Chapter 74: Malignant Neoplasms of the Oropharynx

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Proper evaluation and treatment of tumors of the oropharynx require knowledge of the anatomy, staging, etiology, histopathology, and clinical behavior of the cancer; of the various options for treatment; and of the proper management of immediate and long-term complications. Generally a team, including an otolaryngologist, radiation therapist, medical oncologist, prosthodontist, speech therapist, and nursing specialist, offers the best comprehensive treatment.

Anatomy

The oropharynx includes four different sites: (1) the base of the tongue, (2) the soft palate, (3) the tonsillar area (fossa and pillars), and (4) the posterior pharyngeal wall. The oropharynx extends from the plane of the hard palate superiorly to the plane of the hyoid bone inferiorly and is continuous with the oral cavity (Figs. 74-1 and 74-2). The faucial arch includes both surfaces of the entire soft palate and the uvula, the anterior border of the base of the anterior tonsillar pillar, and the line of the circumvallate papilla. The base of the tongue extends from the line of the circumvallate papilla to the junction with the base of the epiglottis (the vallecula), and includes the pharyngoepiglottic and glossoepiglottic folds.

The lateral wall of the oropharynx is made up largely of the tonsil and tonsillar fossae. The posterior tonsillar pillar, the narrow lateral wall, and the posterior wall comprise the pharyngeal wall. The tonsillar fossa, which harbors the palatine tonsil, is an area bounded anteriorly by the anterior tonsillar pillar (palatoglossus muscle) and posteriorly by the posterior tonsillar pillar (palatopharyngeal muscle). The soft palate includes the uvula and is continuous laterally with the tonsillar pillars. Lateral to the tonsil region are the pharyngeal constrictor muscles, the mandible, and the lateral pharyngeal space. The internal carotid artery is just lateral and posterior to the tonsillar fossa (Fig. 74-3).

The posterior pharyngeal wall of the oropharynx begins at the inferior limit of the nasopharynx around the soft palate and extends inferiorly to the epiglottis. This wall is composed of mucosa, submucosa, pharyngobasilar fascia, underlying superior constrictor muscle, and buccopharyngeal fascia. Loose areolar tissue occupies the space between the buccopharyngeal fascia and the prevertebral fascia. The buccopharyngeal fascia acts as a natural barrier to prevent posterior extension of carcinoma. A tumor often will invade the muscle but not penetrate this fascia, thereby allowing a clear margin of resection. In larger and more aggressive tumors, however, the buccopharyngeal fascia may be penetrated; if this occurs, the prevertebral fascia is involved with the tumor fixating to the vertebra. This tumor usually cannot be resected.

The mucosa at the base of the tongue is irregular, and the lingual tonsil lies on the base's surface. Generally these are more concentrated toward the lateral areas. Palpation may confuse this irregular area with disease. A midline mucosal fold, the glossal epiglottic fold, divides the vallecula and connects the base of the tongue to the epiglottis (see Fig. 74-3). Deep to the tonsillar fossa lie the superior constrictor and upper fibers of the middle constrictor muscle. Other muscles that affect this area are the palatoglossus, palatopharyngeal, salpingopharyngeal, and stylopharyngeal. The major blood supply to the tonsil is the tonsillar branch of the facial artery. Other involved vessels include the ascending pharyngeal and dorsal lingual arteries and the palatine branches of the internal maxillary and facial arteries. The peritonsillar veins pierce the inferior constrictor muscle and drain into the common facial vein and pharyngeal plexus (see Fig. 74-2).

The posterior wall of the oropharynx is related to the second and third cervical vertebrae. Tumors of the oropharynx may extend to the parapharyngeal space, which extends from the base of the skull to the hyoid bone (Fig. 74-4). It is bounded anteriorly by the pterygomandibular raphe and posteriorly by the prevertebral fascia. The lateral boundary is the internal pterygoid muscle, mandible, and deep surface of the parotid. The medial boundary is the tonsillar area and superior constrictor muscle. Tumor invading this space may involve the carotid artery and the internal jugular vein, as well as the ninth, tenth, eleventh, and twelfth cranial nerves (CN IX, X, XI, and XII). Once the nerves are involved, the tumor may spread peripherally or extend closely along the nerves to the base of skull area. Involvement of the pterygoid muscles will produce trismus.

The most common lymph node initially involved with a lesion of the oropharynx is the jugulodigastric. Lesions of the base of the tongue and lateral oropharyngeal walls also may drain to the retropharyngeal and parapharyngeal nodes. These nodes drain into the jugulodigastric and posterior cervical groups. Base of the tongue and midline palatal areas may drain bilaterally.

Histopathology

As in the oral cavity, precancerous lesions may occur in the oropharynx, but to a lesser extent. These lesions include leukoplakia secondary to hyperkeratosis with or without atypical changes, erythroplasia, lichen planus, and nicotine mucositis. In the oropharynx the palate is most likely to be involved with any of these changes.

Any white plaque may be described as *leukoplakia*. This is a clinically descriptive term and has no pathologic meaning unless qualified by a biopsy. A leukoplakia lesion may reveal hyperkeratosis, with or without atypical cellular changes, or early invasive carcinoma. Most cases of benign leukoplakia are secondary to smoking habits. Erythroplasia is a flat or slightly elevated, circuscribed injected plaque. These lesions are more likely to be associated with underlying carcinoma or leukoplakia lesions with very atypical changes. *Lichen planus* is usually a delicate, white, lacy lesion on the buccal mucosa; however, it may occur on the soft palate. *Nicotine mucositis* may produce changes on the palate that range from leukoplakia, hyperkeratotic areas to injected, flap plaques or small, raised lesions. At times many palatal mucosal changes may involve different appearances, and distinguishing those that are clinically significant is difficult. These are often seen in patients who are heavy smokers and drinkers, and many reveal extensive mucosal changes in the oral cavity and oral pharynx.

Squamous cell carcinoma

More than 90% of malignant tumors in the oropharyngeal region are squamous cell carcinoma. Grossly, these tumors may be exophytic and bulky or ulcerative and deeply infiltrative. Histologically, squamous cell carcinoma may be separated into nonkeratinizing, keratinizing, verrucous, spindle cell, and adenoid squamous carcinoma.

Keratinizing and nonkeratinizing carcinoma

Nonkeratinizing carcinomas may be well or poorly differentiated. Classically they spread submucosally and have a "pushing" margin. They are derived from a respiratory tract mucosa, which originates endodermally. Keratinizing squamous cell carcinomas are considered to derive more often from ectodermally derived tissue. Generally these lesions tend to be ulcerative and fungating, have less of a tendency for submucosal spread, and have infiltrating margins. The keratinization characteristics of a squamous cell carcinoma do not affect the rate of lymph node metastases or survival of the patient. In general, the degrees of differentiation and keratinization of the primary tumor are less relevant than the primary tumor's location, size, stage, and extent of deep invasion.

Verrucous carcinoma

Verrucous carcinoma occurs rarely in the oropharynx and more often in the oral cavity. It is a histologic variant of a well-differentiated squamous cell carcinoma. Histology reveals well-differentiated, keratinized epithelium in long, papillomatous folds. Growth is usually slow, producing few symptoms. Regional lymph nodes may be confusingly enlarged because of the inflammatory resopnse and may masquerade as metastatic tumor. The lesion may erode underlying structures, including bone, but does not demonstrate widespread surface involvement. Cellular atypism and mitosis are rare, and therefore multiple biopsies usually are required for definitive diagnosis. A deep biopsy demonstrating invasion of the deeper structures is helpful; having the surgical pathologist look at the lesion clinically is especially beneficial to correlate the histopathology with the clinical pathology. Recommended treatment is wide surgical excision. Radiation therapy is not recommended, since transformation to a more anaplastic aggressive form has been reported.

Spindle cell carcinoma

The histopathology of spindle cell carcinoma reveals a spindle-shaped mesenchymal cell resembling anaplastic sarcoma, with various mixtures of squamous cells. The epidermoid component may be overlooked unless many sections are reviewed. Electron microscopy reveals that these are variants of squamous cell carcinoma and are not primary connective tissue tumors. These tumors spread to regional lymph nodes; generally the treatment is the same as that for squamous cell carcinoma.

Adenoid squamous cell carcinoma

The adenoid squamous cell carcinoma is a rare variant and occasionally occurs in the base of tongue. These lesions must be distinguished from adenoid cystic tumors, which originate in the minor salivary glands in this area. They are treated the same as routine squamous cell carcinoma.

Lymphocytic lesion

The large amount of lymphoid tissue in the oropharyngeal area is sometimes involved in malignant transformation. The most common lymphocytic lesion is the *lymphoma.* This occurs especially in the palatine tonsil (Fig. 74-5), and it also may occur in the base of the tongue. These lesions may be unifocal or may involve many areas, particularly both palatine tonsils. They are more likely to be large and bulky, and the surgeon frequently is surprised to find such a large lesion with a relatively brief history of symptoms. These tumors usually do not appear as ulcerating lesions. Typically the tonsil is grossly enlarged. In many cases the entire tonsil is involved with homogeneous disease, and no evidence of normal tonsil is present. Lymphoma of the tonsil and base of tongue area may be the first symptom of systemic lymphoma, which may be widespread throughout the body. In other cases the disease may be diagnosed early and only the palatine tonsil or base of the tongue may be involved; or the disease may be limited to the primary oropharyngeal area and cervical sites (Table 74-1).

Salivary gland carcinoma

Since minor salivary glands are scattered throughout the soft palate and base of the tongue, occasionally adenoid cystic carcinomas and other salivary gland carcinomas may involve the oropharyngeal area. They behave as their counterparts in other head and neck areas, with local growth, perineural invasion, and metastasis to the lung. Other rare malignant tumors also may occur in the oropharyngeal area.

Etiology

The most significant factor associated with squamous cell carcinoma of the oropharynx is use of tobacco, although the correlation is less than with squamous cell carcinoma of the oral cavity. The oropharynx has fewer dependent drainage areas when compared to the oral cavity, which has several mucous reservoirs that pool and concentrate to dissolve carcinogens, promoting prolonged contact with mucosa.

Tobacco may vary in its carcinogenic activities, depending on use. The habit of "reverse" smoking practiced in certain countries consists of placing the lighted end of the cigarette or cigar inside the mouth. Poor habits include smoking cheap cigarettes with high concentration of toxins (BIDI) and chewing tobacco combined with slate, lime, or betel nut leaves. All these habits seem to increase tobacco's carcinogenic potential.

Most tumors of the oropharynx are seen in patients who are heavy drinkers as well as heavy smokers, and separating the effects of each agent is impossible. Alcohol certainly acts as a direct irritant to the mucosa and may also act indirectly by promoting malnutrition and sclerosis. These two side effects may stimulate activity of carcinogens in this area indirectly and may change mucosal reactivity to various carcinogenic stimulants. Patients who are heavy smokers and drinkers typically have extensive mucositis of the entire oropharyngeal and laryngeal area, manifested by injection of the mucosa. Other areas may be raised as well as injected and may present a confusing picture to the physician trying to distinguish simple irritative mucositis from a tumor (Fig. 74-6).

In some patients there appears to be a relationship between papillomavirus and cancers of the tonsil. DNA changes associated with papillomavirus have been documented in some patients with tonsillar carcinoma (Brandsma and Abramson, 1989).

