Chapter 15

Total Parotidectomy

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Contents

Core Features

- Total parotidectomy is a spectrum of operations based on anatomy and on tumor extent.
- The surgeon applies knowledge of embryology, anatomy, tumor pathology and behavior, and tumor extent to individualize the operation to the patient.
- The deep parotid gland contains lymphatic nodes that must be adequately managed in malignant tumors.
- Adequate management of the deep parotid gland requires control of the intraglandular external carotid artery and its branches.

Complications to Avoid

- The surgeon should not embark on parotidectomy without the availability of frozen-section pathologic review.
- The surgeon should not embark on parotidectomy without the capability to perform total parotidectomy, neck dissection, and extended operation.
- The surgeon should not be reassured that a parotid mass is benign solely on the basis of fine-needle aspiration.
- The surgeon should be prepared to address facial nerve deficits at the time of the initial operation.

"… it follows from the complex relations of the parotid gland that its entire removal as a surgical procedure is an anatomic impossibility."

Sir Frederic Treves, 1901

Introduction

The first reference to removing the parotid gland with identification and preservation of the facial nerve was by Carwardine in 1907 [8]. In 1916, Sistrunk described 112 cases of parotidectomy with preservation of the facial nerve [3]. Like many operations performed today, the procedure languished in relative obscurity until advances in anesthesia and hemostasis and the modifications of talented practitioners advanced it to the prominent position that it holds in the armamentarium of the modern head and neck surgeon. Experience gained during the past half century of parotid surgery at Mayo Clinic by surgeons such as Oliver H. Beahrs, Lawrence W. DeSanto, and Kerry D. Olsen, continually performing 75–100 parotid operations a year, serves as the foundation for this chapter. The outcomes of the operation have shown a need for flexibility and the ability to individualize the approach and the procedure to a particular patient and tumor. This chapter discusses definitions, indications, preoperative evaluation, procedural technique, and postoperative care with an emphasis on the need for an experienced surgeon to have a flexible approach to parotid conditions. The interested student who studies and rigorously applies these techniques will realize the exhilaration that accompanies a well-designed and executed parotid operation.

Parotidectomy is one of the most challenging of all operations facing the head and neck surgeon. The tumors requiring treatment are usually benign, but if left to observation they can lead to disfiguring facial masses or malignant degeneration. Meticulous removal of the tumor with inclusion of surrounding normal glandular tissue is necessary to prevent recurrence. The operation requires careful dissection and preservation of the facial nerve trunk and its peripheral branches because both the surgeon and the patient usually expect a high level of facial function postoperatively. Tumors of the parotid gland are uncommon, but the histologic variety, variability of tumor site in relationship to the facial nerve, and complexity of different operative maneuvers to achieve tumor eradication require experience and expertise on the part of the surgeon. Some tumors may require only simple excision with partial parotidectomy, whereas other tumors may require radical excision with sacrifice of the facial nerve, lymph node dissection, or resection of surrounding structures. Finally, preoperative evaluation with clinical examination, imaging, and even cytologic examination often cannot adequately prepare the surgeon for the situation in the operating theater. Sound decision-making based on adequate experience must be practiced intraoperatively to achieve a successful outcome. All of these facets of parotidectomy make it one of the most interesting and formidable in the job description of an oncologic surgeon—casual operators need not apply.

The surgeon must rely on detailed anatomic knowledge of the parotid gland and its relationship to surrounding structures, particularly neural and vascular, to perform the operation safely. The pertinent relationships are presented in the anatomy section of this chapter, but the surgeon who wants to minimize operative complications in this area must master the anatomy through careful study of anatomic texts and the practice of anatomic dissection. The varieties of tissue thickness, neural and vascular structural heterogeneity, and variability of tumor relationships to surrounding structures are too vast to present pictorially. The surgeon will spend a career mastering this complexity, and technique improves with further performance of the task. Still, several anatomic points are worth presenting more than once: (1) the anatomy of the facial nerve trunk as it exits the stylomastoid foramen and enters the parotid gland is very constant; (2) the separation of the parotid gland into a superficial and deep portion divided by the facial nerve is a surgical, and not an embryologic, distinction, and thus the tumors that present in these regions and their relationship to lymphatic structures are not different; and (3) roughly 80% of the parotid gland (and 80% of the 15–20 intraglandular lymph nodes) lies superficial to the facial nerve, and 20%

of the gland and its lymphatics lie in the deep portion medial to the nerve.

What constitutes a total parotidectomy? This question deserves some attention because of the variability in techniques and philosophies of different surgeons. In general, total parotidectomy connotes the removal of both the superficial portion of the gland and the entire deep gland beneath the facial nerve. In extreme cases, the operation also may entail removal of the peripheral facial nerve and even surrounding muscle, bone, and skin. In practice, the more extensive version of the operation is rarely indicated. When performed, it is usually in the treatment of advanced malignancies. More commonly, the surgeon finds the need to perform a subtotal parotidectomy by removing the superficial gland and a portion of the gland deep to the facial nerve. The surgeon performing parotid surgery must possess the skill and knowledge to perform the various forms of total parotidectomy, thereby adequately removing disease while avoiding unnecessary morbidity.

When does a surgeon need to contemplate total parotidectomy? Surgeons who perform parotidectomy also need thorough knowledge regarding clinical behavior of the various pathologic lesions that can arise in the major salivary glands. Benign tumors, such as pleomorphic adenomas, oncocytomas, and Warthin's tumors, usually necessitate only subtotal removal of the gland with preservation of the facial nerve. Benign tumors that arise in the deep lobe often require initial elevation or removal of the superficial lobe followed by mobilization of the facial nerve before subtotal removal of the deep portion of the gland. Occasionally the surgeon may not be able to determine the deep lobe origin of the tumor before mobilization of the superficial gland. Operative exploration may show the need for removal of the deep lobe in tumors that arise in the midpoint of the parotid adjacent to the facial nerve. The inexperienced operator may omit the possibility of total gland removal and facial nerve mobilization during the preoperative consent process for a patient with a seemingly innocuous parotid mass. Some multifocal tumors, despite benign behavior, may require total parotidectomy to ensure complete removal. Parapharyngeal tumors may require superficial and deep parotid removal if they are dumbbell-shaped tumors that pass through the stylomandibular tunnel, or they may require only deep lobe removal if they are confined to the parapharyngeal space.

Malignant tumors of the parotid gland often require total removal of the gland. The exception is low-grade tumors with a low risk of nodal metastasis. All malignant tumors that arise in the deep gland and any tumor with confirmed metastasis to the parotid gland require total parotidectomy for adequate removal. High-grade tumors arising in the superficial gland warrant total parotidectomy to ensure adequate treatment of the parotid lymph nodes. Tumors that spread outside the parotid gland or involve the facial nerve usually warrant total parotidectomy. Because of the complexity of tumor presentation and behavior, the parotid surgeon benefits from considerable familiarity with the behavior of the many types of parotid tumors, both benign and malignant. The surgeon also needs to understand how histologic grade can influence tumor behavior and consequently dictate the extent of surgery necessary for adequate extirpation. Obviously the availability of a competent pathologist who has equally detailed familiarity with the evaluation and diagnosis of salivary gland conditions is essential for adequate surgical treatment of parotid tumors. If the surgeon cannot work closely and efficiently in the operating room with a skilled frozen-section pathologist, then that surgeon should question the ability to perform competent surgical care of the patient with a parotid mass.

Background Information

Embryology

The major salivary glands develop by the ingrowth of oral epithelium into the underlying mesenchyme [7]. In the case of the parotid gland, the ectoderm grows backward across the masseter muscle and is against the developing external ear structures. Although the embryologic development of the facial nerve was a source of some controversy for more than a century, it is now known that the facial nerve migrates anteriorly and becomes surrounded by the developing gland. The gland then insinuates into the spaces around the mandible, temporal bone, and surrounding muscles. The clinical implication of this embryologic development is that the histologic features of the superficial and deep portions of the gland are identical. Despite being the first of the major salivary glands to initiate development, the parotid gland is the last to become encapsulated by fascia. The clinical implication of late encapsulation is incorporation of a variable but substantial number of lymph nodes within the parenchyma of the parotid gland, in both the superficial and the deep lobes. Fascial structures also interdigitate between the superfi-

cial and deep lobes of the gland and around the intraglandular facial nerve.

