2 PAROTID MASS

Ashok R. Shaha, M.D., F.A.C.S.

Approach to Evaluation of a Parotid Mass

There are three major salivary glands in the human body—the parotid gland, the submandibular gland, and the sublingual gland—of which the parotid gland is the largest. In addition, there are approximately 600 to 800 minor salivary glands distributed throughout the entire upper aerodigestive tract, starting from the lip and extending to the lower end of the esophagus and up to the pulmonary alveoli. Almost half of these minor salivary glands are on the hard palate. Accordingly, any mass on the hard palate should be considered a minor salivary gland tumor until proved otherwise.¹

The majority of salivary gland tumors originate in the parotid gland. Approximately 75% to 80% of parotid tumors are benign.²,³ In the evaluation and surgical treatment of parotid tumors, it is essential to maintain awareness of the possibility of temporary or permanent facial nerve injury [see Discussion, Principles of Facial Reanimation, below]. Because surgery necessarily entails some risk of an injury to this structure or its branches, as well as because most parotid masses do not give rise to significant symptoms, many patients with parotid tumors may find the prospect of surgical therapy difficult to accept.

Clinical Evaluation

HISTORY

Evaluation of a parotid mass begins with a good clinical history. The most important question is, how long has the mass been present? If local pain and swelling of recent onset (i.e., within the past few days) are reported, infection or obstruction is the likely cause. If the mass has been present for a longer period (i.e., weeks to months), a neoplasm is more likely. Unfortunately, the presentations of some nonneoplastic conditions resemble those of neoplasms, and distinguishing one type of condition from the other can be challenging. Thus, the history should continue with further questions focusing on local or systemic signs and symptoms, the presence of swelling or other masses in the salivary glands, and previous medical conditions (including skin cancer).

Classification

Major salivary gland masses can be classified as nonneoplastic, lymphoepithelial, or neoplastic.⁴

Nonneoplastic The causes of nonneoplastic masses include congenital, granulomatous, infectious or inflammatory, and non-infectious conditions. Some congenital lesions (e.g., hemangioma or vascular malformation) present as a vague swelling in the parotid region that has been present since childhood. One congenital lesion, a first branchial cleft cyst, presents as a mass inferior to the cartilaginous ear canal, with a cyst tract that can be either medial or lateral to the facial nerve and may even divide the trunk of the nerve. This cyst is most commonly noted in the second through fourth decades in life.

Granulomatous diseases are frequently manifested by an asymptomatic, gradual enlargement of a lymph node within the gland; often, they cannot be readily distinguished from neoplasms. In sarcoidosis, salivary gland involvement may cause duct obstruction, pain associated with the duct, xerostomia, or enlargement of the gland. The diagnosis is supported by chest x-rays that show bilateral hilar adenopathy and by elevated levels of angiotensin-converting enzyme (ACE).

As noted (see above), infectious or inflammatory diseases involving the parotid, unlike neoplasms, tend to give rise to pain in their early stages. Most such inflammatory conditions begin with diffuse enlargement of one or more salivary glands. Although parotitis is generally unilateral, it may be bilateral if a systemic causative condition is involved, and other salivary glands may be affected as well. The pain reported may be related to the presence of a stone in the salivary duct or to diffuse obstructive parotitis. Chronic parotitis may lead to recurrent infection and inflammation. When recurrent swelling of the salivary gland does occur, it is directly related to eating and increased salivation.

Sialadenosis is a noninflammatory, nonneoplastic condition of unknown origin that is characterized by diffuse enlargement of the salivary gland, with no discrete mass or inflammation.

Lymphoepithelial Lymphoepithelial lesions may be divided into lymphocytic infiltrative diseases and lymphomas. In many cases, patients with lymphocytic infiltrative diseases (e.g., Mikulicz disease, sicca complex, and Sjögren syndrome) have had their conditions for long periods, and they may feel that they have always been chubby, when in fact they have had chronic enlargement of both parotid glands. In patients with Sjögren syndrome, malignant transformation to high-grade lymphoma is known to occur. Lymphoepithelial cysts are benign cystic lesions that may arise from lymph nodes or from lymphoid aggregates in the salivary gland. These lesions may be associated with HIV infection.

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Approach to Evaluation of a Parotid Mass

**Patient presents with parotid mass**

Obtain clinical history. Perform physical examination of parotid region, focusing on extent of parotid disease, localized effects of lesion, and any motor or sensory deficits.

