16. Head & Neck Tumours

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In 1986, about 21000 patients will be diagnoses as having carcinoma of the oral cavity and 9000 as having carcinoma of the pharynx. The incidence of tumours of these sites would decline substantially if the use of tobacco were decreased. When detected and treated at an early stage, head and neck tumours are curable in 80% of cases. For a variety of reasons, many patients present with locally advanced primaries, involved regional lymph nodes, or distant metastases. Accurate staging is essential to determine the best therapy and to permit comparison of treatment results. In addition to surgery, therapy often involves collaboration with workers in other disciplines such as radiation oncology, medical oncology, maxillofacial prosthodontics, and speech therapy. The first priority is to treat the cancer adeuqately, then to maintain function, and finally to preserve appearance.

Etiology of Head & Neck Cancer

A carcinogen is an agent that initiates a cancer. Examples include tobacco, ionizind radiation, and certain viruses. Initiating agents may require cofactors to achieve or hasten carcinogenesis. The process is affected by the intensity and duration of exposure to initiating and promoting factors as well as by host factors such as genetic susceptibility and immune status.

A number of factors have been implicated as causes of squamous cell carcinomas of the oral and nasal passages. The vermilion surfaces of the lips are susceptible to ultraviolet irradiation and tobacco. Over 90% of squamous cell carcinomas of the lips involve the more exposed lower lip, and 70% of lip cancers occur in elderly, fair-skinned men with a history of prolonged sun exposure. Women and blacks are rarely affected. Sunlight is not the sole cause of carcinoma of the lip, however, because there is a poor correlation between the incidence of lip cancer and other sun-related skin cancers. Tobacco is probably the other main etiologic agent, since about 80% of patients with lip cancer are smokers. Neoplasia could be initiated by chemical damage from the tobacco or thermal damage from the heat of the cigarette or pipe stem.

Tobacco is the principal carcinogen responsible for oral and oropharyngeal cancer, but alcohol consumption is also important. The increasing incidence of oral and lung cancers among women in the USA is directly attributable to increasing cigarette consumption. The geographic and anatomic incidence of oral and oropharyngeal squamous carcinomas varies according to local customs and patterns of tobacco use. Alcohol may contribute by directly damaging the oral mucosa or by causing nutritional deficiencies that destabilize the squamous mucosa and promote the carcinogenic effects of tobacco condensates in saliva. Alcohol may also be carcinogenic independently of tobacco, but this is difficult to prove, because most alcoholics are smokers. For a given level of tobacco exposure, however, the risk of oral cancer increases with increasing alcohol consumption.

The dominant association of tobacco and alcohol use with cancer have made it difficult to identify other independent risk factors. Poor oral hygiene is common among patients with oral cancer, but it is not clear whether this is a causative or only an associated factor. Chronic

irritation from sharp teeth and ill-fitting dentures has also been implicated but in the absence of other risk factors is unlikely to cause cancer. Syphilitic glossitis may be an etiologic agent for tongue cancer.

The incidence of squamous cell carcinoma of the hypopharynx and larynx among smokers is higher overall than the incidence of oral cancer, which might be explained by the higher concentrations of aromatic hydrocarbons and nitrosamines in the more distal part of the aerodigestive tract. The incidence of Plummer-Vinson syndrome, an uncommon condition consisting of iron deficiency anemia, atrophic glossitis, hypochlorhydria, pharyngeal webs, and postcricoid carcinoma of the hypopharynx, has decreased as a result of improved nutrition and health services.

Certain occupations are associated with an increased risk of head and neck cancer. Wood workers in the furniture industry of Oxfordshire, England, had a high incidence of adenocarcinomas of the nasal cavity and paranasal sinuses. The same is true of workers in the shoe industry, although a definite carcinogen has not been identified.

Many factors have been implicated in the etiology of carcinoma of the nasopharynx, a rare disease among blacks and Caucasians but among the most common cancers affecting people from Kwangtung Province in China. The major causative factors appear to be genetic and viral. Chinese who emigrate to the USA have a diminished risk, but the incidence is still almost 20 times higher than among native-born Americans. Epstein-Barr virus (EBV) is believed to be a promoting factor - if not the actual cause - of some nasopharyngeal carcinomas. Most patients have elevated antibody titers to EBV that roughly correlate with the stage or volume of disease.

Finally, radiation therapy has been shown to increase the incidence of thyroid, salivary gland, and some mucosal carcinomas. The latent period varies from a few years to many years. Irradiation was used in the past to treat benign head and neck conditions, but this practice has now been stopped. Nonetheless, patients still present with thyroid carcinomas who had radiotherapy for acne or benign lymphoid enlargement during childhood. A few patients develop radiation-induced mucosal carcinomas and sarcomas many years after radiotherapy for other head and neck cancers.

Diagnosis

The evaluation of a patient with a tumor of the head or neck begins with a complete history and physical examination.

History

The 4 most common presenting symptoms are pain, bleeding, obstruction, and a mass. Pain should be characterized as to frequency, duration, severity, location, and radiation. It is difficult to quantify pain, so it may be more helpful to inquire about the amount and type of analgesics used. Several specific patterns are important. Pain around the orbits and at the skull base can be referred from the nasopharynx. Otalgia can be caused by tumors of the base of the tongue, tonsil, or hypopharynx because of involvement of cranial nerves V, IX, and X. Odynophagia may result from deep penetration by tumors of the base of the tongue or

hypopharynx or from extensive cervical lymph node metastases. Bleeding is usually mild and intermittent and is most commonly associated with tumors of the nasal cavity, nasopharynx, and oral cavity. Obstruction causing alterations of phonation, breathing, swallowing, or hearing may be a manifestation of either minimal or advanced disease. Hoarseness is often an early finding in tumors of the glottis, whereas cancers only a few millimeters away on the false vocal cord can grow and metastasize before causing a change in voice. Trismus usually indicates extension of tumor into the pterygoid muscles. Dysphagia is often a late symptom of obstruction at the base of the tongue, hypopharynx, or cervical esophagus. Loss of hearing may be the first symptom of tumors arising in or invading the auditory tract from the external auditory canal or nasopharynx.

A history of cancer in the region is common, and accurate documentation of its histologic type, stage, and date is vital. Squamous cell tumors arising in the same general area after more than 3 years are usually new primaries. The late appearance of lymph node metastases may be from the original tumor or from a new primary lesion. Lung lesions following trreatment of squamous cell cancer of the head and neck are just as likely to be new pulmonary tumors as metastases.

The medical, social, occupational, and family history should be reviewed. Information should be obtained about the use of tobacco and alcohol and exposure to ionizing radiation and chemical carcinogens. A nutritional history, noting diet and weight loss, is important in planning treatment and in identifying patients who will require aggressive nutritional therapy. Patients with tumors of the head or neck are often noncompliant and of low socioeconomic status. A full family and psychosocial history will also be helpful in assessing the need for postoperative support. It is important to obtain a detailed family history in patients with enlarged cervical nodes or thyroid nodules, because of the possibility of multiple endocrine neoplasia syndromes.

