TPT placement during or immediately after treatment was associated with greater overall weight loss and morbidity, implying that aggressive intervention for the remainder of therapy does not adequately compensate for significant depletion once evidence of malnutrition has occurred.

Lee et al. (1998) reviewed records for 88 patients with locally advanced head and neck cancer undergoing accelerated twice-

daily radiotherapy or chemoradiotherapy. They found that patients with lower baseline performance status and oropharyngeal tumors were more likely to be selected for PPT placement (41%) and demonstrated significantly less severe weight loss (greater than 5% decline in weight). The 59% who did not receive a PPT experienced greater hospitalizations for dehydration, at which point TPTs usually were placed (31%). Although overall hospitalizations, treatment interruptions, and survival at three years were not statistically significant, patients perceived to be at higher risk were more likely to have earlier intervention (PPT), which may be a confounding factor. Earlier intervention in the TPT group may have averted hospitalizations for dehydration, which is consistent with findings in other studies (Beaver et al., 2001).

Although few prospective studies have been conducted to evaluate PPT efficacy, Piquet et al. (2002) compared patients selected for PPT (i.e., age greater than 70 years, body mass index less than 20, or recent weight loss greater than 10%) against comparable historical controls. Based on the criteria, 74% of patients qualified for PPT and an additional 13% ultimately received TPT for significant dehydration and weight loss. In the control group, 11% had early PEG tubes placed based on clinical judgment and an additional 27% underwent subsequent TPT placement. As expected, patients prospectively evaluated for prophylactic intervention experienced significantly less weight loss and no hospitalizations for dehydration compared with the standard care group.

Implications for Nursing Care

Malnutrition is a recognized complication of head and neck cancer and its treatment. The clinical significance of its occurrence is manifested by the incidence of dehydration-related emergency room visits and hospitalizations, reduced treatment efficacy because of treatment delays and dose reductions, impact on quality of life, and overall survival. Treatment toxicity, including mucositis and radiation dermatitis, may be exacerbated by poor nutritional state during therapy and may impact recovery time because of the effects of malnutrition on wound healing. Altered immune function also may increase the risk of infections, particularly when combined with integumentary compromise.

Multiple strategies have been suggested to prevent morbidity related to nutritional deficit and weight loss. Assessment of baseline weight and evidence of pretreatment weight loss or eating impairment may herald poor treatment tolerance and the need for increased nutritional support. Patient assessments should be performed weekly or more frequently as warranted, with special attention to swallowing ability, weight change, hydration status, electrolytes, and albumin to ensure early detection and intervention. Weight loss of more than 1%–2% per week, or 5% in less than a month, should prompt further patient assessment, nutritional counseling, and more aggressive interventions (e.g., promotion of high-calorie, high-protein nutritional supplements) (Larsson et al., 2005; Nitenberg & Raynard, 2000). Regular dietary counseling during treatment also has been recommended because it has been associated with less weight loss during treatment (Dawson, Morley, Robertson, & Soutar, 2001). Use of megestrol acetate during treatment to stimulate appetite has been investigated and may be of some benefit in certain circumstances (McQuellon et al., 2002). However, the benefits of stimulating appetite when a physical impediment exists to swallowing may not be fully realized.

Based on a review of available literature, all patients undergoing radiotherapy for head and neck cancer should be assessed prior to therapy and at regular intervals during treatment for the potential need for enteral feeding tube placement. When TPT placement occurs later in treatment (after the third or fourth week), weight loss is less likely to improve, increasing the incidence of treatment interruptions and hospitalization. Early identification of patients in need of PEG tube support prior to treatment or in the first few weeks of therapy should be a priority in nursing evaluation and counseling (Beaver et al., 2001; van Bokhorst-de van der Schuer et al., 1999; Zogbaum et al., 2004).

Characteristics Associated With Risk for Nutrition-Related Morbidity

Patterns of malnutrition-related morbidity have been reported and highlight risk characteristics in three major domains: patient-related factors, tumor-related factors, and treatment-related factors.

