Paparella: Volume III: Head and Neck

Section 2: Disorders of the Head and Neck

Part 4: The Pharynx

Chapter 23: Cancer of the Oropharynx

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Cancer of the oropharynx is an uncommon disease, with 8300 new pharyngeal cancers being diagnosed every year in the USA according to the American Cancer Society standards of 1988. Unfortunately, although many cancers are demonstrating a decline in incidence, the reverse appears to be occurring in cancer involving the upper aerodigestive tract. There has been a steady absolute increase in the number of cases diagnosed and a change in demographic characteristics. Traditionally, this disease was most commonly diagnosed in the 60 years and older age groups, but today cases in the third, fourth, and fifth decades of life are not uncommonly seen. Changes in alcohol and tobacco usage, for women particularly, have changed the male to female ratio from 10:1 to 4:1.

Anatomy

For clinical purposes, the oropharynx can be regarded as consisting of the oropharynx proper and the palatine arch. It extends from the plane of the hard palate superiorly to the plane of the hyoid bone inferiorly and communicates with the nasopharynx above and the hypopharynx below. Anteriorly, it is continuous with the oral cavity through the oropharyngeal isthmus.

The palatine arch consists of the soft palate, the anterior tonsillar pillar, and the retromolar trigone. The retromolar trigone is the triangular area over the anterior aspect of the ramus of the mandible posterior to the third molar. Although this area is anatomically located within the oral cavity, it blends medially with the anterior tonsillar pillar, and cancer in this area behaves in a fashion similar to that arising in the oropharynx.

The roof of the oropharynx is formed anteriorly by the pharyngeal portion of the soft palate, but it is incomplete posteriorly, communicating with the nasopharynx via the nasopharyngeal isthmus. The lateral and posterior margins of the isthmus are formed by fibers of the palatopharyngeus muscle, which encircle the pharynx inside the superior constrictor muscle forming Passavant's ridge, against which the soft palate impinges when elevated by the levator palati muscle. Other fibers of the palatopharyngeus muscle form the posterior tonsillar pillar.

Anteriorly, the oropharynx consists of the base of the tongue and the oropharyngeal isthmus opening into the oral cavity. This isthmus is bordered by the soft palate above, the anterior tonsillar pillars laterally, and the dorsum of the tongue at the level of the circumvallate papillae below. The mucosa of the base of the tongue is extremely irregular because of the

underlying lingual tonsils, which vary considerably in size. The midline mucosal fold, the glossoepiglottic fold, connects the base of the tongue to the epiglottis. Laterally, the pharyngoepiglottic folds extend from the lateral margins of the epiglottis to the lateral pharyngeal walls. They separate the oropharynx from the hypopharynx. The area bounded by the epiglottis, base of the tongue, and pharyngoepiglottic folds is the vallecula.

The limits of the lateral walls of the oropharynx are formed by the anterior and posterior pillars, which are mucosal folds overlying the palatoglossus and palatopharyngeus muscles, respectively. The tonsillar fossa occupies the space between these two pillars. Deep to this space, the lateral wall consists of the superior constrictor muscle and upper fibers of the middle constrictor muscle and is reinforced by the palatoglossus, palatopharyngeus, salpingopharyngeus, and stylopharyngeus muscles. Between the inferior pole of the tonsillar fossa laterally and the base of the tongue medially lies the tonsillolingual sulcus, which forms part of the lateral food passage and is notoriously difficult to visualize on routine clinical examination.

The faucial (palatine) tonsil is a mass of lymphoid tissue that fills the tonsillar fossa. The free surface varies considerably in appearance and consists of a large number of narrow crypts (tonsillar crypts). The normal tonsil varies in size at different periods of life and may bulge into the pharynx or be sessile and buried within the tonsillar fossa. The deep surface is covered by a fibrous tissue capsule, and fibers of the palatoglossus and palatopharyngeus muscles are attached to this capsule. The major blood supply to the tonsil is derived from the tonsillar branch of the facial artery. Other sources of blood supply are from the ascending pharyngeal and dorsal lingual arteries, as well as the palatine branches of the internal maxillary artery. The peritonsillar veins emerge from their deep surface and, after piercing the inferior constrictor muscle, end in the common facial vein and pharyngeal plexus.

The posterior wall of the oropharynx is related to the second and third cervical vertebrae and consists of mucosa, inferior constrictor muscle, and buccopharyngeal and prevertebral fascia. Inferiorly, the boundary between the oropharynx and the hypopharynx is formed by the upper border of the epiglottis anteriorly and the pharyngoepiglottic fold laterally.

Parapharyngeal space

Knowledge of the anatomy of the parapharyngeal space is essential to the understanding of the signs and symptoms produced by direct tumor extension into this area and to an appreciation of the various surgical techniques. This area is divided into a prestyloid space and a poststyloid space by the styloid process and the three muscles arising from it: the stylohyoid, stylopharyngeus, and styloglossus muscles. The prestyloid space is bounded medially by the buccopharyngeal fascia overlying the superior constrictor muscles and laterally by the medial pterygoid muscle. The glossopharyngeal nerve lies within this space, entering the pharynx between the superior and middle constrictor muscles. This nerve provides motor branches to the pharyngeal musculature and sensory branches to the oropharynx. The lingual nerve, which is a branch of the mandibular division of the trigeminal nerve, also runs through this space. It supplies the mucous membrane of the anterior two thirds of the tongue and floor of the mouth.

Between the medial pterygoid muscle and the mandible lies the pterygomandibular space through which courses the inferior alveolar nerve and internal maxillary artery. Tumors cause signs and symptoms from direct involvement of these nerves and may spread through the base of the skull by perineural invasion.

Lymphatic Drainage

The primary drainage site from the oropharynx is to the jugulodigastric (tonsillar) node in the upper deep jugular chain. Also of importance are the retropharyngeal and parapharyngeal nodes, which drain the pharyngeal portion of the soft palate, the lateral and posterior oropharyngeal walls, and the base of the tongue. These nodes lie in the retropharyngeal and parapharyngeal space closely related to the last four cranial nerves, the internal jugular vein, and the internal carotid artery at the base of the skull. The most superior lateral node is known as the node of Rouviere. The efferent channels from these nodes drain to the jugulodigastric and posterior cervical group. The retromolar trigone area may drain directly into the submandibular nodes. Bilateral spread may occur in midline tumors, particularly those involving the base of the tongue.

Physiology

To better understand the sequelae of disease and surgery in this area, a brief description of the pharyngeal phase of deglutition is helpful. In the first voluntary act of swallowing, the bolus of food is forced by the tongue through the oropharyngeal isthmus into the oropharynx. Once this has occurred, the palatoglossus muscle contracts, thereby reducing the size of the oropharyngeal isthmus and preventing reflux of the food into the oral cavity. The larynx is elevated against the epiglottis, which, in turn, is pushed backward and downward by the movement of the tongue base. The nature of the bolus now determines its subsequent progress. If the bolus is liquid or semiliquid, the thrust of the tongue is sufficient to project it into the esophagus. If it is solid, however, the pharyngeal muscles contract and propel the food into the esophagus. Any process interfering with the normal anatomy of the oropharynx may result in dysphagia with aspiration or reflux through an incompetent nasopharyngeal or oropharyngeal isthmus. Depending on the distortion of the anatomy by disease or surgery, severe dysarthria and impaired mastication may also occur.