Physical Examination

The examination must be conducted in a well-lighted area with all necessary instruments and supplies close at hand. The examiner should use the same sequence of examinations with each patient, but it is often best to delay palpation of tender areas until the end of the session. The head and neck area should be observed while taking the history. It may be easier to note facial weakness or areas of asymmetry and hear changes in voice during the interview.

The examination should start with inspection. Small squamous cell carcinomas of the sin and melanomas are common causes of enlarged regional nodes. Each subsite of the upper aerodigestive tract must be carefully inspected. Dentures must be removed and the lips and tongue retracted to obtain a clear view of the oral cavity. The dimensions of a mass or ulcer can be estimated by placing a tongue blade (2 cm wide) over the area. Careful inspection is required to see changes of early erythroplasia and leukoplakia, which may be limited to small areas in users of smokeless tobacco. A bimanual technique should be used to examine the floor of the mouth. Palpation is also useful to detect tumors in all areas of the oropharynx, especially the base of the tongue. Parapharyngeal tumors arising from the retromandibular extension of the parotid gland, nerves, lymph nodes, and carotid body may present as masses in the tonsillar area. Complete examination of the nasopharynx, larynx, and hypopharynx may

require the use of a topical anesthetic spray. Although most sites are well seen with a head light and laryngeal mirror, flexible fiberoptic endoscopes often provide a better view with less patient discomfort, particularly of the nasopharynx and hypopharynx.

A detailed neurologic examination may reveal localizing signs when no other findings are present. Hyposmia may be caused by primary tumors of the olfactory bulb or tumors of the nasal cavity and paranasal sinuses. Sensory loss in the distribution of the infraorbital nerve is more often a manifestation of maxillary sinus tumors than of inflammation. Dysfunction of cranial nerves III-VII and IX-XII may occur with nasopharyngeal carcinoma. Horner's syndrome suggests metastases or a simultaneous lung primary.

Lymph nodes along the jugular chain, which lie medial to the sternocleidomastoid muscle, are best examined by grasping around the muscle and feeling the nodes between the thumb and first 2 fingers. Nevertheless, physical examination of lymph nodes is not very accurate. Thirty percent of patients with clinically negative nodes have metastases on pathologic staging, and 20% of those with clinically suspicious nodes will be histologically free of tumor. Tumor in lymph nodes above the clavicles originates from primary lesions above the clavicles in 85% of cases.

Biopsy

Definitive diagnosis can usually be made with biopsy at the time of the initial examination. For mucosal lesions, pinch or punch biopsy is obtained at the margin away from areas of obvious necrosis. One important exception is the small lesion that would be completely removed by a biopsy. It is important that the *responsible surgeon* perform the biopsy, because knowledge of the original findings is crucial when planning treatment. Another exception is tumors in the area of the parotid gland (see salivary gland tumors), which are best managed by exploration and appropriate resection rather than incisional or excisional biopsy.

The diagnosis of masses elsewhere in the neck should be made by aspiration needle biopsy when feasible. Incisions for open biopsies should be chosen to facilitate later resections. Lymph node specimens may require special handling for cultures, lymphocyte markers, and immunohistochemical stains.

Additional Studies

The many possible additional studies are overutilized and of limited value. A chest x-ray should be obtained to exclude lung metastases and secon primary tumors. When a new lung lesion appears after treatment of a head and neck cancer, it more often represents a lung primary than a metastasis. CT scans and MRI have replaced other kinds of head and neck x-rays in most cases, although paranasal sinus and mandible views may show important changes. Although the presence of a tumor is usually evident on CT scans, the boundary between surrounding edema is often obscure. A barium swallow may be helpful in patients with dysphagia, but laryngograms are of little value compared with CT scans and direct inspection.

Lymphatic Anatomy of the Head & Neck

Since the majority of head and neck tumors are squamous cell carcinomas, metastases most often involve regional lymph nodes. Salivary gland tumors, papillary carcinoma of the thyroid, and melanoma also spread principally via lymphatics. There are 3 main groups of lymphatic tissue in the head and neck. The first contains the structures of Waldeyer's ring (palatine tonsils, lingual tonsils, adenoids, and adjacent submucosal lymphatics); the second comprises transitional lymphatics (submental, submandibular, parotid, retroauricular, and occipital nodes); and the third includes the cervical lymph nodes (internal jugular chain, spinal accessory chain, supraclavicular area). The lymph nodes are also categorized by level within the neck, and clinicians and pathologists should report findings in these terms. An accurate prediction of the origin of a metastasis can often be made just by knowing the site of the involved node. Table 16-1 summarizes the anatomic sites that drain to each lymph node group.

Table 16-1. Routes of lymphatic spread from common head and necks sites.

Lymph Node Group	Primary Site
Submental	Lower lip, anterior oral cavity, skin
Submandibular	Lower lip, oral cavity, facial skin
Subdigastric	Oral cavity, oropharynx, hypopharynx
Midcervical	Hypopharynx, base of tongue, larynx, thyroid
Lower cervical	Hypopharynx, thyroid, lung, GI tract
Occipital	Scalp
Posterior triangle	Nasopharynx, hypopharynx, thyroid.

The pattern of flow within the lymphatics is predictable unless it has been distorted by a tumor, previous surgery, or irradiation. The jugular chain and transverse cervical lymphatics drain into the thoracic duct on the left side of the neck. In 15% of individuals, there is also a thoracic duct on the right side. The thoracic duct empties into the great vessels near the junction of the internal jugular and subclavian veins in Waldeyer's triangle. Care must be taken to avoid injury to the duct during neck dissections and supraclavicular lymph node biopsies.

Lymphatic drainage from areas below the diaphragmmm, the left upper extremity, the left side of the neck, and variable areas of the left lung all drain into the left thoracic duct. It is not known why supraclavicular nodes on the left side (Virchow's node) often harbor metastases from distant sites.

Staging of Head & Neck Cancer

Head and neck cancer should be staged in order to classify the tumor, estimate the prognosis, and plan treatment. This entails an accurate description of the location and size of the primary, the status of the cervical lymph nodes, and the presence or absence of distant metastases. A chart should be made containing a drawing and a written description of the findings. The TNM staging system has done much to standardize the reporting of results of treatment. In the oral cavity, oropharynx, and major salivary glands, T stage is defined

primarily by tumor size; while in the larynx, hypopharynx, and nasopharynx, definition of T stage depends on the extent of local involvement. The following summary of the TNM system applies to most areas.

Definitions of T (tumor) categories:

T_1: Greatest diameter 2 cm or less, or confined to the anatomic site of origin.
T_2: Greatest diameter 2-4 cm, or extending into an adjacent site.
T_3: Greatest diameter more than 4 cm, or tumor extending into adjacent region, or with fixaton of the vocal cord.
T_4: Massive tumor with invasion of surrounding structures (soft tissue, bone, cartilage, facial nerve).

Definitions of N (lymph node) categories:

N_0: No clinically involved nodes.
N_1: Single ipsilateral node, 3 cm or less in diameter.
N_2: Single ipsilateral node 3-6 cm in diameter, or multiple positive nodes more than 6 cm in diameter.
N_3: Massive ipsilateral nodes, bilateral nodes, or contralateral nodes.

Definition of M (metastasis) categories:

M_0: No distant metastases.
M_1: Distant metastases present.

