INTRODUCTION

Evaluation of patients with a parotid lesion should result in the development of a differential diagnosis that includes neoplastic and nonneoplastic entities. The primary exercise in the initial evaluation of a patient with a parotid swelling, therefore, is to distinguish neoplastic from nonneoplastic processes and to initiate the exercise of proper diagnosis and treatment.1 Salivary gland tumors as a whole are rare compared with the overall incidence of head and neck tumors. Overall, salivary gland tumors vary worldwide from about 0.4 to 13.5 cases per 100,000 people in the population.2 The parotid gland is the most common site of occurrence of salivary gland tumors, generally comprising 60% to 75% of all salivary gland tumors in large series (Table 1).3–6 The most common benign tumor of the parotid gland and the most common salivary gland tumor overall is the pleomorphic adenoma. The most common malignant tumor of the parotid gland is the mucoepidermoid carcinoma. Most nonneoplastic salivary gland swellings represent acute or chronic infections of these glands.7 Although any of the major or minor salivary glands can become infected, these conditions most commonly occur in the parotid and submandibular glands, with the sublingual and minor salivary glands rarely becoming infected. From an etiologic standpoint, these infections are caused by a diverse number of bacterial, mycobacterial, viral, fungal, or parasitic organisms, or occasionally by immunologically mediated mechanisms. Moreover, an equally diverse number of risk factors may predispose patients to parotid infections (Box 1). An assessment has been reported of the relative frequency of neoplastic versus nonneoplastic disease of the major salivary glands, including the parotid gland. In this study, the investigators evaluated 140 parotidectomy specimens, 102
(73%) of which showed neoplastic disease and 38 (27%) specimens showed nonneoplastic entities. In this study, the investigators also examined 110 submandibular gland excisions, 17 (15%) of which were performed for neoplastic disease and 93 (85%) of which were performed for nonneoplastic disease. When examining a patient with a parotid swelling, therefore, the likelihood of a neoplastic process should be highly considered, because it is more likely than when examining a patient with a submandibular swelling.

INITIAL EVALUATION AND GENERAL CONCEPTS

History

The initial evaluation of a patient with a parotid gland swelling must begin with a comprehensive history and physical examination, which should primarily distinguish infectious/obstructive processes from neoplastic processes. Historical elements that must be considered during this initial evaluation include whether the examination is being performed in an inpatient or outpatient setting; the patient’s specific symptoms and their chronicity; and the possible presence of systemic disease. A patient with acute parotid swelling who is examined in an intensive care unit setting after surgery, for example, might be experiencing a parotitis. By contrast, a patient with a 10-year history of parotid swelling who is being examined in an outpatient setting might be experiencing a parotid neoplasm. The setting in which this initial evaluation occurs provides valuable information as to the cause of a parotid swelling, including a parotitis. For example, the microbiological cause and treatment of a community-acquired parotitis is different from that of a hospital-acquired parotitis. The clinician may begin to disclose important information as to the cause of the parotitis based on the setting in which they are examining the patient. In general terms, gram-positive organisms are more commonly encountered in community-acquired infections, whereas gram-negative organisms are more commonly encountered in hospital-acquired infections.

Symptoms being experienced by patients with parotid enlargement may further divulge their disease state and also qualify its magnitude. The presence of a painful swelling, particularly prandial pain, or pain during eating, may suggest a diagnosis of sialolithiasis. However, prandial pain is not pathognomonic of a diagnosis of sialolithiasis, because parotitis unrelated to sialolithiasis may also present in this way. Moreover, some patients with malignant tumors of the parotid gland complain of pain such that early discovery of such malignancies is of paramount importance. The patient’s perception of the expression of purulence from the salivary duct should be ascertained during the history. Clearly, the greater the magnitude of purulent infection noted on physical examination, the greater the likelihood that admission to the hospital and incision and drainage are necessary. In addition, the presence of a significant volume of purulence at the opening of a salivary duct may point to the value of obtaining special imaging studies for proper patient management.

Obtaining information regarding the presence of comorbid systemic disease and therapeutic medications is an important aspect of the history taking of all patients regardless of their chief complaint. With regard to patients in particular with parotid swellings, inquiring as to the presence of diabetes, HIV/AIDS, and recent surgery may permit the disclosure of nonmodifiable, relatively nonmodifiable, and modifiable predisposing features of parotitis (see Box 1).