Cases of oropharyngeal cancer are increasing, and the age of patients is decreasing. Previously it was diagnosed most often in 60- to 70-year-old patients; however, cases appearing in the fourth and fifth decades of life are common. The incidence is higher in males, and the male/female ratio is approximately 4:1. The incidence of oropharyngeal cancer is low compared to the overall cancers in the body. Of the almost 1 million new cancers diagnosed each year in the USA, approximately 7000 to 9000 are in the oropharynx.

Staging

The staging currently used is based on the American Joint Committee on Cancer (AJC) system (1980), as outlined in this section (American Joint Committee for Cancer End Results Reporting, 1980). In this system clinical staging is defined before therapy, and the initial classification does not change after response to subsequent treatment.

Staging tumors in the oropharynx may be difficult. The measurements usually are performed on the lesion's surface; however, this may not give an accurate definition of the tumor's size. A base of tongue lesion may be greater than 2 cm. The same applies to tonsillar lesions, especially if the lesion originates in the epithelium in the depths of one of the crypts. The surface lesion may be deceptive, and if palpation is not performed, the extent may be misjudged. Distinguishing between T3 and T4 lesions may be difficult; at times distinguishing between a lymph node and a direct extension of the primary tumor into the neck's soft tissues is impossible. Bimanual palpation to evaluate these lesions is mandatory. Computed tomography (CT) scans may be helpful in determining the depth and extent. Most tumors of the palate are easily visible, and staging is more accurate in these cases. Judging the location of the tumor's primary origin sometimes is difficult. Lesions of the tonsil are frequently extend to and involve the retromolar trigone and palate as well as the inferior lateral pharyngeal wall. Base of tongue lesions may involve the vallecula and epiglottis, and distinguishing between a supraglottic primary lesion and a base of tongue primary lesion may be impossible. Thus the physician must be careful in interpreting the data regarding tumors in this area.

Mechanism of Cancer Behavior and Clinical Presentation

As elsewhere in the body, oropharyngeal tumors spread along tissue planes of least resistance and along neurovascular structures in the head and neck. They extend to lymphatics and lymph nodes, erode into the blood vessels, and metastasize systemically to distant areas of the body. Microvascular invasion has a significant impact on survival. It is correlated with local and neck recurrences and distant metastasis (Close and Brown, 1989). Most squamous cell carcinomas of the oropharynx originate on the surface and generally spread in a surface fashion (Fig. 74-7).

As the lesion enlarges, deeper structures may be involved, and base of tongue tumors classically have a more vertical, deep growth pattern. When tumors involve the pharyngeal wall, submucosal spread is common, but the prevertebral fascia usually is not involved until an advanced stage. Generally tumors spread along preformed pathways such as fascial planes. This method of growth is more common than deep muscle invasion, at least initially. Perineural invasion by tumor may occur at any time but classically occurs early and frequently in adenoid cystic carcinoma. The functions of the involved nerve may or may not be compromised. Generally bone and cartilage are considered to be barriers to tumor spread and usually are not involved until an advanced stage. Periosteum and perichondrium are also natural tumor barriers because of their density as well as their lack of many capillaries. Once tumors in the oropharynx invade deeply, the parapharyngeal space may be involved, which allows tumors to spread up and down the neck from the base of the skull to the lower neck and even into the upper mediastinum (see Fig. 74-4).

Lymphatic metastasis

Lymphatic metastasis typically occurs in oropharyngeal carcinoma and most often is related to the depth of tumor invasion, the size of the tumor, and the amount of lymphatic channels supplying the primary site. Although with any primary site the occurrence of cervical metastasis is reasonably predictable, some unpredictability is present in each case (Table 74-2). This involves variability in terms of filtering and trapping of the lymph nodes. This, in turn, may be modified by inflammation and fibrosis from past disease or radiation. Generally cancers of the oropharynx metastasize in an orderly fashion superiorly to interiorly, rom the high cervical first-echelon nodes downward to the mid-cervical and lower cervical lymph nodes; however, this is not true in all cases. "Skipped" metastases may bypass the upper cervical nodes and may appear first as a lower cervical node. The lower cervical node may be clinically involved on the gross examination, and the physician might assume that intervening lymph channels also may be skipped. For treatment purposes, however, the physician should assume that the intervening lymph channels and lymph nodes are probably involved microscopically and that they should be treated. The physician also cannot safely assume that no microscopic involvement of the cervical lymph nodes has occurred if no palpable first-echelon nodes exist.

The primary-echelon lymph node drainage from the oropharynx is to the upper deep jugular chain (Fig. 74-8). The superior parapharyngeal nodes lie medial to the posterior belly of the digastric muscle deep to the sternocleidomastoid and also the tail of the parotid gland. The jugular chain of lymph nodes extends from the upper neck downward to the clavicle area, and these nodes lie very close to the internal jugular vein. A chain of lymph nodes also is distributed along CN XI in the posterior neck triangle. These nodes tend to be somewhat superficial; as CN XI enters the anterior neck triangle very superiorly, however, the nerve and its associated lymph nodes are deep and closely associated with the internal jugular vein at the base of the skull (Schuller et al, 1978). The posterior triangle contains far fewer lymph nodes than the anterior triangle, but these posterior nodes may be involved with oropharyngeal tumors more often than with tumors of the oral cavity.

Bilateral metastasis

Bilateral metastasis from tumors of the oropharynx may occur, especially from the soft palate and base of tongue area. Bilateral neck metastases occur more often from midline primary lesions and from tumors with bilateral lymphatic drainage. Contralateral lymph node metastases may occur from crossed primary afferent lymphatic vessels or after the first-echelon ipsilateral nodes are involved and secondary collateral lymphatic flow develops. This is especially true in patients who have had neck surgery and/or been treated with previous irradiation. Both these modalities typically change the lymph low, and collateral circulation increases. Tumor involvement of the upper cervical nodes also may change lymph flow (Fisch and Sigel, 1964). Unusual lymphatic involvement may represent a somewhat peculiar pattern of metastases from the obvious primary tumor; however, the physician must remember that the "unusual" lymph node metastases may represent metastatic spread from a second primary tumor that may not have been obvious initially. As with regional metastases, distant metastases occur with increasing frequency with larger tumors (Tables 74-3 and 74-4) (Berger and Fletcher, 1971).

There is a correlation betweem initial cervical lymph node involvement and development of distant metastases. The most common site of distant metastases are lungs, liver, and bones (Zbaren and Lehmann, 1987).

Base of tongue

Primary squamous cell carcinomas of the base of the tongue are relatively rare. The ratio of anterior two thirds lesions to base of tongue lesions is approximately 4:1. Base of tongue carcinomas are notorious for deep infiltration into the muscular tissues. Symptoms frequently do not appear until these lesions are at an advanced stage. They may produce a sore throat or a sensation of a mass in the throat.

The soreness may increase with swallowing, coughing, or any movement of the tongue. Referred otalgia may be the first symptom. Otalgia without obvious ear pathologic findings demands a thorough examination of the entire oropharyngeal, hypopharyngeal, and laryngeal areas. The referred otalgia is mediated through CN IX or X, with both nerves peripherally distributed in both the oropharyngeal and the ear areas (Fig. 74-9).

As the disease advances, the pterygoid muscles may be invaded, producing trismus. Base of tongue tumors may extend anteriorly to involve the oral cavity portion of the tongue. They may also extend superiorly and laterally to involve the tonsil (Fig. 74-10). Inferior growth results in extension into the lateral pharyngeal wall with involvement of the epiglottis and preepiglottic space.

Base of tongue tumors typically appear at a more advanced stage than tumors of the anterior two thirds of the tongue. Thus they have been considered very invasive, wildly metastatic, and anaplastic. The concept that base of tongue tumors are more aggressive may be a misconception and may only indicate that these tumors are ound at a later stage because of the lack of symptoms and the difficulty most primary care physicians have in examining this area. Asymptomatic early lesions are rarely diagnosed, since this area is not visualized by direct examination and requires a mirror to be inspected adequately. Some patients may have the sensation of a mass in the throat and may palpate it themselves. Internal bleeding and necrosis may produce rapid enlargement and pain. Many of these tumors may not be diagnosed until palpation of the base of the tongue area is performed, and in many cases the physician is surprised at the size of the lesion when first encountered. Extensive deep invasion may exist with only a very small surface lesion (Fig. 74-11).

As the tumor enlarges, lymph nodes metastases are common. The base of tongue area is rich in lymphatics, and the tumor's propensity for early invasion of the muscle predisposes it to early lymphatic involvement. The muscular contractions on the involved tumor may help propel the malignant cells at an earlier rate into the lymphatic system. The first-echelon node is the subdigastric (jugulodigastric) node (Fig. 74-12), with the metastatic path extending inferiorly to the midjugular and lower jugular nodes. The submaxillary and posterior cervical nodes also may be involved. Lymph node metastases at the initial appearance of this disease are extremely common, and the first symptom is often an enlarged high cervical node. Approximately 60% to 75% of patients with cancer of the base of the tongue have a clinically positive cervical node at the initial visit, and 20% to 30% have bilateral nodes (Fig. 74-13). Incidence of occult nodes in clinically negative necks is approximately 20%, but because of the selectivity of treatment regarding surgery and radiation therapy, the actual risk for occult disease probably is closer to 50% or 60% (Berger et al, 1971; Lindberg, 1972; Northrop et al, 1972).

Anterior tonsillar pillar and the tonsil

The anterior tonsillar pillar and the tonsil are the most common locations for tumors within the oropharynx. Rarely a primary tumor is limited to the posterior pillar. Frequently lesions on the anterior tonsillar pillar may appear as areas of leukoplakia or may be raised and infected. These may be asymptomatic until noticed by the patient looking at the mouth in the mirror, or they may be diagnosed by a routine oral examination before symptoms appear.

As the lesions enlarge, the central portion may ulcerate and the borders may rise. They may spread to the retromolar trigone and extend laterally to the buccal mucosa (Fig. 74-14). Once they involve the buccal mucosa, occult spread to the buccal fat pad may occur and appear as a subtle fullness in the cheek (Fig. 74-15). Some anterior tonsillar pillar lesions extend superiorly and medially to involve the soft palate and may even extent to the hard palate. As the lesions extend medially, they involve the tongue, and the prognosis subsequently worsens with this involvement. The anterior tonsillar pillar is reasonably close to the medial aspect of the mandible, and lesions adhering to the mandible and eventually invading the periosteum and bone are not unusual. Inferior alveolar nerve involvement in these tumors may occur at an earlier stage in elderly patients, since in edentulous mandibles the inferior alveolar nerve is more superficial and therefore is more prone to involvement from overlying mucosal cancers (Figs. 74-16 and 74-17). Tumors of the anterior tonsillar pillar eventually may spread posteriorly to involve the tonsil tissue. As these lesions erode deeply, the pterygoid muscles may be involved, producing trismus and pain (see Fig. 74-15).

Lesions arising primarily in the tonsillar fossa are less likely to appear as leukoplakia and frequently are exophytic or ulcerative (Fig. 74-18). These lesions usually extend posteriorly to the posterior pillar, interiorly to the lateral oropharyngeal wall, and interiorly and medially to involve portions of the base of the tongue. As these lesions enlarge, they extend laterally and penetrate the parapharyngeal space and may extend superiorly toward the base of the skull with neurologic involvement. Once these lesions extend inferiorly to involve the lateral pharyngeal wall, they may extend down to the piriform fossa. Lesions that arise primarily in the posterior tonsillar pillar may spread inferiorly along the palatal pharyngeal muscle, extending into the pharyngeal constrictor muscle, the pharyngeal epiglottic fold, and the posterior aspect of the thyroid cartilage. Since these lesions are more posterior, the spinal accessory lymph nodes are more likely to be involved, as are the posterior triangle lymph nodes.

