EXCISION OF TUMORS OF THE PRESTYLOID PARAPHARYNGEAL SPACE

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INTRODUCTION

Tumors of the prestyloid parapharyngeal space are uncommon but challenging due to the variety of lesions encountered and the complex anatomy of the involved area. Fortunately, these tumors are generally benign, and therefore, they bring expectations from the patient and the physician that excision should lead to low morbidity and very low mortality. Since patients rarely die of these tumors, the goal of management should be to perform the operation safely with complete removal of the tumors to minimize the risk of recurrence and to preserve surrounding structures.

The prestyloid portion of the parapharyngeal space is actually a potential space. It contains adipose tissue, a portion of the deep lobe of the parotid gland (the retromandibular portion), minor salivary glands, and scattered vessels and nerves (Table 29.1). Tumors of salivary gland origin in the pharyngeal space have the same distribution as those in the parotid gland, that is, 80% to 90% are benign and 10% to 20% are malignant. The majority are pleomorphic adenomas. The challenge to the surgeon is understanding tumor behavior and appropriate preparation to manage the simple and complex tumors that are encountered in this area.

It is essential that the surgeon is familiar with the anatomy. The prestyloid space superiorly is contained by fascial areas that direct tumor growth. The parapharyngeal space itself is divided into the pre- and poststyloid areas by the fascia of the styloid process that connects to the tensor veli palatini muscles and its surrounding fascia (Fig. 29.1). Another important structure is the stylomandibular ligament that forms part of the boundary of the stylomandibular tunnel. The stylomandibular ligament unites the fascia of the styloid process to the angle of the mandible. It can be thinned by tumors but is always present, and its division insures adequate opening of the parapharyngeal space and successful subsequent tumor removal. It is also a structure where constriction can occur as tumors grow between the mandible and this ligament. This leads to the classic “dumbbell” tumors that extend from the tail of the parotid gland into the parapharyngeal space. Table 29.2 lists the anatomic boundaries of the prestyloid space.

HISTORY

Most tumors of the prestyloid space are benign and, as such, have a slow growth rate and generally are asymptomatic. The majority are discovered on routine physical examination when a physician, or the patient, notices a bulging or displacement of the nonrigid portions of the parapharynx: generally the medial surface, the displacement of the constrictor muscles, or the inferior soft border near the inferior aspect of the parotid gland or digastric muscle. For prestyloid tumors, displacement of the lateral pharyngeal wall usually occurs in the region of the tonsil or soft palate or anterior tonsillar pillar (Fig. 29.2). Eventually, as the tumors enlarge, they will displace the entire tonsil and lateral pharynx up to the nasopharynx. One may notice tumors in the deep lobe of the parotid that also extend through the stylomandibular tunnel and present as a swelling or mass in the pretragal area, as well as the pharynx. It is common today to discover prestyloid lesions on routine imaging—CT or MRI scans—done for other indications.
As these tumors extend superiorly, the muscles of the eustachian tube can be compressed, causing a feeling of fullness and pressure in the ear. Eustachian tube dysfunction can also lead to middle ear effusion with decreased hearing. Involvement of the medial pterygoid muscle can lead to trismus, which is more common with malignant tumors. As the tumor enlarges, it displaces the pharynx and interferes with eating, speech, and especially sleep. Some of the early symptoms are snoring or symptoms of obstructive sleep apnea. This occurs before these tumors impact eating and phonation.

There are several cases of prestyloid parapharyngeal lesions that were untreated in elderly sick individuals that enlarged to the point where they caused significant dysphagia, inanition, respiratory distress, and death. It is also not uncommon for lesions of the prestyloid parapharyngeal space to be confused with pathology of the tonsil, such as infection, enlargement, or tumors. Pain is not a common finding, but if it is present, one must be concerned about a malignant lesion. Other symptoms of malignancy, of course, include the presence of facial nerve involvement and regional adenopathy.