**Diffuse enlargement is present**

- Diagnosis is obvious
  - Plan treatment (conservative or surgical, as indicated).

**Solitary mass is identified**

- Diagnosis is uncertain
  - Initiate further workup:
    - Imaging (CT, MRI, ultrasonography, sialography, sialoendoscopy, PET)
    - FNA biopsy (routine use is controversial)

**Lesion is benign**

- Treat surgically with superficial parotidectomy, preserving facial nerve.

**Lesion is malignant**

- Treat surgically with superficial, total, or radical parotidectomy, as necessary, preserving facial nerve if possible.
- If cervical lymphadenopathy is present, consider elective neck dissection (comprehensive or selective, as appropriate).
- Provide postoperative radiotherapy for all patients except those with T1 or T2 tumors of low-grade histology and clear margins.
Primary lymphoma of the salivary gland is uncommon, occurring in fewer than 5% of patients with parotid masses. Suggestive clinical features include (1) the development of a parotid mass in a patient with a known history of malignant lymphoma, (2) the occurrence of a parotid mass in a patient with an immune disorder (e.g., Sjögren syndrome, rheumatoid arthritis, or AIDS), (3) the presence of a parotid mass in a patient with a previous diagnosis of benign lymphoepithelial lesion, (4) the finding of multiple masses in one parotid gland or of masses in both parotid glands, and (5) the association of a parotid mass with multiple enlarged cervical lymph nodes unilaterally or bilaterally.6

Neoplastic Neoplastic masses may be present for years without causing any symptoms. Benign salivary tumors are more common in younger persons, whereas malignant parotid lesions are more common in the fifth and sixth decades of life.7 The classic presentation of a benign parotid tumor is that of an asymptomatic parotid mass that has been present for months to years. Benign neoplasms of the parotid include pleomorphic adenoma, basal cell adenoma, myoepithelioma, Warthin tumor, oncocytoma, and cystadenoma. The observation of rapid growth in a long-standing pleomorphic adenoma is suggestive of malignant transformation. In a 2005 study of 94 patients with pleomorphic adenoma, malignant transformation to carcinoma was documented in 8.5% of cases.8 Rapid tumor growth, metastasis to lymph nodes, deep fixation, and facial nerve weakness are all strongly suggestive of malignant disease and are indicators of a poor prognosis.9 Although pain is more often experienced by patients with benign conditions, it is also reported by some patients with infiltrative malignant tumors. In the latter patients, pain is another indicator of a poor prognosis.10

The presence of facial nerve palsy should raise the index of suspicion for malignancy. Occasionally, patients present with classic Bell palsy. This condition is usually of viral origin, and most patients recover over time. If Bell palsy persists, however, further investigation is required, including imaging studies to rule out any obvious parotid lesion. Facial palsy occurring in association with parotitis and anterior uveitis is known as Heerfordt syndrome and is often seen in patients with sarcoidosis.

PHYSICAL EXAMINATION

The physical examination should focus on the extent of the disease in the parotid, the neck, and the parapharynx; the localized effects of the tumor (including trismus); and the motor or sensory deficits resulting from neural invasion.

The mass is palpated to determine whether it is painless or painful; whether it is soft, firm, hard, or cystic; and whether it is mobile or fixed to deep tissue or skin. The skin of the scalp, the ear, and the face is examined for lesions. The neck is palpated for adenopathy. In the oral cavity, the ducts are examined for discharge or saliva after the glands are milked. The pharyngeal wall is examined for deviation, and the jaw is examined for trismus.

The parotid occupies a large area, starting from the zygoma and extending to the upper portion of the neck and behind the mandible to what is commonly called the tail of the parotid. Occasionally, the parotid tissue extends behind the earlobe, in which case it may be misdiagnosed preoperatively as a nonsalivary pathologic condition. Accessory parotid tissue is present along Stenson’s duct in approximately 21% of persons.11 Patients sometimes present with a tumor (most commonly, a benign mixed tumor) of this accessory tissue.12 Attempts to excise such masses locally must be avoided, because of the high risk of injury to branches of the facial nerve.