Lesions of the tonsillar and pillar areas drain to the upper cervical nodes. Cancers involving the anterior tonsillar pillar have less risk of forming clinically positive lymph nodes compared to lesions limited to the tonsillar fossa. The anterior tonsillar pillar drains into the upper internal jugular vein lymph nodes, as well as into the submaxillary gland lymph nodes (Fig. 74-19). The risk of their involving the spinal accessory and posterior triangle lymph nodes is low. Contralateral spread infrequently occurs in early lesions, but the risk of occult metastases in clinically negative necks is significant (Barkley et al, 1972; Million et al, 1963).

Tonsillar fossa lesions have a higher risk of lymph node involvement compared to lesions of the anterior tonsillar pillar. The lymph node distribution for the tonsil includes the upper cervical as well as the spinal accessory and posterior triangle nodes (Fig. 74-19). Contralateral neck metastases also may occur, and the risk for this involvement increases as more structures are involved, such as the soft palate and base of the tongue. The risk also increases with enlarging ipsilateral neck nodes, which may produce obstruction and retrograde lymphatic flow. Although primary lesions of the posterior tonsillar pillar are rare their lymph node metastatic direction also would be more posterior, with involvement of the high cervical as well as the spinal accessory and upper posterior triangle nodes (Fig. 74-19).

Unlike base of tongue lesions, tonsillar and anterior tonsillar tumors may be easily visualized, and dentists and physicians frequently diagnose them on routine oral examinations (Fig. 74-20). The patient may notice a sore throat and by looking in the mirror may see the lesion. As the tumors enlarge, they produce increasing pain; the dentures may not fit, which may be an initial symptom. With their spread to other structures, these lesions may produce trismus, bleeding, fixation of the tongue, and referred otalgia. Primary lesions of the tonsillar fossa usually are quite large before symptoms manifest (see Fig. 74-18). This area seems to be less sensitive than the anterior tonsillar pillar. Lesions that occur primarily at the inferior pole may be difficult to visualize by direct examination, and mirror visualization may be necessary. Again, bimanual palpation is mandatory to determine the extent of these lesions. The tonsillar tissue may harbor a hidden primary tumor that originates deep in one of the tonsillar crypts. In an unknown primary tumor evaluation with known metastatic squamous cell carcinoma in a high cervical node, tonsillectomy probably should be the routine biopsy procedure as opposed to a simple biopsy, if no other lesion is obvious. If the tumor is hidden deep in the tonsillar crypts, routine biopsies may miss this primary lesion.

Soft palate

Soft palate carcinomas occur almost exclusively on the anterior surface of the palate. They rarely involve the posterior surface until advanced stages. Lesions appear with leukoplakia, or they may be raised or flattened, injected lesions (Fig. 74-21). At times, heavy smokers may have many areas of leukoplakia and injection; thus distinguishing which lesions are significant can be difficult. Even if a biopsy reveals squamous cell carcinoma, accurately delineating the borders of the lesion may be difficult (Fig. 74-21).

Occasionally several small primary tumors occur in the same patient, with large areas of intervening normal mucosa. Most lesions are diagnosed at a reasonably early stage, when they are still limited to the anterior soft palate. As the lesions enlarge, they spread to the tonsillar pillars and extend down into the tongue area (Fig. 74-22). They also may extend laterally and then superiorly into the nasopharynx. Larger lesions may appear with large, ulcerative defects of the soft palate. The constrictor muscles of the pharynx and pterygoid muscles may be involved at a later stage, with resultant pain and trismus.

As the tumor enlarges, it may involve the palatine nerves, with resulting pain and extension of tumor along the nerve toward the cranial area (Fig. 74-23). These lesions produce a sore throat, and bleeding may occur. Changes in swallowing, speech, and voice may also be initial symptoms. Most of these tumors are easily visualized by the patient and physician.

Soft palate lesions metastasize to the digastric nodes and then into the upper cervical nodes (Fig. 74-24). The spinal accessory and posterior triangle nodes are involved less often. As the tumor extends laterally into the tonsillar areas and base of the tongue, the metastatic rate increases, along with the rate of spinal accessory and posterior triangle node involvement. Tumors close to the midline have a significant bilateral metastatic rate, and soft palate lesions in general have a higher contralateral metastatic rate compared to tonsillar and anterior pillar lesions. From 40% to 50% of patients have clinically positive lymph nodes at the initial examination, and approximately 15% have bilateral nodes.

Diagnostic Evaluation

In patients who have symptoms related to the oropharynx, such as sore throat, bleeding, voice changes, and dysphagia, a thorough examination is mandatory. This includes indirect examination using laryngeal and nasopharyngeal mirrors as well as direct examination. Bimanual palpation of the oropharynx is necessary in all cases (Fig. 74-25). The primary lesions should be accurately delineated, and a drawing or sketch should be made and added to the patient's permanent record.

Panendoscopy, including nasopharyngoscopy, laryngoscopy, esophagoscopy, and bronchoscopy, should be performed routinely in all cases, even when the primary lesion is obvious and its limits are easily defined. Panendoscopy is needed not only to delineate the extent of the primary lesion, but also to search for other primary tumors. The incidence of secondary primary tumors occurring with primary tumors of the oropharynx is significant (McGuirt, 1982).

With the patient under general anesthesia, the physician carefully palpates the neck or lymph nodes (Fig. 74-26). At times, cervical lymph nodes may become palpable during general anesthesia with muscle relaxation. The physician also should determine whether the lymph nodes are fixed. Biopsy of the lesions should be done with sharp instruments to avoid crushing artifact, and necrotic central areas of the tumor generally should be avoided. Multiple biopsies in questionable areas should be done to help define the exact limits of the tumor. Specifically in lesions of the base of the tongue, several deep biopsies may be necessary because the surface lesion may be small. Excisional biopsy may be appropriate if the physician suspects the lesion is benign (Fig. 74-27). Tatooing tumor margins with India ink is helpful, especially in those patients who received some type of therapy before surgical intervention. If a lymphoma is suspected, then larger biopsies usually should be performed to help the pathologist make a more accurate diagnosis; in many cases the gross macroscopic pattern of the tumor helps to determine the diagnosis of lymphoma. Careful palpation of the primary tumor should yield information concerning whether the primary lesion is fixed to an underlying structure such as the mandible or pterygoid muscles. It is also helpful to patients with deep lobe parotid tumors appearing in the oropharynx (Fig. 74-28).

Barium swallow examinations may help to delineate the inferior extent of the lesion. Mandibular radiographs and bone scans freuently reveal useful information concerning possible tumor involvement of the mandible.

CT scans may determine the extent of the lesion, especially around the base of skull (Fig. 74-29). Because of its close anatomic proximity, the carotid artery may also require evaluation to rule out tumor involvement. Advances in magnetic resonance imaging (MRI) angiography offer future promise regarding the noninvasive evaluation of the vascular system (Ross et al, 1989). Presently, the definitive diagnosis of carotid involvement requires angiography. Neurophysiologic evaluation for the possibility of carotid resection involves balloon test occlusion of the internal carotid, followed by xenon/CT blood flow mapping (Johnson et al, 1991) or SPECT brain scanning (Sharp et al, 1986). Results from these experimental techniques help to predict the propensity for neurologic sequelae should the internal carotid require ligation, either intentionally or following iatrogenic injury.

MRI scans may be useful in determining overall extent of the tumor and impingement or invasion of contiguous structures. They may be helpful in distinguishing tumor persistence from delayed fibrosis (Piiolet and Steckel, 1990).

Management Philosophy

The literature concerning tumors of the oropharynx frequently separates these tumors into several smaller groups, such as those of the soft palate, tonsil, anterior tonsillar pillar, and base of the tongue. In fact, these lesions are derived from a common mucosal covering that blends together to form one area. These cancers frequently extend from one area to the next without restrictions. Although the literature on treatment results discusses the sites of origin with a degree of certainty, in some cases the site of origin may be uncertain when the tumor involves adjacent areas. A specific example is the base of the tongue. When a tumor involves both the superior laryngeal area and the base of tongue and vallecula, determining the exact site of origin often is impossible, even at the initial diagnosis. Making this distinction certainly is impossible when the physician is reviewing charts retrospectively; the treatment results may be skewed, depending on the reviewer's assignment of the tumor to a specific site.

The biggest problem with oropharyngeal cancers is late diagnosis. Often these tumors simply do not produce symptoms until a late stage and appear with a cervical metastasis at the initial examination. In the past, oropharyngeal cancers were considered to be more aggressive and anaplastic than tumors of the anterior oral cavity. Some authors believe that the only difference between oropharyngeal and anterior oral cavity cancers is the more advanced stage of disease of oropharyngeal lesions at first appearance. The concepts of treatment of tumors in this area have changed over time. Initially these tumors were approached with surgery to the primary and metastatic site. Later the emphasis on therapy shifted to radiation as the primary treatment modality, and over the past several years a shift toward more combined therapy with radiation and surgery has occurred. Changing and improving techniques both in radiation therapy and in surgical resection and reconstruction have improved the cure rates and have allowed patients to maintain more physiologic functions of the oropharyngeal area.

The role of chemotherapy in the treatment of these lesions continues to evolve (Schuller, 1991). Chemotherapy aimed at increasing local-regional control rates in advanced lesions has been used with good response in some patients without additional morbidity after surgical resection or postoperative radiation therapy (Jacobs and Pajak, 1987). There seems to be no difference between the induction and sequential groups (Jacobs and Ru, 1991). If the pathology specimen reveals microvascular invasion, adjuvant chemotherapy is recommended since the prognosis is worsened (Close and Brown, 1989).

When reviewing the literature concerning treatment of these tumors, at times the interpretation of the data is difficult because of different methods of reporting. Some radiotherapists have used the term *locally controlled*, whereas others have used *locally cured;* therefore the data must be interpreted carefully in each series. Kaplan et al (1977) reported that T1 and T2 tumors did well with radiation alone, but the failure rate with T3 and T4 was significant. They also acknowledged that the early growth could be treated by surgical approaches. Tong et al (1982), in a series of 104 patients treated with radiation alone, reported that 100% of the T1 lesions and 74% of the T2 lesions were controlled in 3 years. T3 and T4 growths demonstrated 49% and 33% control, respectively. Shrewsbury et al (1981) reported that radiation alone could control growths without associated cervical metastases, but they thought combined radiation and surgery were more beneficial for the more advanced primary tumors with associated cervical metastasis. Mantravadi et al (1978) reported a series of 94 patients in terms of survival rates rather than control. In all the T1 growths, without metastasis, the patients survived for 5 years, but only 60% with T2 growths survived with radiation alone. Interestingly, in this series 70% of patients had cervical metastasis, even with the primary cancers being T1 and T2. In patients who had nodular disease, only 20% were alive at 5 years; of those patients who did not have nodular disease, only 42% survived for 5 years. This study emphasizes the distinction between "controlled disease" and "survival". In a Stanford University series, Eller et al (1976) reported that 50% of patients with T1 tonsil growths treated with radiation alone survived for 5 years. The percentage decreased to 18% in T3 lesions. In patients base of tongue cancers, only 35% of patients with T1 and T2 primary cancers and 22% with T3 lesions survived 5 years.