Carcinogenesis

Many life style, environmental, and genetic factors are implicated as important etiologic agents in the development of head and neck cancer. The vast majority of these cancers arise in susceptible persons after prolonged exposure to known environmental carcinogens. Tobacco, in the form of cigarette, pipe, or cigar smoking, has been implicated with a specific dose-response relationship, that is, the risk rises in a linear fashion with the amount of tobacco smoked. Smokeless tobacco is becoming increasingly popular among the youth of America, particularly sniff dipping and chewing tobacco. An association between cancer of the oral cavity and the oropharynx and smokeless tobacco has been confirmed.

Ionizing radiation has long been acknowledged as a cause of cancer. Low-dose radiation to the head and neck was an extremely popular therapy many years ago for benign lesions, for example, thymus or adenoid enlargement, acne, and eustachian tube dysfunction. Today this treatment has been noted to induce not only thyroid and salivary cancer but also mucosal cancers of the upper aerodigestive tract. Likewise, high-dose therapeutic radiation may act as a double-edged sword and may, in fact, cause cancer.

Although dental trauma and poor oral hygiene have been implicated as a cause of oropharyngeal cancer, this has never been definitely proved.

The consumption of alcohol is linked to the development of cancer in the upper aerodigestive tract, particularly the oral cavity and oropharynx. The exact mechanism is unclear but is thought to be due to a combination of a local toxic effect on the mucosa and a systemic effect from the associated dietary deficiencies, hepatic damage, and a possible alteration in the patient's immunity. It appears to act synergistically with tobacco, causing a disproportionate increase in cancer as the alcohol and tobacco consumption increases.

Infectious agents have also been implicated as possible causes of cancer in the oral cavity and oropharynx. Tertiary syphilis has been associated with cancer of the tongue, but thankfully this condition is rarely seen today. Of greater interest is the role of the human papilloma virus as a carcinogenic agent. This has been well documented in the gynecologic literature, and research is currently under way to investigate its role in cancer of the upper aerodigestive tract.

Exposure to environmental factors alone does not necessarily result in cancer, and there appears to be a need for an individual susceptibility to the development of cancer. This susceptibility may be hereditary, familial, or acquired - for example, immunosuppression, AIDS.

Nutritional factors are thought to predispose to the development of cancer. The Plummer-Vinson syndrome, associated with iron deficiency anemia, is known to have a high incidence of cancer of the tongue and esophagus. Oral submucosal fibrosis, which is thought to be due to a vitamin deficiency, has also been implicated, particularly in cancer of the buccal mucosa. Although certain dermatologic conditions, including dystrophic epidermolysis bullosa and lichen planus, are regarded as premalignant, these conditions tend to result predominantly in cancer of the oral cavity.

Thus, multiple causative factors play a role in the development of carcinoma of the oropharynx. In 1944, Willis stated that when carcinogenic stimuli affect epithelial tissue, all the epithelium in that area is affected similarly but not necessarily equally. A neoplasm, therefore, is more likely to develop in locations in which the stimuli have been maximal; however, similar neoplastic change may occur at a later stage in adjacent tissue that was exposed to the same carcinogens. This concept of "condemned mucosa" or "field cancerization" is important in understanding cancer of the upper aerodigestive tract. The mucosa of the upper aerodigestive tract should, therefore, be regarded as a "field of growth" that is constantly being bathed by the carcinogens and, therefore, will potentially have numerous areas of premalignant and early

malignancy changes. Multiple tumors may arise simultaneously or metachronously in this field, necessitating constant vigilance and long-term follow-up, particularly if the patient continues to smoke and drink.

Pathologic Features

Not all growths that develop in the oropharynx are squamous cell carcinoma. A wide variety of benign and malignant tumors may arise from the tissues in this area. In addition, tumors may arise from parapharyngeal structures but present initially within the lumen of the pharynx and mimic primary intrapharyngeal tumors (Table 1).

Table 1. Differential Diagnosis of Masses in the Oropharynx

Benign	Malignant
Epithelial	Squamous cell carcinoma
Papilloma	Minor salivary gland tumors
Minor salivary gland tumor	Lymphoma
Retention cyst	Sarcoma
Mesenchymal	Melanoma
Fibroma	*Malignant Parapharyngeal Tumors*
Lipoma	
Hemangioma	
Lymphangioma	
Neuroma	
Benign Parapharyngeal Tumors	

Benign Tumors

Epithelial. Probably the most common tumor seen in the oropharynx is the simple papilloma. This pedunculated lesion may arise on the tonsil, faucial pillars, or soft palate and may be single or multiple. It is usually asymptomatic and is discovered incidentally by the patient, dentist, or physician. Rarely, it may be large enough to cause irritation. For practical purposes, all these lesions are benign, although cases of malignant transformation of papilloma in the pharynx have been reported. As technology for typing the causative papillomavirus becomes increasingly sophisticated, a better appreciation of which lesions will progress to malignancy will be obtained.

Mucous retention cysts are also extremely common, and their only importance is to differentiate them from other submucosal masses, particularly minor salivary gland tumors. Likewise, simple adenomas and pleomorphic adenomas arise uncommonly in the pharynx.

Mesenchymal. Lipomas, fibromas, and neuromas rarely occur and may be pedunculated or sessile. Hemangiomas may arise in the palate, tonsil, and posterior and lateral pharyngeal wall

or may occur predominantly in the parapharyngeal space. Capillary hemangiomas patently require no treatment, nor should asymptomatic cavernous hemangiomas be treated. The large or bleeding cavernous hemangiomas are, of course, a tremendous therapeutic dilemma. Angiography may delineate the extent of the lesion and identify any feeder vessel. Unfortunately, ligation and embolization only offer a short-lived palliative effect. In situations in which the bleeding is coming from a focal point, it may be controlled by using a low-powered yttrium aluminum garnet (YAG) laser.

Malignant Tumors

Squamous Cell Carcinoma is the most common malignancy in the oropharynx. Although clinically this cancer appears more aggressive than oral cavity cancer, with a concomitant worse prognosis, this phenomenon is more likely due to the advanced staging at the initial presentation associated with late diagnosis. Macroscopically, various types are described: superficial and exophytic, ulcerative and infiltrative, and fungating. The superficial spreading exophytic lesion is found most commonly on the soft palate and faucial arch. These lesions are frequently associated with areas of "condemned" mucosa and are less aggressive, with a lower incidence of nodal metastases. Ulcerative, infiltrative, and fungating squamous cell carcinomas occur more often in the tonsillar fossa and tongue base and are associated with more aggressive behavior, a higher rate of metastases, and a more ominous prognosis.

Several attempts to correlate histopathologic findings with cure rate and ultimate survival have been made over the years. Squamous cell carcinomas are traditionally graded as well differentiated, moderately differentiated, and poorly differentiated based on the amount of keratinization, intercellular bridging, and the degree of nuclear pleomorphism. Some authors have noted better prognosis with well-differentiated cancers; however, this has not been a universal experience. Crissman and co-workers, in reviewing the histopathologic characteristics of 77 patients with oropharyngeal carcinoma, established that the pattern of invasion at the host-tumor interface was the most important prognostic parameter. Carcinomas that invade in small aggregates have a greater propensity to infiltrate blood and lymphatic vessels compared with those that invade with a broad pushing border. They also have a worse prognosis. In addition, the frequency of mitoses is an important predictor of survival.

Other poor prognostic indicators include tumor size, histologic evidence of nodal metastases, and young patients who are nonsmokers and nondrinkers.

Lymphoepithelioma is a variant of squamous cell carcinoma and represents a poorly differentiated carcinoma, with the lymphocytes not actively participating in the malignant transformation. They usually arise from the faucial or lingual tonsils themselves. They behave somewhat differently from most squamous cell carcinomas in that they have a propensity to early nodal and distant metastases. Histologically, they consist of nests of epithelial cells with lymphocytes scattered between the cells. They are exquisitely sensitive to radiation therapy.

