

**The Challenges of
Postoperative
Radiotherapy for
Post-surgical
Head and Neck
Cancer Patients**

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Head and neck cancer accounts for 2.5% of all cancer diagnoses for 2000 and less than 2% of cancer deaths. Yet, it is considered by many to be the most dreaded site for cancer to occur, as both the disease and treatment cannot be hidden from view. Cancers of the head and neck can arise in the oral cavity, pharynx, or larynx. In 2000, the American Cancer Society¹ estimated that 40,300 new cases of head and neck cancers and 11,700 deaths in this year (<http://www.ama-assn.org>).

Men are diagnosed with head and neck cancer twice as often as women. Those with the greatest risk are men over 40 years of age. This phenomenon is no mystery, because a history of excessive use of tobacco and alcohol are contributing factors to the development of this cancer. In the past, these behaviors were more common among men than women; but as these habits increase among women, the risk of these cancers also rises. This ratio of men to women has been narrowing over the last two decades.

The choice of treatment plan is individualized for these patients with special emphasis on the stage of neoplasm, tumor size and location, patient's physical condition, patient's

emotional status, treating team's experience, and available treatment facilities. The treatment may be surgery alone, radiation alone, or a combination of both. In general, when head and neck cancers are treated early (stage I and II), they are highly curable with radiation or surgery alone. Advanced cancers (stages III and IV) are candidates for treatment by a combination of surgery and radiation. Furthermore, because local recurrence and/or distant metastases are common in this group of patients, they should be considered for clinical trials.

Patients with more advanced cancers or in situations where it was not possible to resect the lesion with adequate surgical margins will require postoperative radiation. This article will discuss the complex patient care issues surrounding treatment of patients who require postoperative external beam radiotherapy.

Table 1: A guide to assessment of the oral cavity					
Category	Rating	1	2	3	4
Lips	1 2 3 4	Smooth, pink, moist, and intact	Slightly wrinkled and dry; one or more isolated, reddened areas	Dry and somewhat swollen; may have one or two isolated blisters; inflammatory line of demarcation	Very dry and edematous; entire lip inflamed; generalized blisters or ulceration
Gingiva and oral mucosa	1 2 3 4	Smooth, pink, moist, and intact	Pale and slightly dry; one or two isolated lesions, blisters, or reddened areas	Dry and somewhat swollen; generalized redness; more than two isolated lesions, blisters, or reddened areas	Very dry and edematous; entire mucosa very red and inflamed; multiple confluent ulcers
Tongue	1 2 3 4	Smooth, pink, moist, and intact	Slightly dry; one or two isolated, reddened areas; papillae prominent, particularly at base	Dry and somewhat swollen; generalized redness but tip and papillae are redder; one or two isolated lesions or blisters	Very dry and edematous; thick and engorged; entire tongue very inflamed; tip very red and demarcated with coating; multiple blisters or ulcers
Teeth	1 2 3 4	Clean; no debris	Minimal debris; mostly between	Moderate debris clinging to one-	Teeth covered with debris

			teeth	half of visible enamel	
Saliva	1 2 3 4	Thin, watery, plentiful	Decrease in amount	Saliva scanty and may be somewhat thicker than normal	Saliva thick and ropey, viscid, or mucid
<i>Adapted from Beck SL, Yasko JM: Guidelines for Oral Care. 2nd ed. Crystal lake, IL;Sage,1993.</i>					

Radiotherapy

Radiation therapy causes cellular death by eliminating the proliferation of cells. The radiated energy damages DNA by breaking the covalent bonds that hold it together. The cells are able to function but cannot survive mitosis. The rate of cellular response to radiation damage is directly related to the rate at which cells divide. This holds true for both tumor cells and normal cells. Injury occurs in normal tissues with rapid cell proliferation, such as mucous membranes and skin epithelium.

Radiation to the head and neck region has significant side effects, both acute and long term. Specific reactions depend on the treatment site, dose, and patient's response. Acute side effects include mucositis, xerostomia, taste changes, skin reactions, pain, and fatigue. Long-term side effects may include xerostomia, hypothyroidism, and taste changes.