Patient-related factors may reflect the patient's overall health status regarding presence of comorbidities, prior treatment, or the impact of tumor presence. They include the presence of *eating difficulty prior to treatment* (related to disease presence or prior surgery) (Larsson et al., 2005), *losing more than 10% of weight* in the six months prior to beginning treatment (Beaver et al., 2001; Piquet et al., 2002; van Bokhorst-de van der Schuer et al., 1999), and *poor initial performance status* (Karnofsky performance status less than 80% at the start of treatment) (Munshi et al., 2003). Although being older than age 70 was considered a risk factor by Piquet et al., other studies have not supported greater risk associated with age alone. The impact of social status (living alone) has not been specifically correlated with risk but should be investigated further. A recent investigation recognized poorer overall outcomes in *unpartnered male patients* with head and neck cancer in comparison to those living with a wife or significant other (Konski et al., 2006). Clearly, maintaining adequate nutritional intake and hydration through treatment is a greater challenge for those who live independently and have less assistance and support.

Tumor-related factors that contribute to the risk of malnutrition-related morbidity are *advanced tumor stage* (III or IV) and pharyngeal *primary tumor site* (nasopharynx, hypopharynx, or oropharynx, particularly base of tongue) (Beaver et al., 2001; Larsson et al., 2005). Advanced-stage disease may contribute to more tumor-related symptoms and may prompt more aggressive treatment, including combined modality approaches. As pharyngeal structures are involved more directly in the swallowing mechanism than other head and neck sites (e.g., the oral cavity, larynx), greater impact on swallowing difficulty in patients is not unexpected.

Treatment-related factors that contribute to the risk of malnutrition and its complications include *radiation in combination with chemotherapy, radiation dose of 60 Gy and greater,* and *hyperfractionated radiation schedule*s (e.g., smaller dose given twice per day at least six hours apart) (Beaver et al., 2001; Larsson et al., 2005; Munshi et al., 2003; Piquet et al., 2002; van Bokhorst-de van der Schuer et al., 1999; Zogbaum et al., 2004). Interestingly, field size has not been recognized as a risk factor during treatment, which may be related to the greater importance

of the sensitivity of the specific structures in the field (e.g., the base of tongue) rather than absolute field size itself.

Conclusions

PPT placement has demonstrated efficacy in reducing weight loss and dehydration-related events during radiotherapy for head and neck cancer in select patients. Although evidence-based standards are not in place to guide selection, nurses can influence patients based on risk factors that have been identified. Further investigation, including more prospective studies evaluating specific selection criteria for use, is needed to ensure proper use of this supportive measure. More information also is needed to address the needs of special groups of head and neck cancer populations, including women and unpartnered men. The disturbing number of patients who receive TPT late in treatment illustrates the need for more proactive intervention. Selection criteria based on evidence, rather than clinical judgment alone, may assist in earlier identification of patients. Attention to systematic evaluation of all patients being considered for head and neck cancer irradiation also raises the level of awareness and encourages proactive practices. With greater understanding of appropriate interventions, significant weight loss during treatment need not be perceived as inevitable after all.

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References

Beaver, M.E., Matheny, K.E., Roberts, D.B., & Myers, J.N. (2001). Predictors of weight loss during radiation therapy. *Otolaryngology Head and Neck Surgery, 125,* 645–648.

Bonner, J.A., Harari, P.M., Giralt, J., Azarnia, N., Shin, D.M., Cohen, R.B., et al. (2006). Radiotherapy plus cetuximab for squamous-cell carcinoma of the head and neck. *New England Journal of Medicine, 354,* 567–578.

Dawson, E.R., Morley, S.E., Robertson, A.G., & Soutar, D.S. (2001). Increasing dietary supervision can reduce weight loss in oral cancer patients. *Nutrition and Cancer, 41,* 70–74.

Hoffman, H., Cooper, J.S., Weber, R., Ang, K., Porter, K., & Langer, C.J. (2004). Changing patterns of practice in the managment of nasopharynx carcinoma (NPC): Analysis of the National Cancer Database (NCDB). *Journal of Clinical Oncology, 22*(Suppl. 14S), 5501.

Jemal, A., Siegel, R., Ward, E., Murray, T., Xu, J., & Thun, M.J. (2007). Cancer statistics, 2007. *CA: A Cancer Journal for Clinicians, 57,* 43–66.

Konski, A.A., Pajak, T.F., Movsas, B., Coyne, J., Harris, J., Gwede, C., et al. (2006). Disadvantage of men living alone participating in Radiation Therapy Oncology Group head and neck trials. *Journal of Clinical Oncology, 24,* 4177–4183.

Larsson, M., Hedelin, B., & Athlin, E. (2003). Lived experiences of eating problems for patients with head and neck cancer during radiotherapy. *Journal of Clinical Nursing, 12,* 562–570.