Once the TNM classification is established, the tumor stage is defined as follows:

SI: T_1N_0
SII: T_2
SIII: T_3N_1
SIV: T_4N_2 T_4N_3

The prognosis for each stage at different sites is not the same, although it is roughly equivalent. The approximate 5-year survival is as follows: stage I, 75-95%; stage II, 50-75%; stage III, 25-50%; and stage IV, less than 25%. Additional factors, including a past history of cancer, medical illnesses, nutrition, and activity status, have a great bearing on outcome. This pattern applies to patients with squamous cell carcinomas and minor salivary cancers arising from the mucous membranes. Cancers from the skin and thyroid gland, melanoma, and lymphoma are classified differently.

Cancer of the Oral Cavity

Anatomy

The oral cavity is bounded anteriorly by the border of the lips and posteriorly by the anterior tonsillar pillars, the posterior aspect of the hard palate, and the circumvallate papillae of the tongue. Subsites are (1) the vermilion surfaces of the lips; (2) the alvelar process of

the mandible; (3) the alveolar process of the maxilla; (4) the retromolar trigone, which overlies the ascending ramus of the mandible behind the last lower molar tooth; (5) the hard palate; (6) the buccal mucosa, which lines the cheeks and inner aspects of the lips and includes the upper and lower buccoalveolar gutters; (7) the floor of the mouth; and (8) the anterior two-thirds of the tongue (oral tongue), which is limited posteriorly by the circumvallate papillae and includes the tip, dorsum, lateral borders, and undersurface of the mobile tongue.

Pathology

Over 95% of cancers of the oral cavity are squamous cell carcinomas. They are predominantly well and moderately well differentiated and are often prceded by leukoplakia or erythroplakia. Leukoplakia ("white patch") is not necessarily a premalignant condition, although it is induced by factors that cause carcinomas. When a biopsy of a leukoplakic patch shows severe cellular atypia, dysplasia, and dyskeratosis, the condition is premalignant. Erythroplakia (red granular patches of mucosa) is more likely to be premalignant or frankly malignant than is leukoplakia. Macroscopically, oral cavity cancers can be exophytic growths, flat tumors with central ulceration and indurated edges, or deeply infiltrating ulcers. Verrucous carcinoma is an exophytic lesion that is usually white because of surface hyperkeratosis. This tumor is histologically well differentiated throughout and has a better prognosis than infiltrating lesions. Oral cancers, especially those of the upper and lower alveolar mucosa, often invade nearby bone. The mandible is most frequently involved. Minor salivary tumors arise in submucosal glands, which are most abundant in the hard palate. Ulceration is a late feature. Melanoma, which may affect the mucosa of the mouth, has a very poor prognosis.

Cancers of the upper lip drain to parotid and submandibular nodes, while those of the lower lip drain to submental and submandibular nodes. Lateral tongue, floor of mouth, and buccal cancers drain to the ipsilateral submandibular and upper and mid jugular chain nodes, but they nmay also drain to lower jugular nodes. Midline tumors of the lip, tongue, and floor of mouth may drain bilaterally.

The incidence of lymph node involvement from squamous cancers of the oral cavity is related to the site and size of the primary lesion. Cancers of the oral tongue and floor of mouth have a higher incidence of nodal involvement than do cancers of the lip, hard palate, or buccal mucosa. Overall, about 30% of patients with oral cancers have clinical or subclinical lymph node involvement.

Clinical Features

Patients with squamous carcinoma of the oral cavity usually present with ulcerated tumors that have been present for weeks or months. They are typically men aged 50-70 years with a history of heavy tobacco and alcohol use. Dental hygiene is frequently poor, and areas of surrounindg erythroplakia and leukoplakia may be seen adjacent to the lesion. Submandibular or jugular chain nodes are palpable in about 30% of patients. Clinical assessment of both normal and enlarged lymph nodes tends to be wrong in one-third of patients (false-negatives and false-positives). Pain is usually not a prominent feature in the absence of deep invasion.

Treatment

A. Primary Tumor: The site and size of the tumor determine the choice of therapy. Squamous carcinomas of the vermilion surface of the lip are best excised and the defect primarily closed as long as no more than 30% of the lip must be removed. With lesions requiring removal of more than one-third of the lip, closure can usually be achieved by transposition of a segment of the opposite lip on a vascular pedicle. When the entire vermilion border has been damaged, vermilionectomy may be performed along with excision of the tumor, and a new vermilion surface can be created by advancing the buccal mucosa or using a pedicle tongue flap.

Within the oral cavity, small tumors can usually be excised through the open mouth. Small defects may be closed by direct suture or split-thickness skin grafts. Tumors larger than 2 cm in diameter require more extensive excision, aiming for at least 1- to 2-cm margins from macroscopic disease. The resulting defect requires reconstruction to replace the oral lining and to maintain oral function. For squamous carcinomas involving bone, it is necessary to remove bone deep to the tumor. If the bone is invaded clinically or by x-ray, segmental resection of the mandible should be performed.

Removal of an oral tumor that includes segmental resection of the mandible and a radical neck dissection is termed a **composite resection.** This procedure is uncommon now, as a more selective approach is preferred. Mandibular resection is reserved for cases in which bone is invaded, and radical neck dissection is reserved for clinically palpable lymph nodes.

Radiotherapy is an alternative to surgery for oral cavity cancers smaller than 4 cm in diameter (T_1 and T_2 tumors). The potential side effects of mucositis, xerostomia, and osteoradionecrosis of the mandible must be balanced against potential advantages. Large tumors are better treated with combined surgery and postoperative radiotherapy, because this improves the chances of local control. It has been suggested that radiotherapy may induce anaplastic changes in verrucous carcinomas, but there is no evidence to support this claim.

B. The Neck: Clinically palpable lymph nodes are usually treated by radical neck dissection, which involves removal of all the lymphatic tissue of the neck along with the sternomastoid muscle and internal jugular vein. The spinal accessory nerve is resected in a classic radical neck dissection, but if the upper jugular chain nodes are not involved, the nerve may be preserved to reduce the disability of a trapezius muscle palsy. Modified radical neck dissection, which spares the sternocleidomastoid muscle, spinal accessory nerve, and usually the internal jugular vein, may be used if palpable disease in the neck is minimal.

Since lymph nodes are histologically involved in 30% of patients with oral cavity cancers when the neck is clinically normal, prophylactic neck dissection is sometimes recommended. There is no evidence, however, that this improves survival. Following neck dissection, adjuvant radiotherapy, reduces the likelihood of local recurrence, but overall survival is unchanged because distant metastases are so common.

Prognosis

For T_1, T_2, T_3, and T_4 tumors, the 5-year survival rates are 80%, 60%, 40%, and 20%, respectively. The presence of lymph node metastases halves the prognosis for any given T stage.

Cancer of the Oropharynx

Anatomy

The oropharynx extends from the hard palate superiorly to the hyoid bone inferiorly. The subsites of the oropharynx are (1) the inferior surface of the soft palate, including the uvula; (2) the posterior pharyngeal wall; (3) the anterior and posterior tonsillar pillars; (4) the tonsils and tonsillar fossae; and (5) the posterior one-third of the tongue, which lies between the circumvallate papillae and the valleculae. The lingual surface of the epiglottis is part of the supraglottic larynx.