Additionally, these individuals need to eliminate their prior albeit unhealthy coping mechanisms of tobacco and alcohol use. It has been shown that patients who continue to smoke during radiation therapy have a decreased response rate and shorter survival time than those who do not.² And, the risk of a second tumor is increased.³

Mucositis

Mucositis develops in radiation-exposed mucous membranes. Oral mucositis or stomatitis is an inflammatory reaction of the oral mucosa caused by multiple stressors, including cancer and its treatment. The cancer, surgical resection, and cytotoxic effects of radiation therapy traumatize the oral mucosa. A reduction in saliva production, xerostomia, another side effect of head and neck radiation to be discussed later in this paper, exacerbates mucositis by causing changes to the oral flora. Use of concomitant chemotherapy, particularly antimetabolites such as fluorouracil, a common agent used in adjuvant therapies for head and neck cancer, heightens the risk of oral complications.

Stomatitis is one of the earliest side effects to manifest and may initially present from 1 to 3 weeks into therapy. Early signs include mild erythema, edema, and complaints of dryness and mild burning. As the stomatitis advances, ulcerative lesions may be seen on the oral mucosa. The patient complains of pain.⁴

The best treatment for mucositis is to begin an aggressive, prophylactic oral regimen at the start of radiotherapy. Mouth care is essential during therapy to improve comfort, prevent infection, and minimize mucositis. A dental evaluation and correction of any periodontal and dental disease should be done prior to therapy. If the patient has dentures, they must fit properly.

It is important for the patient to avoid the use of tobacco and alcohol, because they irritate the mucosa and will exacerbate mucositis. Encourage the intake of plenty of fluids to hydrate the mucosa. Trauma to the oral cavity should be minimized; this goal can be achieved by avoiding foods that are too hot or cold, spicy or acidic, hard or coarse.

A thorough oral assessment should be done with each patient, using an oral mucositis grading system (Table 1). The patient should be instructed to implement a dental hygiene program, including:

- twice daily oral self-examination, reporting any changes in sensation, appearance, or taste;
- daily flossing;
- brushing four times daily, 30 minutes after eating and at bedtime, with a soft, small-headed toothbrush and fluoride toothpaste
- removing and thoroughly cleaning dentures or an oral prosthesis;
- rinsing the mouth thoroughly after brushing;
- moistening the lips with a lip balm of choice.

Mouth rinses can be a solution of one quart of warm water with either 2 teaspoons of salt or 1 teaspoon of baking soda, or both. Oral rinses, such as chlorhexidien gluconate 0.12% (Peridex(r), Periogard(r)), may also be used. Commercial mouthwashes are to be avoided, as most contain alcohol and, although initially refreshing, have a drying effect on the mucosa.

At the first sign of stomatitis, increase the frequency of oral rinses with the solution of choice between brushing and once during the night. Prophylactic nystatin suspension swishes should be started at the first sign of inflammation to prevent a secondary fungal infection. Fungal infections account for 50% to 70% of oral infections. *Candida albicans* is the most common pathogen.⁵

If stomatitis continues to worsen, oral rinses should be increased to every 2 hours and twice during the night. Discontinue flossing if pain, thrombocytopenia (platelet count below 50,000), or neutropenia (absolute neutrophil count below 1000) are present. The soft toothbrush may need to be replaced by an oral sponge.

A systemic and/or topical analgesic may need to be used, especially before eating. Topical analgesics include sprays, gels, and liquids with benzocaine or lidocaine (Hurricane(r), Zilactin-B(r), Orajel(r)). These analgesics can be used alone or mixed with other agents. A common suspension is equal proportions of xylocaine viscous 2%,

diphenhydramine elixir, and an antacid; 15 cc are administered every 2 to 4 hours to a maximum of 12 doses per day.