The most common presentation of a parotid mass, whether benign or malignant, is an asymptomatic swelling in the preauricular or retromandibular region. Occasionally, patients present with metastases to the intraparotid or periparotid lymph nodes. There are approximately 17 to 20 lymph nodes in the substance of the parotid and along its tail, and there may be a smaller number of lymph nodes within the deep lobe of the gland. These lymph nodes may be directly affected by metastatic tumors originating from the anterior scalp or the temporal, periorcular, or malar regions. Especially with elderly patients, it is extremely crucial to obtain a detailed history of any previously excised skin lesions, some of which may have been squamous cell carcinomas (SCCs) that metastasized to the periparotid nodes. Generally, such metastasis involves multiple superficial lymph nodes and presents as diffuse enlargement of the parotid parenchyma. With the massive involvement of the parotid gland, facial nerve palsy is not uncommon in this setting. The majority of metastases to the parotid gland derive from cutaneous SCC or melanoma; however, metastatic spread from the lung, the breast, and the kidney also is known to occur.13

The location of the parotid mass is a very important diagnostic factor. The classic presentation of a benign mixed tumor is as a marblelike lesion in the parotid gland—a firm, mobile mass that commonly originates in the superficial portion of the gland and generally is not fixed to the deeper structures or to the skin. Parotid tumors that originate in the deep lobe may present as a vague, diffuse swelling behind the angle of the mandible; more often, however, they present as a swelling of the parapharyngeal area accompanied by medial displacement of the tonsil or the soft palate.

Although physical examination of a parotid mass is a simple process in itself, it should be accompanied by a thorough evaluation of the head and neck that includes a detailed examination of the oral cavity and the oropharynx, nasopharynx, hypopharynx, and laryngopharynx areas. Occasionally, a tumor of the oropharynx presents as cervical lymphadenopathy or as metastatic disease in the tail of the parotid. In such cases, it may be difficult to determine whether the patient has a primary salivary gland tumor or a metastatic lesion. The presence of any suspicious pathologic condition in the oropharynx or the base of the tongue is an indication for appropriate endoscopy and biopsy of the suspected primary site.

Physical findings suggestive of malignancy include a large and fixed mass, facial nerve weakness, lymph node metastasis, and skin involvement; patients with advanced parotid malignancies may present with trismus. Whereas patients with benign parotid tumors rarely exhibit facial nerve weakness, approximately 12% to 15% of patients with parotid malignancies have facial nerve dysfunction at presentation.14 The most common causes of facial nerve weakness in this setting are adenoid cystic carcinoma, poorly differentiated carcinoma, and SCC. Primary SCC of the parotid is quite rare, and a diagnosis of SCC in the gland should lead one to suspect that a tumor has metastasized to the parotid lymph nodes. Before the diagnosis of primary SCC of the parotid is made, high-grade mucoepidermoid carcinoma and metastatic SCC must be excluded.

The presence of cervical lymph node metastasis may direct one’s attention to the parotid mass, though only about 20% of persons with parotid malignancies actually have clinically apparent cervical lymph node metastases at the time of initial presentation.10 The parotid tumors most commonly associated with metastatic disease to the lymph nodes at presentation are high-
grade mucoepidermoid carcinoma, poorly differentiated carcinoma, and SCC. Lymph node metastases may also derive from high-grade adenocarcinomas or malignant mixed tumors.

Some patients are totally asymptomatic, with the only significant physical finding being a mass visible through the open mouth, which is suggestive of either a deep-lobed parotid tumor or a parapharyngeal tumor. The majority of parotid tumors develop within the superficial lobe of the parotid—not surprisingly, given that between 80% and 90% of the parotid tissue is superficial to the facial nerve. However, a significant minority of parotid masses—about 10%—are found within the deep lobe. Most deep-lobed parotid tumors are benign, in which case surgical treatment generally consists of a superficial parotidectomy with dissection and preservation of the facial nerve, followed by removal of the tumor. Occasionally, however, malignant deep-lobed parotid tumors do occur. Such tumors frequently involve the facial nerve, and surgical treatment may require sacrifice of the facial nerve in select circumstances. Most patients who have undergone surgical treatment of a malignant deep-lobed tumor will require postoperative radiation therapy.

Investigative Studies

The majority of parotid masses can easily be evaluated with a careful history and a thorough physical examination. Nevertheless, it sometimes happens that even after these measures have been carried out, there remains some clinical uncertainty regarding whether the pathologic process is of parotid or of nonsalivary origin. A number of nonsalivary tumors (e.g., neurofibromas, lipomas, lymphadenopathies, metastatic cutaneous lesions, and lymphomas) are known to present in the parotid region on occasion. These tumors frequently involve the facial nerve, and surgical treatment may require sacrifice of the facial nerve in select circumstances. Most patients who have undergone surgical treatment of a malignant deep-lobed tumor will require postoperative radiation therapy.