Physical Examination

The performance of a physical examination follows the history taking and may permit the clinician to distinguish an infectious/obstructive process from a neoplastic process (Fig. 1). In particular, extraoral inspection and palpation of the parotid swelling may determine the presence or absence of tenderness, erythema, and warmth. Intraoral inspection and palpation may identify purulence
Box 1
Risk factors associated with parotid gland infections

*Nonmodifiable risk factors*
- Advanced age of patient
- Relatively nonmodifiable risk factors
  - Anorexia nervosa/bulimia
  - Congestive heart failure
  - Cushing disease
  - Cystic fibrosis
  - Diabetes mellitus
  - Human immunodeficiency virus (HIV)/AIDS
  - Hepatic failure
  - Renal failure
  - S/P radiation therapy to parotid gland

*Modifiable risk factors*
- Dehydration
- Malnutrition
- Medications
  - Anticholinergics
  - Antihistamines
  - Antihypertensives
  - Antisialagogues
  - Barbiturates
  - Chemotherapeutic agents
  - Diuretics
  - Phenothiazines
  - Tricyclic antidepressants
- Oral infection
- Sialolithiasis

or a stone at the Stenson’s duct. Intraoral examination and inspection of the quality and quantity of expressed parotid saliva is an essential aspect of the physical examination (*Fig. 2*). Examination of the soft palate and the lateral pharynx is indicated so as to determine if the deep lobe of the parotid gland might contain tumor. In addition, an evaluation of the cervical lymph nodes may give the clinician the impression of no adenopathy, inflammatory adenopathy, or metastatic adenopathy related to a parotid malignancy. Specifically, inflammatory lymph nodes may show tenderness and a compressible nature on physical examination, whereas metastatic lymph nodes are more likely to be nontender and indurated on physical examination. Further, the integrity of the facial nerve should be assessed in all patients with parotid swellings (*Fig. 3*). At the time of the history and physical examination of a patient with a parotid swelling, a decision should be made as to whether basic imaging with a panoramic radiograph is indicated. This radiograph is occasionally able to show the presence of an intraglandular or extraglandular stone associated with the parotid gland (*Fig. 4*). Panoramic radiographs should be obtained in patients with a diffuse parotid swelling suggestive of inflammatory disease so as to rule out the presence of a sialolith.

*Laboratory Investigation*

The usefulness of obtaining blood tests in a patient with parotid disease largely centers on the investigation for dehydration and the magnitude of leukocytosis in the case of a parotitis identified on physical examination. The serum electrolytes, particularly sodium, osmolarity, and white blood cell count, should be scrutinized in all patients with a suppurative parotitis, but specifically in those patients admitted to the hospital, including postoperative patients and those patients admitted to an intensive care unit. Intravenous fluid resuscitation as well as antibiotic administration represents first-line therapy for inpatients with a suppurative parotitis. On occasion, an outpatient requires admission to the hospital for similar therapy for parotitis. Under such circumstances, the magnitude of the leukocytosis, if present, as well as the general appearance of the patient as noted on physical examination, assists the surgeon in determining if an admission to the hospital is indicated. A stat Gram stain with aerobic and anaerobic culture and sensitivity of expressed pus at Stenson’s duct should be obtained in all patients with a suppurative parotitis, and preferably before initiating antibiotic therapy.

*Imaging*

The results of the history and physical examination lead to a decision as to whether a sophisticated imaging study is required to assist in the diagnosis and treatment planning. Computed tomography (CT) is indicated in the assessment of patients with parotid swellings related to infectious disease (*Fig. 5A*) as well as patients with suspected parotid neoplasms (see *Fig. 5B*). CT scans in both types of patients anatomically define the location of a neoplasm in preparation for tumor surgery or quantify the magnitude of infection and possible abscess in the case of an infectious process. If significant salivary infection is noted on imaging studies, a decision can be made to perform incision and drainage of the parotid abscess.
Moreover, CT scans anatomically define the location of an intraglandular or extraglandular stone in the case of sialolithiasis. Magnetic resonance imaging (MRI) scans may be substituted for CT scans according to the preference of the surgeon. One particular benefit of MRI scans is the ability to suggest a likely diagnosis of pleomorphic adenoma of a salivary gland when a hyperintense and well-localized mass is noted on T2-weighted images.

Once imaging studies are obtained, the surgeon may wish to perform a fine-needle aspiration biopsy (FNAB) for additional diagnostic information or the surgeon may elect to proceed directly

Fig. 1. A 39-year-old man with a 3-week history of rapidly developing left facial swelling (A, B). Physical examination revealed diffuse swelling of the left parotid gland and trismus with cervical adenopathy. Axial (C) and coronal (D) computed tomography (CT) scans supported a diagnosis of acute parotitis. The patient was treated with antibiotics and the process resolved. This patient is compared with a 64-year-old man with a 2-year history of left facial swelling (E, F). Physical examination revealed a discrete mass of the superior aspect of the left parotid gland. Axial (G) and coronal (H) CT scans showed an enhancing mass of the left superficial lobe of the parotid gland that abutted the mandibular condyle. A left superficial parotidectomy was performed, which identified mucoepidermoid carcinoma.
with surgical intervention associated with the pathologic process of the parotid gland, whether it is suspected to represent a neoplastic or non-neoplastic process. When an FNAB is preferred, it can be performed in the office or with imaging guidance.