**TABLE 29.1** Structures Contributing to Tumors of the Prestyloid Parapharyngeal Space

<table>
<thead>
<tr>
<th>Structures</th>
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<tbody>
<tr>
<td>Adipose Tissue</td>
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<tr>
<td>Deep lobe of the parotid gland</td>
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<tr>
<td>Minor salivary glands and ectopic salivary rests</td>
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<tr>
<td>Muscles</td>
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<tr>
<td>Nerves</td>
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<td>Vessels</td>
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**PHYSICAL EXAMINATION**

Small tumors, due to their location in the prestyloid parapharyngeal space, cannot be detected on physical examination. A tumor must be >3 cm to cause displacement of the surrounding structures before it can be seen or felt. Early tumors are detected only serendipitously on a prior imaging study. It is important to carefully inspect the pharynx and the parotid gland and palpate both intraorally and bimanually. A palpable deep parotid mass that is immobile and of indeterminate deep extent may extend into the parapharyngeal space. One must assess the function of the seventh cranial nerve and palpate the parotid and neck carefully for any enlarged nodes. In a
series from Mayo Clinic of almost 200 parapharyngeal tumors, an intraoral mass alone occurred in 63%, an external mass in the parotid region was present in 58%, and both findings were found in only 28% of the cases.

**INDICATIONS**

- Parapharyngeal deep lobe benign parotid tumors
- Parapharyngeal deep lobe malignant parotid tumors
- Mesenchymal tumors located in the prestyloid space

**CONTRAINDICATIONS**

As with any mass of the parotid gland, the decision to operate must take into consideration the patient’s age, the patient’s health, his or her wishes, and the surgeon’s experience. In addition, one should have available key colleagues, including pathologists, to complete the procedure as dictated by the pathologic findings. The final recommendation for surgery is always individualized based upon the patient, the history, the examination, and the evaluation. The discussion about removing a benign pleomorphic adenoma from the parapharyngeal space is vastly different than that of an obvious malignant tumor in this region.

**PREOPERATIVE PLANNING**

Management of a prestyloid parapharyngeal tumor is approached similar to any mass discovered in the parotid gland on physical examination. Whether it is felt on clinical examination or noted on imaging studies, the evaluation is the same. Since prestyloid tumors are usually of salivary gland origin, awareness of a mass will lead to a recommendation for removal—for diagnosis, to prevent growth, and to prevent malignant degeneration.
The most common tumors extend from the retromandibular portion of the deep lobe of the parotid gland. As such, they grow into the space and generally have a round or irregular shape. The dumbbell shape is rarer and occurs when tumors extend through the stylomandibular tunnel. Other sources of salivary gland tumors include the extraparotid minor salivary gland tissue that can occur when minor salivary glands are found lateral to the superior constrictor muscles. These tumors, if <4 cm, can be detected as minor salivary gland in origin on imaging study by the finding of preservation of the adipose tissue plane between the tumor and the deep lobe of the parotid gland. The presence of adipose tissue in the parapharyngeal space aids in removal, as the majority of the tumors have to be removed by finger capsular dissection. Dissection is further aided as the capsule of a pleomorphic adenoma in the parapharyngeal space appears to be thicker on histologic study than many of the pleomorphic adenomas found within the superficial or deep portion of the parotid gland. Table 29.3 lists the tumors and lesions found in the prestyloid parapharyngeal space.

After the history and physical examination are completed, the key steps include accurate imaging to assess the extent and characteristics of the tumor. One can gain additional information regarding the possible tumor histology and involvement of surrounding structures. An MRI scan with gadolinium is most helpful as it provides triplanar information to determine the tumor’s extent, its relationship to surrounding structures, and relationship to key vasculature. If an MRI scan is contraindicated, then a high-resolution CT with contrast is indicated.

The findings of a prestyloid mass with discreet borders and generally low-signal T1 and bright T2 are often indicative of a pleomorphic adenoma. Generally, no further study is necessary. It is important to remember, however, that a pleomorphic adenoma in the parapharyngeal space can be predominately cystic and over time may even cause erosion of surrounding bony structures such as the pterygoid plates and still be benign.