Pathology

Most oropharyngeal tumors are squamous carcinomas, but they tend to be less well differentiated than oral cavity lesions, and deep infiltration is common. Minor salivary gland neoplasms and lymphomas - particularly non-Hodgkin's lymphoma involving the tonsil and other parts of Waldeyer's ring - arise in this area. Tumors of the parapharyngeal space may also present as oropharyngeal swellings, indenting the mucosa of the lateral pharyngeal wall or soft palate. These are most often retromandibular parotid tumors, neurogenic tumors (eg, neurilemmoma, neurofibroma), or carotid body tumors.

The oropharynx is richly supplied with lymphatics. Posterior pharyngeal wall tumors drain bilaterally to jugular chain nodes and retropharyngeal nodes of Rouvière. Tumors of the tonsillar region drain primarily to the upper and mid jugular chain nodes and also to spinal accessory nodes in the posterior triangle.

The overall incidence of nodal involvement from oropharyngeal cancers is approximately 70% and correlates with tumor size. Even small lesions of the tonsillar region or tongue base are likely to have nodal metastases.

Clinical Features

Patients usually present with ulcerating tumors, and about 60% have nodal involvement. Tumors of the base of the tongue tend to be diagnosed at an advanced stage, and presentation with a neck mass and no obvious primary is common with these lesions. Tongue base cancers are not necessarily more aggressive than those of the oral tongue, but their poorer prognosis is probably due to overall larger size and an increased incidence of nodal metastases at the time of diagnosis. Approximately 70% of patients with tongue base tumors present with advanced disease (stage III or IV), compared with only 30% of patients with carcinoma of the oral tongue.

Tumors of the tonsillar region readily extend to the mandible and may invade the bone. Large tumors in this region may also invade the medial pterygoid muscle, producing trismus. This is an important presenting symptom, and it may limit access for examination. Referred otalgia is also common with deeply infiltrating cancers. Tongue base cancers may spread laterally to involve the mandible, anteriorly to involve the oral tongue, and inferiorly to involve the preepiglottic space and supraglottic larynx. The diagnosis of a parapharyngeal mass presenting as an oropharyngeal swelling is usually not difficult; bimanual palpation is useful.

Treatment

A. The Primary: The best treatment for oropharyngeal cancer remains controversial. For small tumors (T_1 and T_2) surgery or radiotherapy gives similar results, and treatment must be individualized. Small cancers of the tonsillar region respond well to radiotherapy (ie, 75% local control at 3 years). While tongue base cancers are less radiosensitive, irradiation is often the best initial treatment, since resection of this area produces so much morbidity. For early oropharyngeal cancers, surgical access may be achieved by splitting the lower lip and jaw and retracting the mandible laterally. Larger tumors pose a greater problem, and the choices for therapy are (1) surgery combined with postoperative radiation therapy versus (2) initial radiotherapy followed by surgery in the event of recurrence. Overall, combined therapy offers the best chance of disease control and prolonged survival. In this region, resection must be radical and often entails removal of a segment of the mandible with the primary tumor. This is necessary even when the mandible is not invaded, since it allows wide removal of the nearby pterygoid muscles, which are frequently invaded. Total glossectomy may be necessary to encompass large tumors of the tongue base, but this creates a substantial functional loss. Total glossectomy must often be accompanied by laryngectomy to remove the tumor completely or to prevent subsequent aspiration pneumonia. Operative defects may be repaired with skin grafts, pedicled myocutaneous flaps, or microvascular free flaps. Tracheostomy is mandatory to protect the airway after oropharyngeal resection.

Excision of a soft palate cancer is relatively straightforward but leads to regurgitation of food into the nasal cavity upon swallowing. Therefore, small lesions may be treated with radiation therapy and surgical salvage if necessary.

B. The Neck: Clinically palpable nodes should be treated by radical neck dissection. If the neck is clinically clear, radiotherapy to at least the upper neck nodes (levels 2 and 3) is appropriate for all but the earliest tumors. If the primary lesion is treated by irradiation, the upper level neck nodes should be included in the radiation fields. If the primary is treated surgically, an elective modified neck dissection is appropriate, since the resection or reconstruction usually entails entering the neck. If the neck is not entered in the course of resecting an oropharyngeal tumor and postoperative radiotherapy is planned for the primary site, it is reasonable to include the area at risk in the radiation field instead of performing an elective neck dissection.

Prognosis

With either surgery or radiotherapy, patients with T_1 and T_2 tumors of the oropharynx have a 5-year survival rate of about 60%. Survival of patients with larger tumors and with

nodal metastases is about 25%. Quality of life is a major consideration in the treatment of oropharyngeal cancers, since swallowing and speech are often affected by treatment, especially by radical surgical resection.

Cancer of the Hypopharynx

Anatomy

The hypopharynx extends from the hyoid bone superiorly to the lower border of the cricoid cartilage inferiorly. It comprises 4 subsites: (1) the piriform sinuses (one on each side of the larynx); (2) the postcricoid area (immediately behind the larynx); (3) the posterior pharyngeal wall; and (4) the marginal area, where the medial wall of the piriform sinus and the false vocal cord meet superiorly at the aryepiglottic fold. Laterally, the piriform sinuses are bounded by the ala of the thyroid cartilage and the thyrohyoid membrane. The hypopharynx, lined by stratified squamous epithelium, has a muscular wall consisting of the middle and inferior constrictor muscles. The retropharyngeal space posterior to the hypopharynx, which contains lymphatics and loose areolar tissue, separates the visceral compartment of the neck from the prevertebral muscles with their overlying prevertebral fascia.

Pathology

Over 95% of hypopharyngeal cancers are squamous carcinomas, which usually present as infiltrating ulcers with indurated borders. The incidence of poorly differentiated lesions is higher in the hypopharynx than in other regions. The size of these cancers can be deceptive on clinical evaluation because of submucosal lymphatic extension. Minor salivary tumors and lymphomas occasionally occur in the hypopharynx, where they are usually submucosal. Benign hypopharyngeal lesions include webs, strictures, and pharyngoesophageal (Zenker's) diverticula.

Squamous carcinomas of the hypopharynx have a great propensity for lymphatic invasion. Many patients have positive lymph nodes at the time of initial presentation, and the hypopharynx - especially the piriform sinus - must be examined in any adult with metastatic cancer in a cervical node and no obvious primary tumor. Occult node metastases (ie, clinically negative but histologically positive) are also common, making the overall incidence of nodal involvement with hypopharyngeal cancer about 70%. The principal nodal groups involved are the upper, mid, and lower jugular chain nodes; the retropharyngeal nodes of Rouvière; and, less frequently, the nodes along the spinal accessory nerve in the posterior triangle.

Clinical Features

The most common site for hypopharyngeal carcinoma is the piriform sinus, accounting for 60% of cases. The postcricoid region is affected in 25% of patients and the posterior pharyngeal wall in 15%. Postcricoid lesions are frequently circumferential and cause dysphagia, while piriform sinus lesions tend to be silent for a longer time. Patients with this disease are typically men in their fifth to eighth decades who have a history of excessive alcohol and tobacco use. Plummmer-Vinson syndrome, the main exception, is seen principally in Scandinavian women with iron deficiency anemia.