Variability in reported cure rates may be related somewhat to the method of staging. A T1 cancer of the tonsillar area is any cancer less than 2 cm in its greatest diameter. A tumor only millimeters in diameter is classified the same as a tumor almost 2 cm. The lesion only millimeters in size should reasonably seem to have a better prognosis than a 2 cm lesion. Some reported T1 lesions may be extremely superficial and may be part of the tumors that occur in "field" cancerization, which occurs in the oropharyngeal area with high exposure to alcohol and smoke. The cure rates for these superficial lesions may be very high, thus skewing the results of the larger lesions, which still could be classified at the upper limits as T1 lesions.

Tere are undoubtedly multiple factors that influence prognosis and tumor behavior in addition to the anatomic staging. It has been noted that recurrences are higher in patients who receive blood transfusions during their therapy (Jackson adn Rise, 1989; Jones and Weissler, 1990). In the future immunologic staging may be useful. Evidence now exists that decreased proportions of cytotoxic suppressor cells are frequently associated with advanced head and neck cancers and portend a poor outcome after therapy (Wolf and Schmaltz, 1987).

The above discussion has considered the stage of the disease as the determining factor in treatment decisions. In each patient there are factors to consider other than the stage of the lesion. The patient's general health must be considered. Associated diseases may debilitate the patient enough that surgery should be given less consideration. A poor pulmonary status may not allow preservation of the larynx, and therefore a total laryngectomy may be performed for a lesion even though a less total operation may be technically feasible for the stage of the lesion. The psychology and beliefs of the patient may not allow certain treatments. Forcing patients into certain treatments is not in the best interest of the therapist or the patient. The role of the family and support system is important in the decision making. They will usually play a major role in the rehabilitation and long-term follow-up care. It is important to have them clearly understand the treatment decisions initially and as care proceeds. There are different acceptable treatments for each lesion, and therefore treatment decisions also depend on the philosophy and experience of the physician. The facilities available and access to them are important in the decision-making process. This includes intensive care for postoperative patients, radiation equipment, chemotherapy, and support services such as speech therapy and prosthodontics. The responsible physician should consider all of these factors in making decisions for each individual patient.

Role of radiation therapy

The literature seems to suggest that modern radiation therapy can control small cancers of the tonsillar area; however, with larger lesions and those that have metastasized to the cervical nodes, other options of therapy seem necessary to improve the cure rates (Parsons et al, 1982). Combined methods of radiation therapy and surgery are becoming more popular (Thawley et al, 1983). If the combination of these two modalities is performed correctly, it is hoped that their survival potential will approach the sum of the survival of both methods used separately and that complications will not be unacceptable. In Jesse and Lindberg's study (1975) of 345 patients with oropharyngeal tumors, the combination of radiation and surgery produced local and regional control in twice as many patients as did either method used alone. The absolute 5-year survival rate did not reflect this improvement; patients died more often from distant metastases than from disease in the neck. In other words, they lived to die of the disease, but in a different way.

Experiments have shown that radiation is most effective in well-oxygenated tissues. Thus radiation before surgery should be performed when the tissues are well oxygenated. With modern techniques such as vascularized flap reconstruction, however, this may not be as viable an argument as in the past. A previous theory stated that preoperative treatments can make a so-called inoperable tumor operable. This is not likely to occur, and judgment at the time of the postradiation resection is at best difficult. Preoperative radiation theoretically should decrease the number of viable cancer cells, thereby decreasing the potential for metastasis at the time of surgery; however, this may not be true. Preoperative radiation therapy may alter the lymphatic fields and local tumor resistance, and since the tumor must remain in the patient for a longer period, an increase in distant metastases is theoretically possible. Most surgeons will agree that surgery performed in a field that has received radiation is more likely to produce a complication than one performed in a nonradiated field. For these reasons, preoperative radiation therapy is now on the decline, and the postoperative concept of radiation is most widely used in combined therapy.

The surgeon must question the concept of removing gross disease or debulking the lesion so that radiation therapy may be given at an early stage. Even though some believe that radiation therapy may sterilize a small tumor left in the patient, most series of cancer resections show a definite worsening of prognosis with positive margins in the oropharyngeal area (Rollo et al, 1981). Although the theory of controlling neck disease with postoperative radiation therapy is valid, not many series strongly support this concept. Retrospective studies have shown that neck recurrences decrease but survival may not increase. A Mayo Clinic study revealed that in N0, N1, and N2 stages of neck disease, neck recurrences decreased with postoperative radiation following a neck dissection (DeSanto et al, 1982). Complication rates are probably lower in patients who have received postoperative radiation, but a truly randomized study has not yet shown the definitive benefits of postoperative radiation. Perhaps postoperative radiation may only be changing the mode of death in patients with high-risk disease. More careful studies need to be performed before a final decision is made (Lindberg et al, 1974).

Management

Neck

When treatment is planned for tumors of the oropharynx, the primary site and the lymphatic drainage must be considered. At least 50% of all patients with oropharyngeal tumors have clinically positive necks, and the percentage of occult-positive necks is significant.

Many factors affect the incidence of neck metastases from oropharyngeal tumors. The larger the tumor, the more likely that neck metastatic disease exists (see Table 74-2). Less-differentiated tumors are associated with a higher incidence of metastatic cervical lymph nodes. Exophytic tumors with pushing borders generally are considered to be associated with a lower rate of lymph node metastasis. Other factors may play a role in determining the rate of cervical metastastis. The patient's immunologic system may be affected by various nutritional and other unknown factors. A previous history of infection or radiation to the cervical area also may affect the metastatic rate.

The incidence of cervical lymphatic metastases probably is most closely related to the supply of lymphatics to the primary tumor. Tumor cells usually do not stop in the intervening lymphatic channels between nodes. When metastatic spread occurs, the tumor cells usually stop and grow in the cervical nodes. If lymphatic vessels become obstructed, the tumor cells may grow in that area. Radiation therapy may cause partial obstruction of the lymphatic trunks and lymph nodes. Enlarged nodes secondary to infection may also produce lymphatic blockage. Following radical neck dissection, ipsilateral obstruction of the lymph channels is observed, and subcutaneous shunting of the lymph flow toward the contralateral submaxillary area occurs via the submental lymphatics (Haagensen et al, 1972). Radiation therapy to the neck usually does not obstruct the lymphatics completely but does produce a partial obstruction. This obstruction is related to dose and volume. Bilateral high-dose radiation therapy to the neck frequently divers lymph flow anteriorly to the submental space (Fisch, 1966). This usually produces swelling in the submental area and intermittently may be associated with bouts of cellulitis during the early postradiation months.

The incidence of N0 necks in patients with oropharyngeal tumors varies according to the site of the lesion (see Table 74-2). The soft palate, anterior tonsillar pillar, and retromolar trigone have a higher incidence of N0 necks, probably because these are sensitive as well as easily visible areas and lesions are diagnosed at an early stage. Base of tongue and tonsillar fossa lesions, however, have a low incidence of N0 necks. These areas are less painful, and even T1 lesions typically appear with a clinically positive neck. If patients with N0 necks who have primary lesions in the oropharynx are not treated with some therapy to the neck area, 10% to 25% will develop clinically positive neck nodes later (Northrop et al, 1972). Even if these patients then are treated successfully for the cervical metastasis, they are still at an increased risk to develop distant metastases, and their prognosis is worse than if they had been treated initially. Treatment of the primary oropharyngeal lesion and observation of the clinically negative neck for future disease generally are not recommended. Since the metastatic rate in all oropharyngeal lesions is reasonably high and lymphatic supply to all these areas is abundant, the initial treatment plan should involve therapy to the primary site as well as to the associated local and cervical lymphatics.

The clinically negative neck may be treated with either surgery or radiation. The standard classic radical neck dissection produces considerable cosmetic and functional deformity, with loss of the sternocleidomastoid muscle and the resulting painful shoulder syndrome secondary to transection of the CN XI and atrophy of the trapezius muscle (Martin, 1951). Functional neck dissection remove the lymphatics but preserve CN XI, jugular vein, and sternocleidomastoid muscle, thus decreasing the morbidity and functional problems associated with neck dissections (Bocca and Pignataro, 1967; Calearo and Teatini, 1983; Goepfert et al, 1980). The supraomohyoid neck dissection, which leaves the lymph nodes intact below the omohyoid muscle, is not recommended for oropharyngeal lesions because of the risk of occult-positive nodes remaining ni the inferior portion of the neck.

Functional neck dissection for clinically negative necks theoretically should be as effective as irradiation. Functional neck dissection, however, are more dificult and require more time than do standard radical neck dissection. The precision of removing the lymph nodes and associated lymphatic channels may vary widely, depending on the surgeon's expertise and experience. The lymph nodes associated with CN XI that are very superior in the neck are more likely to be involved with disease from oropharyngeal lesions. This particular area is a difficult site to eradicate effectively with a functional neck dissection, and the physician must question the effectiveness of removal of disease in this area. Data support the effectiveness of functional neck dissections for clinically negative necks and also the use of irradiation for clinically negative necks (Chow and Levin, 1989; Fletcher, 1972; Jesse et al, 1978; Lingemann et al, 1977; Mendenhall et al, 1980). In the treatment of the clinically negative neck in advanced cancer there are no significant differences in the rates of neck cancer recurrence among the elective neck irradiation, dissection, and combined treatment group (Weissler and Weigel, 1989).

When there is a choice, the neck dissection should be in continuity with the primary lesion. Higher recurrence rates are reported with discontinuous dissections (Leemans and Tiwari, 1991).

If the primary lesion is treated with irradiation, little morbidity is added if elective neck irradiation is performed concurrently. In patients with primary lesions of the oropharynx, whole neck irradiation usually is recommended rather than partial upper neck irradiation, which sometimes is used for lesions of the anterior oral cavity (Million, 1974). In patients with lesions that have a higher incidence of occult bilateral cervical metastases, such as midline palate and base of tongue lesion, bilateral neck radiation is performed (Barkley et al, 1972).

Patients with clinically positive necks must be treated with surgery, radiation, or a combination of both. In patients with N1 or N2 disease, radical neck dissection generally is considered adquate treatment (Wetmore and Swenn, 1984). Generally, if the primary site is to be treated surgically, surgery is performed initially, followed by postoperative irradiation if indicated. Radiation therapy is performed initially if it is the principal modality for the primary lesion or if a cervical metastasis is fixed or questionably resectable (Ghossein and Bataini, 1984). If the initial radical neck dissection demonstrates tumor histologically to be at or near the line of resection, tumor invasion through the capsule of the node, or many positive nodes, then postoperative radiation therapy is added (Khafif and Rafle, 1991). Radiation therapy is indicated in the N0 stage of disease in the contralateral side of the neck with high-risk tumors and in lesions extending beyond the midline (Khafif, 1991). Radiation therapy is usually adequate for patients with small N1 nodes (0 to 2 cm), but it frequently is combined with a neck dissection for large N1 nodes (3 cm) and more advanced neck disease. Large fixed nodes (more than 5 cm) usually are treated with irradiation with the hope that the cervical metastasis will shrink and become more resectable. If clinically positive neck nodes do not disappear following a complete course o radiation, neck dissection should be performed. The worst results (14% survival) are generally in patients who are irradiated for surgical failure of neck disease. Results for surgical salvage following radiation failure are better (42%). Recurrence rates are lower in the combined therapy group than in the surgical group of patients with N2 and N3 stages of disease (Khafif and Rafle, 1991).