Fine needle aspiration (FNA) biopsy, either transorally or directed with CT or ultrasound, can accurately identify pleomorphic adenomas. This rarely is done as it does not usually change the recommendation for removal. However, one should never perform a transoral or open biopsy of a parapharyngeal mass as the subsequent capsular rupture can lead to scarring and increased risk of tumor recurrence.

Imaging characteristics of low-grade carcinomas are difficult to distinguish from benign lesions. That is why the availability of pathologic assistance and frozen section evaluation is so helpful at the time of surgery. If there is concern of malignancy based upon history, physical examination, and imaging, then an FNA may be helpful for operative planning and in the preoperative discussion with the patient. One must remember, however, the difficulty in accurately diagnosing any salivary gland neoplasm on the basis of a FNA. There remains a high incidence of false positives and false negatives.

Once a tumor of the parapharyngeal space is identified, the discussion with the patient as to why it should be removed includes the following: to make a diagnosis, to avoid growth, to eliminate the risk of malignant degeneration, and to appropriately treat it if it is malignant. If the pathologist notes malignancy, the histology may warrant cervical nodal removal, removal of the entire parotid gland to remove intraparotid nodes, or removal of involved surrounding structures such as bone, vessels, and nerves. One must be prepared to perform the necessary reconstruction in these situations. The full complement of risks, benefits, and potential complications is always discussed with the patient preoperatively.

**SURGICAL TECHNIQUE**

Multiple surgical approaches have been described to remove masses from the prestyloid parapharyngeal space. These include a cervical approach, a transparotid approach, a submandibular approach, a transoral approach, and a cervical–parotid approach. Mandibulotomy can also be combined with these approaches for a variety of tumors. However, in most cases, mandibulotomy is not indicated except for extremely large or select malignant tumors.
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The variety of tumors encountered includes the challenge of removing a 1-cm tumor high in the superior aspect of the prestyloid parapharynx, as well as a 13-cm lesion that involves a massive amount of the parapharyngeal space.

For a description of the surgical technique, it is most helpful to assume that the tumor is the most common one, a pleomorphic adenoma arising from the retromandibular portion of the deep lobe of the parotid. This is the classic prestyloid lesion, and if it is managed successfully, one can then approach other tumors in this area using minor variations in this technique.

I use the cervical–parotid approach, which has proved safe, effective, and versatile. This approach provides the basic framework for surgical excision of tumors in this area. It also provides flexibility to alter the approach based upon size, pathologic findings, and surgical findings. If there is involvement of surrounding structures, additional surgery can be done. A retroauricular incision is added to access tumors that involve or extend into the skull base or posterior fossa. A mandibulotomy approach with parasymphseal swing is used for select malignancies, superiorly based small lesions, or massive tumors in the prestyloid space. A mandibu- lotomy, however, is necessary in <5% of all prestyloid tumors.

The transoral approach can be performed for highly select tumors, especially extraparotid salivary lesions when imaging studies show a benign appearance and there is a clear separation of the tumor from the deep lobe and from the surrounding vessels. This approach can also be used for rare, select neurogenic tumors. A transoral removal is done through or adjacent to the tonsil bed. Several authors suggest that these should be removed using a transoral robotic approach as opposed to conventional instrumentation. The main disadvantage of the robotic approach is the lack of tactile feel and the risk of rupture of the tumor capsule with retraction. If there is tumor rupture, oftentimes recurrence will not be noted for up to 10 or 20 years, and one may get a false sense of security. If a transoral approach is used in the wrong individual, there can be incomplete removal, damage to vessels and nerves, capsular rupture, and subsequent tumor recurrence.

For safety, control, and adequate removal of the lesion, I generally recommend the cervical–parotid approach for most cases of prestyloid parapharyngeal lesions. This approach allows for short hospitalization, minimal morbidity, safety, and proven efficacy.