The chief symptoms are pain, dysphagia, and weight loss. Pain may be localized to the site of the tumor or may be referred to the ipsilateral ear. About 25% of patients, especially those with lesions of the piriform sinus, present with a palpable neck node and no other symptoms. Advanced tumors may invade the larynx and cause vocal cord paralysis and hoarseness. A barium swallow may aid in the diagnosis of hypopharyngeal cancer, but direct laryngopharyngoscopy and biopsy are necessary to confirm the diagnosis and assess the extent of disease.

Treatment

The objectives of treatment are to cure the disease and maintain continuity of the upper digestive tract. Intensive nutritional therapy may be necessary before treatment if longstanding dysphagia has resulted in cachexia. These patients also commonly have pulmonary disease that must be assessed preoperatively.

A. The Primary: Hypopharyngeal tumors are usually best treated by surgery. Elderly or medically unfit patients with small tumors may be treated with radiotherapy, but local mucositis and swallowing difficulties can be major problems during therapy. Even for small lesions, surgery often must be extensive, usually entailing total laryngectomy and at least partial pharyngectomy. For larger lesions, total pharyngolaryngectomy is usually required, which necessitates pharyngeal reconstruction. Some surgeons recommend that the entire esophagus be removed along with the larynx and pharynx, which decreases the likelihood of local recurrence at the inferior suture line and facilitates reconstruction by the gastric pull-up technique. However, not all patients require total laryngo-pharyngo-esophagectomy. When laryngo-pharyngectomy has been performed and the pharynx cannot be closed primarily, pharyngeal reconstruction is best done as a one-stage procedure using either microvascular free jejunal graft or a myocutaneous flap from the pectoralis major or latissimus dorsi. Older techniques made use of skin flaps from the chest wall, but these are staged procedures and should be avoided where possible.

If surgical treatment is followed by postoperative radiotherapy to the primary site and neck, the local control rate may be improved.

B. The Neck: The incidence of metastases is so high that some form of neck treatment is appropriate for all patients. Radical neck dissection is indicated for palpable node disease. For clinically negative nodes, when the primary site is treated by radiotherapy, the neck should also be irradiated. If the primary is treated surgically, modified neck dissection should be performed. If postoperative radiotherapy is given to the area of the primary, radiotherapy should also encompass the neck, and neck dissection can be avoided.

Prognosis

Recurrence is most common at the primary site or neck, usually within 2 years after treatment. Distant metastases appear in 25% of patients - higher than with cancers of the oral cavity and oropharynx. The overall 5-year survival rate for patients with carcinoma of the hypopharynx is 25%. The survival rate is moderately good for early lesions but dismal for advanced tumors. The role of adjuvant chemotherapy is unclear, because clinical trials have so far failed to show better results.

Cancer of the Nasal Cavity, Nasopharynx & Sinuses

Anatomy

The nasal cavity is divided into right and left nasal fossae by the nasal septum. Each fossa has an anterior opening (naris, or nostril), a posterior opening (choana), and bony projections called conchae, or turbinates, protruding from the lateral walls. Posterior to the nasal cavity is the nasopharynx. Its roof is formed by the skull base, which slopes downward and backward, while the inferior limit is level with the plane of the hard palate. The lateral wall is composed of the torus tubarius, the auditory tube orifice, and the lateral wall of Rosenmüller's fossa. The paranasal sinuses consist of the maxillary and ethmoid sinuses bilaterally, the frontal sinus, and the sphenoid sinus. Each maxillary sinus shares a common wall with the orbit above, the nasal cavity medially, the oral cavity inferiorly, and the infratemporal fossa posteriorly.

The mucosa of the nasal cavity consists of ciliated pseudostratified columnar epithelium (respiratory mucosa) except in the region of the superior turbinate and the adjacent lateral wall and septum, which is lined by specialized nonciliated epithelium (olfactory mucosa). The sinuses are lined by respiratory epithelium, and melanocytes are scattered throughout the region. The nasopharynx is lined by respiratory epithelium in early life, but squamous metaplasia occurs with aging, so that about 60% of the respiratory mucosa is replaced by squamous epithelium in the first decade of life. Initially, this squamous epithelium is nonkeratinizing, but after age 50 keratinization occurs.

Pathology

The most common tumor of the nasal cavity and paranasal sinuses is squamous cell carcinoma. The maxillary antrum is the most common site, while primary malignant neoplasms of the nasal cavity are rare. Adenocarcinoma, sarcoma, melanoma, lymphoma, and minor salivary gland tumors also occur. Esthesioneuroblastoma is an uncommon malignant neoplasm that arises from olfactory mucosa at the superior aspect of the nasal cavity. It readily invades the ethmoid sinuses and may involve the orbit. In the nasopharynx, squamous carcinoma, 80% of which are nonkeratinizing, also predominate. Lymphoepithelioma, a subgroup of nonkeratinizing squamous carcinoma, is poorly differentiated, lacks squamous or glandular differentiation, and has an accompanying lymphocyte component. It is quite radiosensitive.

Tumors of the skin of the vestibule of the nose may drain to parotid, submandibular, or upper jugular nodes. Otherwise, nasal cavity and antral cancers tend not to have nodal metastases unless they are advanced and have invaded surrounding skin, muscle, oral cavity, or pharynx. The nasopharynx is richly supplied with lymphatics, and tumors in this region readily drain bilaterally to upper and midjugular chain nodes and to posterior triangle nodes. Nodal metastases occur in 80% of patients with nasopharyngeal cancers, and a neck mass is the initial manifestation of 50% of patients with this tumor. Unlike nearly all other head and neck sites, tumors of the nasopharynx may metastasize to the posterior triangle in the absence of jugular chain lymph nodes.

Clinical Features

Tumors of the nasal cavity, paranasal sinuses, and nasopharynx are frequently advanced at presentation. Early symptoms, such as nasal obstruction, nasal discharge, and sinus congestion, are so commonly associated with benign conditions that they are frequently neglected until the disease is advanced. Bleeding may occur. Bone invasion and involvement of adjacent structures are common. Cancers of the maxillary sinus may invade the hard palate and enter the oral cavity or the orbital floor, causing visual symptoms and proptosis. Anterior invasion through the skin may also occur. In advanced disease, metastases in the neck may be the initial manifestation. Cranial nerve symptoms may result from invasion of the skull by tumor. Along with the tonsillar fossa, the tongue base, and the piriform sinus, the nasopharynx is an important site of clinically occult primary cancer.

Treatment

The diagnosis and assessment of extent of disease are more difficult with tumors in this area than elsewhere in the head and neck and require histologic examination of a good biopsy specimen. CT scanning should be performed to delineate the ewxtent of disease, although it is sometimes difficult to differentiate between tumor and edematous mucosa in a sinus. MRI may prove helpful in making this differentiation.

Radiotherapy is the principal treatment for carcinoma of the nasopharynx. Undifferentiated tumors respond better than well-differentiated ones, and treatment is more successful in younger patients. A dose of 7000 cGy is usually required for the primary site. Both sides of the neck should be treated because of the very high incidence of nodal metastases. Five-year survival rates for stages I, II, III, and IV disease, respectively, are 85%, 75%, 45%, and 10%. One-third of patients die of distant metastatic disease, most often located in bones, lung, and liver. Adjuvant chemotherapy may improve survival.