IMAGING

Generally, parotid masses are imaged with either computed tomography or magnetic resonance imaging. CT is superior to MRI for evaluation of the bony structures, whereas MRI may be more helpful in distinguishing between inflammatory conditions and salivary neoplasms. CT scanning is indicated in patients with diffuse enlargement of the parotid gland, tumor extension beyond the superficial lobe, facial nerve weakness, trismus, or deep-lobed parotid tumors that are difficult to evaluate clinically. If the parotid mass appears to be fixed to the deeper structures, it is appropriate to proceed with CT to evaluate the extent and parapharyngeal extension of the disease. MRI is indicated in patients with facial nerve paralysis. Occasionally, it may be necessary to perform both CT and MRI. Both imaging methods are helpful and accurate in distinguishing deep-lobed parotid tumors from other parapharyngeal masses. They are also useful for evaluating suspicious lymph nodes and the periphery of the mass (specifically with respect to determining whether the lesion is encapsulated or has irregular borders).

Ultrasonography can be useful for determining the location of the lesion and for guiding fine-needle aspiration (FNA) biopsy. In the past, technetium-99m sestamibi scanning was commonly employed for the diagnosis of oncocytoma and Warthin tumor. Various other diagnostic studies are available for evaluation of parotid masses. At one time, sialography was commonly employed to assess patients with suspected salivary stones, as well as to evaluate the ductal arrangements in patients with chronic sialoadenitis. Currently, however, sialography is rarely used, both because there is a significant possibility of an infectious flare-up and because the study actually yields only minimal information. In the early 1980s, CT sialography became popular for a time; however, it was quite a complicated procedure, and clinicians eventually found that the information it yielded could easily be obtained from spiral (helical) CT. Occasionally, surface-coil MRI may be helpful for evaluating parotid masses deriving from subcutaneous processes. Sialoendoscopy has generated considerable interest, especially in Europe and Germany; however, this sophisticated technology has not yet entered everyday practice. Although sialoendoscopy may be of some value in the assessment of salivary stone disease or chronic sialodacysis, it is rarely performed in the United States at present, and its eventual role in the evaluation of parotid masses remains to be determined.

For a classic benign mixed tumor presenting in the form of a small nodule in the superficial lobe of the parotid gland, imaging is not required.

Currently, the role of positron emission tomography (PET) in the initial evaluation of a parotid mass remains undefined. This modality may, however, be of some value in the evaluation of suspected recurrent parotid cancers, lymph node metastases, or distant metastases.

**FINE-NEEDLE ASPIRATION BIOPSY**

Routine use of FNA biopsy in the evaluation of a parotid mass [see Table 1] continues to be controversial. One reason for the controversy is that cytologic evaluation is difficult. Another is that the extent of surgical treatment can easily be defined by means of the clinical assessment. The main argument against routine use of FNA biopsy is based on the standard approach to most parotid masses, which is a superficial parotidectomy that includes identification and preservation of the facial nerve. Nevertheless, FNA biopsy can be quite helpful, especially for the purposes of preoperative consultation with patients regarding the suspected pathologic process and the extent of surgical therapy. FNA biopsy has an overall accuracy that exceeds 90%, and it is considered a good investigational tool as long as it is used in the appropriate clinical context.

In the case of a classic benign mixed tumor, which presents as a mobile, confined, superficial nodule in the parotid gland, FNA biopsy is not required for further treatment. However, in cases where the clinical picture is not definitive and one cannot determine whether the pathologic process is of parotid origin or not, FNA biopsy is extremely important. Besides distinguishing between benign and malignant conditions, FNA biopsy can also distinguish between salivary and nonsalivary processes [see Table 1].

**Table 1 Uses of FNA Biopsy in Evaluation of Parotid Mass**

<table>
<thead>
<tr>
<th>Use of FNA Biopsy</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>To identify suspected malignancy</td>
<td>To diagnose metastatic carcinoma</td>
</tr>
<tr>
<td>To identify suspected lymphoma</td>
<td>To distinguish between salivary and nonsalivary lesions</td>
</tr>
<tr>
<td>To facilitate conservative management of Warthin tumor or pleomorphic adenoma in a poor-risk patient</td>
<td>To confirm preoperatively suspected malignancy in a patient with facial palsy</td>
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<tr>
<td>To evaluate bilateral tumors</td>
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</table>
A variety of different lymph node pathologies, benign parotid tumors, and even suspected malignant parotid tumors can be differentiated by means of FNA biopsy. Furthermore, lymphoepithelial lesions of the parotid, benign mixed tumors, and Warthin tumors are easily diagnosed with this procedure. FNA biopsy is particularly useful when a parotid mass is likely to be the result of metastasis.