Tonsillar area

Generally, early T1 and T2 lesions are treated by irradiation (Fig. 74-30). Primary treatment by surgery usually is not recommended initially because of the functional problems inherent in resections to this area compared to the high success rate and low morbidity with irradiation. Limited surgical excision for small lesions usually is not recommended except in specific patients, such as those with very small lesions who have had prior radiation therapy. Limited surgical resection of small lesions without concomitant treatment to the local and regional lymphatics is inappropriate.

Radiation therapy locally fails to cure approximately 20% of T2 lesions and 30% to 50% of T3 lesions. In these moderately advanced lesions, surgery is recommended if the primary lesion fails to show adequate regression at 5000 rad. Surgeons generally agree that combining surgery and irradiation is best for management of lesions that extend beyond the confines of the tonsillar fossa; many recommend combined therapy if clinically positive neck nodes appear initially. Generally, for these advanced lesions (T3 to T4), a composite resection - including the primary tumor the associated local lymphatics, and the neck area - is performed, followed by postoperative radiation therapy. Planned preoperative radiation therapy usually is recommended only if large fixed nodes are found at the initial examination.

Most lesions of the tonsillar areas are treated with radiation through parallel opposed portals. The area includes the tonsillar fossa, the tonsillar pillars, the retromolar trigones, the soft palate, and base of the tongue (Fig. 74-31). In limited lesions found early, the portal extends at least to the level of the third molar tooth. Occult anterior extension into the buccal pouch may be present when anterior lateral spread to the retromolar trigone occurs; in these cases the portals are adjusted more anteriorly. If trismus is present, the pterygoid area up to the base of the skull is covered. If possible, portals are designed to spare the contralateral mucosa and salivary glands and thus reduce the incidence of xerostomia. Generally only the ipsilateral neck is treated unless there is significant invasion of the soft palate, especially close to the midline; clinically positive nodes appear in the ipsilateral neck; or the tongue has been invaded. Some therapists may boost the invaded adjacent tongue area by a small interstitial implant for an additional 1000 to 1500 rad.

The cure rate for T1 lesions of the tonsillar areas treated with radiation therapy is approximately 85%; for T2 lesions, 75%; for T3, 45%; and for T4, 25%. Determinate 5-year survival rates in Givene et al's series (1981) are stage I, 93%; stage II, 57%; stage III, 27%; and stage IV, 17%. The status of the neck nodes dramatically affects the survival rate. Krause's study (1973) of tonsillar lesions at the University of Iowa demonstrated a 5-year determinate survival rate of 75% for T1N0 lesions when radiotherapy was employed. This survival rate fell 25%, however, when the lesion became T1N1. Patients treated initially with radiation therapy may be saved surgically, but the percentage of cured patients decreased with advancing stage of tumor. Million and Cassisi (1984) reported an ultimate control from radiation therapy followed by surgery of 100% in T1, 79% in T2, 60% in T3, and 25% in T4 lesions of the tonsillar area. Advanced primary lesions are seldom cured with single-modality therapy, whether irradiation or surgery. Recurrent lesions at the primary site may be candidates for surgery. In one series survival after salvage surgery was 34% at 3 years and 23% at 5 years (Pacheco-Ojeda and Marandas, 1992). If the lesion is considered unresectable, cryotherapy or laser treatment may give temporary local control. Chemotherapy also is frequently used (Bataini et al, 1989). Spiro and Spiro (1989) reported determinate cure rates of 89%, 83%, 58%, and 49% in stages I to IV, respectively. The MD Anderson Cancer Center reported control rates of 94%, 79%, 58%, and 50% in patients with T1, T2, T3, and T4 disease, respectively (Wong et al, 1989).

Soft palate

Some early soft palate lesions may be very small and well circumscribed. Usually soft palate lesions are more diffuse, however, and even if a small, circumscribed lesion exists, other areas of palate must be suspected as having a tumor (Fig. 74-32). In many cases these lesions occur in elderly patients whose entire soft palate mucosa is injected and shows changes related to nicotine stomatitis; several biopsies may be necessary to determine the exact extent of the primary lesion. This is one reason that radiation generally is the primary treatment. It treats not only the primary lesion but the local area as well, including any epithelium that may have malignant changes not obvious to the physician. Radiation also treats the local lymphatics, which is important if the incidence of bilateral neck disease is to decrease.

Surgical resections of early lesions usually are recommended only for tiny carcinomas of the uvula. Larger resections of the palate for more advanced lesions without radiation therapy increase the chances for local and regional metastases. The functional disability from soft palate resection is significant; therefore surgical therapy being recommended as the only therapy for soft palate lesions is uncommon. If surgical therapy is performed initially, postoperative radiation usually is planned as combined therapy. Irradiation technique generally involves parallel opposed external beam portals to include the primary lesion and the upper neck nodes bilaterally, since even small T1 soft palate lesions may have occult bilateral cervical metastases. If the lesion is small and discrete, a radioactive seed implant may be used initially, followed by external beam therapy. The implant may permit a reduced external beam dose, as well as decrease radiation side effects and improve local control because of a higher biologic dose.

Carcinomas involving the soft palate generally produce cervical metastases in at least one third of cases. Generally the cure rates with radiation alone for T1 lesions with N0 necks are 80% to 90% and for T2 lesions with N0 necks 70% to 80%; for T3 and T4 lesions the cure rates drop dramatically to 20% to 30%. Because of these low survival rates for advanced T3 and T4 lesions, these tumors generally are managed by combined therapy of surgical resection followed by postoperative radiation (Million and Cassisi, 1984). Recurrent disease following primary radiation therapy must be managed with surgery if the lesion is resectable. If it is not amenable to surgical resection, then cryotherapy and laser treatment may give temporary local control; chemotherapy is frequently useful.

Base of tongue

Carcinoma of the base of the tongue generally is considered to be a more formidable than carcinoma of the palate or tonsil. These lesions are frequently large at the initial diagnosis (Fig. 74-33). Many patients have obvious neck metastases, and a significant number have bilateral neck metastases at the initial evaluation. The majority of series include few patients who are T1, with most usually staged as T3 or T4. The overall cure rate for most series, regardless of therapeutic modality, is usually about 30%.

The treatment regimens vary according to different institutions. Some centers initially treat with radiation as a primary modality and reserve surgery for irradiation failures (Parsons et al, 1982). However, surgery following irradiation failure only improves the cure rate by about 10%; thus initial surgery followed by postoperative radiation frequently is recommended in an attempt to improve the dismal prognosis. Although surgical resections of the base of the tongue involve significant functional morbidity, surgical reconstruction has improved significantly over the past years, and patients tolerate surgical resections better. Because of the improved use of myocutaneous flaps, postoperative radiation is more likely to be tolerated without complications at this site. Surgical resection is seldom used as a single modality because of the aggressive nature of this tumor, the advanced stage of disease, and the frequent cervical metastases.

Irradiation of cancer of the base of the tongue is delivered by parallel opposed external beam portals to the primary site, which also includes the bilateral regional lymph nodes (Fig. 74-34). The areas treated include the base of the tongue, portions of the oral tongue, the vallecula, pharyngeal walls, suprahyoid epiglottis, and the superior portion of the preepiglottic space. The cervical nodes, including the spinal accessory nodes bilaterally, are treated up to the base of the skull. Care must be taken to ensure an adequate portal for the anterior portion of the base of the tongue, since many of these tumors extend deeply and anteriorly into this area. Since base of tongue tumors have a significantly high rate of bilateral metastasis, both sides of the neck routinely are treated. The amount of radiation may be boosted by the submental route. This is more effective for central rather than lateral lesions. Interstitial implants may be used if the lesion is in the anterolateral base of the tongue. Planned preoperative radiation therapy usually is not recommended except for large, fixed neck nodes. If radiation is used as a primary therapeutic modality, surgery may be recommended if significant improvement is not seen at 5000 rad. Attempting to improve the prognosis, the physician usually used planned initial surgical resection with reconstruction, followed by irradiation after about 3 weeks. Recurrent disease usually is treated with surgical resection if this was not performed initially; however, the survival rates are low except for very small lesions. Regardless of the modality chosen, the cure rates are low, since most lesions are treated at advanced stages. The 5-year cure rates are from 20% to 50% (Million and Cassisi, 1984; Thawley et al, 1983).

Surgical Therapy of Oropharyngeal Tumors

The principles of surgical resection and reconstruction for the oropharynx are generally the same whether the tumors involve the tonsillar area, the soft palate, the base of tongue, or various combinations of these areas. Surgical management mandates a careful initial examination. During endoscopy, usually performed with the patient under general anesthesia, the surgeon takes care to map the extent of the primary lesion by visualization as well as by manual palpation. Other areas of the upper respiratory and gastrointestinal tract are examined at the endoscopy to rule out tumor extension and to search for other primary lesions in this area. CT and nuclear magnetic resonance (NMR) scans may help to determine the extent of the primary lesions, especially when the surgeon is looking for pterygoid and base of skull extension (Fig. 74-35) (Schaefer and Muerkel, 1982). Biopsies should be performed at the time of endoscopy. Necrotic centers of tumors should be avoided, and biopsies generally are taken at the periphery to include normal tissue as well as the tumor. Biopsies of questionable areas of tumor are done, and the tumor area may be tattooed with ink, especially if patients are going to be treated initially with radiation.

Limited intraoral excision of oropharyngeal tumors generally is condemned except in unusual circumstances. If surgical resection is considered, the surgeon must plan the resection of the primary lesions along with the appropriate lymphatic drainage areas. Most often this involves resection of the primary site and some type of neck dissection. In planning the resection and reconstruction the surgeon must consider the extent of primary lesion as well as the local and regional metastases. The surgeon also must consider any past and possible future treatments, assess the functional deformity, and make appropriate plans for reconstruction of functional defects and for cosmesis. If local excisions in the soft palate and tonsillar area are planned, most can be closed primarily by split-thickness skin or dermal grafts. Palatal reconstruction for small defects usually is unnecessary, since a prosthesis usually can remedy any functional defect.

The approach to resection of larger primary tumors of the oropharynx involves consideration of the mandible. Previously, with most surgical resections of oropharyngeal tumors, a portion of the mandible was removed. A section of this bone traditionally has been included in this resection dating back to the development of the "classic commando" operation (Fig. 74-36) (Crile, 1906). Removing a portion of the mandible was considered necessary along with the primary lesion, and neck dissection was considered necessary to ensure the en bloc resection. Surgical techniques have changed over the years, however; the surgeons generally are now trying to preserve the mandible when it is considered safe in terms of tumor resection. Marchetta et al (1971) demonstrated that malignant cells were not found in the periosteal lymphatics unless the gross tumor lesions were in direct contact with the mandibular mucoperiosteum. Partial marginal mandibular resections may be performed for lesions lying close to but not directly involving the lingual surface of the mandible. These resections ensure an adequate margin yet preserve the continuity of the mandible (Fig. 74-37).