Although either surgery or radiotherapy may be used to treat early-stage tumors of the paranasal sinuses, combined therapy is best for advanced disease. Small cancers of the maxillary sinus may be treated by partial maxillectomy, but if radiotherapy is to be used, antrostomy will be required to allow drainage of the cavity. Surgery has advantages. The presence of early bone involvement decreases curability with radiotherapy, and salvage surgery is often required. Furthermore, it is difficult to detect recurrent disease following radiotherapy. For advanced tumors, radiotherapy may improve operability, but the subsequent resection should encompass the original extent of disease. Orbital exenteration is necessary for maxillary tumors invading the floor of the orbit. Resectable cancers of the upper nasal cavity and ethmoid sinuses most often require craniofacial excision, which entails frontal craniotomy to assess the extent of intracranial extension. Invasion of the anterior cranial fossa with dural involvement or posterior extension through the orbital apex makes tumors in this region incurable by surgery. Because the incidence of neck metastases is low with cancers of the paranasal sinuses, prophylactic neck dissection or irradiation is unnecessary.

Survival varies according to the stage of disease, and the 5-year survival rate averages 30%.

Unknown Primary Cancers in the Head & Neck

In about 5% of cases of metastatic tumor in the neck, the primary is clinically occult. One-third of patients who have an unknown primary after the initial examination will have the site identified on subsequent workup. The site of the metastasis often suggests the location of the primary because of specific lymphatic flow patterns in the neck. Fiberoptic examinations of the nasopharynx and hypopharynx can be performed under topical anesthesia in the office. Fine-needle aspiration of a mass can be performed at the initial examination. Other biopsies should be delayed until x-ray studies have been completed to avoid creating artifacts on the x-rays. CT scans show the primary site in 15% of cases, but in most cases the primary is evident from clinical findings. Examination under anesthesia is required to thoroughly inspect all regions. Any abnormal areas should be biopsied, but "blind biopsy" of normal-appearing tissue is appropriate only for suspected lesions of the nasopharynx. The most common sites of occult tumors are the nasopharynx, hypopharynx (piriform sinus), and oropharynx (tonsillar fossa), but lung and esophagus occasionally are implicated. Treatment is based on the extent and location of disease in the neck. When nodes are confined to the parotid area, an appropriate parotidectomy is performed (see salivary gland tumors). Cervical metastases should be treated by radical neck dissection, although a modified radical neck dissection may be used for minimal disease not close to the spinal accessory nerve. Postoperative radiation is recommended when there are multiple involved nodes or any node with extracapsular extension. Bilateral neck irradiation is used only for bilateral metastases. Prophylactic irradiation of all potential primary sites is not recommended. When the primary is not found initially and treatment is limited to the involved neck, only 20% of patients ever have the primary tumor identified. The cure rate is about 40% in the presence of lymph node metastases above the supraclavicular fossa. Involved nodes lower in the neck are associated with 5% survival at 5 years. All of the above statistics refer to patients with squamous cell carcinoma. Other histologic types have different prognoses.

Neck Metastases From Primaries Outside the Head & Neck

Only 15% of lymph node metastases in the neck come from primaries below the clavicles. Most of these metastases arise in lower jugular chain and supraclavicular nodes, particularly on the left side. This is because lymph drainage terminates on the left side of the neck from (1) all areas below the diaphragm, (2) the left upper extremity, and (3) portions of the left lung. The most common primary site is the lung; other sites include the pancreas, esophagus, stomach, breast, ovary, and prostate. Involved lymph nodes in the lower jugular chain on either side are particularly difficult to detect unless one palpates themm between the index finger and thumb in the area medial to the sternocleidomastoid muscle. Aspiration needle biopsy is useful for differentiating adenocarcinoma from squamous cell tumors. CT scans should be performed, but they reveal the primary in only 25% of cases. While most lesions that present this way have no effective treatment, it is important to diagnose breast, prostate, and genital cancers, which often do respond to specific therapy.

Salivary Gland Tumors

Salivary tissue consists of glands divided according to size into major and minor glands. The paired major salivary glands consist of the parotid, submandibular, and sublingual glands. The minor salivary glands are widely distributed in the mucosa of the lips, cheeks,

hard and soft palate, uvula, floor of mouth, tongue, and peritonsillar region; a few are found in the nasopharynx, paranasal sinuses, larynx, trachea, bronchi, and lacrimal glands. Clinically, the parotid gland is most important, because of its size. Most salivary tumors occur in the parotid.

Tumors of salivary tissue constitute about 5% of head and neck tumors and affect major salivary glands 5 times more often than minor salivary glands. The incidence of malignancy among salivary gland tumors varies inversely with the size of the gland. About 25% of parotid tumors, 40% of submandibular gland tumors, and 70% of sublingual and minor salivary gland tumors are malignant. Since 70% of salivary gland tumors occur in the parotid and three-fourths of these are benign, the majority of salivary gland neoplasms are benign.

Salivary gland tumors are thought to originate from 2 cell types: intercalated and excretory duct reserve cells. Myoepithelial cells are present in many salivary tumors but rarely as the principal malignant cell type. A classification of salivary tumors is given in Table 16-2.

Table 16-2. Classification of primary epithelial salivary gland tumors.

I. Benign

Mixed tumor (pleomorphic adenoma)
Warthin's tumor (papillary cystadenom lymphomatosum)
Oncocytoma
Monomorphic adenoma
Sebaceous adenoma
Benign lymphoepithelial lesion

II. Malignant

Mucoepidermoid carcinoma: low-grade, intermediate-grade, high-grade
Adenoid cystic carcinoma
Acinic cell carcinoma
Adenocarcinoma
Clear cell carcinoma
Malignant oncocytoma
Carcinoma ex pleomorphic adenoma
True malignant mixed carcinoma (biphasic malignancy)
Primary squamous cell carcinoma
Epithelial-myoepithelial carcinoma.

Benign Salivary Gland Tumors

The commonest benign tumor is the mixed salivary gland tumor, or pleomorphic adenoma, which accounts for 70% of parotid tumors and 50% of all salivary gland tumors. Pleomorphic adenomas are more common in women than in men, and the peak incidence is the fifth decade. They are slow-growing, lobular, and not well encapsulated. They may become very large without interfering with facial nerve function. Although mixed tumors are benign, they recur unless completely removed. Enucleation is inadequate. When tumor recurs

in the parotid region, the facial nerve is at greater risk from damage during reoperation than it was during the initial procedure. Malignant transformation in a benign tumor is uncommon.

Warthin's tumor (papillary cystadenoma lymphomatosum), the next most common benign tumor, accounts for about 5% of parotid neoplasms. It is believed to arise from ectopic epithelial salivary tissue within lymph nodes external to or within the parotid gland. Warthin's tumors are usually cystic, typically occur in men in the sixth and seventh decades, and are bilateral in about 10% of cases. They occur almost exclusively in the parotid gland and have a typical histologic appearance, consisting of a papillary-cystic pattern with a marked lymphoid component. The latter is not part of the neoplastic process.

