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The Occurrence of Sleep-Disordered Breathing Among Patients With Head and Neck Cancer

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Objective: **To identify the incidence of obstructive sleep apnea (OSA) in patients treated for head and neck cancer. Obstructive sleep apnea is a relatively common and highly morbid condition that affects 9.1% of male and 4% of female middle-aged adults.[1] Patients who have been successfully treated for head and neck cancer may often have a partially obstructed upper airway which is functional during the day, but collapses during sleep.** ***Study Design/Methods:*** **Twenty-four patients successfully treated for tumors of the tongue-base, pharynx, or supraglottic larynx were enrolled. Through OSA-related questionnaires, physical examination, and polysomnography, the incidence of OSA in this patient population was determined and compared with that of the general population.** ***Results:*** **The incidence of OSA (91.7%) in this head and neck cancer patient population was found to be significantly (P = .001) higher than that of the general population. (In a random sampling of middle-aged adult males between the ages of 30 and 60 years old with a respiratory disturbance index (RDI) >15, the prevalence was previously reported to be 9.1%.[1]) Sixteen of 24 patients (72.7%) had clinically defined symptoms of sleep apnea. Ten of 24 patients (41.7%) received radiation therapy; all had an RDI >15. Eleven of the 14 patients (78.5%) who did not receive radiation therapy also had an RDI >15. Eight patients (33.3%) continue to regularly use continuous positive airway pressure with significant improvement in symptoms.** ***Conclusions:*** **Identification and treatment of OSA may be an important factor in improving quality of life for patients with head and neck cancer.** ***Key Words:*** **Obstructive sleep apnea, head and neck cancer, sleep-disordered breathing.**

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INTRODUCTION

Obstructive sleep apnea (OSA) is a relatively common and highly morbid condition that affects 9.1% of male and 4% of female middle-aged adults.[1] The sleep apnea syndrome is clinically defined by episodes of both apnea (cessation of airflow for 10 or more sec[2]) and hypopnea (decreased effort to breathe at least 50% less than the baseline and with at least a 4% decrease in oxygen saturation, or SaO_2) and symptoms of functional impairment.[3] The syndrome can produce significant morbidity and mortality and has been associated with severe daytime hypersomnolence, cardiovascular complications, including systemic hypertension[4] and cardiac arrhythmias,[5] and automobile accidents.[6–8]

Attempts have been made to assess the full impact that sleep-disordered breathing incurs on the health of the general public. The repeated pauses in breathing during sleep lead to the fragmentation of sleep and decreases in oxyhemoglobin saturation. Sleep-disordered breathing ranges from partial airway collapse and increased upper airway resistance, apparent as snoring and episodes of hypopnea, to complete airway closure and severe episodes of apnea that produce the majority of problems described above. Studies reporting that snoring is associated with myocardial infarction, stroke, and hypertension[9–11] suggest that even a minimal level of sleep-disordered breathing may cause significant adverse health effects.[12]

The pathophysiology of sleep apnea syndrome is based on the inability of the patient to maintain a patent upper airway during sleep. The cause of this inability varies significantly among patients but includes three categories of problems: 1) enlarged soft tissues such as the tongue base and palate, 2) narrowing of the pharyngeal space by anatomic abnormalities, or 3) loss of function of the pharyngeal dilator musculature. It is reasonable to assume that patients who have undergone treatment for head and neck cancer with and without reconstruction using flaps to replace tissue may have one or all of these abnormalities. It is also possible that radiation therapy to the pharynx and larynx may cause narrowing of the airway and impair function of the pharyngeal dilator musculature. On the other hand, it is possible that radiation therapy may cause loss of elasticity that is beneficial in preventing collapse of the airway during sleep. This study was undertaken to assess the incidence of OSA in patients with head and neck cancer treated by surgical resection and compare them with the general population. In addition, a subgroup of patients who underwent radiation therapy was compared with those who did not receive radiation therapy.

MATERIALS AND METHODS

Patient Evaluation

Twenty-four patients who had previously been treated for resection of a head and neck cancer involving the tongue base, pharynx, or supraglottic larynx were asked to complete an OSA sleep questionnaire (Table I).