Occasionally, in an elderly person whose overall physical condition is poor, a conservative approach can be taken when a Warthin tumor is diagnosed by means of FNA biopsy. Similarly, in a person with a long-standing benign mixed tumor, observation may be appropriate if the patient is not a candidate for surgical intervention and if FNA biopsy confirms that the lesion is benign.

FNA biopsy findings that suggest lymphoma may help one avoid unnecessary parotidectomy and risk to the facial nerve. Often, it is hard to achieve a definitive diagnosis of lymphoma by means of FNA biopsy alone. In such cases, core biopsy or open biopsy can be performed to establish the diagnosis. Core biopsy of a parotid mass is a difficult procedure (unless the mass is very large and very superficial), and it is generally contraindicated on the grounds that it may cause bleeding or facial nerve injury. Nevertheless, if core biopsy can be performed safely, it can be a good choice in cases where lymphoma is suspected on the basis of FNA biopsy.²¹ Open incisional biopsy can also be performed safely when done in conjunction with continuous monitoring of the facial nerve.²²

Benign lymphoepithelial lesions related to HIV disease are readily diagnosed by means of FNA biopsy, especially if they are multiply recurrent cystic lesions in the tail of the parotid or if they occur bilaterally. In general, HIV-related pathology is quite easy to diagnose with FNA; HIV-infected patients with benign lymphoepithelial lesions may be treated by providing appropriate management of the underlying illness.

The crucial points for clinicians with respect to FNA biopsy in the setting of a parotid mass are (1) that this investigative study will not make a definitive diagnosis of parotid malignancy and (2) that one therefore should not make decisions about how to manage the facial nerve solely on the basis of an FNA-suggested malignant diagnosis. Any decisions regarding the approach to the facial nerve should also be based on preoperative assessment of facial nerve function and intraoperative evaluation of the nerve in relation to the tumor.

### Table 2: Salivary and Nonsalivary Pathologic Processes Distinguished by FNA Biopsy

<table>
<thead>
<tr>
<th>Salivary processes</th>
<th>Benign</th>
<th>Mixed tumor</th>
<th>Warthin tumor</th>
<th>Malignant</th>
<th>Primary salivary gland cancer</th>
<th>Metastatic disease in salivary gland</th>
<th>Cystic adenoma</th>
<th>SCC</th>
<th>Adenocarcinoma</th>
<th>Melanoma</th>
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<tbody>
<tr>
<td>Nonsalivary processes</td>
<td>Lipoma</td>
<td>Sebaceous cyst</td>
<td>Lymph node pathology</td>
<td>Benign melanoma</td>
<td>Metastatic cancer</td>
<td>Lymphoma</td>
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### Table 3: American Joint Committee on Cancer TNM Clinical Classification of Major Salivary Gland Tumors

<table>
<thead>
<tr>
<th>Primary tumor (T)</th>
<th>TX: Primary tumor cannot be assessed</th>
<th>T0: No evidence of primary tumor</th>
<th>T1: Tumor ≤ 2 cm in greatest dimension without extraparenchymal extension</th>
<th>T2: Tumor &gt; 2 cm but ≤ 4 cm in greatest dimension without extraparenchymal extension</th>
<th>T3: Tumor having extraparenchymal extension without seventh nerve involvement and/or &gt; 4 cm but ≤ 6 cm in greatest dimension</th>
<th>T4: Tumor invades base of skull, seventh nerve, and/or &gt; 6 cm in greatest dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional lymph nodes (N)</td>
<td>N0: No regional lymph node metastasis</td>
<td>N1: Metastasis in a single ipsilateral lymph node, ≤ 3 cm in greatest dimension</td>
<td>N2: Metastasis in a single ipsilateral lymph node, &gt; 3 cm but ≤ 6 cm in greatest dimension, or in multiple ipsilateral lymph nodes, none &gt; 6 cm in greatest dimension</td>
<td>N2c: Metastasis in bilateral or contralateral lymph nodes, none &gt; 6 cm in greatest dimension</td>
<td>N3: Metastasis in a lymph node &gt; 6 cm in greatest dimension</td>
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<tr>
<td>Distant metastasis (M)</td>
<td>M0: No distant metastasis</td>
<td>M1: Distant metastasis</td>
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### Staging and Prognosis