Verrucous Carcinoma, in contrast, is a very well-differentiated carcinoma, characterized by slow growth and propensity for local or distant metastases.

Nonsquamous Cell Cancers may develop from minor salivary glands in the oropharynx. They should be differentiated from tumors arising in the deep lobe of the parotid gland presenting in and distorting the oropharynx. Fifty to 70 per cent of all minor salivary gland tumors are malignant. Of the malignant tumors, the most common is the adenoid cystic carcinoma, but other malignancies such as the mucoepidermoid carcinoma, adenocarcinoma, acinic cell tumor, small cell tumor, and malignant pleomorphic adenoma have all been described. They usually develop as a painless submucosal mass that gradually increases in size and rarely become ulcerated.

Hodgkin's and non-Hodgkin's *lymphoma* may arise in the tonsil and base of the tongue and should be strongly suspected in a unilateral enlargement of the tonsil, particularly if associated with large cervical nodes.

Sarcomas occasionally arise in the oropharynx.

Spread of Cancer

Carcinoma of the Tonsil

The majority of oropharyngeal cancers arise in the tonsil or tonsillar fossa. As it enlarges, the tumor begins to infiltrate into the surrounding tissues to involve the posterior pharyngeal wall and base of the tongue and may extend inferiorly into the hypopharynx. Deep extension can cause fixation to or erosion of the ascending ramus of the mandible or involvement of the medial pterygoid muscle. Parapharyngeal space involvement can result in perineural invasion along cranial nerves, with eventual extension to the base of the skull.

Carcinoma of the Base of the Tongue

Tumors of the base of the tongue may arise de novo or may be secondary to spread from regional areas, for example, the tonsil, anterior portion of the tongue, and supraglottic larynx. In any event, these lesions are associated with a poor prognosis because of late diagnosis, difficulty in determining the exact extent of these tumors, and their tendency to early bilateral regional metastases. The early cancers can be relatively asymptomatic and frequently mistaken for lingual tonsils. The late tumors tend to spread deeply into the root of the tongue and also into the pre-epiglottic space and they defy delineation.

Carcinoma of the Palatine Arch

Carcinoma of the anterior tonsillar pillar and soft palate usually presents as superficial spreading or exophytic lesions in areas of "condemned" mucosa, and multicentric cancers are common. Generally, these tumors have a better overall prognosis, but if left untreated, they will extend laterally along the soft palate to involve the lateral pharyngeal walls and the retromolar

trigone.

Carcinoma of the Pharyngeal Wall

Cancer of the posterior and lateral pharyngeal wall often presents at an advanced stage because of the relative lack of symptoms associated with early lesions. Submucosal spread is not uncommon. Interestingly, the tumors may reach considerable size before invading the prevertebral fascia. Once they have invaded the prevertebral musculature, the tumor usually is unresectable and probably not curable.

Patient Evaluation

History and Physical Examination

Early tumors of the oropharynx are remarkably asymptomatic, frequently attaining a considerable size before manifesting any symptoms. A vague discomfort and irritation is an early complaint. Pain, however, is the most common presenting symptom. Unfortunately, this usually signifies deep infiltration. Referred otalgia is also common and likewise signifies advancing disease. As the cancer invades deeply, the pain increases, and trismus may result if the pterygoid muscles are infiltrated. Regional metastases may be the presenting sign in 20 per cent of cases. Extensive invasion of the base of the tongue causes reduced tongue mobility and dysarthria ("hot potato" voice). Large tumors of the oropharynx cause dysphagia. Oral intake is reduced, and weight loss and malnutrition become a common feature in patients with advanced cancer.

A complete head and neck examination is essential for patients with oropharyngeal cancer. The neck must be palpated for cervical metastases and even direct tumor extension into the neck. Fifty-five to 75 per cent of patients with oropharyngeal cancer have neck metastases at presentation, and 20 per cent will have bilateral metastases. Direct examination of the oropharynx should allow ready identification of most cancers of the oropharynx. This visualization will be improved by depressing the tongue. Indirect mirror examination of fiberoptic nasopharyngoscopy and laryngoscopy allows a more complete examination of the base of the tongue, lateral and posterior pharyngeal walls, and nasopharynx. Unfortunately, base of the tongue involvement is difficult to determine visually and is better assessed by palpation. This usually is not tolerated well by the patient and is ideally performed under anesthesia. Trismus, a sign of deep tumor extension, often makes adequate visualization and palpation even more difficult. As part of the routine head and neck examination, the patient should be asked to protrude the tongue. This may indicate a hypoglossal nerve palsy, or if there is deep infiltration into the root of the tongue, there will be significant impairment of protrusion. Always test for impaired sensation over the mental nerve. This may indicate involvement of the inferior alveolar nerve in the oropharynx or even spread along the nerve as it courses through the mandible. A complete dental examination is also necessary.

A complete medical history and physical examination are essential in the evaluation of patients with oropharyngeal cancer. The tobacco and alcohol habits of these patients put them at

significant risk for chronic lung disease, heart disease, peripheral vascular disease, and liver disease. Alcoholics are at risk for alcohol withdrawal syndromes and require attention and medical prophylaxis. Poor oral intake and alcoholism may cause malnutrition. All of these problems must be addressed, as they may influence the therapeutic modality selected. The age distribution of this patient population necessitates screening for colorectal and prostate cancer by rectal examination and stool Hemoccult testing. Radiographic screening for lung cancer is also necessary. A psychologic evaluation is occasionally helpful in the overall management of these patients.

Special Investigations

A complete blood count, renal profile, liver profile, and chest x-ray studies are routinely performed.

A Panorex of the mandible may be helpful in determining any overt tumor erosion or widening of the inferior alveolar canal or mental foramen signifying tumor spread along the nerve. This also aids in determining the status of the dentition. Computed tomography (CT), though not always necessary, may be helpful in selected cases. It is particularly useful in identifying prevertebral muscle invasion or over cervical vertebrae erosion. Base of skull involvement may also be obvious on the CT scan. CT may also depict the extent of the primary tumor and the presence of regional adenopathy, although these findings should always be correlated with the clinical findings and not relied upon exclusively. Magnetic resonance imaging (MRI) offers better resolution of soft tissue planes and thus is potentially better in demonstrating prevertebral muscle invasion and the extent of tongue involvement by tumor.

Although the reported incidence of distant metastases in patients presenting with oropharyngeal cancer has been reported to be as high as 20 per cent, our experience has been much lower. Controversy continues to rage as to when to perform a metastatic workup and what that workup should consist of. In general, if the index of suspicion for metastases is great - that is, advanced staging of primary and nodal disease, symptoms of bone pain, and elevated bone and hepatic enzyme levels - a full metastatic workup is indicated. In our hands, this consists of a chest and abdominal CT scan and a bone scan. Certainly if the index of suspicion is not great, an x-ray chest film and blood workup may suffice. The occurrence of false-positive and false-negative results remains a problem.

Examination Under Anesthesia

All cases of cancer of the oropharynx should be examined under anesthesia, irrespective of size or whether they are amenable to assessment in the office. The major reason for this is that it allows the tumor to be accurately evaluated with regard to size and degree of infiltration. All too often, only the "tip of the iceberg" is seen in the office. Palpation under anesthesia is an excellent means of determining the extent of base of the tongue involvement and whether the tumor is fixed to the prevertebral musculature. The tumor can be accurately tattooed and multiple biopsies taken under anesthesia. The tattooing is performed with India ink using an 18-gauge

needle and puncturing 2 cm from the *palpable* margin. This is particularly useful if preoperative radiation or chemotherapy is to be performed.