Description of Technique

Universal protocol confirms the correct identification of the patient and the operative site. Using general anesthesia without paralysis, the is prepped and draped to expose the hemiface, neck, entire ear, and the corner of the mouth and the eye. A pen is used to mark the incision in front of the ear and extended into a natural skin crease beneath the mandible. The skin incision is then made with a 15-blade, and the flaps are raised over the parotid fascia to expose the upper neck using a scalpel and Jones scissors. The parotid gland is then separated from the anterior border of the sternocleidomastoid muscle and from the cartilaginous ear canal. Kocher clamps are placed on the edge of the gland to retract the gland. If one can preserve the posterior branch of the great auricular nerve, this is done. The anterior branch is divided. The gland is then separated from the superior border of the posterior belly of the digastric muscle. The main trunk of the facial nerve is then identified, and the postauricular artery is ligated. The lower division and lower branches of the facial nerve are followed out to the level of the submandibular gland (Fig. 29.3). At this point, the stylomandibular fascia that separates the submandibular gland from the tail of the parotid gland is divided freeing the submandibular gland to allow for anterior retraction of this gland. A block of upper deep jugular nodes are removed after elevating the fascia from the sternocleidomastoid muscle and are sent to pathology. The removal of these nodes allows exposure of cranial nerves X, XI, and XII; the internal jugular vein; and the internal and external carotid arteries (Fig. 29.4). The posterior belly of the digastric muscle and the stylohyoid muscles are then isolated and divided near the mastoid tip and retracted medially. This gives further exposure of the vascular structures, nerves, and the styloid process. The external carotid artery is now easily seen as it passes between the stylohyoid and stylopharyngeus muscle. This artery is divided (Fig. 29.5). A ribbon retractor is then placed on the angle of the mandible to retract it medially. This makes identification of the stylomandibular ligament easier. This dense, connective tissue band extends from the styloid process to the angle and a portion of the ramus of the mandible. It can be quite thinned by very large tumors, and one must be careful to excise the ligament and not cut the tumor. In most cases, however, the ligament can be easily isolated and divided with scissors (Fig. 29.6). The mandible can then be further retracted anteriorly, opening the parapharyngeal space. At this point, the surgeon generally gets the first view of the tumor (Fig. 29.7). With the mandible retracted and with finger dissection, a plane is then established along the styloglossus and submandibular gland inferiorly and continues anteriorly to the mass. I establish a plane superiorly along the medial pterygoid muscle and medially along the constrictor muscles (Fig. 29.8). Next, I identify the site of attachment of the tumor to the deep lobe of the parotid gland. It is helpful to know the exact location of the main trunk of the facial nerve as you can be surprised by the proximity of the tumor to the facial nerve and the often superior extension in the deep lobe of a parapharyngeal lesion above the level of the facial nerve. If the styloid process is impinging on the surface of the tumor and if there is any risk for potential rupture of the tumor capsule with inferior displacement of the tumor by finger dissection, the styloid process can be removed (Fig. 29.9). This occurs when a long, thin, or sharp styloid compresses the tumor capsule. The portion of the deep lobe around the tumor attachment site from the retromandibular portion of the deep lobe of the parotid gland is isolated (Fig. 29.10). Knowing the position of the facial nerve and the external...
FIGURE 29.3 Isolation of the lower division and main trunk of the facial nerve.

FIGURE 29.4 Exposure of the neurovascular components of the upper neck.
carotid vessels and associated veins is essential in this step and allows for removal of a portion of the gland with avoidance of tumor rupture. The tumor is then easily delivered into the surgical field and removed (Fig. 29.11).

Hemostasis is obtained with bipolar cautery, a Hemovac drain is placed, and the Hemovac is put on suction for 2 days. The digastric and stylohyoid muscles are sutured. The superficial portion of the parotid gland is repositioned and sutured to the sternocleidomastoid muscle. The incision is then closed using chromic sutures and 5-0 fast-absorbing chromic in the skin. A parotid and neck dressing is then applied.

Reconstruction is generally not necessary. If there is a malignancy that requires removal of the entire parotid gland and surrounding adjacent structures, I have to individualize the need to follow the operative bed for recurrence versus the desire to reconstruct the soft tissue defect.