TECHNIQUES INVOLVED IN THE DIAGNOSIS AND MANAGEMENT OF PAROTID DISEASE

FNAB

The parotid glands can show a wide range of pathologic changes, which can be challenging to properly characterize exclusively by clinical features. Benign lesions may resemble malignant lesions and vice versa. No single diagnostic modality is accepted unequivocally as the definitive approach to parotid disease. Although it is generally accepted that FNAB is useful in the preoperative setting, the accuracy is highly dependent on both operator experience and the diagnostic skills of the cytopathologist. Results of the FNAB must be considered by the surgeon in the global context, correlating the patient’s history, physical examination, and imaging studies. FNAB is generally considered a rapid, simple, inexpensive and complication-free method of initial diagnosis of head and neck lesions, including parotid swellings (Fig. 6). It is of value in providing a sample of pus for Gram stain, culture, and sensitivity in the case of a suspected suppurative parotitis or providing a sample for cytologic diagnosis in the case of a suspected parotid neoplasm. Fine-needle aspiration of a parotid neoplasm has the
distinct advantage of not seeding the overlying skin, which would otherwise occur if open biopsy or a core biopsy had been performed of a parotid neoplasm. If skin is seeded with tumor, subsequent proper surgical management is less likely to succeed.10,11 Nevertheless, the role of fine-needle aspiration has not been universally accepted and its use remains controversial.12 Batsakis and colleagues13 have argued that most parotid masses require surgical removal such that FNAB has no meaningful influence on the management of patients with parotid disease. Nonetheless, fine-needle aspiration has been described as being part of a triple assessment of a parotid gland swelling, which also includes a clinical examination and an imaging study when deemed appropriate.14 These investigators also pointed out that FNAB helps to avoid unnecessary surgery in many cases. Heller and colleagues15 reported that cytologic assessment altered patient management in greater than one-third of cases, most commonly in the avoidance of surgery.

When considering an FNAB of a discrete parotid mass that was identified on physical examination and further defined on an imaging study, the surgeon should also consider the information that they wish to glean from such an aspiration. From the surgeon’s standpoint, perhaps the most important piece of information that should be sought is the neoplastic character of the discrete mass, specifically, whether the tumor is benign or malignant (Fig. 7). This information not only permits the surgeon to discuss this finding with the patient during an informed consent process but it also permits the surgeon to offer the patient a neck dissection if a malignancy is identified on the needle biopsy. From a practical standpoint, the diagnosis of benign versus malignant is the only important piece of information that is required. The specific type of benign or malignant tumor is probably not required of the cytologist interpreting the needle aspiration, because surgical treatment is not likely to change within the categories of benign versus malignant disease. To this end, it is important to review the reported sensitivity and specificity of FNAB (Table 2).

Atula and colleagues12 reviewed 438 FNABs of the parotid gland in 365 patients and compared these with final histopathology of the parotid specimens, and also assessed the outcome of patients who were not operated. Two hundred and seventeen FNABs from 191 parotid lesions in 175 patients were obtained from parotid glands that were not operated with follow-up of hospital records over a period of 2 to 9 years available to the investigators. Two hundred and seven FNABs were taken from 188 primary parotid tumors in 187 patients in whom histopathology of the parotid tumor was available to the investigators. The cytology was categorized as either nonneoplastic, benign neoplastic, possibly malignant, and malignant. FNAB detected benign neoplasms with an accuracy of 78% in this study, whereas the accuracy in detecting malignant tumors was 84%. A false-negative rate of 45% for malignancies was established in this study. Fifty percent of the 22 FNABs that were classified as possibly malignant were benign tumors by histopathology. Cytology was benign in 196 (90%) FNABs of 217 not confirmed by histology. During the follow-up of 2 to 9 years, only 2 patients proved to have malignant tumors amongst the group of cytologically benign lesions. The investigators concluded their study by indicating that FNAB should be used as a building block in the diagnosis of parotid lesions. They also concluded that the cytologic findings must correlate with the clinical picture, and a report of normal tissue or cystic fluid from a parotid lesion should not necessarily be accepted as a final diagnosis.