Surgical Anatomy

The adult parotid gland occupies a region in front of the ear, varying in width from 3.4 to 5.8 cm. It weighs between 14 and 28 g [5]. It is irregular and variable in shape, and it has been described as having four surfaces: superficial, deep, anterior, and posterior [1]. The posterior surface overlaps and is grooved by its contact with the sternocleidomastoid muscle, mastoid process, and external auditory meatus. This inferior variability in size and shape has the clinical implication that any infra-auricular mass should be assumed to have an origin in the parotid gland until proved otherwise with imaging or surgical exploration. Many inexperienced practitioners have inadvertently incised this area with the intent of "excisional" biopsy, only to find themselves within the parenchyma of the gland dealing with an unexpected parotid neoplasm.

The deep surface of the gland is molded against the medial wall of the musculoskeletal recess formed by the mastoid process, external acoustic meatus, head of the mandible, and ascending ramus of the mandible. These surrounding structures have surgical importance. The medial wall of the bony recess is the styloid process and, deeper, the transverse process of the atlas. The medial bony recess is incomplete, but helping to fill it are the posterior belly of the digastric muscle and the styloid musculature. These muscles, particularly the digastric muscle and stylohyoid muscle, indent the deep surface of the gland and are easily seen during complete parotidectomy. Anteriorly, the ramus of the mandible and the masseter muscle contact the deep portion of the parotid. The bulk of the pterygoid muscles in the infratemporal fossa is not visualized during total parotidectomy, but the insertion of the lateral pterygoid at the temporomandibular joint is related to the deep portion of the gland that extends deep to the posterior border of the mandible. The stylomandibular ligament unites the styloid process to the mandibular ramus. Together with the ascending ramus of the mandible and the skull base, it forms the stylomandibular tunnel described by Patey and Thackray [11]. Tumors from the retromandibular portion of the parotid gland may pass through the stylomandibular tunnel and thus extend to the prestyloid portion of the parapharyngeal space.

Related Fascia

The superficial layer of the deep cervical fascia splits to invest the parotid gland and then fuses superiorly with the periosteum of the zygoma. Over the lateral surface of the gland, this fascia is often termed the parotid fascia, and it serves as an excellent barrier above which a tissue flap containing the superficial fascia and subcutaneous fat can be raised. The parotid fascia sends numerous septae passing among the lobules of glandular tissue. Anterior to the gland, the fascia continues to invest the masseter muscle. The deep fascia of the medial gland is thinner, is continuous with the fascia of the styloid muscles, and continues downward to form a portion of the stylomandibular ligament before fusing with the fascia of the digastric muscle and periosteum of the angle of the mandible.

Vascular Anatomy

The variability of the venous system in and around the parotid gland makes it difficult for the surgeon to understand many clinically useful relationships. Two important relationships bear mention: (1) the superficial temporal and internal maxillary veins fuse within the gland to form the posterior facial vein, which generally splits as it exits the gland into a posterior (retromandibular) branch that drains into the external jugular vein and an anterior branch that drains into the common facial vein and then into the internal jugular vein, and (2) the veins generally lie deep to the facial nerve within the gland, the cervical branch of the facial nerve usually passing over the posterior facial vein and the marginal nerve passing over the anterior facial vein.

The external carotid artery and its terminal branches are intimately connected to the parotid gland. Unlike the posterior facial vein, which runs superficial to the digastric and stylohyoid muscles, the external carotid artery runs deep to these muscles before curving upward and entering that portion of the gland molded inward by the styloid process. The branches of the external carotid artery are commonly divided as anterior, posterior, ascending, and terminal, but the branches involved in total parotidectomy are best considered in terms of the relationship of their origin proximal or distal to the digastric muscle. The superior thyroid, lingual, and ascending pharyngeal arteries originate proximal to the digastric muscle, and generally are not encountered during parotidectomy.

The occipital and facial arteries originate at the inferior border of the digastric muscle. The occipital artery runs posteriorly under the digastric muscle, grooves the mastoid near the insertion of this muscle, and runs away from the parotid bed. The facial artery ascends deep to the digastric muscle and curves back over the stylohyoid muscle before passing between the submandibular gland and mandible. The artery crosses over the mandible at the anterior border of the masseter muscle.

The remaining distal branches of the carotid artery are more intimately related to the parotid gland. The posterior auricular artery originates near the superior border of the digastric muscle and runs backward between the mastoid process and external auditory meatus. It sometimes is encountered in the dissection of the facial nerve trunk, but it does not run in the glandular tissue. The internal maxillary artery and superficial temporal arteries originate from the intraglandular portion of the external carotid artery. The internal maxillary artery runs deep to the ascending ramus of the mandible to lie deep or superficial to the lateral pterygoid muscle. The superficial temporal artery grooves the deep surface of the gland and runs upward between the tragus and temporomandibular joint. It gives off the transverse facial artery, which runs anteriorly over the mandibular ramus toward the masseter muscle.

The internal jugular vein passes deep to the operative field during total parotidectomy. It is rarely encountered, except in the removal of tumors that extend to the parapharyngeal space. The internal jugular vein leaves the skull base medial and posterior to the styloid process and descends immediately on the anterior surface of the transverse process of C1. It runs deep to the digastric and styloid muscles.

The internal carotid artery ascends vertically on the anteromedial surface of the internal jugular vein. It also is rarely encountered during complete parotidectomy, being confined to the poststyloid portion of the parapharyngeal space. The exception is tortuous turns in the superior cervical internal carotid artery, which can sometimes bring the artery far more lateral than the surgeon might expect.

Lymphatic Anatomy

The parotid gland contains a rich and intricate system of both afferent and efferent lymphatics. The afferent lymphatic channels draining into lymph nodes on the superficial surface of the gland serve as the principal collecting system for the frontotemporal scalp, upper face, lacrimal gland, and external ear. The afferent lymphatic channels draining to lymph nodes on the deep surface of the gland drain the palate, nasopharynx, auditory canal, and middle ear.

The efferent channels drain to both the superficial and the deep cervical lymphatic systems. The average adult parotid gland contains 15–20 intraglandular lymph nodes [12]. In the past there has been some controversy over the density of deep glandular lymph nodes and the necessity of doing total parotidectomy for lymphatic metastasis. However, the current understanding of embryologic formation of the superficial and deep portions from a singular gland anlage, coupled with the dense interconnection of lymphatics between the glandular and paraglandular lymphatics and superficial and deep portions of the gland, argue for total parotidectomy in these situations. The adult deep lobe parotid gland contains lymph nodes 75% of the time, and the average number of nodes in the deep gland is 2.3 [4].

Neural Anatomy

Although the anatomic variability of the facial nerve and detailed descriptions of the percentages of different branching patterns have contributed to the body of knowledge surrounding parotid surgery, the surgeon should be aware of the constancy of the position of the main trunk of the facial nerve [1]. The facial nerve exits the stylomandibular foramen, which lies at the base of the styloid process at the end of the tympanomastoid fissure. After leaving the foramen, the main trunk of the facial nerve gives off branches to the postauricular muscles and posterior belly of the digastric muscle, and then it curves anteriorly. These branches may have to be divided during mobilization of the nerve in the performance of total parotidectomy. The facial nerve then becomes embedded in parotid tissue and usually runs superficial to the posterior facial vein (often in contact with it) and lateral to the external carotid artery. Occasionally, some of the branches of the facial nerve run deep to the facial vein.

To identify the facial nerve trunk, the surgeon can utilize the spatial relationships mentioned, but none of these structures is actually visible during mobilization of the gland. The structures that are most useful for identification of the facial nerve early in parotidectomy

are the posterior belly of the digastric muscle, cartilaginous tragal pointer, and mastoid tip. A finger tip placed on the lateral surface of the mastoid process will direct the surgeon to the proper plane and zone of dissection to identify the facial nerve trunk. Every parotid surgeon has encountered that moment of uncertainty when dissecting through a thick parotid gland before encountering the facial trunk, but one must remember that in a plane along the anterior surface of the mastoid tip no vital structure exists between the fingertip and the trunk of the seventh nerve. It exists as a singular white structure that is 2–3 mm in diameter at this location [1]. In the case of deep lobe tumors, the main trunk of the facial nerve may be more lateral, and it may be encountered sooner than expected. In children, the main trunk may not be as deep as expected.

The major division of the facial nerve, the pes anserinus, is located within 1.3 cm of the stylomastoid foramen [3]. The nerve divides into an upper temporofacial division and a lower cervicofacial division. Anastomotic branches occur commonly between the upper division nerves, rarely between the mandibular branch and other branches, and never between the branches of the cervicofacial division. Considerable controversy exists about the relationship of the facial nerve and the surrounding parotid parenchyma. The controversy has significance from two separate clinical aspects, namely, (1) what can be done surgically, and (2) what should be done oncologically.