For cancers of the parotid gland (as well as those of other major salivary glands), staging is accomplished by means of the familiar tumor-node-metastasis (TNM) system developed by the American Joint Committee on Cancer (AJCC) and the International Union Against Cancer (UICC) [see Tables 3 and 4].²³

The prognostic factors in the management of parotid gland tumors must be understood in relation to the stage the disease has reached, the need for postoperative radiation therapy, and the overall long-term outcome [see Table 5]. Such factors include age.
at diagnosis, pain at presentation, TNM staging, skin invasion, facial nerve dysfunction, perineural growth, positive surgical margins in the final pathology report, soft tissue invasion by the primary tumor, treatment type, and extranodal spread of the metastatic disease in the neck. To make definitive decisions regarding treatment, it is necessary to analyze these prognostic factors critically in individual patients. An example of such critical analysis is the prognostic index devised by the Dutch Head and Neck Cooperative Group for patients with parotid cancer.24,25 In this index, a weighted combination of the parameters of age, pain, tumor size, nodal stage, skin invasion, facial nerve dysfunction, perineural growth, and positive surgical margins is employed to compute a prognostic score. The score is then used to assign patients to one of four groups, each of which is associated with an expected recurrence-free percentage.

### Management

Treatment of a parotid mass depends on the nature and extent of the lesion [see Table 6]. Malignant parotid masses are treated surgically according to established oncologic principles [see Surgical Therapy, below], with postoperative radiation therapy added as necessary [see Radiation Therapy, below]. Generally, benign parotid masses are managed surgically as well, with exploration of the parotid gland, evaluation of the neoplasm, and appropriate parotidectomy with identification and preservation of the facial nerve and its branches. In the case of a suspected benign mixed tumor, enucleation is contraindicated because of the possibility of tumor spillage, incomplete removal of the tumor, injury to the capsule and resultant seeding of the tumor into the parotid tissue, or inadvertent injury to the branches of the facial nerve. Enucleation of such a tumor is very likely to result in local recurrence, which invariably is much more difficult to manage than the original lesion was and poses a high risk of injury to the facial nerve.

### SURGICAL THERAPY

#### Parotidectomy with or without Facial Nerve Reconstruction

The minimum surgical procedure for a parotid mass is superficial parotidectomy with identification and preservation of the facial nerve [see 2:6 Parotidectomy]. Subtotal parotidectomy may be required for larger tumors that involve the deep lobe of the parotid gland; however, true total parotidectomy with preservation of the facial nerve is almost impossible, because of the parotid gland tissues surrounding the nerve. If the tumor involves the facial nerve and is directly infiltrating into it, a diagnosis of malignancy should be explored, and only if the diagnosis is confirmed should the facial nerve be sacrificed. Preoperative facial nerve weakness generally indicates that the tumor is involving the nerve, in which case due consideration should be given to the sacrifice and subsequent reconstruction of this structure.

Reconstruction of the facial nerve can be performed with a nerve graft from the greater auricular nerve, from the sural nerve in the leg, or from the ansa hypoglossi. In view of the technical complexity of nerve grafting, preoperative consultation with a plastic surgeon may be necessary. The functional results of nerve grafting vary considerably, depending on the age of the patient, the extent of the disease, and the identification of and appropriate anastomosis to the peripheral branches of the facial nerve. If postoperative radiation therapy is envisioned, its potential deleterious effects on nerve regeneration should be kept in mind.

If the tumor involves only an isolated branch of the facial nerve, one may opt for selective sacrifice of that branch, along with nerve grafting. If the tumor extends beyond the parotid gland and involves the infratemporal fossa, the ascending ramus of the mandible, or the mastoid process, a much more extensive surgical procedure (e.g., composite resection, lateral temporal bone resection, or radical parotidectomy with sacrifice of the entire facial nerve) becomes necessary. Such patients invariably require postoperative radiation therapy [see Radiation Therapy, below]. However, in the majority of patients who present with an isolated parotid mass and a functioning facial nerve, every attempt should be made to preserve the nerve.26 It is rarely necessary to sacrifice a functioning facial nerve: the only indication for doing so is a situation in which the entire tumor cannot be resected without sacrifice of the main trunk or the branches of the facial nerve and there is concern about leaving any gross tumor behind.