Ali and colleagues16 retrospectively reviewed 129 patients with parotid lesions who had...
undergone parotid surgery and for whom histologic assessment of their parotid disease was available. There were 98 benign lesions diagnosed and 31 malignant tumors diagnosed. The sensitivity of the FNAB was 84%, the specificity was 98%, and the accuracy was 94%. The FNAB result was nondiagnostic in 5 (3.8%) cases. The investigators of this study correctly typed pleomorphic adenoma in 73 of 77 (95%) cases. Of the 98 benign histologic diagnoses in this study, 86 (88%) were correctly typed. Fourteen of 16 (87.5%) cases of mucoepidermoid carcinoma were correctly typed, and 4 of 4 cases of adenoid cystic carcinoma were correctly typed in this study. Of the 31 cases of malignant parotid tumors in this study, 24 (88%) were correctly typed. The investigators indicated that FNAB plays an important role in the accurate diagnosis of parotid tumors. They pointed out that the accurate preoperative differentiation of these tumors may prepare the surgeon and patient for an appropriate surgical procedure. Christensen and colleagues\textsuperscript{17} found that a correct subtyping of a benign salivary gland lesion was achieved in 97% of their cases, and the accurate diagnosis of a malignancy was achieved in 71% of their cases. Layfield\textsuperscript{18} pointed out that one of the most difficult lesions within the salivary glands to accurately diagnose with FNAB is the mucoepidermoid carcinoma, indicating that these neoplasms are both overdiagnosed and underdiagnosed. Mucoepidermoid carcinomas can be cytologically divided into low-grade and

Fig. 3. An 83-year-old man with a 6-month history of a right paralytic ectropion (A). Physical examination also identified a right parotid mass. A complete right facial nerve palsy was noted on examination, including the temporal branch (B), the zygomatic branch (C), the buccal branch (D), and the marginal mandibular branch (E).
high-grade neoplasms. Low-grade mucoepidermoid carcinomas may be difficult to separate from mucous retention cysts. High-grade mucoepidermoid carcinomas may be cytologically difficult to separate from squamous cell carcinomas and adenocarcinomas of the parotid glands.

Zbaren and colleagues\textsuperscript{19} analyzed and compared the value of FNAB and frozen section in the assessment of parotid tumors. The investigators performed a chart review and cross-sectional analysis of 838 patients with previously untreated parotid pathologies who were operated on between 1987 and 2007 in their institution. A preoperative FNAB was performed in 426 patients and a frozen-section analysis was performed in 166 patients. One hundred and ten patients were

Fig. 4. A 43-year-old man with a 12-year history of right parotid swelling (A, B). Physical examination identified diffuse indurated swelling of the right parotid gland and a sialolith at the right Stenson’s duct (C). The panoramic radiograph (D) showed the sialolith to be superimposed on the crown of tooth 2. The axial computed tomography scan showed the sialolith as well as an ectatic Stenson’s duct proximal to the stone, which indicates obstruction of salivary flow (E).
enrolled in the study. The sensitivity, specificity, and accuracy of FNAB were 74%, 88%, and 79%, respectively. The sensitivity, specificity, and accuracy of frozen section were 93%, 95% and 94%, respectively. The histologic tumor type was correctly diagnosed by FNAB and frozen section in 27 of 42 (64%) and 39 of 42 (93%) benign tumors, respectively, and 24 of 68 (35%) and 49 of 68 (72%) malignant tumors, respectively.

The investigators summarized their study by identifying the superiority of frozen section over FNAB in detecting malignancy and tumor typing. They recommended frozen-section analysis for the determination of the histologic subtype or grade in planning the extent of surgery of malignant parotid tumors. These investigators indicted that FNAB is useful in avoiding surgery, in the case of inflammatory lesions, and in limiting...
surgical procedures, in the case of benign parotid tumors.