From the standpoint of surgical technique, a definite plane of dissection can be developed along the facial nerve. This is commonly the technique used in removal of tumors of the superficial portion of the parotid gland. From an oncologic standpoint, the parotid gland is a unilobar, multilobular structure. The intimate continuity of ducts and parenchymal connections that traverse the plane of the facial nerve makes separation of the gland along this plane a surgical, and arbitrary, separation when dealing with invasive neoplasms.

The greater auricular nerve crosses over the sternocleidomastoid muscle and divides into multiple branches below the external ear. The anterior branch sends sensory fibers to the ear lobe as well as the skin and fascia over the parotid gland. Posterior branches of the greater auricular nerve may be preserved during parotidectomy for benign disease.

The auriculotemporal nerve, a branch of the fifth cranial nerve, passes in the superior deep portion of the gland as it leaves the infratemporal fossa. It gives sensory fibers and postganglionic parasympathetic fibers from the otic ganglion to the parotid gland.

Parotid Duct

The parotid duct is formed at the anterior border of the gland as smaller tributaries from within the gland converge. An "accessory" lobe of the parotid gland may be loosely connected to the main body of the gland or completely separate from it and lie adjacent to the duct. Variations in the distribution of the tributaries have limited surgical significance.

Definitions and Indications

Superficial Parotidectomy

Superficial parotidectomy entails removal of the lateral portion of the parotid gland with preservation of the facial nerve. It is the standard operation for masses that arise in the portion of the parotid gland lateral to the facial nerve, particularly when the histopathologic nature of the mass has not been confirmed. Superficial parotidectomy is adequate treatment for benign tumors of the superficial parotid gland, such as pleomorphic adenoma, and for localized, well-encapsulated malignant tumors of low histologic grade which arise in the lateral lobe of the parotid gland. High recurrence rates following operation for pleomorphic adenoma have been attributed to inadequate surgical excision, and superficial parotidectomy should be the standard operative procedure in the armamentarium of the parotid surgeon [9]. Some surgeons advocate partial or subtotal parotidectomy for tumors that arise in the lateral parotid tail. The surgeon entertaining the decision to perform subtotal superficial parotidectomy needs to be confident in both the histologic nature of the mass and the encapsulation and localized nature of the tumor. If either of these issues is in question, a formal superficial parotidectomy should be performed. The goal of removal of a benign parotid tumor is complete removal with a cuff of normal parotid tissue around the tumor and preservation of the facial nerve. No parotid tumor should be removed by excisional biopsy without clear visualization of the branches of the facial nerve.

Deep Parotidectomy

To understand deep parotidectomy, the components of the deep gland need to be conceptualized. From a surgical dissection view, the deep parotid consists of three main parts (again, contiguous): (1) the portion of the

gland between cranial nerve VII and over the masseter muscle, (2) the gland deep to cranial nerve VII between the mandible and the mastoid/external auditory canal (greatest volume), and (3) the retromandibular gland that extends to or into the parapharyngeal space. The surgeon may individualize the extent of resection to involve some or all of these portions on the basis of the pathologic findings and presentation of the tumor. The major operations involving the deep parotid may include superficial parotidectomy combined with partial deep lobe parotidectomy, superficial parotidectomy with total deep lobe parotidectomy with or without resection of cranial nerve VII, isolated deep parotidectomy, deep lobe parotidectomy with parapharyngeal space extension, and extended total parotidectomy usually with resection of cranial nerve VII. These operations are described separately below, and illustrative cases are used to highlight typical indications.

Superficial Parotidectomy with Partial Deep Lobe Resection

This operation is commonly performed for benign tumors of the central deep parotid gland, such as pleomorphic adenoma involving the gland deep to the facial nerve. The surgeon may not always be able to predict the relationship of the tumor to the peripheral nerve from preoperative examination or imaging, and the decision to resect the deep gland may evolve during the operation after dissection of the superficial gland. This operation also may be performed for low-grade malignancies of the superficial gland for which the surgeon wants to include a portion of the deep gland to ensure an adequate margin of resection. Rarely, this operation is performed in patients with refractory chronic sialadenitis in an effort to remove all chronically infected gland and prevent postoperative sialocele. The operation also may be used for patients with mucosa-associated lymphoid tissue (MALT) lymphoma of the parotid gland in the absence of other signs of lymphoma. This situation should be expected in patients with rheumatoid arthritis or Sjögren's syndrome who have development of nodular enlargement of the parotid gland.

Case Example 1

A 37-year-old dental hygienist was referred from her primary physician with a 2-year history of a right-sided 2.5-cm infra-auricular mass. She came with a computed tomogram that showed a 2.5-cm mass within the parenchyma of the inferior parotid gland. The mass was nontender, and she had no adenopathy, skin changes, or facial nerve paresis. She had done extensive research on parotid gland conditions, and she was intensely concerned with the aesthetic outcome of any surgical intervention. She underwent preoperative examination and discussion, and intraoperative exploration progressed with exposure of the parotid gland, identification of the facial nerve, and mobilization of the superficial lobe of the parotid gland. As the operation progressed, it became obvious that the mass was deep to the facial nerve trunk and cervicomandibular division. The main trunk was draped over the main portion of the mass in the deep parotid gland. The superficial lobe was removed, the facial nerve trunk and peripheral branches were mobilized, and the deep gland between the mandible and mastoid and a portion of the gland over the masseter were removed in continuity with the mass. Frozen-section pathologic findings confirmed pleomorphic adenoma arising within the deep gland. The parotid defect was reconstructed with an abdominal dermal fat graft to mask the perimandibular defect.

Superficial Parotidectomy with Total Deep Lobe Resection

Total removal of the superficial and deep parotid gland should be performed for malignant neoplasms with confirmed or suspected metastasis to the parotid lymph nodes, including the following situations: (1) metastasis to a superficial parotid node from a primary parotid tumor or an extraparotid malignancy, (2) any parotid malignancy that indicates metastasis by involvement of cervical lymph nodes, and (3) any high-grade parotid malignancy with a high risk of metastasis. Total parotidectomy also is performed for primary parotid malignancies originating in the deep lobe and for primary malignancies that extend outside the parotid gland. The operation also is performed for multifocal tumors, such as oncocytomas, to ensure complete removal. The operation may involve sparing or sacrifice of the facial nerve branches or trunk depending on tumor extent to the nerve.

Case Example 2

A 45-year-old man was referred for treatment of a biopsy-proven malignant melanoma 1.3 mm in greatest depth centered over the temporal skin in the supra-auricular area. Preoperative positron emission tomography

showed a fluorodeoxyglucose-avid 1.2-cm node in the superficial parotid gland. The patient underwent wide local excision of the temporal melanoma and superficial and deep parotidectomy with facial nerve preservation and upper neck dissection. Frozen and permanent pathologic findings included 2 of 6 neck nodes in the superficial parotid gland positive for metastatic melanoma, 1 of 3 nodes in the deep parotid glands positive for melanoma, and 1 of 25 neck nodes positive for melanoma. The patient was treated with postoperative radiation and followed for the possibility of locoregional or distant recurrence.

Isolated Deep Parotidectomy

Isolated removal of the deep parotid gland is most often performed for benign tumors of the inferior parotid gland deep to the facial nerve. This operation can be used for "dumbbell" tumors of the deep parotid gland that enter the parapharyngeal space through the stylomandibular tunnel. During this operation, the superficial gland is mobilized to aid in identification of the facial nerve, but it is not removed if not involved with tumor.

Case Example 3

A 37-year-old woman was involved in a motor vehicle accident and examined for superficial wounds in the emergency department. On physical examination, she had fullness of her soft palate and tonsillar asymmetry. Magnetic resonance imaging showed a 3.5-cm mass in the prestyloid parapharyngeal space with a small cuff of tissue contiguous with the deep parotid gland. She had no other head or neck abnormalities. She underwent surgical exploration with a cervicoparotid approach, mobilization of the inferior parotid gland, and identification of the facial trunk and inferior nerve division. Blunt finger dissection was used to mobilize the mass from the parapharyngeal space and deliver it into the neck, with care taken to avoid rupturing the capsule of the mass against the styloid process. The mass was sent for pathologic review with a cuff of inferior deep parotid tissue. Histopathologic results confirmed the presence of encapsulated pleomorphic adenoma. The patient was discharged from the hospital after overnight observation and was free of evidence of recurrent disease at 4 years postoperatively.

Extended Total Parotidectomy

Removal of the superficial and deep parotid gland also may be extended to involve adjacent structures such as the overlying skin, the underlying mandible, the temporal bone and external auditory canal, or the deep musculature of the parapharyngeal space. These extensions are dictated by tumor growth and behavior. Patients with extensive parotid malignancies must be counseled regarding the possibility of extended resections and the resulting functional and cosmetic morbidity. The head and neck surgeon may need to anticipate the extent of defect and incorporate plans for reconstruction into the overall surgical design.