Always perform the biopsy at the end of the procedure, as the resultant bleeding may interfere with the rest of the examination. A further reason for evaluation under anesthesia is the ability to perform panendoscopy, that is, laryngoscopy, bronchoscopy, esophagoscopy, and evaluation of the pharynx while the patient is anesthetized, looking for multicentric cancers, which are noted in approximately 10 per cent of patients at the time of presentation.

Immediately following examination under anesthesia, tumor mapping is performed using a preprinted diagram of the oropharynx. This is helpful in staging the tumor, entry in a computerized registry, and preoperative surgical planning - especially in teaching institutions in which multiple surgeons may be involved.

Staging

Following examination under anesthesia, the cancer is staged according to the TNM system (tumor, node, metastases). Accurate staging is essential to aid the clinician in the planning of therapy, to provide a prognosis for the patient, and to assist in the evaluation of treatment results and the exchange of information among treatment centers. Two major systems are currently in use - the International Union Against Cancer (UICC) and the American Joint Committee on Cancer Staging and End Results Reporting (AJC). It is important to be aware that with regard to the oropharynx, the lingual surface of the epiglottis is classified as part of the supraglottic larynx by the AJC and as part of the oropharynx by the UICC. In addition, the superior surface of the soft palate is regarded as part of the oropharynx by the AJC and as part of the nasopharynx by the UICC. The T category descriptions are the same for both systems, with tumor size forming the basis for oropharyngeal cancers (Table 2). The criteria for node classification are, however, completely different in the two systems, with the size and number of nodes being important in the AJC system and mobility versus fixation being the criterion in the UICC. Distant metastases carry the same significance in both systems. There are obviously significant intrinsic weaknesses in both staging systems, with there being no allowance for differences in tumor behavior and host response. Also, clinical evaluation of the extent of the disease is far from optimal and is not very objective or reproducible. Unfortunately, these systems remain the best we have to offer at this time.

Management

In spite of multiple advances in diagnostic techniques, the improved capability to resect increasingly advanced cancers and then reconstruct the resultant defect, and new and ever-changing radiation and chemotherapy protocols, the selection of the ideal therapy for the patient with oropharyngeal cancer is as confusing today as it was 25 years ago. The disease is better understood, as are the needs of the patient, and yet this knowledge has not really been translated as yet into improved survival rates. This disappointment should not, however, deter the oncologist from using all the powerful new tools that have been placed at his or her disposal to better help

the stricken patient. If, in the end, the only goal that can be accomplished is effective palliation with improved quality of life for the remaining days, this is a laudable accomplishment and worth pursuing. The basic premise of management is to maximize the results of treatment, whereas at the same time minimizing the morbidity associated with the treatment.

Table 2. TNM Classification for Carcinoma of the Oropharynx

Primary Tumor (T)

T_{is}	Carcinoma in situ
T_1	Tumor 2 cm or less in greatest diameter
T_2	Tumor more than 2 cm but nor more than 4 cm in greatest diameter
T_3	Tumor more than 4 cm in diameter
T_4	Massive tumor more than 4 cm in diameter with invasion of bone, soft tissues of neck, or root (deep musculature) of tongue

Nodal Involvement (N)

N_x	Minimum requirements to assess the regional nodes cannot be met
N_0	No clinically positive node
N_1	Single clinically positive homolateral node 3 cm or less in diameter
N_{2a}	Single clinically positive homolateral node more than 3 cm but not more than 6 cm in diameter
N_{2b}	Multiple clinically positive homolateral nodes, none more than 6 cm in diameter
N_{3a}	Clinically positive homolateral node or nodes, one more than 6 cm in diameter
N_{3b}	Bilateral clinically positive nodes (each side of the neck should be staged separately)
N_{3c}	Contralateral clinically positive node or nodes only

Distant Metastases (M)

M_x	Minimum requirements to assess the presence of distant metastasis cannot be met
M_0	No evidence of metastasis
M_1	Distant metastasis present (specify site).

Therapeutic Options

Therapeutic options available to the physician are myriad but essentially can be categorized as follows: (1) surgery, (2) radiation, (3) combination surgery and radiotherapy, (4) chemotherapy, either alone or as an adjunct to surgery and radiation therapy, and (5) symptomatic palliative therapy.

Each of these modalities has its proponents and detractors, but in the final analysis, because of the lack of any proven definitive approach, the oncologist uses the regimen that he or she feels most comfortable with and that seems best for the individual patient in an individual

setting.

Factors Affecting Choice of Therapy

Staging of the Neoplasm

The site and extent of the tumor are most important in deciding the optimal regimen. Smaller, less advanced lesions can be cured by either radiation or surgery and, therefore, the choice of which approach to use would be entirely dependent on other factors. The large, more advanced tumors, in contrast, are associated with a poor prognosis irrespective of the therapy used. In this situation, though every attempt at cure should be made, one does not want to subject the patient to mutilation and subsequent impaired quality of life in a futile attempt at cure.

Presence of Associated Disease

Head and neck surgery, though complex, in general does not result in a profound disturbance of body metabolism postoperatively. The patient in whom the cancer develops, however, is frequently poorly nourished and may have significant pulmonary, cardiovascular, and hepatic disease. If severe, these conditions may prevent surgery from being a therapeutic option or they may influence the type of surgery proposed, for example, poor pulmonary reserve necessitating a total laryngectomy in association with glossectomy to prevent aspiration.

The Psychologic Attitude of the Patient

The fear of cancer usually outweighs the fear of surgery or radiotherapy. This is, unfortunately, not always the case and irrational fear may dictate a change in policy. Never force the patient into an option that is not desired.

Attitude of Family and Support System

The family must be involved in the decision-making process. If they fail to live up to their obligations in aiding the patient in rehabilitation and being accepted back into society, the therapy will be judged a failure, no matter how successful it might appear to the oncologist.

The Philosophy and Experience of the Oncologist

Each oncologist develops his or her own philosophy of management based on past experience and intuition in dealing with a particular oncologic problem in a particular setting. Until a fail-safe, guaranteed "cookbook" cure for cancer is available, a diversity of opinion is to be expected and should, in fact, be encouraged.

Available Facilities

It is a fact of life that many head and neck tumors are managed away from the "ivory tower" of academic institutions, in which enormous backup and support systems are in place for the management of these patients. Not every oncologist has access to dedicated nurses, prosthodontists, social workers, speech therapists, and so on. Although perhaps a case can be made for the management of all cases in a controlled centralized environment, at this time, it is not occurring. The lack of an experienced surgeon, radiotherapist, or chemotherapist, and the lack of support facilities, for example, an intensive care unit, should all be taken into consideration in making the final decision as how to best treat the patient.

Radiation Therapy

As surgical techniques for ablation and reconstruction have advanced in the past decade, so too have radiotherapeutic techniques. As in surgery, the results of radiation vary according to the skill and experience of the radiotherapist and the facilities at his or her disposal. The results of radiation alone in the treatment of early lesions of the oropharynx are comparable to those obtained from surgery. This usually consists of delivering a dose of 60 to 70 Gy through a shrinking field to the primary lesion and to both sides of the neck over the course of 6 to 7 weeks, as indicated. Alternatively, reduced external radiation can be combined with radium implants, thereby boosting the tumor dose; however, implants are difficult to insert in the oropharynx. Likewise, submental boosts of external radiation have been used in an attempt to minimize osteoradionecrosis of the mandible. Low-dose, as well as twice-daily radiotherapy, has been reported to improve local control rates. As the stage of the tumor increases, the efficacy of radiotherapy alone declines, and planned combination radiotherapy and surgery appears to offer a better chance for cure.