No patients who received a total laryngectomy or were breathing with the assistance of a tracheotomy/tracheostomy were included in the study. The symptoms were divided into three major categories based on the pattern of occurrence: always, frequent, and rare. The sleep questionnaire consisted of the following symptoms: 1) restless sleep, 2) loud and heavy snoring, 3) daytime sleepiness, 4) decreased daytime alertness, 5) irritability and short temper, 6) morning headaches, 7) forgetfulness, 8) mood or behavior changes, 9) anxiety or depression, or 10) a decreased interest in sex.

Clinically significant OSA was defined as experiencing at least two of the first four symptoms always or frequently during the day. The other symptoms were considered nonspecific. Based on the above criteria, patients were placed in the following two groups: 1) clinically significant or 2) not clinically significant. Each patient's body mass index (BMI) was calculated and each patient underwent routine polysomnography.

Polysomnography

An all-night-attended, comprehensive sleep study was performed using a computerized polygraph to monitor electroencephalogram (C3-A2, C4-A1), left and right electrooculogram, electrocardiogram, chin and anterior tibialis electromyogram, abdominal and thoracic movement by inductive plethysmograph, nasal oral airflow, oxygen saturation (SaO_2) by pulse oximetry, and throat sonogram. Apnea was defined as cessation of breathing for at least 10 seconds. Hypopnea was a decreased effort to breathe at least 50% less than the baseline and with at least a 4% decrease in SaO_2. Respiratory distress index (RDI) was calculated as the sum of total events (apneas and hypopneas) per hour. Oxygen saturation was monitored by pulse oximetry, and minimum oxygen (O_2) levels were identified as well as mean O_2 levels.

Patients displaying an RDI between 15 and 40 *or* a minimum oxygen saturation between 75 and 90 were classified as having mild to moderate OSA. Patients with an RDI >40 or a minimum SaO_2 <75 were classified as having severe OSA. Those individuals with an RDI <15 or a minimum SaO_2 >90 were classified as clinically insignificant.

TABLE I.
Primary Cancer Location.

Primary Cancer Location	Total No. of Patients
Soft palate	2
Larynx	7
Supraglottic larynx	4
Tongue base	7
Pharynx	4

Statistical Analysis

Traditional statistical analysis using χ^2 and Fisher exact tests were used comparing our head and neck cancer population to a study of OSA in a normal population.[1]

RESULTS

There were 24 patients in this study (21 men and three women). Ages ranged from 39 years to 83 years (mean, 64.8 y). Body mass index ranged from 16% to 31.7% (average, 22.34%). The apnea and hypopnea index, also known as the RDI, ranged from 7.79 to 96 (average, 49.86). Using the definition of a clinically significant sleep apnea as an RDI >15 or a minimum oxygen desaturation as less than 90%, 22 of 24 patients (91.7%) had clinical OSA (defined by polysomnograph). Sixteen (72.7%) of those 22 had recognizable symptoms.

Ten (41.7%) of 24 patients received radiation therapy; all (100%) of those patients had an RDI >15. In the nonradiation therapy group, 11 of 14 (78.5%) had an RDI >15.

Subjects who agreed to undergo polysomnography were compared with regard to their responses to all questionnaire items on sleep characteristics. Sixteen patients (72.7%) of the 22 who had an RDI >15 experienced clinically defined symptoms of sleep apnea.

All patients who had an abnormal polysomnogram were referred for continuous positive airway pressure (CPAP) titration studies. Home therapy with CPAP was recommended. Sixteen patients discontinued use of the CPAP soon after initiation. Eight patients continue to use CPAP on a regular basis with improvement of clinical symptoms.

Our data showed that 91.7% of our study population had OSA. In the study by Young et al.,[1] 9.1% of males in a normal population had OSA defined as an RDI >15. When our study is compared with the normal population, we notice a higher percentage of OSA in patients with head and neck cancer. This difference is statistically significant ($P = .001$).