Case Example 4

A 63-year-old attorney presented with a mass in the left parotid gland, jaw pain, and upper facial weakness of 4 weeks' duration. He had a history of removal of a squamous cell carcinoma from the ipsilateral forehead skin 18 months earlier. On physical examination, a fixed 3.5-cm mass was present in the superior parotid gland. The patient also had trismus and House grade 2/6 ipsilateral upper facial nerve dysfunction. Imaging disclosed an enhancing mass present in the parotid gland with central necrosis and extension to the mandibular ramus, temporalis muscle, and pterygoid musculature. He underwent surgical excision with total parotidectomy, including facial nerve sacrifice, partial mandibulectomy, and resection of the overlying skin, ear canal, lateral temporal bone, and surrounding musculature. Pathologic findings included metastatic squamous cell carcinoma to 5 of 12 intraparotid nodes and 6 of 48 ipsilateral neck nodes. He underwent reconstruction with fibular free tissue transfer, cervicofacial rotation flap, and sural nerve interposition graft to the facial nerve defect. The patient underwent postoperative radiation therapy. Distant metastasis developed 2.5 years after therapy was completed.

Evaluation of the Patient

Evaluation of the patient with a parotid mass should always start with a history concentrating on tumor presentation. Factors such as slow versus rapid growth, pain, facial paresis or paralysis, and overlying skin changes or associated lymphadenopathy can be informative in the

distinction between benign and malignant lesions. Risk factors for malignancy such as prior radiation exposure and tobacco abuse should be sought, and inquiry should be made into previous diagnostic and therapeutic forays. The evaluation should review possible coagulation disorders, medical conditions, medications, dietary supplements, and allergies that could affect general anesthesia. The physician should inquire about a history of recurrent or chronic infections or inflammation of the parotid gland. With ready access to electronic medical information, today's patients are often partially or thoroughly informed as to the pathophysiology and treatment of parotid masses. Time spent during the history to explore patients' concerns and preconceived notions regarding their parotid mass can serve to relieve anxiety and foster realistic expectations.

After the history is obtained, a careful examination of the head and neck should concentrate on the preauricular and malar skin. The external auditory canal and tympanic membrane should be examined. Ipsilateral and contralateral facial nerve function should be evaluated with a standardized grading system. Generally, patients with intact facial nerve function can retain their facial nerve, even in the setting of malignancy, but patients with impaired facial nerve function usually have significant invasion of the nerve. During palpation of the gland and mass, the key factors to assess are size, consistency, mobility, and location. Intraoral examination should investigate the palate and lateral pharynx for asymmetry suggesting parapharyngeal extension. The neck is then palpated to assess for lymphadenopathy.

The role of imaging in parotidectomy is controversial. Imaging is not necessary for the evaluation of a patient with an easily identifiable mass in the parotid gland with benign characteristics on history and physical examination. Imaging begins to add clinically useful information when, after the physical examination, the surgeon is uncertain about the presence or extent of the lesion. It also is useful when the surgeon suspects extension outside the parotid gland. Parotid masses extending deep to the mandible into the parapharyngeal space should always be imaged preoperatively. Magnetic resonance imaging with gadolinium usually provides the greatest amount of information regarding tumor consistency, extent, and relationship to surrounding gland and other structures. Computed tomography with contrast may be added or substituted to gain information regarding tumor relationship to adjacent bony or vascular structures. The role of positron emission tomography is growing in the evaluation of malignant tumors with potential metastasis (see Chapter 2, Imaging of the Salivary Glands).

Fine-needle aspiration for the evaluation of parotid masses is also controversial. The literature reports variable accuracy when it is used for parotid masses, and the experience of the cytopathologist can greatly influence the results [13]. Fine-needle aspiration rarely alters the decision for the treatment of parotid masses. It may have use for evaluation of a patient with a parotid mass who is of poor health or reluctant to undergo surgical removal of the mass. For a patient with an obvious malignancy, it may help characterize the type of malignancy, which may be useful for pretreatment counseling (see Chapter 8, Fine-needle Aspiration Biopsy).

Preoperative Discussion

After the complete evaluation, the surgeon should thoroughly discuss the assessment, treatment plan, and goals of operation with the patient. This plan should be individualized to the patient and the tumor characteristics. The discussion includes an assessment of benign versus malignant tumor behavior. Even when the diagnosis is based on the findings of fine-needle aspiration, the surgeon should prepare the patient for an alteration of the diagnosis based on intraoperative findings and frozen-section analysis. The treatment plan must be designed around safe and complete tumor extirpation, avoidance of piecemeal removal, appropriate management of cervical lymphatics, facial nerve preservation if oncologically sound, and appropriate rehabilitation measures. All patients undergoing parotid surgery should be counseled regarding placement of the incision and postoperative scar, expected cosmetic defect, expected postoperative function and time to full recovery, possibility of the need for adjunctive radiation therapy for high-grade malignant tumors, and postoperative sequelae such as paresthesias and gustatory sweating. All patients undergoing parotidectomy should be counseled regarding the possibility of postoperative facial paresis or paralysis. This point becomes especially salient in patients undergoing total parotidectomy, particularly the elderly. Older patients have both slower and more incomplete recovery of facial function after manipulation of the nerve to the degree necessary for complete parotidectomy. If the facial nerve is involved with tumor, as evidenced on examination or imaging, the patient should be counseled regarding nerve sacrifice and rehabilitation.

Reconstruction of the functional and cosmetic deficits resulting from the operation should be discussed with the patient, including, as appropriate, the possible need for nerve grafting, the donor site incisions, and morbidity. Superficial parotidectomy results in mild to moderate facial contour asymmetry, and total parotidectomy results in a significant depression in the preauricular and inframandibular areas. The surgeon can attempt to minimize contour irregularity in removal of benign deep parotid masses by preservation of the superficial lobe. The patient should be counseled regarding the possibility of parotid bed reconstruction with autologous material (such as dermal fat graft) or artificial material.

Sometimes a patient has previously had partial parotid surgery for a tumor that requires total parotidectomy for adequate management. Often this situation results when the permanent pathologic findings show a malignant high-grade lesion and the preoperative or intraoperative histopathologic findings indicated a benign or low-grade lesion. Our advice in these situations is to complete the treatment that would have been recommended and performed if the surgeon had had the correct information at the outset. This advice often involves reentering a previously operated field, carefully identifying and mobilizing the facial nerve, removing the remainder of the parotid gland, and performing a neck dissection. This can be a difficult dissection, and the patient should be counseled regarding the possible need for facial nerve monitoring, facial nerve injury, and need for facial reanimation and nerve reconstruction procedures. Following sound principles of management is still preferable to observation in the face of uncertainty regarding adequate tumor removal.

The necessity for thorough preoperative counseling when this operation is to be performed cannot be overestimated, and a carefully planned and executed operation can still result in a dissatisfied surgeon and patient if the patient has not been counseled about appropriate expectations after the operation.

Surgical Technique

Preparation

Before entering the operating theater, the surgeon should arrange for a pathologist to provide reliable frozen-section review of the tissue. This approach will save many patients the cost, time, and morbidity of returning for further surgical resection for an undiagnosed malignancy. A quality assurance system should be in place to ensure the correct patient and site of surgery. Appropriate imaging studies should be thoroughly reviewed and visible during the operation. The risk of bleeding is low, and typing and cross-matching for blood transfusion are not needed during the operation. Antibiotics are not routinely administered unless there are preoperative signs of infection. The operation is performed with the patient under general endotracheal anesthesia, and the endotracheal tube is positioned and taped to the oral commissure and cheek opposite to the lesion. The patient is placed in a 45° reverse-Trendelenburg position or lounge-chair position with the head higher than the heart. The head is turned to the opposite side of the lesion, and the neck is extended by placement of a rolled sheet under the shoulders. The patient is prepared by sterile scrub and draped so that the ear, lateral corner of the ipsilateral eye, ipsilateral oral commissure, and entire ipsilateral neck are visible in the field. If facial nerve monitoring is to be used, the nerve monitor is placed in the orbicularis oris and orbicularis oculi muscles to ensure upper and lower division monitoring. The surgeon stands on the side of the patient ipsilateral to the gland to be dissected, the assistant stands at the head and opposite the surgeon, and the scrub technician stands on the side of the surgeon.