A number of topical agents can be used to protect the mucosa and to promote healing. A sucralfate (carafate) suspension can also be used. The sucralfate adheres to and protects exposed proteins in the inflamed mucosa and may stimulate prostaglandin release.^{6,7} Orabase, a paste of carboxymethylcellulose, can be applied to the irritated areas but should not be used if an infection is present. Zilactin, a hydroxypropylcellulose gel, forms a protective film that can last up to 8 hours. Vitamin E oil extracted from a 400-mg capsule can be applied with a cotton-tip applicator to oral lesions. If the oral cavity needs debrided, a 1:4 hydrogen peroxide and water solution can be used; however, it should be discontinued when ulcers are debrided, as prolonged use can inhibit tissue granulation and slow healing.

When a tracheal stoma is included in the radiation field, a mucositis of the trachea or tracheitis may result. The tracheal mucosa becomes inflamed, some blood streaking of the sputum may be noted, and there is a risk of infection. It can best be prevented and managed by maintaining adequate humidification. The patient can use a number of techniques to increase humidification. They include instilling sterile normal saline (1 to 2 cc) into the stoma, three to four times a day; wearing a moistened stoma cover; using a bedside humidifier; and increasing fluid intake. Trauma to the tracheal mucosa should be minimized.



If the patient has a tracheostomy tube, it should be coated with a water-soluble lubricant and an obturator used for tube changes. If the patient has had a total laryngectomy, the tube should be coated with a water-soluble lubricant, and an obturator should be used when the tube is re-inserted after cleaning or no laryngectomy tube should be used at all. Whenever a tracheostomy or laryngectomy tube is used, it is vital that the tube is well secured. Cotton-twill tracheostomy tape or a manufactured tracheostomy tube holder (Dale Medical) can be used (Figure 1). The tracheostomy tube holder contains an elastic that enables movement and accommodates the cough reflex, while holding the tube secure.

Once radiation therapy is completed, mucositis will begin to improve. Healing may be delayed if a fungal infection is associated with the mucositis, but generally healing should occur several weeks after radiation therapy is completed.

Xerostomia

Saliva is produced by the major and minor salivary glands. It is a natural lubricant, which aids chewing, formation of a bolus of food, and swallowing. Enzymes in saliva begin the digestive process. Saliva keeps the mouth clean and free of debris and bacteria, aids in

taste, and is important for speech. Salivary glands produce 1,000 to 1,500 ml of saliva each day.⁸

Xerostomia or mouth dryness can result from radiation therapy to the head and neck region, certain chemotherapy agents, and surgery that involves removal of salivary gland(s). Radiotherapy-induced xerostomia results from radiation damage to the salivary glands. As radiation exposure reaches 1000 cGy, mild to moderate xerostomia is noted. If the radiation dose exceeds 4000 cGy to the salivary glands, they will not recover.⁹ Some patients report subjective improvements but there were no improvements in saliva production. These subjective improvements are contributed to the most part to the patients' ability to compensate for the salivary changes.¹⁰ Rating scales can be used to describe the degree of xerostomia. The Radiation Therapy Oncology Group uses two scales: one for acute reactions; the other for late or delayed reactions (Table 2).

The decrease in saliva production can affect oral comfort, mucosal health, dentition, deglutition, the ability to chew normally, and the ability to speak. The patient may complain of dryness, burning sensations, sore lip and tongue, ulcerations, ill-fitting dentures, difficulty swallowing, and abnormalities of taste and smell. Xerostomia affects oral health, as it contributes to the development of dental caries, loss of teeth, mucositis, oral infections, and osteonecrosis. The patient is often instructed to use fluoride trays daily during treatment to help to prevent tooth decay. Painful mucositis and reluctance to perform adequate oral care exacerbate the threat of dental caries. Meticulous oral care must be initiated at the start of therapy as described earlier for the prevention and treatment of mucositis.