**POSTOPERATIVE CARE**

Hemovac drains are kept on continuous suction for 48 hours to collapse the dead space and lessen the risk of infection, seroma, or hematoma. For very small tumors, this can be done overnight. Antibiotics are given for 24 hours to prevent infection, as there is a large dead space after tumor removal. The parotid and neck dressings are removed the following day and reapplied for one further day for additional pressure and hemostasis.
The patient is hospitalized until the drains are removed, generally within 48 hours after surgery. For wound care, antibiotic ointment or Vaseline is applied to the incision site until the sutures dissolve or fall out. Patients are allowed to shower 48 hours following their operation.

**COMPLICATIONS**

Complications generally occur because of poor knowledge of regional anatomy, an incomplete preoperative assessment, performing the wrong operation, or an inexperienced surgeon. One must individualize the approach and operative extent based upon the surgical findings. The complication to avoid is rupture of the tumor capsule.
FIGURE 29.9 Styloid process can be removed in certain cases to assist in exposure or lessen risk of tumor capsule rupture.

FIGURE 29.10 Removal of the deep lobe portion of the parotid gland at the site of the tumor origin.

FIGURE 29.11 Tumor has been removed with exposure of the constrictor muscle and remaining tumor cavity.
and tumor spillage. Incomplete removal, especially with pleomorphic adenomas, will likely lead to tumor recurrence and the need for subsequent treatment. Subsequent surgery in the parapharyngeal space is much more difficult. There are often multiple tumors, and a long-standing problem begins with managing recurrent pleomorphic adenomas. Rupture of the tumor capsule can occur even with wide exposure. The thickness of the tumor capsule can be quite variable depending upon whether the tumor is mesenchymal or glandular. The glandular areas are often softer and easier to rupture. Rupture can occur due to inadvertent pressure of the tumor against the mandible, the styloid process, and the pterygoid plates or from failure to adequately remove a portion of the deep lobe near the site of the attachment point of the tumor. One must maximize exposure before any manipulation of the tumor is done.

If rupture does occur, one should remove all gross tumor and then thoroughly irrigate the wound. Even with rupture, it has been reported that recurrence occurs in only 10% of patients, but it can take 10 to 20 years to detect, and therefore, these numbers may rise with time.

Injury to the facial nerve is one of the most feared complications and should not occur if the surgeon knows where the nerve is located. If you know the location of the nerve, you should not injure it. It is often not appreciated how close the deep lobe component of the parapharyngeal tumor is to the main trunk of the facial nerve. Temporary mild paresis of the lower face can occur from mobilization of the marginal branch of the facial nerve, but this generally resolves in a short period of time.

First bite syndrome is a common occurrence with mobilization or division of the inferior portion or tail of the parotid gland. The exact etiology of this is indeterminate. First bite pain lasts for several seconds and then is gone. It may occur with only certain foods or beverages. Starting the meal with another type of food may prevent the pain. First bite pain generally lessens over time and is gone by 1 year.

Numbness of the ear lobe as a result of cutting the greater auricular nerve always occurs. However, in one year’s time, secondary to an ingrowth of additional sensory nerves, the main area of numbness is the lobule of the ear. Hematomas, seromas, and infections are all lessened by meticulous hemostasis, antibiotics, Hemovac drains, and pressure dressings.

Damage to the carotid artery is rare with prestyloid lesions, but one has to be aware of the potential risk to the internal carotid artery in elderly individuals. Tortuous carotid arteries can extend to or through the floor of the parotid bed and contact the capsule of prestyloid tumors. Injury, in these cases, is possible. Hematoma and postoperative bleeding with parapharyngeal lesions can cause significant airway obstruction requiring emergency tracheostomy and necessary reexploration of the surgical site. Therefore, surgical care and attention to detail is mandatory.

Removal of a malignant prestyloid tumor with its attendant expanded excision and, when necessary, removal of surrounding structures, nerves, bone, muscle, vessels, and lymphatics all increase the risk of potential morbidity. The biggest risk remains tumor recurrence.