Incisions and Flap Elevation

The incision site is marked with a surgical marker. The incision begins in the preauricular crease at the superior root of the helix and curves gently below the lobule, and then turns anteriorly to run horizontally in a skin crease approximately two finger widths below the angle of the mandible (Fig. 15.1). This limb of the incision should be oriented so that it could be extended into an incision that will accommodate dissection of the neck. The incision should not extend far posteriorly into the thin skin below the lobule over the mastoid tip. This skin will become ischemic in patients who use tobacco or have diabetes, and the surgeon will risk development of skin flap loss.

In patients who are particularly concerned with scar camouflage, the incision can be placed in the retrotragal area to hide the scar better. If the surgeon performs this type of incision, the incision line should lie just inside the anterior edge of the tragus and the dissection of the skin over the tragus should be very thin, in the immediate subcutaneous plane to avoid elevation of the tragal

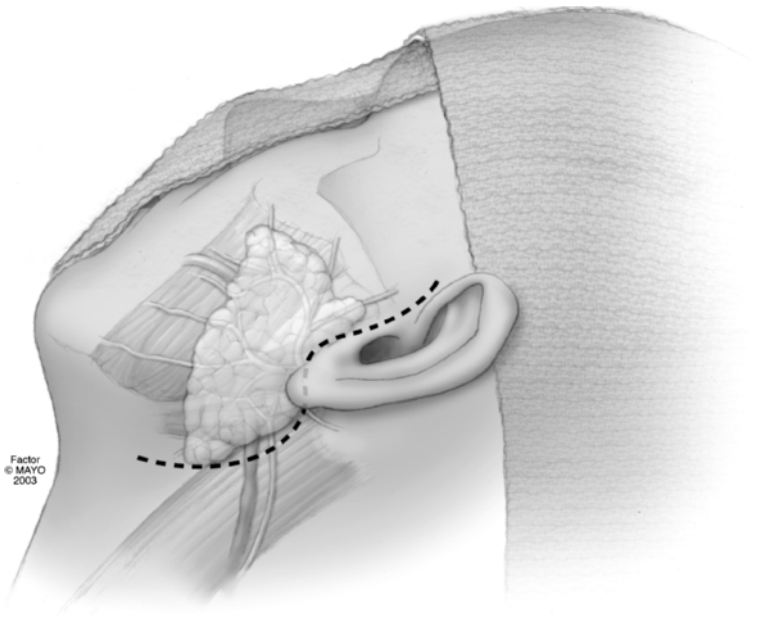

Fig. 15.1: Parotid incision. (From Olsen [10]. Used with permission of Mayo Foundation for Medical Education and Research)

perichondrium. The inferior incision also can be curved around the lobule and up onto the posterior conchal cartilage and back into the hairline. This incision is similar to the incision used in rhytidectomy, and its use can allow the surgeon to totally hide the incisional sequelae of parotidectomy. Although the exposure offered with this incision can allow full mobilization of the parotid gland, it is more difficult to incorporate neck dissection into the operation with this exposure. For this reason, postauricular incisions should be used only when the surgeon is convinced that the patient has benign disease.

The surgeon may crosshatch the incision lines superficially with a no. 10 or 15 blade to assist in precise realignment during closure. The incision is then made from superior to inferior through the skin into the subcutaneous tissue with the scalpel. Double skin hooks are placed into the facial flap, and the flap is raised for 1 cm with the blade. The assistant places firm upward retraction on the skin flap with the hooks, and back-traction is applied on the skin with a sponge by the surgeon or a second assistant. The surgeon should raise the flap immediately over the parotid fascia, which is recognizable as a white fibrous layer deep to the subcutaneous fat and superficial musculoaponeurotic system layer. Care should be taken not to enter a superficial tumor or the substance of the gland during flap elevation. Flap elevation continues with Jones scissors spread open perpendicularly along the parotid fascia; the scissors opens tunnels along the parotid gland which are then connected with blunt and sharp dissection over the parotid fascia (Fig. 15.2). In this way, the filamentous cutaneous ligaments that anchor the skin to the deep facial structures are divided, and small vessels are coagulated with bipolar cauterization. Flap elevation in this fashion can be carried to the anterior edge of the parotid gland. At this point, tissues are no longer cut, and the surgeon only bluntly spreads the tissue beyond the edge of the parotid gland. Spreading should occur in the same perpendicular orientation of the scissors tips, with the long axis of the scissors oriented parallel to the branches of the facial nerve. Dissection should continue anteriorly over the fascia of the masseter muscle. Branches of the facial nerve may be seen coursing toward the mid face just deep to this fascia. At the periphery, the parotid duct should not be looked for or isolated during this portion of the operation. Doing so could put the buccal branches of the facial nerve that accompany this duct at risk.

Skin hooks should next be placed on the inferior and posterior edges of the skin flap beneath the lobule. The anterior edge of the sternocleidomastoid muscle is identified, and the greater auricular nerve and external jugular vein, located just anterior to the nerve, are identi-

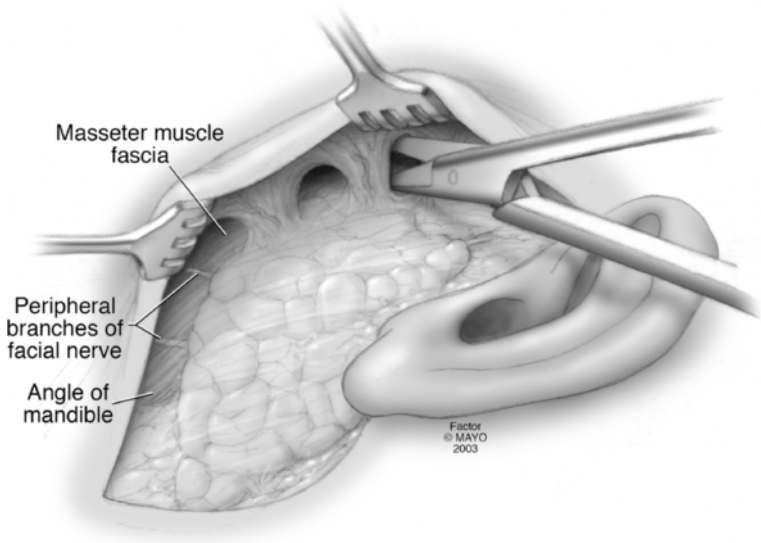

Fig. 15.2: Separation of the facial flap from the parotid gland. (From Olsen [10]. Used with permission of Mayo Foundation for Medical Education and Research)

fied. The greater auricular nerve and its branches are the largest component of the upper surgical plexus [10]. The nerve divides into mastoid, auricular, and facial branches, and the posterior branches can be preserved in some operations. The greater auricular nerve should be followed distally beyond its branch point before division. It then can be divided at its branches and reflected inferiorly, thereby allowing for the potential for nerve grafting from the facial nerve trunk to distal branches if the facial nerve has to be sacrificed. If possible, the external jugular vein should not be divided. After elevation of the skin flaps, the skin is secured with elastic hook retraction or self-retaining retractors to allow for adequate visualization of the entire field.

Deeper Dissection

The parotid gland is next separated from the anterior sternocleidomastoid muscle by sharp dissection. The gland is secured with Kocher clamps along its inferior border away from any tumor and retracted superomedially to assist in dissection. The gland also is separated bluntly from the tragal cartilage by spreading with Jones scissors parallel to the plane of the cartilage down to the level of the tragal cartilaginous pointer. A small bridge of tissue is divided to permit contiguous exposure of the entire anterior border of the sternocleidomastoid muscle and the tragal pointer. Several veins in this tissue require bipolar cauterization. A finger placed to the depth of the cartilaginous canal can allow palpation of the bony canal, the mastoid tip, and the tympanomastoid suture line.