Bartels and colleagues\textsuperscript{20} established the sensitivity, specificity, and accuracy of imaging and FNAB, alone or in combination, in distinguishing benign from malignant parotid lesions. A retrospective study of all patients with parotid masses referred to their center was performed. Five hundred and eighty-six patients were identified, of whom 48 patients met all of the necessary criteria for inclusion in their study, including a parotid lesion of any histologic origin, FNAB results with sufficient cells, available final surgical pathologic results, and adequate preoperative imaging studies available for review. Thirteen of the patients were imaged with CT scans and 35 with MRI. Pathologic examination revealed that 23 (48\%) of the lesions were malignant and 25 (52\%) were benign. The evaluation of the parotid lesions with FNAB alone resulted in a sensitivity, specificity, and accuracy of 83\%, 86\%, and 85\%, respectively. The sensitivity, specificity, and accuracy of CT alone were 100\%, 42\%, and 69\%, respectively. The sensitivity, specificity, and accuracy of MRI alone were 88\%, 77\%, and 83\%, respectively. The sensitivity, specificity, and accuracy of MRI combined with FNAB were 88\%, 94\%, and 91\%, respectively. The sensitivity, specificity, and accuracy of CT combined with FNAB were 83\%, 86\%, and 85\%, respectively. The investigators concluded that imaging and FNAB are comparable in their ability to correctly identify malignant parotid lesions preoperatively and that combining the 2 modalities yields no advantage in terms of sensitivity, specificity, and accuracy of a malignant diagnosis. Moreover, the investigators pointed out that many patients with a parotid mass do not require anything more than a careful history and physical examination for management of a well-circumscribed, mobile, slowly growing mass. They indicated that preoperative testing rarely changes the need for or nature of the operation. In instances of an atypical history, a fixed or poorly defined mass, or if the potential for facial nerve involvement was high, the additional testing to determine anatomic boundaries or the risk of malignancy may be useful in surgical planning and patient counseling. The results of this study suggested that MRI is the first test of choice, because it was as effective as FNAB at confirming the suspicion of malignancy, and the MRI can also provide detailed anatomic information about the extent of the primary tumor as well as the adjacent lymph nodes.

**Table 2**

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<th>Number of Cases</th>
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<td>Ali et al,\textsuperscript{16} 2011</td>
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<td>Bartels et al,\textsuperscript{20} 2000</td>
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<td>Zbaren et al,\textsuperscript{19} 2008</td>
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<tr>
<td>Zurrida et al,\textsuperscript{10} 1993</td>
<td>246</td>
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**Superficial Parotidectomy**

The standard operation for the removal of a tumor of the superficial lobe of the parotid gland is the time-honored superficial parotidectomy (Fig. 8). As part of this surgery, the superficial lobe of the parotid gland is removed with the tumor and the entire course of the facial nerve is intentionally dissected and preserved, unless it is directly
Fig. 8. A 59-year-old man (A) with an 8-year history of a left parotid mass. His beard had interfered with his frequent self-examination as a result of the lack of shaving. The recent onset of pain in the area led to his seeking consultation. Axial (B) and coronal (C) CT scans revealed a heterogeneous mass within most of the superficial lobe of the left parotid gland. A preoperative FNAB suggested the presence of a benign tumor. A left superficial parotidectomy was performed with a modified Blair incision (D). The dissection included the identification of the parotid capsule (E). The main trunk of the facial nerve was identified with the use of a nerve stimulator and the specimen was elevated off the full extent of the facial nerve (F). The pseudocapsule of the tumor remained intact as it was elevated off the nerve. The superficial parotidectomy specimen (G) was processed with permanent sections and carcinoma ex-pleomorphic adenoma was identified. The greater auricular nerve was sacrificed as part of this superficial parotidectomy.
invaded by the tumor. The approach to the superficial parotidectomy is typically with the modified Blair incision. The skin flap is elevated in a plane superficial to the parotid capsule. The sternocleidomastoid muscle is identified and the posterior edge of the parotid gland is separated from the muscle. Inferiorly, the platysma muscle is divided, and superior dissection is performed toward the tail of the parotid gland. Superiorly, the posterior edge of the parotid gland is sharply separated from the auricular cartilage. This sharp dissection is continued until the pointer cartilage is identified. Although the pointer cartilage does point to the main trunk of the facial nerve, the nerve is located more deeply in this region. A nerve stimulator is used at this time so as to initiate the process of identifying the main trunk of the facial nerve. The posterior belly of the digastric muscle is identified inferiorly, and blunt dissection is performed in a superior direction so as to identify the junction of the posterior belly of the digastric muscle and the sternocleidomastoid muscle. The main trunk of the facial nerve is predictably located approximately 4 mm superior to this junction and at the same depth as this junction. Once the main trunk is identified, careful dissection is performed superficial to this nerve, and the bifurcation of the temporofacial and cervicofacial trunks is noted. Continued dissection of the deep surface of the superficial lobe and pseudocapsule of the parotid tumor is performed, the entire course of the facial nerve is exposed, and the entire superficial lobe of the parotid gland is removed. The specimen is thereafter delivered.