RESULTS

Prestyloid tumors that are benign have a low risk of recurrence if the exposure and principles described in the cervical–parotid approach are followed. Detection of recurrence, however, can be challenging, and patients have to be followed with yearly and then every other year imaging studies. A report detailing results in 68 patients with pleomorphic adenomas of the parapharyngeal space showed recurrences in only three patients. In cases in which the tumor was ruptured, recurrence may be detected over many years. For all cases of parapharyngeal lesions that were benign, in one reported series, time of recurrence was noted from 2 to 23 years with a median of 7 years. Factors associated with recurrence included prior open biopsies, tumor rupture, and incomplete removal. There clearly are unique challenges removing certain prestyloid lesions such as lympho-vascular lesions and, of course, malignancies.

Patients with malignant tumors of the prestyloid parapharyngeal space generally do poorly, and their ultimate outcome is primarily determined by the histology and extent of the tumor. In one series of 35 cases of malignant tumors of the prestyloid space, recurrence or persistence was noted in 27, and ultimately, 63% died of their tumor. When recurrence does occur, death is likely in over 80%. In this series, only five patients were alive without disease at the time of last follow-up indicating the problems with late diagnosis, tumor extent, and significant morbidity with malignant lesions of the prestyloid space.

PEARLS

- For large tumors, maximizing the space to work in when mobilizing a tumor will reduce the risk of capsular rupture by retraction of the mandible, medialization of the lateral aspect of the submandibular gland, division of the stylocleidomandibular ligament, division of the external carotid artery, division and reflection of the posterior belly of the digastric and stylohyoid muscle, and removal of a prominent stylohyoid process.
- For dumbbell tumors that are palpable as a parotid mass and displace the facial nerve, the superficial lobe can be reflected anteriorly to isolate the nerve and then replaced after tumor resection.
For most prestyloid tumors, only a small portion of the deep lobe of the parotid needs to be removed.

Identification of the facial nerve will avoid injury to this structure.

Always individualize the approach to the surgery in this area based upon the clinical behavior, size, imaging studies, and operative findings.

In elderly patients, the internal carotid artery can be quite tortuous and extend through the floor of the parotid musculature and fascia of the prestyloid space to lie in close contact to the tumor. Careful review of imaging will aid avoidance of carotid injury to the carotid artery.

The cervical–parotid approach can be extended retroauricularly for patients with skull base extension from involvement of the posstyloid portion of the parapharyngeal space. Further exposure of the parapharyngeal space can be done with a combined parasympathetic mandibulotomy through a lip split incision.

For small tumors, removal of the upper jugular nodes and isolation of the vessels are not necessary.

Keep a Hemovac drain in place for 2 days to collapse dead space and reduce the risk of hematoma or infection.

If a plane is not established easily around the borders of the tumor, with the exception of the attachment portion to the deep lobe, you should be concerned about malignancy or prior transoral biopsy.

Treat a prestyloid parapharyngeal tumor like one would manage a palpable mass in the parotid gland.

Awareness of the facial nerve will aid in removing the necessary deep lobe parotid tissue with the tumor.

Frozen section pathology will aid in performing additional surgery, that is, a parotidectomy or neck dissection. This discussion should occur preoperatively with the patient. Additional surgery is easier to do at the time of the first operation than later.

PITFALLS

Not identifying the facial nerve could lead to injury of this structure.

Failure to always individualize the approach to the surgery in this area based upon the clinical behavior, size, imaging studies, and operative findings.

In elderly patients, the internal carotid artery can be quite tortuous and extend through the floor of the parotid musculature and fascia of the prestyloid space to lie in close contact to the tumor. Careful review of imaging will aid avoidance of injury to the carotid artery.

Not keeping a Hemovac drain in place for 2 days to collapse dead space may increase the risk of seroma, hematoma, or infection.

Biopsy of a tumor via an incisional transoral approach as opposed to a FNA may lead to the recurrence of the tumor.

SUGGESTED READING