After the parotid gland has been completely separated from the sternocleidomastoid muscle and the tragus, the posterior belly of the digastric muscle should be identified. The search for this muscle should not be too low in the surgical field, thereby putting the internal jugular vein or accessory nerve at unnecessary risk. Another common error is to search for the muscle too anterior in the field, thereby putting the marginal branch of the facial nerve at risk. The mastoid tip and the posterior border of the angle of the mandible serve as landmarks for the posterior digastric muscle. Once the muscle belly is identified immediately deep to the angle of the mandible, the remainder of the parotid gland is freed with blunt dissection. The surgeon is advised to trade the Jones scissors for a curved clamp at this point and to use this instrument for the remainder of the dissection as a means to resist the temptation to cut tissue until the facial nerve is clearly identified and mobilized. At this point, this dissection should have allowed for generous exposure of the entire inferior surface of the parotid gland, the posterior belly of the digastric muscle, and the mastoid tip and tragal cartilage. Some of the musculature that makes up the bed of the deep parotid gland may also be seen. The surgeon may visualize the stylohyoid muscle; the stylopharyngeus and styloglossus muscles are more superior and not seen yet. Near the angle of the mandible between the

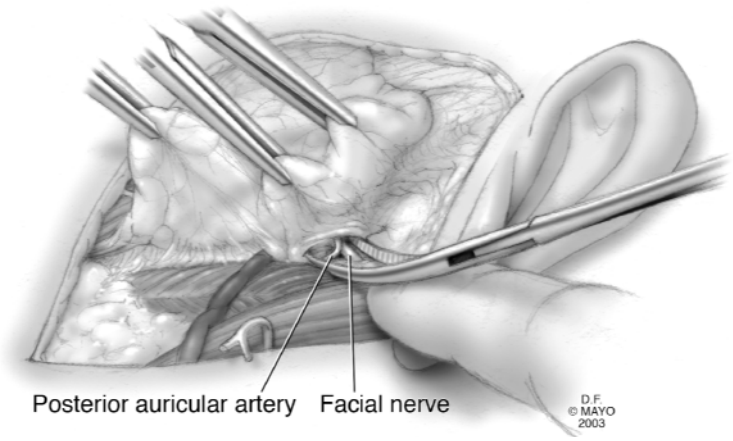

Fig. 15.3: Identification of the facial nerve. (From Olsen [10]. Used with permission of Mayo Foundation for Medical Education and Research)

stylohyoid and stylopharyngeus muscles, the external carotid artery enters the deep portion of the parotid gland. Hemostasis should be achieved with bipolar cauterization. Only when the field is widely exposed on a broad front and meticulous hemostasis has been achieved should the surgeon begin to expose the main trunk of the facial nerve.

Facial Nerve Mobilization

Kocher clamps are repositioned along the posterior parotid gland to provide adequate countertraction (Fig. 15.3). The assistant, in addition to providing traction, should also watch the patient's face to report movement as "twitching" of the facial musculature, which indicates stimulation of the facial nerve. The main trunk of the facial nerve exits the stylomastoid foramen immediately posterior to the styloid process. The styloid process is rarely felt during superficial parotidectomy. The nerve gives off branches to the posterior belly of the digastric muscle and postauricular muscles before it turns anterolaterally and enters the parotid gland just anterior to the border where the digastric muscle inserts into the mastoid. Tumors may thin the nerve or displace the trunk, but the position where the nerve enters the gland is constant.

Placing a finger on the mastoid tip, the surgeon uses the position of the cartilaginous tragal pointer and superior edge of the digastric muscle to identify the position of the facial nerve. It may be helpful to identify deeper structures such as the styloid process or tympanomastoid suture line to aid in nerve identification though these structures are not in view during this portion of the dissection. A small curved clamp is oriented perpendicular to the anticipated direction of the facial trunk to elevate tissues layer by layer. Scissors are never used for dissection down to the nerve, and no tissue is cut in this area until the nerve is seen. The tissue will separate with blunt dissection and traction before the nerve will tear, and this technique will prevent the surgeon from ever inadvertently cutting the facial nerve. Blunt dissection proceeds posterior to anterior until the surgeon identifies the nerve as a white cord 2–3 mm wide. The nerve is striking once it is identified, and it will not be confused with other structures in the vicinity. Further mobilization is performed by separating gland from the nerve, proceeding anteriorly; often the assistant will notice some twitching of the face during this separation (Fig. 15.4). The surgeon should dissect distally along the nerve to identify the pes and confirm that the main trunk has been identified proximal to any significant branches. By increasing upward retraction on the gland, the assistant can reduce any bleeding that may obscure the field. The only troublesome vessel in this area is the posterior auricular artery.

The posterior auricular artery travels posteriorly along the digastric muscle after it arises from the external carotid artery or, more rarely, the occipital artery. It usually lies inferior to the facial nerve trunk, but it may overlie it before sending branches to the mastoid and external auditory canal. The artery should not be divided until the facial nerve is identified. After identification of the trunk and during mobilization of the inferior parotid gland, the artery is ligated to prevent later hemorrhage.

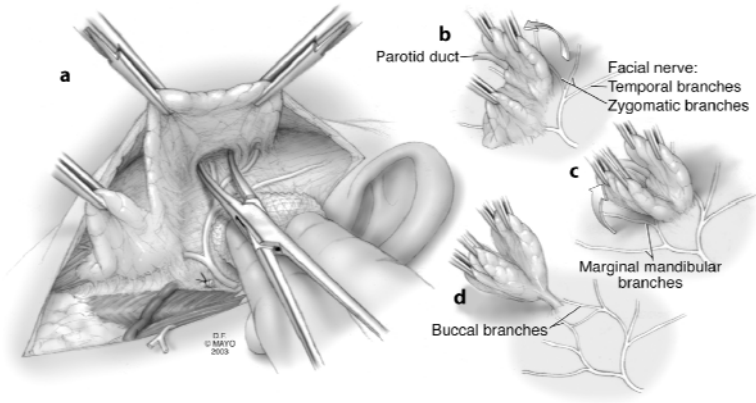

Fig. 15.4: Dissecting the facial nerve from the superficial gland. (From Olsen [10]. Used with permission of Mayo Foundation for Medical Education and Research)

Removal of the Superficial Gland

Traction on the gland should be in an upward direction; often the assistant retracts the gland anteriorly to enable the assistant to see the procedure, and the surgeon may have to redirect the retraction repetitively to ensure efficient direction of pull. The surgeon chooses either a superior division or an inferior division to work along initially. Often it is helpful to work away from the majority of the tumor to mobilize as much of the gland as possible before working along the less forgiving portion of the gland. The gland is separated at its edge, the temporal or marginal branches being followed to the periphery. The thickest fascia is encountered posterosuperiorly; this must be divided sharply or the surgeon will make tunnels into the gland along the nerve, and the procedure will slow to a crawl. Posteriorly, the surgeon will encounter branches of the superficial temporal vein, and these veins can be cauterized with bipolar cautery or ligated depending on their size.

Inferiorly, the surgeon will encounter the posterior facial vein, which is crossed by the inferior branches of the facial nerve. The marginal branch usually passes directly anterior to this vein and the anterior facial vein. The cervical branch may be superficial or deep or have branches on both sides of this vein. The vein should be carefully ligated after identification and preservation of these branches. Troublesome bleeding during dissection usually can be controlled by traction on the Kocher clamps by the assistant and by countertraction applied with a sponge on the gland by the surgeon. Obvious bleeding vessels can be cauterized with bipolar cautery. Vessels directly adjacent to the nerve branches should not be cauterized until the superficial lobe is completely mobilized.

After following a nerve branch to its peripheral emergence from the parotid gland, the surgeon returns to a proximal position along that nerve and searches for another branch to follow. In this manner the dissection progresses from posterior to anterior and either superiorly or inferiorly until the superficial gland has been completely separated from the facial nerve and the deep parotid gland. At this point, the surgeon should have a clear impression of the relationship of the tumor to the facial nerve, superficial gland, deep gland, and surrounding structures. It may be necessary to dissect along the tumor capsule to separate it from the deep gland and facial nerve. Careful retraction and meticulous dissection can prevent rupture of the tumor capsule, which is often pivotal in the prevention of recurrence. If the facial nerve is adherent to the tumor, the surgeon may elect to perform a biopsy of the nerve based on what is known about the histopathologic nature of the main tumor.

The gland is now left attached to only the parotid duct. The surgeon inspects this area to ensure that no buccal branches are adherent to the duct. The duct is divided and ligated, and the specimen is sent for examination by the pathologist. The wound should now be irrigated and the field inspected for bleeding vessels, which are ligated. The surgeon may need to wait for frozen-section pathologic results to make a decision about proceeding with total parotidectomy or closing. This time can be spent inspecting the wound, achieving meticulous hemostasis, and palpating the deep gland and neck to assess adequate tumor removal and lymphadenopathy. This is also an excellent time to review anatomic relationships and teach parotid anatomy and tumor pathology to assistants and surgeons in training.