Radiation alone, therefore, may be used effectively for (1) small limited cancers, (2) when surgery is not an option because of the lack of an experienced head and neck surgeon or adequate facilities for surgery, (3) when the patient is physically or emotionally unable to undergo extensive surgery, (4) if the patient refuses surgery, and (5) for palliation in the patient with an extremely advanced tumor.

Radiation should not, however, be indiscriminately used with a view to salvaging the patient with surgery later. The success rate with surgical salvage is extremely poor, and surgery after high-dose curative radiation is associated with high morbidity.

Radiation, itself, is not without complications and may be associated with unpleasant sequelae, for example, xerostomia, loss of taste, mucosal ulceration, osteoradionecrosis, pharyngeal necrosis with fistula formation, and hemorrhage.

Newer radiation techniques, including the use of hyperthermia, electron beam therapy, and twice-daily therapy, all await long-term follow-up in order for their precise role to be properly defined.

Combination Surgery and Radiation Therapy

The concept of combined therapy for advanced cancer is not new; however, only in the past 15 years has it been used on a consistent basis. The rationale for its use is based on the following observations:

The major reason for surgical failure is the residual viable tumor cells that are left in the patient. This occurs because of the unrecognized peripheral projection of malignant cells, undetected lymphatic or hematogenous metastasis, or the implantation of tumor during surgery. Conversely, the major reason for radiation failure is the projection of tumor outside the treatment field or the presence of anoxic cells in the center of the neoplasm that remain untreated. Therefore, theoretically, planned combination radiation and surgery should be able to minimize the source of failure in each method.

Although it is strongly suggestive that combined therapy offers the best prognosis for advanced tumors, there remain some unresolved points, namely, that there have, as yet, been no properly controlled trials that definitely support this concept. In addition, it is not yet clear whether preoperative or postoperative radiation should be used. In the 1970s, the use of preoperative radiation, usually consisting of 45 to 50 Gy followed by a 4-week delay to allow the acute radiation reaction to subside before the surgery, was the most popular regimen.

In recent years, however, the trend has been to perform the surgery followed by postoperative radiation consisting of 60 Gy. The advantage of this approach is that the operative morbidity is significantly diminished, a slightly higher dose of radiation can be given, and there is less chance of inadequate resection, as the margins are more easily identified. A disadvantage exists, however; if a surgical complication should occur, the radiation may be delayed sufficiently to become ineffective. In fact, open wounds may be irradiated without fear of worsening the situation and preventing healing. Preoperative radiation is favored by the fact that the tumor would theoretically be more radiosensitive if the blood supply were not compromised by the surgery and that radiation may seal off the lymphatics, thereby allowing subsequent surgical manipulation without fear of tumor seeding. Overall, though combined therapy seems to be more effective in advanced tumors, there seems to be little difference in survival rates between patients treated with preoperative radiation versus those treated with postoperative radiation.

Adjunctive Chemotherapy

Chemotherapy has been used as a last resort for terminal cancer patients for many years, with its role being palliative in relieving pain and obstructive symptoms. The use of chemotherapeutic agents as an adjunct to both surgery and irradiation in the treatment of head and neck cancer continues to provoke interest. Unfortunately, though many drugs have shown tremendous promise in this role in terms of causing tumor regression, there is no definitive evidence that this approach has any influence on ultimate long-term prognosis. Whether adjunctive chemotherapy will aid in the control of local disease or prevent tumor dissemination as yet remains unanswered. It is to be hoped that chemotherapy will one day take its place as part

of a multimodality treatment regimen for head and neck cancer.

Surgery

Historically, it should be appreciated that the reason radiation assumed a dominant role in the treatment of oropharyngeal cancers is because the oropharynx was assumed to be inaccessible to surgical resection. Today, however, myriad surgical approaches to lesions of the oropharynx have been described (Table 3). Which approach is optimal for a particular cancer is dependent on the site and size of the tumor and on whether a concomitant lymph node dissection is needed.

Table 3. Surgical Approaches to the Oropharynx

Intraoral resection
Mandible-sparing procedures
    Lateral pharyngotomy
    Transhyoid pharyngotomy
Mandible-splitting procedures
    lateral osteotomy
    Midline osteotomy
Composite resection (jaw-neck procedure).

Intraoral Resection

Great caution should be exercised before recommending an intraoral resection for cancer of the oropharynx. It is a very rare lesion, indeed, that is amenable to such an approach. Included in this warning is the inclination to perform a tonsillectomy for squamous cell cancer apparently confined to the tonsil. Cancer does not obey normal tissue planes, and this operation can at best be interpreted as a debulking procedure and at worst as opening tissue planes for further spread.

Some lesions may, however, benefit from intraoral resection, including (1) superficial exophytic lesions, particularly those arising from the posterior oropharyngeal wall and soft palate, and (2) the "condemned mucosa", with multicentric lesions frequently identified on the soft palate. These lesions may be treated by superficial local excision or ablation of the affected epithelium. The excision can be accomplished using a scalpel, cautery, or CO_2 laser with equally good results. The CO_2 laser certainly has some advantages, including improved hemostasis, less edema, and more preciseness, but it is certainly *not* essential for the treatment of these lesions. As always, frozen section control should be performed when excising these tumors, not only from the peripherally but also from the depth of the resection.

After resection, the defect is usually allowed to heal by secondary intention. Occasionally, a nasogastric tube may be needed for a few days to facilitate healing.

Other defects may be closed primarily by mobilizing the surrounding mucosa or by using a split-skin graft, which should be quilted into position or, if necessary, stented with a bolster.

Mandible-Sparing Procedures

Lateral Pharyngotomy is an excellent approach to moderately sized lesions on the posterior and lateral pharyngeal wall provided that they are small enough and inferior enough so that adequate access can be attained without disrupting the mandible. Of course, if the lesion is large, the pharyngotomy may be extended superiorly and combined with a lateral mandibular osteotomy to improve access. This technique may be combined with a neck dissection. It has also been described as an approach for cancers arising from the tip of the epiglottis or the base of the tongue, but these lesions invariably require a supraglottic laryngectomy for resection. Key points in the technique are to enter the pharynx by retracting the thyroid ala medially and incising the mucosa of the upper pyriform sinus and extending the incision superiorly. The superior laryngeal nerve must be identified and avoided.

Transhyoid Pharyngotomy. The transhyoid pharyngotomy is an excellent approach to lesions of the lower posterior oropharyngeal wall that are too large or too inferior to remove transorally. It, too, has been described as an approach to base of the tongue and epiglottic carcinomas, but it is not advisable to use this technique in such situations because the pre-epiglottic space is violated and the vallecula is entered blindly with a danger of compromising the resection. It may, however, be useful for benign lesions in these areas.

Technically, the incision is made over the hyoid bone; flaps are then developed and the body of the hyoid is removed. Care is taken not to damage either the superior laryngeal or hypoglossal nerves. The vallecula is entered, and an excellent view of the posterior pharyngeal wall is obtained. After resection, the wound is closed primarily. A temporary tracheostomy is performed, and the procedure can be combined with a neck dissection if indicated. This procedure results in an excellent cosmetic and functional result.

Mandible-Splitting Procedures

If access to the tumor cannot be readily obtained by working around the mandible, it may be necessary to split the mandible for adequate exposure. After the resection and reconstruction has been completed, the mandible is then reapproximated and is either wired or plated into position. Two types of osteotomies may be performed.

Lateral Osteotomy. Classically known as Trotter's operation, this technique necessitates a stepped osteotomy of the body of the mandible, with the exact site depending on the size and site of the tumor and the state of the patient's dentition. It may be combined with a concomitant neck dissection, and after the mandible has been splayed apart, the tumor is removed in continuity with the neck dissection. After resection, the mandible is approximated using wire or plating.