Larsson, M., Hedelin, B., Johansson, I., & Athlin, E. (2005). Eating problems and weight loss for patients with head and neck cancer: A chart review from diagnosis until one year after treatment. *Cancer Nursing, 28,* 425–435.

Lee, J.H., Mitchell, M., Unger, L.D., Weinstein, G.S., Weber, R.S., Chalian, A.A., et al. (1998). Prophylactic gastrostomy tubes in patients undergoing intensive irradiation for cancer of the head and neck. *Archives of Otolaryngology—Head and Neck Surgery, 124,* 871–875.

Lees, J. (1999). Incidence of weight loss in head and neck cancer patients on commencing radiotherapy treatment at a regional oncology centre. *European Journal of Cancer Care, 8,* 133–136.

McQuellon, R.P., Moose, D.B., Russell, G.B., Case, L.D., Greven, K., Stevens, M., et al. (2002). Supportive use of megestrol acetate (Megace) with head/neck and lung cancer patients receiving radiation therapy. *International Journal of Radiation Oncology, Biology and Physics, 53,* 1180–1185.

Munshi, A., Pandey, M.B., Durga, T., Pandey, K.C., Bahadur, S., & Mohanti, B.K. (2003). Weight loss during radiotherapy for head and neck malignancies: What factors impact it? *Nutrition and Cancer, 47,* 136–140.

Nitenberg, G., & Raynard, B. (2000). Nutritional support of the cancer patient: Issues and dilemmas. *Critical Reviews in Oncology/Hematology, 34*(3), 137–168.

Piquet, M., Ozsahin, M., Larpin, I., Zouhair, A., Coti, P., Monney, M., et al. (2002). Early nutritional intervention in oropharyngeal cancer patients undergoing radiotherapy. *Supportive Care in Cancer, 10,* 502–504.

Riera, L., Sandiumenge, A., Calvo, C., Bordas, J.M., Alobid, I., Llach, J., et al. (2002). Percutaneous endoscopic gastrostomy in head and neck cancer patients. *Journal for Oto-Rhino-Laryngology and Its Related Specialties, 64,* 32–34.

Scolapio, J.S., Spangler, P.R., Romano, M.M., McLaughlin, M.P., & Salassa, J.R. (2001). Prophylactic placement of gastrostomy feeding tubes before radiotherapy in patients with head and neck cancer: Is it worthwhile? *Journal of Clinical Gastroenterology, 33,* 215–217.

Seiwert, T.Y., & Cohen, E.E. (2005). State-of-the-art management of locally advanced head and neck cancer. *British Journal of Cancer, 92,* 1341–1348.

Shafman, T.D. (2006). Combination chemotherapy and radiation therapy for upper aerodigestive tract cancers. *Medicine and Health, Rhode Island, 89*(2), 55–58.

Sinclair, J.J., Scolapio, J.S., Stark, M.E., & Hinder, R.A. (2001). Metastasis of head and neck carcinoma to the site of percutaneous endoscopic gastrostomy: Case report and literature review. *Journal of Parenteral and Enteral Nutrition, 25,* 282–285.

Stokman, M.A., Spijkervet, F.K., Burlage, F.R., Dijkstra, P.U., Manson, W.L., de Vries, E.G., et al. (2003). Oral mucositis and selective elimination of oral flora in head and neck cancer patients receiving radiotherapy: A double-blind randomized clinical trial. *British Journal of Cancer, 88,* 1012–1016.

van Bokhorst-de van der Schuer, M.A., van Leeuwen, P.A., Kuik, D.J., Klop, W.M., Sauerwein, H.P., Snow, G.B., et al. (1999). The impact of nutritional status on the prognoses of patients with advanced head and neck cancer. *Cancer, 86,* 519–527.

van Bokhorst-de van der Schuer, M.A.E., von Blomber-van der Flier, B.M., Kuik, D.J., Scholten, P.E., Siroen, M.P., Snow, G.B., et al. (2000). Survival of malnourished head and neck cancer patients can be predicted by human leukocyte antigen-DR expression and interleukin-6/tumor necrosis factor-alpha response of the monocyte. *Journal of Parenteral and Enteral Nutrition, 24,* 329–336.

Zogbaum, A.T., Fitz, P., & Duffy, V. (2004). Tube feeding may improve adherence to radiation treatment schedule in head and neck cancer: An outcomes study. *Topics in Clinical Nutrition, 19*(2), 95–106.

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