Oncocytomas are benign tumors composed of large oxyphilic cells called oncocytes. On electro microscopy, the cytoplasm of the oxyphilic cells is packed with mitochondria.

Monomorphic adenomas are rare benign salivary gland tumors that are usually epithelial (but occasionally myoepithelial) in origin. They may be related to benign mixed tumor and are most commonly seen in minor salivary glands of the lip.

The differential diagnosis of a swelling in the parotid region includes parotitis, primary salivary neoplasm, upper jugular chain node enlargement, tumor of the tail of the submandibular gland, enlarged preauricular or parotid lymph node, branchial cleft cyst, epithelial inclusion cyst, or any mesenchymal neoplasm.

Treatment

Benign salivary tumors should be excised. Adequate exposure of the parotid gland requires a preauricular incision carried into the neck to allow adequate exposure of the gland and facial nerve. The aim of the operation is to completely excise the tumor with an adequate margin of normal tissue. In the parotid, the minimum adequate operation is superficial parotidectomy, which entails removal of the salivary tissue superficial to the facial nerve. Enucleation should be avoided because it greatly increases the likelihood of recurrence and nerve damage. When a tumor arises in the gland deep to the facial nerve, a superficial parotidectomy is performed, the facial nerve is preserved, and the tumor deep to the nerve is removed.

Benign tumors of the submandibular gland require total removal of the gland for diagnosis and treatment. Aspiration biopsy may be helpful if cancer is suspected. The entire contents of the submandibular triangle should be removed.

Since tumors of minor salivary tissue have a higher likelihood of being malignant, they should be initially biopsied (aspiration biopsy) so that appropriate definitive treatment can be planned. If a preoperative diagnosis of cancer has not been made, frozen section should be done during surgery so that an appropriately radical procedure can be performed as indicated.

Malignant Salivary Tumors

Mucoepidermoid carcinoma is the most common parotid cancer. Acinic cell carcinomas are derived from serous acinar cells and thus are found almost exclusively in the

parotid gland. Adenoid cystic carcinomas, which are uncommon in the parotid, have a great propensity for local recurrence and perineural invasion. Patients with this tumor tend to have a protracted illness, with recurrences appearing 15 years or more after treatment. Patients with distant metastases from adenoid cystic carcinoma may survive for 5 or more years. In the parotid region, the presence of pain, rapid recent enlargement, skin involvement, or facial nerve paralysis suggests cancer. Enlarged lymph nodes in association with a salivary gland mass should always be considered a manifestation of cancer until proved otherwise. Less common tumors include carcinoma arising in a pleomorphic adenoma and primary squamous cell carcinoma. The former is typically an adenocarcinoma for which the synonym "malignant mixed tumor" should be avoided, since it implies cancer of both the epithelial and the myoepithelial components, which is exceedingly rare. Primary squamous carcinomas - approximately 1% of salivary cancers - must be differentiated from mucoepidermoid carcinoma and metastatic squamous carcinoma in a parotid lymph node.

Among minor salivary cancers, adenoid cystic carcinoma is the most common, followed by adenocarcinoma and mucoepidermoid carcinoma. Approximately 70% of all minor salivary tumors occur in the oral cavity, principally in the hard palate. The prognosis varies according to the site of origin, with tumors of the nasal cavity and sinuses having the worst prognosis. They often present at an advanced stage with local destruction. Neither the symptoms nor the gross appearance helps predict the histology, so biopsy is necessary.

Treatment

The diagnosis of cancer may be obvious when facial nerve paralysis or other evidence of local nodal invasion is present: under such circumstances, aggressive treatment can be planned. In general, complete local excision with a margin of normal tissue is the appropriate form of biopsy, which in the parotid region means superficial parotidectomy. For submandibular tumors, the entire submandibular triangle should be cleared. In contrast, minor salivary tumors are better biopsied uising an incisional or punch technique, so the surgeon who will carry out definitive treatment can assess the site and extent of the lesion. Frozen section examination is adequate to confirm the diagnosis.

Surgical treatment depends on the extent of disease. Unless the facial nerve is paralyzed or found to be directly invaded by tumor at surgery, it should be preserved. Extensive invasion of parotid or submandibular tumors beyond the gland requires a radiocal resection designed to completely remove the lesion. For localized low-grade tumors, complete excision is usually sufficient. For high-grade malignancy or incomplete excision, postoperative radiotherapy is indicated for the primary site and draining lymph nodes. Postoperative radiotherapy is also appropriate following extensive resections for advanced tumors. Clinically involved lymph nodes should be removed by an appropriate neck dissection, but prophylactic neck dissection is unnecessary except perhaps for submandibular gland cancers, where this would facilitate radical excision of the primary. Radical surgery is usually not performed when distant metastases are present, except for adenoid cystic carcinoma.

When the facial nerve must be divided, it should be repaired. After planned surgical excision, the facial nerve can be reconstructed using a nerve graft, eg, the sural nerve. These grafts are effective in about 60% of cases, but complete recovery may take up to 2 years.

Prognosis

Prognosis depends on the clinical stage, the histologic grade, the tumor site, the patient's age, and the completeness of removal. The most important is the clinical stage of the disease. The prognosis for patients with stage I and stage II disease is good after adequate treatment. The prognosis is poor regardless of treatment in the face of local extension or lymph node or distant metastases.

The next most important factor is the histologic grade of the tumor. Low-grade tumors, such as acinic cell carcinomas and low-grade mucoepidermoid tumors, have an excellent prognosis; survival rates at 10 years are about 80%. The 10-year survival rate after treatment of high-grade lesions, such as malignant pleomorphic adenoma (adenocarcinoma), squamous cell carcinoma, and high-grade mucoepidermoid carcinoma, is about 30%.

Reconstruction Following Head & Neck Surgery

The primary aim is complete eradication of disease. This is most likely to be achieved at the initial attempt, since treatment of recurrences is less successful. The dilemma is that surgery which achieves a good cosmetic result may be oncologically inadequate. Even so, resection must consider both function and appearance.

Surgical defects can be repaired by direct closure, skin grafting, or tissue transfer. Direct closure is ideal for small lesions of the skin and for smaller mucosal lesions of the oral cavity and oropharynx. Direct closure of large defects in the oral cavity and oropharynx can create distortion, with tongue tethering and so forth, and should be avoided. Skin grafts may be used for defects of the skin or mucosa of the mouth and oropharynx. The advantage is that skin grafting can be done quickly and avoids a lengthy reconstructive operation. Recurrences can be recognized earlier when a skin graft is used compared with a flap.

New tissue to close surgical defects may be obtained in several ways, including local rotation or transposition skin flaps for the skin of the face and neck and local flaps of buccal or tongue mucosa for small defects in the oral cavity. To close larger defects, tissue can be transferred from more distant sites using skin flaps (deltopectoral flap and forehead flap); myocutaneous flaps (pectoralis major flap and latissimus dorsi flap); and vascularized free tissue transfers, also called free flaps (radial forearm flap). Each of these techniques has advantages and disadvantages, and the reconstructive procedure must be tailored to the patient and the site and extent of operative defect.