The ideal indications for this procedure are moderately sized lesions of the tonsil, lateral pharyngeal wall, or base of the tongue that are not in close proximity to the mandible or directly invading the mandible itself. If postoperative radiation is to be given, this type of osteotomy is contraindicated because it will be in the radiation field, and nonunion may result. It would, therefore, be better to perform a midline osteotomy that would be out of the radiation field.

A further, if somewhat minor, sequela of this approach is that the inferior alveolar nerve is transected, with resultant anesthesia in its distribution.

Midline Osteotomy. Perhaps a more useful technique for splitting and preserving the mandible is the midline osteotomy. Much discussion exists as to whether the osteotomy should be symphyseal or parasymphyseal and whether it should be straight or stepped. It is our opinion that the actual osteotomy is best performed in a stepped manner just anterior to the mental foramen, ensuring that the inferior alveolar nerve is preserved. The mandible is then swung apart after a release incision is made along the lateral floor of the mouth, leaving an adequate cuff of mucosa on the lingual surface of the alveolar ridge to allow primary closure or flap reconstruction. After the lesion has been excised and reconstructed, the mandible is reapproximated and plated.

This technique is likewise indicated for moderately sized lesions of the oropharynx that do not invade the mandible. It is also an excellent approach to posterior pharyngeal wall and base of the tongue cancers.

A variant of this technique is the *median translingual pharyngotomy* (median labiomandibular glossotomy), which also requires a midline osteotomy, but instead of releasing the mandible along the lateral portion of the floor of the mouth, the tongue is divided down the midline. This is useful as an approach to the posterior portion of the pharynx or for resection of benign or low-grade malignancies of the base of the tongue. This approach results in minimal functional deformity but is only rarely indicated.

Composite Resection (Jaw-Neck Procedure)

Composite resection consisting of a neck dissection, together with partial mandibulectomy and in continuity excision of the oropharyngeal lesion, has been and still is the cornerstone for the management of advanced cancers of the oropharynx. It is without a doubt the method of choice for extensive cancer, for cancer with over mandible involvement, and for postradiation salvage situations in which the exact extent of the tumor is unclear. Although regarded as a very radical procedure, it may be associated with a very unacceptable cosmetic and functional result under the most ideal circumstances.

Details of this procedure are readily available in most surgical atlases, and only the highlights will be presented here.

The incision usually consists of a modified Frazier or McFee incision, which will allow a radical neck dissection to be performed. The upper horizontal incision may allow a degloving approach to the oropharynx or may be extended into a lip-splitting incision to improve access if necessary. This is not, in our experience, routinely necessary.

A standard neck dissection is then performed and is pedicled on the angle and posterior third of the body of the mandible. It is very important to be sure that the neck dissection is completely free from the carotid system before attempting resection of the primary tumor. Occasionally, in advanced tumors when there is a perception that the tumor has extended into the upper part of the neck, it is better to perform the upper neck dissection, particularly the submandibular triangle, in continuity with the excision of the primary tumor.

Initially, mucosal cuts are made to delineate the area to be resected, and a spinal needle is passed from the oral cavity into the neck at the site of the anterior line of excision external to the mandible to mark out the site of the anterior osteotomy. The periosteum along the lower aspect of the body of the mandible is then incised and carefully elevated, exposing the mandible to be excised. The anterior osteotomy is then performed. The superior or posterior osteotomy can be performed just below the temporomandibular joint. Occasionally, it may be necessary to disarticulate the temporomandibular joint to obtain an adequate margin. If reconstruction of the mandible is being contemplated, it may be advisable to perform a vertical posterior osteotomy just posterior to the entrance of the inferior alveolar canal, leaving a 2 cm-wide vertical strut of mandible.

Using a heavy scissors intraorally, the mucosal cuts on the soft palate are deepened through the nasopharynx, and the dissection is continued along the mucosal incisions. The segment of the mandible with the tumor is then splayed outward exposing the full extent of the tumor, which can now be easily resected from the external approach by following the previously performed mucosal cuts. The pterygoid musculature is divided last because dissection in this area is often accompanied by profuse bleeding. The secret to removal is adequate exposure and an exact three-dimensional concept of the extent of the proposed excision.

At this stage, the cut end of the mandible is rongeured to prevent the sharp edge from eroding through the skin. The defect is then reconstructed, as described further on. After reconstruction, a dermal skin graft is placed over the carotid artery unless it can be covered by the muscle pedicle of a myocutaneous flap.

In an uncomplicated situation, the postoperative management is relatively simple, with the tracheostomy being removed at 7 days and the nasogastric tube a few days later. There may be difficulty with deglutition and aspiration initially, but the patient quickly learns to overcome this. Antibiotics are used prophylactically in the perioperative period.

Indications for Associated Laryngectomy

Squamous cell cancer of the base of the tongue may extend inferiorly to involve the supraglottic larynx and the pre-epiglottic space. In this situation, a decision has to be made as to whether to perform a total or supraglottic laryngectomy in combination with the glossectomy. Essentially, a number of factors need to be taken into account in this decision-making process, particularly the general physical and emotional status of the patient, the extent of the tumor, and the respiratory reserve. In general, a young healthy patient with less than half of the base of the tongue removed, leaving at least one hypoglossal nerve intact, will be able to tolerate a concomitant supraglottic laryngectomy without significant aspiration problems. If, however, a large portion of the base of the tongue needs to be removed, or both hypoglossal nerves need to be sacrificed, it is probably better to perform a total laryngectomy to prevent severe aspiration problems. Likewise, in the poor-risk patient with poor pulmonary reserve, it may also be advisable to perform a total laryngectomy even though the partial laryngectomy is technically feasible.

Another clinical situation that should be considered is a large lesion of the base of the tongue not involving the larynx, but necessitating total glossectomy for adequate excision. In this situation, the larynx does not require resection oncologically, and every attempt should be made to try to preserve the larynx. Deglutition will be severely compromised in most cases, and if the aspiration is severe, a temporary or permanent gastrostomy may be needed. This, however, is a small price to pay for preserving so important a structure. Many well-motivated patients may even be able to learn to swallow without aspiration. The larynx can always be sacrificed as a second-stage procedure if the patient is totally unable to overcome the swallowing difficulties.

Reconstruction

If there has been any advance in the past decade in the management of head and neck cancer, it has been in the realm of reconstruction. Adequate reconstruction is not only important from the aesthetic point of view but also, of course, is vital functionally. Poorly conceived reconstruction will result in significant alteration in speech, mastication, and deglutition. However, the resection should never be tailored to fit the preconceived reconstructive plan, as any compromise will result inevitably in recurrent cancer and subsequent death.

Healing By Secondary Intention

Small defects of the soft palate and posterior pharyngeal walls following intraoral resection can comfortably be allowed to heal by secondary intention, particularly if the area excised is relatively superficial, for example, mucosa and submucosa. This is frequently preferable to primary closure, particularly if advancing the edges of the defect will lead to distortion of the pharynx.

Primary Closure

Almost any defect of the oropharynx can be repaired by primary closure. However, the resultant distortion of the pharynx may be so significant that all the vital functions of the pharynx and, for that matter, the oral cavity are compromised. Small superficial and through-and-through defects are, however, quickly and easily managed in this way.

Primary closure used to be the technique of choice following composite resection because of its ease and simplicity and because of the difficulty experienced in raising a reliable flap. Indeed, one of the indications given for performing a partial mandibulectomy was not for oncologic reasons but to facilitate this closure.