The superficial parotidectomy specimen includes the entire superficial lobe of the parotid gland and tumor, with a resultant full dissection and intentional preservation of the facial nerve. Marginal tumor excisions and close margins are encountered and frankly expected in the region of the preserved main trunk of the facial nerve and its branches. The status of close margins has been studied extensively, particularly with regard to recurrence of the parotid tumor. Moreover, the status of the pseudocapsule that separates the tumor from the margin of the specimen has received due scrutiny as well. Ghosh and colleagues21 have assessed risk factors for recurrence of marginally excised parotid pleomorphic adenomas. They reviewed 394 patients who underwent parotidectomy, of whom 274 had a diagnosis of pleomorphic adenoma. A total of 160 patients had an adequate cuff of tissue (several millimeters) surrounding the tumor, whereas 114 patients were considered to have a marginal clearance around their tumors and were therefore believed to be at risk for recurrence. Eighty-three of the 114 patients were included in the study because complete records were available for retrospective study. The overall recurrence rate in these patients was 6.0% (5 patients). Of the 5 recurrences, 3 tumors were noted to be widely present at the excision margin, 1 tumor was widely present within 1 mm of the margin, and 1 tumor showed a margin greater than 1 mm. This last case experienced tumor spillage at the time of surgery. The investigators compared the cases in which tumor was widely present at the excision margin with those cases in which tumor was present within 1 mm of the excision margin. The recurrence rate was 17.6% in the former group and 1.8% in the latter group. In 33 of the 83 cases (39.8%), the surgeon considered that the tumor was adherent to 1 or more branches of the main trunk of the facial nerve. In 91% of these cases, it was possible by careful dissection to avoid having tumor present at the excision margin. The investigators concluded by indicating that the adequacy of excision of pleomorphic adenomas depends primarily on the presence or absence of tumor cells at the surgical excision margin. The microscopic presence of any thickness of pseudocapsule containing the tumor translates to low risk of recurrence.

McGurk and colleagues22 similarly examined the clinical significance of the tumor pseudocapsule in the treatment of parotid pleomorphic adenomas by superficial parotidectomy. Their incidence of 2% recurrence led to their conclusion that careful dissection close to a pleomorphic adenoma need not lead to a high incidence of recurrence and that in practice the microinvasion of the capsule by tumor buds has limited clinical significance in so far as possible recurrence is concerned.

The issue of the parotid pseudocapsular form has been extensively studied as it relates to pseudocapsular vulnerability at the time of superficial parotidectomy, particularly with regard to its possible absence, microinvasion of the pseudocapsule by the tumor, tumor buds, pseudocapsular lamellation, and bosselation, defined as a smooth bulging prominence at the tumor margin. Webb and Eveson23 retrospectively examined 126 primary pleomorphic adenomas, of which 106 were located in the parotid gland. These investigators identified an increased pseudocapsular thickness in the presence of a hypercellular tumor compared with focal pseudocapsular absence seen in hypocellular tumors (69% of cases). In addition, they found that small tumors tended to be hypercellular, whereas larger tumors (>25 mm) were hypocellular, with an inherently thinner pseudocapsule. The investigators found
microinvasion of the pseudocapsule with tumor buds in 11.9% of cases. All buds were bounded by a thin fibrous pseudocapsule and were closely connected to the main tumor mass. Bosselation was noted in 76 of 126 tumors (60.3%). Exposure of the pseudocapsule was evident in 81% of the cases operated in this series. The investigators concluded that salivary gland surgeons should be prepared for precise dissection of the pseudocapsule to avoid rupture, particularly in the region of the facial nerve. Their findings indicated a frequently flimsy, variable, and uncertain border between a pleomorphic adenoma and the host tissue. They indicated that the superficial parotidectomy should guarantee at least some adequate tissue margin around the tumor.

**Partial Superficial Parotidectomy**

Although the superficial parotidectomy led to a dramatic decline in local recurrence of parotid tumors when compared with the once-performed enucleation procedure, the superficial parotidectomy resulted in resection of a significant amount of normal parotid tissue, leading to a loss of parotid function. In addition, temporary facial nerve paralysis caused by complete facial nerve dissection was occasionally noted as part of the superficial parotidectomy. The observed complications of the superficial parotidectomy led many surgeons to perform a limited or partial superficial parotidectomy. This surgical procedure removes the parotid tumor surrounded by a cuff of normal parotid tissue and identifies and dissects the facial nerve only in the vicinity of the sacrifice of the parotid tumor (Fig. 9). Like the superficial parotidectomy, the partial superficial parotidectomy may result in an extracapsular dissection (ECD) in the vicinity of the facial nerve dissection. O’Brien retrospectively evaluated 363 partial superficial parotidectomies performed on 355 patients with benign parotid disease. The incidence of immediate postoperative facial nerve weakness was 27% (98 patients), which proved to be temporary in 87 patients and permanent in 11 patients (3%). Because some of the cases