Xerostomia profoundly affects eating, sleeping, speaking, and the ability to perform physical exercise. There is a lack of saliva, and existing saliva is thick and ropey, which makes it difficult to eat dry or thick foods. Meals are interrupted by the need to take frequent sips of fluids, which may result in early satiety. Oral dryness alters the taste of food and smell. This combination of factors will have a negative impact on the patient's nutritional status. Saliva is also important for retention and stability of dentures. Sleep is

Table 2: Radiation therapy oncology group radiation morbidity scoring criteria: salivary gland

Acute Reactions

- 0 No change over baseline
Mild mouth dryness/ slightly thickened saliva/ may have slightly
- 1 altered taste, such as metallic taste/ changes are not reflected by alteration in baseline feeding
Moderate to complete dryness/
- 2 thick, sticky saliva/ markedly altered taste
- 3 Not used
- 4 Acute salivary gland necrosis

Late Reactions

- 0 No change over baseline
- 1 Slight dryness of mouth / good response on stimulation
- 2 Moderate dryness of mouth / poor response on stimulation
- 3 Complete dryness of mouth / no response on stimulation
- 4 Fibrosis

Source: Radiation Therapy Oncology Group (RTOG), American College of Radiology, Philadelphia, PA

interrupted as the dry mouth and the feeling that the tongue is stuck to the roof of their mouth awaken the patient. Conversations are impaired by the need to take sips of water to keep the mouth moist in order to articulate clearly; this necessity is especially problematic for patients who are required to do public speaking.

Interventions for xerostomia are intended to provide comfort, to prevent and minimize stomatitis/oral infections, and to maintain nutrition. The sensation of dryness is best alleviated with frequent oral rinses and sips of water or juice. Meticulous mouth care, as described above to prevent mucositis, is also recommended for management of xerostomia. Patients are encouraged to carry sipping water to help to relieve symptoms temporarily. Encourage the patient to increase oral intake to three liters per day, if able.

A number of saliva substitutes or oral moisturizers are commercially available, such as Salivart(r) or MouthKote(r). They are convenient and may offer longer relief than water alone. The use of sugarless gum or candy, particularly sour flavors, may help to increase the salivary flow. Sleep interruptions may be minimized by use of a humidifier in the bedroom and coating the mouth with a teaspoon of olive oil or butter at bedtime.

Thick, ropery secretions may be problematic, especially at mealtime. Papain is an enzyme found in papayas that can help to dissolve tenacious secretions. The patient may find some relief by eating papayas or drinking papaya juice. Papain can also be found in meat tenderizer, and a solution of meat tenderizer and water can be used as a swish and spit before meals to help to dissolve the thick secretions.

It is important to maintain adequate nutrition, and xerostomia interferes with this goal. The lack of saliva interferes with chewing, digestion, and taste. Changes in how foods are prepared and eaten will make it more pleasurable and help to maintain nutrition. Soft, moist foods are easier to eat. The use of gravies and sauces should be encouraged to moisten food and make it easier to chew and swallow. Avoid dry, sticky foods like peanut butter. Alcohol and tobacco use are taboo and should be avoided, as they further dry and irritate the mucosa.

Two pharmaceutical agents are now available for treatment of radiation-induced xerostomia. These products are important for supportive care, as they directly address the treatment and prevention of xerostomia rather than only manage symptoms. Amifostine (Ethyol(r)) is a radioprotective agent that can help to prevent or minimize the occurrence of acute and late xerostomia, mucositis, and loss of taste.

Taste changes

The sense of taste includes four primary sensations: sweet, sour, bitter, and salty. Taste buds, the receptors and conductors of taste sensation, respond to all four taste sensations but in varying degrees. Alterations in taste and smell have been reported in people with cancer, independent of treatment for their disease.¹¹ Taste changes are an early response to radiation therapy in the head and neck region and may precede mucositis and xerostomia. Taste alterations are believed to result from both the loss of saliva and the

direct pathological effect of radiation on the taste buds. Radiation damage to the microvilli of the taste buds may be the source of taste changes. Salt and bitter sensations are most commonly altered; sweet taste is least affected. This change may lead to an aversion to beef, pork, chocolate, coffee, or tomatoes.