If performed, this technique should consist of a three-layered closure with the most important suture being at the trifurcation of soft palate, tongue base, and buccal mucosa. Great care should be exercised to avoid tethering the tongue too high on the lateral pharyngeal wall, as this will result in difficulty with deglutition. Also, the contralateral tonsillolingual fold may be released to allow mobilization of the tongue and minimize the tension on the suture line.

Primary closure following a jaw-neck procedure in this modern day is only rarely performed because of the acknowledged advantages of flap reconstruction.

Free Skin Graft or Dermal Graft

Free skin grafts are extremely useful in closing defects of the posterior pharyngeal wall and may be maintained in position by means of stenting or by the quilting technique. This use of a stent in the oropharynx necessitates a temporary tracheostomy and, for this reason, quilting is preferable; however, it does not appear to fix the graft as well as a stent.

Split-skin graft reconstruction following a through-and-through composite resection has been used successfully. This method uses a large redundant pouch of either split skin or dermal graft, which is sutured into the defect with a single layer of absorbable suture. This pouch is then packed with a bolster consisting of an antibiotic ointment-impregnated iodoform gauze. This results in a saliva-tight anastomosis and minimal shrinkage. Intermaxillary fixation assists in graft immobilization, thereby improving graft acceptance. Although excellent results have been reported, and the technique is certainly quickly and easily performed, a regional flap is probably preferable in the vast majority of cases.

Tongue Flaps

The tongue, because of its size, composition, and situation, is ideal for reconstruction of regional defects, particularly following resection of the base of the tongue and lateral pharynx. The advantages of the tongue flap are (1) that it has a rich blood supply, which ensures viability, even under the most adverse circumstances and (2) that no additional defect is created, as is the case if regional flaps are used.

The major disadvantage is that speech and deglutition will be adversely affected to a greater degree than when using other forms of reconstruction. If it is though that this may be a major factor in the postoperative rehabilitation of the patient, it is better not to use these flaps.

Numerous tongue flaps are available for reconstruction. The easiest technique for reconstructing the lateral pharynx consists of dividing the tongue longitudinally in the midline and basing the flap laterally on the floor of the mouth. The flap is filleted to increase its surface area and is then rotated 180° into the surgical defect and is sutured into position. The remaining portion of the tongue is then closed upon itself. A variation of this technique is the set-back technique, which can be used to close base of the tongue defects.

Another alternative is to base the tongue posteromedially, but this is possible only if a minimal amount of tongue has been involved in the resection.

Some controversy exists as to whether to denervate the tongue flap in order to decrease its movement and, therefore, its metabolism, rendering it more liable to survive. Others believe that the intact nerve supply aids in subsequent deglutition.

Regional Cutaneous Flaps

The advantage of regional skin flaps is that they enable tension-free reconstruction using viable, nonirradiated, healthy tissue.

For many years, the *forehead flap* was the definitive flap for reconstruction of these defects. It was enormously popular because of its great reliability. The donor site defect, however, was unacceptable cosmetically. Even though it is hardly used today, some knowledge of this flap is essential, as it may still be indicated if no other flap is available. If this flap is to be used, every effort should be made to preserve the superficial temporal artery during the neck dissection so that there will be adequate blood supply to the flap. The flap is carefully elevated from the forehead down to the pericranium, ensuring that the postauricular vessels are incorporated in the flap. It is then rotated into the oropharynx through a separate incision 2 cm below the zygoma. Care must be taken to ensure that the incision is large enough so that it does not constrict the flap. The flap is used to close the defect, and the pedicle is tubed externally. Split skin is then placed over the donor site.

An alternative technique is to deliver the flap under the zygoma, or occasionally the zygomatic arch may need to be resected to prevent constriction of the flap. In 2 to 3 weeks, the pedicle is constricted with a tourniquet to determine its viability and then, as a second stage, the unused portion is severed and returned to the forehead.

The versatile *deltopectoral flap* is an excellent means of reconstructing this defect. It may be used in two ways: 91) as a two-stage procedure whereby the flap is sutured into the defect after inversely tubing its pedicle under the skin flaps, which creates a controlled pharyngostoma that has to be closed as a second stage and (2) as a one-stage procedure in which the pedicle is

deepithelialized prior to suturing the flap into the defect. This allows the pedicle to be buried within the wound and eliminates the need for a second stage. Great care should be exercised when deepithelializing the pedicle to avoid compromising the blood supply of the flap.

Myocutaneous Flaps

In the past decade, myocutaneous flaps have gained increasing popularity as the definitive method for reconstructing defects in the oropharynx. The pectoralis major, trapezius, sternocleidomastoid, and latissimus dorsi flaps all have a role, either on their own or combined with bone as an osteomyocutaneous flap if the mandible needs to be reconstructed. Of these flaps, the pectoralis major remains the most popular because of its reliability and ease of harvesting. The sternocleidomastoid flap is the least useful because of its rather tenuous blood supply as it is increasingly mobilized. In addition, it may well be contraindicated in patients who will require a radical neck dissection for ablation of the tumor. Trapezius myocutaneous flaps are not quite as reliable as the pectoralis major flap, and as the patient requires repositioning intraoperatively, it is not very convenient.

The advantages of these flaps are that a large defect may be closed, and the bulkiness of the pedicle not only protects the carotid system but also camouflages the cosmetic defect created by the neck dissection and partial mandibulectomy. The bulkiness of the flap initially may be a problem, impairing deglutition and even the airway occasionally, but this usually settles with time.

Free Flaps With Microvascular Anastomosis

Free flap reconstruction of the oropharynx has always been an attractive concept. The groin flap, dorsalis pedis flap, latissimus dorsi flap, radial forearm flap, and free jejunal graft have all been used with great success. Many of these flaps may be used not only on their own but also combined with underlying bone to provide reconstruction of the mandible if indicated. The major advantage is the ability to harvest an almost limitless amount of tissue that can be used to close almost any defect. The disadvantages are that it is time-consuming, requires a two-team approach with personnel well trained in microvascular technique, and the recipient site must have at least one artery and one vein available for use. Although the artery poses no difficulty, the venous component may not be readily available after a radical neck dissection, and a vein graft may become necessary. The popularity of this technique will, therefore, always be limited because of the inconvenience associated with it. When facilities for this technique exist, however, it is a most attractive alternate approach to reconstruction.

The free jejunal graft can be used as a patch graft for limited repair of the pharynx or as an intact tube for reconstruction following total laryngopharyngectomy for extensive tumors. The major disadvantage as a patch graft is that hypersecretion from the jejunum results in severe aspiration problems, rendering it inconvenient to use. Conversely, it is an excellent technique for reconstructing the total laryngopharynx, with the ability for it to stretch high up into the nasopharynx and down into the superior mediastinum. The radial forearm flap, at this stage, is

probably the most convenient and reliable free flap for reconstruction of partial oropharyngeal defects.

Reconstruction of the Mandible

Significant controversy exists as to the indications for reconstruction of the posterior aspect of the mandible following composite resection. Although aesthetically and functionally it appears reasonable to reconstruct, this is not always necessary provided that the soft tissue has been adequately replaced. The methods of reconstructing are multiple, and the ideal method in any one situation would frequently depend on the technique used for soft tissue reconstruction; for example, bone can be incorporated in a free flap, eg, iliac crest or radius and rib or scapula can be used with a myocutaneous flap. There has recently been a resurgence of interest in using mandible replacement plates. This may well prove to be the easiest and least time-consuming method for posterior mandible replacement.