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**Fig. 9.** A partial superficial parotidectomy performed for a preoperative FNAB result suggestive of pleomorphic adenoma (A). This surgery involved the removal of the tumor with approximately 1 cm of surrounding parotid gland (B). A portion of the superior and inferior aspects of the superficial lobe of the parotid gland remained at the conclusion of the partial superficial parotidectomy, and the greater auricular nerve was preserved (C).
operated in this series were recurrent tumors with preexisting facial nerve weakness, the incidence of permanent weakness of the facial nerve amongst the patients with intact preoperative facial nerve function was 2.5%. Three patients (0.8%) experienced recurrence of their tumors. The author indicated that partial superficial parotidectomy is the operation of choice for previously untreated localized parotid tumors lying superficial to the plane of the facial nerve. It was pointed out that most malignant tumors of the superficial lobe of the parotid gland could also be removed by this technique. Lim and colleagues specifically examined the ability of the partial superficial parotidectomy to control malignant disease of the parotid gland. They retrospectively reviewed 43 patients treated with a partial superficial parotidectomy for parotid cancer confined to the superficial lobe. Sixteen tumors (37%) were high-grade and 27 tumors (63%) were low-grade. The overall survival rate and disease-free rate at 5 years were 88% and 79%, respectively. Univariate analyses showed histologic tumor grade and pathologic neck node metastases to be significant variables. Recurrences developed in 8 cases (19%); 6 of the recurrences occurred in high-grade cases and 2 of the recurrences occurred in low-grade cases. The investigators concluded by stating that partial superficial parotidectomy with appropriate postoperative radiation therapy is an oncologically acceptable procedure in the treatment of low-grade parotid cancers confined to the superficial lobe where the facial nerve is sufficiently distant from the tumor.

Roh and colleagues performed a randomized clinical trial comparing partial parotidectomy versus superficial or total parotidectomy. They enrolled 101 patients with benign tumors based on FNAB and randomly assigned these patients to 1 of 2 groups according to the extent of parotidectomy: 52 underwent limited partial parotidectomy (functional surgery group) and 49 patients underwent superficial or total parotidectomy (conventional surgery group). The limited partial parotidectomy group underwent preservation of their greater auricular nerves and the main trunk of the facial nerve was identified. The overlying parotid tissue was dissected free of the nerve and maintained on the tumor with approximately 0.5 to 1.0 cm tumor-free margins. The superficial or total parotidectomy group underwent a modified Blair approach to their tumor surgery, and the greater auricular nerve was sacrificed during the surgery. A superficial or total parotidectomy was performed appropriately and all branches of the facial nerve were fully dissected. Twenty-one of 52 patients (40%) in the limited partial parotidectomy group experienced early complications, whereas 49 of 49 (100%) patients in the superficial or total parotidectomy group experienced early complications. Temporary facial nerve weakness was noted in 23 of the 101 patients overall (22.8%) and was significantly more common in the superficial or total parotidectomy group. The fact that no tumor recurrences were noted in both groups in a 4-year follow-up period as well as other complications of less magnitude in the limited parotidectomy group justifies this approach to benign parotid tumor removal.

**Extracapsular Dissection**

Extracapsular dissection (ECD) represents the most conservative and practical approach to parotid tumor surgery; a meticulous dissection immediately outside the tumor pseudocapsule is performed without intentionally identifying and dissecting the main trunk or branches of the facial nerve (Fig. 10). The justification of this procedure is that 60% of parotid tumors have been estimated to lie on the facial nerve. Because surgical protocol calls for preservation of the facial nerve, the result is frequently a dissection along the pseudocapsule of the tumor, with no margin of normal parotid tissue in this region. It has become apparent amongst those surgeons commonly performing parotid surgery that, despite the close association of the facial nerve to the pseudocapsule of the parotid tumor, recurrence is uncommon. George and McGurk reported on 156 consecutive patients with benign tumors who were operated with ECD. Complications were rare in their series, including permanent facial nerve palsy (1%), temporary facial nerve palsy (3%), sialocele (1%), and Frey’s syndrome (<1%). These investigators reported that ECD is not suitable for malignant tumors, and FNAB was used routinely in the preoperative workup of their patients.