DISCUSSION

Patients with head and neck cancer have multiple causes for fatigue and possibly hypersomnolence. Surgical and radiation treatment may be debilitating and recovery is often prolonged. Poor nutritional intake, anxiety, depression, and sometimes pain may be further contributing factors to sleep deprivation and fatigue. In fact, fatigue is often overlooked as a symptom in patients with head and neck cancer and is considered "normal" and acceptable. Although not all contributing factors can be eliminated, we should identify and treat causes of fatigue that are treatable. Obstructive sleep apnea is a common disorder in the general population but far more common in head and neck patients.

It has long been known that a paralyzed vocal cord can cause obstructive sleep apnea. This has been accepted as fact because it is logical that a narrowed airway will contribute to OSA, but this has never been proven. A narrowed larynx, hypopharynx, or pharynx can also be contributing factors to OSA. In addition to narrowing the airway by surgical resection or radiation that destroys tissues involved by tumor, we often add flaps for reconstruction that will further narrow the airway. This study clearly showed that the incidence of OSA in head and neck patients is extremely high (91.7%) versus that in the general population (9.1%).

Body mass index has been shown to be an important variable in OSA. In fact, high BMI (over 28) has been clearly demonstrated to be a significant factor in OSA.[13] In this study, 22 of the 24 patients had a normal or low BMI so that BMI cannot be considered a factor in the high occurrence rate of OSA. In fact, the two patients who had a BMI greater than 28 did not have significant sleep apnea. Both of these patients had T1 lesions of the larynx treated by laser cordectomy. They had a tumor and treatment that did *not* result in a narrowed airway.

Radiation theoretically may have opposing effects on the upper airway. On the one hand, scarring may cause contracture and narrowing of the airway. On the other hand, radiation may have a beneficial effect of tightening redundant soft tissue in the upper airway or reducing excessive tongue base tissue. Both of these effects would decrease the likelihood of OSA. We therefore compared the radiation group (10 patients) with the non-radiation group (14 patients) to determine if there was a difference. Both showed a significantly higher occurrence rate of OSA compared with the general population. Because the groups were so small, statistical analyses of the subgroups (radiated vs. non-radiated) was not done.

Although the incidence of OSA in the radiated group was 100% versus 78.5% in the non-radiated group, some of this difference may likely be the higher percentage of T3 and T4 tumors in the radiated group. The larger tumors are more likely to adversely affect the residual upper airway. In any event, there is clearly no benefit of radiation to prevent OSA in the patient with head and neck cancer.

Identification of the cause of symptoms may be important in itself in comprehensive assessment of our patients, but the ultimate goal of diagnosis is to allow for treatment. Patients with head and neck cancer are *not* likely to be candidates for standard forms of treatment for OSA such as uvulopharyngopalatoplasty, radiofrequency ablation, hyoid or mandibular and maxillary advancement techniques. In most cases, the anatomic changes resulting from the cancer treatment, concern for cancer recurrence, poor healing secondary to radiation, generalized debilitation, and other factors would preclude surgical correction of the obstructed upper airway.

There are, however, two forms of treatment readily available to these patients when indicated. CPAP and tracheotomy are two major forms of treatment that should be considered in this group of patients. CPAP compliance is known to be poor, but some patients do benefit significantly from CPAP use and are therefore faithfully compliant. In our group of patients, all patients with an RDI >15 and symptoms (16) were offered CPAP trials. Eight patients in our group continued to use CPAP on a regular basis.

Although none of our patients had OSA severe enough to warrant a tracheostomy, it may well be indicated in some patients with head and neck cancer who have OSA.

Treatment for head and neck cancer has evolved over the past 100 years. The major changes in the last 20 years are not in treatment or reconstruction, but in consideration of quality of life issues that affect our patients. Resection of a tumor with poor quality of life is not a highly desirable result of modern-day treatment. Identification and treatment of OSA may be important factors in improving quality of life. OSA with its sequelae, including fatigue, irritability, hypersomnolence, and depression, may be one avoidable problem in patients with head and neck cancer.

CONCLUSION

Head and neck cancer, head and neck surgery, and radiation are risk factors for OSA. Patients who underwent therapy should be assessed for clinical symptoms of OSA. Treatment options are limited but include CPAP and tracheotomy. The role of traditional surgical management of OSA for this subgroup has not been studied and deserves further evaluation. Identification and treatment of OSA may be important factors to improve quality of life for this group of patients.

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