Palliation

The management of the patient who is incurable either because of late presentation or failed therapy is a tremendous challenge to the oncologist. Every effort should be made to alleviate suffering and to allow the patient to spend his or her last days with dignity. The use of irradiation or chemotherapy to obtain tumor shrinkage or to alleviate pain should be considered. Tracheostomy, esophagostomy, or gastrostomy may be indicated. Placement in an institution even for short periods to relieve the burden on the relatives and friends may be necessary. The patient's medication - for example, analgesics - must be constantly reevaluated to ensure that pain is controlled.

Rehabilitation

For too long, the act of ablating the carcinoma, no matter how radical the procedure, to cure the patient was regarded as the goal of both the oncologist and the patient. In recent years, however, great emphasis has been placed on the total rehabilitation of the patient. In order to accomplish this, probably the most important factor is the patient's motivation. Without the patient wanting to be rehabilitated, the oncologist and the rehabilitation team are helpless. Total rehabilitation is the function of a team of professionals, with the surgeon playing a lesser but coordinating role. Speech therapists, physical therapists, social workers, occupational therapists, prosthodontists, and nurses, together with the patient's immediate family, are all vital members of this team. A number of factors have to be considered.

Cosmetic Appearance

With younger patients and more women being treated for this disease, there is an increasing awareness of the cosmetic appearance after therapy. Although much of the surgery is mutilating to some degree, modern reconstructive modalities have been able to minimize the deformity created. Certainly the surgery should never be compromised in an attempt to minimize

the defect created. Scars in the neck can be covered with scarves, hair may be styled to cover the defect, and men may grow beards.

Speech

Dysarthria is a consequence of oral cavity and oropharyngeal resection, with the degree of tongue removal being the dominant factor in determining the severity of the speech defect. The articulation defect most apparent is in the formation of speech fricatives (eg, this, that) that require linguodental approximation. Prevention by ensuring that the tongue is not tethered too high or too low if primary closure is used or by the interposition of flaps or grafts to provide more mobility is the best method of treatment. If a tongue tie does result, however, the problem can be improved by dividing the scar tissue and placing a generous split-thickness skin graft to release the tongue or by using a CO_2 laser for tongue release. A speech therapist is invaluable in aiding these patients postoperatively.

Velopharyngeal incompetence due to removal of much of the soft palate is another cause of dysarthria. Although the soft palate can be replaced intraoperatively with an inert flap, it has been our experience that prosthetic rehabilitation in the postoperative period affords the best relief.

Deglutition

If a large portion of the tongue has been removed and the remaining tongue is tethered, the posterior propulsion of food into the hypopharynx becomes awkward. The bolus has a tendency to be propelled down the side of the surgical defect and often directly into the larynx. This, combined with the anesthesia of the flap-covered portion of the pharynx, results in aspiration problems with all the sequelae of repeated lower respiratory tract infections, fear of eating, and debility. Most patients can be trained to correct this problem by swallowing therapy. Occasionally, a cricopharyngeal myotomy may be necessary as a secondary procedure if the swallowing problem continues. This has, unfortunately, been of only limited value in our experience. Velopharyngeal incompetence with reflux of food through the nose is also a problem but is helped by the use of a dental appliance.

Mastication

In patients in whom partial mandibulectomy has been performed, the mandible is frequently deviated by scarring, resulting in interference with mastication. Once this has developed, two dental devices may be used to correct it: the maxillary guide plane and the mandibular flange prosthesis. The maxillary guide plane is a plastic ramp that extends the occlusal surfaces of the posterior teeth on the functional side toward the midline. The teeth of the divided mandible make contact on the plane and are guided into occlusion by the ramp. The mandibular flange prosthesis is used in dentulous patients. Metal frameworks are fitted to both maxillary and mandibular arches, and the flange is built up vertically from the buccal aspect of the lower teeth, which extends into the maxillary buccal sulcus at which point it rests against a

bar extending from the maxillary framework. As the patient opens and closes the mandible, the flange prevents any horizontal deviation. The frameworks are removed at a later stage. Exercises to maintain proper occlusion are helpful.

Prevention, however, is far more important, and without a doubt the best prophylactic measure is the judicious use of flap reconstruction to prevent scarring and tethering of the mandibular remnant. In addition, reconstruction of the mandible using bone or plating, particularly if the ipsilateral temporomandibular joint has not been disturbed, will further improve this situation. The use of external splints (Joe Hall Morris splint) for a number of months postoperatively may be advantageous, but in our experience has usually proved unnecessary.

Psychosocial Functioning

Too often, insufficient attention is devoted to the tremendous psychologic adjustments the patient has to make, with attention zeroing in on his or her physical adjustments. The emotional status of the patient in the postoperative period is important. The patient is frequently depressed, and this interferes with motivation for physical rehabilitation. An experienced and understanding nursing, medical, and paramedical staff is, therefore, important in aiding the patient to overcome this problem. If necessary, psychiatric guidance should be sought.

In addition, there may be a change in the relationship with the immediate family driven by fear of being rejected by them. Adequate family counseling is vital. The patient must learn to accept the situation and make the necessary alterations in life style to compensate for the particular disability.

Prognosis (Table 4)

Comparisons of survival rates for cancer of the oropharynx are extremely difficult because of the changing methods of classification and the difference in interpretation of the material. For this reason, controversy still exists as to the relative advantages and disadvantages of one form of therapy over another. A relatively small number of cancers of the oropharynx are seen, and this is compounded by the fact that the oropharynx is divided into four major locations (tonsil, base of tongue, soft palate, and pharyngeal wall) and this, together with 24 possible T and N combinations, results in cancer of the oropharynx being divided into 96 separate categories requiring accurate analysis. In addition, reporting of end results has not been uniform and further complicates comparisons. Results of therapy are frequently reported in terms of local control as opposed to survival. Survival is reported as absolute, actuarial, and determinate. Consequently, one is forced to review results carefully and with some skepticism, and in the final analysis be compelled to make recommendations based on personal experience. Hopefully, these factors will become standardized over the years and allow more meaningful interpretation of the results.

The prognosis for oropharyngeal carcinoma depends on the location of the primary tumor and the stage at the time of presentation. Soft palate cancers tend toward an earlier diagnosis and, therefore, an earlier stage at the time of presentation. They respond well in their early stage to

either radiation or surgery, with excellent survival rates. Unfortunately, in the late stages of advanced disease, the survival is extremely poor.

Table 4. Survival Rate for Cancer of the Oropharynx

	Stage 1	**Stage 2**
Tonsil	63%	21%
Base of tongue	42-63%	10-21%
Pharyngeal wall	77%	20%
Palatine arch	75%	10%.

Tonsillar cancers are more aggressive and more advanced at the time of diagnosis and, once again, the early lesions do well whatever modality is used, with the advanced lesions doing poorly in spite of combination therapy consisting of surgery, radiation, or chemotherapy, or any combination. The presence of clinically significant regional node metastases, pain, and tongue involvement are associated with a significant decline in survival.

Because of the advanced stage at the time of presentation, base of tongue cancers have very poor survival, irrespective of the therapeutic modality.

Primary cancers of the pharyngeal wall occur less commonly but tend toward more extensive disease at presentation.

Overall, it appears that single-modality treatment, be it irradiation or surgery, may well be adequate for the very early lesions, with the possible benefits of combined therapy being negated by increased morbidity. However, the larger lesions appear to do better with combined therapy.

Of interest is an analysis of the reasons for failure. Inability to eradicate the cancer at the primary site, with local recurrence, is by far the most important cause of failure, and it invariably occurs within 2 years. The next most common sites of recurrence are in the neck, particularly on the contralateral side, and distant metastases. In patients who survive, the chances of developing a second or third primary cancer in the upper aerodigestive tract or in the lower respiratory tract are, of course, high.