Significant taste loss occurs at doses of 3000 cGy or greater. Damage to the taste buds may be seen 10 to 14 days after therapy begins and continue for 14 to 21 days after its completion. Partial recovery occurs 1 to 2 months after treatment; a complete recovery of normal taste sensation may take up to 4 months. Some decreased taste may be permanent and thought to be related to xerostomia.¹²

Patients with head and neck cancer experience taste changes resulting from surgery, chemotherapy, and radiotherapy. Surgery to the oral cavity and tongue lead to a loss of sweet and salty receptors; procedures involving the palate lead to a loss of sour and bitter receptors. Patients with a tracheotomy or laryngectomy have an altered olfactory component to taste, resulting from the diversion of airflow from the nose to the stoma, which commonly causes hypogeusia (decreased taste) or ageusia (absence of taste).

Taste changes and loss have an impact on appetite and contribute to nutritional deficits. People with cancer who lose 10% or more of their normal body weight do not live as long as those with similar cancers at similar stage who remain well nourished.¹³ Many patients are malnourished at diagnosis; this physical state is exacerbated by head and neck surgery that affects swallow, taste, and appetite. Now, as they face radiation and the multiple oral complications caused by stomatitis, xerostomia, and taste changes, maintaining adequate appetite and nutrition is a challenge.

All patients should be assessed for actual or potential malnutrition. A lack of oral intake should be anticipated. At the beginning of therapy, a dietary consult should be initiated and the patient and family counseled about high-calorie and high-protein diets, oral supplements, food preparation tips, and other suggestions to stimulate appetite. Despite this counseling, patients may require the insertion of a feeding tube to maintain nutrition; it is preferable to use the gastrointestinal tract and place a percutaneous gastric tube. The application of a G-tube holder will lower tube profile and help to discourage patient "pull-out." It allows the patient to be more active and comfortable without the discomfort and irritation caused by adhesive tape.

Use of appetite stimulants may be considered. Megestrol acetate (Megace(r)), synthetic progesterone, is effective in treating anorexia and cachexia, related to cancer and AIDS. Other measures that can be used to stimulate appetite include encouraging the patient to eat favorite foods, small frequent meals, eliminate any unpleasant odors or add pleasant ones, use relaxation techniques before meals, and exercise. To counteract changes to taste, encourage the patient/family to experiment with spices, such as basil, mint, lemon, and vanilla; avoid using hot spices, such as pepper, as they may irritate the mucosa. Cooking food in sauces or adding them may help to camouflage taste as well as moisten food. Maintaining the nutritional status improves quality of life and helps the patient to cope with the morbidity of cancer treatment.

Skin reactions

Today's radiation techniques minimize skin reactions by delivering the maximum radiation dose beneath the skin surface. However, in head and neck cancers, the tumor bed may be close to or even involve the skin. Within the irradiated field, the skin will react to treatment. Melanocytes are stimulated by radiation, so the skin darkens then peels. Moist desquamation can occur when the rate of epidermal destruction exceeds the rate of repair, and complete epidermal denudation with exposure of the dermis results. The loss of skin integrity and oozing of serum from the dermis are problematic but rarely does the site become infected. Healing is spontaneous and occurs 2 to 4 weeks after therapy is completed.

Areas that are subject to pressure are most prone to moist desquamation. They include the collar line, clavicular area, and regions exposed to secretions, such as a tracheal stoma. It may be helpful if the patient wears shirts without collars and avoids other constricting or irritating clothing on skin within the radiation field. The tracheal stoma needs to be kept clean and dry. If the patient has a metal tracheostomy/laryngectomy tube, they will be removed or replaced with a PVC tube during therapy. If there is a lot of drainage and a tracheostomy dressing is used, the dressing needs to be changed frequently. The tracheostomy ties may also be irritating; it is important to keep them clean and dry and to avoid constriction. A tracheostomy tube holder (Dale Medical) will help to decrease the irritation and pressure and to improve skin care. The tube holder minimizes pressure, because the band is soft and wider than cotton-twill tape with a built-in elastic to provide security with stretch.