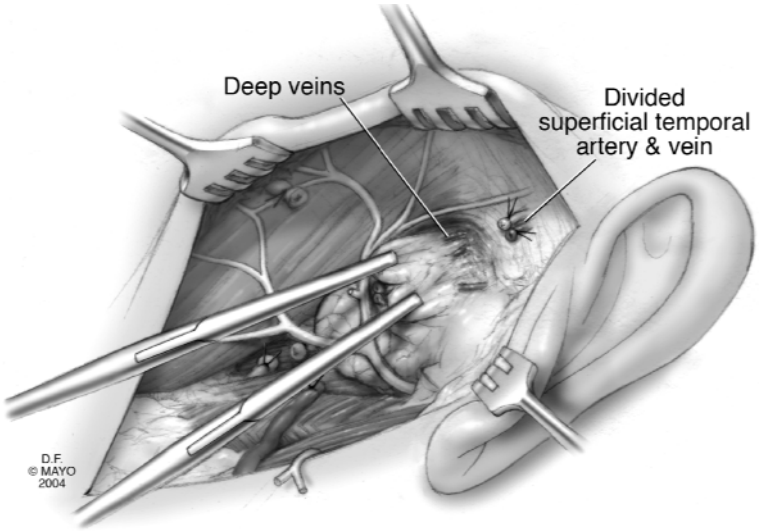

Fig. 15.5: Mobilization of the deep parotid gland and gaining of vascular control. (Used with permission of Mayo Foundation for Medical Education and Research)

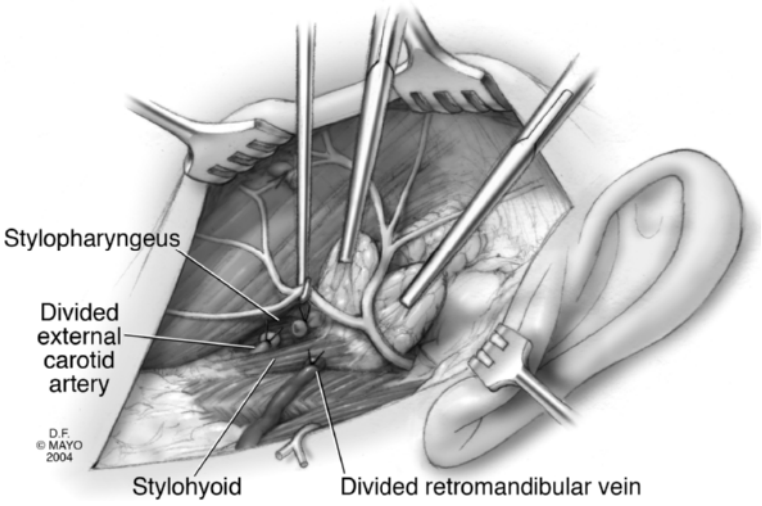

Fig. 15.6: Division of the carotid artery and posterior facial vein. (Used with permission of Mayo Foundation for Medical Education and Research)

Deep Parotidectomy

The essence of deep parotidectomy is vascular control. Once the surgeon has made the decision to perform deep parotid gland removal, the intraglandular segments of the external carotid artery and deep veins are ligated and divided (Fig. 15.5). The superficial temporal artery and vein are ligated at the superior periphery of the gland. Often the surgeon must ligate several branches in this area, because the vessels may branch at the periphery of the gland. The external carotid artery is isolated superior to the digastric muscle before it enters the inferior surface of the gland. The surgeon may need to divide the digastric and stylohyoid musculature to gain adequate access. In some elderly patients, the artery is tortuous in this area, and care should be taken to visualize branches off the artery, or to clearly identify the internal carotid artery and differentiate it from the external carotid artery, before ligation of the external carotid vessel. The posterior facial vein is divided and ligated if this step has not already been performed (Fig. 15.6). The transverse facial artery is divided at the superior anterior periphery of the gland. The only

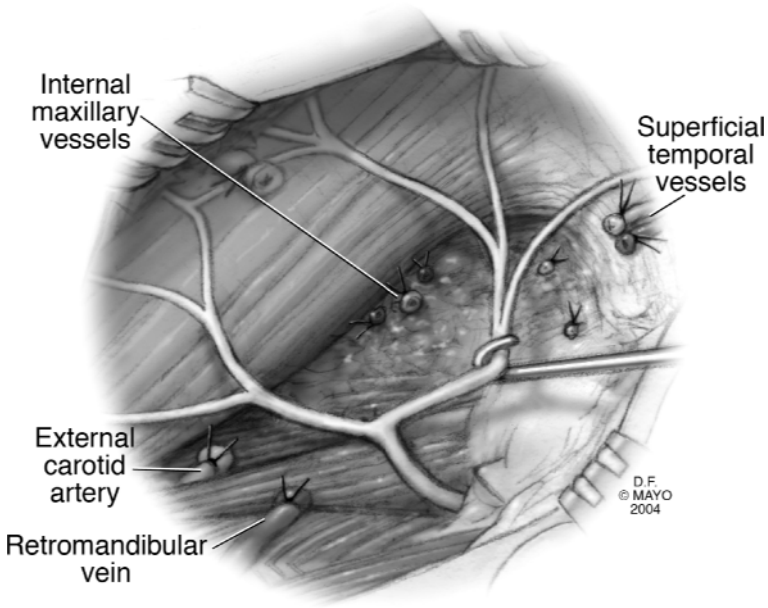

Fig. 15.7: Removal of the deep gland by mobilization of the facial nerve. (Used with permission of Mayo Foundation for Medical Education and Research)

significant vascular structures remaining at this point are the internal maxillary artery and venous tributaries to the pterygoid musculature located at the posterior border of the masseter muscle and mandibular ramus. These vessels are managed later in the procedure after mobilization of the deep gland for better exposure.

After control of the intraglandular vessels is obtained, the facial nerve trunk and branches are mobilized off of the underlying tumor. This step is best performed with a combination of blunt and sharp dissection with the nerve directly in view and gently retracted by the assistant with a nerve hook (Fig. 15.7). After complete mobilization of the nerve, the gland can be bluntly dissected from the deep bed with retraction and separation of the fascial attachments with a small curved clamp. The gland is separated from the temporomandibular joint, bony ear canal, condyle of the mandible, and styloglossus and stylopharyngeus muscles.

Now the deep venous tributaries that enter the pterygoid musculature can be cauterized or ligated and divided. The internal maxillary artery and adjacent veins will be encountered at the posterior mandibular ramus and need to be ligated and divided. The gland is now easily mobilized from superior to inferior and delivered from beneath the facial nerve trunk and inferior facial nerve division into the neck. The deep portion of the gland adjacent to the parapharyngeal space is mobilized with blunt dissection. If necessary for access, the stylomandibular ligament can be mobilized anteriorly to further open the stylomandibular tunnel. Portions of the tumor or gland that enter this area can be mobilized with finger dissection.

The gland is completely freed from attachment to any adjacent structures and sent for frozen-section pathologic examination. Small vessels around the deep gland adjacent to the mastoid and trunk can be cauterized using the bipolar forceps. The wound is irrigated, and meticulous hemostasis is achieved. If necessary, the incision can be extended for neck dissection at this time.

At the conclusion of the operation, a suction drain is placed in the wound through a separate stab incision in the postauricular skin and sewn into place. The wound is closed with interrupted absorbable sutures of 4-0 poliglecaprone 25 in the deep dermis and platysma and 5-0 absorbable sutures in the subcuticular skin. A conforming dressing or antibiotic ointment can be applied, and the patient is awakened and extubated.

Total Parotidectomy with Facial Nerve Sacrifice

In general, if facial nerve function is normal preoperatively, even in patients with malignancy, then the nerve can be preserved with careful dissection of the tumor

off the nerve sheath. If the nerve is paretic or fully paralyzed preoperatively, then it is involved with tumor and is normally resected during tumor resection. Nerve that is clearly invaded by high-grade malignant tumor should be resected with the specimen to negative proximal and distal margins. This may necessitate sacrificing peripheral branches, divisions, or even the main trunk of the facial nerve. Intraoperatively, a nerve that is infiltrated with tumor will appear swollen and usually darker than the normal glistening white appearance of normal facial nerve. A biopsy of a questionably involved peripheral nerve branch can be performed intraoperatively, but biopsy of the nerve will result in paresis or paralysis. Once a decision has been made to resect a nerve that is embedded in or infiltrated by tumor, the surgeon should check the proximal and distal nerve margins repetitively until they are both cleared, as evidenced on frozen-section pathologic examination. This may necessitate following the nerve into the mastoid bone by performing mastoidectomy to access the vertical or horizontal section of the proximal facial nerve.

After negative proximal and distal facial nerve margins are obtained, the nerve is reconstructed with primary neurorraphy or grafting. Mastoidectomy and nerve mobilization may be necessary to attain proper length of the facial nerve for tension-free anastomosis. Appropriate grafts include the ipsilateral greater auricular nerve if it is not involved with tumor or an ipsilateral sural nerve graft. The graft should be harvested with meticulous technique, freshened, and approximated without tension or redundancy with minimal use of well-placed 9-0 nylon sutures. If the proximal facial nerve is not suitable for grafting, peripheral branches can be grafted to the ipsilateral hypoglossal nerve by placement of an interpositional jump graft to preserve facial tone.