Multiple techniques are available to determine bone involvement, including nuclear scanning, plain radiographs, and CT scans; however, none seems more accurate than assessing bone involvement by direct intraoperative inspection. If the periosteum strips cleanly from the bone, then invasion of the bone is unlikely. In the past a portion of the mandible was removed with the tumor to make the closure easier (Fig. 74-38). If the mandible is left intact, the closure is more difficult, since less collapse of the surrounding tissue occurs and some reconstruction in this area usually is necessary. The use of flaps, especially the myocutaneous type, has greatly improved the techniques of reconstruction and allowed increased numbers of patients to retain their intact mandibles.

Approaches for combined primary and neck resection

Planning the approach should include whether the mandible will be spared such as in the lateral or transhyoid pharyngotomy or whether the mandible will be transected. If the mandible will be transected, it may be split in the anterior midline or laterally. The mandible may not be completely transected but only partially, allowing maintenance of the arch support of the mandible. The approach to the lesion and neck disease must include considerations of approach, the resection, and closure. Multiple options exist in each case, and the decision-making process must consider many variables.

The neck incisions for combined primary and neck resections should be planned to allow good blood supply to the neck skin flaps and good access to the area of resection (Fig. 74-39, A). Generally the neck incision includes an upper horizontal limb, which usually starts in the area of the mastoid tip, extends inferiorly, and then parallels the lower border of the mandible. This incision is made approximately 2 to 3 cm inferior to the mandible to avoid the marginal mandibular nerve. The anterior limb of the horizontal incision then may curve superiorly to extend up through the submental, chin, and lower lip areas, or it may continue to the opposite side of the neck for a few centimeters, allowing the surgeon to perform a visor flap for the chin and lower lip (Fig. 74-39).

A lower limb is dropped from the posterior portion of the horizontal incision, extending inferiorly down the neck posteriorly and allowing access to the contents of the anterior and posterior neck triangles. The junction of the vertical and horizontal limbs of this incision should be planned so that it is not over the carotid area; thus if the tip of the flap becomes necrotic at the junctional area, the carotid artery will not be exposed. The junctional angles should be at 90 degrees to maintain maximal blood supply to the tip of each flap. The upper limb of the incision allows access to the oropharyngeal area through (1) a lip-splitting incision (Babin and Calcaterra, 1976), allowing a lip and cheek flap to be elevated (Fig. 74-40), or (2) by allowing creation of a visor flap (Fig. 74-41), thus preserving the continuity of the chin and lip area.

If the surgeon wishes to gain access to the oropharyngeal area without splitting the lower lip, the upper horizontal limb of the cervical incision may be extended across the midline approximately 2 cm. An intraoral incision is made along the anterior buccal gingival sulcus, extending from the contralateral mental foramen area anteriorly and then posteriorly on the ipsilateral side. The soft tissue between the upper cervical incision and the buccal gingival incision is joined so that a visor lip and cheek flap is created. This may be elevated superiorly, allowing access to the oropharyngeal area. The major limitation in gaining adequate access using this approach is failure to extend the flap far enough to the contralateral side (see Fig. 74-39, B). If a neck dissection is done in continuity with a primary resection, the base of the neck dissection is generally anchored at the area of the angle of the mandible at the inferior medial surface (see Figs. 74-36, B, and &4-42). This most closely approximates the area of lymphatic drainage from the areas of the oropharynx.

By splitting the lip or using a visor flap, the surgeon carries the incision along the ipsilateral gingival buccal sulcus posteriorly, and a lateral lip and cheek flap is created and elevated (see Fig. 74-40). This permits access to the lateral border of the mandible posteriorly, and the surgeon may perform an osteotomy in this area for access to the oropharynx (Fig. 74-43) with preservation of the mandible. If the mandible is to be included in the resection, it is transected anterior to the tumor, and superior mandible cuts are performed, generally in the area of the condyloid and coronoid processes (see Fig. 74-42). An alternate osteotomy may be performed anteriorly by swinging the ipsilateral mandible laterally and extending a medial incision along the ipsilateral glossal gingival sulcus back to the anterior portion of the planned resection (Fig. 74-44). This allows the mandible to be rotated laterally and the contralagteral tongue to be pulled to the opposite side, thus permitting access to the primary site of resection. The anterior osteotomy is joined together during closure (Fig. 74-45).

If a marginal mandibulectomy is to be performed, the bony cuts are performed before starting the soft tissue intraoral incisions around the tumor (Fig. 74-46). As the resection continues, the anterior resection of the tumor is begun and extended posteriorly and inferiorly so that visualization is always adequate. Typically a portion of the tongue is resected to obtain a surgical margin. This anterior tongue incision is extended to the medial aspect of the resection and then extended posteriorly (Fig. 74-47). At the same time the lateral resection is extended posteriorly and superiorly to include adequate portions of the mandible, if it is included in the resection. As the primary tumor resection continues, traction is placed on this area so that it is pulled anteriorly and laterally out of the oropharyngeal site. If the tumor is primarily limited to the tonsillar and soft palate areas, the portion of the tongue resected may be small and the posterior limits of the resection are easily reached (Fig. 74-48). Usually the tissue still attached is around the pterygoid muscles lying directly over the internal carotid artery (Fig. 74-49). If the tumor does not involve the pterygoids, these are cutt off of the mandible, usually superiorly to inferiorly. The primary tumor area is then dissected from the internal carotid artery, generally inferiorly to superiorly.

Palate removal

Depending on the extent of the tumor, various portions of the palate may require removal. If the tumor extends onto the hard palate, chisels are used to make appropriate hard palate cuts, and this area is removed along with the resection (Fig. 74-50). In patients with trismus whose tumor involves the pterygoids, these muscles are removed and the pterygoid plates are transected with a chisel to ensure their removal (Fig. 74-51). If the tumor involves the base of the tongue, a greater portion of the tongue will have to be removed; extreme care is necessary to obtain an adequate margin around the tumor's deep extent. This is done by palpating the base of the tongue to determine the areas to be resected. The surgeon also must be careful to ensure preservation of the contralateral lingual artery.

Median translingual pharyngotomy

An alternate approach to the primary tumor involves a median translingual pharyngotomy (Fig. 74-52). The midline of the tongue is incised, bisecting the tongue into bilateral equal segments and extending back to the area of the tumor in the base of the tongue (Fig. 74-53). This approach is generally only useful for small, limited midline base of tongue lesions.

Transhyoid pharyngotomy

The transhyoid pharyngotomy is another approach that may be used for base of tongue lesions (Figs. 74-54 to 74-56). This technique has the advantages of maintaining mandibular and occlusal integrity, avoiding cosmetic deformity, and preventing scarring in the anterior oral cavity for maximal mobility of the tongue remnant (Moore and Calcaterra, 1990; Zeitels and Vaughan, 1991). The danger of this approach is that the vallecula is entered blindly, and the surgeon must be absolutely sure that the tumor is not transected during the approach. The hyoid bone may be transected or often is removed. The vallecula is entered, and the resection is performed from the neck area. Care must be taken to avoid injury to the lingual artery and hypoglossal nerve (CN XII). The defect is closed primarily. This procedure has only limited applicability.

Lateral pharyngotomy

The lateral pharyngotomy may be useful for small lesions of the posterior and lateral pharyngeal wall. The pharynx is entered laterally by retracting the thyroid ala and entering the superior portion of the piriform fossa and extending superiorly. The superior laryngeal nerve should be spared. This approach is limited superiorly by the mandible. Surgeons should be cautious in using this limited approach since most lesions require more exposure for adequate resection.

Associated laryngectomy procedures

Supraglottic laryngectomy

Base of tongue tumors may extend inferiorly and lateraly to involve the vallecula, epiglottis, and other portions of the supraglottic larynx. If tumors are small and inferior in the base of the tongue, approaching these tumors through a supraglottic laryngectomy approach may be more appropriate. This basically involves a supraglottic resection with extension of the resection into the base of the tongue.

The surgeon must consider the postoperative function in relation to the amount of the base of the tongue resected. With a supraglottic laryngectomy and loss of the epiglottis and false vocal cords, the base of the tongue is critical to allow adequate swallowing and to prevent aspiration. Factors involved in this decision include the age and respiratory status of the patient, the extent of the tumor, and the amount of tongue to be resected. Generally no more than half of the base of the tongue should be removed in a supraglottic laryngectomy (Fig. 74-57). The surgeon must ascertain that the remaining hypoglossal nerve (CN XII) is intact, as well as the lingual artery. An associated cricopharyngeal myotomy should be performed. Reconstruction with a flap (Fig. 74-57) is useful if much of the base of the tongue is resected with a supraglottic laryngectomy. If a flap is not used, a tight, tenuous closure with resultant fistula is common (Pearson and Donald, 1984).

Total laryngectomy

If a large portion of the base of the tongue requires excision, or if both hypoglossal nerves are sacrificed, then usually patients will aspirate with an associated supraglottic laryngectomy. In these patients a concomitant total laryngectomy should be perforemd. In poor-risk patients, an associated total laryngectomy may be required, even if a supraglottic laryngectomy is technically feasible. This is especially true in patients with excessive alcohol intake and poor pulmonary function (Sessions, 1983). Some patients may have excessively bulky tumors of the tongue that may involve the base of tongue area to such an extent that a total glossectomy is necessary (Fig. 74-58). Patients requiring a total glossectomy are at high risk to aspirate, and concomitant total laryngectomy procedures usually are performed (Fig. 74-59) (Sessions et al, 1973). Some patients, however, are able to learn to swallow effectively without aspiration. With the use of more bulky myocutaneous flaps and microvascular reconstruction an increasing number of patients with total glossectomies may be able to retain their larynx (Biller and Lawson, 1983; Effron et al, 1981). Functional results after total or near-total glossectomy with laryngeal preservation may be improved with ancillary procedures of laryngeal suspension, palatal augmentation, and videofluoroscopy to improve swallowing (Weber and Ohlms, 1991).

Near-total laryngectomy

The near-total laryngectomy may be used successfully in some cases of base of tongue tumors that extend inferiorly. This preserves portions of the larynx and laryngeal speech and allows for adequate tumor resection (DeSanto and Pearson, 1989). This technique demands careful patient selection, precise surgical technique, and intense postoperative rehabilitation.

Closure

If the resection produces a small defect, it frequently can be closed primarily, especially if a portion of the mandible has been removed, allowing the tissues to collapse and making *primary closure* possible (see Fig. 74-38). If the resected area is more extensive or if osteotomies have been performed and the mandible may be reapproximated, primary closure is more difficult and some type of reconstruction is necessary. If the defect is closed primarily, this usually includes suturing the lateral pharyngeal wall to the base of the tongue; the more anterior portions of the tongue are sutured to the lateral posterior buccal area at the previous site of the resected tonsil (Fig. 74-60). This produces some tethering of the tongue and thus limited tongue mobility; however, many patients are able to function very well with good speech and adequate swallowing. If one third or greater of the width of the tongue has been resected, the limitations of speech, tongue mobility, and swallowing may be significant when the primary closure technique is used. The surgeon seldom can resect a significant portion of the base of the tongue and perform a primary closure without risking complications. If the closure heals, the patient usually will be oropharyngeally crippled, with inadequate swallowing abilities. A tight primary closure in the base of the tongue typically results in a postoperative dehiscence with resultant fistula; thus some type of flap reconstruction usually is necessary for base o tongue tumors.

Carotid artery protection

If a neck dissection is part of the surgery and the sternocleidomastoid muscle is removed, proper protection of the carotid artery is necessary. Measures may involve a dermal graft (Fig. 74-61), a local scalene muscle flap, or the muscle pedicle of a myocutaneous flap (see Fig. 74-72) or microvascular flap. Before wound closure, hemostasis should be meticulous to avoid postoperative bleeding and hematoma.