#### Intraoperative Frozen-Section Examination

The role of intraoperative frozen-section examination in the evaluation of a parotid mass, like that of FNA biopsy, is the subject of considerable debate. Nevertheless, frozen-section examination has been found to be useful for distinguishing salivary processes from nonsalivary processes and benign disease from malignant disease. In 80% to 90% of cases, the findings from intraoperative frozen-section examination correlate with the final pathologic diagnosis.27 This study is also helpful in making a definitive diagnosis of Warthin tumor. If frozen-section examination shows a benign mixed tumor and this finding agrees with one’s clinical judgment, lateral superficial parotidectomy should be sufficient. If frozen-section examination shows high-grade mucoepidermoid carcinoma, selective neck dissection may be considered (mainly for staging purposes, to determine whether any of the deep jugular nodes are positive). If frozen-section examination provides a definitive diagnosis of malignancy, further decisions about the extent of parotidectomy and possible selective neck dissection can be made accordingly; if not, the procedure originally planned can be performed, with any further interventions (if required) dictated by the final pathologic diagnosis. Obviously, the decision whether to sacrifice the facial nerve must not be based solely on whether the frozen section shows a benign or a malignant process.

### Table 5 Prognostic Factors for Salivary Gland Tumors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Prognostic Factor</th>
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<tbody>
<tr>
<td>Age at diagnosis</td>
<td>Facial nerve dysfunction</td>
</tr>
<tr>
<td>Pain at presentation</td>
<td>Perineural growth</td>
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<tr>
<td>T stage</td>
<td>Positive surgical margins</td>
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<tr>
<td>N stage</td>
<td>Soft tissue invasion</td>
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<tr>
<td>Skin invasion</td>
<td>Treatment type</td>
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### Table 6 Principles of Treatment of Parotid Tumors

<table>
<thead>
<tr>
<th>Principle</th>
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<tr>
<td>Adequate local excision of tumor, based on extent of primary lesion</td>
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<tr>
<td>Preservation of facial nerve if possible</td>
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<tr>
<td>Elective neck dissection reserved for selected patients</td>
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<tr>
<td>Postoperative radiotherapy when indicated (in appropriate fields)</td>
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<td>Prognosis determined primarily by stage and grade of tumor</td>
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Table 7 Indications for Postoperative Radiation Therapy for Parotid Cancer

<table>
<thead>
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<th>Indication</th>
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<tr>
<td>Aggressive, highly malignant tumor</td>
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<tr>
<td>Invasion of adjacent tissues outside parotid capsule</td>
</tr>
<tr>
<td>Regional lymph node metastases</td>
</tr>
<tr>
<td>Deep-lobe cancer</td>
</tr>
<tr>
<td>Gross residual tumor after resection</td>
</tr>
<tr>
<td>Recurrent tumor after resection</td>
</tr>
<tr>
<td>Invasion of facial nerve by tumor</td>
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Neck Dissection

Overall, about 20% of patients with malignant parotid tumors present with clinically detectable cervical lymphadenopathy (cN+). There is wide agreement that these patients require either a comprehensive or a modified neck dissection [see 2:7 Neck Dissection], depending on the extent of the disease, but there continues to be controversy regarding the management of patients with salivary malignancies who have no clinically detectable cervical lymphadenopathy (cN0). In one study, approximately 14% of the patients were in cN+ status; however, approximately 12% were in cN0 status but presented with pathologically positive nodes (pN+). In view of the low frequency of occult metastasis in the group as a whole, the investigators generally did not recommend routine elective treatment of the neck. They did find that certain histologic grades were associated with a higher incidence of metastatic disease to the neck nodes: the incidence of occult metastasis was about 49% in patients with high-grade lesions, compared with 7% in those with intermediate-grade or low-grade lesions. In addition, the incidence of having occult metastatic disease was more than 20% in patients with tumors larger than 4 cm, compared with 4% in those with smaller tumors.

The incidence of lymph node metastasis is affected not only by the size and histologic grade of the tumor but also by the histologic type, the primary tumor stage, the presence of facial nerve palsy, the patient’s age, the extraparotid extension of the disease, and the degree of perilymphatic invasion. In a multivariate analysis, the variables that showed the highest correlation with the incidence of lymph node metastasis were the histologic type (i.e., adenocarcinoma, undifferentiated carcinoma, high-grade mucoepidermoid carcinoma, SCC, or salivary duct carcinoma) and the T stage.