The surgeon may elect to perform additional procedures after resection of the facial nerve. The upper eyelid may be managed by placement of a gold-weight or temporary lateral tarsorrhaphy, the brow may be elevated with direct browlift, and the lower lid may be suspended with lateral canthoplasty and lid shortening. These maneuvers become more essential in elderly patients with skin laxity because of the potential for early problems with ectropion and corneal exposure, which develop much more readily than in younger patients with tighter skin tone [6]. Management of the lower face with suspension may be performed primarily or secondarily based on the surgeon's and the patient's expectations for facial nerve recovery. The surgeon should be cautious in performing temporalis transfer after total parotidectomy performed as previously described, because the deep and superficial temporalis vasculature has been compromised by division of the external carotid contributions.

Resection of Adjacent Structures and Reconstruction

The operation may be extended to involve resection of adjacent structures that are involved with tumor. It may include lateral or subtotal temporal bone resection, partial mandibular resection, resection of the overlying skin, resection of portions or all of the auditory canal, and resection of surrounding musculature. The surgeon should be guided by the extent of gross tumor and the frozen-section results. The surgeon should not be limited by inexperience, less than thorough knowledge of adjacent anatomy, or concerns with the potential for reconstruction. The goal after embarking on this operation for malignancy is total tumor removal with negative margins. The preoperative work-up should have assessed the resectability of the tumor. Patients with extensive parotid malignancies should be cared for only in an operating theater that possesses technically adept and competent teams supplying necessary skills in frozen-section pathology. The team should possess the capability to perform full tumor extirpation at the parotid bed, skull base, temporal bone, and neck. The team should also be competent with reconstruction use of locoregional flaps and microvascular reconstruction. If these capabilities are not available in one center at one setting, then the patient deserves referral to a more experienced team. At no time should the surgeon subject the patient to the fallacy that near total tumor removal is adequate treatment and that additional adjuvant chemotherapy or radiation will "mop up" the remaining positive margins.

After complete removal of the parotid gland, the patient is left with a significant cosmetic defect. If the operation included resection of the facial nerve or adjacent structures, the patient may be left with a significant cosmetic or functional defect. Reconstruction of these defects depends on the patient's desires, age, additional treatment plans, and expected outcomes and on many other factors. In short, it is highly individualized to the patient. The preoperative discussion should have explored these options in depth to fully guide the surgeon at the time of the operation. We often divide the resection and the reconstruction into separate but intimately coordinated teams. Among the many benefits of this approach is the concept that the resecting surgeon is not influenced sub-

consciously to minimize the operation because of concerns with the feasibility of reconstructing the defect.

Options for reconstruction include primary closure, dermal fat grafting, muscle transposition with locoregional flaps of the sternocleidomastoid or pectoralis muscles, and microvascular cutaneous, musculocutaneous, and innervated muscular flaps. Again, the reconstruction will be guided by the functional and aesthetic goals of the surgeon and patient. The details of these reconstructions are discussed elsewhere in this book (see Chapter 26, Reconstruction after Excision of Cancer of the Salivary Glands).

Postoperative Care

Hospitalization and Wound Care

After total parotidectomy with nerve preservation, patients are admitted to the hospital for overnight observation. Undetected and expanding hematoma can cause airway compromise that can be life-threatening. If a dressing has been applied, it is removed the next morning, the wound is inspected, and the patient can be discharged with instructions in wound care, bathing, and activity. Patients are instructed to watch the wound for redness, swelling, or drainage that indicates the presence of infection, seroma, or hematoma.

Young patients may have minimal to moderate facial paresis (House grade 2–3) after total parotidectomy. Older patients will generally have more significant paresis after the operation, and it will usually take longer (3–6 months) to recover fully. Facial paresis may actually worsen during the first 2 days after the operation because of neurapraxia. During recovery, adequate eye care is essential to prevent exposure-related ophthalmologic complications. Patients are instructed to lubricate the eye with an ophthalmic ointment before sleeping, and they should be instructed to use moisturizing drops frequently during the day. This prophylaxis should be continued until full eye closure is achieved. A moisture chamber may be helpful for some patients. For patients without adequate Bell phenomenon or who lack dexterity or mental faculty to adequately assess and self-treat dryness of the eye, consideration should be given to more aggressive eye care such as temporary tarsorrhaphy and regular ophthalmologic examination.

Patients are instructed that they will experience numbness of the auricle, particularly around the lobule. The numbness will be most noticeable in patients with pierced ears. It will improve for up to a year after the operation, but the inferior lobule usually remains anesthetic. The depression around the ear improves slightly with time, but it will persist in patients with total parotidectomy, and it will be more severe with greater removal of surrounding tissue. Patients are instructed to move their head and neck after the operation, and they are given instructions on shoulder exercises if a neck dissection has been performed. Counseling is given on "first-bite" pain which consists of pain on initiating chewing. Patients are instructed to chew gum for physiotherapy. The pain usually resolves completely with time.

Long-term Care and Expectations

Frey's syndrome (gustatory sweating) results when the postganglionic parasympathetic nerve fibers of the parotid gland aberrantly reinnervate the sweat glands in the skin. This develops 6–12 months postoperatively, and it is present in all patients. Patients may not volunteer its presence until questioned, or they may complain of "leaking saliva" from the incision when eating. Management may range from reassurance and explanation, which are more readily accepted when a patient has been counseled preoperatively, to application of clear antiperspirants to anticholinergic therapy and botulinum toxin application to interpositional grafting. Rarely are aggressive treatments necessary, because the potential complications of infection, seroma, and nerve injury rarely are justified by the severity of the symptoms (see Chapter 5, Treatment of Frey's Syndrome).

Few patients have sialocele develop after total parotidectomy; the incidence decreases as the majority to all of the gland is removed. If it develops, it can be managed by needle aspiration and a pressure dressing. Rarely, insertion of a Penrose or suction drain, compression dressing, and a short course of anticholinergic therapy may be necessary.

Patients are referred for adjuvant therapy as indicated by tumor histology and extent. Indications for radiotherapy postoperatively include high-grade tumors with perineural invasion, nodal extent to multiple nodes, extracapsular nodal extension, and close margins with a high chance of tumor recurrence [14].

Adequate follow-up for patients who undergo parotidectomy for malignancy entails regular 3-month examinations for 2 years followed by 6-month examinations for 3 years and thereafter yearly follow-up. This schedule can be modified according to the pathologic findings

and suspicion of recurrence by the surgeon. Some parotid tumors, such as mucoepidermoid carcinoma, have a very low chance of recurrence after adequate removal, whereas others, such as adenoid cystic carcinoma, may recur years after wide resection [2]. Regular imaging with serial magnetic resonance imaging or positron emission tomography can aid in the detection of recurrence when meaningful intervention is still possible. Patients may be hesitant to come for follow-up because of fear, denial, or inappropriate confidence of cure, and the surgeon should be thorough and assure the patient of the importance of this part of the treatment.

Finally, patients should be reassured that the healing after total parotidectomy takes months rather than days. Discomfort, cosmetic deficits, and functional deficits generally improve for up to 2 years postoperatively. Patients who have had both proper treatment and preparation for the sequelae of total parotidectomy will return regularly and have disease-free survival and improvement that will satisfy both the patient and the surgeon.

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Take Home Messages

- Total parotidectomy is a spectrum of operations from straightforward to complex.
- The surgeon performing total parotidectomy should possess detailed knowledge of parotid and periparotid anatomy, experience in parotid surgery and facial nerve surgery, and thorough knowledge of the behavior of benign and malignant parotid tumors.
- The surgeon individualizes the operation to the tumor and the patient.
- The parotid gland is separated artificially by the surgeon into a large portion superficial to the facial nerve and a smaller portion deep to the nerve.
- Both portions of the parotid gland can develop benign and malignant tumors and contain lymph nodes.
- Cancer with the potential to metastasize to lymphatics in the parotid gland should be managed by total parotidectomy.
- Thorough preoperative work-up and discussion build rapport and confidence between the surgeon and patient.
- Fine-needle aspiration is rarely necessary or completely accurate preoperatively.
- Frozen-section pathologic examination is essential for decision making during parotidectomy.
- If the facial nerve functions normally preoperatively, it generally should be preserved.
- If the facial nerve is dysfunctional preoperatively or infiltrated by tumor intraoperatively, it should be resected to achieve negative margins.
- The key to total parotidectomy is adequate control of the intraglandular external carotid artery and deep veins.
- Total parotidectomy results in a defect that may require reconstruction.

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