Reconstruction

Free skin or dermal graft

If the primary site is to be reconstructed, several choices are available. Free skin grafts (Figi and Masson, 1953) or dermal grafts (Cairns, 1975) are useful in closing defects of the tonsil and lateral posterior tongue areas (Fig. 74-61). These are sutured in place and generally held with a sutured bolster. Usually the skin graft reconstruction should be generous to allow for shrinkage (Sessions, 1983). Generally a pouch is produced laterally to improve tongue mobility and create a lateral gutter to improve control of oral secretions (Fig. 74-62). Intermaxillary fixation assists in graft immobilization, improving the success of the graft take. Partial loss of the graft is not unusual; however, enough of the graft usually is retained to be beneficial, and frequently the area of lost graft will granulate, with stimulation of epithelial regrowth and healing by secondary intention (Lafferriere et al, 1980).

Tongue flaps

Tongue flaps are another alternative to reconstruction and are frequently employed in reconstruction of the tonsillar area (DeSanto et al, 1975; Sessions et al, 1975). The advantages of the tongue flap are its ease of accessibility, its excellent blood supply, and its lack of cosmetic defect. The disadvantage of the tongue flap is the possibility of poor speech and deglutition. The most common approach involves dividing the tongue longitudinally in the midline and rotating it 180 degrees to close the defect in the tonsillar lateral palate area (Fig. 74-63). Occasionally, less of the tongue has to be used as a flap, and more than half may be retained for functional use. Despite the accessibility and excellent blood supply, the resultant speech defects and deglutition problems limit the usefulness of the tongue flap in oropharyngeal reconstruction.

Regional flaps

Regional flaps allow a larger volume of healthy tissue for reconstruction. These flaps may be skin, muscular, or myocutaneous.

Regional skin flaps. Some skin flap choices include postauricular flap, forehead flap, deltopectoral flap, and nape of neck flap. The *postauricular flap* was recently reintroduced as another candidate for reconstruction of moderately sized oropharyngeal defects (Fig. 74-64). Available as either a pedicled or microvascular free transfer, the former is particularly well suited for defects of the oropharynx. Based on the posterior auricular branch of the external carotid artery, the venous drainage via the postauricular vein is more often the limiting aspect. Variation in the outflow of this superficial system prevents elevation of a healthy pedicle in up to 15% of cases. The skin paddle offers a unique, pliable surface comparable to the lining of the oral cavity. Inclusion of the great auricular nerve offers the potential for neurosensory restoration, although a resultant functional benefit has yet to be shown. Donor site morbidity is minimal as would be expected in the postauricular area (Kohle and Leonard, 1987; Leonard, 1987).

The *forehead flap* is based on the superficial temporal artery (Fig. 74-65), and it may be either brought directly through a cheek incision to repair more anterior defects or brought under the zygomatic arch for reconstruction of more posterior defects (Fig. 74-66). Usually this flap provides more than adequate tissue for repair of even large defects in the tonsillar or base of tongue area. In 2 to 3 weeks the unused portion of the flap is returned to the forehead, or it may be severed and the forehead defect allowed to granulate to elevate this area. A split-thickness skin graft is placed on the donor site. The forehead flap is an excellent flap for reconstruction of the oropharyngeal area. Its disadvantages are the resultant forehead cosmetic deformity and the requirement of two stages. It cannot be considered a high-priority flap because of the cosmetic disfigurement.

The *deltopectoral flap* also may be used to repair oropharyngeal defects. This flap is most often based medially (Fig. 74-67). Its blood supply is more tenuous than the forehead flap, and delaying the flap with an initial extra stage may be necessary. This flap, if created properly by extending to or even including portions of the shoulder, usually is long enough to reach the tonsillar and base of tongue area. This flap is used in a two-stage procedure by suturing the flap in the defect and creating a controlled pharyngostome. After 2 to 3 weeks the pharyngostome is closed and the flap is severed.

Nape of neck flaps are also useful for repair of the oropharyngeal defect; however, these almost always require a delaying procedure to ensure adequate blood supply (Fig. 74-68). The amount of tissue available for use is limited, and this flap is not commonly used.

Regional muscular flaps. Several regional muscular flaps are available for the closure of moderately large oropharyngeal defects. The *masseter flap* with its overlying fascia can be swung over the mandible after release of its inferior mandibular attachments. Defects must be limited to the palatoglossal fold, tonsillar fossa, tonsillolingual sulcus, or lateral tongue base. In these select cases, morbidity is minimal as is the cosmetic defect (Tiwari and Snow, 1989).

The temporalis muscle can also be rotated into the oral cavity in a similar fashion, again including the overlying fascia for an eventual double-layer closure. Transection of the coronoid process facilitates access to the oral cavity. Care must be taken not to compromise the maxillary artery because this is critical to sustain the flap via the paired deep temporal branches. Epithelialization of the fascia occurs within 2 weeks, and functional impairment is minimal. Cosmetically the depression over the zygoma is well hidden by the overlying hair-bearing tissue and may be obliterated using an implant if desired. Injury to the temporal branches of the facial nerve as they cross the zygoma is avoided through gentle retraction in this area (Huttenbrink, 1986; Koranda and McMahon, 1987).

The *levator scapulae muscle flap* was formerly used to protect the carotid artery following neck dissection. It may also be used in oropharyngeal reconstruction to provide soft tissue for bulk and buttress suture lines (Goodman and Donald, 1990; Netterville and Wood, 1991).

Regional myocutaneous flaps. The development of myocutaneous flaps has made reconstruction of the oropharynx and base of tongue somewhat more predictable (Ariyan, 1980; Schuller, 1984). The use of these flaps has generally replaced the use of skin flaps. The myocutaneous flaps have the advantages of supplying a large amount of healthy tissue with an excellent blood supply and of usually allowing one-stage reconstruction. For larger oropharyngeal composite defects the *pectoralis major flap* is most often used (Fig. 74-69); however, the *trapezius flap* also provides adequate tissue for oropharyngeal reconstruction (Fig. 74-70) (Urken, 1991). Although the trapezius flap is a successful one, loss of a portion of this muscle creates more functional disability than loss of the *pectoralis flap;* therefore the trapezius is not used as often. The *sternocleidomastoid flap* is not used frequently because concomitant neck surgery interferes with its development (Fig. 74-71). In addition, reliable survival of the cutaneous portion occurs in less than 50% of cases.

The pedicle of the myocutaneous flap is beneficial, since it provides bulkiness in the neck (Fig. 74-72) and serves both a cosmetic and a protective function for the underlying structures. In some patients the flaps may actually be too bulky because of excessive adipose tissue; however, the flaps usually thin with time, and this is seldom a permanent problem. If the bulkiness is a problem, the skin may be removed from the flap, the fat resected, and the skin grafted to the underlying muscle. This produces a thinner piece of tissue and has proved to be a reliable technique (Smith and Collins, 1984).

Innervated latissimus dorsi and pectoralis major flaps (Urken, 1991) retain their bulk and provide excellent closure of tongue base defects, often avoiding the need for concomitant laryngectomy. For moderately sized tumors with mandibular sparing, the large myocutaneous flaps such as the pectoralis and trapezius may actually be too bulky. Several smaller regional flaps may be applied to such cases as discussed earlier.

Microvascular free flaps

The use of free flaps with microvascular anastomosis is a viable technique and may be indicated in certain circumstances. The advantage of this technique is the large amount of tissue available and the flexibility of usage in difficult oropharyngeal reconstruction. In some cases the flap can incorporate bone, allowing free flap reconstruction of the mandible and the surgical defect. The disadvantages of the technique are that it requires extra time, which lengthens an already long surgical procedure, and it requires a two-team approach with personnel well trained in microvascular techniques. The recipient defect site must have an appropriate artery and vein available, which can pose problems following prior neck dissection and radiation therapy. A variety of options exists, and the choice of each graft varies with each patient and the experience of the surgeon.

The radial forearm fasciocutaneous free flap offers thin, pliable skin with a capacity for neurosensory restoration (Fig. 74-73). Inclusion of the medial and lateral antebrachial cutaneous nerves provides vascularized nerve grafts for repair to the glossopharyngeal nerve or branches of the cervical plexus. Morbidity consists of a skin graft to the volar surface of the forearm, which can be subsequently removed after adjacent skin expansion. Harvesting from the extremity facilitates a two-team approach, reducing operative time and morbidity (Takato and Kiyonori, 1987; Urken and Weinber, 1990).

For complicated oropharyngeal lesions, such as radiation treatment failures in the tonsillar fossa, the greater omentum free flap offers several unique features. It may include a portion of the greater curve of the stomach with its attached omentum (Fig. 74-74). The flap is relatively easy to harvest, offers large-bore, long pedicle vessels, is available in a variety of sizes, and has a tenacious adhesiveness and resilience, even in anoxic tissue beds. It provides moist, non-hair-bearing, soft, pliable tissue that is easily tailored to fit complex soft tissue defects. The omentum provides carotid artery protection, soft tissue augmentation, good lymph drainage, and a smooth surface that does not collect food particles (Panje and Little, 1988; Panje and Piitcock, 1989).

Fianlly, when a large oropharyngeal malignancy necessitates composite resection including segmental mandibulectomy, an osteocutaneous free flap may be indicated. At present the fibula free flap offers the advantage of a neurosensory skin paddle potential as well as minimal donor site morbidity. As a truly "accessory" bone, all but a 10 cm distal segment may be transferred without significant functional or cosmetic donor site morbidity. In cases requiring the excision of dentulous mandible, osseointegrated implants may be placed at the primary reconstruction, and integration proceeds despite ongoing postoperative radiation therapy.

Other flaps include the rectus abdominis based on the deep inferior epigastric vessels (Urken, 1991) and the latissimus dorsi scapular flap based on the subscapular vessels. This flap includes the scapular and parascapular skin flaps, the serratus and latissimus dorsi muscle flaps, and the lateral scapular bone flap (Fig. 74-75). A segment of vascularized rib can be included with the serratus. The advantage of this combined flap is the independent vascular pedicles of its components, which allow freedom in orientation of the various portions of this flap. It has a disadvantage of being difficult to harvest simultaneously with the primary reconstruction (Aviv and Urken, 1991; Haughey and Fredrickson, 1991).

Composite free flaps offer the advantage of providing skin, soft tissue bulk, and bone for mandibular reconstruction. There are many donor sites, including iliac crest, scapula, metatarsus, rib, radius, fibula, ulna, and humerus. No donor site provides ideal replacement for missing oral cavity soft tissue. Perhaps the best overall reconstruction is attained with an iliac crest - internal oblique osteomyocutaneous flap. It provides excellent bone and two soft tissue flaps for mucosal and cutaneous defects. The ultimate best may require the combination of two separate free flaps, a vascularized bone flap and a sensate soft tissue flap (Urken, 1991).

Mandible reconstruction

Mandible reconstruction has always been a challenging problem. In some cases resection of the posterior mandible with primary closure without bone reconstruction may result in minimal disability. In other cases there is significant cosmetic deformity and functional mastication, speech, and swallowing disabilities. Implanting metal mandibular prostheses in preoperatively radiated tissue commonly led to infection requiring removal of the implant. Use of postoperative radiation contributes to a higher success rate with metal implants.