Daily assessment of the skin is essential. The irritated skin needs to be treated with care. Skin within the radiation field should not be rubbed or exposed to sun or temperature extremes. If dry desquamation occurs, the area should be lubricated frequently and protected from further damage. Lotions containing aloe and lanolin are commonly used. The patient should not use creams and lotions without discussing them with the radiation or oncology staff. Moist desquamations should be kept clean and dry.

Pain

Stomatitis is the most common complaint of pain. Topical analgesics should be used, especially before meals. This pain can be quite severe and chronic. Narcotic analgesics should be used, if warranted. Pain assessment should be done frequently and the patient encouraged to keep a pain diary, so the analgesia of choice can be titrated for maximum comfort. Use of long-acting opioids works well to control the chronic pain of stomatitis. A number of agents are available, including long-acting morphine (MS Contin(r)), long-acting oxycodone (OxyContin(r)) and transdermal fentanyl (Duragesic(r)). The fentanyl patch provides additional benefits to this patient population, because it does not require the patient to swallow and is effective for 72 hours. As with any chronic pain management, a short-acting opioid should also be prescribed for breakthrough pain.¹⁴

Fatigue

Fatigue is the most common complaint of patients with cancer. As many as 96% of patients report fatigue in conjunction with chemotherapy and radiotherapy.¹⁴ Like pain, fatigue can only be measured by the patient's subjective report. Multiple factors contribute to fatigue resulting from the cancer and its treatment. These factors either disrupt oxygen uptake and metabolism or compromise nutrition and hydration. Psychological factors, such as anxiety and depression, also contribute to fatigue. From 40% to 93% of patients undergoing radiotherapy.¹⁵ Treatment-related fatigue has a clear temporal pattern. In patients receiving radiation therapy, fatigue is often cumulative and may peak after a period of weeks. Occasionally, fatigue persists for a prolonged period beyond the end of treatment.

An initial approach to management of fatigue is to correct any potential contributory etiologies. They may include elimination of nonessential centrally acting drugs, treatment of sleep disorders, effective pain management, reversal of anemia or metabolic abnormalities, such as an electrolyte imbalance or dehydration, and management of depression. Education of the patient and family and counseling about energy-saving tips and the importance of exercise to alleviate fatigue is an essential aspect of care.

Conclusion

Many challenges face the health-care team members who help patients and families through radiation therapy for head and neck cancer. Patients experience a number of side effects during therapy, including mucositis, xerostomia, taste changes, skin reactions, pain, and fatigue. Successful management demands the attention of a dedicated health-care team: radiation oncologist, otolaryngologist, radiation oncology nurse, radiation therapist, social worker, and dietician. The team would not be complete or successful without the involvement and efforts of the patient and family. They must be provided with the necessary information to understand the treatment experience and to anticipate and manage side effects. This involvement encourages the patient to maintain control, promotes self esteem, and has a positive impact on the patient's quality of life.

This author believes that head and neck cancer patients are "special people." They are usually concrete thinkers who display amazing resiliency, presenting a stoic front coupled with humor. The art of providing nursing care to this population is equally special. Mary Jo Dropkin, RN, PhD, described it eloquently¹⁶:

"Nursing care of the head and neck cancer patient is examining and touching an extensive facial wound without being horrified, struggling to maintain pressure on a ruptured carotid artery, and shaving around a facial defect. It is being there for the first look in the mirror after surgery, appreciating laughter without sound, and encouraging expression of feelings that may be difficult and time consuming to write down. It is walking arm in arm around the hall with one so severely disfigured that he was afraid to venture out alone, knowing that a prosthesis will be truly beneficial only after the defect is accepted, and

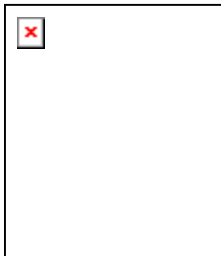
engaging in face-to-face interaction. Nursing care of the head and neck cancer patient is a direct encounter with each dimension of body image."

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