In 2003, McGurk and colleagues reported on 821 patients with previously untreated epithelial parotid neoplasms in whom the preoperative diagnosis and judgment for surgery was based only on clinical examination. The tumors were classified by clinical criteria into simple tumors (clinically benign), which were discrete, mobile, and measured less than 4 cm in diameter. Complex tumors were clinically defined as those greater than 4 cm, fixed to surrounding tissues, associated with facial nerve palsy, that had deep lobe involvement, or were associated with cervical lymphadenopathy. Among the simple tumors, 503 patients underwent ECD and 159 patients underwent superficial parotidectomy. Thirty-two
of these 662 simple tumors (5%) proved to be carcinomas. Of these 32 patients, 12 patients underwent ECD and 20 underwent superficial parotidectomy. The 5-year and 10-year cancer-specific survival rates were 100 and 98%, respectively for ECD and superficial parotidectomy. Of the 630 patients with simple tumors and benign histologies, there were 10 recurrences at 15 years. Eight recurrences occurred after 491 ECDs (1.6%) and 2 recurrences occurred after 139 superficial parotidectomies (1.4%). The investigators concluded by stating that ECD represents a viable alternative surgical approach to superficial parotidectomy for benign tumors because there are no differences in recurrence rates as well as a reduced incidence in overall morbidity.

**Incisional Parotid Biopsy**

Incisional parotid biopsy (Fig. 11) is rarely performed in the determination of the diagnosis of a discrete mass of the parotid gland. The primary concern with such an approach is the inherent seeding of the skin overlying the tumor such that its sacrifice is required at the time of definitive tumor surgery. In addition, the wide use of FNAB has largely replaced the need for incisional biopsy of discrete parotid masses. However, incisional parotid biopsy frequently is indicated in the determination of the character and diagnosis of equivocal diffuse processes of the parotid gland, many of which indicate underlying systemic disease. Sjögren’s syndrome is perhaps the prototypical systemic disease that can be diagnosed in early stages by incisional parotid biopsy. In Marx’s review of 54 patients with Sjögren’s syndrome, 31 (58%) had a positive labial biopsy, whereas 54 (100%) had a positive parotid biopsy. The incisional parotid biopsy also serves to rule out the presence of lymphoma in the background of Sjögren’s syndrome, which is estimated to occur in approximately 5% to 10% of these patients. Incisional parotid biopsy is also useful in providing an early diagnosis for otherwise equivocal cases of sarcoidosis and siaiosis. Incisional biopsy of parotid neoplasms might be indicated when the tumor has eroded through the skin such that its sacrifice is already indicated at the time of surgery (Fig. 12). Such a biopsy is likely able to provide a more precise tissue diagnosis than FNAB.

**THE ROLE OF NECK DISSECTION IN THE MANAGEMENT OF PAROTID CANCER**

The role of neck dissection in concert with superficial parotidectomy or partial superficial parotidectomy must be critically considered in the
management of patients with parotid cancers. Cervical lymph node metastases have been reported to be rare in patients with cancer of the major salivary glands, with an overall incidence of clinical lymph node metastases of 16% for carcinoma of the parotid gland. The thought process of the past was that elective neck dissection was seldom, if ever, indicated in the management of parotid cancer. Moreover, it was believed that the incidence of occult nodal metastases was higher in patients with anaplastic, high-grade mucoepidermoid and salivary duct carcinoma and adenocarcinoma than in patients with low-grade mucoepidermoid and acinic cell carcinoma. Other reports indicate that the overall incidence of cervical lymph node metastases from parotid cancers ranges from 18% to 28%. Although the role of neck dissection is clear if clinically apparent lymph node metastases exist in patients with parotid cancer, a lack of consensus exists regarding the proper surgical management of the clinically negative neck. To this end, the incidence of occult cervical lymph node metastases associated with parotid cancers has been reported to be between 2% and 50%. The observed morbidity associated with prophylactic neck dissection is insignificant. The ease of extending the modified Blair incision inferiorly and anteriorly permits the performance of a prophylactic neck dissection in patients with parotid cancers. The realization of both issues seems to justify the near routine performance of a prophylactic neck dissection in patients with malignancies of the parotid gland. Therefore, the ability to discern malignant disease in the parotid gland is of obvious preoperative benefit, when a commitment exists to the performance of an elective neck dissection in the management of parotid cancer. The beneficial role of preoperative FNAB is clear to ablative surgeons. When the neck is treated electively, only the ipsilateral side should undergo neck dissection because contralateral lymph node metastases related to parotid cancer are negligible. Armstrong and colleagues indicated that a 3-level prophylactic neck dissection is statistically likely to identify occult neck disease in 90% of cases, such that a traditional supraomohyoid neck dissection is oncologically preferred.

**SUMMARY**

Disease of the parotid gland is represented by a diverse array of diagnoses, ranging from acute infection to malignant neoplastic disease with...
facial nerve palsy. At first glance, chronic infections may resemble tumors such that the surgeon must develop an algorithm to proceed in a methodical and scientific fashion that provides early and effective treatment of patients with parotid disease. The techniques described in this discussion represent a means to that end.

REFERENCES