Bone may be used by incorporating it in a myocutaneous or free microvascular flap. The consistency of success and versatility of the microvascular techniques have led to the increased use of bone grafts including rib, fibula, radius, metatarsus, ulna, scapula, and iliac crest. Currently the iliac crest and fibula seem to be the best overall grafts (Fig. 74-76). An important factor in selection is availability of bone with enough mass and height for placement of dental implants (Urken, 1991; Urken and Weinberg, 1991). Dental implants may be placed into the grafted bone at the initial reconstruction with later fitting of a dental prosthesis (Fig. 74-77). The rate of loss of periimplant bone in vascularized bone grafts is unknown at this time, but osteointegration of the implants appears to be good. A technique that may have future use in this area is mandibular reconstruction using human recombinant bone-inducing factor that stimulates bone formation (Toriumi and Kotler, 1991).

Rehabiliation

Rehabilitation of patients undergoing surgical resections of the oropharynx involves a team approach. The motivation of the patient is extremely important. Many patients are elderly and in poor general health with marginal nutritional status. The addition of radiation therapy and large surgical resections with reconstruction causes alterations in swallowing and speech and possibly an altered appearance. These factors place patients under great physical and emotional strain. The team approach, with the physician in charge, is extremely useful for encouragement of the patient during the months of required therapy and rehabilitation. Nursing staff, speech therapists, physical therapists, social workers, and prosthodontists all must play an active role to accomplish consistent, satisfactory rehabilitation. Rehabilitation is greatly enhanced by the prevention of complications. Cosmetic appearance, speech, deglutition, and mastication depend greatly on proper preoperative planning not only by the surgeon in terms of resection and reconstruction but also by the prosthodontist and radiation therapist.

Complications

Irradiation

Patients receiving therapy typically develop mucositis in the oropharyngeal area. This is menifested by injection and irritation of the involved mucosa. Mucositis generally changes the quality and quantity of mucus produced, and the long-term results usually involve some dryness in the involved area as well as thickening of mucus. Typically this is not a difficult problem and is managed with topical care of the involved area. Patients' taste sensation also may be affected, with temporary loss of taste and with some foods tasting the same. Again, usually this resolves over time, but some patients are left with permanent taste changes.

Dysphagia from the resultant mucositis may occur during radiation therapy. It also may develop following radiation therapy as the area heals with scarring and fibrosis and may be severe enough to interfere with swallowing. Dysphagia may produce weight loss, and weight should be monitored carefully, especially with preoperative radiation therapy. Weight loss with resulting negative nitrogen balance may adversely affect the healing potential during and after the operation. Fibrosis of the treated primary tumor area as well as of the neck also may produce a stiffness in the soft tissues, which may be uncomfortable for patients and may make follow-up more difficult, since neck stiffness may mask an underlying tumor for a significant period. The stiffness in the soft tissue may limit the mobility of the neck, and intensive physical therapy should be an ongoing process. Scarring and fibrosis of the palate may produce poor function with resultant nasopharyngeal regurgitation. Occasionally perforations of the palate develop, especially if the tumor involves full thickness of the palate.

Ulcerations may occur in the palate, tonsil, and base of tongue (Fig. 74-78) following irradiation therapy. These ulcerations may be painful and also may be associated with hemorrhage. They may present a confusing diagnostic dilemma, since they could harbor persistent or recurrent tumor. In patients with total laryngectomies, postoperative radiation may induce a tracheitis in the stoma area, which usually responds to topical humidification and local medical therapy. Rarely cranial nerve XII palsies may result from radiation therapy to oropharyngeal tumors.

The potential for tissue necrosis always exists when radiation therapy is used. This consideration is important when skin flaps are being designed. The relationship of the vascular supply to the flap must be carefully planned to minimize future breakdown of a flap. Dermal grafts over the carotid artery should be used if the risk of skin necrosis is significant (Fig. 74-79). Mandibular radionecrosis may occur with external beam radiation therapy but is much more common if therapy involves supplemental interstitial implants. This may represent a therapeutic dilemma and often appears as a draining necrotic area on the medial aspect of the mandible intraorally (Fig. 74-80). Continued exposure to saliva and food often prevents healing; therapy involves local topical care. Occasionally local intraoral flaps may be used to cover the radionecrotic area and stimulate healing. Hyperbaric oxygen therapy may be useful; however, many patients finally require some type of partial mandibular resection of the necrotic area. Any dental and alveolar disease must be resolved before the initiation of radiation therapy. Failure to do this will result in a high rate of dental complications.

Medico-surgical complications

Many patients who have oropharyngeal tumors are elderly and may have general medical problems that must be properly managed as well. Most of these patients require medical management by an appropriate specialist. A history of a previous myocardial infarct, possible arrhythmias, cardiac failure, hypertension, or emphysema should alert the surgeon to potential management problems. A careful pretreatment medical evaluation is usually a routine part of treatment planning for these patients. The nutrition status of patients may be borderline (Sobol et al, 1979a, 1979b). In addition, hypokalemia may predispose these patients to poor healing unless this is recognized and treated. During the course of radiation patients may have decreased appetites; supplemental feedings are necessary. Patients with large tumors, dysphagia, and weight loss may require supplemental nasogastric tube feedings or gastrostomy feedings.

Anesthesia management may be difficult for several reasons besides the local oropharyngeal lesion. During induction of anesthesia, a potential or airway obstruction exists in some patients who have bulky tumors. With relaxation, obstruction may result with inability to ventilate the patient properly. Early recognition of this eventuality allows for a controlled, stepwise establishment of airway control. Patients with oropharyngeal tumors may have decreased ability to open the mouth, and intubation via the oral route may be difficult; nasal endotracheal intubation should be considered. Manipulation of the base of the tongue area with a laryngoscope may result in bleeding and subsequent difficulty in intubation. Preoperative anesthetic consultation is necessary to prevent catastrophes during the induction of anesthesia. Initially performing a tracheostomy with the patient under local anesthesia may be preferable.

The key to treating surgical complications is in their prevention. Careful planning at each step of the therapeutic process will decrease complications dramatically. Tumors must be mapped carefully so their exact extent is well known before beginning therapy. The surgical resection of the tumor must be planned carefully, and the reconstruction should be part of the initial plan.

Cosmesis

The skin incisions should be designed so as to allow easy access to the primary area as well as the neck. They should be planned so that either local or regional skin flaps can be used. Although adequate resection of the tumor is the most important consideration, postoperative cosmetic appearance is certainly included in the planning process. Attempts are made to hide scars in natural skin lines. Loss of bulk is restored with soft tissue flaps, and mandible contour is replaced with implants or bone. Routine skin incisions and skin flaps may have to be modified, depending on the patient's previous irradiation or surgical history.

Oropharyngeal dysfunction

An important part of surgical planning involves the prevention of oropharyngeal dysfunction. The oropharyngeal inlet and lumen must be prepared to avoid stricture, otherwise, dysphagia, poor swallowing, and drooling will result in a patient who is oropharyngeally crippled (Conley, 1962; Dubernick and Antoni, 1974). With any treatment of the oropharynx the mouth function must be considered to prevent problems with speech and mastication.

Mastication

Resection of part of the mandible without replacement commonly results in drift of the remaining mandible with poor dental occlusion and interference with mastication. This may be improved with oral prostheses that prevent or decrease horizontal deviation. The best treatment is prevention of the mandibular drift by flap reconstruction or replacement with a plate or bone graft. Mastication is further enhanced by dental implants on the grafted bone.

Deglutition

Swallowing is most dependent on base of tongue function and prevention of aspiration. If the resected defect is tightly closed a stricture may result, producing dysphagia. The closure of the defect must be planned so that no tightness results. If excessive tension exists in the closure, wound breakdown, necrosis, and fistula will predictably occur. Proper flap design to ensure adequate tissue for reconstruction and to maintain proper flap circulation is critical. A planned pharyngotomy as an alternative to a tenuous closure is a valid consideration; in most cases it relieves the pressure on the suture line and may make the difference between success and failure in healing. Tethering of this area and loss of bulk and function may allow the bolus of food to descend quickly down into the hypopharynx resulting in aspiration. If a significant amount of the base of the tongue is resected it should be replaced with some type of flap reconstruction. A certain amount of bulk in this area is necessary for prevention of aspiration and successful swallowing. Anesthesia of the flap is a detriment to swallowing but may be overcome with swallowing therapy.

Aspiration may occur postoperatively if improper planning and reconstruction are done. The loss of a substantial portion of the base of the tongue combined with loss of the supraglottis puts the patient at high risk for aspiration. In some cases a cricopharyngeal myotomy may help to prevent aspiration by facilitating swallowing. If aspiration is severe enough, resulting in chronic pulmonary complications, total laryngectomy may be necessary. Most patients require nasogastric tube feedings for at least 2 weeks postoperatively or until healing is complete and deglutition achieved. Swallowing may be aggravated by leakage of liquid into the nose from resection of the palate. This is usually easily corrected with a prosthesis.

Speech

The amount of tongue resected and the resultant tongue mobility are the most important factors in the quality of resultant postoperative speech. If possible the tongue should be able to touch the incisors and the hard palate. Although the tongue may be satisfactorily used to close a defect, resultant tethering should be avoided. Common errors are to suture the tongue too high on the remnant soft palate or too laterally. Mobility may be improved by tongue release with skin grafting or prevented by proper use of flap reconstruction. Velopharyngeal incompetence results from resection of the soft palate and produces a more nasal quality to speech. The soft palate defect may be surgically reconstructed, but this is usually corrected by a prosthesis.

The long-term surgical complications primarily relate to dealing with oropharyngeally crippled patients. As stated earlier, this problem should be dealth with at the initial planning and treatment to minimize its effects. The success rate of rehabilitation and the prevention of complications are enhanced if these patients are managed by a team approach, with multiple specialists contributing to the overall effort.

Tumor recurrence

The recurrence of tumors (Fig. 74-81) after treatment is the most difficult therapeutic complication. Most patients have had extensive resections and radiation; therefore therapy options are limited. Preventive planning and execution at the initial treatment will diminish recurrence. If the initial evaluation is inaccurate and the resection and reconstruction are planned improperly, local recurrence of tumor will occur at a predictably higher rate.

The option include resection (Fig. 74-82), external beam radiation implants (Fig. 74-83), hyperthermia (Lele, 1984), cryotherapy, laser treatment, and chemotherapy (Eisenberger et al, 1984). The decision to excise recurrent tumor should be formulated as curative or palliative. Frank discussion with the patient and family should give them realistic expectations of surgical results, complications, and postoperative function. The surgeon may be doing the patient an injustice to pursue extensive surgery if the tumor is almost certainly incurable (Fig. 74-84). At times external beam radiation may be boosted to give palliation. Radiation implants may be useful to increase the radiation at a local site (Fig. 74-83). Cryotherapy may produce some palliation to control the local growth of tumors (Baker et al, 1984). Laser therapy may be useful to resect a recurrence or to debulk and control large recurrences.

Chemotherapy may be employed for local recurrences and regional or distant metastases. The responses are unpredictable, with some lesions showing dramatic regression and others displaying little or no response.

Proper management of recurrent tumors requires the best from all surgeons. Proper judgment and correct medical-surgical decisions must be balanced by sympathetic and empathetic support of the patient and family. This continuing support is as important as the initial therapy. The team management of the patient with terminal cancer provides support in all areas in this period of life transition.