Jaw reconstruction poses technical difficulties, but vascularized free compound flaps such as the deep circumflex iliac artery osteomyocutaneous flap appear to be most reliable. Most surgeons try to preserve the mandible when it is not invaded by tumor; but when a segmental resection is required, the continuity of the mandibular arch is disturbed, which leads to deformity. If part of the horizontal or vertical ramus of the mandible is resected, the resulting cosmetic and functional disturbance is usually acceptable. Removal of the anterior part of the mandibular arch destroys the contour of the chin and creates the so called "Andy Gump" deformity, which severely affects eating, speech, and appearance. Such defects should be reconstructed when operative risk is acceptable.

Prostheses are especially useful following amputation of the nose or ear or after orbital exenteration. A good facsimile of the lost part can usually be attached to a pair of glasses. Excellent function can be attained with dental obturators for patients with defects in the hard palate and upper alveolar ridges.

Radiation Therapy

Radiotherapy may be used as definitive treatment with curative intent, as a pre- or postoperative adjunct to surgery, or for palliation.

Definitive Radiotherapy

Mucosal squamous carcinomas are sensitive to irradiation, especially if they are small and only superficially invasive. Tumors of the oral cavity and oropharynx stage T_1 and T_2 (ie, 4 cm in diameter) may be equally well treated with surgery or radiotherapy. In some cases, radiotherapy has the advantage of avoiding the disfiguring side effects of surgery while being equally effective. However, mucositis, subsequent xerostomia, the possibility of osteroradionecrosis, and logistic problems associated with radiotherapy must be considered. Curative radiotherapy usually entails an interstitial implant as well as external beam therapy. Local control rates are about 70%, and 5-year cure rates are about 50% for early oral cancers, so radiotherapy is an acceptable alternative to surgery in many cases. Large oral cavity tumors respond poorly to radiotherapy, and surgery is most often the best treatment for these lesions, sometimes followed by local radiotherapy. In the oropharynx, especially for the tonsil, radiotherapy is best for small tumors, because the response rate is good and the neck can be irradiated simultaneously to treat occult metastatic disease. Large tumors of the tonsil require surgery combined with radiotherapy. The surgical treatment of tongue base cancers larger than about 3 cm usually entails total glossectomy and laryngectomy - a procedure with considerable morbidity. Radiotherapy is often the best initial treatment for these lesions, with surgery reserved for treatment failures.

Nasopharyngeal tumors are usually responsive to radiotherapy, and resection is impossible in this area anyway. A common side effect is occlusion of the auditory tube and subsequent otitis media. Irradiation may be used to treat nasal and paranasal sinus cancers, but current evidence suggests that surgery followed by radiation therapy gives better results. Radiotherapy is excellent for early (T_1 or T_2) laryngeal cancers and has the advantage that speech is preserved. Five-year survival rates range from 70 to 90% depending on the extent of disease.

Palpable neck metastases are sometimes treated by radiotherapy alone if they are small (ie, < 3 cm in diameter). If nodes remain palpable after treatment, neck dissection is necessary. In general, however, overt metastatic disease in the neck is best treated initially by neck dissection.

In most of these situations, treatment is given in fractions of 180-200 cGy, 5 days a week for approximately 6 weeks. Doses of 6000-7000 cGY are delivered to the primary site. When lymph nodes are not palpable but there is a high likelihood that they harbor occur cancer, elective irradiation to the neck to a dose of 5000 cGy is often added.

Adjuvant Radiotherapy

Surgery is often combined with radiotherapy to improve tumor control. Preoperative radiotherapy has been used, but it has 2 disadvantages: It produces edema and increased vascularity of the operative field, and it alters the lesion so that accurate histologic assessment is impossible. Therefore, postoperative radiotherapy is more popular. Treatment can be more selective, since it is reserved for patients known from clinical or histologic findings to be at high risk of recurrence. Examples include a large primary lesion (T_3 or T_4) tumors of high histologic grade or poor differentiation, histologically positive surgical margins, macroscopic residual disease, and perineural invasion.

Treatment is usually started after the wound has healed. After a neck dissection in which positive lymph nodes have been found, adjuvant radiotherapy improves control when multiple lymph nodes are positive and when disease has spread beyond the node capsule.

When radiotherapy is given preoperatively, the dose is usuall 4500 or 5000 cGy; when given postoperatively, the dose is 5000-6000 cGy, sometimes with a boost to an area of high risk.

Palliative Radiotherapy

In some instances, where the primary tumor is very large and not surgical resectable or metastatic neck disease is fixed, radiotherapy may be given in high doses (eg, 6000 cGy or more), but with palliation as the most realistic goal. Occasionally the response is good, and previously unresectable disease is sometimes rendered resectable. Nonetheless, the prognosis still depends on the original extent of disease, and the chances of cure are low.

The effects of radiotherapy are additive; once a full course of treatment has been given to an area, the tissue can tolerate no more without risking major complications. Surgical procedures in a previously irradiated field are more difficult, and tumors previously treated by radiotherapy tend to respond poorly to later chemotherapy. The main acute complications of radiotherapy are dermatitis and mucositis, which, if severe, may require treatment to be suspended temporarily or terminated. Long-term complications include fibrosis and vascular sclerosis, severe xerostomia, and osteoradionecrosis. Patients with bad teeth should have them extracted before radiotherapy. Those who retain their teeth must maintain excellent dental hygiene.

Antitumor Chemotherapy

Chemotherapy is useful in 3 main settings: (1) It may be given as induction or neoadjuvant treatment, which aims to reduce the size of the primary tumor before definitive surgery or radiotherapy. The extent of surgery or radiotherapy should be determined by the original extent of the tumor, not the postchemotherapy size. Chemotherapy is sometimes given simultaneously with radiotherapy to potentiate the effects of irradiation. (2) Cytotoxic drugs may be given as an adjuvant to treat occult distant metastases. (3) Chemotherapy may be given as palliation.

The most effective drugs are methotrexate, cisplatin, fluorouracil, bleomycin, vincristine, and cyclophosphamide. Cytotoxic agents are usually given intravenously, but some may also be given intra-arterially, which theoretically allows a larger dose to be delivered directly to the tumor. Intra-arterial chemotherapy has not been shown to be more effective than intravenous chemotherapy; however, it is clear that chemotherapy alone is almost never curative. Even if the tumor regresses completely, microscopic disease remains, and the tumor will recur if no other treatment is given. As yet there is no good evidence that induction or adjuvant chemotherapy improves survival, but a major randomized clinical trial is currently examining this question. While it is reasonable to give palliative chemotherapy outside the setting of a clinical trial, adjuvant chemotherapy should not be regarded as standard therapy and should probably be administered only in controlled clinical trials.

We do know that patients who respond to chemotherapy tend to respond well to their definitive treatment, while those who respond poorly to chemotherapy usually respond poorly to their definitive treatment. Also, previously treated patients - especially those who have had radiotherapy - do not respond to chemotherapy as well as do previously untreated patients. Finally, exophytic and superficial tumors respond more favorably than deeply infiltrating ones.

Current evidence suggests that multidrug regimens that include cisplatin are most effective in previously untreated patients with head and neck cancers. Among previously treated patients, methotrexate in moderate doses is as effective as any other drug or combination of drugs.