Thus, elective neck dissection may be considered in patients with advanced-stage primary tumors, those whose tumors are of high histologic grades, and those whose tumors are of certain specific histologic types. A selective neck dissection may be performed to remove the lymph nodes of the submandibular triangle, level II, level III, and the upper part of level V for the purposes of staging. However, a comprehensive neck dissection that encompasses levels I through V may be necessary in patients who present with clinically obvious cervical metastases.

Discussion

Implications of Histopathologic Classification of Parotid Gland Cancer

Although considerable controversy and debate continue to surround the histopathologic classification of malignant parotid tumors, most clinicians currently prefer either the classification system of the Armed Forces Institute of Pathology or that of the World Health Organization. The most common types of parotid tumor are mucoepidermoid carcinoma, adenoid cystic carcinoma, adenocarcinoma, malignant mixed tumor, acinic cell carcinoma, and primary SCC [see Figure 2].

As noted (see above), primary SCC of the parotid gland is quite rare, and most diagnoses of parotid SCC represent skin cancer...
that has metastasized to the periparotid lymph nodes. Primary SCC has a high malignant potential, and radical surgical extirpation (with preservation of the facial nerve when possible), followed by planned postoperative radiotherapy, is the treatment of choice.37

Mucoepidermoid carcinomas are best divided into low-grade, intermediate-grade, and high-grade tumors.38 For high-grade tumors, selective node dissection may be appropriate, with due consideration given to postoperative radiation therapy. For the majority of low-grade tumors—provided that they are properly excised with appropriate superficial parotidectomy—postoperative radiation therapy is unnecessary, because the incidence of local recurrence is lower than 5%.

Adenoid cystic carcinoma is a unique salivary gland tumor with a classic Swiss-cheese appearance under the microscope. There is a very high incidence of perineural spread with skip metastasis along the facial nerve and its branches, and the incidence rises with higher T stages.39 The incidence of local recurrence is also very high, and high-grade tumors are considered to be at very high risk for relapse.27 Such therapy appears to reduce the incidence of local recurrence.40 The incidence of cervical lymph node metastasis in patients with adenoid cystic carcinoma is low; however, the incidence of distant metastasis (especially pulmonary metastasis) appears to be high.41 It is noteworthy that even when adenoid cystic carcinoma patients have pulmonary metastases, they tend to do remarkably well. Quite often, the metastatic disease in the lungs remains dormant for months or even years. At present, the role of chemotherapy in the management of adenoid cystic carcinoma and parotid tumors is supported only by anecdotal evidence and remains investigational.

**Principles of Facial Reanimation**

Every surgeon who performs parotid surgery, especially surgery for parotid cancer, should be familiar with the principles of facial reanimation. If the facial nerve dysfunction is recognized before the operation, appropriate arrangements may be made for plastic surgical consultation and facial nerve grafting. If the proximal stump of the facial nerve can be identified and the peripheral branches detected at the time of the operation, a nerve graft repair can be performed. The main donor nerves used in facial nerve grafting are the greater auricular nerve, the ansa hypoglossi, and the sural nerve. Of these, the greater auricular nerve is the preferred source for a graft: harvesting is relatively easy, the diameter matches that of the facial nerve, and the arborization of the distal branches allows for a greater number of facial nerve grafts.42 The use of loupes or a microscope helps in the placement of the 9-0 nylon stitches employed in facial nerve grafting.

Regeneration of the facial nerve may take 3 to 6 months. There is some controversy regarding whether postoperative radiation therapy has a beneficial effect on functional outcome after nerve grafting; some studies cite detrimental effects,43 whereas others report adequate functional outcomes.42,44 In any case, if it is feasible to perform nerve grafting, every attempt should be made to do so. Currently, hypoglossal nerve transfer is rarely performed,45 because various effective alternatives (e.g., fascia lata slings and Gore-Tex slings) are available. A consultation with a facial plastic surgeon may be quite helpful in the management of patients with total facial nerve palsy.

One of the most important considerations in addressing facial nerve paralysis is how to prevent exposure keratopathy and other ocular complications. Placement of a gold weight or a palpebral spring on the upper eyelid may be considered as a primary rehabilitative measure aimed at preventing corneal ulceration and opacification.46 In the past, lateral tarsorrhaphy was commonly employed for this purpose, but currently, as a consequence of the superior results obtained with the gold weight and the palpebral spring, it is rarely performed. Other, simpler measures for preventing or minimizing ocular complications include the use of artificial tears and an eye patch during the day and the use of ointment with proper taping to keep the eyelid closed at night.

**References**